



Criterion 1 – Curricular Aspects

Key Indicator	1.1	Curriculum Design and Development
Metric	1.1.2	Percentage of Programmes where syllabus revision was carried out during academic year 2022-23

DEPARTMENT OF BIOTECHNOLOGY

Sl. No.	Programme Code	Programme name	Year of Introduction	Year of revision	Percentage of Syllabus content added or replaced
01.	101	Bachelor of Biotechnology	2002-03	2022	16.9 %

S.No	Contents
1.	Minutes of Board of Studies
2.	Extracts of minutes of the Academic Council Meeting
3.	Curiculum and Syllabus of the programme – Before Revision
4.	Curiculum and Syllabus of the programme – After Revision

Legend : Highlighted Color - Red

- Indicates courses which are removed from syllabus before revision

Highlighted Color - Green

 Indicates courses which are removed from syllabus after revision

1. A. Minutes of the Board of Studiesof Bachelor of Technology – Biotechnology conducted on 16.07.2022

Department of Biotechnology Faculty of Engineering and Technology Persys Nagar, Vallan, Tharjasut - 613 400, Tami Nadu, Iodu Phone: 901 - 6162 - 264400 Fac: 901 - 4362 - 264660 Email: headbioigpnu.odu Web: www.pru.odu





ANNEXURE-II

BOARD OF STUDIES MEETING

For B.Tech. Biotechnology (FULL TIME) PROGRAMME

Minutes of Meeting

Date: 16.07.2022 Time: 10. 00 AM

Venue: Marie curie Hall

Mode of Meeting: off line and online (Google meet)

Meeting Link: meet.google.com/int-afgs-cxb

The Board of Studies (BOS) meeting was held in both offline and online mode on 16.07.2022 for framing the B.Tech. Biotechnology Honors course and its Curriculum with syllabi of Regulation 2021 Revision -I.

Agenda:

- Implementation of B.Tech, Biotechnology Honors course and suggestions from board studies members for Regulation 2021 Revision -L
- Presentation of increased six course outcomes on biotechnology syllabus for B.Tech. Biotechnology degree programme for Regulation 2021 Revision -I.
- Presentation of Split on XBT602 process biotechnology into two courses as XBT602 Process biotechnology - Upstream and XBT603 Process biotechnology - Downstream respectively.
- Presentations of modified Programme Educational Outcomes (PEOs) for involve BOS and DAC members in framing.

Members present

SLN 0.	Name	Designation	Membership	
1.	Dr. A.Ashokkumar	Assistant Professor & Head, Dept, of Biotechnology, PMIST	Chairperson	
2.	Dr.S.Meenakshisundaram	Professor and Dean, Centre for Biotechnology, Alagappa College of Technology, Anna University Chennai	External Member (Academic Exper for BOS)	
3.	Dr.N.Shivakumar	Associate Director Enterprise Technology Services AstraZeneca India Pyt Ltd Chennai	External Member (Member from Industry for BOS	
4.	Mr.M.Jagadeesh M.Tech	Research Scholar IIT Hydrabad	Member from Ålumni For BOS	
5.	Mrs.G.Sharmila Gulabdeen	No.200 NGO Nagar NK Road Thanjavur – 6 Sharmilagulab2002@gmail.com	Parent Invite	
6.	Dr.S.Kumaran	Associate Professor, Dept. of Biotechnology Dean Research PMIST	Member	
7.	Dr.K.Anbarasu	Assistant Professor, Dept. of Biotechnology, PMIST	Member	
8.	Dr.B.Nazeema Banu	Assistant Professor, Dept. of Biotechnology, PMIST	Member	
9,	Ms.P.Mala	Assistant Professor, Dept. of Biotechnology, PMIST	Member	
10.	Ms.R.Ramya	Assistant Professor, Dept. of Biotechnology, PMIST	Member	
11.	Ms.S.Keerthana	Assistant Professor, Dept. of Biotechnology, PMIST	Member	
12.		Final year students, Dept. of		
	Joseph Antony, A	Biotechnology, PMIST		
	J.S.Kavya	Third year students, Dept. of	Student Members	
	M.Sivakarthikeyan	Biotechnology, PMIST	1754C106475120000022	
	G. Riswana Affrin R. Chandhru	Second year students, Dept. of Biotechnology, PMIST		

Table.1. Members of the BoS

8th BOS/BIOTECH/Date: 19.08.2021

MINUTES

BOS Minutes for 16.07.2022

- Dr. A. Ashokkumar, Associate Professor and Head of the Department welcomed all the stake holders and expert members, and introduced the invited experts and students.
 B.Tech (Honors) Biotechnology specialization in computer science and biology and the curriculum and syllabus for B. Tech Biotechnology for Regulation 2021 Revision-I, was discussed and finalized.
- The difference between regulation 2021 and regulation 2021 revision –I was highlighted.

External Suggestions:

- BOS member Dr.S.Meenakshisandram raised a query on Honors degree which should be given to advanced learners other hand it could be given in minor degree only. In this regard BOS chairman Dr.A.Asbokumar showed the AICTE recommendation and convinced.
- Dr.A.Ashokkumar presented the curriculum and syllabus of Honors degree and also discussed over the increased six course outcomes from syllabus of Biotechnology courses, split of XBT602 Process Biotechnology of Regulation 2021 and discussed over the modified PEOs. BOS members accepted, and suggestions are given below.
- In the Honors degree of computer science and biology the application part of biology computer science interpretation should be conducted through appropriate experts from the respective pioneer Institutes / Industries.
- The students may take the courses like JAVA, R programme, Python as a trash course during their holidays and also the earned certificates can be considered for IPT.
- In house biotechnology faculty members must be equipped themselves in above programme languages to train the students instead of depending on computer faculty for the effective way of communication with biotechnology application.

Regulation 2021	Regulation 2021 Rev.1		
XBT 602-Process biotechnology	XBT 602 Process biotechnology - Upstream XBT603 Process biotechnology - Down Stream		
(a)	C and JAVA		
	Python BIOSTATISTICS R Programme and R Studio		
+			
-	MATLAB		
141	Mini Project		

Table.2. List of the subject topics and syllabus Revised

8th BOS/BIOTECH/Date: 19.08.2021

A. LIST OF NEWLY INTRODUCED COURSES IN REGULATION 2021 -Revision -I

S.No	Course	Semester	Course Title	Credits Detail				
	Code			L	T	P	C	H
1.	XBTHC1	111	C and JAVA	1	0	2	3	5
2.	XBTHC2	IV	Python	1	0	2	3	5
3.	XBTHC3	IV	Biostatistics	2	1	0	3	. 5:
4.	XBTHC4	v	R Program and R Studio	1	0	2	3	5
5.	XBTHC5	VI	MATLab	1	0	2	3	5
6.	XBTHC6	VII	Mini Project	0	0	.5	5	10
			Total	6	1	13	20	35

Computer Science and Biology

B. LIST OF COURSES REMOVED

Table .3 Table of courses removed with remarks

	Course Code and Name	Remarks		
		Replaced by XBT602 Process biotechnology -		
	XBT602-Process Biotechnology	Upstream		
		XBT603 Process Biotechnology-Down Stream		

C. PERCENTAGE CHANGE IN THE SYLLABUS

Number of new courses added = 6 = 20 credits

Credits revised in average with and Regulation 2021 and Regulation 2021-Revision-I % change = 100%

COURSES ON EMPLOYABILITY/ENTREPRENEURSHIP/SKILL DEVELOPMENT

The courses are given below

Course Code	Courses	Category
XBTHC1	C and JAVA	Employability
XBTHC2	Python	Employability
XBTHC3	Biostatistics	Employability
XBTHC4	R Program and R Studio	Employability
XBTHC5	MAT Lab	Employability
XBTHC6	Mini Project	Employability
	Code XBTHC1 XBTHC2 XBTHC3 XBTHC4 XBTHC5	CodeCoursesXBTHC1C and JAVAXBTHC2PythonXBTHC3BiostatisticsXBTHC4R Program and R StudioXBTHC5MAT Lab

8th BOS/BIOTECH/Date: 19.08.2021

9 1 2

D. DISCUSSION ON PROGRAMME ARTICULATION MATRIX (PO COVERAGE BY ALL COS)

The existing POs and PSO were presented. The members agreed that there need not be any changes in the PSO and POs.

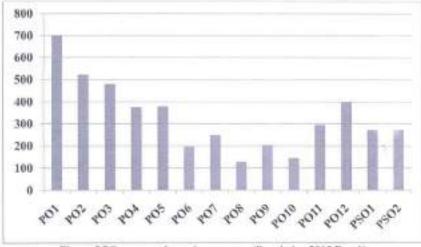


Figure I PO coverage by various courses (Regulation 2018 Rev-1)

It is found that the curriculum covers all POs with small deviations. PO1 is strongly supported than the other POs.

HoD/Biotechnology (Dr.A.Ashokkumar)

Dean (FET)

(Dr.S.Senthamil Kumar)

2 1 C 1 C 4

lor 1.25 -m Dean (Academic) (Dr. A.George)

8th BOS/BIOTECH/Date: 19.08.2021

Iembers of the Board of Studies and Department Advisory Committee
Venue: Biotechnology Department Office: Google Meet
BOS DAC (16Jul2022): meet google.com/fyh-gitr-yms

SLN 0.	Name	Designation	Membership	Signature
1.	Dr. A.Ashekkamar	Associate Professor & Head, Dept. of Biotechnology, PMIST	Chairperson	A Jord & Har
2. Dr.S.Mornakshisundaram		Professor and Dean, Centre for Biotechnology, Alagappa College of Technology, Anna University Chemai	External Momber (Academic Expert for BOS)	Ar 16712
3.	Dr.R.Mahendran	Associate Professor & Head Centre of Excellence in Non-Thermal Processing (CENTP) IIFPT Therjavar	External Member (Academic Expert for DAC)	Lehnerger
1	Dr.N.Shiyakumar	Associate Director Emergelse Technology Services AstraZeseca Italia Prt Ltd Chennal	External Member (Member from Industry for BOS)	ONILINE
3.	Mr.H.Saravanan	Project Delivery Head DEE Pharma SUPCOT, Cudddore	External Member (Member from Industry for DAC)	ONTIME
<u>6.</u>	Dr.M.Shannilu Began	Associate Professor & Head, Dept. of CSE, PMIST	Special Member	M. Samla Bel-
7.	Mr.M.Jagadoesh	Research Scholar ITT Hydrabad	Member from Alumni For BOS	DNITINE
8.	Mrs.G.Shannila Gulabdeen	No.200 NGO Nagar NK Road Thanjavar - 6 Sharadlagalab2002/digmail.com	Parent Invite	0.809
9.	Dr.S.Kumanan	Astociate Professor, Dept. of Biotechnology Dean Research PMIST	Member	due an In 13
10.	Dr.K. Anharasa	Assistant Professor, Dept, of Biotechnology, PMIST	Member	ONLINE
11.	Dr.K.Geetha	Assistant Professor, Dept. of Hiotechnology, PMIST	Member	5K-015/9/
12	De.S.Vauanthavel	Assistant Professor, Dept. of Biotechnology, PMIST	Member	-S. Vate 1/31
° 13.	Ms.P.Mala	Assistant Professor, Dept. of Biotechnology, PMIST	Member	Pholeteler
14	Ms.R.Ramya	Assistant Professor, Dept. of Biotechnology, PMIST	Membar	The Hillerto
15	Mt.S.Keerfluns	Assistant Professor, Dept. of Biotechnology, PMIST	Member	5 Justhan 2
16	M.Threpmi	Final year student, Dept. of	Value Roos & Roos Cont	W 25-12 Febr
17	S. Shunkar	Blotechnology, PMIST	Student Members	S. Ship malle
	G. Riswana Affrin	Third year student, Dept. of		G. F. Anni
10	R. Pavithran	Biotechnology, PMIST A \$415Janet Professor, Dept	Menhel	usalima

Page 9 of 119

6.11

6.

2. Extracts of Minutes of the 40thAcademic Council Meeting conducted on 27.08.2022

Periyar Nagar, Vallam, Thanjawar - 613 403, Tamil Nadu, India Phone: +91 - 4362 - 264600 Faa: +91 - 4362 - 264660 Email: registrar@pmw.edu Web: www.pmu.edu



MINUTES OF FORTIETH MEETING OF THE ACADEMIC COUNCIL

Date : 27.08.2022 Time : 10.30 A.M Venue: Richard Dawkins Hall Place : PMIST, Vallam – Thanjavur

The Fortieth Meeting of the Academic Council of the Periyar Maniammai Institute of Science & Technology (PMIST), Vallam, Thanjavur held on 27.08.2022 at 10.30 a.m.

Prof.S.Velusami, Hon'ble Vice-Chancellor, chaired the meeting.

The following Academic Council Members were present

1.	Dr.D.Aarthi Saravanan	Member
2.	Dr.A.Anand Jerard Sebastine	Member
3.	Dr.S.Arumugam	Member
4.	Dr.P.Aruna	Member
5.	Dr.S.Asokan	Member
6.	Dr.S.Buvaneswari	Member
7.	Dr.A.George	Member
8.	Dr.S.Gomathi	Member
9.	Dr.P.Guru	Member
10.	Dr.V.Hamsadhwani	Member
11.	Dr.R.Jayanthi	Member
12.	Dr.N.Jayanthi	Member
13.	Dr.J.Jeyachidra	Member
14.	Mr.I.Karthic Subramaniayan	Member
15.	Dr.T.Kavitha	Member
16.	Dr.K.Kesavan	Member
17.	Dr.R.Krishnamurthi	Member
18.	Dr.S.P.Kulanthaivel Babu	Member

1

19.	Dr.D.Kumar	Member		
20.	Dr.S.Kumaran	Member		
21.	Dr.D.Maghesh Kumar	Member		
22.	Dr.B.Mahendra Mohan	Member		
23.	Dr.C.Narmadha	Member		
24.	Dr.T.Narmadha	Member		
25.	Mr.A.Pugazhenthi	Member		
26.	Dr.KVR.Rajandran	Member		
27.	Mr.R.Rakesh	Member		
28.	Dr.D.Ramesh	Member		
29.	Ar.N.Ramesh Babu	Member		
30.	Dr.D.Ruby	Member		
31.	Dr.V.Sangeetha	External Member		
32.	Dr.J.Santhosh	Member		
33.	Dr.J.Sathyapriya	Member		
34.	Dr.K.Selvakumar	Member		
35.	Dr.K.Selvam	Member		
36.	Dr. S.Senthamil Kumar	Member		
37.	Dr.V.A.Shanmugavelu	Member		
38.	Dr.M.Sharmila Begum	Member		
39.	Dr.M.A.Sikandar	External Member		
40.	Dr.C.V.Subramanian	Member		
41.	Dr.G.Thamilvanan	Member		
42.	Dr.K.Thirumaran	External Member		
43.	Dr.P.Vijayalakshmi	Member		
44.	Dr.S.Suppiah	Special Invitee		

ADDRESS BY THE VICE-CHANCELLOR

The Chairperson welcomed all the Academic Council External and Internal members. He also presented the academic activities, organized by various Departments and Centers, held after the previous Academic Council Meeting.

2

the courses in B.Tech.- Aerospace Engineering curriculum and syllabi, Regulation 2021).

DEPARTMENT OF BIOTECHNOLOGY

FET B.Tech Bio 40.3.2 TO CONSIDER AND APPROVE the Curriculum and Syllabi for B.Tech (Hons).- Biotechnology with specialization in Computer Science and Biology in the existing regulation 2021 under Full Time (Regulation 2021, Revision 1; Full time mode). The courses pertaining to the specialization and their credits (In addition to the courses in B.Tech.- Biotechnology curriculum and syllabi, Regulation 2021) are given below:

C. Mar	Course	Semester	Courses Title		Cred	Credits Detail		
S.No.	Code		Course Title	L	T	P	C	H
15	XBTHC1	111	C and JAVA	15	0	2	3	5
2	XBTHC2	IV	Python	1	0	2	3	5
3.	XBTHC3	IV	Biostatistics	2	1	0	3	5
4.	XBTHC4	×.	R Program and R Studio	1	0	2	3	5
5	XBTHC5	VI	MATLAB	1	0	2	3	5
6	XBTHC6	VII	Mini Project	0	0	5	5	10
			Total	6	1	13	20	35

Computer Science and Biology

Notes:

- The Board of Studies of the Department of Biotechnology recommended the Curriculum and Syllabus for B.Tech Biotechnology Honors programme with specialization in "Computer Science and Biology" under Full Time in existing Regulation 2021).
- Based on the National Biotechnology Strategy (2021-2025) released from Department of Biotechnology, Government of India, the existing Programme Educational Objectives (PEO) are modified.

The matter is placed before the Academic Council for approval.

Resolution

RESOLVED TO APPROVE the Curriculum and Syllabi for B.Tech (Hons).- Biotechnology with specialization in "Computer Science and Biology" in the existing regulation 2021 under Full Time (Regulation 2021, Revision 1; Full time mode). The courses pertaining to the specialization and their credits (In addition to the courses in B.Tech.-Biotechnology curriculum and syllabi, Regulation 2021).

DEPARTMENT OF CIVIL ENGINEERING

FET B.Tech-Civil 40.3.3 TO CONSIDER AND APPROVE the Curriculum and Syllabi for B.Tech (Hons).- Civil Engineering with specialization in GIS and Remote Sensing programme (Regulation 2021, Revision 1: Full time mode). The courses pertaining to the specialization and their credits (In addition to the courses in B.Tech – Civil Engineering Curriculum and Syllabi, Regulation 2021) are given below:

New Courses:

Course code	Semester	Course Title	L	т	P	с	н
XCEHR1	10	Photogrammetry	3	0	0	3	3
XCEHR2	IV	Image processing	3	0	1	4	5
XCEHR3	V	Remote sensing	3	0	1	4	5
XCEHR4	VI	Geographic information system	3	0	1	4	5
XCEHR5	VII	Mini Project	0	0	5	5	10
		Total	12	0	8	20	28

Notes:

The Board of Studies of the Department of Civil Engineering recommended Curriculum and Syllabi for B.Tech.-(Hons) Civil Engineering with specialization in GIS and Remote Sensing programme under Full-Time (Regulation 2021, Revision 1).

The matter is placed before the Academic Council for approval.

Resolution

RESOLVED TO APPROVE the Curriculum and Syllabi for B.Tech (Hons).-

15

3. CurriculumandSyllabusoftheProgramme–BeforeRevision

Semester I

S.No.	AICTE	Course	Courses		Cre	dits			H	ours	
3. 110.	Code	Code			Т	Р	С	L	Т	Р	Total
1.	BSC	XMA101	Calculus and Linear Algebra	3	1	0	4	3	1	0	4
2.	ESC	XCP102	Programming for Problem Solving	3	0	0	3	3	0	0	3
3.	BSC	XAP103	Applied Physics for Engineers	3	1	0	4	3	1	0	4
4.	ESC	XBT104	Biology for Engineers	3	0	0	3	3	0	0	3
5	HSMC	XGS105	Speech Communication	0	0	3	3	0	0	3	3
6	MC	XUM106	Constitution of India *#	0	0	0	0	2	0	0	2
7	ESC	XCP107	Programming for Problem Solving Laboratory	0	0	1	1	0	0	3	3
8	BSC	XAP108	Applied Physics for Engineers Laboratory	0	0	2	2	0	0	3	3
			Total	12	2	6	20	14	2	9	25

Semester II

S.No.	AICTE	Course Code	Courses		Cre	dits			I	Hours	
3. 1 1 0.	Code	Course Coue	Courses	L	Т	Р	С	L	Т	Р	Total
1.	BSC	XMA201	Calculus, Ordinary Differential Equations and Complex Variable	3	1	0	4	3	1	0	4
2.	ESC	XBE202	Electrical and Electronic Engineering Systems	3	1	0	4	3	1	0	4
3.	BSC	XAC203	Applied Chemistry for Engineers	3	1	0	4	3	1	0	4
4	HSMC	XGS204	Technical Communication	2	0	0	2	2	0	0	2
5	ESC	XWP205	Workshop Practices	1	0	2	3	1	0	3	4
6	ESC	XBT206	Chemical Engineering Thermodynamics	2	1	0	3	2	1	0	3
7	ESC	XBE207	Electrical and Electronic Engineering Systems Laboratory	0	0	1	1	0	0	3	3
8	BSC	XAC208	Applied Chemistry for Engineers Laboratory	0	0	1	1	0	0	3	3
			Total	14	4	4	22	14	4	9	27

Semester III

O M	AICTE	a a 1	C		С	redits				Hour	
S.No.	Code	Course Code	Courses	L	Γ		C	L	Т	Р	Total
1.	BSC	XPS301	Probability and statistics	3	C) 0	3	3	0	0	3
2.	PCC	XBT302	Biochemistry	2	1	0	3	3	1	0	4
3.	PCC	XBT303	Microbiology	3	C) 0	3	3	0	0	3
4.	PCC	XBT304	Material and Energy Balances	2	1	0	3	2	1	0	3
5.	PCC	XBT305	Genetics and Evolutionary Biology	3	C	0	3	3	0	0	3
6.	HSMC	XUM306	Entrepreneurship Development	2	C	0	2	2	0	0	2
7	MC	XUM307	Universal Human Values 2:	2	1	0	3	2	1	0	3
	(HSMC)		Understanding Harmony	2						_	
8	PCC	XBT308	Biochemistry Laboratory	0	C		2		0	6	6
9	PCC	XBT309	Microbiology Laboratory	0	C		2	0	0	6	6
10	PROJ	XBT310	In-plant Training - I	-	-	1	1	-	-	2	2
			Total	17	3	5	25	5 18	3	14	35
Semester IV											
S.No.	AICTE	Code	Courses			edits				lours	
	Code			L	Τ	P	C	L	Τ	P	Total
1.	PCC	XBT401	Basic Transport Processes	2	1	0	3	2	1	0	3
2.	PCC	XBT402	Bioenergetics and Metabolism	2	1	0	3	2	1	0	3
3.	PCC	XBT403	Cell Biology	3	0	0	3	3	0	0	3
4.	PCC	XBT404	Immunology	3	0	0	3	3	0	0	3
5.	HSMC	XUM405	Economics for Engineers	3	0	0	3	3	0	0	32
6 7	MC	XUM406	Disaster Management ^{*#}	0	0	0	0	2	0	0	2
/	PCC	XBT407	Basic Transport Processes Laboratory	0	0	1	1	0	0	4	4
8	PCC	XBT408	Cell Biology Laboratory	0	0	2	2	0	0	8	8
9	PCC	XBT409	Immunology Laboratory	0	0	1	1	0	0	4	4
			Total	13	2	4	19	15	2	16	33
	Semeste	r V									
S.No.	AICTE	Code	Courses			edits	1			lours	1
	Code			L	T ^	<u>P</u>	C	L	T ^	P	Total
1	PCC	XBT501	Bioanalytical Tools	3	0	0	3	3	0	0	3
2	PCC	XBT502	Molecular Biology	3	0	0	3	3	0	0	3
3 4	PCC	XBT503	Bio reaction Engineering	23	1	0 0	3	3	1 0	0	4
	PCC	XBT504	Plant Biotechnology		0		-	-	-	-	-
5	PEC	XBT505A	A. Food Biotechnology	3	0	0	3	3	0	0	3
		XBT505B	B.Agricultural Biotechnology	3	0	0	3	3	0	0	3
		XBT505C	Pharmaceutical Biotechnology	3	0	0	3	3	0	0	3
6	OE	XOE1	Open Elective Courses	3	0	0	3	3	0	0	3
7	PCC	XBT507	Bioanalytical Tools Laboratory	0	0	1	1	0	0	6	6
8	PCC	XBT508	Bio reaction Engineering Laboratory	0	0	2	2	0	0	8	8
9	PROJ	XBT509	In-plant Training - II	-	-	1	1	-	-	2	2
10	PMC	XBTMO1	Minor Course I ^{*#}	0	0	0	0	0	0	2	2
			Total	17	1	4	22	18	1	18	37

Sei	mester VI										
S.No.	AICTE	Course Code	Courses		Cr	edits			Hours L T P T 3 0 0 3 3 2 0 3 3 0 0 3 3 0 0 3 3 0 0 3 3 0 0 3 3 0 0 3 1 0 4 4		
5. 1NO.	Code	Course Code	Courses	L	Т	Р	С	L	Т	Р	Total
1	PCC	XBT601	Animal Biotechnology	3	0	0	3	3	0	0	3
2	PCC	XBT602	Process Biotechnology	3	1	0	4	3	2	0	5
		XBT603A	Mass Transfer Fundamentals	3	0	0	3	3	0	0	3
3	PEC	XBT603B	Fermentation Technology	3	0	0	3	3	0	0	3
		XBT603C	Nanobiotechnology	3	0	0	3	3	0	0	3
4	OE	XOE2	Open Elective Courses	3	0	0	3	3	0	0	3
5	HSMC	XGS605	Professional Skills	1	0	2	3	1	0	4	5
6	MC	XUM606	Cyber Security ^{*#}	0	0	0	0	3	0	0	3
7	PCC	XBT607	Process Biotechnology Laboratory	0	0	4	4	0	0	8	8
8	PMC	XBTMO2	Minor Course II ^{*#}	0	0	0	0	0	0	2	2
			Total	13	1	6	20	16	2	14	32

Semester VII

S.No.	AICTE	Course Code	Courses		Cre	dits			He	ours	
5. 1NO.	Code	Course Code			Т	Р	С	L	Т	Р	Total
1	PCC	XBT701	Microbial Biotechnology	3	0	0	3	3	0	0	3
2	PCC	XBT702	Recombinant DNA Technology	3	0	0	3	3	0	0	3
3	PEC	XBT703A	A. Stem Cell Biotechnology	2	1	0	3	2	1	0	3
		XBT703B	B. Cancer Biology	2	1	0	3	2	1	0	3
		XBT703C	C. Design of Bioprocess Equipments	2	1	0	3	2	1	0	3
4	OE	XOE3	Open Elective Courses	3	0	0	3	3	0	0	3
5	MC	XES705	Environmental studies ^{*#}	0	0	0	0	3	0	0	3
6	PCC	XBT706	Recombinant DNA Technology Laboratory	0	0	2	2	0	0	6	6
7	PCC	XBT707	Bioinformatics	1	0	1	2	1	0	5	6
8	PROJ	XBT708	Project Work (Phase-I)	0	0	2	2	0	0	6	6
9	PROJ	XBT709	In-plant Training – III	-	-	2	2	-	-	2	2
10	PMC	XBTMO3	Minor Course III ^{*#}	0	0	0	0	0	0	2	2
			Total	12	1	7	20	15	1	21	37

Semester VIII

S.No.	AICTE	Course Code	Courses		Cre	dits			Н	ours	
5.110.	Code	Course Coue	Courses	L	LT		С	L	Т	Р	Total
1	PEC	XBT801A	A. Introduction to Quantum Biology, AI and Data Science	2	1	0	3	2	1	0	3
		XBT801B	B. Enzyme Engineering	2	1	0	3	2	1	0	3
		XBT801C	C. Bio waste and Bio products Utilization	2	1	0	3	2	1	0	3
2	OE	XOE4	Open Elective Courses	3	0	0	3	3	0	0	3
3	OE	XOE5	Open Elective Courses	3	0	0	3	3	0	0	3
4	PROJ	XBT804	Project Work (Phase-II)	0	0	9	9	0	0	18	18
5	PMC	XBTMO4	Minor Course IV ^{*#}	0	0	0	0	0	0	2	2
			Total	8	1	9	18	8	1	20	29

Grant Total Credits: 166

Sl	Category	Name of the Course	Credit
no			
1.	PMC	Training on GC-MS, HPLC	0
2.	PMC	Training on AFM, SEM	0
3.	PMC	Training on PCR and	0
		Electrophoresis	
4.	PMC	MATLAB Basics for	0
		Biotechnology researchers	
5.	PMC	Training on Lab Scale	0
		Fermentor	

LIST OF SKILL ORIENTED MINOR COURSES

LIST OF OPEN ELECTIVE COURSES OFFERED FROM BIOTECHNOLOGY

Sl	Category	Name of the Course	Credit
no			
1.	OE	Intellectual Property Rights	3
2.	OE	Biosafety Management	3
3.	OE	Digital Health	3

LIST OF VALUE ADDED COURSES SUGGESTED

Sl	Category	Name of the Course	Components						
no									
1.	PMC	R Program and R Studio for	Employability						
		Biotechnologist							
2.	PMC	Python for Biotechnologist	Employability						
3.	PMC	Training on Hospital's	Research Skill						
		Clinical Research Lab	and Employability						
4.	PMC	Downstream Manufacturing	Employability						
		(Microbial)	•						
1	Notel _ Lecture T _ Tutorial P _ Practical C _ Credit								

NoteL – Lecture, T – Tutorial, P – Practical, C – Credit

Each faculty made presentation on their suggestions on the courses allotted to them before the Board of studies members.

Semester	Credits	Hours / Week	Number of courses
Ι	20	25	8
11	22	27	8
III	25	33	10
IV	19	33	9
V	22	35	10
VI	20	31	8
VII	20	35	10
VIII	18	29	5
I – VIII	166	248	69

Summary of the credits and hours

Year	Semester	Total Credits	Total Hours / Week	No. of courses	Value Addition Suggested
Ι	Ι	20	25	8	No
1	II	22	27	8	No
II	III	25	33	10	Yes
11	IV	19	33	9	Yes
TIT	V	22	35	10	Yes
III	VI	20	31	9	Yes
137	VII	20	35	10	Yes
IV	VIII	18	29	5	Yes
	I – VIII	166	248	69	

				I Seme	ster				
COURS	E COD	E	XMA 101			L	Т	Р	C
COURS	E NAM	IE	Mathemati	ics I (Calculus and	l Linear Algebra)	3	1	0	4
С	P	Α				L	Т	Р	Η
3	0.5	0.5				3	1	0	4
PRERE	QUISI	Г Е: Di	fferentiation	and Integration					
COURS	E OUT	COM	ES:						
Course o	outcom	es:				Dor	nain	I	Level
CO1	Apply	y the o	rthogonal tra	ansformation to red	uce quadratic form	Cog	nitive	Rei	member
	to can	onical	forms.					Ā	Apply
CO2	Apply	y pov	ver series	to tests the con	nvergence of the	U	nitive	Rei	member
	Seque	ences a	ind series an	ndHalf range Fouri	er sine and cosine	Psyche	omotor		Apply
	series	•							huided
									sponse
CO3				composite function	ons and implicit	-	nitive	Rei	member
	functi	ons. E	uler's theorem	m and Jacobian		Psyche	omotor	G	huided
									sponse
CO4	Expla	in the	functions of	two variables by T	Taylor's expansion,	Cog	nitive		member
004					without constraints	005	inti ve		derstand
					rivatives, Gradient,			UII	leistand
			vergence.		iruires, crucient,	Affe	ctive	R	eceive
CO5	-		0	d Integral calcul	us to notions of	Cog	nitive	4	Apply
			nd to imprope	-		008		-	-PP-J
UNIT -I		trices	<u> </u>						12
Linear T	ransfori	nation	- Eigen valu	les and Eigen vecto	ors -Properties of Eig	en value	es and E	igen v	vectors -
					ces – Real Matrices:				
Symmetr	ric and (Orthog	onal Quadrat	tic form – canonica	al form - Nature of Q	uadratic	form a	nd	
Transfor	mation	of Qua	dratic form t	to Canonical form (Orthogonal only).				
UNIT -I	I Seq	uences	s and series						12
Sequence	es: Defi	nition	and example	s-Series: Types and	d convergence- Serie	es of pos	sitive ter	ms – '	Tests of
converge	ence: co	mparis	son test, Integ	gral test and D'Ale	mbert's ratio test F	ourier se	eries: Ha	alf ran	ge sine
and cosir	ne series	s- Pars	eval's Theore	rem.					
UNIT -	Mu	ltivari	able Calculu	is: Partial Differe	ntiation				12
III									
Limits ar	nd conti	nuity -	-Partial differ	rentiation – Total I	Derivative – Partial d	lifferent	iation of	Com	posite
Function	s: Chan	ge of V	Variables – Ľ	Differentiation of an	n Implicit Function -	Euler's	Theorem	m- Jac	obian.
UNIT -	Mu	ltivari	able Calculu	us: Maxima and M	Iinima and Vector	Calculu	S		12
IV									
					ma, Minima of funct				
				's Method of Under	termined Multipliers	– Direc	tional D	erivat	ives -
			and Curl.						
				gral Calculus					12
Evolutes					proper integrals; Beta				
	nerties	Applic	cations of def	finite integrals to ev	valuate surface areas	and vol	lumes of	frevol	lutions.
their pro									
their proj		TURE		TUT	ORIAL		TO	ΓAL	

Text Books:

- 1. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill New Delhi, 11th Reprint, 2015. (Unit-1, Unit-3 and Unit-4).
- 2. N.P. Bali and Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, Reprint, 2014. (Unit-2).
- B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40th Edition, 2010. (Unit-5).

Reference Books:

- 1. G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9th Edition, Pearson, Reprint, 2002.
- 2. Veerarajan T., "Engineering Mathematics for first year", Tata McGraw-Hill, New Delhi, 2008.
- 3. D. Poole, "Linear Algebra: A Modern Introduction", 2nd Edition, Brooks/Cole, 2005.
- 4. Erwin kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.

					Cos vei	bub O		ppmg				
						Grac	luates	s Attrik	outes			
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2			2					1		2
CO2	3	1								1		1
CO3	3	1								1		1
CO4	3	2								1		1
CO5	3	2			1					1		2
Total	15	8	0	0	3	0	0	0	0	5	0	7
Scaled Value	3	2			1					1		
() - No	Relati	ion, 1 -	- Low	v Relati	on, 2-	Mediu	um Rela	ation,	3- High	Relati	on
		1-5	$\rightarrow 1$,		6	- 10 -	→ 2,		11	– 15 –	→ 3	

Cour	seCode		:	XCP102	L	Т	Р	С
Cour	seNam	e	:	PROGRAMMINGFORPROBLEMSOLVING	3	0	0	3
Prere	equisite		:	BasicUnderstandingSkills	L	Т	Р	Η
С	P	Α			3	0	0	3
3	0	0						
Cour	seObje	ctiv	es					
• To	olearnpi	ogr	am	ninglanguagebasicsand syntax				
		-						
• To	oignite 1	ogi	calt	linking				
• To	ounders	tan	lotr	ctured programmingapproach				
• 10	Junuers	tain	1511	ctured programmingapproach				
• To	odealwi	th u	ser	efined datatypes				
				, , , , , , , , , , , , , , , , , , ,				
• To	o knowa	aboi	ıtda	tastorage in secondarymemory				
C	0				•		T	1
		me.	Ajt	erthecompletionofthecourse, studentswillbe Dom	ain		Leve	L
able t					•	•	1	
CO1	Defin		•	gramming fundamentals and <i>Solve</i> Cognit	live	App	bly	
			sım	bleprogramsusingI/O statements				

Cos versus GA mapping

	in simple	programs	using	Cognitive	Understand
	olstructuresandarrays	•	<u> </u>		
CO3 Expla andpo	<i>uin the simple pro</i> pinters	ograms using	functions	Cognitive	Understand
CO4 Expla	iin simple programs usii	ng structures and	lunions	Cognitive	Understand
CO5 Expla	uin simpleprograms usin	gfiles and Build	simpleprojects	Cognitive	Understand
COURSEC	NTENT				
UNIT-I	PROGRAMMINGFU	JNDAMENTAI	LSANDI/OSTA	TEMENTS	9
Introduction	to componentsofa comp	utersystem, Prog	ram–Flowchart	-Pseudo code-	Software
	on to C language – C				
andOperator	s – sample program s	tructure -Heade	r files – Data	Types- Varia	ables - Outpu
statements –	Inputstatements.				
UNIT -II	CONTROLSTRUCT	URE ANDARR	AYS		9
ControlStruc	tures-ConditionalContro	olstatements:Bra	nching,Looping	-	
	alcontrolstructures:switcl		,gotostatements	_	
•	DimensionalArray–Decla				
	n–AccessingArrayEleme	U	U U	•	
	-MatrixOperations-Mul			n–Initialization	n.Storage
	-extern-static.Strings:Ba		strings.		
UNIT -III	FUNCTIONS ANDPO				9
	uilt-infunctions-UserDef				
	stofunctions-Recursion-				
	rationAddressoperator-P				
	Call byReference-Pointer	toarrays-UseofP	ointersitself-ref	erentialstructur	res-
Notionoflink UNIT -IV	STRUCTURESANDU				9
	dUnions-Givingvaluesto		zin astrustures E	mationcondate	-
	cturetoelementstofunctio				
	hin a structureandUnion.	iis-i assingentire		ion s-Anayson	Istructure-
UNIT -V	FILES				9
	FilemanagementinC-F Closingafile-Thegetan FilesandStructures.				
			D		
L	T		P		Total
L 45	T 0		P 0		Total 45
45	0				
45 TEXTBOO 1. ByronG	0	ithC",IIIEdition,	0		45
45 TEXTBOO	0 KS	ithC",IIIEdition,	0		45
45 TEXTBOO 1. ByronG 010 2. Yeshwa	0 KS ottfried,"Programmingw ntKanethker, "LetusC",E		0 (IndianAdapted		45
45 TEXTBOO 1. ByronG 010 2. Yeshwa	0 KS ottfried,"Programmingw ntKanethker, "LetusC",E		0 (IndianAdapted		45
45 TEXTBOO 1. ByronG 010 2. Yeshwa REFERENG	0 KS ottfried,"Programmingw ntKanethker, "LetusC",E	3PBPublications	0 (IndianAdapted ,2008	Edition),TMH	45
45 TEXTBOO 1. ByronG 010 2. Yeshwa REFERENC 1. E.Balag	0 KS ottfried,"Programmingw ntKanethker, "LetusC",E CEBOOKS	3PBPublications	0 (IndianAdapted ,2008	Edition),TMH	45
45 TEXTBOO 1. ByronG 010 2. Yeshwa REFERENC 1. E.Balag 2. BrianW	0 KS ottfried,"Programmingw ntKanethker, "LetusC",E CEBOOKS uruswamy, Programming	3PBPublications ginANSIC,TataN	0 (IndianAdapted ,2008 //cGraw-Hill,7 th	Edition),TMH	45
45 TEXTBOO 1. ByronG 010 2. Yeshwa REFERENO 1. E.Balag 2. BrianW DennisM	0 KS ottfried, "Programmingw ntKanethker, "LetusC", E CEBOOKS uruswamy, Programming Kernighanand I.Ritchie, "TheCProgram	BPBPublications ginANSIC,TataMumingLanguage"	(IndianAdapted ,2008 //cGraw-Hill,7 th ,PearsonEducati	Edition),TMHj edition2017. onInc.2005	45
45 TEXTBOO 1. ByronG 010 2. Yeshwa REFERENC 1. E.Balag 2. BrianW DennisM 3. Johnson	0 KS ottfried,"Programmingw ntKanethker, "LetusC",E CEBOOKS uruswamy, Programming Kernighanand	BPBPublications ginANSIC,TataM mingLanguage" oplicationsProgr	(IndianAdapted ,2008 //cGraw-Hill,7 th ,PearsonEducati	Edition),TMHj edition2017. onInc.2005	45
45 TEXTBOO 1. ByronG 010 2. Yeshwa REFERENC 1. E.Balag 2. BrianW DennisM 3. Johnson IIIEditio	0 KS ottfried,"Programmingw ntKanethker, "LetusC",E CEBOOKS uruswamy, Programming Kernighanand A.Ritchie,"TheCProgram baughR.andKalinM.,"Ap on,Pearson EducationInd	BPBPublications ginANSIC,TataM mingLanguage" oplicationsProgr	(IndianAdapted ,2008 //cGraw-Hill,7 th ,PearsonEducati	Edition),TMHj edition2017. onInc.2005	45
45 TEXTBOO 1. ByronG 010 2. Yeshwa REFERENC 1. E.Balag 2. BrianW DennisM 3. Johnson IIIEditic E-REFERE	0 KS ottfried,"Programmingw ntKanethker, "LetusC",E CEBOOKS uruswamy, Programming Kernighanand A.Ritchie,"TheCProgram baughR.andKalinM.,"Ap on,Pearson EducationInd	BPBPublications ginANSIC,TataM mingLanguage" oplicationsProgr ia,2003	(IndianAdapted ,2008 McGraw-Hill,7 th ,PearsonEducati amminginANSI	Edition),TMHj edition2017. onInc.2005 C",	45
45 TEXTBOO 1. ByronG 010 2. Yeshwa REFERENC 1. E.Balag 2. BrianW DennisM 3. Johnson IIIEditic E-REFERE 1. https://w	0 KS ottfried, "Programmingw ntKanethker, "LetusC", E CEBOOKS uruswamy, Programming Kernighanand I.Ritchie, "TheCProgram baughR.andKalinM., "Ap on, Pearson EducationInd NCES	BPBPublications ginANSIC,TataM umingLanguage" oplicationsProgr ia,2003 gramming/questi	0 (IndianAdapted ,2008 McGraw-Hill,7 th ,PearsonEducati amminginANSI	Edition),TMHj edition2017. onInc.2005 C",	45
45 TEXTBOO 1. ByronG 010 2. Yeshwa REFERENC 1. E.Balag 2. BrianW DennisM 3. Johnson IIIEditic E-REFERE 1. https://w 2. https://w	0 KS ottfried, "Programmingw ntKanethker, "LetusC", E CEBOOKS uruswamy, Programming Kernighanand I.Ritchie, "TheCProgram baughR.andKalinM., "Ap on, Pearson EducationInd NCES www.indiabix.com/c-prog	BPBPublications ginANSIC,Tata mingLanguage" oplicationsProgr ia,2003 gramming/questi ogramming-lang	0 (IndianAdapted ,2008 McGraw-Hill,7 th ,PearsonEducati amminginANSI	Edition),TMHj edition2017. onInc.2005 C",	45

				Μ	lappin	g of C	CO's	with P	'0 :					
			PROGRAM OUTCOMES											
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	0	0	3	0	0	0	0	0	2	3	2	0
CO2	3	2	0	0	2	0	0	0	0	0	2	3	2	0
CO3	2	2	1	2	2	0	0	0	0	0	2	2	2	0
CO4	2	2	1	2	2	0	0	0	0	0	2	2	2	0
CO5	2	2	1	0	2	0	0	1	0	2	2	2	2	0
Total	12	10	3	4	11	0	0	1	0	2	10	12	10	0
ScaledValue	3	2	1	1	3	0	0	1	0	1	2	3	2	0
		1 –	$5 \rightarrow 1$	l ,		6 –	10 -	×2,		11	- 15 -	$\rightarrow 3$		
	()-NoR	elatio	n,1-I	Low Re	elatior	n,2-M	edium	Relat	ion,3-H	lighR	elation	n	

COUH	RSE CODE	XAP103	L	Т]	P	С	
	RSE NAME	APPLIED PHYSICS FOR ENGINEERS	3	1	(*	4	
	C:P:A	2.8:0.8:0.4	L	Т]	P	Н	
PRERI	EQUISITE:	Basic Physics in HSC level	3	1	(0	4	
COUR	SE OUTCON	MES	Do	main		L	evel	
CO1		basics of mechanics, <i>explain</i> the principles of	Cog	nitive	:		ember, erstand	
	•	nd <i>determine</i> its significance in engineering	Darrah	~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~				
000		technological advances.	Psych				hanism	
CO2		he laws of electrostatics, magneto-statics and	Cog	nitive			ember,	
		etic induction; <i>use</i> and <i>locate</i> basic applications	D 1				alyze,	
	of electroma	gnetic induction to technology.	Psych		ctive:		hanism	
							spond	
CO3		the fundamental phenomena in optics by	Cog	nitive	: :		Understand,	
		at and <i>describe</i> the working principle and					pply	
	application of	of various lasers and fibre optics.	Psych				Mechanism	
				ctive			ceive	
CO4	-	gy bands in solids, <i>discuss</i> and <i>use</i> physics	Cog	nitive	:	Unde	erstand,	
	principles of	f latest technology using semiconductor devices.					alyze	
			Psych			Mec	hanism	
			Affe	ective	:	Re	ceive	
CO5		Knowledge on particle duality and inger equation for simple potential.	Cog	nitive	:		erstand, pply	
UNIT -		CS OF SOLIDS				9+		
conserva	ation of energy	Newton's laws of motion - work and energy - impuls and momentum - Friction. rain - Hooke's law - Stress strain diagram - Classific				•		
		orsion pendulum - Applications of torsion pendulum						
		g's modulus: Uniform bending and non-uniform bending		0		I		
		MAGNETIC THEORY	0			9+	3	
		- Electrostatic field and potential of a dipole; Dielect						
		sMossotti Equation - Laws of magnetism - Ampere's F omagnetic waves; their transverse nature - expression						
	d light - quar	ter and half wave plates - production and detection						

UNIT -III OPTICS, LASERS AND FIBRE OPTICS

9+3

8th BOS/BIOTECH/Date: 19.08.2021

Optics: Dispersion- Optical instrument: Spectrometer - Determination of refractive index and dispersive power of a prism- Interference of light in thin films: air wedge - Diffraction: grating.

LASER: Introduction - Population inversion -Pumping - Laser action - Nd-YAG laser - CO₂ laser - Applications **Fibre Optics:** Principle and propagation of light in optical fibre - Numerical aperture and acceptance angle - Types of optical fibre - Fibre optic communication system (Block diagram).

UNIT –IV SEMICONDUCTOR PHYSICS

9+3

Semiconductors: Energy bands in solids - Energy band diagram of good conductors, insulators and semiconductors - Concept of Fermi level - Intrinsic semiconductors - Concept of holes - doping - Extrinsic semiconductors - P type and N type semiconductors - Hall effect.

Diodes and Transistors: P-N junction diode - Forward bias and reverse bias - Rectification action of diode - Working of full wave rectifier using P N junction diodes - PNP and NPN transistors - Three different configurations - Advantages of common emitter configuration - working of NPN transistor as an amplifier in common emitter configuration.

UNIT –V QUANTUM PHYSICS

9+3

Introduction to quantum physics, black body radiation, Compton effect, de Broglie hypothesis, wave – particle duality, uncertainty principle, Schrodinger wave equation (Time dependent and Time independent), particle in a box, Extension to three dimension - Degeneracy.

TEXT BOOKS

1. Gaur R. K. and Gupta S. L., "Engineering Physics", Dhanpat Rai Publications, 2009.

2. Avadhanulu M. N. "Engineering Physics" (Volume I and II), S. Chand & Company Ltd., New Delhi, 2010. **REFERENCE BOOKS**

- 1. Palanisamy P. K., "Engineering Physics", Scitech Publications (India) Pvt. Ltd, Chennai.
- 2. Arumugam M., "Engineering Physics" (Volume I and II), Anuradha Publishers, 2010.
- 3. Senthil Kumar G., "Engineering Physics", 2nd Enlarged Revised Edition, VRB Publishers, Chennai, 2011.
- 4. Mani P., "Engineering Physics", Dhanam Publications, Chennai, 2007.

E RESOURCES

NPTEL, Engineering Physics, Prof. M. K. Srivastava, Department of Physics, IIT, Roorkee.

	LECTURE	TUTORIAL	PRACTICAL	TOTAL HOURS
Hours	45	15	-	60

Mapping of CO's with PO:

			PROGRAM OUTCOMES											
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	2	2	1	-	-	-	1	-	-	1		
CO2	3		1		1	-	-	-		-	-	1		
CO3	3	2	2	2	1	-	-	-	1	-	-	1		
CO4	3	2	2	2	1	-	-	-	1	-	-	1		
CO5	3		2			-	-	-		-	-	1		
CO6														
Total	15	6	9	6	4				3			5		
ScaledValue	3	2	2	2	1	-	-	-	1	-	-	1		
		1 –	$5 \rightarrow 1$	l,		6 –	10 -	> 2,		11	- 15 -	$\rightarrow 3$		
	()-NoR	elatio	n,1-I	Low R	elation	n,2-M	ledium	Relat	ion,3-H	lighR	elatio	n	

X	BT1	04		`L	Т	Р	С
С	Р	Α	BIOLOGY FOR ENGINEERS	3	0	0	3
	•	•			-	-	
3	0	0		L	Т	P	H
				3	0	0	3

	outcome	Domain	Level
CO1			
CO1	<i>Describe</i> how biological observations of 18th Century that lead to major discoveries.	Cognitive	Understand
CO2	<i>Explain</i> the cell morphology and their functions	Cognitive	Understand
CO2 CO3	<i>Explain</i> the Cent morphology and their functions <i>Explain</i> the Human anatomy and Physiology	Cognitive	Understand
CO4	Recall the types of Tissue and its functions	Cognitive	Understand
CO4 CO5	Illustrate the essential of Amino Acids DNA/RNA	Cognitive	Understand
UNIT I	Introduction	Cognitive	6
UNIT II		we need to st discoveries I by referring to	udy biology? - Examples from o the original 9
	Introduction to the cell biology – Cell size and shape - Che of cell and its properties; structure of Cell membrane and co signaling, Transport across cell membrane		es; Cell cycle; Ce
UNIT II	I Human physiology and anatomy Introduction to Human Anatomy and Physiology-Anat Organization of the Human Body-Skin and the Integum Muscular Systems -Nervous System-Cardiovascular Sy System-Respiratory System- Digestive System -Urinary System	entary System- /stem -Lympha	- Skeletal System
UNIT IV		stem	9
UNIT V	Principles and Application of Biosensor; Basics of Biochip – Bio fuel – Introduction to Bio mechanics - Neural Netw		
	Stem Cell; Introduction to Genetics; Genetic Engineerin		-
	Hazardous Effect.		lication, Biosafet
	Hazardous Effect. LECTURE TUTORIAL		lication, Biosafer
Text Bo	Hazardous Effect. LECTURE TUTORIAL 45 0		lication, Biosafet
1. B S 2. D D	Hazardous Effect. LECTURE TUTORIAL 45 0 bks: 0 iology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd or. Sohini Singh and Dr. Tanu Allen, "Biology for Engineers", Velhi, 2014. Velhi, 2014.	g and its App	lication, Biosafer TOTAL 45 , L.; Wasserman,
1. B S 2. D D Reference 1. C 2. P C 3. N	Hazardous Effect. LECTURE TUTORIAL 45 0 oks: 0 iology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd or. Sohini Singh and Dr. Tanu Allen, "Biology for Engineers", V	g and its App , Lisa; Cain, M, /ayu Education Doi, R.H., Joh ox, M. M.W.H.	lication, Biosafe TOTAL 45 , L.; Wasserman, of India, New n Wiley and Sons Freeman and
1. B S 2. D D Reference 1. C 2. P C 3. M D 4. M	Hazardous Effect. LECTURE TUTORIAL 45 0 obss: 0 iology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd or. Sohini Singh and Dr. Tanu Allen, "Biology for Engineers", Velhi, 2014. Biology: State outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; rinciples of Biochemistry (V Edition), By Nelson, D. L.; and Company folecular Genetics (Second edition), Stent, G. S.; and Calender, Distributed by Satish Kumar Jain for CBS Publisher ficrobiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2 Dublishers	g and its App , Lisa; Cain, M, /ayu Education Doi, R.H., Joh ox, M. M.W.H. R.W.H. Freem	Iication, Biosafer TOTAL 45 , L.; Wasserman, of India, New n Wiley and Sons Freeman and an and company,
S 2. D D Reference 1. C 2. P C 3. M D 4. M P	Hazardous Effect. LECTURE TUTORIAL 45 0 oks: 0 iology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd or. Sohini Singh and Dr. Tanu Allen, "Biology for Engineers", Velhi, 2014. See Books: outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; rinciples of Biochemistry (V Edition), By Nelson, D. L.; and Company folecular Genetics (Second edition), Stent, G. S.; and Calender, pistributed by Satish Kumar Jain for CBS Publisher ficrobiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2	g and its App , Lisa; Cain, M, /ayu Education Doi, R.H., Joh ox, M. M.W.H. R.W.H. Freem	lication, Biosafe TOTAL 45 , L.; Wasserman, of India, New n Wiley and Sons Freeman and an and company,

Online References:

- 1. <u>www.bio12.com/ch3/RaycroftNotes.pdf</u>
- 2. www.engineering.uiowa.edu/bme050/cvb-solids.pdf
- 3. www.biologyjunction.com/mendelian_genetics.html

Mapping Of Course Outcomes with Program Outcomes

			PROGRAM OUTCOMES											
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	2	2	3	1	2	1	2	2	3	0	1	1
CO2	2	3	2	2	3	2	2	1	1	2	3	1	1	1
CO3	2	2	1	1	3	2	2	1	1	2	3	1	0	1
CO4	3	2	1	2	3	2	2	1	1	2	3	0	1	1
CO5	3	3	2	3	3	2	3	1	1	2	3	0	1	2
Original	14	14	9	11	17	10	12	6	7	10	16	3	5	7
Value		1.			17	10	12	Ŭ		10	10	5	5	,
Scaled	3	3	2	3	3	2	3	2	2	2	3	1	1	2
Value	3	3	4	3	3	4	3	4	4	4	3	I	L	2
			1	l – 5	$\rightarrow 1$,	6 –	$10 \rightarrow$	2, 1	1 - 15	$5 \rightarrow 3$				
	0 -]	No Re	lation,	1 - I	Low Re	lation,	2- M	edium	Relati	ion, 3- H	ligh R	Relatio	n	

	XGS1	105		Speech Commur	nication			L 0	Т 0	P 3	SS 0	C 3
С	P	Α						L	Т	Р	SS	Η
2.6	0.4	0						0	0	3	0	3
Cours	se Ou	tcomes	: After	r completion of the course, stu	dents will l	be able	Dom	ain		т	evel	
to					<u> </u>			am				
CO1				the types of speeches		Cognitiv			R	eme	mber	
CO2		11 0		iques in public speaking		Cognitiv				App	-	
CO3				nmon patterns in organizing a s	speech	Cognitiv	/e		R	eme	mber	
CO4	0	Construc	the na	ature and style of speaking		Cognitiv	/e			Crea	ate	
CO5		Practicing	g the sp	peaking skills		Psychon	notor	G	uideo	l Res	ponse	;
UNIT				f Speeches							9	
1.1 -	Four	types of	of spee	eches- 1.2 – Analyzing the a	audience-1.3	3 - Deve	elopin	g ide	eas a	ind s	uppor	rting
materi	ials											
UNIT	' –II	P	ublic S	Speaking							9	
2.1 - I	ntrod	uction to	Public	c Speaking								
2.2 - 0	Compo	etencies	Neede	d for successful speech making	5							
2.3 - 3	Speak	ing abou	t every	yday life situations								
UNIT				ation of Speech							9	
3.1 –	Deve	loping a	speec	h out line - 3.2 - Organizing	g the speech	n- 3.3 – I	Introd	uctic	on - (deve	lopme	nt –
conclu	ision											
UNIT			resent								9	
				e draft speech								
				ues using ICT tools								
4.3 – 1	Using	example	es from	n different sources								
UNIT			ctivitie								9	
5.1 – I	Readi	ng activi	ties -5	.2 – Creative presentations -5.3	3 – Media pi	resentatio	on tec	nniqu	les			
	LEC	TURE		TUTORIAL	PRAC	CTICAL				T	OTAI	
		0		0		45					45	
				23		8 th BOS	S/BIO	ГЕС	H/Da	te: 1	9.08.2	2021

Suggested Readings: (i) Michael Swan. *Practical English Usage*. OUP. 1995 (ii) Sanjay Kumar and Pushp Lata. *Communication Skills*. Oxford University Press. 2011

						PR	OGR	AM C	OUTC	COMES	5			
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	0	0	0	0	0	2	0	1	0	0	0	0	0
CO2	2	0	0	0	0	0	2	0	1	0	0	0	0	0
CO3	1	0	0	0	0	0	1	0	1	0	0	0	0	0
CO4	2	0	0	0	0	0	1	0	1	0	0	0	0	0
CO5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	7	0	0	0	0	0	6	0	4	0	0	0	0	0
ScaledValue	2	0	0	0	0	0	2	0	1	0	0	0	0	0
		1	$-5 \rightarrow$	• 1.		6 -	10 -	> 2,		11	- 15	$\rightarrow 3$		

XU	U M 1	06		CONSTRUCTON OF			L	T	P	C
С	Р	•		CONSTITUTION OF	INDIA		0 L	0 T	0 P	0 H
<u> </u>	<u>г</u> 0	A 0					<u>L</u> 3	<u> </u>	r	<u>п</u> 3
	, v	v	nes: After	completion of the course, stu	dents will be ab	le to I)oma	<u> </u>	v	Level
CO				f Constitution.		Cognitive				derstand
CO	2	Exp	lain the Uni	on Executive		Cognitive	e		Un	derstand
CO	3	Iden	tify the con	cept of Union Legislature		Cognitive	e		Un	derstand
CO	4	Ana	lysis the Un	ion Judiciary		Cognitive	e		A	analyse
CO	5	Exp	lain the Cer	tre State Relation		Cognitive	e		Un	derstand
Cou	ırse (Conte	ent							Hours
UN	IT-I									9
Con	stitut	ional	History- Th	e Constitutional Rights- Pream	ble- Fundament	al Rights-	Func	lame	ntal I	Juties-
		1	iples of Stat	te Policy.						
	IT –I									9
				President of India (powers an	nd functions)- V	ice-Presid	ent o	f Ind	ia-Th	e Council
			ime Ministe	er- Powers and Functions.						
	IT-II									9
				ure and Functions of Lok S idia- Important Committees of						7a Sabha-
	IT-IN			and important commutees of	Lok Subilit Sp			<u>L Duo</u>	iiu.	9
			iciary- Pow	ers of the Supreme Court- Ori	ginal Jurisdiction	n- Appelet	e juri	sdict	ions-	Advisory
			dicial revie	1		11	5			5
UN	IT-V									9
				ical Parties- Role of governor, p		ons of Chi	ef Mi	niste	r-Leg	islative
Asse				Powers and Functions of the Hi						
	LE	CTU	RE	TUTORIAL	PRACTI	CAL		T	TOTA	۱L
		45		0	0				45	
		E NCI Iorris		vernment and politics of India	. NewDelhi, B 1	Publisher	s. 19′	74.		
				al Government in India, Bom						
				ment and politics of India, Lo	•	-	, -			

4. B.C.Rout- Democractic Constitution of India.

5. Gopal K.Puri- Constitution of India, India 2005.

Mapping Of Course Outcomes with Program Outcomes

						PR	OGR	AM C	DUTC	COMES	5			
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	0	0	1	0	0	0	0	0	0	0	0	0	0
CO2	2	0	0	1	0	0	0	0	0	0	0	0	0	0
CO3	2	0	0	1	0	0	0	0	1	0	0	0	0	0
CO4	2	0	0	1	0	0	0	1	1	0	0	0	0	0
CO5	2	2	0	1	0	0	0	1	1	0	0	0	0	0
Total	10	2	0	5	0	0	0	2	3	0	0	0	0	0
Scaled value	2	1	0	1	0	0	0	1	1	0	0	0	0	0
	•	•	1 -	$5 \rightarrow$	1,	6 - 10	$\rightarrow 2$, 11	- 15	$\rightarrow 3$	•	•	•	•

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

COUF	RSECC	DDE	XCP107		L	Т	Р	С
COUF	RSENA	ME	Programming For ProblemSolvingLaboratory		0	0	1	1
PRER	EQUI	SITES	BasicUnderstandingSkills		L	Т	Р	Н
С	Р	Α			0	0	2	3
0.75	1	0.25			U	U	4	3
LEAR	NING	OBJEC	TIVES					
• To	learnpr	ogramn	ninglanguagebasicsand syntax					
• To	ignitelo	ogicalthi	nking					
• To	underst	tandstru	ctured programmingapproach					
• To	dealwit	huserde	fined datatypes					
• To	knowa	lboutdat	astorage in secondarymemory					
COUF	RSEOU	JTCOM	IES	DC	MAI	Ν	LEV	EL
CO1	Solve	simpler	programs using I/Ostatements	Cog	gnitive	e A	Apply	
				Psy	como	tor F	Respon	nd
CO2	Solve	program	ns usingcontrolstructuresandarrays	Cog	gnitive	e A	Apply	
				Psy	como	tor F	Respor	nd
CO3	Solve	program	ns usingfunctionsandpointers	U 0	gnitive		Apply	
				•	como		Respon	nd
CO4	Solve	program	ns usingstructures		gnitive		Apply	
					como		Respon	nd
CO5	Solve	program	ns usingfiles		gnitive		Apply	
				Psy	como	tor F	Respon	nd

S.No.	ListofExp	eriments		COs
1	ProgramtodisplayaLeave Letterasper	properformat		CO1
2	i. Programforaddition oftwonumbeii. Programtosolveanymathematical			CO1
3	Programtofindgreatestof3numbersusin	ngBranchingStat	ements	CO2
4	Programtodisplaydivisiblenumbersber Statement	tweenn1andn2us	singlooping	CO2
5	Programtosearchanarrayelementinana	rray.		CO2
6	Programtofindlargest/smallestelement	tinanarray.		CO2
7	Programtoperformstringoperations.			CO3
8	Programtofind areaof a rectangle of ag types.	iven numberuse	fourfunction	CO3
9	Programstopassandreceivearrayandpo types	intersusingfourf	unction	CO3
10	ProgramsusingRecursion forfindingfa	ctorial ofanumb	er	CO3
11	Programtoreadanddisplaystudentmark Withvariables	sheetofastudent	structures	CO4
12	Programtoreadanddisplaystudentmark Witharrays	sofaclassusings	ructures	CO4
13	Programtocreatelinked listusingstruct	ureswithpointers		CO4
14	Programforcopyingcontents of one file	to anotherfile.		CO5
15	Programusingfilestostoreanddisplayst Structureswith array	udentmarklistof	aclass using	CO5
	HOURS	TUTORIAL	PRACTICAL	TOTAL
	HOURS	0	30	30

MappingofCOwithPO's

						PR	OGR	AM C	OUTC	COMES	5			
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	0	0	3	0	0	0	0	0	2	3	2	0
CO2	3	2	0	0	2	0	0	0	0	0	2	3	2	0
CO3	2	2	1	2	2	0	0	0	0	0	2	2	2	0
CO4	2	2	1	2	2	0	0	0	0	0	2	2	2	0
CO5	2	2	1	0	2	0	0	1	0	2	2	2	2	0
Total	12	10	3	4	11	0	0	1	0	2	10	12	10	0
ScaledValue	3	2	1	1	3	0	0	1	0	1	2	3	2	0
		1 –	$5 \rightarrow 1$,		6 –	10	× 2,		11	- 15 -	$\rightarrow 3$		
	()-NoR	elatio	n,1-I	Low Re	elatior	n,2-M	edium	Relat	ion,3-H	lighR	elatio	1	

				-										-			
		SE COI			P108								L	'	Т	Р	С
C	OURS	SE NAN	1E		PLIE BOR			5 FOR	ENG	INEEI	RS		0		0	2	2
	С	:P:A		0:2	:0								L	'	Т	Р	Н
PR	ERE	QUISI	ГЕ:	Ba	sic Pł	nysics	s in HS	SC lev	vel				0		0	3	3
COU	JRSI	E OUT	CON	IES									Do	mai	in]	Level
CO		Determ systems			•				y in	engine	eering	^g P	sycho	mot	tor:	Me	chanism
CO		use ar			-				elec	troma	gnetic	: P	sycho	mot	tor:	Me	chanism
		induction									0		Affec				espond
CO		<i>Descril</i> lasers a				princi	ple and	d appl	icatio	on of va	arious	s P	sycho	mot	tor:	Me	chanism
CO		<i>use</i> pl semico					of lat	est to	echno	ology	using	^g P	sycho	mot	tor:	Me	chanism
							LA	BOR	ATO	RY							
1.	Tors	sional Pe	endul	um - ċ	leterm	inatio					l rigid	ity m	odulus	of	the g	given n	naterial of
	the v	wire.										-					
2.		form Be															
3.		-Unifor												l of	the b	beam.	
4.		er Bridg											e wire.				
5.		ctromete															
6.		ctromete									irs in l	Hg so	urce u	sing	g grat	ting.	
7.		wedge -						-									
8.		er - Dete er gratin		ation of	of wav	veleng	th of gi	iven la	ser so	urce an	d size	of th	e givei	n mi	icro	particl	eusing
9.		t office I		Deter	minati	ion of	band g	ap of a	a give	n semic	conduc	ctor.					
10.	PN .	Junction	Dio	le - De	etermi	natio	n of V-	I chara	cteris	tics of t	he giv	ven di	ode.				
REF	ERE	NCE BO	OOK	S:													
1	. Sa	amir Kui			"A te	xt boo	ok of A	dvance	ed Pra	ctical F	Physic	s", N	ew Cei	ntral	l Ag	ency (I	P) Ltd,
)08.					~ ~		~			_		_			
		rora C.I			•				•	•						2012	
3	3. Ui	mayalSu					·							U			
			LE	CTU	RE	Т	UTOR	IAL	P	RACT	ICAL	,	Т	TOT		HOUI	RS
	H	ours		0			0			30					3	0	
			N	Iapp	ing O	f Co	urse O			ith Pr	0			es			
								PR	OGR	AM O	OUTC		ES				
			1	2	3	4	5	6	7	8	9	10	11		12	PSO1	PSO2
CC			3	2	2	2	1	-	-	-	1	-	-		1		
CC			3	2	1	2	1	-	-	-	1	-	-	-	1		
CC			3	$\frac{2}{2}$	2	2	1	-	-	-	1	-	-	-	1		

	L	ECTU	RE	Т	UTOR	RIAL	P	PRACT	ICAL		TO	TAL	HOUR	5
Hours		0			0			30)			3	0	
	Ι	Aapp	ing O	f Co	urse C	Outcor	nes w	vith Pr	ogran	n Outo	comes	5		
						PR	OGR	RAM (DUTC	OMES	5			
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	2	2	1	-	-	-	1	-	-	1		
CO2	3		1		1	-	-	-		-	-	1		
CO3	3	2	2	2	1	-	-	-	1	-	-	1		
CO4	3	2	2	2	1	-	-	-	1	-	-	1		
Total	12	6	7	6	4				3			5		
ScaledValue	3	2	2	2	1				1			1		
		1 –	$5 \rightarrow 1$	1,		6 –	10 -	> 2,		11	- 15 -	$\rightarrow 3$		
	()-NoR	elatio	n,1-I	Low R	elatio	n,2-M	ledium	Relati	on,3-H	IighR	elatio	n	

II Semester

Variable	XM	URSE	CODE	COURSE N	AME	L	Т	Р	С
P A L T P H 0.5 0.5 0.5 3 1 0 4 REREQUISTE: Mathematics I (Calculus and Linear Algebra) DOMAIN Domain Level Additional trained and triple integrals and to find line, surface and volume of an integral by Applying Greens, Gauss divergence and Stokes theorem. Domain Level Apply OULSEE OUTCOMES: Domain Level Solve Second order differential equations with variable cognitive avious methods. Of Solve Second order ordinary differential equations with variable cognitive apply couchy arouse methods. Of Solve Second order ordinary differential equations and to findharmonic functions and harmonic conjugate. Conformal mapping of translation and rotation. Mobius theorem. Taylor of an integrals (Cartesian) Apply Cauchy residue theorem to evaluate contour integrals involving sine and cosine functions, singularities, Laurent's series. Apply Cauchy residue theorem to evaluate Cauchy integral formula, Liouvilles theorem. Taylor Multivariable Calculus (Integration) 12 Mit Multivariable Calculus (Integration)		A201			rdinary Differential Equations and Complex	3	1	0	4
0.5 0.5 3 1 0 4 REREQUISTIE: Mathematics I (Calculus and Linear Algebra) OURSE OUTCOMES: OURSE OUTCOMES: Domain Level OI Find double and triple integrals and to find line, surface and volume of an integral by Applying Greens, Gauss divergence and Stokes theorem. Cognitive Apply O2 Solve first order differential equations of different types which are cognitive coefficients using various methods. O3 Solve Second order ordinary differential equations and to findharmonic functions and harmonic conjugate. Conformal mapping of translation and rotation. Mobius transformation. Cognitive Cognitive Response Apply Cauchy residue theorem to evaluate contour integrals involving sine and cosine function and to state Cauchy integral formula, Liouvilles theorem. Cognitive Receive Receive Response Apply Cauchy residue theorem to evaluate Cauchy integral formula, Liouvilles theorem. Affective Receive Receives. ant 1 Multivariable Calculus (Integration) 12 Affective Receive Receive Receive Receive Receive Receive Receive Receive Receives. ant 1 Multivariable Calculus (Integration) 12 Cogni	С	Р	Α	v al lable		L	Т	Р	Н
REREQUISITE: Mathematics I (Calculus and Linear Algebra) OURSE OUTCOMES: Domain Level OIN Find double and triple integrals and to find line, surface and volume of an integral by Applying Greens, Gauss divergence and Stokes theorem. Domain Level O2 Solve first order differential equations of different types which are solvable for p, y, x and Clairaut's type. Cognitive Apply O3 Solve first order differential equations and to findharmonic functions and harmonic conjugate. Cognitive Apply Conformal mapping of translation and rotation. Mobius transformation. Cognitive Apply Guided Response Apply Cauchy residue theorem to evaluate contour integrals involving sine and cosine functions, singularities, Laurent's series, zeros of analytic functions, singularities, Laurent's arises. Affective Receive Receive arises arises. nti 1 Multivariable Calculus (Integration) 12 Nultivariable Calculus (3	0.5	0.5						
OURSE OUTCOMES: Domain Level OI Find double and triple integrals and to find line, surface and volume of an integral by Applying Greens, Gauss divergence and Stokes theorem. Cognitive solvable for p, y, x and Clairaut's type. Cognitive Cognitive solvable for p, y, x and Clairaut's type. Cognitive coefficients using various methods. Apply O3 Solve Second order ordinary differential equations with variable coefficients using various methods. Cognitive Apply Apply O4 Use CR equations to verify analytic functions and to findharmonic functions and harmonic conjugate. Conformal mapping of translation and rotation. Mobius transformation. Cognitive Apply Remember Apply O5 Apply Cauchy residue theorem to evaluate contour integrals involving sine and cosine function and to state Cauchy integral formula, Liouvilles theorem. Taylor's series, zeros of analytic functions, singularities, Laurent's series. Cognitive Affective Affective Receive nit I Multivariable Calculus (Integration) 12 Uultiple Integrals (Cartesian) to pollar) - Triple integrals (Cartesian), Scalar line integrals - vector lin tegrals - scalar surface integrals - vector surface integrals - Theorems of Green, Gauss and Stokes. 12 nit II First order ordinary differential equations of bigher orders 12 acat - linear differential equations of bigher orders 12	PRF	EREOI	JISITE: N	Aathematics I	(Calculus and Linear Algebra)				
Dourse outcomes: Domain Level O1 Find double and triple integrals and to find line, surface and volume of an integral by Applying Greens, Gauss divergence and Stokes theorem. Cognitive Apply Remember O2 Solve first order differential equations of different types which are solvable for p, y, and Clairaut's type. Cognitive Apply O3 Solve Second order ordinary differential equations with variable coefficients using various methods. Cognitive functions and harmonic conjugate. Cognitive Conformal mapping of translation and rotation. Mobius transformation. Cognitive Psychomo tor Apply O5 Apply Cauchy residue theorem to evaluate contour integrals involving sine and cosine function and to state Cauchy integral formula, Liouvilles theorem. Taylor's series, zeros of analytic functions, singularities, Laurent's series. Affective Receive nit 1 Multivariable Calculus (Integration) 12 tultiple Integration: Double integrals (Cartesian) - change of order of integration in double integrals vector line tegrals - scalar surface integrals - vector surface integrals - Theorems of Green, Gauss and Stocks. 12 taxact - linear and Bernoulli's equations - Euler's equations - Equations not of first degree: equation dvable for p - equations solvable for y - equations solvable for x and Clairaut's type. 12 taxact - linear and Bernoulli's equations - Luer's equations - Bessel functions of the first kin		-							
O1 Find double and triple integrals and to find line, surface and volume of an integral by Applying Greens, Gauss divergence and Stokes theorem. Cognitive solvable for p. y. x and Clairaut's type. Cognitive Solve first order differential equations of different types which are solvable for p. y. x and Clairaut's type. Cognitive Solve Second order ordinary differential equations with variable coefficients using various methods. Cognitive Cognitive Apply Apply O4 Use CR equations to verify analytic functions and to findharmonic functions and harmonic conjugate. Conformal mapping of translation and rotation. Mobius transformation. Cognitive Apply Sychomo tor Remember Apply O5 Apply Cauchy residue theorem to evaluate contour integrals involving sine and cosine function and to state Cauchy integral formula, Liouvilles theorem. Taylor's series, zeros of analytic functions, singularities, Laurent's series. Cognitive Affective Apply Nultiple Integration: Double integrals (Cartesian) - change of order of integration in double integrals hange of variables (Cartesian to polar) - Triple integrals (Cartesian), Scalar line integrals - vector lint tegrals - scalar surface integrals - vector surface integrals - Theorems of Green, Gauss and Stokes. 12 Nultiple Integration: Double integrals or bligher orders 12 scatc - linear and Bernoull's equations - Luler's equations - Equations not of first degree: equation lavable for p - equations solvable for y- equations solvable for x and Clairaut's type. 12 nit -II Ordinary differentia						Domain		Lev	el
of an integral by Applying Greens, Gauss divergence and Stokes theorem. Remember Remember O2 Solve first order differential equations of different types which are solvable for p. y. x and Clairaut's type. Cognitive Apply O3 Solve Second order ordinary differential equations with variable coefficients using various methods. Cognitive Apply O4 Use CR equations to verify analytic functions and to findharmonic functions and harmonic conjugate. Conformal mapping of translation and rotation. Mobius transformation. Cognitive Psychomo tor Remember Apply O5 Apply Cauchy residue theorem to evaluate contour integrals involving sine and cosine function and to state Cauchy integral formula, Liouvilles theorem. Taylor's series, zeros of analytic functions, singularities, Laurent's series. Cognitive Affective Apply nit -I Multivariable Calculus (Integration) 12 Affective Receive time resides. nit-I Multivariable Calculus (Integration) 12 Affective Receive time resides. 12 Iultiple Integration: Double integrals. Cortex surface integrals - Vector	CO			ble and triple	integrals and to find line, surface and volume				-
solvable for p, y, x and Clairaut's type. Image: Construct of the second order ordinary differential equations with variable constructions and harmonic conjugate. Construct of the second order ordinary differential equations and to findharmonic functions and harmonic conjugate. Conformal mapping of translation and rotation. Mobius transformation. Conformal mapping of translation and rotation. Mobius transformation. Remember Apply Guided to response to evaluate contour integrals involving sine and cosine function and to state Cauchy integral formula, Liouvilles theorem. Cognitive residue theorem. Apply Cauchy residue theorem. Apply could be the to the evaluate contour integrals involving sine and cosine functions, singularities, Laurent's series. Cognitive residue theorem. Apply could be the to the evaluate contour integrals involving sine and cosine function and to state Cauchy integral formula, Liouvilles theorem. Apply could be the to the evaluate contour integrals involving sine and cosine function and to state Cauchy integral formula, Liouvilles theorem. Apply could be the to the evaluate contour integrals integrals - vector lime to polar) - Triple integrals (Cartesian). Scalar line integrals - vector lime tegrals - vector surface integrals - theorem of Green, Gauss and Stokes. 12 nit -II First order ordinary differential equations of bigher orders 12 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2			of an int	egral by App	•	0			nber
coefficients using various methods. Coefficients using various methods. Coefficients using various methods. O4 Use CR equations to verify analytic functions and to findharmonic functions and harmonic conjugate. Cognitive Remember Apply Psychomo four transformation. Remember Apply Couchy residue theorem to evaluate contour integrals involving sine and cosine function and to state Cauchy integral formula, Liouvilles theorem. Cognitive Apply Receive Receive Receive Receive Receive Receive Receive Series. nit -1 Multivariable Calculus (Integration) 12 Ululiple Integration: Double integrals (Cartesian) - change of order of integration in double integrals are vector surface integrals - vector lint tegrals - scalar surface integrals - vector surface integrals - theorems of Green, Gauss and Stokes. 11 First order ordinary differential equations 12 xact - linear and Bernoulli's equations - Euler's equations - Equations not of first degree: equation olvable for p - equations solvable for y - equations solvable for x and Clairaut's type. 12 nit -1 Ordinary differential equations of higher orders 12 actor - Final equations - Bulger's equation functions-finding harmonic injugate - elementary analytic functions - analytic functions-harmonic functions-finding harmonic injugate - elementary analytic functions (exponential, trigonometric, logarithm) and their properties nit -1 Complex Variable – Differentiation series zeros of analytic functions - singularities - Laurent'	CO2	2				Cognitiv	e.	Apply	
functions and harmonic conjugate. Conformal mapping of translation and rotation. Mobius transformation. Apply Guided Response O5 Apply Cauchy residue theorem to evaluate contour integrals formula, Liouvilles theorem. Taylor's series, zeros of analytic functions, singularities, Laurent's series. Cognitive Affective Apply nit -1 Multivariable Calculus (Integration) 12 (Lulpile Integration: Double integrals (Cartesian) - change of order of integration in double integrals hange of variables (Cartesian to polar) - Triple integrals (Cartesian), Scalar line integrals - vector line tegrals - scalar surface integrals - vector surface integrals - Theorems of Green, Gauss and Stokes. 12 nit -II First order ordinary differential equations scalar surface integrals - vector surface integrals - Theorems of Green, Gauss and Stokes. 12 nit -III Ordinary differential equations - Euler's equations not of first degree: equation solvable for p - equations solvable for y - equations solvable for x and Clairaut's type. 12 nit -IV Complex Variable – Differentiation 12 ifferentiation-Cauchy-Riemann equations- analytic functions-harmonic functions-finding injugate- elementary analytic functions (exponential, trigonometric, logarithm) and their properties onformal mappings- Mobius transformations and their properties 12 nit -V Complex Variable – Integration 12 ontour integrals - Cauchy-Goursat theorem (without proof) - Cauchy Integral formula (without proof) iouville's th	CO3	3				Cognitiv	e.	Apply	
Conformal mapping of translation and rotation. Mobius transformation. Psychomo tor Psychomo tor Guided Response O5 Apply Cauchy residue theorem to evaluate contour integrals involving sine and cosine function and to state Cauchy integral formula, Liouvilles theorem. Taylor's series, zeros of analytic functions, singularities, Laurent's series. Cognitive Apply Apply ntt -1 Multivariable Calculus (Integration) 12 Receive ntt -1 Multivariable Calculus (Integration) 12 12 tultiple Integration: Double integrals (Cartesian) - change of order of integration in double integrals - vector surface integrals - Theorems of Green, Gauss and Stokes. 12 ntt -1 First order ordinary differential equations 12 vact - linear and Bernoulli's equations - Euler's equations not of first degree: equation solvable for y - equations solvable for x and Clairaut's type. 12 nti -11 Ordinary differential equations of higher orders 12 accond order linear differential equations with variable coefficients- method of variation of parameters auchy-Euler equation- Power series solutions- Legendre polynomials- Bessel functions-finding harmonio injugate- elementary analytic functions (analytic functions-harmonic functions-finding harmonio injugate- elementary analytic functions (exponential, trigonometric, logarithm) and their properties onformal mappings- Mobius transformations and their properties 12 nit -V Complex Variable	CO4	4				Cognitiv			nber
transformation. To a spendom To a Response O5 Apply Cauchy residue theorem to evaluate contour integrals involving sine and cosine function and to state Cauchy integral formula, Liouvilles theorem. Cognitive Apply Taylor's series, zeros of analytic functions, singularities, Laurent's series. Affective Receive nit -1 Multivariable Calculus (Integration) 12 Utiliel Integration: Double integrals (Cartesian) - change of order of integration in double integrals - scalar surface integrals - vector surface integrals - Theorems of Green, Gauss and Stokes. 12 nit -11 First order ordinary differential equations 12 xact - linear and Bernoulli's equations - Euler's equations - Equations not of first degree: equation olvable for y - equations solvable for x and Clairaut's type. 12 nit -11 Ordinary differential equations of higher orders 12 econd order linear differential equations with variable coefficients- method of variation of parameters auchy-Euler equation- Power series solutions- Legendre polynomials- Bessel functions of the first kind and eir properties 12 nit -1V Complex Variable - Differentiation 12 ifferentiation-Cauchy-Riemann equations- analytic functions-harmonic functions-finding harmonic onformal mappings- Mobius transformations and their properties 12 notour integrals - Cauchy-Goursat theorem (without proof) - Cauchy Integral form									
OF Iter of a series of analytic function and to state Couchy integrals formula, Liouvilles theorem. Taylor's series, zeros of analytic functions, singularities, Laurent's series. Cognitive Apply Apply null integration 12 full integration: Double integrals (Cartesian) - change of order of integration in double integrals hange of variables (Cartesian to polar) - Triple integrals (Cartesian), Scalar line integrals - vector limetegrals - scalar surface integrals - vector surface integrals - Theorems of Green, Gauss and Stokes. 12 nit II First order ordinary differential equations 12 scate - linear and Bernoulli's equations - Euler's equations - Equations not of first degree: equation divable for p - equations solvable for y - equations solvable for x and Clairaut's type. 12 scate - linear differential equations of higher orders 12 cond order linear differential equations of higher orders 12 scond order linear differential equations - Legendre polynomials- Bessel functions of the first kind and eir properties 12 nit III Ordinary differentiation 12 ifferentiation-Cauchy-Riemann equations - analytic functions-harmonic functions-finding harmonic onformal mappings- Mobius transformations and their properties 12 nit IV Complex Variable – Differentiation 12 ontour integrals - Cauchy-Goursat theorem (without proof) - Cauchy Integral formula (wit					or iransiauon and rotation. Mobius	•			
involving sine and cosine function and to state Cauchy integral formula, Liouvilles theorem. Taylor's series, zeros of analytic functions, singularities, Laurent's series. Affective Receive nit -I Multivariable Calculus (Integration) 12 fultiple Integration: Double integrals (Cartesian) - change of order of integration in double integrals hange of variables (Cartesian to polar) - Triple integrals (Cartesian), Scalar line integrals - vector line tegrals - scalar surface integrals - vector surface integrals - Theorems of Green, Gauss and Stokes. 12 nit -II First order ordinary differential equations scalar surface integrals - vector surface integrals - Equations not of first degree: equation lyvable for p - equations solvable for y. equations solvable for x and Clairaut's type. 12 nit -II Ordinary differential equations of higher orders 12 econd order linear differential equations with variable coefficients- method of variation of parameters auchy-Euler equation- Power series solutions- Legendre polynomials- Bessel functions of the first kind and eir properties 12 nit -IV Complex Variable – Differentiation injugate- elementary analytic functions and their properties 12 nofformal mappings- Mobius transformations and their properties 12 not uritegrals - Cauchy-Goursat theorem (without proof) - Cauchy Integral formula (without proof) iouville's theorem (without proof)- Taylor's series- zeros of analytic functions- singularities- Laurent' rise – Residues- Cauchy Residue theorem (without proof) - Cauchy Integral formula (without	00	_							nse
Taylor's series, zeros of analytic functions, singularities, Laurent's series. Affective Receive nit -1 Multivariable Calculus (Integration) 12 (ultiple Integration: Double integrals (Cartesian) - change of order of integration in double integrals - scalar surface integrals - vector surface integrals - Theorems of Green, Gauss and Stokes. 12 nit -11 First order ordinary differential equations 12 kact - linear and Bernoulli's equations - Euler's equations - Equations not of first degree: equation 12 availe for p - equations solvable for y- equations solvable for x and Clairaut's type. 12 nit -11 Ordinary differential equations of higher orders 12 scond order linear differential equations with variable coefficients- method of variation of parameters auchy-Euler equation-Power series solutions- Legendre polynomials- Bessel functions of the first kind and eir properties 12 ifferentiation-Cauchy-Riemann equations - analytic functions-harmonic functions-finding harmonic onjugate- elementary analytic functions (exponential, trigonometric, logarithm) and their properties onformal mappings- Mobius transformations and their properties 12 nit -V Complex Variable – Integration 12 ontour integrals - Cauchy-Goursat theorem (without proof) - Cauchy Integral formula (without proof) iouville's theorem (without proof) - Taylor's series- zeros of analytic functions- singularities- Laurent' 12 onto	CO:	5	involving	g sine and co	sine function and to state Cauchy integral	Cognitiv	e.	Apply	
Iultiple Integration: Double integrals (Cartesian) - change of order of integration in double integrals hange of variables (Cartesian to polar) - Triple integrals (Cartesian), Scalar line integrals - vector limetegrals - scalar surface integrals - vector surface integrals - Theorems of Green, Gauss and Stokes. nit -II First order ordinary differential equations 12 xact - linear and Bernoulli's equations - Euler's equations - Equations not of first degree: equation alvable for p - equations solvable for y - equations solvable for x and Clairaut's type. 12 nit -III Ordinary differential equations of higher orders 12 econd order linear differential equations with variable coefficients- method of variation of parameters auchy-Euler equation- Power series solutions- Legendre polynomials- Bessel functions of the first kind and eir properties 12 nit -IV Complex Variable – Differentiation 12 ifferentiation-Cauchy-Riemann equations- analytic functions-harmonic functions-finding harmonic onjugate- elementary analytic functions (exponential, trigonometric, logarithm) and their properties 12 nit -V Complex Variable – Integration 12 iontour integrals - Cauchy-Goursat theorem (without proof) - Cauchy Integral formula (without proof) touville's theorem (without proof) - Taylor's series- zeros of analytic functions- singularities - Laurent', tries – Residues- Cauchy Residue theorem (without proof) - Evaluation of definite integral involving since d cosine- Evaluation of certain improper integrals using the Bromwich contour. 12			Taylor's			Affective	e 1	Receiv	e
hange of variables (Cartesian to polar) - Triple integrals (Cartesian), Scalar line integrals - vector line tegrals - scalar surface integrals - vector surface integrals - Theorems of Green, Gauss and Stokes. nit -II First order ordinary differential equations 12 xact - linear and Bernoulli's equations - Euler's equations - Equations not of first degree: equation 12 nit -III Ordinary differential equations of higher orders 12 nit -III Ordinary differential equations of higher orders 12 econd order linear differential equations with variable coefficients- method of variation of parameters 12 auchy-Euler equation- Power series solutions- Legendre polynomials- Bessel functions of the first kind and eir properties 12 nit -IV Complex Variable – Differentiation 12 ifferentiation-Cauchy-Riemann equations- analytic functions-harmonic functions-finding harmonic onjugate- elementary analytic functions (exponential, trigonometric, logarithm) and their properties 12 notour integrals - Cauchy-Goursat theorem (without proof) - Cauchy Integral formula (without proof) augustic functions - singularities- Laurent's rise – Residues- Cauchy Residue theorem (without proof) - Evaluation of definite integral involving since d cosine- Evaluation of certain improper integrals using the Bromwich contour. 12 LECTURE TUTORIAL TOTAL 45 15 60	Unit	t -I	Multiva	riable Calculu	s (Integration)			12	2
tegrals - scalar surface integrals - vector surface integrals - Theorems of Green, Gauss and Stokes. nit -II First order ordinary differential equations 12 xact - linear and Bernoulli's equations - Euler's equations - Equations not of first degree: equation dvable for p - equations solvable for y. equations solvable for x and Clairaut's type. 12 nit -III Ordinary differential equations of higher orders 12 econd order linear differential equations with variable coefficients- method of variation of parameters auchy-Euler equation- Power series solutions- Legendre polynomials- Bessel functions of the first kind and eir properties 12 nit -IV Complex Variable – Differentiation 12 ifferentiation-Cauchy-Riemann equations- analytic functions-harmonic functions-finding harmonic onjugate- elementary analytic functions (exponential, trigonometric, logarithm) and their properties 12 nit -V Complex Variable – Integration 12 ontour integrals - Cauchy-Goursat theorem (without proof) - Cauchy Integral formula (without proof) iouville's theorem (without proof) - Taylor's series- zeros of analytic functions- singularities- Laurent' rise – Residues- Cauchy Residue theorem (without proof) - Evaluation of definite integral involving sind cosine- Evaluation of certain improper integrals using the Bromwich contour. LECTURE TUTORIAL TOTAL 45 15 60 ext Book: B.S. Grewal, "Higher Engineering Mathematics", Khanna Publis	Mul	tiple Ir	ntegration:	Double integ	rals (Cartesian) - change of order of integra	tion in do	ouble	integr	als -
nit -II First order ordinary differential equations 12 xact - linear and Bernoulli's equations - Euler's equations - Equations not of first degree: equation of variable for p - equations solvable for y - equations solvable for x and Clairaut's type. 11 nit -III Ordinary differential equations of higher orders 12 accord order linear differential equations with variable coefficients- method of variation of parameters auchy-Euler equation- Power series solutions- Legendre polynomials- Bessel functions of the first kind and eir properties 12 nit -IV Complex Variable – Differentiation 12 ifferentiation-Cauchy-Riemann equations analytic functions-harmonic functions-finding harmonic onjugate- elementary analytic functions (exponential, trigonometric, logarithm) and their properties 12 nit -V Complex Variable – Integration 12 ontour integrals - Cauchy-Goursat theorem (without proof) - Cauchy Integral formula (without proof) touville's theorem (without proof)- Taylor's series- zeros of analytic functions- singularities- Laurent's integral contour. 12 uid cosine- Evaluation of certain improper integrals using the Bromwich contour. 12 60 ext Book: B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40th th Edition, 2008. 60 efference Books: G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9 th Edition, Pearson, Reprint, 2002.	Cha	nge of	variables	(Cartesian to	polar) - Triple integrals (Cartesian), Scalar la	ine integra	als -	vector	line
xact - linear and Bernoulli's equations - Euler's equations - Equations not of first degree: equation blvable for p - equations solvable for y- equations solvable for x and Clairaut's type. nit -III Ordinary differential equations of higher orders 12 econd order linear differential equations with variable coefficients- method of variation of parameters 12 auchy-Euler equation- Power series solutions- Legendre polynomials- Bessel functions of the first kind and eir properties 12 ifferentiation-Cauchy-Riemann equations- analytic functions-harmonic functions-finding harmonic onjugate- elementary analytic functions (exponential, trigonometric, logarithm) and their properties 12 nit -V Complex Variable – Integration 12 ontour integrals - Cauchy-Goursat theorem (without proof) - Cauchy Integral formula (without proof) touville's theorem (without proof)- Taylor's series- zeros of analytic functions- singularities- Laurent's integral involving since docsine- Evaluation of certain improper integrals using the Bromwich contour. 14 LECTURE TUTORIAL TOTAL 45 15 60 ext Book: B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40th th Edition, 2008. efference Books: G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9 th Edition, Pearson, Reprint, 2002. 1000000000000000000000000000000000000	integ	grals - s		×		Bauss and	Stok	es.	
Init -III Ordinary differential equations of higher orders 12 econd order linear differential equations with variable coefficients- method of variation of parameters auchy-Euler equation- Power series solutions- Legendre polynomials- Bessel functions of the first kind and eir properties 12 nit -IV Complex Variable – Differentiation 12 ifferentiation-Cauchy-Riemann equations- analytic functions-harmonic functions-finding harmonic onjugate- elementary analytic functions (exponential, trigonometric, logarithm) and their properties 12 nit -V Complex Variable – Integration 12 ontour integrals - Cauchy-Goursat theorem (without proof) - Cauchy Integral formula (without proof) touville's theorem (without proof) - Taylor's series- zeros of analytic functions- singularities- Laurent's tries – Residues- Cauchy Residue theorem (without proof)- Evaluation of definite integral involving since decime - Evaluation of certain improper integrals using the Bromwich contour. 16 LECTURE TUTORIAL TOTAL 45 15 60 ext Book: B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40th th Edition, 2008. efference Books: G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9 th Edition, Pearson, Reprint, 2002. 100				,	•				
nit -III Ordinary differential equations of higher orders 12 econd order linear differential equations with variable coefficients- method of variation of parameters auchy-Euler equation- Power series solutions- Legendre polynomials- Bessel functions of the first kind and eir properties 12 nit -IV Complex Variable – Differentiation 12 ifferentiation-Cauchy-Riemann equations- analytic functions-harmonic functions-finding harmonic njugate- elementary analytic functions (exponential, trigonometric, logarithm) and their properties 12 nit -V Complex Variable – Integration 12 ontour integrals - Cauchy-Goursat theorem (without proof) - Cauchy Integral formula (without proof) touville's theorem (without proof)- Taylor's series- zeros of analytic functions- singularities- Laurent's rise – Residues- Cauchy Residue theorem (without proof)- Evaluation of definite integral involving sine ad cosine- Evaluation of certain improper integrals using the Bromwich contour. TOTAL 45 15 60 ext Book: B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40th th Edition, 2008. eference Books: G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9 th Edition, Pearson, Reprint, 2002.	Exa			_			egree	equa:	tions
econd order linear differential equations with variable coefficients- method of variation of parameters auchy-Euler equation- Power series solutions- Legendre polynomials- Bessel functions of the first kind and eir properties nit -IV Complex Variable – Differentiation 12 ifferentiation-Cauchy-Riemann equations- analytic functions-harmonic functions-finding harmonic onjugate- elementary analytic functions (exponential, trigonometric, logarithm) and their properties 12 nit -V Complex Variable – Integration 12 nit -V Complex Variable – Integration 12 ontour integrals - Cauchy-Goursat theorem (without proof) - Cauchy Integral formula (without proof) 12 ontour integrals - Cauchy Residue theorem (without proof) - Evaluation of definite integral involving sind cosine- Evaluation of certain improper integrals using the Bromwich contour. 12 LECTURE TUTORIAL TOTAL 45 15 60 ext Book: B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40th th Edition, 2008. eference Books: G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9 th Edition, Pearson, Reprint, 2002. 14		able for				• •			
auchy-Euler equation- Power series solutions- Legendre polynomials- Bessel functions of the first kind and eir properties nit -IV Complex Variable – Differentiation 12 ifferentiation-Cauchy-Riemann equations- analytic functions-harmonic functions-finding harmonic onjugate- elementary analytic functions (exponential, trigonometric, logarithm) and their properties onformal mappings- Mobius transformations and their properties 12 nit -V Complex Variable – Integration 12 ontour integrals - Cauchy-Goursat theorem (without proof) - Cauchy Integral formula (without proof) iouville's theorem (without proof)- Taylor's series- zeros of analytic functions- singularities- Laurent's ries – Residues- Cauchy Residue theorem (without proof)- Evaluation of definite integral involving sind d cosine- Evaluation of certain improper integrals using the Bromwich contour. LECTURE TUTORIAL TOTAL 45 15 60 ext Book: B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40th th Edition, 2008. eference Books: G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9 th Edition, Pearson, Reprint, 2002.	solv	able for				be.			
eir properties ifferentiation 12 ifferentiation-Cauchy-Riemann equations- analytic functions-harmonic functions-finding harmonic onjugate- elementary analytic functions (exponential, trigonometric, logarithm) and their properties onformal mappings- Mobius transformations and their properties int -V Complex Variable – Integration 12 ontour integrals - Cauchy-Goursat theorem (without proof) - Cauchy Integral formula (without proof) iouville's theorem (without proof)- Taylor's series- zeros of analytic functions- singularities- Laurent's rites – Residues- Cauchy Residue theorem (without proof)- Evaluation of definite integral involving sind d cosine- Evaluation of certain improper integrals using the Bromwich contour. LECTURE TUTORIAL TOTAL 45 15 60 ext Book: B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40th th Edition, 2008. eference Books: G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9 th Edition, Pearson, Reprint, 2002.	Unit	t -III	Ordinar	y differential	equations of higher orders	•			
nit -IVComplex Variable – Differentiation12ifferentiation-Cauchy-Riemannequations- analyticfunctions-harmonic functions-finding harmonic onjugate- elementary analyticfunctions (exponential, trigonometric, logarithm) and their properties onformal mappings- Mobius transformations and their properties nit -V12ontourintegrals - Mobius transformations and their properties ontour integrals - Cauchy-Goursat theorem (without proof) - Cauchy Integral formula (without proof) iouville's theorem (without proof)- Taylor's series- zeros of analytic functions- singularities- Laurent's rries – Residues- Cauchy Residue theorem (without proof)- Evaluation of definite integral involving since ad cosine- Evaluation of certain improper integrals using the Bromwich contour.TOTAL 45LECTURETUTORIALTOTAL 60ext Book: G.B. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40thth Edition, 2008. efference Books: G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9th Edition, Pearson, Reprint, 2002.	Unit Seco	t -III ond ord	Ordinar ler linear	y differential differential eq	equations of higher orders uations with variable coefficients- method of	variation	-	aramet	ters -
ifferentiation-Cauchy-Riemann equations- analytic functions-harmonic functions-finding harmonic onjugate- elementary analytic functions (exponential, trigonometric, logarithm) and their properties onformal mappings- Mobius transformations and their properties nit -V Complex Variable – Integration 12 ontour integrals - Cauchy-Goursat theorem (without proof) - Cauchy Integral formula (without proof) iouville's theorem (without proof)- Taylor's series- zeros of analytic functions- singularities- Laurent's ries – Residues- Cauchy Residue theorem (without proof)- Evaluation of definite integral involving sind d cosine- Evaluation of certain improper integrals using the Bromwich contour. LECTURE TUTORIAL TOTAL 45 15 60 ext Book: B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40th th Edition, 2008. eference Books: G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9 th Edition, Pearson, Reprint, 2002.	Unit Secc Cau	t -III ond ord chy-Eu	Ordinar ler linear ler equation	y differential differential eq	equations of higher orders uations with variable coefficients- method of	variation	-	aramet	ters -
onjugate- elementary analytic functions (exponential, trigonometric, logarithm) and their properties onformal mappings- Mobius transformations and their properties nit -V Complex Variable – Integration 12 ontour integrals - Cauchy-Goursat theorem (without proof) - Cauchy Integral formula (without proof) iouville's theorem (without proof) - Cauchy Integral formula (without proof) iouville's theorem (without proof)- Taylor's series- zeros of analytic functions- singularities- Laurent's accisine- Evaluation of certain improper integrals using the Bromwich contour. LECTURE TUTORIAL TOTAL 45 15 60 ext Book: B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40th th Edition, 2008. eference Books: G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9 th Edition, Pearson, Reprint, 2002.	Unit Secc Cau their	t -III ond ord chy-Eu proper	Ordinar ler linear ler equation ties	y differential differential eq on- Power serie	equations of higher orders uations with variable coefficients- method of es solutions- Legendre polynomials- Bessel fun	variation	-	aramet rst kind	ters - d and
Informal mappings- Mobius transformations and their properties nit -V Complex Variable – Integration 12 ontour integrals - Cauchy-Goursat theorem (without proof) - Cauchy Integral formula (without proof) integrals - Cauchy-Goursat theorem (without proof) - Cauchy Integral formula (without proof) iouville's theorem (without proof)- Taylor's series- zeros of analytic functions- singularities- Laurent's tries – Residues- Cauchy Residue theorem (without proof)- Evaluation of definite integral involving sind cosine- Evaluation of certain improper integrals using the Bromwich contour. LECTURE TUTORIAL TOTAL 45 15 60 ext Book: B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40th th Edition, 2008. eference Books: G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9 th Edition, Pearson, Reprint, 2002.	Unit Secc Cau their Unit	t -III ond ord chy-Eu proper t -IV	Ordinar ler linear ler equation rties Complex	y differential differential eq on- Power serie x Variable – D	equations of higher orders uations with variable coefficients- method of es solutions- Legendre polynomials- Bessel fun Differentiation	variation ctions of t	he fi	aramet rst kind 12	ters - d and
nit -V Complex Variable – Integration 12 ontour integrals - Cauchy-Goursat theorem (without proof) - Cauchy Integral formula (without proof) iouville's theorem (without proof) - Cauchy Integral formula (without proof) iouville's theorem (without proof)- Taylor's series- zeros of analytic functions- singularities- Laurent's involving sind ontour integrals - Cauchy Residue theorem (without proof) - Evaluation of definite integral involving sind involving sind ories - Residues- Cauchy Residue theorem (without proof) - Evaluation of definite integral involving sind involving sind ind cosine- Evaluation of certain improper integrals using the Bromwich contour. Integral LECTURE TUTORIAL TOTAL 45 15 60 ext Book: B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40th th Edition, 2008. eference Books: G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9 th Edition, Pearson, Reprint, 2002. Integral	Unit Secc Cau their Unit Diff	t -III ond ord chy-Eu proper t -IV erentiat	Ordinar ler linear ler equation ties Complex tion-Cauch	y differential differential eq on- Power serie x Variable – D ny-Riemann	equations of higher orders uations with variable coefficients- method of es solutions- Legendre polynomials- Bessel fun Differentiation equations- analytic functions-harmonic fur	variation ctions of t	he fi	aramet rst kind 12 harn	ters - d and
ontour integrals - Cauchy-Goursat theorem (without proof) - Cauchy Integral formula (without proof) iouville's theorem (without proof)- Taylor's series- zeros of analytic functions- singularities- Laurent's eries – Residues- Cauchy Residue theorem (without proof)- Evaluation of definite integral involving sind ad cosine- Evaluation of certain improper integrals using the Bromwich contour. LECTURE TUTORIAL 45 15 60 ext Book: B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40th th Edition, 2008. eference Books: G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9 th Edition, Pearson, Reprint, 2002.	Unit Secc Cau their Unit Diff	t -III ond ord chy-Eu proper t -IV erentiat ugate-	Ordinar ler linear ler equation rties Complex tion-Cauch elementar	y differential differential eq on- Power serie x Variable – D ny-Riemann ry analytic fu	equations of higher orders uations with variable coefficients- method of es solutions- Legendre polynomials- Bessel fun Differentiation equations- analytic functions-harmonic fun unctions (exponential, trigonometric, logarith	variation ctions of t	he fi	aramet rst kind 12 harn	ters - d and
iouville's theorem (without proof)- Taylor's series- zeros of analytic functions- singularities- Laurent's ries – Residues- Cauchy Residue theorem (without proof)- Evaluation of definite integral involving sind ad cosine- Evaluation of certain improper integrals using the Bromwich contour. LECTURE TUTORIAL TOTAL 45 15 60 ext Book: B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40th th Edition, 2008. eference Books: G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9 th Edition, Pearson, Reprint, 2002.	Unit Secc Cau their Unit Diff conj Con	t -III ond ord chy-Eu proper t -IV erentiat ugate- formal	Ordinar ler linear ler equation ties Complex tion-Cauch elementar mappings	y differential differential eq on- Power serie x Variable – D ny-Riemann ry analytic fu - Mobius trans	equations of higher orders uations with variable coefficients- method of es solutions- Legendre polynomials- Bessel fun Differentiation equations- analytic functions-harmonic fun equations (exponential, trigonometric, logarith formations and their properties	variation ctions of t	he fi	aramet rst kind 12 harn proper	ters - d and c nonic rties-
ries – Residues- Cauchy Residue theorem (without proof)- Evaluation of definite integral involving sind ad cosine- Evaluation of certain improper integrals using the Bromwich contour. LECTURE TUTORIAL TOTAL 45 15 60 ext Book: B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40th th Edition, 2008. eference Books: G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9 th Edition, Pearson, Reprint, 2002.	Unit Secc Cau their Unit Diff Conj Con	t -III ond orc chy-Eu proper t -IV erentiat ugate- formal t -V	Ordinar ler linear ler equation rties Complex tion-Cauch elementar mappings- Complex	y differential differential eq on- Power serie x Variable – D ny-Riemann ry analytic fu - Mobius trans x Variable – In	equations of higher orders uations with variable coefficients- method of es solutions- Legendre polynomials- Bessel fun Differentiation equations- analytic functions-harmonic fun equations (exponential, trigonometric, logarith formations and their properties ntegration	variation ctions of t nctions-fin m) and t	he finding	aramet rst kind 12 harn proper 12	ters - d and c nonic rties-
LECTURE TUTORIAL TOTAL 45 15 60 ext Book: B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40th th Edition, 2008. eference Books: G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9 th Edition, Pearson, Reprint, 2002.	Unit Secc Cau their Unit Diff Con Unit Con	t -III ond orc chy-Eu proper t -IV erentiat ugate- formal t -V tour in	Ordinar ler linear ler equation ties Complex tion-Cauch elementar mappings- Complex tegrals - C	y differential differential eq on- Power serie x Variable – D ny-Riemann ry analytic fu - Mobius trans x Variable – In Cauchy-Goursa	equations of higher orders uations with variable coefficients- method of es solutions- Legendre polynomials- Bessel fun Differentiation equations- analytic functions-harmonic fun inctions (exponential, trigonometric, logarith formations and their properties ntegration at theorem (without proof) - Cauchy Integral	variation ctions of t nctions-fin m) and t formula	he finding heir	aramet rst kind 12 harm proper 12 iout pr	ters - d and conic rties- coof)-
451560ext Book: B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40th th Edition, 2008.eference Books:G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9 th Edition, Pearson, Reprint, 2002.	Unit Secce Caud their Unit Diff Conj Unit Con Liou	t -III ond orc chy-Eu proper t -IV erentiat ugate- formal t -V tour in wille's	Ordinar ler linear ler equation ties Complex tion-Cauch elementar mappings- Complex tegrals - C theorem	y differential differential eq on- Power serie x Variable – D ny-Riemann o ry analytic fu - Mobius trans x Variable – In Cauchy-Goursa (without proof	equations of higher orders uations with variable coefficients- method of es solutions- Legendre polynomials- Bessel fun Differentiation equations- analytic functions-harmonic fur inctions (exponential, trigonometric, logarith formations and their properties ntegration at theorem (without proof) - Cauchy Integral C)- Taylor's series- zeros of analytic function	variation ctions of t nctions-fin m) and t formula s- singula	he finding heir	aramet rst kind 12 harn proper 12 out pr - Laur	ters - d and nonic rties- 2 oof)- rent's
ext Book: B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40th th Edition, 2008. eference Books: G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9 th Edition, Pearson, Reprint, 2002.	Unit Secc Cau thein Unit Con Unit Con Liou serie	t -III ond ord chy-Eu proper t -IV erentiat ugate- formal t -V tour in wille's es – Re	Ordinar ler linear ler equation ties Complex tion-Cauch elementar mappings- Complex tegrals - Cauch theorem (mapping) tegrals - Cauch theorem (mapping)	y differential differential eq on- Power series x Variable – D ny-Riemann of ry analytic fu - Mobius trans x Variable – I n Cauchy-Goursa (without proof auchy Residue	equations of higher orders uations with variable coefficients- method of es solutions- Legendre polynomials- Bessel fun Differentiation equations- analytic functions-harmonic fur inctions (exponential, trigonometric, logarith formations and their properties ntegration at theorem (without proof) - Cauchy Integral C)- Taylor's series- zeros of analytic function theorem (without proof)- Evaluation of defin proper integrals using the Bromwich contour.	variation ctions of t nctions-fin m) and t formula s- singula	he finding heir	aramet rst kind 12 harn proper 12 out pr - Laur	ters - d and nonic rties- 2 oof)- rent's
eference Books: G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9 th Edition, Pearson, Reprint, 2002.	Unit Secc Cau thein Unit Con Unit Con Liou serie	t -III ond orc chy-Eu proper t -IV erentiat ugate- formal t -V tour in wille's es – Re cosine-	Ordinar ler linear ler equation ties Complex tion-Cauch elementar mappings- Complex tegrals - C theorem (sidues- Ca Evaluatio	y differential differential eq on- Power serie x Variable – D ny-Riemann o ry analytic fu - Mobius trans x Variable – In Cauchy-Goursa (without proof auchy Residue on of certain in	equations of higher orders uations with variable coefficients- method of es solutions- Legendre polynomials- Bessel fun Differentiation equations- analytic functions-harmonic fur inctions (exponential, trigonometric, logarith formations and their properties ntegration at theorem (without proof) - Cauchy Integral C)- Taylor's series- zeros of analytic function theorem (without proof)- Evaluation of defin proper integrals using the Bromwich contour.	variation ctions of t nctions-fin m) and t formula s- singula ite integra	he finding heir (with rities al inv	aramet rst kind 12 harn proper 12 out pr - Laur	ters - d and nonic rties- 2 oof)- rent's
G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9 th Edition, Pearson, Reprint, 2002.	Unit Secce Caud their Unit Conj Con Unit Con Liou seric and	t -III ond orc chy-Eu proper t -IV erentiat ugate- formal t -V tour in iville's es – Re cosine-	Ordinar Ier linear Ier equation ties Complex tion-Cauch elementar mappings- Complex tegrals - Ca theorem sidues- Ca Evaluation LECTUR 45	y differential differential eq on- Power serie x Variable – D ny-Riemann of ry analytic fu - Mobius trans x Variable – In Cauchy-Goursa (without proof auchy Residue on of certain im E	equations of higher orders uations with variable coefficients- method of es solutions- Legendre polynomials- Bessel fun Differentiation equations- analytic functions-harmonic functions (exponential, trigonometric, logarith formations and their properties ntegration at theorem (without proof) - Cauchy Integral c)- Taylor's series- zeros of analytic function theorem (without proof)- Evaluation of defin proper integrals using the Bromwich contour. TUTORIAL 15	variation ctions of t nctions-fin m) and t formula s- singula ite integra TOT. 60	he fir ding heir (with rities 1 inv AL	aramet rst kind 12 harm proper 12 out pr - Laur volving	ters - d and nonic rties- 2 oof)- rent's
	Unit Secce Caud their Unit Conj Con Unit Con Liou seric and	t -III ond orc chy-Eu proper t -IV erentiat ugate- formal t -V tour in iville's es – Re cosine-	Ordinar Ier linear Ier equation ties Complex tion-Cauch elementar mappings- Complex tegrals - Ca theorem sidues- Ca Evaluation LECTUR 45	y differential differential eq on- Power serie x Variable – D ny-Riemann of ry analytic fu - Mobius trans x Variable – In Cauchy-Goursa (without proof auchy Residue on of certain im E	equations of higher orders uations with variable coefficients- method of es solutions- Legendre polynomials- Bessel fun Differentiation equations- analytic functions-harmonic functions (exponential, trigonometric, logarith formations and their properties ntegration at theorem (without proof) - Cauchy Integral c)- Taylor's series- zeros of analytic function theorem (without proof)- Evaluation of defin proper integrals using the Bromwich contour. TUTORIAL 15	variation ctions of t nctions-fin m) and t formula s- singula ite integra TOT. 60	he fir ding heir (with rities 1 inv AL	aramet rst kind 12 harm proper 12 out pr - Laur volving	ters - d and nonic rties- 2 oof)- rent's
28 8 th BOS/BIOTECH/Date: 19.	Unit Secce Cau their Unit Conj Con Unit Con Liou serie and Text	t -III ond orc chy-Eu proper t -IV erentiat ugate- formal t -V tour in iville's es – Re cosine- t Book erence	Ordinar Ier linear Ier equation ties Complex tion-Cauch elementar mappings- Complex tegrals - Ca theorem (sidues- Ca Evaluation LECTUR 45 : B.S. Gree Books:	y differential differential eq on- Power series x Variable – D ny-Riemann of ry analytic fur - Mobius trans x Variable – In Cauchy-Goursa (without proof auchy Residue on of certain im E wal, "Higher E	equations of higher orders uations with variable coefficients- method of es solutions- Legendre polynomials- Bessel fun Differentiation equations- analytic functions-harmonic functions (exponential, trigonometric, logarith formations and their properties ntegration at theorem (without proof) - Cauchy Integral c)- Taylor's series- zeros of analytic function theorem (without proof)- Evaluation of defin proper integrals using the Bromwich contour. TUTORIAL 15 Engineering Mathematics", Khanna Publishers,	variation ctions of t nctions-fin m) and t formula s- singula ite integra TOT . 60 40th th Edi	he fir ding heir (with rities l inv AL	aramet rst kind narn proper 12 out pr - Laur volving 2008.	ters - 1 and 2 nonic rties- 2 0 oof)- rent's sine

Erwin kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.
 W. E. Boyce and R. C. DiPrima, "Elementary Differential Equations and Boundary Value Problems", 9thEdn. Wiley India, 2009.

4. S. L. Ross, "Differential Equations", 3rd Ed., Wiley India, 1984.

5.E. A. Coddington, "An Introduction to Ordinary Differential Equations", Prentice Hall India, 1995.

6. E. L. Ince, "Ordinary Differential Equations", Dover Publications, 1958.

7.J. W. Brown and R. V. Churchill, "Complex Variables and Applications", 7th Ed., McGraw Hill, 2004.

8. N.P. Bali and Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, Reprint, 2008.

					Cos vei	rsus G	A ma	pping				
						Grad	luates	s Attrik	outes			
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2			2					1		2
CO2	3	1								1		1
CO3	3	1								1		1
CO4	3	2								1		1
CO5	3	2			1					1		2
Total	15	8	0	0	3	0	0	0	0	5	0	7
Scaled Value	3	2			1					1		
C) - No	Relati	ion, 1 -	- Low	v Relati	on, 2-	Mediu	ım Rela	ation,	3- High	Relat	ion
		1 – 5 -	$\rightarrow 1$,		6	- 10 -	→ 2,		11	$-15 \rightarrow$	• 3	

COURSE	CODE	COURSE NAME		L	Т	Р	С
XBE202		ELECTRICAL AND ELECTRONICS		3	1	0	4
		ENGINEERING SYSTEMS		3	1	U	4
Prerequis	sites	Physics		L	Т	Р	Η
C:P: A		3:0:0		3	1	0	4
Course O	utcomes		Dom	ain		L	evel
CO1	Relate the	e fundamentals of electrical parameters and	Cognitive	τ	Under	stand	
	build and	d explain AC, DC circuits by Using					
	measuring	devices					
CO2	Explain th	ne operation of DC and AC machines.	Cognitive	J	Under	stand	
CO3	Illustrate	various semiconductor devices and their	Cognitive	I	Under	stand	
	application						
	characteris	stics of basic semiconductor devices.					
CO4	Explain	the number systems and logic gates.	Cognitive	τ	Under	stand	
	Construct	the different digital circuit.					
CO5	Outline t	he different types of microprocessors and	Cognitive	J	Under	stand	
	their appli	cations.					
UNIT-I: I	FUNDAME	ENTALS OF DC AND AC CIRCUITS,		9	9+3		
MEASUF	REMENTS						
Fundamen	tals of DC-	- Ohm's Law - Kirchhoff's Laws - Sources	- Voltage a	nd Cu	urrent	Relat	ions -
Star/Delta	Transform	ation - Fundamentals of AC – Average Val	ue, RMS Va	lue, F	Form 1	Factor	- AC
power and	d Power Fa	ctor, Phasor Representation of sinusoidal q	uantities - S	Simple	e Seri	es, Pa	rallel
		- Operating Principles of Moving coil and M	•	Instru	iments	s (Am	meter,
Voltmeter) and Dynam	mometer type meters (Watt meter and Energy	y meter).				
		ICAL MACHINES			9+3	-	
Constructi	on, Princip	le of Operation, Basic Equations, Types and	Application	of D	C Gen	erator	s, DC
		20	oth DOC	піот	TECH		10.00
		29	8 th BOS/	BIOI	ECH/	Date:	19.08

	ors - Basics of	0													-
-	ciple of Operat		-				mer, '	Three	phase	trans	formers	s, Aut			r.
	IT- III: SEMIC												9+		
	ssification of S														Diode
Dio	de, PNP, NPN	Trans	istors,	Field	Effe	ct Trar	nsisto	rs and	Silico	n Co	ntrolled	Rect	ifier –		
App	lications.														
UN	IT- IV: DIGIT	AL E	LEC	FRON	VICS	5							9+	3	
	ic of Concepts														ctors,
	tiplexer, demult	1	,			oder, F	lipfloj	ps, Uj	o/Down	n cou	nters, S	hift R	legiste	ers.	
	T- V: MICRO												9+ 3		
	hitecture, 8085,	-	-					-			-				
	timing and co		0			•						ons, a	addres	sing m	odes,
Inter	rfacing Basics:	Data	transf	er con	cept	s – Sin	iple P	rogra	mming	g cono	cepts.				
	LECTURE			TUT	OR	IAL					TOT	ΓAL			
	45				15						6	0			
	KT BOOKS														
1. N	letha V.K, Roh	it Me	hta, 20)20. P	rinci	ples of	Elect	ronic	$s, 12^{th} \epsilon$	ed, S	Chand I	Publis	shing.		
2. A	lbert Malvino,	Davio	l J.Bat	es., 20	017.	Electro	onics	Princi	ples. 7	th ed	, Tata N	/lcGra	aw-Hi	ll. New	
D	elhi.														
3. R	ajakamal, 2014	. Dig	ital Sy	stem-	Princ	ciple &	Desi	gn. 21	nd ed. I	Pears	on educ	ation	•		
4. N	Iorris Mano, 20	15. D	Digital	Desig	n. Pr	entice	Hall o	of Ind	ia.						
5. R	amesh, S. Gaor	ıkar, 2	2013, 1	Micro	proc	essor A	Archit	ecture	e, Prog	ramn	ning and	l its A	Applica	ations v	vith
	8085, 6 th ed , In										C				
	FERENCE BO														
1. C	orton, H.,2004	Elect	rical T	echno	ology	. CBS	Publi	shers	& Dist	tribut	ors.				
2. S	yed, A. Nasar, 1	1998,	Electi	rical C	lircui	its. Sch	aum	Series	5.						
3. Ja	acob Millman a	nd Cł	nristos	, C. H	alkia	ls, 196	7, Ele	ctroni	cs Dev	vices,	New D	elhi:	McGr	aw-Hill	1.
4. N	lillman, J. and I	Halkia	as, C.	C., 19	72. I	ntegrat	ted El	ectro	nics: A	nalog	g and Di	igital	Circui	its and	
	ems, Tokyo: M									-	-	-			
5. M	Iohammed Rafi	quzza	aman,	1999.	Mic	roproc	essors	s - Th	eory ar	nd Ap	oplicatio	ons: Ii	ntel an	d Moto	orola.
Pren	ntice Hall Intern	ation	al.			-			-	-	-				
E-R	EFERENCES														
	TPEL, Basic E		cal Te	chnolo	ogy (Web C	Course	e), Pro	of. N. K	K. De	, Prof. 7	Г. К .]	Bhatta	charya	and
	. G.D. Roy, IIT				0.						, ,			5	
	rof.L.Umanand		01		ectu	res.con	n/Cou	rse/2	335/Ba	sic-E	Electrica	l-Tec	hnolo	gv#. IIS	Sc
	galore.	, r													
	ttp://nptel.ac.in/	Onlir	necour	ses/N	agen	dra/. D	r. Na	gendr	a Krisł	manu	ıra. IIT	Madr	as.		
	r.L.Umanand, l				0		•	0		-				[SC	
	galore.				1000	51112 - 0		.,				08,	,		
	pping of COs v	vith I	Pos												
			0.0												
[PR	OGR	AM O	UTC	COMES				
		1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
	CO1	3	3	1	1	1	1			1	1	1		3	3
	CO2	3	3	1	1	1	1			1	1	1		3	3
	CO3	2	2	2	1	2	2	1	1	1	1	1	I	3	3

						PR	OGR	AM C	OUTC	OMES	5			
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	1	1	1	1			1	1	1		3	3
CO2	3	3	1	1	1	1			1	1	1		3	3
CO3	2	2	2	1	2	2	1	1	1	1	1		3	3
CO4	2	2	1	1	1	1	1	1	1	1	1		3	3
CO5	2	2	1	1	1	1	1	1	1	1	1		3	3
Total	12	12	6	5	6	6	3	3	5	5	5		15	15
ScaledValue	3	3	2	1	2	2	1	1	1	1	1		5	5
		1 –	$5 \rightarrow 1$,		6 –	10 -	> 2,		11	- 15 -	$\rightarrow 3$		
	()-NoR	elatio	n,1-L	Low Re	elatior	n,2-M	edium	Relat	ion,3-H	lighR	elatio	n	

8th BOS/BIOTECH/Date: 19.08.2021

COUF	RSE CODE	XAC203		L	Т	Р	С
COUF	RSE NAME	Applied Chemistry For Engineers		3	1	0	4
PRER	EQUISITES	Nil		L	Т	Р	H
C:P:A	L	3.5:1.0:0.5		3	1	0	4
COUF	RSE OUTCOM	ES	DOM	I AIN		LE	VEL
CO1	electron affini	eriodic properties such as ionization energy, ty, oxidation states and electro negativity. arious water quality parameters like hardness	Cogn	itive		Un	derstand
CO2	_	<i>Measure</i> microscopic chemistry in terms of lar orbitals and intermolecular forces.	Cogn Psych		tor	Un Set	derstand
CO3	-	Ik properties and processes using and kinetic considerations.	Cogn Psyci	itive			ply chanism
CO4	,	<i>trate and Discuss</i> the chemical reactions that synthesis of molecules.	Cogn	itive			derstand alyze
CO5	Apply, Measurelectromagneti	<i>ure</i> and <i>Distinguish</i> the ranges of the c spectrum used for exciting different gy levels in various spectroscopic techniques	Cogn Psyci		tor	Re: Ap	member ply echanism
UNI	Γ_I PERIOD	IC PROPERTIES AND WATER CHEMIST	RV			8	+3
Defin alkali UNI Therr Free reduc metho	Ition and explanationInity. <td< th=""><th>bases, molecular geometries. Water Chem ation of hardness, determination of hardness b FREE ENERGY IN CHEMICAL EQUILIB ions: energy, entropy and free energy. Estimati Cell potentials, the Nernst equation and ap ity equilibria. Corrosion-Types, factors affect energy considerations in metallurgy through Ell</th><th>RIA ions of plications of ting conting conting</th><th>rA m entro ons. a orrosi n diag</th><th>ethoc opy an Acid fon r grams</th><th>I-Intro 12 nd free base ate a s. Adv</th><th>2+3 2+3 ee energie , oxidation nd Contrivantages</th></td<>	bases, molecular geometries. Water Chem ation of hardness, determination of hardness b FREE ENERGY IN CHEMICAL EQUILIB ions: energy, entropy and free energy. Estimati Cell potentials, the Nernst equation and ap ity equilibria. Corrosion-Types, factors affect energy considerations in metallurgy through Ell	RIA ions of plications of ting conting	rA m entro ons. a orrosi n diag	ethoc opy an Acid fon r grams	I-Intro 12 nd free base ate a s. Adv	2+3 2+3 ee energie , oxidation nd Contrivantages
		ctroless plating of nickel and copper on Printed C AND MOLECULAR STRUCTURE	Circu	it Boa	ard (F)+3
nanop Equat field Band poten gases surfac UNIT Princ types Vibra	particles Molections for atomic theory and the structure of so the structure of so that energy surjustical phenomenators. SPECTR iples of spectros of electronic structures.	Particle in a box solution and their application cular orbitals of diatomic molecules and ple- and molecular orbitals. Energy level diagrams energy level diagrams for transition metal ion lids and the role of doping on band structur <i>faces</i> Ionic, dipolar and Vander waals interact nomena. Potential energy surfaces of H ₃ , H ₂ F and OSCOPIC TECHNIQUES AND APPLICAT copy and selection rules. Electronic spectrosc transition and application. Fluorescence and copy-types of vibrations, Instrumentation	ots of s of di us and ures. <i>In</i> tions. nd HC FIONS opy-ch 1 its a	the atomic their nterm Equa N and nomo	mult ic mag colect tions d traje	icente blecul netic <i>ular</i> of st ectori 7 e, aux as in	er orbital les. Cryst propertie forces an tate of re les on the 7+3 xochrome medicin

UNIT–V	STEREOCHEM	ISTRY AND	ORGANIC REACT	IONS	8+3
Representat	ions of 3 dimension	onal structures,	structural isomers and	d stereoisomers, co	onfigurations and
• •	•		ereomers, optical act	•	<u> </u>
			ional metal compound		
			involving substitutio		
	-		pening reactions. Syn	nthesis of a comi	monly used drug
molecule- A	spirin and paracet	TUTORIAL	PRACTICAL	TOTAL	HOUDS
Hours	45	1010KIAL 15	0		
TEXT BOO		15	U		
1 Puri B	R Sharma L R	Kalia K K Pr	inciples of Inorganic	Chemistry (23 rd	1
			Chand & Co., 1993	chemistry, (20	
,		0	JK, Black well scienc	e. 2006.	
	-	•	's Physical Chemistry		xford publishers
2014.	_,,		injereni enemilier.	,, 10 Lunion , 0	r southers
	ne S. Lewis D. F	lements of Phys	sical Chemistry, Lond	lon Mac Millan &	Co Ltd 1983
		=	hemistry (6th edition)		
	n Ltd., 1976.	R.H. Organie C.	iterinistry (oth edition)	, new rork, r myr	1
	,	entals of Mole	cular Spectroscopy,	(3 th Edition). Mo	cGraw-Hill Bool
	ny, Europe 1983.		speedoseopy,	(*, 1)1	
-	• •	l. Advanced Or	ganic Chemistry, (4 th	edition). S./ Ch	and & Company
	w Delhi, 1977.	, 1 u (unice u o 1	game chemistry, (1		una ez compan.
	·	try. Conformati	on and mechanism, (9 th Edition) New	Age Internationa
	ers, 2017.	dry. Comornau	ion and meenamon, (rige internationa
	CE BOOKS				
		Madan S Patha	nia, "Principles of Ph	vsical Chemistry"	. Vishal
	ng Co., Edition 20		, -	<i>jj</i>	,
	0		ng Chemistry", Volur	ne I/II-Tata McGi	raw-
	ishing Co. Ltd. N		ing chiefinistry , voidi		
E Resource	s - MOOCs:				
1. <u>http:</u>	//www.mooc-list.	com/course/che	mistry-minor-sayloro	rg	
	://www.canvas.ne	<u>*</u>			
3. <u>http:</u>	//freevideolecture	s.com/Course/22	263/Engineering-Che	<u>mistry-I</u>	
4. <u>http:</u>	//freevideolecture	s.com/Course/3	001/Chemistry-I		
5. <u>http:</u>	//freevideolecture	s.com/Course/3	167/Chemistry-II		
6. <u>http:</u>	//ocw.mit.edu/cou	rses/chemistry/			

Mapping of CO's with PO's:

						PR	OGR	AM C	OUTC	OMES	5			
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	0	0	0	0	0	2	3	3	0	0	0	0	0
CO2	2	0	0	0	0	0	1	2	2	0	0	0	0	0
CO3	3	0	0	0	0	0	2	3	3	0	0	0	0	0
CO4	3	0	0	0	0	0	3	3	3	0	0	0	0	0
CO5	3	0	0	0	0	0	2	2	3	0	0	0	0	0
Total	14	0	0	0	0	0	10	13	14	0	0	0	0	0
ScaledValue	3	0	0	0	0	0	2	3	3	0	0	0	0	0
		1 –	$5 \rightarrow 1$	Ι,		6 -	- 10 -	×2,		11 -	- 15 -	$\rightarrow 3$		
	()-NoR	elatio	n,1-I	Low R	elatio	n,2-M	ledium	Relati	ion,3-H	lighR	elatio	n	

							L	Т	Р	SS	С
X	GS204	Ļ					2	0	0	0	2
		I	-	Technical Comm	unication			1			1
2	<u>P</u>	A	-				L	T	P	SS	H
3	0	0					2	0	0	0	2
				Course Outcomes		Domain			Le	vel	
ter co	omplet	ion of t	he co	urse, students will be able to							
01				sic principles of Technical wi	riting.	Cognitiv	e		Unde	erstan	d
02				cial techniques in writing.		Cognitiv	e			pply	
03	-			municative styles of writing.		Cognitiv	e		Eva	aluate	
04	Cla	ssify th	nenatu	re of Report writing.		Cognitiv	e		Unde	erstan	d
ourse	e Conte	ent								Ho	ours
NIT-l				inciples							8
				echnical Writing							
				cal Writing							
		e and T									
<u>NIT -</u>			chniq								8
				sed in writing							
				tion of mechanism2.3 – Descr	ription- Classifi	ication-Inte	rpret	ation			_
NIT-I				nication	1						7
I - M	lodern	develop	pment	in style of writing 3.2 - New	letter writing fo	ormats					
NIT-I	IV	Re	nort	writing							7
				ing 4.2 – Project writing form	ats						
	LECTU			TUTORIAL	PRACTI	[CAL		Г	OTA	٩L	
	30			0	0				30		
(i)	Joł	n Seal	y, Wr	ed Readings: iting and Speaking Author; O: Communicating Business Eng		•			2009		
(i) (ii)		•		Communicating Business. Eng		•			2009		

Mapping of COs with Pos

						PF	ROG	RAM	OUT	ГСОМ	ES			
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	0	0	3	0	0	0	0	0	2	3	2	0
CO2	3	2	0	0	2	0	0	0	0	0	2	3	2	0
CO3	2	2	1	2	2	0	0	0	0	0	2	2	2	0
CO4	2	2	1	2	2	0	0	0	0	0	2	2	2	0
CO5	2	2	1	0	2	0	0	1	0	2	2	2	2	0
Total	12	10	3	4	11	0	0	1	0	2	10	12	10	0
ScaledValue	3	2	1	1	3	0	0	1	0	1	2	3	2	0
		1 –	$5 \rightarrow$	1,		6-	- 10 -	$\rightarrow 2$,		1	1 – 1	$5 \rightarrow 3$	3	
	()-NoR	Relatio	on,1-	Low R	elatic	on,2-1	Mediu	mRe	lation,3	-Higl	nRelat	ion	

C	COU	RSE CODE	COURSE NAME		L	Т	P	C	
	X	WP205	Workshop Practice	8	1	0	2	3	
С	Р	Α			L	Т	P	Η	
1.0	2.0	0			1	0	3	4	
PRE	RE	QUISITE: NIL							
			se outcomes:	Domain]	Level		
CO1			nachining methods and	Cognitive	Uı	ndersta	ind		
		Practice machini		Psychomotor			espons	e	
CO ₂	:		casting process, moulding methods	Cognitive		ememb			
			ng and Smithy applications.	Psychomotor		rceptio			
CO3			pentry and fitting operation and	Cognitive	-	pplyGu			
			y and fitting operations.	Psychomotor		sponse			
CO4	:		al joining operation and <i>Practice</i>	Cognitive	-	ndersta			
		welding operation		Psychomotor			espons	e	
CO5		,	ectrical and electronics basics and	Cognitive	-	ndersta			
		Makes appropriat	te electrical connections.	Psychomotor		ememb			
					Gı	uided r	espons	e	
		E CONTENT			~				
EX	P.N(TITLE		CC		ATIO	N	
	1		to machining process			<u>CC</u>			
	2	¥	using lathe operation			CC			
	3		about CNC machining and machines			CC			
	4		on of plain turning using CNC			CC			
	5		al casting operation			CC			
	6		on of moulding process			CC			
	7	•	thy operation			CC			
	8	Study of carp				CC			
	9		Carpentry			CC			
	10		Tenon joint – Carpentry			CC			
	11	Study of fitti	8			CC			
	12	Square fitting				CC			
	13	Triangular fit				<u> </u>			
	14	Study of wel	8		CO4				
	15		oint - welding			CC			
	16	Tee joint – W	Velding 34		CO4 BIOTECH/Date: 19.08.202				

17	Introduction to house wiring	CO5
18	One lamp controlled by one switch	CO5
19	Two lamps controlled by single switch	CO5
20	Staircase wiring	CO5
TEXT BOO	KS	
1. Workshop	Technology I,II,III, by S K Hajra, Choudhary and A K Chaoud	hary. Media Promoters and
Publishers Pv	rt. Ltd., Bombay	
2. Workshop	Technology by Manchanda Vol. I,II,III India Publishing House, J	lalandhar.
REFERENC	ES	
1. Manual on	Workshop Practice by K Venkata Reddy, KL Narayana et al; Ma	cMillan India Ltd.
2. Basic Wor	kshop Practice Manual by T Jeyapoovan; Vikas Publishing House	e (P) Ltd.,New Delhi

Workshop Technology by B.S. Raghuwanshi, Dhanpat Rai and Co., New Delhi.
 Workshop Technology by HS Bawa, Tata McGraw Hill Publishers, New Delhi.

E RESOURCES http://nptel.ac.in/courses/112107145/

Mapping of CO's with PO'S:

						PR	OGR	AM C	OUTC	COMES	5			
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	1	1	1	1	1	-	1	1	-	1	2	0	0
CO2	2	1	1	1	1	1	-	1	1	-	1	2	0	0
CO3	2	1	1	1	1	1	-	1	1	-	1	2	0	0
CO4	2	1	1	1	1	1	-	1	1	-	1	2	0	0
CO5	2	1	1	1	1	1	-	1	1	-	1	2	0	0
Total	10	5	5	5	5	5	-	5	5	-	5	10	0	0
ScaledValue	2	1	1	1	1	1	-	1	1	-	1	2	0	0
		1 –	$5 \rightarrow 1$	l,		6 –	10 -	> 2,		11	- 15 -	$\rightarrow 3$		
	()-NoR	elatio	n,1-I	Low R	elatior	n,2-M	ledium	Relat	ion,3-H	lighR	elatio	1	

X	BT2()6	CHEMICAL ENGINEERING THERMODYNA	MICS	L 2	T 1	P 0	C 3
С	Р	A			L	Τ	Р	Н
3	0	0	Course Outcomes	Domain	2	1	0 Lev	3 vel
Afte	r con	npleti	on of the course, students will be able to		1			
CO	l		e the basic laws of thermodynamics and the amentals of thermodynamics.	Cognitive				mber stand
CO2	2	Inte	rpret the PVT relationship for various systems.	Cognitive		In	terpr	etation
CO3	3		mate the thermodynamic relations and the modynamic properties.	Cognitive				mber stand
CO4	4	Арр	ly the phase equilibrium in various systems like ible and immiscible systems.	Cognitive			Арј	ply
CO	5	Kno	ws the chemical equilibrium for industrial reactions	Cognitive		-		mber stand
Cou	rse (Conte	nt		·			Hours

	Funda	ment	als Of	The	rmody	nami	cs							6+3
Definitions of S														
and Extensive										e and	Phase	Rule	, Reve	ersible ar
Irreversible pro	ocesses, O	verall	view	on la	ws of	therm	odyn	amics.						
UNIT –II	PVT F													6+3
PVT behaviour														
gases – Equatio					_	ssibili	ity ch	arts –ł	neat e	ffects o	n che	mical	reaction	
UNIT-III	Solutio													6+3
Classification														
Jacobians – Fug	•••	-					-				-		-	
chemical poten				ions	-Activ	ity in	solut	10NS –	heat	effects	of mi	xing p	rocesse	
UNIT-IV	Phase	-			1:1: -	•	-14 :		4				- f	6+3
Criteria of pha	-			-				-		•	-			
systems, Vapou	-	-												
binary or ternal using Van laar														
UNIT-V	Reacti				i azeoi	Topic	uata ·	- Liqu	u-Li	luiu Eq	umor	iuiii u	lagrams	6+3
Reaction stoich					nicol D	anatic	n Ea	uilibri	um	Fauilik	rium	Cons	tont E	
constant and st														
pressure on eq														
pinding – Mem														
LECTU										ICAL		cuuci	TOT	
30			1	1				1 N	1101				45	
TEXT BOOK	S:				-									
	nan K.V.A	A textl	book o	f Che	emical	Engir	neerir	o The	rmod	vnamic	s''. P	HI 20	06.	
	J.M., Van													
	dynamics											Engi	leering	
Thermo	uynannes	, / L	anion	, wice	Jiaw-		nerna	uionai	Luitt	011,200.)			
REFERENCE	S:													
	, Chemica	l, Bio	chemi	cal a	nd Eng	ineeri	ing Tl	hermo	dynar	nics, 4 ^t	^h Edit	ion, V	Viley In	dia, 2006
I. S.I.Sandler,					-		-		-				-	dia, 2006
I. S.I.Sandler, 2. Rao., Y.V.C	C., Chemi	cal en	gineer	ing T	Thermo	odynaı	mics,	Unive	rsity	Press, I	Hyder	abad,	2005.	
 S.I.Sandler, Rao., Y.V.G Lehninger I 	C., Chemie Principles	cal en of Bi	gineer ochem	ing T istry	Thermo, David	odynai 1 L. N	mics, elson	Unive and N	rsity ⁄Iicha	Press, H el M. C	Hyder lox, V	abad, V. H.	2005. Freema	n; 6th
 S.I.Sandler, Rao., Y.V.G Lehninger I edition (13 	C., Chemio Principles February	cal en of Bio 2013)	gineer ochem , 1158	ing T istry page	Thermo , David es ISB	odynai 1 L. N N-10:	mics, elson 1464	Unive and N 10962	rsity ⁄Iicha	Press, H el M. C	Hyder lox, V	abad, V. H.	2005. Freema	n; 6th
 S.I.Sandler, Rao., Y.V.O Lehninger F edition (13) EREFERENC 	C., Chemic Principles February C ES: Therr	cal en of Bie 2013) nodyr	gineer ochem , 1158 amics	ing T istry page ofBio	Thermo , David es ISB omolec	odynai 1 L. N N-10: cularS	mics, felson 1464 ysten	Unive and N 10962 ns:	rsity Aicha 1, IS	Press, I el M. C BN-13	Hyder lox, V : 978-	abad, V. H. -1464	2005. Freema 109621.	n; 6th
 S.I.Sandler, Rao., Y.V.G Lehninger I edition (13 EREFERENC http://ocw.mit.e 	C., Chemic Principles February C ES: Therr	cal en of Bie 2013) nodyr	gineer ochem , 1158 amics	ing T istry page ofBio	Thermo , David es ISB omolec	odynai 1 L. N N-10: cularS	mics, felson 1464 ysten	Unive and N 10962 ns:	rsity Aicha 1, IS	Press, I el M. C BN-13	Hyder lox, V : 978-	abad, V. H. -1464	2005. Freema 109621.	n; 6th
 S.I.Sandler, Rao., Y.V.O. Lehninger I edition (13) EREFERENC http://ocw.mit.e 2005/ 	C., Chemie Principles February CES:Therr edu/course	cal en of Bio 2013) nodyr es/bio	gineer ochem , 1158 amics	ing T istry page ofBio	Thermo , David es ISB omolec	odynai 1 L. N N-10: cularS	mics, felson 1464 ysten	Unive and N 10962 ns:	rsity Aicha 1, IS	Press, I el M. C BN-13	Hyder lox, V : 978-	abad, V. H. -1464	2005. Freema 109621.	n; 6th
 S.I.Sandler, Rao., Y.V.O. Lehninger I edition (13) EREFERENC http://ocw.mit.e 2005/ 	C., Chemie Principles February CES:Therr edu/course	cal en of Bio 2013) nodyr es/bio	gineer ochem , 1158 amics	ing T istry page ofBio	Thermo , David es ISB omolec	odynai 1 L. N N-10: cularS	mics, felson 1464 ysten	Unive and N 10962 ns:	rsity Aicha 1, IS	Press, I el M. C BN-13	Hyder lox, V : 978-	abad, V. H. -1464	2005. Freema 109621.	n; 6th
 S.I.Sandler, Rao., Y.V.O. Lehninger I edition (13) EREFERENC http://ocw.mit.e 2005/ 	C., Chemie Principles February CES:Therr edu/course	cal en of Bio 2013) nodyr es/bio	gineer ochem , 1158 amics	ing T istry page ofBio	Thermo , David es ISB omolec	odynar 1 L. N N-10: cularS g/20-1	mics, felson 1464 ysten 10j-t	Unive and M 10962 ns: hermo	rsity Iicha 1, IS dynar	Press, H el M. C BN-13 mics-of	Hyder lox, W : 978- -bion	abad, V. H. -1464	2005. Freema 109621.	n; 6th
 S.I.Sandler, Rao., Y.V.O. Lehninger I edition (13) EREFERENC http://ocw.mit.e 2005/ 	C., Chemic Principles February ES: Therr edu/course Os with F	cal en of Big 2013) nodyr es/bio POs	gineer ochem , 1158 amics logical	ing T istry, page ofBio lengi	Thermo , David es ISB omoleconeering	odynan 1 L. N N-10: cularS g/20-1 PR(mics, felson 1464 ysten 10j-t	Unive and M 10962 ns: hermo	rsity Aicha 1, IS dyna UTC	Press, H el M. C BN-13 mics-of	Hyder ox, V : 978- -bion	abad, V. H. -1464 nolecu	2005. Freema 109621. lar-syst	n; 6th ems-fall-
 S.I.Sandler, Rao., Y.V.O Lehninger F edition (13 EREFERENC http://ocw.mit.e 2005/ Mapping of Co 	C., Chemic Principles February CES:Therr edu/course Os with F	cal en of Bid 2013) nodyr es/bio POs	gineer ochem , 1158 amics logical	ing T istry, page ofBid lengin	Thermo , David es ISB omoleconeering	odynan 1 L. N N-10: cularS g/20-1 PR(mics, felson 1464 ysten 10j-t OGR	Unive and M 10962 ns: hermo AM O 8	rsity Aicha 1, IS dynar OUTC 9	Press, H el M. C BN-13 mics-of COMES 10	Hyder ox, W : 978- -bion - - 11	abad, V. H. -1464 nolecu	2005. Freema 109621. lar-syst	n; 6th ems-fall- PSO2
 S.I.Sandler, Rao., Y.V.O Lehninger F edition (13 EREFERENC http://ocw.mit.e 2005/ Mapping of CO 	C., Chemic Principles February CES:Therr edu/course Os with P	cal en of Bio 2013) nodyr es/bio POs	gineer ochem , 1158 aamics logical	ing T istry, page ofBic lengin	Thermo , David es ISB omoleconeering	odynan 1 L. N N-10: cularS g/20-1 PR(<u>6</u> 0	mics, felson 1464 ysten 10j-t OGR 7	Unive and N 10962 ns: hermo AM O 8 0	rsity Aicha 1, IS dynar UTC 9	Press, F el M. C BN-13 mics-of COMES 10 0	Hyder lox, W : 978- -bion - - - - - bion - - - 2	abad, V. H. -1464 nolecu 12 2	2005. Freema 109621. lar-syst PSO1 0	n; 6th ems-fall- PSO2 2
 S.I.Sandler, Rao., Y.V.O Lehninger F edition (13 EREFERENC http://ocw.mit.e 2005/ Mapping of Co CO1 CO2 	C., Chemic Principles February ES: Therr edu/course Os with F 1 3 3 3	cal en of Bio 2013) nodyr es/bio POs	gineer ochem , 1158 amics logical 3 0 2	ing T istry, page ofBio lengin	Thermo , David es ISB omoleconeering	odynan 1 L. N N-10: cularS g/20-1 PRC 6 0	mics, felson 1464 ysten 10j-t DGR 7 0 2	Unive and M 10962 ns: hermo AM O 8 0 0	rsity Aicha 21, IS dynar DUTC 9 0 0	Press, H el M. C BN-13 mics-of COMES 10 0 0	Hyder ox, W : 978- -bion -bion 11 2 2	abad, V. H. -1464 nolecu 12 2 2	2005. Freema 109621. lar-syst PSO1 0 3	n; 6th ems-fall- PSO2 2 2
 S.I.Sandler, Rao., Y.V.O Lehninger F edition (13 EREFERENC http://ocw.mit.e 2005/ Mapping of Co CO1 CO2 CO3 	C., Chemic Principles February CES:Therr edu/course Os with F	cal en of Bie 2013) nodyr es/bio POs 2 2 3 3 3	gineer ochem , 1158 amics logical 3 0 2 2 2	ing T istry, page ofBio lengin	Thermo , David es ISB omoleconeering 5 0 1 1	odynan 1 L. N N-10: cularS g/20-1 PR(<u>6</u> 0 0	mics, felson 1464 ysten 10j-t OGR 7 0 2 2	Unive and N 10962 ns: hermo AM O 8 0 0 0	rsity Iicha 1, IS dynar UTC 9 0 0 0	Press, F el M. C BN-13 mics-of COMES 10 0 0 0	Hyder lox, W : 978- -bion - - - bion - - 2 2 2	abad, V. H. -1464 nolecu 12 2 2 2 2	2005. Freema 109621. lar-syst 0 3 3	n; 6th ems-fall- PSO2 2 2 2
 S.I.Sandler, Rao., Y.V.O Lehninger F edition (13 EREFERENC http://ocw.mit.e 2005/ Mapping of Co CO1 CO2 	C., Chemic Principles February ES: Therr edu/course Os with F 1 3 3 3	cal en of Bio 2013) nodyr es/bio POs	gineer ochem , 1158 amics logical 3 0 2	ing T istry, page ofBio lengin	Thermo , David es ISB omoleconeering	odynan 1 L. N N-10: cularS g/20-1 PRC 6 0	mics, felson 1464 ysten 10j-t DGR 7 0 2	Unive and M 10962 ns: hermo AM O 8 0 0	rsity Aicha 21, IS dynar DUTC 9 0 0	Press, H el M. C BN-13 mics-of COMES 10 0 0	Hyder ox, W : 978- -bion -bion 11 2 2	abad, V. H. -1464 nolecu 12 2 2	2005. Freema 109621. lar-syst PSO1 0 3	n; 6th ems-fall- PSO2 2 2

	1	1	1		1	1		1			1	1	1	
Total	16	15	10	10	5	3	8	2	1	0	11	12	12	
ScaledValue	3	3	2	2	1	1	2	1	1	0	3	3	3	
$1-5 \rightarrow 1,$						$6-10 \rightarrow 2$,				$11 - 15 \rightarrow 3$				
0-NoRelation,1-Low Relation,2-MediumRelation,3-HighRelation														

8th BOS/BIOTECH/Date: 19.08.2021

COURSE CODE	COURSE NAME	L	Т	Р	C	
XBE207	ELECTRICAL AND ELECTRONICS ENGINEERING SYSTEMS LABORATOR	ay 0	0	1	1	
Prerequisite	Physics	L	Т	Р	Н	
C : P : A	1.5 : 1 : 0.5	0	0	3	3	
a. Undersb. Study t	SJECTIVES: Ips toLearn the basic concepts of electrical and electrostand the basic wiring methods and connection. the characteristics of diodes, Zener diodes, NPN trans the working of simple logic gates, adders and subtraction	istors.	ts.			
Course Outco		Domain		L	evel	
CO1	Apply the fundamental electrical concepts and differentiate the various electronic components.	Cognitive Psychomot Affective	or	Unde	erstand Set luing	
CO2	Implement and execute the different types of wiring connections.	Cognitive Psychomot Affective	or	Understand Set Valuing		
CO3	Demonstrate the Fluorescent lamp connection with choke.	Cognitive Psychomot Affective	or	S	Understand Set Valuing	
CO4	Characterize and display the basic knowledge on the working of PN junction and Zener diode.	Cognitive Psychomot Affective	homotor S			
CO5	Implement and execute the various digital electronic circuits such as Adders and Subtractors.	Cognitive Psychomot Affective	or	S	erstand Set luing	
 Study o Testing using V Fluores Staircas Forward Forward Input an Constru 	iments: of Electrical Symbols, Tools and Safety Precautions, Power of Active and Passive elements – Resistors, Inductors and C of DC Voltage and Current in series and parallel resistors foltmeter, Ammeter and Multimeter. cent lamp connection with choke. se Wiring d and Reverse bias characteristics of PN junction diode. d and Reverse bias characteristics of zener diode. and Output Characteristics of NPN transistor. action and verification of simple logic gates. action and verification of adders and subtractors.	Capacitors, Bread		readboar	d by	
10. Constru	iction and vernication of adders and subtractors.			ТО	тат	
		I FKAL	TICAL TOTAL 30 30			

						Grad	luates	s Attrik	outes					
	1	2	3	4	5	6	7	8	9	10	11	12		
CO1	3	3	1	1	1	1			1	1	1			
CO2	3	3	1	1	1	1			1	1	1			
CO3	2	2	2	1	2	2	1	1	1	1	1			
CO4	2	2	1	1	1	1	1	1	1	1	1			
CO5	2	2	1	1	1	1	1	1	1	1	1			
Total	12	12	6	5	6	6	3	3	5	5	5			
Scaled Value	3	3	2	1	2	2	1	1	1	1	1			
0) - No	Relati	on, 1 -	- Low	v Relati	on, 2-	Mediu	um Rela	ation,	3- High	Relation			
		1 – 5 -	$1-5 \rightarrow 1$, $6-10 \rightarrow 2$, $11-15 \rightarrow 3$											

Cos versus GA mapping

COUR	SE CODE	XAC208	L	Т	P	С				
COUR	SE NAME	Applied Chemistry For Engineers laboratory	0	0	1	1				
PRER	EQUISITES	Nil	L	Т	P H					
C:P:A		3.5:1.0:0.5	0	0	3	3				
COUR	SE OUTCOME	S	DOM	AIN	LEV	EL				
CO1	<i>Identify</i> the perelectron affinity <i>Describe</i> the value and alkalinity.	Cognit Psycho	tive omotor		erstand eption					
CO2	-	<i>leasure</i> microscopic chemistry in terms of ar orbitals and intermolecular forces.	Cogni Psycho	tive omotor	Unde Set	erstand				
CO3	<i>Interpret</i> bul thermodynamic	k properties and processes using and kinetic considerations.	Psycho	CognitiveApPsychomotorMeAffectiveReal						
CO4	,	<i>rate and Discuss</i> the chemical reactions that synthesis of molecules.	Cognit Psycho Affect	erstand yze						
CO5	electromagnetic	<i>re</i> and <i>Distinguish</i> the ranges of the spectrum used for exciting different sy levels in various spectroscopic techniques	Cognitive Apply Psychomotor Mechanis							
Labora	atory Part				30 hrs					

Experiments :	
1. Determination of chloride ion present in the water sample by Argentometric	CO1
method.	CO1
2. Determination of total, temporary and permanent hardness of water sample by	CO 2
EDTA method.	CO2
3. Determination of cell constant and conductance of solutions.	CO2
4. Potentiometry - determination of redox potentials and emfs.	CO3
5. Determination of surface tension and viscosity.	CO3
6. Adsorption of acetic acid by charcoal.	005
7. Determination of the rate constant of a reaction.	CO4
8. Estimation of iron by colorimetric method.	CO4
9. Synthesis of a polymer/drug.	CO5
10. Saponification/acid value of oil.	005
	CO5

REFERENCE BOOKS

1. Mendham, Denney R.C., Barnes J.D and Thomas N.J.K., "Vogel's Textbook of Quantitative Chemical Analysis", 6th Edition, Pearson Education, 2004.

- 2. Garland, C. W.; Nibler, J. W.; Shoemaker, D. P. "Experiments in Physical Chemistry", 8th Ed.; McGraw-Hill: New York, 2003.
- 3. E Resources MOOCs:

1.http://freevideolectures.com/Course/2380/Chemistry-Laboratory-Techniques 2. <u>http://freevideolectures.com/Course/2941/Chemistry-1A-General-Chemistry-Fall-2011</u> 3. http://ocw.mit.edu/courses/chemistry/5-301-chemistry-laboratory-techniques

LECTURE	TUTORIAL	PRACTICAL	TOTAL HOURS
0	0	45	45

Mapping of CO's with PO's:

			PROGRAM OUTCOMES											
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	0	0	0	0	0	2	3	3	0	0	0	0	0
CO2	2	0	0	0	0	0	1	2	2	0	0	0	0	0
CO3	3	0	0	0	0	0	2	3	3	0	0	0	0	0
CO4	3	0	0	0	0	0	3	3	3	0	0	0	0	0
CO5	3	0	0	0	0	0	2	2	3	0	0	0	0	0
Total	14	0	0	0	0	0	10	13	14	0	0	0	0	0
ScaledValue	3	0	0 0 0 0 0 2 3 3 0 0 0 0 0											
	$1-5 \rightarrow 1$, $6-10 \rightarrow 2$, $11-15 \rightarrow 3$													
	0-NoRelation,1-Low Relation,2-MediumRelation,3-HighRelation													

III Semester

COU	RSE CO	ODE	XPS301		L	Т	Р	C
COU	RSE NA	AME	PROBABILITY AND STATISTICS		3	0	0	3
С	Р	Α			L	Т	Р	Η
2.5	0.5	0			3	0	0	3
PRE	REQU	ISITE:N	Nil					
Learn 1. 2. 3.	ning O Appr Deve sumr Inter unde The	bjective reciate the clop ski naries and pret and rstandate main objective		oriate diagrams, rsis of simple dat lyses in a cle e foundations of	tabu tasets ear c prob	onc abil	ise ities	anc anc
COU	mode		imate prediction and computer networks etc.					
	se outco		E5.	Domain	Leve	el		
CO1	-		itional probability, independent events; find expected oments of Discrete random variables with properties.	Cognitive	Understand			
CO2	Find densi	distribu ty functi	tion function, Marginal density function, conditional on, Define density function of conditional distribution nal, exponential and gamma distributions.	Cognitive	Remember			
CO3	Bino	mial, Po elation co	res of central tendency, statistical parameters of bisson and Normal, correlation, regression. Rank befficient of two variables. Moments, Skewness and	Cognitive Psychomotor	Rem			onse
CO4	prop	ortion, s	e sample test for single proportion, difference of single mean, difference of means and difference leviations with simple problems.	Cognitive	Und			<u>5115C</u>
CO5	Expl mean	l ain sm 1 and c	all sample test for single mean, difference of orrelation coefficients, variance test, chi-square ple Problems.	Cognitive	Und	ersta	nd	
UNIT	' I: Basi	ic Proba	bility		9			
Proba rando	ability om vari	spaces, iables, t	conditional probability, independence, Discrete he multinomial distribution, Poisson approximat f Bernoulli trials, sums of independent random v	on to the binor	les, nial	dist	ribut	ion

Random Variables, Moments, Variance of a sum, Chebyshev's Inequality. **UNIT II: Continuous Probability Distributions & Bivariate Distributions**

Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities. Bivariate distributions and their properties, distribution of sums and quotients, conditional densities.

UNIT III: Basic Statistics

Measures of Central tendency: Moments, Skewness and Kurtosis - Probability distributions: Binomial, Poisson and normal - evaluation of statistical parameters for these three distributions, Correlation and

9

9

regression - Rank correlation.

UNIT IV: Applied Statistics

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

UNIT V: Small Samples

Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chisquare test for goodness of fit and independence of attributes.

LECTURE	TUTORIAL	TOTAL
45	0	45

9

9

TEXTBOOKS

1. Veerarajan T., "Probability, Statistics and Random Processes", Tata McGraw-Hill, New Delhi, 2010 2. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 43rd Edition, 2015.

REFERENCES

- 1. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.
- 2. P. G. Hoel, S. C. Port and C. J. Stone, "Introduction to Probability Theory", Universal Book Stall, 2003 (Reprint).
- 3. S. Ross, "A First Course in Probability", 6th Ed., Pearson Education India, 2002.
- 4. W. Feller, "An Introduction to Probability Theory and its Applications", Vol. 1, 3rd Ed., Wiley, 1968.
- 5. N.P. Bali and Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, Reprint, 2010.

E – REFERENCE nptel

Probability and Statistics by Prof.Someshkumar, Department of Mathematics, IIT Kharagpur. (http://nptel.ac.in/noc/noc courselist.php)

r	Cos versus GA mapping													
						Grad	luates	s Attrib	utes					
	1	2	3	4	5	6	7	8	9	10	11	12		
CO1	3	2	1						1	1		1		
CO2	3	2	1						1	1		1		
CO3	3	2	1	1					1	1		1		
CO4	3	2	1	1	1	1			1	1	1	1		
CO5	3	2	1	1	1	1	1		1	1	1	1		
Total	15	10	5	3	2	2	1		5	5	2	5		
Scaled Value	3	2	1	1	1	1	1		1	1	1	1		
0) - No	Relati	on, 1 -	Low	v Relati	on, 2-	Medi	um Rela	ation,	3- High	Relat	ion		
		1 – 5 -	$1-5 \rightarrow 1$, $6-10 \rightarrow 2$, $11-15 \rightarrow 3$											

							L	Т	P	С			
X	BT3	302					2	1	0	3			
~			-	BIOCHEMIST	RY		-	-					
C	P	A	-					T	P	H			
3	0	0					3	1	0	4			
	-	site: -	ti-roat										
		g Object		course, the students									
Opor		-		the fundamentals of biomolec									
•													
•	vv	oulu na		the functions of proteins and Course Outcomes	biosignannig	Domai	in		Level				
After	the	complet		ne course, students will be able	e to	Doma	111		Level				
	R	-		<i>iderstand</i> about role of water		Cognitive		Reme	mher				
CO1		ids.		inersiana about fore of water		Cognitive		Kenner	noei				
	R		and D	nderstand proteins and their	r structures	Cognitive		Recall					
CO2		-		out enzymes.	structures.	coginitive		Recuit					
~~~	D.			<i>iderstand</i> about carbohydrate	e and glycol	Cognitive		Under	stand				
CO3		ology.		······································	8-9				~ • • • • - • •				
004	R	0,	e and U		Under	stand							
CO4		ids.		C									
CO5	Re	ecognize	e and Un		Undon	atand							
						_		Understand					
I - W	Vate	r, Amin	o acids	and Proteins					6+3				
Secon	ndar	y, Tertia	ary struc	perties, Peptides, Proteins, ture and Quaternary Structure d Enzymes			e of	Proteins	$\frac{6+3}{6+3}$	nary,			
				Protein to a Ligand: Oxyger	Binding Dr	otains: Cor	nnlam	ontory		tions			
				ands: Protein Interactions Mo									
			-	ntroduction to Enzymes: He	-				-				
				ulatory Enzymes.	j			-~,	r				
•									(.)				
				l Glycobiology saccharides: Polysaccharides:	Clussoniu	antage Drata	o altra		6+3	taina			
				hydrates as Informational									
		rates.	. <b>Ca</b> 100	injurates as informational	Wiolecules.	The Suga		ic. wo	IKIIIg	vv itili			
			and Ni	ıcleic acids					6+3				
				des and nucleic acids: Nuclei	c Acid Struc	ture: Nuclei	ic Aci	l Chem		Other			
			leotides.				10 1 101		1501 9.	o thei			
				embranes and transport					6+3				
			-	l Lipids in Membranes: Lipic	ls as Signals	. Cofactors	, and I	Pigment		rking			
				membranes and transport:									
				solute transport across membr									
	L	ecture		Tutorial	Pract	ical		Tot	tal				
		30		15	0			45	5				
Text	Boo	ks:											
1	. Le	ehninger	r Princip	les of Biochemistry, David I	. Nelson and	Michael M	I. Cox	к, W. H	. Free	man;			
				bruary 2013), 1158 pages ISB									
2.			stry, Do	onald Voet, Judith G. Voet 4	th Edition, 20	011, 1520	pages	ISBN:	978-0	-470-			
	91	410-6.											
				42		8 th BOS/B	IOTEC	'H/Date	• 19 0	8 202			

3. Branden C. and Tooze J., "Introduction to Protein Structured, Second Edition", Garland Publishing, NY, USA, 1999.

# **Reference Books:**

- 1. Introduction to Protein structure, 2nd Ed by Carl Branden and John Tooze, Garland Press, 1999.
- 2. Structure and Mechanism in Protein Science, Alan Fersht, Freeman, 1999.
- 3. Protein engineering in Industrial biotechnology, Ed. Lilia Alberghina, Harwood Academic Publishers, 2002.
- 4. Creighton T.E. Proteins, Freeman WH, Second Edition, 1993.

# **E-References:**

- 1. http://vlab.amrita.edu/?sub=3&brch=63
- 2. https://www.youtube.com/channel/UCbWTmSK7bYM9kRZAdfy_gyg

# Mapping of COs with POs

	PO1	PO2		PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	1	2	0	1	0	0	1	1	1	1	3	2	3
CO 2	1	1	2	0	1	0	0	1	1	1	1	0	3	2
CO 3	1	1	2	0	1	0	0	1	1	1	1	2	2	1
CO 4	1	1	2	0	1	0	0	1	1	1	1	0	1	0
CO 5	1	1	2	0	1	0	0	1	1	1	1	2	0	0
	5	5	10	0	5	0	0	5	5	5	5	7	8	6

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

# Mapping of Subjects with POs

	PO 1	PO 2	<b>PO</b> 3	<b>PO</b> 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
Origina l Value	5	5	10	0	5	0	0	5	5	5	5	7	8	6
Scaled Value	3	3	6	0	3	0	0	3	3	0	3	4	5	3

 $1-5 \rightarrow 1$ ,  $6-10 \rightarrow 2$ ,  $11-15 \rightarrow 3$ 0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

x	KBT 3	0.2		L	Т	Р	С
	DI J	03	MICDODIOLOCY	3	0	0	3
С	P	Α	MICROBIOLOGY	L	Т	Р	Η
3	0	0		3	0	0	3
PR	EREQ	UISI	TE: Biology				

# Learning Objectives:

Upon completion of this course, the students will be able to understand the existence of microbial world through the study of the characteristics of microorganisms, their classification, their interaction with various environments, growth in different media and their control.

	Course Outcomes	Domain	Level
After	the completion of the course, students will be able to		
C01	<i>Comprehend</i> knowledgeabout historical perspective of microbiology and its developments. <i>Recognize</i> the fundamental concepts in the structure and functioning of a prokaryotic cell. <i>Perform</i> staining techniques to observe	Cognitive	Understand Remember

	microorganisms				
	microorganisms				
	Acquire knowled	dge about microbial tax	xonomy and	Cognitive	Understand
CO2	-	6	xonomy and	Cognitive	Remember
	microbial classific	ation methods			
	Acquire knowled	ge about microbial ecosyst	em and their	Cognitive	Understand
CO3	-	erent environments	eni and then	Cognitive	Remember
					Remember
	Acquire knowled	lge on the bacterial gro	owth, growth		
<b>CO4</b>	curveandmicrobia	l nutritional requirem	nents, Perform	Cognitive	Understand
CO4	culturing techniqu	es to isolate microorganisma	s, <b>Choose</b> the		Remember
		for the cultivation of microo			
		mechanisms of various	-		
CO5		hogens applications of mic		Cognitive	Understand
005		ge on the drug resistance of p		Cogintive	Remember
	· ·				
		DUCTION TO MICROBI			7
•		Microbiology – Overview	•		
• 1		l wall, Flagella, Capsule –			: Microscopy (light
dark-fi	<b>^</b>	, electron), Staining techniqu	· · ·	differential).	
J	II CLASS	<b>IFICATION OF MICROC</b>	DRGANISMS		9
Microł	bial Taxonomy: Bi	nomial Nomenclature – Five	e Kingdom cla	ssification syste	m: Monera, Protista
	-	– Three Domain classification	-	•	
		gical characteristics, Physio			
	_	cal characteristics, Molect	-		
	fication.	ai characteristics, worder	ulai character	15105 - 10	ses. Structure and
Classii				MICDODI	T
Ι	III MICRO		AND	MICROBIA	11 11
		AUTIUNS			
Microl		ACTIONS	Fcosystems F	Freshwater Eco	systems Terrestrial
	bial Ecology: Mi	croorganisms in Marine			
Ecosys	bial Ecology: Mi stems – Microbial I	croorganisms in Marine nteractions: Microbe-Micro	be interactions,		be interactions.
Ecosys I	oial Ecology: Mi stems – Microbial I V MICRO	croorganisms in Marine nteractions: Microbe-Microl <b>BIAL GROWTH AND N</b>	be interactions, UTRITION	Human-Microb	be interactions.
Ecosys I Microb	oial Ecology: Mi stems – Microbial I V MICRO oial Growth: Grow	croorganisms in Marine I nteractions: Microbe-Microb <b>BIAL GROWTH AND N</b> th curve (lag, exponential, st	be interactions, UTRITION tationary, death	Human-Microb	be interactions.
Ecosys I Microb cell ma	oial Ecology: Micstems – Microbial I Stems – Microbial I IV MICRO Dial Growth: Growt ass), Factors influe	croorganisms in Marine nteractions: Microbe-Micro <b>BIAL GROWTH AND N</b> th curve (lag, exponential, st encing growth (water activit	be interactions, U <b>TRITION</b> tationary, death ty, pH, tempera	Human-Microb n phase), Measur ature, oxygen, p	te interactions. 11 rement (cell number pressure, radiation) -
Ecosys I Microb cell ma Microb	oial Ecology: Mi stems – Microbial I V MICRO Dial Growth: Growt ass), Factors influe Dial Nutrition: Cult	croorganisms in Marine I nteractions: Microbe-Microb <b>BIAL GROWTH AND N</b> th curve (lag, exponential, st	be interactions, U <b>TRITION</b> tationary, death ty, pH, tempera	Human-Microb n phase), Measur ature, oxygen, p	rement (cell number pressure, radiation) -
Ecosys I Microb cell ma	bial Ecology: Micstems – Microbial I Stems – Microbial I W MICRO Dial Growth: Growt ass), Factors influe Dial Nutrition: Cult late).	croorganisms in Marine I nteractions: Microbe-Microb <b>BIAL GROWTH AND N</b> th curve (lag, exponential, st encing growth (water activit cure media (defined, completed)	be interactions, UTRITION tationary, death ty, pH, tempera ex), Culture te	Human-Microb phase), Measu ature, oxygen, p chniques (sprea	te interactions. 11 rement (cell number, pressure, radiation) –
Ecosys I Microb cell ma Microb pour pl	bial Ecology: Micstems – Microbial I Stems – Microbial I W MICRO Dial Growth: Growt ass), Factors influe Dial Nutrition: Cult late).	croorganisms in Marine nteractions: Microbe-Micro <b>BIAL GROWTH AND N</b> th curve (lag, exponential, st encing growth (water activit	be interactions, UTRITION tationary, death ty, pH, tempera ex), Culture te	Human-Microb phase), Measu ature, oxygen, p chniques (sprea	te interactions. 11 rement (cell number, pressure, radiation) –
Ecosys I Microb cell ma Microb pour pl	bial Ecology: Mi stems – Microbial I V MICRO bial Growth: Growt ass), Factors influe bial Nutrition: Cult late). V ANTIBI	croorganisms in Marine Interactions: Microbe-Microb BIAL GROWTH AND N th curve (lag, exponential, st encing growth (water activit cure media (defined, complete IOTICS AND ANTIMICR	be interactions, UTRITION tationary, death ty, pH, tempera ex), Culture te OBIAL RESI	Human-Microb n phase), Measur ature, oxygen, p chniques (sprea STANCE	be interactions. 11 rement (cell number, pressure, radiation) – d plate, streak plate 7
Ecosys Microt cell ma Microt pour pl Antibio	bial Ecology: Micstems – Microbial I Stems – Microbial I V MICRO Dial Growth: Growt ass), Factors influe Dial Nutrition: Cult late). V ANTIBI Dotics: Antibacterial	croorganisms in Marine Interactions: Microbe-Microb <b>BIAL GROWTH AND N</b> th curve (lag, exponential, st encing growth (water activit cure media (defined, complet <b>IOTICS AND ANTIMICR</b> I, Antifungal, Antiviral, Ant	be interactions, UTRITION tationary, death ty, pH, tempera ex), Culture te OBIAL RESI tiprotozoan, A	Human-Microb n phase), Measur ature, oxygen, p chniques (sprea STANCE	be interactions. 11 rement (cell number, pressure, radiation) – d plate, streak plate 7
Ecosys Microt cell ma Microt pour pl Antibio Resista	bial Ecology: Micstems – Microbial I MICRO bial Growth: Growt ass), Factors influe bial Nutrition: Cult late). M ANTIBI otics: Antibacterial ance: Mechanisms	croorganisms in Marine Interactions: Microbe-Microb <b>BIAL GROWTH AND NI</b> th curve (lag, exponential, st encing growth (water activit cure media (defined, complet <b>IOTICS AND ANTIMICR</b> , Antifungal, Antiviral, Antipiral, Antipiral, Antipiral, Antiviral, Antipiral,	be interactions, UTRITION tationary, death tationary, death ex), Culture te OBIAL RESI tiprotozoan, Au resistance.	Human-Microb n phase), Measur ature, oxygen, p chniques (sprea STANCE	be interactions. 11 rement (cell number, pressure, radiation) – d plate, streak plate 7 rugs – Antimicrobia
Ecosys Microt cell ma Microt pour pl Antibio Resista	DialEcology:Microbial IStems – Microbial I <b>MICRO</b> VMICRODial Growth:GrowthDial Nutrition:CultDial Nutrition:CultLECTUREMICRO	croorganisms in Marine I nteractions: Microbe-Micro <b>BIAL GROWTH AND N</b> th curve (lag, exponential, st encing growth (water activit cure media (defined, complet <b>IOTICS AND ANTIMICR</b> I, Antifungal, Antiviral, Antiof resistance, Prevention of 1 <b>TUTO</b>	be interactions, UTRITION tationary, death tationary, death ex), Culture te OBIAL RESI tiprotozoan, Au resistance.	Human-Microb n phase), Measur ature, oxygen, p chniques (sprea STANCE	te interactions. 11 rement (cell number, pressure, radiation) – d plate, streak plate 7 rugs – Antimicrobia TOTAL
Ecosys I Microb cell ma Microb pour pl Antibio Resista	bial Ecology: Microbial I stems – Microbial I <b>W</b> MICRO bial Growth: Growt ass), Factors influe bial Nutrition: Cult late). <b>V</b> ANTIBI otics: Antibacterial ance: Mechanisms of LECTURE 45	croorganisms in Marine Interactions: Microbe-Microb <b>BIAL GROWTH AND NI</b> th curve (lag, exponential, st encing growth (water activit cure media (defined, complet <b>IOTICS AND ANTIMICR</b> , Antifungal, Antiviral, Antipiral, Antipiral, Antipiral, Antiviral, Antipiral,	be interactions, UTRITION tationary, death tationary, death ex), Culture te OBIAL RESI tiprotozoan, Au resistance.	Human-Microb n phase), Measur ature, oxygen, p chniques (sprea STANCE	be interactions. 11 rement (cell number, pressure, radiation) – d plate, streak plate, 7 rugs – Antimicrobia
Ecosys Microt cell ma Microt pour pl Antibio Resista I	bial Ecology: Micstems – Microbial I W MICRO bial Growth: Growt ass), Factors influe bial Nutrition: Cult late). V ANTIBI otics: Antibacterial ance: Mechanisms of LECTURE 45 BOOKS:	croorganisms in Marine Interactions: Microbe-Microb <b>BIAL GROWTH AND NI</b> th curve (lag, exponential, strencing growth (water activit cure media (defined, completing) <b>IOTICS AND ANTIMICR</b> I, Antifungal, Antiviral, Anti- of resistance, Prevention of 1 <b>TUTOP</b> 0	be interactions, UTRITION tationary, death ty, pH, tempera ex), Culture te OBIAL RESI tiprotozoan, A resistance. RIAL	Human-Microb a phase), Measur ature, oxygen, p chniques (sprea STANCE ntihelminthic dr	be interactions. 11 rement (cell number, pressure, radiation) – d plate, streak plate 7 rugs – Antimicrobia TOTAL 45
Ecosys Microt cell ma Microt pour pl Antibio Resista I	bialEcology:Microbial Istems – Microbial IIVMICRODialGrowth:GrowthDialGrowth:GrowthDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:Nutrition:DialNutrition:Nutrition:DialNutrition:Nutrition:DialNutrition:Nutrition:DialNutrition:Nutrition:DialNutrition:Nutrition:DialNutrition:Nutrition:DialNutrition:Nutrition:DialNutrition:Nutrition:DialNutritio	croorganisms in Marine I nteractions: Microbe-Micro <b>BIAL GROWTH AND N</b> th curve (lag, exponential, st encing growth (water activit cure media (defined, complet <b>IOTICS AND ANTIMICR</b> I, Antifungal, Antiviral, Antiof resistance, Prevention of 1 <b>TUTO</b>	be interactions, UTRITION tationary, death ty, pH, tempera ex), Culture te OBIAL RESI tiprotozoan, A resistance. RIAL	Human-Microb a phase), Measur ature, oxygen, p chniques (sprea STANCE ntihelminthic dr	be interactions. 11 rement (cell number, pressure, radiation) – d plate, streak plate 7 rugs – Antimicrobia TOTAL 45
Ecosys Microb cell ma Microb pour pl Antibio Resista I TEXT 1.	bial Ecology: Microbial I stems – Microbial I W MICRO bial Growth: Growt ass), Factors influe bial Nutrition: Cult late). V ANTIBI otics: Antibacterial ance: Mechanisms of LECTURE 45 BOOKS: Prescott, L. M., H Education, 2005.	croorganisms in Marine Interactions: Microbe-Microb <b>BIAL GROWTH AND NI</b> th curve (lag, exponential, strencing growth (water activit cure media (defined, completing) <b>IOTICS AND ANTIMICR</b> I, Antifungal, Antiviral, Anti- of resistance, Prevention of 1 <b>TUTOP</b> 0	be interactions, UTRITION tationary, death ty, pH, tempera ex), Culture te OBIAL RESI tiprotozoan, A resistance. RIAL	Human-Microb a phase), Measur ature, oxygen, p chniques (sprea STANCE ntihelminthic dr	be interactions. 11 rement (cell number pressure, radiation) - d plate, streak plate 7 rugs – Antimicrobia TOTAL 45
Ecosys I Microb cell ma Microb pour pl Antibio Resista I TEXT 1.	bialEcology:Microbial Istems – Microbial IIVMICRODialGrowth:GrowthDialGrowth:GrowthDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:CultDialNutrition:Nutrition:DialNutrition:Nutrition:DialNutrition:Nutrition:DialNutrition:Nutrition:DialNutrition:Nutrition:DialNutrition:Nutrition:DialNutrition:Nutrition:DialNutrition:Nutrition:DialNutrition:Nutrition:DialNutritio	croorganisms in Marine Interactions: Microbe-Microb <b>BIAL GROWTH AND NI</b> th curve (lag, exponential, strencing growth (water activit cure media (defined, completing) <b>IOTICS AND ANTIMICR</b> I, Antifungal, Antiviral, Anti- of resistance, Prevention of 1 <b>TUTOP</b> 0	be interactions, UTRITION tationary, death ty, pH, tempera ex), Culture te OBIAL RESI tiprotozoan, A resistance. RIAL	Human-Microb a phase), Measur ature, oxygen, p chniques (sprea STANCE ntihelminthic dr	be interactions. 11 rement (cell number pressure, radiation) - d plate, streak plate 7 rugs – Antimicrobia TOTAL 45
Ecosys Microb cell ma Microb pour pl Antibio Resista I TEXT 1.	bial Ecology: Missions – Microbial I W MICRO Dial Growth: Growth ass), Factors influe Dial Nutrition: Cult bial Nutrition: Cult bial Nutrition: Cult bial Nutrition: Cult Dial Nutrition: Cult	croorganisms in Marine Interactions: Microbe-Microb <b>BIAL GROWTH AND NI</b> th curve (lag, exponential, strencing growth (water activit cure media (defined, completing) <b>IOTICS AND ANTIMICR</b> I, Antifungal, Antiviral, Anti- of resistance, Prevention of 1 <b>TUTOP</b> 0	be interactions, UTRITION tationary, death ty, pH, tempera ex), Culture te OBIAL RESI tiprotozoan, Ar resistance. RIAL	Human-Microb a phase), Measur ature, oxygen, p chniques (spreas STANCE ntihelminthic dr	be interactions. 11 rement (cell number, pressure, radiation) - d plate, streak plate 7 rugs – Antimicrobia TOTAL 45 Hill Higher
Ecosys Microb cell ma Microb pour pl Antibio Resista I TEXT 1.	bial Ecology: Micstems – Microbial I MICRO Dial Growth: Growth ass), Factors influe Dial Nutrition: Cult late). V ANTIBI otics: Antibacterial ance: Mechanisms of LECTURE 45 BOOKS: Prescott, L. M., H Education, 2005. RENCES: Morcello, J. A., M	croorganisms in Marine Interactions: Microbe-Microb BIAL GROWTH AND N th curve (lag, exponential, st encing growth (water activit cure media (defined, complet IOTICS AND ANTIMICR I, Antifungal, Antiviral, Ant of resistance, Prevention of 1 TUTOI 0 arley, J. P., and Klein, D. A.	be interactions, UTRITION tationary, death ty, pH, tempera ex), Culture te OBIAL RESI tiprotozoan, Ar resistance. RIAL Microbiology.	Human-Microb a phase), Measur ature, oxygen, p chniques (spreas STANCE ntihelminthic dr	be interactions. 11 rement (cell number pressure, radiation) - d plate, streak plate 7 rugs – Antimicrobia TOTAL 45 Hill Higher
Ecosys Microb cell ma Microb pour pl Antibio Resista I TEXT 1. REFE 1.	bial Ecology: Micstems – Microbial I MICRO bial Growth: Growt ass), Factors influe bial Nutrition: Cult late). V ANTIBI otics: Antibacterial ance: Mechanisms of LECTURE 45 BOOKS: Prescott, L. M., H Education, 2005. RENCES: Morcello, J. A., M Microbiology: Ap	croorganisms in Marine I nteractions: Microbe-Micro <b>BIAL GROWTH AND NI</b> th curve (lag, exponential, st encing growth (water activit cure media (defined, comple <b>IOTICS AND ANTIMICR</b> , Antifungal, Antiviral, Ant of resistance, Prevention of 1 <b>TUTOP</b> arley, J. P., and Klein, D. A. lizer, H. E., &Granato, P. A. plication to patient care, 200	be interactions, UTRITION tationary, death tay, pH, tempera ex), Culture te OBIAL RESI tiprotozoan, Arresistance. RIAL Microbiology. Laboratory ma 03	Human-Microb n phase), Measurature, oxygen, p chniques (spreas STANCE ntihelminthic dr 5th. <i>McGrawJ</i> anual and workt	be interactions.
Ecosys Microb cell ma Microb pour pl Antibio Resista I TEXT 1. REFE 1. 2.	bial Ecology: Micstems – Microbial I V MICRO Dial Growth: Growth ass), Factors influe Dial Nutrition: Cult ate). V ANTIBIN otics: Antibacterial ance: Mechanisms of LECTURE 45 BOOKS: Prescott, L. M., H Education, 2005. RENCES: Morcello, J. A., M. Microbiology: Ap Prescott, L. M., H	croorganisms in Marine Interactions: Microbe-Microb <b>BIAL GROWTH AND NI</b> th curve (lag, exponential, strencing growth (water activit cure media (defined, completed <b>IOTICS AND ANTIMICR</b> I, Antifungal, Antiviral, Anti- of resistance, Prevention of 1 <b>TUTOP</b> 0 arley, J. P., and Klein, D. A. Iizer, H. E., &Granato, P. A. plication to patient care, 200 arley, J. P., & Klein, D. A. I	be interactions, UTRITION tationary, death ty, pH, tempera ex), Culture te OBIAL RESI tiprotozoan, Air resistance. RIAL Microbiology Laboratory maga Laboratory exer	Human-Microb	be interactions. 11 rement (cell number. pressure, radiation) - d plate, streak plate 7 rugs – Antimicrobia TOTAL 45 Hill Higher pook in iology, 2002.
Ecosys Microb cell ma Microb pour pl Antibio Resista I TEXT 1. REFE 1. 2. 3.	bial Ecology: Micstems – Microbial I MICRO Dial Growth: Growth ass), Factors influe Dial Nutrition: Cult late). V ANTIBI otics: Antibacterial ance: Mechanisms of LECTURE 45 BOOKS: Prescott, L. M., H Education, 2005. RENCES: Morcello, J. A., M. Microbiology: Ap Prescott, L. M., H Black, Jacquelyn of	croorganisms in Marine I nteractions: Microbe-Micro <b>BIAL GROWTH AND N</b> th curve (lag, exponential, st encing growth (water activit cure media (defined, comple <b>OTICS AND ANTIMICR</b> , Antifungal, Antiviral, Ant of resistance, Prevention of 1 <b>TUTOI</b> arley, J. P., and Klein, D. A. lizer, H. E., &Granato, P. A. plication to patient care, 200 arley, J. P., & Klein, D. A. I G. <i>Microbiology: principles</i>	be interactions, UTRITION tationary, death ty, pH, tempera ex), Culture te OBIAL RESI tiprotozoan, Arresistance. RIAL Microbiology. Laboratory man aboratory exer and exploration	Human-Microle a phase), Measurature, oxygen, p chniques (spreas STANCE ntihelminthic dr 5th. <i>McGrawJ</i> anual and workt rcises in microbi <i>ns</i> . John Wiley	be interactions. 11 rement (cell number pressure, radiation) - d plate, streak plate 7 rugs – Antimicrobia TOTAL 45 Hill Higher pook in iology, 2002. & Sons, 2008.
Ecosys Microb cell ma Microb pour pl Antibio Resista I TEXT 1. REFE 1. 2. 3.	bial Ecology: Micstems – Microbial I W MICRO Dial Growth: Growt ass), Factors influe Dial Nutrition: Cult late). V ANTIBINATION Otics: Antibacterial ance: Mechanisms of LECTURE 45 BOOKS: Prescott, L. M., H Education, 2005. RENCES: Morcello, J. A., M. Microbiology: Ap Prescott, L. M., H Black, Jacquelyn of Tortora, Gerard J.	croorganisms in Marine I nteractions: Microbe-Microb <b>BIAL GROWTH AND NI</b> th curve (lag, exponential, st encing growth (water activit cure media (defined, comple <b>OTICS AND ANTIMICR</b> , Antifungal, Antiviral, Antiof resistance, Prevention of 1 <b>TUTOP</b> arley, J. P., and Klein, D. A. plication to patient care, 200 arley, J. P., & Klein, D. A. I G. <i>Microbiology: principles</i> , Berdell R. Funke, Christine	be interactions, UTRITION tationary, death tay, pH, tempera ex), Culture te OBIAL RESI tiprotozoan, Ar resistance. RIAL Microbiology. Laboratory ma D3 Laboratory exer and exploratio e L. Case, and '	Human-Microb a phase), Measurature, oxygen, p chniques (spread STANCE STANCE ntihelminthic dr 5th. <i>McGrawJ</i> anual and workt recises in microbi <i>ns.</i> John Wiley Fed R. Johnson.	be interactions. 11 rement (cell number pressure, radiation) - d plate, streak plate 7 rugs – Antimicrobia TOTAL 45 Hill Higher pook in iology, 2002. & Sons, 2008.
Ecosys Microb cell ma Microb pour pl Antibio Resista I TEXT 1. REFE 1. 2. 3. 4.	bial Ecology: Micstems – Microbial I Microbial I Microbial I Microbial Growth: Growth ass), Factors influe bial Nutrition: Cult ate). Microbial Nutrition: Cult ate). Morcello, ANTIBI Morcello, J. A., M. Microbiology: Ap Prescott, L. M., H Black, Jacquelyn G Tortora, Gerard J. <i>introduction</i> . Vol.	croorganisms in Marine I nteractions: Microbe-Micro <b>BIAL GROWTH AND N</b> th curve (lag, exponential, st encing growth (water activit cure media (defined, comple <b>OTICS AND ANTIMICR</b> , Antifungal, Antiviral, Ant of resistance, Prevention of 1 <b>TUTOI</b> arley, J. P., and Klein, D. A. lizer, H. E., &Granato, P. A. plication to patient care, 200 arley, J. P., & Klein, D. A. I G. <i>Microbiology: principles</i>	be interactions, UTRITION tationary, death tay, pH, tempera ex), Culture te OBIAL RESI tiprotozoan, Ar resistance. RIAL Microbiology. Laboratory ma D3 Laboratory exer and exploratio e L. Case, and '	Human-Microb a phase), Measurature, oxygen, p chniques (spread STANCE STANCE ntihelminthic dr 5th. <i>McGrawJ</i> anual and workt recises in microbi <i>ns.</i> John Wiley Fed R. Johnson.	be interactions. 11 rement (cell number pressure, radiation) - d plate, streak plate 7 rugs – Antimicrobia TOTAL 45 Hill Higher pook in iology, 2002. & Sons, 2008.
Ecosys Microb cell ma Microb pour pl Antibio Resista I TEXT 1. REFE 1. 2. 3. 4. E-REF	bial Ecology: Micstems – Microbial I MICRO Dial Growth: Growth ass), Factors influe Dial Nutrition: Cult late). V ANTIBIN otics: Antibacterial ance: Mechanisms of LECTURE 45 BOOKS: Prescott, L. M., H Education, 2005. RENCES: Morcello, J. A., M. Microbiology: Ap Prescott, L. M., H Black, Jacquelyn of Tortora, Gerard J. <i>introduction</i> . Vol. FERENCES:	croorganisms in Marine I nteractions: Microbe-Micro <b>DBIAL GROWTH AND NU</b> th curve (lag, exponential, st encing growth (water activit cure media (defined, comple <b>OTICS AND ANTIMICR</b> , Antifungal, Antiviral, Ant of resistance, Prevention of the <b>TUTOH</b> arley, J. P., and Klein, D. A. lizer, H. E., &Granato, P. A. plication to patient care, 200 arley, J. P., & Klein, D. A. I G. <i>Microbiology: principles</i> , Berdell R. Funke, Christine 9. San Francisco, CA: Benja	be interactions, UTRITION tationary, death tay, pH, tempera ex), Culture te OBIAL RESI tiprotozoan, Ar resistance. RIAL Microbiology. Laboratory ma D3 Laboratory exer and exploratio e L. Case, and '	Human-Microb a phase), Measurature, oxygen, p chniques (spread STANCE STANCE ntihelminthic dr 5th. <i>McGrawJ</i> anual and workt recises in microbi <i>ns.</i> John Wiley Fed R. Johnson.	be interactions. 11 rement (cell number pressure, radiation) - d plate, streak plate 7 rugs – Antimicrobia TOTAL 45 Hill Higher pook in iology, 2002. & Sons, 2008.
Ecosys Microb cell ma Microb pour pl Antibio Resista I TEXT 1. REFE 1. 2. 3. 4. E-REF	bial Ecology: Micstems – Microbial I Microbial Growth: Growth ass), Factors influe bial Nutrition: Cult late). V ANTIBI otics: Antibacterial ance: Mechanisms of LECTURE 45 BOOKS: Prescott, L. M., H Education, 2005. RENCES: Morcello, J. A., M. Microbiology: Ap Prescott, L. M., H Black, Jacquelyn of Tortora, Gerard J. introduction. Vol. FERENCES: http://www.austin	croorganisms in Marine Interactions: Microbe-Microb <b>BIAL GROWTH AND NI</b> th curve (lag, exponential, strencing growth (water activity cure media (defined, completion <b>IOTICS AND ANTIMICR</b> , Antifungal, Antiviral, Anti- of resistance, Prevention of 1 <b>TUTOP</b> arley, J. P., and Klein, D. A. plication to patient care, 200 arley, J. P., & Klein, D. A. I G. <i>Microbiology: principles</i> , Berdell R. Funke, Christing 9. San Francisco, CA: Benja ncc.edu/rohde/noteref.htm	be interactions, UTRITION tationary, death tationary, death ty, pH, tempera ex), Culture te OBIAL RESI tiprotozoan, Ar resistance. RIAL Microbiology. Laboratory ma D3 Laboratory exer and exploration e L. Case, and ' amin Cumming	Human-Microb a phase), Measurature, oxygen, p chniques (spread STANCE STANCE ntihelminthic dr 5th. <i>McGrawJ</i> anual and workt recises in microbi <i>ns.</i> John Wiley Fed R. Johnson.	be interactions. 11 rement (cell number pressure, radiation) - d plate, streak plate 7 rugs – Antimicrobia TOTAL 45 Hill Higher pook in iology, 2002. & Sons, 2008.
Ecosys Microb cell ma Microb pour pl Antibio Resista I TEXT 1. REFE 1. 2. 3. 4. E-REF 1. 2.	bial Ecology: Micstems – Microbial I V MICRO Dial Growth: Growth ass), Factors influe Dial Nutrition: Cult late). V ANTIBI otics: Antibacterial ance: Mechanisms of LECTURE 45 BOOKS: Prescott, L. M., H Education, 2005. RENCES: Morcello, J. A., M. Microbiology: Ap Prescott, L. M., H Black, Jacquelyn of Tortora, Gerard J. <i>introduction.</i> Vol. FERENCES: http://www.austin http://www.austin	croorganisms in Marine Interactions: Microbe-Microl <b>BIAL GROWTH AND NI</b> th curve (lag, exponential, strencing growth (water activit cure media (defined, completing) <b>IOTICS AND ANTIMICR</b> , Antifungal, Antiviral, Anti- of resistance, Prevention of 1 <b>TUTOP</b> arley, J. P., and Klein, D. A. Iizer, H. E., &Granato, P. A. plication to patient care, 200 arley, J. P., & Klein, D. A. I. G. <i>Microbiology: principles</i> , Berdell R. Funke, Christing 9. San Francisco, CA: Benja mcc.edu/rohde/noteref.htm 0. edu/molb2210_lect/lecture.	be interactions, UTRITION tationary, death tationary, death ty, pH, tempera ex), Culture te OBIAL RESI tiprotozoan, Ar resistance. RIAL Microbiology. Laboratory ma D3 Laboratory exer and exploration e L. Case, and ' amin Cumming	Human-Microb a phase), Measurature, oxygen, p chniques (spread STANCE STANCE ntihelminthic dr 5th. <i>McGrawJ</i> anual and workt recises in microbi <i>ns.</i> John Wiley Fed R. Johnson.	be interactions. 11 rement (cell number, pressure, radiation) – d plate, streak plate 7 rugs – Antimicrobia TOTAL 45 Hill Higher pook in iology, 2002. & Sons, 2008.
Ecosys Microb cell ma Microb pour pl Antibio Resista I TEXT 1. REFE 1. 2. 3. 4. E-REF	bial Ecology: Micstems – Microbial I V MICRO Dial Growth: Growth ass), Factors influe Dial Nutrition: Cult late). V ANTIBI otics: Antibacterial ance: Mechanisms of LECTURE 45 BOOKS: Prescott, L. M., H Education, 2005. RENCES: Morcello, J. A., M. Microbiology: Ap Prescott, L. M., H Black, Jacquelyn of Tortora, Gerard J. <i>introduction.</i> Vol. FERENCES: http://www.austin http://www.austin	croorganisms in Marine Interactions: Microbe-Microb <b>BIAL GROWTH AND NI</b> th curve (lag, exponential, strencing growth (water activity cure media (defined, completion <b>IOTICS AND ANTIMICR</b> , Antifungal, Antiviral, Anti- of resistance, Prevention of 1 <b>TUTOP</b> arley, J. P., and Klein, D. A. plication to patient care, 200 arley, J. P., & Klein, D. A. I G. <i>Microbiology: principles</i> , Berdell R. Funke, Christing 9. San Francisco, CA: Benja ncc.edu/rohde/noteref.htm	be interactions, UTRITION tationary, death tationary, death ty, pH, tempera ex), Culture te OBIAL RESI tiprotozoan, Ar resistance. RIAL Microbiology. Laboratory ma D3 Laboratory exer and exploration e L. Case, and ' amin Cumming	Human-Microb a phase), Measurature, oxygen, p chniques (spread STANCE STANCE ntihelminthic dr 5th. <i>McGrawJ</i> anual and workt recises in microbi <i>ns.</i> John Wiley Fed R. Johnson.	be interactions. 11 rement (cell number pressure, radiation) - d plate, streak plate 7 rugs – Antimicrobia TOTAL 45 Hill Higher pook in iology, 2002. & Sons, 2008.

# MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES

		PROGRAM OUTCOMES													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	
CO1	3	3	1	1	1	0	1	0	1	1	1	1	0	0	
CO2	3	3	1	1	1	2	2	1	1	1	1	1	0	0	
CO3	3	1	2	3	1	2	1	0	1	1	1	1	2	0	
CO4	3	3	2	0	1	0	2	0	1	1	1	1	0	2	
CO5	3	2	2	3	1	2	2	1	1	0	1	1	2	2	
	15	12	8	8	5	6	8	2	5	4	5	5	4	2	

 $1-5 \rightarrow 1, 6-10 \rightarrow 2, 11-15 \rightarrow 3$ 

No relation, 1-Low Relation, 2- Medium Relation, 3-High Relation

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Original Value	15	12	8	8	5	6	8	2	5	4	5	5	4	2
Scaled Value	6	4	3	3	2	2	3	1	1	1	1	1	0	1

 $1 - 5 \rightarrow 1, \qquad 6 - 10 \rightarrow 2, \qquad 11 - 15 \rightarrow 3$ 

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

				L	Т	Р	С
2	XBT30	4		2	1	0	3
			MATERIAL AND ENERGY BALANCES				
С	Р	Α		L	Т	Р	Η
3	0	0		2	1	0	3

	Course Outcomes	Domain	Level
After	the completion of the course, students will be able to		
CO1	<i>Interpret</i> different unit systems and <i>Express</i> the composition gas liquid and solid systems	Cognitive	Understand Remember
CO2	<i>Compute</i> the material balances across different unit operations	Cognitive	Understand Analyse
CO3	<b>Compute</b> the material balances across chemical reactors	Cognitive	Understand Analyse
CO4	<i>Explain</i> the energy balance calculations for systems with and without chemical reactions	Cognitive	Understand
CO5	Describe the Biotechnology stoichiometry system	Cognitive	Understand Receive
	Course Content		Hours
Unit-l	Stoichiometric Principles and Basic Calculations		6+3
	actory concepts of units, physical quantities in chemical engine relations - Methods of expression, compositions of mixture	•	0 1

Liquids: Equations of state, Vapor pressure, Clausius-Clapeyron equation, Cox chart, Duhring's plot, Raoult's law.

#### Unit-II Material Balances for Non-Reacting System 6+3 Material balances to different unit operations - recycle - bypass and purging. Distillation, extraction, mixing, drying, crystallization, evaporation, adsorption and absorption, Material balance for multiple unit

Unit-III   Material	<b>Balances for Reacting System</b>		6+3
	ith chemical reaction - Limitin	ng and excess reactants	- Combustion - Yield,
	ivity calculations, Material balar	0	
Unit-IV Energy B	alances	-	6+3
Heat capacity of sol	ids, liquids, gases and solutions	s, use of mean heat capa	city in heat calculations,
	sensible heat and latent heats.	Energy balances with che	emical reaction: Heat of
reaction, Heat of com	bustion.		<u>1</u>
	l Stoichiometry		6+3
	h and product formation, Deg	gree of reduction, Electr	on balance, Theoretical
Oxygen demand.			
Lecture	Tutorial	Practical	Total
30	15	0	45
Text Books:			
	an and Lakshmikutty, <i>Chemical</i>		
	nelblau and J. B. Riggs, <b>Ba</b>		lculations in Chemical
0	Pearson India Education Service		
	and S.M. Vora, <b>Stoichiometry</b>	, lata McGraw Hill Pl	iblishing Company Ltd,
4 th Edition, 20		Elamontam Dringinlag	of Chamiagl Duagage
	Felder and Ronald W. Rousseau Sons, INC. 3 rd Edition, 2000.	i, Elementary Frinciples	of Chemical Frocesses,
Reference Books:	Solis, INC. 5 Edition, 2000.		
MULTINCE DUUMS.			
	mani N Anantharaman and Be	egum K M MeeraSherif	fa Process Calculations
1. V. Venkatara	mani, N. Anantharaman, and Be of India. 2nd Edition.	egum, K. M. MeeraSherif	fa, Process Calculations,
1. V. Venkatara Prentice Hall	of India, 2nd Edition.	-	fa, Process Calculations,
<ol> <li>V. Venkatara Prentice Hall</li> <li>D. C. Sikdar,</li> </ol>	of India, 2nd Edition. Chemical Process Calculations, 1	Prentice Hall of India.	
<ol> <li>V. Venkatara Prentice Hall</li> <li>D. C. Sikdar,</li> </ol>	of India, 2nd Edition.	Prentice Hall of India.	

# Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	2	3	2	0	2	0	0	0	0	0	2	2
CO 2	3	3	2	3	2	0	2	0	0	0	0	0	2	2
CO 3	3	3	2	3	2	0	2	0	0	0	0	0	2	2
CO 4	3	3	2	3	2	0	2	0	0	0	0	0	2	2
CO 5	3	3	2	3	2	0	2	0	0	0	0	0	2	2
	15	15	10	15	10	0	10	0	0	0	0	0	10	10

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

# Mapping of Subjects with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Original Value	15	15	10	15	10	0	10	0	0	0	0	0	10	10
Scaled Value	3	3	2	3	2	0	2	0	0	0	0	0	7	6

 $1-5 \rightarrow 1$ ,  $6-10 \rightarrow 2$ ,  $11-15 \rightarrow 3$ 0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

						-	-		_		
						L	Т	P	С		
XBI	Г305					3	0	0	3		
		GEN	NETICS AND EVOLUTIO	NARY BIOL	OGY						
C P	Α					L	Т	0       0         T       P         0       0         0       0         Level         Level         Remember, Understand, Apply         Analyze         Understand, Analyze         Understand, Analyze         Remember         Hours         9         of dominance a principles. Ge         9         ene transfer a clear genomes a nce, examples         lementation.         9         omes as arrays         sis of Mendeli         9			
3 0	0					3	00TP000000Remember, Understand, ApplyAnalyzeUnderstand, AnalyzeUnderstand, AnalyzeUnderstand, AnalyzeOf dominance p9of dominance p9of dominance principles.9of dominance principles.9of dominance p9of dominance principles.9of dominance p9of dominance p9of dominance p9of dominance p9of dominance p9of dominance p9somes as arrays asis of Mendel9n medical genet9rs determining on and inheritar methods to analTotal 45	3			
			try and Microbiology								
Learni	ing Obj	ectives:									
Upon o	complet	ion of this	course, the students								
٠	Would	have learn	t the fundamentals of genetic	s							
•	Would	have learn	t the gene mutations								
		C	Course Outcomes		Domai	in		Level			
After th	he comp	letion of th	he course, students will be ab	le to							
CO1	Relate	and Interp	pretReproduction as the basis	s of heredity	Comitivo		Reme	nber,			
	and Ge	ne interacti	ions		Cognitive		Under	stand			
CO2	Explain	n and Appl	yprinciples of dominance and	l segregation	<b>C</b>		Under	stand,			
	-			0 0	Cognitive		Apply				
	Classif inherita		evelopQuantitative traits an	d polygenic	Cognitive		Analy	ze			
			<i>ect</i> linking the inheritance chromosomes as arrays of go		Cognitive						
			DNA Replication and Transci		Cognitive		•				
			Course content				1	Hours	·		
I –Mer	ndelian	Principles	s of Genetics and Gene Inter	ractions							
nteracti	ions that	t produce n	e of independent assortmente new phenotypes, epistasis. Ind quantitative Inheritance	nt, application	ns of Men	Idelian	princi		Jene		
				and conjugat	ion. Uoriz	ontal	gana ti	-	and		
			uantitative traits, polygenic i								
			n of extranuclear genomes,								
			maternal effect, genomic imp						5 01		
			is of Inheritance and Linka	-		,					
			inking the inheritance of ge		osomes, ch	romos	omes a	s array	vs of		
1			as proof of the chromosom		,			•	<i>,</i>		
			variation;Extra chromosomal								
		and Societ		, , , , , , , , , , , , , , , , , , , ,				9			
			tion screening for genetic dis	eases. Ethical	issues invo	lved in	n medic	al gen	etics.		
		-	nd its practical implications, I					0	,		
	-	ary biolog						9			
			lution and Population Gene	tics;Population	n genetics:	facto	rs deter	mining	g the		
	-		in allale and genotype freq	· •	0			-	-		
-		-	olution; Genetic drift; Specie		-						
			between populations	±		•			-		
	Lectur		Tutorial	Practi	cal		Tot	al			
	45		0	0			4	5			
Text B	ooks:			•							
1.	Lewin's	s Lewin's C	Genes XII, Jocelyn E. Krebs, I	Elliott S. Gold	stein, Steph	nen T.	Kilpatr	ick, 20	17.		
1.	Lewin's	s Lewin's C	Genes XII, Jocelyn E. Krebs,	Elliott S. Gold	stein, Steph	nen T.	Kilpatr	ick, 20	17.		

#### **Reference Books:**

- 1. Basic genetics : a human approach / BSCS. Dubuque, IA, Kendall/Hunt Pub. Co., c1999. 147 p. QH431.B305 1999.
- 2. Beighton, Peter and Greta Beighton. The person behind the syndrome. London, New York, Springer, c1997. 231 p. R134.B45 1997, Foreword by Hans-R. Wiedemann.
- 3. Bland, Jeffrey with Sara Benum. Genetic nutritioneering. Los Angeles, Keats Pub., c1999. 272 p. B155.B59 1999.
- 4. Bouchard, Claude, Robert M. Malina and Louis Pérusse. Genetics of fitness and physical performance. Champaign, IL, Human Kinetics, c1997. 400 p. QP301.B76 1997
- 5. Childs, Barton. Genetic medicine : a logic of disease. Baltimore, Johns Hopkins University Press, c1999. 326 p. RB155.C496 1999.
- 6. Connor, J. M. and Malcolm Ferguson-Smith. Essential medical genetics. Oxford, Eng., Malden, MA, Blackwell Science, 1997. 236 p. RB155.C66 1997.
- 7. Culture, kinship, and genes : towards cross-cultural genetics. Edited by Angus Clarke and Evelyn Parsons. New York, St. Martin's Press, 1997. 272 p. GN289.C55 1997.

#### **E-References:**

- 1. https://nptel.ac.in/syllabus/102107030/
- 2. https://ocw.mit.edu/courses/biology/7-012-introduction-to-biology-fall-2004/video-lectures/lecture-6-genetics-1/
- 3. https://cosmolearning.org/courses/principles-mendelian-molecular-genetics/video-lectures/

# Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	1	2	0	1	0	0	1	1	1	1	1	1	1
CO 2	1	1	2	0	1	0	0	1	1	1	1	1	1	2
CO 3	1	1	2	0	1	0	0	1	1	1	1	2	2	3
CO 4	1	1	2	0	1	0	0	1	1	1	1	3	3	1
CO 5	1	1	2	0	1	0	0	1	1	1	1	1	1	2
	5	5	10	0	5	0	0	5	5	5	5	8	8	9

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

## Mapping of Subjects with POs

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Original Value	5	5	10	0	5	0	0	5	5	5	5	8	8	9
Scaled Value	3	3	4	0	2	0	0	1	1	1	1	3	3	2

 $1-5 \rightarrow 1, \qquad \qquad 6-10 \rightarrow 2, \qquad \qquad 11-15 \rightarrow 3$ 

Subj	ect C	ode	<b>XUM 306</b>	L	Т	P		С
Subj	ect N	ame		2	0	0		2
С	Р	Α	Entrepreneurship Development	L	Т	Р	SS	Η
2.7	0	0.3		2	0	0	1	3
Prere	quisi	te	NIL					
Cours	eObje	ectives						
	0		ethestudentswill					
			Entrepreneurial motivation and inclination					
• Ide	ea abo	out the	market assessment					
	-		ngovernment policies and global opportunitie	es for E	Entrepre	eneursh	ip	
		ment				Г		
	-	tcome			nain	K)	Level	
CO1		-	and <i>describe</i> the role of innovation and for an entrepreneur.	Cogn	itive	K2	Unders	stand
<b>CO2</b>			s and <i>appraise</i> your entrepreneurship	Cogn	itive	K2	Unders	stand
004			th your chosen entrepreneur.		11110	112	Unders	nanu
<b>CO3</b>			e importance of generation of new ideas for	Cogn	itive	K2	Unders	stand
000			urship and <i>illustrate</i> market assessment.	cogn			Chaora	, cuira
CO4	Exp	-	the competition in business and	Cogn	itive/	K2	Unders	stand
	-		nonstrate/comply business model for	U		K3	Apply	
	deal	ing wi	th competition.	Affec	tive	A3	Value	
						A2	Respor	nse
CO5	Des	cribe a	and <i>Explain</i> venture creation and launching	Cogn	itive	K1	Remen	nber
	of s	mall b	usiness and its management.			K2	Unders	stand
CO6	Des	cribe	and Discuss various government policies	Cogn	itive/	K1	Remen	
	and	glot	al opportunities for Entrepreneurship			K2	Unders	stand
		elopm						
		CONT						
UNIT	_		VATION AND ENTREPRENEURSHIP					5
			ition of Innovation, Creativity and Entrep		-			
		-	preneurship development - Entrepreneurial m			-		
			entrepreneur -Role of Family and Society; En national development	mepr	eneursi	np as a	career	
UNIT			ASSESSMENT OF ENTREPRENEURIA		T INI		N	2
01111								
			ssessment of entrepreneurial inclination -I or preneurial inclination rating -Case study of such as the study of such as the study of such as the set of t			-		i tiei
UNIT-	ш		IDEA GENERATION TO MARKET AS			preneui	8	(
UINII			tance of Idea generation-filtering-refinem			tunity	recomi	
		-	iption of chosen idea - value proposition, cu			-	-	
			fits; development status; IP ownership		-			
		user/d	ecision makers/ partners -market need; segi	mentat	ion -m			
		SOM	-case study on market segmentation by popul	lar com	panies			

STOMER – COMPETITION- BUSINESS MODEL		
omer-Target primary customer research, Decision mak	ng unit/	process-Bead
market; Cost of Customer Acquisition - Competition	- compa	rative analysi
petitive advantages-; -Business model -Financial plannii	g -Pitch	documentatio
presentation		
<b>NTURE CREATION AND LAUNCHING OF SMAI</b>	L BUSI	INESS
D ITS MANAGEMENT		
enterprise creation - organizational and legal matters	Operatio	onal plan -Sal
distribution plan - Accounting -Team recruitment and ma	inagemen	nt -Fund raisin
management -Profile of a startup – case studies		
VERNMENT INITIATIVES AND GLOBAL		
PORTUNITIES		
bators and accelerators - capacity building -Startup	policies-	Startup Indi
outors and accelerators - capacity bundling -Stattup		
port for MSME; GeM Portal. Funding–national and intern	ational so	ources-Bilater
port for MSME; GeM Portal. Funding-national and intern		
port for MSME; GeM Portal. Funding–national and international and international by Govt. of India -Global reach for prepreneurship (1)	omoting	cross-cultur Total
port for MSME; GeM Portal. Funding-national and international and international by Govt. of India -Global reach for pepreneurship (1)           L         T         P           30	omoting	g cross-cultur
port for MSME; GeM Portal. Funding–national and international and international by Govt. of India -Global reach for prepreneurship (1)           L         T         P           30             BOOKS	romoting SS 15	cross-cultur Total 45
port for MSME; GeM Portal. Funding–national and international and international by Govt. of India -Global reach for prepreneurship (1)           L         T         P           30             BOOKS         " Lecture Notes on Entrepreneurship Development", a	romoting SS 15	cross-cultur Total 45
port for MSME; GeM Portal. Funding-national and international and international by Govt. of India -Global reach for prepeneurship (1)           L         T         P           30             BOOKS         "Lecture Notes on Entrepreneurship Development", a net         Development", a	omoting SS 15 vailable	ross-cultur Total 45 as softcopy (
port for MSME; GeM Portal. Funding–national and international and international by Govt. of India -Global reach for prepreneurship (1)          L       T       P         30           BOOKS       ************************************	omoting SS 15 vailable	ross-cultur Total 45 as softcopy (
port for MSME; GeM Portal. Funding-national and international and international by Govt. of India -Global reach for prepreneurship (1)           L         T         P           30             BOOKS         State         State         State           '' Lecture Notes on Entrepreneurship Development'', a net         Zimmerer, Norman M. Scarborough, "Essentials of Entranagement'', Pearson; 3rd edition, 2001.	vailable	rship and Sma
port for MSME; GeM Portal. Funding–national and international and international by Govt. of India -Global reach for prepeneurship (1)           L         T         P           30             BOOKS         ************************************	omoting SS 15 vailable	ross-cultur Total 45 as softcopy (
port for MSME; GeM Portal. Funding–national and international and international by Govt. of India -Global reach for prepreneurship (1)           L         T         P           30             BOOKS         Generation         Generation         Generation           **         Lecture Notes on Entrepreneurship Development, a net             **         Zimmerer, Norman M. Scarborough, "Essentials of Entranagement", Pearson; 3rd edition, 2001.         Text           **         Tentt, "Introducing Marketing", Open Text         Campus.ca:8001/bcc/file/ddbe3343-9796-4801-a0cb-	vailable	rship and Sma
port for MSME; GeM Portal. Funding–national and international and international by Govt. of India -Global reach for prepeneurship (1)           L         T         P           a0             BOOKS          Generation of the state	vailable Book	rship and Sma available
port for MSME; GeM Portal. Funding–national and international by Govt. of India -Global reach for prepreneurship (1)           L         T         P           30             BOOKS         ************************************	vailable Book	rship and Sma available
port for MSME; GeM Portal. Funding-national and international by Govt. of India -Global reach for prepreneurship (1)	vailable Book ceting So	rship and Sma available
port for MSME; GeM Portal. Funding–national and international by Govt. of India -Global reach for prepreneurship (1)           L         T         P           30             BOOKS         ************************************	vailable repreneur Book ceting So ration: A	rship and Sma available
port for MSME; GeM Portal. Funding-national and international by Govt. of India -Global reach for prepreneurship (1)	vailable repreneur Book ceting So ration: A 10.	rship and Sma available cience. Vol. 2 A Handbook f

						PR	OGR	AM C	OUTC	COMES	•			
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	1	0	1	0	1	1	1	0	0	0	0	0	1	0
CO2	1	0	1	0	1	1	1	0	0	0	0	0	1	0
CO3	1	0	1	0	1	1	1	0	0	0	0	0	1	0
CO4	1	0	1	0	1	1	1	0	0	0	0	0	1	0
CO5	1	0	1	0	1	1	1	0	0	0	0	0	``1	0
CO 6	1	0	1	0	1	1	1	0	0	0	0	0	`1	0
Total	6	0	6	0	6	6	6	0	0	0	0	0	6	0
ScaledValue	2	0	2	0	2	2	2	0	0	0	0	0	2	0
		1 –	$5 \rightarrow 1$	1,		6 -	10 -	> 2,		11	- 15 -	$\rightarrow 3$		
	(	)-NoR	Relatio	n,1-1	Low R	elatio	n,2-M	ledium	Relat	ion,3-H	lighR	elatio	n	

Subje	ect Cod	le	XUM 307	L	Т	P		С		
Subje	ct Nan	ne	UNIVERSAL HUMAN VALUES 2:	2	1	0	)	3		
С	_	A	UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY	L	Т	P		Η		
3		0		2	1	0	)	3		
Prere	equisit	e	None. Universal Human Values	1 (	desirable	e)				
Course	e Obje	ctive	e: 1. Development of a holistic perspective base	ed o	n self-ex	xplo	ratio	n abou		
hemse	lves (h	uma	n being), family, society and nature/existence.							
2. Und	erstand	ling	(or developing clarity) of the harmony in the h	ıma	n being,	far	nily,	society		
and nat										
	-	-	of self-reflection.							
4. Deve	elopme	ent o	f commitment and courage to act.							
Course					Domain			evel		
CO1	Prese	ent s	sustainable solutions to the problems in societ	у	Cognitiv	ve	Und	erstand		
	and r	natur	e. They are also able to see that these solution	IS						
	are p	racti	cable and draw roadmaps to achieve them							
CO2	Gras	s <b>p</b> th	e right utilization of their knowledge in the	ir	Cognitiv	ve	Und	erstand		
	stream	ms	of Technology/Engineering/Management/ar	y						
	other	are	a of study to ensure mutual fulfillment. E	Χ.						
			enriching production system with rest of nature							
CO3			he importance of generation of new ideas for		Cognitiv	<i>v</i> e	Und	erstand		
000			eurship and <i>illustrate</i> market assessment.	1	cogiiiti	C	ena	crotune		
UNIT		-	rse Introduction - Need, Basic Guidelines	C	ontent «	and	6+	3		
	- 1 •		cess for Value Education	, C		inu		5		
Durnog	a and		ivation for the course, recapitulation from U	ivo	real Um	non	Vol	uos I		
			what is it? - Its content and process;							
			dation- as the process for self-exploration -							
			ok at basic Human Aspirations - Right unde							
			the basic requirements for fulfilment of aspira							
			priority - Understanding Happiness and Pros							
			current scenario - Method to fulfil the	abo	ve hum	an	aspi	rations		
	-	-	l living in harmony at various levels.		•			c		
			to discuss natural acceptance in human being a				-			
-		-	nsibility (living in relationship, harmony and	co-e	xistence	) ra	ther	than as		
arbitra			oice based on liking-disliking.							
UNIT	- II :		derstanding Harmony in the Human Being	- H	larmony	in in	6+	3		
		My								
			man being as a co-existence of the sentient 'I							
			e needs of Self ('I') and 'Body' - happing							
		-	e Body as an instrument of 'I' (I being the					•		
	Inderstanding the characteristics and activities of 'I' and harmony in 'I' - Understanding									
	-		with the Body: Sanyam and Health; correct a			Phy	vsical	needs		
	-	-	erity in detail - Programs to ensure Sanyam and to discuss the role others have played in maki			000	de ar	vailabl		
				-		-				
			from one's own life. Differentiate between p	osp	erny and	ı ac	cum	ulation		
DISCUS	s progr	am 1	for ensuring health vs dealing with disease							
			51 8 th	BC	S/BIOT	EC	H/Da	ate: 19.		

UNIT - III	Understanding	g Harmony in the Fam	ily and Society-	5+3
:		luman-Human Relationship	ny and Society-	575
<u>Understandir</u>	•	man-human relationship; mea	ning of Justice (ning	e universal
	0	rogram for its fulfilment to ens	0	
		values of relationship - Unde		
Difference b	etween intention	n and competence - Understa	nding the meaning of	of Respect,
		and differentiation; the other		
		in the society (society be	-	•
,	1 .	ssness (trust) and co-existence	1	
-		nonious order in society- Undi	vided Society, Unive	rsal Order-
•	to world family.	on relationships in family, h	ostel and institute a	s extended
		acher-student relationship, goal		
•	<b>•</b>	1.0		
UNIT - IV	-	os. Discuss with scenarios. Elic		
UNII - IV	existence as C	g Harmony in the Nature and	Existence - whole	4+2
· The density of the			-4 - 1	£-16:1
	0	in the Nature 1 - Interconne ure- recyclability and self regu		
0		f mutually interacting units in		U
		evels of existence.	r un per tusite spuee	110115010
	•	uman being as cause of imbala	nce in nature (film "	Home" can
be used), pol	lution, depletion	of resources and role of techno	ology etc.	
UNIT - V :	Implications o	f the above Holistic Understa	nding of Harmony	7+3
	on Professiona	l Ethics		
Natural accept	ptance of human	values - Definitiveness of Eth	ical Human Conduct	- Basis for
Humanistic	Education, Hu	manistic Constitution and H	Iumanistic Universa	l Order -
Competence	in professional	ethics: a. Ability to utilize the	ne professional comp	petence for
augmenting	universal human	order b. Ability to identify t	he scope and charac	teristics of
peoplefriend	ly and eco-frien	dly production systems, c. A	bility to identify an	nd develop
appropriate t	echnologies and	management patterns for abo	ove production system	ms Case
studies of ty	pical holistic to	echnologies, management mo	dels and production	systems -
Strategy for	transition from t	he present state to Universal H	Iuman Order: a. At t	he level of
individual: as	s socially and eco	ologically responsible engineer	s, technologists and n	nanagers b.
At the level	of society: as	mutually enriching institution	s and organizations	- Sum up.
Practice Exer	rcises and Case	Studies will be taken up in Pr	ractice (tutorial) Sess	sions eg. to
discuss the co	onduct as an eng	ineer or scientist etc.		
LEC	TURE	TUTORIAL	TOTAL	
	28	14	42+3(SS)	)
		I		

# **TEXT BOOKS:**

Human Values and Professional Ethics - R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010.

## **REFERENCE BOOKS :**

- 1. Jeevan VidyaEk- Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
- 2. Human Values A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
- 3. Leonard, Annie. 2011. The Story of Stuff. New York, NY: Simon & Schuster.
- 4. The Story of My Experiments with Truth Mohandas Karamchand Gandhi
- 5. AICTE Model Curriculum in Humanities, Social Science and Management Courses (UG Engineering & Technology)
- 6. Small is Beautiful E. F Schumacher.
- 7. Slow is Beautiful Cecile Andrews.
- 8. Economy of Permanence J C Kumarappa.
- 9. Bharat Mein Angreji Raj PanditSunderlal.
- 10. Rediscovering India by Dharampal.
- 11. Hind Swaraj or Indian Home Rule by Mohandas K. Gandhi.
- 12. India Wins Freedom Maulana Abdul Kalam Azad
- 13. Vivekananda Romain Rolland (English)
- **14.** Gandhi Romain Rolland (English)

## Mapping of COs with POs

			PROGRAM OUTCOMES												
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	
CO1	1	1	2	0	1	0	0	1	1	1	1	3	2	3	
CO2	1	1	2	0	1	0	0	1	1	1	1	0	3	2	
CO3	1	1	2	0	1	0	0	1	1	1	1	2	2	1	
Total	3	3	6	0	3	0	0	3	3	3	3	5	7	6	
ScaledValue	1	1	1	0	1	0	0	1	1	1	1	1	2	2	
		1 –	$5 \rightarrow 1$	1,		6 -	10 -	> 2,		11	- 15 -	$\rightarrow 3$			
	(	0-NoF	Relatio	n,1-1	Low R	elatio	n,2-M	ledium	Relat	ion,3-H	lighR	elatio	n		

COUR	SECODE	2	XBT308	L	Т	Р	С
-	RSE NAM EQUISIT		Biochemistry Laboratory	0	0	2	2
С	Р	Α		L	Т	Р	Н
1	2	1		0	0	2	6

#### **COURSE OBJECTIVES**

The course will provide

a.Hands on experience in using Biochemistry Lab

b.Practice on handling chemicals

c.Will help to make understanding on research.

	COURSE OUTCOMES	DOMAIN	LEVEL
CO1	Apply theoretical knowledge to perform experiment in	Cognitive,	Apply,
	Biochemistry principles.	Psychomotor	Mechanism,
	V I I	,Affective	Respond
CO2	Practice on handling chemicals for the Biochemistry	Cognitive,	Apply
	experiments.	Psychomotor	Mechanism
	A	,Affective	Respond

		0	30	0	30
	HOURS	LECTURE	PRACTICAL	TUTORIAL	TOTAL
11	. Estimation of Sap	onification Va	lue of Fats/Oils		
			h cholesterol by Zak's met	hod	
9.				1 1	
8.	Detection of Adu		IK .		
7.	• •		livary amylase on starch		
6.	Estimation and pu	•			
	Determination of	•	avonoid		
4.	(	•	•		
3.		•	1		
2.	-	•	Thin Layer Chromatograph	ny	
1.	1 1		on of molar extinction coe		
				Psychomotor ,Affective	Mechanism Respond
CO5	Apply the practice	al knowledge to	o make scientific report.	Cognitive,	Apply.
	practical experier	nce.		Psychomotor ,Affective	Mechanism Respond
CO4	Ŭ		y Phenomena through the		Apply.
				,Affective	Respond
000	of biochemistry e	•		Psychomotor	Mechanism
CO3	( teffing trained o	n analyfical ca	lculations from the result	Cognitive,	Apply.

1. Lehninger Principles of Biochemistry, David L. Nelson and Michael M. Cox, W. H. Freeman; 6th edition edition (13 February 2013), 1158 pages ISBN-10: 1464109621, ISBN-13: 978-1464109621.

#### Mapping of COs with POs

	P01	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	1	2	0	1	0	0	1	1	1	1	3	2	3
CO 2	1	1	2	0	1	0	0	1	1	1	1	0	3	2
CO 3	1	1	2	0	1	0	0	1	1	1	1	2	2	1
CO 4	1	1	2	0	1	0	0	1	1	1	1	0	1	0
CO 5	1	1	2	0	1	0	0	1	1	1	1	2	0	0
	5	5	10	0	5	0	0	5	5	5	5	7	8	6

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

## Mapping of Subjects with POs

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Original Value	5	5	10	0	5	0	0	5	5	5	5	7	8	6
Scaled Value	3	3	6	0	3	0	0	3	3	0	3	4	5	3

 $6-10 \rightarrow 2, \qquad \qquad 11-15 \rightarrow 3$  $1-5 \rightarrow 1$ ,

COURSE CODE	XBT 309	L	Т	Р	С
COURSE NAME	MICROBIOLOGY LAB	0	0	2	2
PREREQUISITES	-	L	Т	Р	Η
C:P:A:1:1.5:0.5		0	0	2	6

# **LEARNING OBJECTIVES**

Upon completion of this course, the students will be able to apply their knowledge of microbiology to demonstrate aseptic microbiological techniques in the laboratory

	COURSE OUTCOMES	DOMAIN	LEVEL
After th	ne completion of course the students will be able to		
CO1	<i>Experiment</i> and <i>Demonstrate</i> media preparation and sterilization techniques	Cognitive, Psychomotor ,Affective	Apply, Mechanism, Respond
CO2	<i>Understand</i> and <i>Perform</i> staining techniques, antimicrobial and cell counting assays	Cognitive, Psychomotor ,Affective	Apply, Mechanism, Respond
CO3	Practice and Demonstrate different culturing techniques	Cognitive, Psychomotor ,Affective	Apply, Mechanism, Respond
CO4	<b>Perform</b> and <b>Determine</b> the characteristics of bacteria	Cognitive, Psychomotor ,Affective	Apply, Mechanism, Respond
CO5	<i>Understand</i> and <i>Experiment</i> on isolation of microbes for metabolites production	Cognitive, Psychomotor ,Affective	Apply, Mechanism, Respond

S.No	List of Experim	nents		COs	;
1	Media preparation and Sterilization			CO1	
2	Preparation of slants /plates and aseptic transfe	er of microbial c	ultures	CO1	
3	Staining and identification of microbes using s	imple and differ	ential staining	CO2	1
4	Isolation of microbes using spread plate metho	d		CO3	
5	Isolation of microbes using streak plate method	d		CO3	
6	Isolation of microbes using pour plate method			CO3	
7	Microbial growth control using Kirby-Bauer n	nethod		CO2	r
8	Cell counting			CO2	,
9	Biochemical characterization of microbes			CO4	
10	Screening of microorganisms for enzyme prod	uction		CO5	
	HOURS	TUTORIAL	PRACTICAL	TOTAL	
	HOUKS	0	30	30	

# MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES

	PROGRAM OUTCOMES													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	1	1	1	0	1	0	1	1	1	1	0	0
CO2	3	3	1	1	1	2	2	1	1	1	1	1	0	0
CO3	3	1	2	3	1	2	1	0	1	1	1	1	2	0
CO4	3	3	2	0	1	0	2	0	1	1	1	1	0	2
CO5	3	2	2	3	1	2	2	1	1	0	1	1	2	2
	15	12	8	8	5	6	8	2	5	4	5	5	4	2

 $1-5 \rightarrow 1, 6-10 \rightarrow 2, 11-15 \rightarrow 3$ 

No relation, 1-Low Relation, 2- Medium Relation, 3-High Relation

# Mapping of Subjects with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Original Value	15	12	8	8	5	6	8	2	5	4	5	5	4	2
Scaled Value	6	4	3	3	2	2	3	1	1	1	1	1	0	1

 $1-5 \rightarrow 1, \qquad \qquad 6-10 \rightarrow 2, \qquad \qquad 11-15 \rightarrow 3$ 

XBT 310	INPLANT TRAINING - I		L 0	Т 0	P 0	SS 0	C 1
C P A			Ĺ	T	P	SS	H
			0	0	0	0	0
PREREQUISI	l'E: Nil						
COURSE OUT	COMES:						
	Course Outcomes	Dor	nain		]	Level	
After the comple	etion of the course, students will be able to						
CO1:Relate cla	ssroom theory with workplace practice	Cognit	ive	Ţ	Jnde	rstand	l
CO2: Comply v practices.	<i>with</i> Factory discipline, management and business	Affe	ctive	F	Respo	ond	
CO3:Demonstr	ates teamwork and time management	Affe	ctive	V	/alue	e	
	and <i>Display</i> hands-on experience on practical luring the programme.						
	<i>ize</i> the tasks and activities done by technical oral presentations.	Cognitive Evaluate					

Minn	nind		s with	ΡΩc												
Iviap		<u>9 CO</u> 2 PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO	10	PSO1	PSO2
			PO2	P05	P04	POS	PU0	PU/	PU8	P09	P010	PUII	PU	12	P301	PS02
CO1		2														
CO2								1	3	_		1			1	1
CO3				_						3	1	3			3	3
CO4			1	2	1	3					_				1	1
CO5		-		_	3						3				1	1
Tota		2	1	2	4	3	0	1	3	3	4	4	0		6	6
Scale	ed	1	1	2	1	1	0	1	1	1	1	1	1		2	2
IV S	leme	ster												1		
V	DT 4	<b>01</b>											L 2			C 3
Δ	BT4	01			1	Rocia 1	Fronce	art Dr	0006606				2	1	0	3
C	Р	•	_		]	Dasic 1	ransp	ort Pr	ocesses	)			L	Т	P	H
3	P         A         L         T         P           0         0         2         1         0															3
3	U	U											4	1	U	3
				Cours	e Outo	omes					Don	nain			Lev	<b>_</b> ]
Δfter	the	comp	letion (				ts will	he ahle	to		Dui				Lev	CI
CO1		1								Co	gnitive			Un	derstan	1
CO1		11 0			1 1	-					0					4
CO3	O2 Apply the particle transport properties in flow of fluids Cognitive Apply															1
CO4									of fluid		gnitive				ply	
CO5									flow o	f	<u> </u>				<b>.</b> .	
000		luids				sport f			110 11 0		gnitive			Ap	ply	
Unit-	·I	Flu	id Tra	anspor	t											6+3
Units	and					and 1	non-Ne	wtonia	n Flui	ds, La	minar a	and tur	buler	nt fl	ow, Co	ntinuity
							uille eq			,					,	5
<b>Unit</b> -	·II	Pa	rticle ]	<b>Fransp</b>	ort											6+3
Charao	cteriz	zation	of par	ticles s	shape a	nd size	e, Size	reducti	on, set	tling a	nd sedin	nentatio	on. Ag	gitat	ion and	Mixing
- powe	er co	nsum	ption in	n mixir	ng, Mix	king in	bioread	ctors, N	Aixing	time, C	Centrifug	gation,	Filtra	tion	theory.	
Unit-	·III	He	at Tra	nsport	ţ											6+3
Cond	uctiv	ve and	conve	ective h	neat tra	nsfer, I	LMTD,	, Overa	ll heat	transfe	er coeffie	cient, F	Ieat e	xcha	angers.	
Unit-				nspor												6+3
Mole	cular	r diffu	ision a	nd filn	n theor	y, Mas	ss trans	sfer co	efficier	its, Ox	ygen tra	ansfer a	and u	ptak	e in bio	reactor,
-		-				-	eration									
Unit-									Process							6+3
Intro	ducti		-	utation	-Exce			3 – Rpi	rogram							
-		Lectur	•0			Tuto				Pract	tical			ŗ	Fotal	
	I		L	1								1			45	
		30	C			15	5			-						
Text	Boo	30 ks:						•.•			• -				0.5	
	Boo	<b>30</b> ks: McCa	be, W			ılian (	C. Sm	ith, aı	nd Pet	- er Ha	rriott, V	Unit C	perat	ions	of C	hemical
Text	Boo N H	<b>30</b> ks: McCa Engine	be, W eering,	McGra	w-Hill	ılian ( , 2010.	C. Sm						•		of C	hemical
Text	Boo N H	<b>30</b> ks: McCa Engine	be, W eering,	McGra	w-Hill	ılian ( , 2010.	C. Sm				rriott, l		•		of C	hemical
<b>Text</b> 1.	Boo N H	30 ks: McCa Engine Warre	be, W eering, n, L. N	McGra 1., C. S	w-Hill	ulian ( , 2010 n, and l	C. Sm H. Pete						•		of C	hemical
<b>Text</b> 1.	Boo N H	30 ks: McCal Engine Warre McGra	be, W eering, n, L. N aw Hil	McGra 1., C. S l Book	aw-Hill 5. Julian Comp	11ian ( , 2010, n, and 1 any, 20	C. Sm H. Pete )05.	er, Unit	operat	ions of		al engi	neerii	ng,		
<b>Text</b> 1. 2.	Bool H	30 ks: McCal Engine Warre McGra Geank	be, W eering, n, L. N aw Hil	McGra 1., C. S l Book Christ	aw-Hill 5. Julian Comp ie Joh	1lian ( , 2010. n, and l any, 20 n, Alle	C. Sm H. Pete )05. en H.	er, Unit Hersel	operat	ions of	chemic	al engi	neerii	ng,		
Text           1.           2.           3.	Boo H H N N S	30 ks: McCa Engino Warre McGra Geank	be, W eering, n, L. M aw Hil oplis, tion pr	McGra 1., C. S l Book Christ cocess p	aw-Hill 5. Julian Comp ie Joh princip	1 1 1 2 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0	C. Sm H. Pete 005. en H. entice h	er, Unit Hersel aall, 20	operat , and 18.	ions of Danie	chemic I H. Le	al engi epek, J	neerii Fransj	ng, port	process	ses and
<b>Text</b> 1. 2.	Boo H H O S	30 ks: McCa Engino Warre McGra Geank separa Welty	be, W eering, n, L. N aw Hil oplis, tion pr J, Ro	McGra I., C. S l Book Christ cocess p rrer GI	w-Hill S. Julian Comp ie Joh princip L, Fost	Ilian ( , 2010) n, and l any, 20 n, Allo les, pre er DG	C. Sm H. Pete 005. en H. entice h	er, Unit Hersel aall, 20	operat , and 18.	ions of Danie	chemic	al engi epek, J	neerii Fransj	ng, port	process	ses and
Text           1.           2.           3.	Boo H H O S	30 ks: McCa Engino Warre McGra Geank separa Welty	be, W eering, n, L. N aw Hil oplis, tion pr J, Ro	McGra I., C. S l Book Christ cocess p rrer GI	aw-Hill 5. Julian Comp ie Joh princip	Ilian ( , 2010) n, and l any, 20 n, Allo les, pre er DG	C. Sm H. Pete 005. en H. entice h	er, Unit Hersel aall, 20	operat , and 18.	ions of Danie	chemic I H. Le	al engi epek, J	neerii Fransj	ng, port	process	ses and
Text           1.           2.           3.	Boo H H O S	30 ks: McCa Engino Warre McGra Geank separa Welty	be, W eering, n, L. N aw Hil oplis, tion pr J, Ro	McGra I., C. S l Book Christ cocess p rrer GI	w-Hill S. Julian Comp ie Joh princip L, Fost	Ilian ( , 2010) n, and l any, 20 n, Allo les, pre er DG	C. Sm H. Pete 005. en H. entice h	er, Unit Hersel aall, 20	operat , and 18.	ions of Danie	Chemic I H. Le tum, He	al engi epek, T eat, and	neerii Fransj	ng, port s Ti	process	ses and Wiley,

#### **Reference Books:**

- 1. Benitez, Jaime, Principles and modern applications of mass transfer operations, John Wiley & Sons, 2016.
- 2. Ravi, R., R. Vinu, and Sathyanarayana N. Gummadi, eds. Coulson and Richardson's Chemical Engineering: Volume 3A: ,Chemical and Biochemical Reactors and Reaction Engineering, Butterworth-Heinemann, 2017.

#### **E-References:**

- 1. https://nptel.ac.in/courses/103/103/103103037/
- 2. http://ce-iitb.vlabs.ac.in/List%20of%20experiments.html?domain=Chemical%20Engineering
- 3. http://uorepc-nitk.vlabs.ac.in/#
- 4. http://iitg.vlab.co.in/?sub=58

# Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	1	1	2	2	2	0	0	0	1	3	0	0
CO 2	3	3	2	2	1	2	2	0	0	0	2	2	1	1
CO 3	3	3	2	3	1	2	2	0	0	0	2	3	2	3
CO 4	3	3	2	3	1	2	2	0	0	0	2	2	2	2
CO 5	3	3	2	3	1	2	2	0	0	0	2	3	3	3
	15	15	9	12	6	10	10	0	0	0	9	13	8	9

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

# Mapping of Subjects with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Original Value	15	15	9	12	6	10	10	0	0	0	9	13	8	9
Scaled Value	3	3	2	3	2	2	2	0	0	0	2	3	2	2

 $1-5 \rightarrow 1, \qquad \qquad 6-10 \rightarrow 2, \qquad \qquad 11-15 \rightarrow 3$ 

									L	Т	P	C
Х	BIOENERGETICS AND METABOLISM									1	0	3
			E	IOENE	RGETIO	CS AND M	<b>IETABOLIS</b>	Μ				
C	P	Α							L	Т	P	Η
3	0	0							2	1	0	3
Pre	requi	site: -										
Lea	rning	g Obje	ctives:									
Upo	n cor	npletio	on of this	course, t	the stude	ents						
	• W	ould h	ave learn v	arious r	netabolic	pathways.						
							ays related to	each other				
					utcomes	•	•	Doma			Level	
Afte	r the	comple	etion of th	e course,	students	will be ab	le to			•		
CO	1 Di	iscuss	and <b>Re</b>	member	fundar	nental an	dmetabolism	Cognitive	e	Reme	mber	
	pa	thways	6									
CO	2 Di	iscuss	and Rem	ember	biosynthe	esis of fat	tty acid and	Cognitive	e	Recall	l	
	ch	olester	ol									
CO	3 <i>Di</i>	iscuss	and Ren	ember	oxidative	e phospho	rylation and	Cognitive	e	Reme	mber	
			osphorylat									
CO	4 <i>Di</i>	iscuss	and Rem	e <b>mber</b> b	iosynthes	sis of amin	no acids and	Cognitive	e	Reme	mber	
		cleotic										
CO	5   Di	iscuss	and Rem	ember 1	report or	n metaboli	ic order and	Cognitive	e	Create		
	di	sease										
											Tanna	
					Course c						Hours	
			ics and G	ycolytic	pathwa	ys					6+3	
Bioe	nerge	tics ar	d Thermo	l <b>ycolytic</b> odynami	<b>pathwa</b> cs, Phos	<b>ys</b> phoryl Gr	oup Transfer			logical	6+3 Oxida	
Bioe Redu	nerge ction	tics ar React	d Thermo ions, met	<b>ycolytic</b> odynami abolic p	<b>pathwa</b> cs, Phos	<b>ys</b> phoryl Gr	oup Transfer			logical	6+3 Oxida	
Bioer Redu Pathy	nerge ction vay, [	tics an React The Cit	d Thermo ions, met ric Acid C	<b>ycolytic</b> odynami abolic p bycle.	<b>pathwa</b> cs, Phos athways:	<b>ys</b> phoryl Gr Glycolysi	is, Gluconeog			logical	<b>6+3</b> Oxida Phosp	
Bioer Redu Pathy II –	nerge ction vay, 7 <b>Fatty</b>	tics an React The Cit y <b>acid</b> ,	d Thermo ions, met ric Acid C Cholestro	ycolytic odynami abolic p bycle. I, Lipid	pathwa cs, Phos athways: and ami	ys phoryl Gr Glycolysi no acid m	is, Gluconeog etabolism	genesis, an	d the	logical Pentose	6+3 Oxida Phosp 6+3	phate
Bioen Redu Pathy II – Biosy	nerge ction way, <b>Fatty</b> (nthes	tics an React <u>The Cit</u> y <b>acid,</b> sis of f	id Thermo ions, met ric Acid C Cholestro atty acids,	ycolytic odynami abolic p Sycle. ol, Lipid Oxidatio	<b>pathwa</b> cs, Phos athways: <b>and ami</b> on of fatt	<b>ys</b> phoryl Gr Glycolysi i <b>no acid m</b> y acid – be	is, Gluconeog etabolism eta oxidation a	genesis, an	d the	logical Pentose on, Ket	6+3 Oxida Phosp 6+3 one Bc	phato
Bioen Redu Pathy II – Biosy Biosy	nerge ction <u>way, 7</u> Fatty nthes nthes	tics an React <u>The Cit</u> y <b>acid,</b> sis of f	d Thermo ions, met ric Acid C Cholestro atty acids, Cholestero	ycolytic odynami abolic p bycle. I, Lipid Oxidatic I, Biosy	<b>pathwa</b> cs, Phos athways: <b>and ami</b> on of fatt nthesis o	ys phoryl Gr Glycolysi no acid m y acid – be f phospho	is, Gluconeog etabolism	genesis, an	d the	logical Pentose on, Ket	6+3 Oxida Phosp 6+3 one Bc	phato
Bioen Redu Pathy II – Biosy Biosy Brou	nerger ction way, <b>Fatty</b> mthes mthes ps, Pa	tics an React The Cit y <b>acid</b> , sis of f sis of ( athway	d Therma ions, met ric Acid C Cholestro atty acids, Cholestero s of Amin	ycolytic odynami abolic p bycle. bl, Lipid Oxidatic l, Biosy o Acid I	<b>pathwa</b> cs, Phos athways: <b>and ami</b> on of fatt nthesis o Degradati	ys phoryl Gr Glycolysi no acid m y acid – be f phosphol on.	is, Gluconeog etabolism eta oxidation a lipids and gly	genesis, an	d the	logical Pentose on, Ket	6+3 Oxida Phosp 6+3 one Bo s of A	phato
Bioen Redu Pathy II – Biosy Biosy Brou III -	nergen ction way, <u>Fatty</u> <b>Fatty</b> ynthes ynthes ps, Pa - <b>Oxi</b>	tics an React The Cit <b>atid</b> , sis of f sis of f athway dative	d Therma ions, met ric Acid C Cholestro atty acids, Cholestero s of Amin phosphor	ycolytic odynami abolic p lycle. l, Lipid Oxidatic l, Biosy o Acid E ylation	<b>pathwa</b> cs, Phos athways: <b>and ami</b> on of fatt nthesis o Degradation <b>and phot</b>	ys phoryl Gr Glycolysi no acid m y acid – be f phospho on. tophoshor	is, Gluconeog etabolism eta oxidation a lipids and gly ylation	genesis, an and omega colipids, N	d the oxidati Metabo	logical Pentose on, Ket lic Fate	6+3 Oxida Phosp 6+3 one Bc s of A 6+3	phato odies mino
Bioer Redu Pathy II – Biosy Biosy Brou III - Elec	hergen ction way, 7 Fatty nthes nthes ps, Pa - Oxio	tics an React The Cit y acid, sis of f sis of f athway dative Transfe	d Therma ions, met ric Acid C Cholestro atty acids, Cholestero s of Amin phosphor er Reactio	ycolytic odynami abolic p ycle. I, Lipid Oxidatic I, Biosy o Acid E ylation as in Mi	<b>pathwa</b> cs, Phos athways: <b>and ami</b> on of fatt nthesis o Degradatio <b>and phot</b> tochondr	ys phoryl Gr Glycolysi no acid m y acid – be f phosphor on. tophoshor ia, ATP Sy	is, Gluconeog etabolism eta oxidation a lipids and gly ylation /nthesis, Regu	genesis, an and omega colipids, N	d the oxidati Metabo	logical Pentose on, Ket lic Fate	6+3 Oxida Phosp 6+3 one Bc s of A 6+3	phat odies mine
Bioen Redu Pathy II – Biosy Biosy Brou Elec Gen	nergen ction way, <u></u> <b>Fatty</b> nthes nthes ps, Pa - <b>Oxi</b> tron- eral F	tics an React The Cit y acid, sis of f sis of f athway dative Transfe Feature	d Therma ions, met ric Acid C Cholestro atty acids, Cholesterc s of Amin phosphor er Reactio s of Photo	ycolytic odynami abolic p cycle. I, Lipid Oxidatic I, Biosy o Acid E ylation as in Mir phospho	<b>pathwa</b> cs, Phos athways: <b>and ami</b> on of fatt nthesis o Degradation and phot tochondri rylation –	ys phoryl Gr Glycolysi no acid m y acid – be f phospho on. tophoshor ia, ATP Sy - Photosyst	is, Gluconeog etabolism eta oxidation a lipids and gly ylation	genesis, an and omega colipids, N	d the oxidati Metabo	logical Pentose on, Ket lic Fate	6+3 Oxida Phosp 6+3 one Bc s of A 6+3 phoryla	phato odies mino
Bioer Redu Pathy II – Biosy Biosy Biosy Brou Elec Gen IV –	hergen ction way, 7 <b>Fatty</b> nthes nthes ps, Pa oxid tron- eral F - <b>Bios</b>	tics an React The Cit <b>y acid</b> , sis of f sis of f athway <b>dative</b> Transfe Feature <b>Synthe</b>	d Therma ions, met ric Acid C Cholestro atty acids, Cholestero s of Amin phosphor er Reactio s of Photo sis of amin	ycolytic odynami abolic p lycle. l, Lipid Oxidatic l, Biosy o Acid I ylation as in Mir phospho no acids	<b>pathwa</b> cs, Phos athways: <b>and ami</b> on of fatt nthesis o Degradation <b>and phot</b> tochondr rylation - <b>and nuc</b>	ys phoryl Gr Glycolysi ino acid m y acid – be f phosphol on. tophoshor ia, ATP Sy - Photosyst leotides	is, Gluconeog etabolism eta oxidation a lipids and gly ylation ynthesis, Regu tem I and II.	genesis, an and omega colipids, M lation of C	oxidati oxidati Metabo	logical Pentose on, Ket lic Fate	6+3 Oxida Phosp 6+3 one Bo s of A 6+3 phoryla 6+3	phate odies mine ation
Bioer Redu Pathy II – Biosy Biosy Brou Elec Gen IV – Ove	hergen ction way, <u>Fatty</u> Fatty nthes ynthes ps, Pa - Oxio tron- eral F - Bios rview	tics an React The Cit <b>athe Cit</b> <b>athe Cit</b>	d Therma ions, met ric Acid C Cholestro atty acids, Cholestero s of Amin phosphor er Reactio s of Photo sis of amin itrogen M	ycolytic odynami abolic p ycle. d, Lipid Oxidatic l, Biosy o Acid E ylation as in Mir phospho no acids Ietabolis	pathwa cs, Phos athways: and ami on of fatt nthesis o Degradatio and phot tochondri rylation - and nuc m, Bios	ys phoryl Gr Glycolysi ino acid m y acid – be f phosphor on. tophoshor ia, ATP Sy - Photosyst leotides ynthesis o	is, Gluconeog etabolism eta oxidation a lipids and gly ylation /nthesis, Regu tem I and II. f amino acid	genesis, an and omega colipids, M lation of C	oxidati oxidati Vietabo	logical Pentose on, Ket lic Fate //e Phosp 	6+3 Oxida Phosp 6+3 one Bo s of A 6+3 phoryla 6+3 radatio	phate odies mine ation
Bioer Redu Pathy II – Bios Bios Bios Bios Bios Bios Bios Bios	nergen ction way, 7 Fatty nthes ynthes ps, Pa - Oxio tron- eral F - Bios rview eotido	tics an React The Cit <b>acid</b> , sis of f sis of f athway <b>dative</b> Transfe Seature <b>synthe</b> of N es – D	d Therma ions, met ric Acid C Cholestro atty acids, Cholesterco s of Amin phosphor er Reactio s of Photo sis of amin itrogen M De Novo I	ycolytic odynami abolic p cycle. I, Lipid Oxidatic I, Biosy o Acid E ylation ns in Mir phospho no acids letabolis Purine N	pathwa cs, Phos athways: and ami on of fatt nthesis o Degradation and phot tochondr rylation - and nuc m, Biosy ucleotide	ys phoryl Gr Glycolysi no acid m y acid – be f phospho on. tophoshor ia, ATP Sy - Photosyst leotides ynthesis o e synthesis	is, Gluconeog etabolism eta oxidation a lipids and gly ylation ynthesis, Regu tem I and II. f amino acid a – Purine N	enesis, an and omega colipids, M lation of C s, biosynt acleotide H	oxidati oxidati Metabo Dxidativ hesis a Biosynt	logical Pentose on, Ket lic Fates ve Phosp ind deg hesis –	6+3 Oxida Phosp 6+3 one Bc s of A 6+3 phoryla 6+3 radatio Pyrim	phate odies mine ation
Bioer Redu Pathy II – Bios Bios Bios Bios Bios Bios Bios Bios	nergen ction way, 7 <b>Fatty</b> nthes nthes ps, Pa <b>Oxid</b> tron- eral F <b>Bios</b> rview eotid leotid	tics an React The Cit y acid, sis of f sis of f athway dative Transfe Feature y of N es – D le-Nuc	d Therma ions, met ric Acid C Cholestro atty acids, Cholestero s of Amin phosphor er Reactio s of Photo sis of amin itrogen M De Novo H leotide M	ycolytic odynami abolic p cycle. I, Lipid Oxidatic I, Biosy o Acid E ylation ns in Mir phospho no acids letabolis Purine N	pathwa cs, Phos athways: and ami on of fatt nthesis o Degradation and phot tochondr rylation - and nuc m, Biosy ucleotide	ys phoryl Gr Glycolysi no acid m y acid – be f phospho on. tophoshor ia, ATP Sy - Photosyst leotides ynthesis o e synthesis	is, Gluconeog etabolism eta oxidation a lipids and gly ylation /nthesis, Regu tem I and II. f amino acid	enesis, an and omega colipids, M lation of C s, biosynt acleotide H	oxidati oxidati Metabo Dxidativ hesis a Biosynt	logical Pentose on, Ket lic Fates ve Phosp ind deg hesis –	6+3 Oxida Phosp 6+3 one Bc s of A 6+3 phoryla 6+3 radatio Pyrim	phat odies mine ation
Bioer Redu Pathy II – Bios Bios Bios Bios Bios Elec Gen IV - Ove Nuc Salv	hergen ction way, 7 <b>Fatty</b> (nthese ps, Pa - <b>Oxio</b> tron- eral F - <b>Bios</b> rview eotide leotide rage F	tics an React The Cit <b>a acid</b> , sis of f sis of f athway <b>dative</b> Transfe <u>seature</u> <b>synthes</b> of N es – D le-Nuc Pathway	d Therma ions, met ric Acid C Cholestro atty acids, Cholestero s of Amin phosphor er Reactio s of Photo sis of amin itrogen M De Novo H leotide M ys.	ycolytic odynami abolic p ycle. I, Lipid Oxidatic I, Biosy o Acid E ylation no acids Ietabolis Purine N onophos	pathwa cs, Phos athways: and ami on of fatt nthesis o Degradatio and phot tochondr rylation - and nuc m, Bios ucleotide phates-R	ys phoryl Gr Glycolysi no acid m y acid – be f phospho on. tophoshor ia, ATP Sy - Photosyst leotides ynthesis o e synthesis	is, Gluconeog etabolism eta oxidation a lipids and gly ylation ynthesis, Regu tem I and II. f amino acid a – Purine N	and omega colipids, M lation of C s, biosynt ucleotide H	oxidati oxidati Metabo Dxidativ hesis a Biosynt	logical Pentose on, Ket lic Fates ve Phosp ind deg hesis –	6+3 Oxida Phosp 6+3 one Bo s of A 6+3 phoryla 6+3 radatio Pyrim estricte	phate odies mine ation
Bioeff Redu Pathy II – Bios Bios Bios Brou Elec Gen IV – Ove nucl Nuc Salv V –	hergen ction way, 7 Fatty These ps, Pa ps, Pa ps, Pa content tron- eral F Bios rview eotide leotide age F Meta	tics an React The Cit <b>acid</b> , sis of f sis of f athway <b>dative</b> Transfe Feature <b>Synthes</b> of N es – D le-Nuc Pathway	d Therma ions, met ric Acid C Cholestro atty acids, Cholestero s of Amin phosphor er Reactio s of Photo sis of amin itrogen M leotide M ys. lisorders	ycolytic odynami abolic p lycle. l, Lipid Oxidatic l, Biosy o Acid D ylation no acids letabolis Purine N onophos	pathwa cs, Phos athways: and ami on of fatt nthesis o Degradation and phot tochondr rylation - and nuc m, Biosy ucleotide phates-R	ys phoryl Gr Glycolysi ino acid m y acid – be f phosphoton. tophoshor ia, ATP Sy Photosyst leotides ynthesis o e synthesis o synthesis o	is, Gluconeog etabolism eta oxidation a lipids and gly ylation ynthesis, Regu tem I and II. f amino acid a – Purine N – Purine and	and omega colipids, M lation of C s, biosynt cleotide H Pyrimidin	oxidati oxidati Metabo Dxidativ hesis a Biosynt ie base	logical Pentose on, Ket lic Fate ve Phosp nd deg hesis – s are re	6+3 Oxida Oxida Phosp $6+3$ one Bo s of A: $6+3$ phoryla $6+3$ radatio Pyrim estricte $6+3$	phate odies mine ation on o idine d b
Bioed Redu Pathy Biosy Biosy Brou <b>III</b> - Elecc Gen <b>IV</b> - Ove Nucc Salv <b>V</b> - Ove	hergen ction way, T Fatty These onthese ps, Pa onthese ps, Pa onthese ps, Pa onthese ps, Pa onthese ps, Pa onthese ps, Pa onthese tron-' eral F - Bios rview eotide leotide age F Meta rall v	tics an React The Cit y acid, sis of f sis of f athway dative Transfe Feature y of N es – E le-Nuc Pathway bolic o iew on	d Therma ions, met ric Acid C Cholestro atty acids, Cholestero s of Amin phosphor er Reactio s of Photo sis of amin fitrogen M De Novo I leotide M ys. lisorders	ycolytic odynami abolic p ycle. J, Lipid Oxidatic l, Biosy o Acid E ylation is in Mir phospho to acids letabolis Purine N onophos and dise of meta	pathwa cs, Phos athways: and ami on of fatt nthesis o Degradatio and phot tochondri rylation - and nuc m, Bios ucleotide phates-R ases bolic pat	ys phoryl Gr Glycolysi ino acid m y acid – be f phosphor on. tophoshor ia, ATP Sy - Photosyst leotides ynthesis o e synthesis ibosomal -	is, Gluconeog etabolism eta oxidation a lipids and gly ylation /nthesis, Regu tem I and II. f amino acid s – Purine N – Purine and	genesis, an and omega colipids, M lation of C s, biosynt acleotide H Pyrimidin	oxidati oxidati vletabo Dxidativ hesis a Biosynt he base ve anal	logical Pentose on, Ket lic Fate ve Phosp nd deg hesis – s are re	6+3 Oxida Oxida Phosp $6+3$ one Bo s of A: $6+3$ phoryla $6+3$ radatio Pyrim estricte $6+3$	phate odies mino ation on o idine d b
Bioed Redu Pathy Biosy Biosy Brou <b>III</b> - Elecc Gen <b>IV</b> - Ove Nucc Salv <b>V</b> - Ove	hergen ction vay, 7 Fatty nthes ynthes ps, Pa - Oxio tron-7 eral F - Bios rview eotido leotido leotido age F Meta rall v lving	tics an React The Cit <b>a cid</b> , sis of f sis of f sis of f athway <b>dative</b> Transfe Geature Synthes of N es – D le-Nuc Pathway bolic of iew on in disc	d Therma ions, met ric Acid C Cholestro atty acids, Cholestero s of Amin phosphor er Reactio s of Photo sis of Photo sis of amin fitrogen M De Novo I leotide M ys. disorders enegetics ease and d	ycolytic odynami abolic p ycle. J, Lipid Oxidatic l, Biosy o Acid E ylation is in Mir phospho to acids letabolis Purine N onophos and dise of meta	pathwa cs, Phos athways: and ami on of fatt nthesis o Degradatio and phot tochondr rylation - and nuc m, Bios ucleotide phates-R bolic pat Report v	ys phoryl Gr Glycolysi ino acid m y acid – be f phosphor on. tophoshor ia, ATP Sy - Photosyst leotides ynthesis o e synthesis ibosomal - hways - Q vriting on 1	is, Gluconeog etabolism eta oxidation a lipids and gly ylation /nthesis, Regu tem I and II. f amino acid s – Purine N – Purine and Dualitative and metabolic disc	enesis, an und omega vcolipids, M lation of C s, biosynt ucleotide F Pyrimidin	oxidati oxidati vletabo Dxidativ hesis a Biosynt he base ve anal	logical Pentose on, Ket lic Fate ve Phosp nd deg hesis – s are re ysis of	6+3 Oxida Phosp 6+3 one Bo s of A 6+3 phoryla 6+3 radatio Pyrim estricte 6+3 metabo	phate odies mino ation on o idine d b
Bioed Redu Pathy Biosy Biosy Brou <b>III</b> - Elecc Gen <b>IV</b> - Ove Nucc Salv <b>V</b> - Ove	hergen ction vay, 7 Fatty nthes ynthes ps, Pa - Oxio tron-7 eral F - Bios rview eotido leotido leotido age F Meta rall v lving	tics an React The Cit <b>acid</b> , sis of f sis of f athway <b>dative</b> Transfe Feature Feature Synthes of N le-Nuc Pathway bolic o iew on in disc ecture	d Therma ions, met ric Acid C Cholestro atty acids, Cholestero s of Amin phosphor er Reactio s of Photo sis of Photo sis of amin fitrogen M De Novo I leotide M ys. disorders enegetics ease and d	ycolytic odynami abolic p ycle. J, Lipid Oxidatic l, Biosy o Acid E ylation is in Mir phospho to acids letabolis Purine N onophos and dise of meta	pathwa cs, Phos athways: and ami on of fatt nthesis o Degradatio and phot tochondr rylation - and nuc m, Bios ucleotide phates-R bolic pat Report v Tutoria	ys phoryl Gr Glycolysi ino acid m y acid – be f phosphor on. tophoshor ia, ATP Sy - Photosyst leotides ynthesis o e synthesis ibosomal - hways - Q vriting on 1	is, Gluconeog etabolism eta oxidation a lipids and gly ylation /nthesis, Regu tem I and II. f amino acid s – Purine N – Purine and pualitative and metabolic disc Pract	enesis, an und omega vcolipids, M lation of C s, biosynt ucleotide F Pyrimidin	oxidati oxidati vletabo Dxidativ hesis a Biosynt he base ve anal	logical Pentose on, Ket lic Fate ve Phosp nd deg hesis – s are ro ysis of Tot	6+3 Oxida Phosp 6+3 one Bo s of A 6+3 phoryla 6+3 radatio Pyrim estricte 6+3 metabo 1	phate odies mine ation on o idine d b
Bioed Redu Pathy Biosy Biosy Biosy Brou III - Elecc Gen IV - Ove Nucc Salv V - Ove	hergen ction way, T Fatty These onthese ps, Pa onthese ps, Pa onthese onthese ps, Pa onthese ps, Pa onthese onthese ps, Pa onthese ps, Pa onthese onthese ps, Pa onthese onthese onthese ps, Pa onthese on	tics an React The Cit <b>acid</b> , sis of f sis of f athway <b>dative</b> Transfe Feature Feature of N es – E le-Nuc Pathway in dise <b>ecture</b> <b>30</b>	d Therma ions, met ric Acid C Cholestro atty acids, Cholestero s of Amin phosphor er Reactio s of Photo sis of Photo sis of amin fitrogen M De Novo I leotide M ys. disorders enegetics ease and d	ycolytic odynami abolic p ycle. J, Lipid Oxidatic l, Biosy o Acid E ylation is in Mir phospho to acids letabolis Purine N onophos and dise of meta	pathwa cs, Phos athways: and ami on of fatt nthesis o Degradatio and phot tochondr rylation - and nuc m, Bios ucleotide phates-R bolic pat Report v	ys phoryl Gr Glycolysi ino acid m y acid – be f phosphor on. tophoshor ia, ATP Sy - Photosyst leotides ynthesis o e synthesis ibosomal - hways - Q vriting on 1	is, Gluconeog etabolism eta oxidation a lipids and gly ylation /nthesis, Regu tem I and II. f amino acid s – Purine N – Purine and Dualitative and metabolic disc	enesis, an und omega vcolipids, M lation of C s, biosynt ucleotide F Pyrimidin	oxidati oxidati vletabo Dxidativ hesis a Biosynt he base ve anal	logical Pentose on, Ket lic Fate ve Phosp nd deg hesis – s are re ysis of	6+3 Oxida Phosp 6+3 one Bo s of A 6+3 phoryla 6+3 radatio Pyrim estricte 6+3 metabo 1	phat odies min atior on co idin d b
Bioed Redu Pathy Biosy Biosy Biosy Brou III - Elecc Gen IV - Ove Nucc Salv V - Ove	hergen ction vay, 7 Fatty nthes ps, Pa ps, Pa oxid tron- eral F - Bios rview eotid leotid leotid leotid age F Meta rall v lving L t Boo	tics an React The Cit y acid, sis of f sis of f sis of f athway dative Transfe Seature synthes y of N le-Nuc bele-Nuc bele-Nuc athway bolic f iew on in disc acture 30 ks:	d Therma ions, met ric Acid C Cholestro atty acids, Cholestero s of Amin phosphor er Reactio s of Photo sis of amin itrogen M De Novo I leotide M ys. lisorders ease and d	ycolytic odynami abolic p ycle. I, Lipid Oxidatic I, Biosy o Acid E ylation ns in Mir phospho no acids letabolis Purine N onophos and dise of meta	pathwa cs, Phos athways: and ami on of fatt nthesis o Degradatio and phot tochondr rylation - and nuc m, Bios ucleotide phates-R bolic pat Report v Tutoria 15	ys phoryl Gr Glycolysi ino acid m y acid – be f phosphor on. tophoshor ia, ATP Sy Photosyst leotides ynthesis o e synthesis ibosomal - hways - Q vriting on 1	is, Gluconeog etabolism eta oxidation a lipids and gly ylation /nthesis, Regu tem I and II. f amino acid a – Purine N – Purine and pualitative and metabolic disc 0	genesis, an and omega acolipids, M lation of C s, biosynt acleotide F Pyrimidin l quantitati orders or di <b>ical</b>	oxidati oxidati ve anal seases.	logical Pentose on, Ket lic Fate ve Phosp nd deg hesis – s are re ysis of Tot 4	6+3 Oxida Phosp 6+3 one Bo s of A 6+3 phoryla 6+3 radatio Pyrim estricte 6+3 metabo tal 5	phat odies mine atior on o idin d b
Bioed Redu Pathy Biosy Biosy Brou III - Elecc Gen IV - Ove Nucc Salv V - Ove	hergen ction way, 7 Fatty Tatty nthes ps, Pa oxid tron-' eral F Bios rview eotid leotid age F Meta rall v lving L t Boo 1. L	tics an React The Cit <b>a cid</b> , sis of f sis of f athway <b>dative</b> Transfe Feature <b>Synthes</b> of N es – D le-Nuc Pathway <b>bolic</b> o iew on in disc <b>ecture</b> <b>30</b> ks:	d Therma ions, met ric Acid C Cholestro atty acids, Cholestero s of Amin phosphor er Reactio s of Photo sis of amin itrogen M be Novo I leotide M ys. disorders ease and d ger Princip	ycolytic odynami abolic p cycle. d. Lipid Oxidatic l, Biosy o Acid D ylation no acids letabolis Purine N onophos of meta asorders.	pathwa cs, Phos athways: and ami on of fatt nthesis o Degradatio and phot tochondr rylation - and nuc m, Bios ucleotide phates-R bolic pat Report v Tutoria 15	ys phoryl Gr Glycolysi ino acid m y acid – be f phosphor on. tophoshor ia, ATP Sy - Photosyst leotides ynthesis o e synthesis ibosomal - hways - Q vriting on n l	is, Gluconeog etabolism eta oxidation a lipids and gly ylation ylation ynthesis, Regu tem I and II. f amino acid a – Purine N – Purine and Dualitative and metabolic disc 0 L. Nelson an	genesis, an und omega voolipids, M lation of C s, biosynt ucleotide F Pyrimidin l quantitati orders or di ical d Michael	d the oxidati Metabol Dxidativ hesis a Biosynt he base ve anal seases.	logical Pentose on, Ket lic Fate ve Phosp und deg hesis – s are re ysis of <b>Tot</b> 48	6+3 Oxida Phosp 6+3 one Bo s of A 6+3 phoryla 6+3 radatio Pyrim estricte 6+3 metabo tal 5	phat odies mine atior on o idin d b olisr mar
Bioed Redu Pathy Biosy Biosy Biosy Brou III - Elecc Gen IV - Ove Nucc Salv V - Ove	hergen ction vay, 7 Fatty Tatty nthes ps, Pa oxid tron-' eral F - Bios rview eotid leotid leotid age F Meta rall v lving L t Boo 1. L	tics an React The Cit y acid, sis of f sis of f sis of f athway dative Transfe Geature y of N es – D le-Nuc Pathway in disc ecture 30 ks: chning th edit	d Therma ions, met ric Acid C Cholestro atty acids, Cholestero s of Amin phosphor er Reactio s of Photo s of P	ycolytic odynami abolic p cycle. d. Lipid Oxidatic l, Biosy o Acid D ylation no acids letabolis Purine N onophos of meta asorders.	pathwa cs, Phos athways: and ami on of fatt nthesis o Degradatio and phot tochondr rylation - and nuc m, Bios ucleotide phates-R bolic pat Report v Tutoria 15	ys phoryl Gr Glycolysi ino acid m y acid – be f phosphor on. tophoshor ia, ATP Sy - Photosyst leotides ynthesis o e synthesis ibosomal - hways - Q vriting on n l	is, Gluconeog etabolism eta oxidation a lipids and gly ylation /nthesis, Regu tem I and II. f amino acid a – Purine N – Purine and pualitative and metabolic disc 0	genesis, an und omega voolipids, M lation of C s, biosynt ucleotide F Pyrimidin l quantitati orders or di ical d Michael	d the oxidati Metabol Dxidativ hesis a Biosynt he base ve anal seases.	logical Pentose on, Ket lic Fate ve Phosp und deg hesis – s are re ysis of <b>Tot</b> 48	6+3 Oxida Phosp 6+3 one Bo s of A 6+3 phoryla 6+3 radatio Pyrim estricte 6+3 metabo tal 5	phat odies mine atior on o idin d b olisr mar
Bioed Redu Pathy Biosy Biosy Brou III - Elecc Gen IV - Ove Nucc Salv V - Ove	hergen ction way, 7 Fatty nthes ps, Pa ps, Pa oxid tron-' eral F Bios rview eotid leotid leotid leotid age F Meta rall v lving L 1. L 6 1	tics an React The Cit y acid, sis of f sis of f sis of f athway dative Transfe Seature synthes y of N es - D le-Nuc Pathway bolic o iew on in dise ecture 30 ks: ehning th edit 464109	d Therma ions, met ric Acid C Cholestro atty acids, Cholestero s of Amin phosphor er Reactio s of Photo sis of amin itrogen M be Novo I leotide M ys. disorders ease and d ger Princip ion editio 9621.	ycolytic odynami abolic p ycle. I, Lipid Oxidatic I, Biosy o Acid E ylation no acids Ietabolis Purine N onophos of meta isorders. les of B n (13 F	pathwa cs, Phos athways: and ami on of fatt nthesis o Degradatio and phot tochondr rylation - and nuc m, Bios ucleotide phates-R bolic pat Report v Tutoria 15 iochemis February	ys phoryl Gr Glycolysi ino acid m y acid – be f phosphor on. tophoshor ia, ATP Sy Photosyst leotides ynthesis o e synthesis ibosomal - hways - Q vriting on n l try, David 2013), 11	is, Gluconeog etabolism eta oxidation a lipids and gly ylation ylation ynthesis, Regu tem I and II. f amino acid a – Purine N – Purine and Dualitative and metabolic disc 0 L. Nelson an	genesis, an and omega acolipids, M lation of C s, biosynt acleotide F Pyrimidin l quantitati orders or di ical d Michael BN-10: 144	d the oxidati verabo veranal seases. M. Con 641096	logical Pentose on, Ket lic Fate ve Phosp ind deg hesis – s are re ysis of <u>Tot</u> 4! x, W. H 21, ISE	6+3 Oxida Phosp 6+3 one Bo s of A 6+3 phoryla 6+3 radatio Pyrim estricte 6+3 metabo 115 The strict of the	phate odies mine ation ation d by on o idin d by man 978

**3.** Branden C. and Tooze J., "Introduction to Protein Structured, Second Edition", Garland Publishing, NY, USA, 1999.

# **Reference Books:**

- 1. Introduction to Protein structure, 2nd Ed by Carl Branden and John Tooze, Garland Press, 1999.
- 2. Structure and Mechanism in Protein Science, Alan Fersht, Freeman, 1999.
- 3. Protein engineering in Industrial biotechnology, Ed. Lilia Alberghina, Harwood Academic Publishers, 2002.
- 4. Creighton T.E. Proteins, Freeman WH, Second Edition, 1993.

# **E-References:**

1. https://nptel.ac.in/courses/102104063/

# Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	1	2	0	1	0	0	1	1	1	1	1	3	2
CO 2	1	1	2	0	1	0	0	1	1	1	1	2	2	3
CO 3	1	1	2	0	1	0	0	1	1	1	1	3	1	2
<b>CO 4</b>	1	1	2	0	1	0	0	1	1	1	1	2	1	1
CO 5	1	1	2	0	1	0	0	1	1	1	1	1	1	1
	5	5	10	0	5	0	0	5	5	5	5	9	8	9

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

# Mapping of Subjects with POs

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Original Value	5	5	10	0	5	0	0	5	5	5	5	9	8	9
Scaled Value	1	1	2	0	1	0	0	1	1	1	1	2	2	2

 $1 - 5 \rightarrow 1, \qquad \qquad 6 - 10 \rightarrow 2, \qquad \qquad 11 - 15 \rightarrow 3$ 

				L	Т	Р	С
X	BT 4	03		3	0	0	3
			CELL BIOLOGY			-	_
С	Р	Α		L	Т	Р	Η
3	0	0		3	0	0	3
Prer	equi	site:-		·	•		•
Lear	rning	; Obje	ectives:				
Upo	n cor	npleti	on of this course, the students				
•	• W	ould o	levelop a deeper understanding of cell structure and he	ow it relates to ce	ell funct	ions.	
•	• W	ould	understand how cells grow, divide, and die and h	ow these impor	tant pro	ocesses	s are
	re	gulate	d.	Ĩ	1		
•	W	ould ι	inderstand cell signaling and how it regulates cellular	functions.			
			Course Outcomes	Domain	J	Level	
After	r the	comp	letion of the course, students will be able to				

CO1	<i>Study</i> and <i>unders</i> cells specialization	ttand the origin of eukaryotic cell	ls and Co	gnitive	Understand Remember Apply
CO2	<i>Recognize</i> the functioning of a end	ndamental concepts in the structur Ikaryotic cell.	re and Co	gnitive	Understand Remember Apply
CO3	Acquire knowled	ge on the transport of proteins be artments	tween Co	gnitive	Understand Remember
CO4	Acquire knowledg	e about cell cycles mitosis and meio		gnitive	Understand Remember
CO5	receptors	61ignaling and types of sign	naling Co	gnitive	Understand Remember
I – Ce	ells and Tissues				9
	elia, Connective tis	ells – Origin of Eukaryotic cells – sue, Nervous tissue, Muscle – Cel			
II – C	ellular Organizati	on and Membrane Transport			9
Mitoc	hondria, Chloroplas e transport – Sodiu	cell structure: Cytoplasmic matrix, t, Nucleus – Functions of cell orga m/potassium pumps, Ca2+, ATPas	anelles – M	embrane T	ransport: Passive and
	Intracellular Prote	in Trafficking			9
111 - 1					
		-	ranes Ve	sicular Trat	-
Transp	port to and from the	Nucleus – Transport Across Memb	oranes – Ve	sicular Trat	-
Transp Intrace	port to and from the ellular Compartmen	Nucleus – Transport Across Memb ts	oranes – Ve	sicular Trat	ficking Between
Transj Intrace IV – (	port to and from the ellular Compartmen C <b>ell Division and C</b>	Nucleus – Transport Across Memb ts <b>Control</b>			ficking Between
Transp Intrace IV – C The co	port to and from the ellular Compartmen C <b>ell Division and C</b> ell cycle – General	Nucleus – Transport Across Memb ts <b>Control</b> description and different stages of	mitosis and		ficking Between
Transp Intrace <b>IV – C</b> The co Metap	port to and from the ellular Compartmen C <b>ell Division and C</b> ell cycle – General	Nucleus – Transport Across Memb ts <b>Control</b>	mitosis and		ficking Between
Transp Intrace IV - C The co Metap V - C	port to and from the ellular Compartmen Cell Division and C ell cycle – General phase, Anaphase, Te ell Signaling	Nucleus – Transport Across Memb ts <b>Control</b> description and different stages of lophase) – Cell Growth Control: Ap	mitosis and poptosis	1 meiosis (	ficking Between 9 Interphase, Prophase 9
Transp Intrace IV - C The co Metap V - C Cell S	port to and from the ellular Compartmen Cell Division and C ell cycle – General bhase, Anaphase, Te ell Signaling ignaling: Types of	Nucleus – Transport Across Memb ts <b>Control</b> description and different stages of	mitosis and coptosis of Cell Sig	1 meiosis ( naling – Ro	ficking Between 9 Interphase, Prophase 9 eceptors in Signaling
Transp Intrace IV - C The co Metap V - C Cell S Types	port to and from the ellular Compartmen Cell Division and C ell cycle – General bhase, Anaphase, Te ell Signaling ignaling: Types of	Nucleus – Transport Across Memb ts Control description and different stages of lophase) – Cell Growth Control: Ap Cell Signaling, General Principles of naling via G-Protein-linked Cell S ptors.	mitosis and coptosis of Cell Sig	1 meiosis ( naling – Ro	ficking Between 9 Interphase, Prophase 9 eceptors in Signaling
Transp Intrace IV - C The co Metap V - C Cell S Types	port to and from the ellular Compartmen Cell Division and C ell cycle – General bhase, Anaphase, Te ell Signaling fignaling: Types of of Receptors, Sig	Nucleus – Transport Across Memb ts Control description and different stages of lophase) – Cell Growth Control: Ap Cell Signaling, General Principles of naling via G-Protein-linked Cell S	mitosis and coptosis of Cell Sig	1 meiosis ( naling – Ro	ficking Between 9 Interphase, Prophase 9 eceptors in Signaling
Transp Intraco IV - C The co Metap V - C Cell S Types linked	port to and from the ellular Compartmen Cell Division and C ell cycle – General bhase, Anaphase, Te ell Signaling bignaling: Types of of Receptors, Sig Cell-Surface Recep Lecture 45	Nucleus – Transport Across Memb ts Control description and different stages of lophase) – Cell Growth Control: Ap Cell Signaling, General Principles of naling via G-Protein-linked Cell S ptors.	mitosis and coptosis of Cell Sig Surface Red	1 meiosis ( naling – Ro	ficking Between 9 Interphase, Prophase 9 eceptors in Signaling gnaling via Enzyme
Transp Intraco IV - C The co Metap V - C Cell S Types linked Text I	port to and from the ellular Compartmen Cell Division and C ell cycle – General bhase, Anaphase, Te ell Signaling bignaling: Types of of Receptors, Sig Cell-Surface Recep Lecture 45 Books: 1. Bolsover, S. R John Wiley &	Nucleus – Transport Across Memb ts Control description and different stages of lophase) – Cell Growth Control: Ap Cell Signaling, General Principles of naling via G-Protein-linked Cell S otors. Tutorial 0 ., Shephard, E. A., White, H. A., and	mitosis and coptosis of Cell Sig Surface Rec Practical 0	1 meiosis ( naling – Ro ceptors, Si	ficking Between 9 Interphase, Prophase 9 eceptors in Signaling gnaling via Enzyme Total 45
Transp Intraco IV - C The co Metap V - C Cell S Types linked	port to and from the ellular Compartmen Cell Division and C ell cycle – General bhase, Anaphase, Te ell Signaling Gignaling: Types of of Receptors, Sig Cell-Surface Recep Lecture 45 Books: 1. Bolsover, S. R John Wiley & ences: 1. Sadava, D. E. 1993. 2. Alberts, Bruce Keith Roberts, 3. Julio E. Celis.	Nucleus – Transport Across Memb ts Control description and different stages of lophase) – Cell Growth Control: Ap Cell Signaling, General Principles of naling via G-Protein-linked Cell S otors. Tutorial 0 ., Shephard, E. A., White, H. A., and	mitosis and poptosis of Cell Sig Surface Red <b>Practical</b> 0 d Hyams, J d Hyams, J <i>ad function</i> . ander Johns	1 meiosis ( naling – Ro ceptors, Si . S. <i>Cell bi</i> Jones & B son, Julian and Science	ficking Between 9 Interphase, Prophase 9 eceptors in Signaling gnaling via Enzyme Total 45 ology: a short course artlett Learning, Lewis, Martin Raff, , 2013.
Transı Intracu IN – C Metap V – C Cell S Types linked Text I Refer	port to and from the ellular Compartmen Cell Division and C ell cycle – General bhase, Anaphase, Te ell Signaling fignaling: Types of of Receptors, Sig Cell-Surface Recep Lecture 45 Books: 1. Bolsover, S. R John Wiley & ences: 1. Sadava, D. E. 1993. 2. Alberts, Bruce Keith Roberts, 3. Julio E. Celis. Press, 2006.	Nucleus – Transport Across Memb ts Control description and different stages of lophase) – Cell Growth Control: Ap Cell Signaling, General Principles of naling via G-Protein-linked Cell S otors. Tutorial 0 ., Shephard, E. A., White, H. A., and Sons, 2011. Cell biology: organelle structure an , Dennis Bray, Karen Hopkin, Alexa and Peter Walter. Essential cell bio	mitosis and poptosis of Cell Sig Surface Red <b>Practical</b> 0 d Hyams, J d Hyams, J <i>ad function</i> . ander Johns	1 meiosis ( naling – Ro ceptors, Si . S. <i>Cell bi</i> Jones & B son, Julian and Science	ficking Between 9 Interphase, Prophase 9 eceptors in Signaling gnaling via Enzyme Total 45 ology: a short course artlett Learning, Lewis, Martin Raff, , 2013.
Transı Intracu IV – C Metap V – C Cell S Types linked Text I Refer	port to and from the ellular Compartmen Cell Division and C ell cycle – General shase, Anaphase, Te ell Signaling bignaling: Types of of Receptors, Sig Cell-Surface Recep Lecture 45 Books: 1. Bolsover, S. R John Wiley & ences: 1. Sadava, D. E. 1993. 2. Alberts, Bruce Keith Roberts, 3. Julio E. Celis. Press, 2006. Cerences:	Nucleus – Transport Across Memb ts Control description and different stages of lophase) – Cell Growth Control: Ap Cell Signaling, General Principles of naling via G-Protein-linked Cell S otors. Tutorial 0 ., Shephard, E. A., White, H. A., and Sons, 2011. Cell biology: organelle structure an , Dennis Bray, Karen Hopkin, Alexa and Peter Walter. Essential cell bio Cell biology: A Laboratory Handbo	mitosis and poptosis of Cell Sig Surface Red <b>Practical</b> 0 d Hyams, J d Hyams, J <i>ad function</i> . ander Johns	1 meiosis ( naling – Ro ceptors, Si . S. <i>Cell bi</i> Jones & B son, Julian and Science	9         9         Interphase, Prophase         9         eceptors in Signaling gnaling via Enzyme         Total         45         ology: a short course         artlett Learning,         Lewis, Martin Raff, , 2013.
Transı Intracu IV – C Metap V – C Cell S Types linked Text I Refer	port to and from the ellular Compartmen Cell Division and C ell cycle – General bhase, Anaphase, Te ell Signaling Gignaling: Types of of Receptors, Sig Cell-Surface Recep Lecture 45 Books: 1. Bolsover, S. R John Wiley & ences: 1. Sadava, D. E. 1993. 2. Alberts, Bruce Keith Roberts, 3. Julio E. Celis. Press, 2006. Cerences: 1. http://nptel.ac	Nucleus – Transport Across Memb ts Control description and different stages of lophase) – Cell Growth Control: Ap Cell Signaling, General Principles of naling via G-Protein-linked Cell S otors. Tutorial 0 ., Shephard, E. A., White, H. A., and Sons, 2011. Cell biology: organelle structure an , Dennis Bray, Karen Hopkin, Alexa and Peter Walter. Essential cell bio	mitosis and poptosis of Cell Sig Surface Rec <u>Practical</u> 0 d Hyams, J d function. ander Johns plogy. Garla	1 meiosis ( naling – Re ceptors, Si . S. <i>Cell bi</i> Jones & B son, Julian and Science tion, Vol. 1	ficking Between 9 Interphase, Prophase 9 eceptors in Signaling gnaling via Enzyme Total 45 ology: a short course artlett Learning, Lewis, Martin Raff, , 2013. , Elsevier Academic

# Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	0	0	0	1	0	0	0	0	0	1	1	0	0
CO 2	3	1	0	1	1	1	0	0	1	1	0	0	0	0
CO 3	3	1	0	0	1	0	0	0	0	0	1	1	0	0
CO 4	3	1	0	1	1	1	0	0	1	1	1	1	0	0
CO 5	3	1	0	1	1	1	0	0	1	1	1	1	0	0
	15	4	0	3	5	3	0	0	3	3	4	4	0	0

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

# Mapping of Subjects with POs

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Original Value	15	4	0	3	5	3	0	0	3	3	4	4	0	0
Scaled Value	3	1	0	1	1	1	0	0	1	1	1	1	0	0
$1-5 \rightarrow 1$	Ι,		6 - 10	$\rightarrow 2$ ,		11	1 - 15	$\rightarrow 3$						

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

				L	Т	Р	С
X	BT 4(	)4		3	0	0	3
			IMMUNOLOGY				
С	Р	Α		L	Т	Р	Η
2.5	0	0.5		3	0	0	3

#### **Prerequisite:** Genetics

# **Learning Objectives:**

# Upon completion of this course, the students

- Would be able to explain role of immune cells and their mechanism in preventing the body from foreign attack and infectious disease, cancer and other disease development.
- Would apply the knowledge of immune associated mechanisms in medical biotechnology research.

	Course Outcomes	Domain	Level
After th	ne completion of the course, students will be able to		
CO1	<i>Outline</i> the general concepts of immune system and <i>describe</i> the cells and organs of the immune system	Cognitive	Remember Evaluate
CO2	<i>Explains</i> the properties of antigens and antibodies and <i>identify</i> their interactions via various tests.	Cognitive	Understand Perception
CO3	<i>Describe</i> various mechanisms of antigen presentation and <i>discuss</i> the role of MHC in Ag Presentation.	Cognitive Affective	Remember Responds Phenomena
CO4	<i>Compares</i> the different types of hypersensitive reactions and <i>explain</i> the autoimmune diseases.	Cognitive	Analyze Understand
CO5	<i>Comprehend</i> the types, mechanism of vaccines and <i>respond</i> to the various immunization techniques	Cognitive	Understand

	Immun	e Syst	em										9	
De	nctions andritic	of imp cell, St	ortant i tem cel	immune lls – In	e cells:	T cell, organs:	B cell Bone	develo marrov	pment v, Splee	, Macro	phage, N	Neutroph	il, NK	cell,
		bitics, Monoclonal antibodies – Antigen-antibody reaction: Cross-Reactivity, Affinity         bitics, Monoclonal antibodies – Antigen-antibody reaction: Cross-Reactivity, Affinity         bitation and agglutination reactions. Immunotechniques: ELISA, RIA, Flow concelectrophoresis, Western Blotting <b>MIC and Antigen Presentation</b> Histocompatibility Complex: Structure, Function and classes of MHC molecules         nsiveness to MHC – Antigen processing and presentation: Endogenous antigens (The ay), Exogenous antigens (The Endocytic Pathway)         omplement, Hypersensitivity and Autoimmunity         ation of immune response; Complement System: Functions, Components, Activation of complement system – Allergy and hypersensitivity: Types of hyperser         mmunity, Auto immune disorders; immune tolerance; Graft versus host reaction.         accines and Cancer Immunology       9         nes: Active and Passive Immunization, Whole-Organism Vaccines, Purified Macro conses, Recombinant-Vector Vaccines, DNA and Multivalent Subunit Vaccines. Turn ne System - Tumor Antigens - Immune Response to Tumors – Cancer immunotherapt         acture       Tutorial       Practical       Total         45       0       0       45         Books:       es Kuby., Immunology, WH Freeman and Company, Newyork.,7th Edition, 2013.       tt, I., Essential Immunology, Blackwell Scientific Publications, Oxford, 12 th Edition,											9	
Cla ant Pre	asses tibiotics ecipitat	and s,Mono ion an	Biolog clonal d agg	ical A antiboo lutinatio	Activiti lies – A on rea	es;Mol Antigei ctions.	lecular n-antibo	basis ody rea	s of action:	antiboo Cross-R	ly dive eactivity	ersity; 7, Affini	Polycle ty, Avie	onal dity,
		<u> </u>											9	
Ma res	ajor Hi ponsivo	stocom eness to	patibili o MHC	ity Cor 2 – Anti	nplex: gen pro	Structu ocessin	g and p	present					,	
													9	
Reg Reg	gulatio gulatio	n of in n of c	mmune ompler	e respo nent sy	nse; C ystem	ompler – Alle	nent S rgy an	ystem: d hype	ersensit	ivity: T	ypes of	hyperse	ivation	
V-	Vacci	nes an	d Can	cer Im	nunolo	ogy						9	)	
as `	Vaccin	es, Rec	combin	ant-Ve	ctor Va	ccines,	, DNA	and M	ultivale	nt Subu	nit Vacc	ines. Tu	mors of	
	Vaccines, Recombinant-Vector Vaccines, DNA and Multivalent Subunit Va mune System - Tumor Antigens - Immune Response to Tumors – Cancer in						Tota	ıl						
	45	5			0				0			45		
Te	xt Boo	ks:				L								
1.	Janes 1	Kuby.,	Immun	ology,	WH Fr	eeman	and Co	ompany	y, New	vork.,7tl	n Editior	n, 2013.		
													n, 2011.	
Re	ferenc													
	,			,			· · ·	,		r and M	olecular			
		$\Omega \log V$	/Ith Hd	n w	R V011#	ndere (			· • • • • • •					
		<b>U</b> .						•			) Ath Ed	lition		
2. 7	Tizard,	R.I. (2	2007). I	mmuno				•			a) 4th Ec	lition,		
2. 7	Tizard, Brooks	R.I. (2 s/Cole 1	2007). I	mmuno				•			a) 4th Ec	lition,		
2. ⁷ E - 1.	Tizard, Brooks • <b>Refer</b> http://	R.I. (2 s/Cole j ences: www.r	2007). I publish aymon	mmund ers. dcheon	ology: A	An Intr Year1/	immun	on 1st H	Edition	(English				
2. ⁷ E -	Tizard, Brooks • <b>Refer</b> http:// http://	R.I. (2 s/Cole <u>j</u> ences: www.r ocw.mi	2007). I publish aymon it.edu/c	mmund lers. dcheon	g.com/	An Intr Year1/	immun	on 1st H	Edition	(English			ular	
2. ⁷ E - 1. 2.	Tizard, Brooks • Refer http:// http://	R.I. (2 s/Cole j ences: www.r ocw.mi nology	2007). I publish aymon it.edu/c -fall-20	dcheon courses/ 005/lect	g.com/ /health- ure-no	An Intr Year1/ science tes/	immun es-and-	o.html techno	Edition	(English t-176-co	ellular-a		ular	
2. ⁷ E - 1. 2. 3.	Tizard, Brooks • Refer http:// http://	R.I. (2 s/Cole j ences: www.r ocw.mi nology- www.u	2007). I publish aymon it.edu/c -fall-20 umich.e	dcheon courses/ 005/lect	g.com/ /health- ure-no	An Intr Year1/ science tes/	immun es-and-	o.html techno	Edition	(English	ellular-a		ular	
2. ⁷ E - 1. 2. 3.	Tizard, Brooks • Refer http:// http:// immu http://	R.I. (2 s/Cole j ences: www.r ocw.mi nology- www.u	2007). I publish aymon it.edu/c -fall-20 umich.e	dcheon courses/ 005/lect	g.com/ /health- ure-no	An Intr Year1/ science tes/	immun es-and-	o.html techno	Edition	(English t-176-co	ellular-a		ular PSO 1	PSO
2. 7 E - 1. 2. 3. appi	Tizard, Brooks • Refer http:// http:// immu: http:// ng of C	R.I. (2 s/Cole j ences: www.r ocw.mi nology- www.u COs wi	2007). I publish aymon it.edu/c -fall-20 umich.e <b>th POs</b> PO3	dcheon courses/ 005/lect cdu/~bn	g.com/ health- ure-no nsteach	An Intr Year1/ science tes/ /lopatin <b>PO6</b>	oductio immun es-and- n/Immu P07	o.html o.html techno	Edition logy/hs y/Immu	(English t-176-co nology.	ellular-a html PO11	ndmolec PO12	PSO 1	
2. <b>E</b> - 1. 2. 3. appin	Tizard, Brooks • Refer http:// http:// immu: http:// ng of C PO1 3	R.I. (2 s/Cole j ences: www.r ocw.mi nology- www.u COs wi PO2 2	2007). I publish aymon it.edu/c -fall-20 unich.e <b>th POs</b> PO3 2	dcheon courses/ 005/lect cdu/~bn s PO4	g.com/ /health- ure-no nsteach	An Intr Year1/ science tes/ /lopatin	oductic immun es-and- n/Immu PO7	o.html o.html techno	Edition logy/hs y/Immu	(English t-176-co nology.	ellular-an html PO11	ndmolec PO12	PSO	<b>PSO</b> 3 2
2. ⁷ E - 1. 2. 3.	Tizard, Brooks • Refer http:// http:// immu http:// ng of C PO1 3 3	R.I. (2 s/Cole j ences: www.r ocw.mi nology- www.u COs wi	2007). I publish aymon it.edu/c -fall-20 umich.e <b>th POs</b> PO3	dcheon courses/ 005/lect cdu/~bn	g.com/ /health- ure-no nsteach PO5	An Intr Year1/ science tes/ /lopatin PO6	oductio immun es-and- n/Immu P07	o.html o.html techno	Edition logy/hs y/Immu	(English t-176-co nology.	ellular-a html PO11	ndmolec PO12	<b>PSO</b> 1 3 2	
2. 7 E - 1. 2. 3. appi	Tizard, Brooks • Refer http:// http:// immu: http:// ng of C PO1 3	R.I. (2 s/Cole j ences: www.r ocw.mi nology- www.u COs wi PO2 2	2007). I publish aymon it.edu/c -fall-20 unich.e <b>th POs</b> PO3 2	dcheon courses/ 005/lect cdu/~bn s PO4	g.com/ health- ure-no nsteach	An Intr Year1/ science tes/ /lopatin PO6	oductic immun es-and- n/Immu PO7	o.html o.html techno	Edition logy/hs y/Immu	(English t-176-co nology.	ellular-an html PO11	ndmolec PO12	<b>PSO</b> 1 3	3

rr									1		- 1	- 1		
	14	8	7	3	3	3	3				3	3	9	9
Mapping o	of Subia	ots with	POs											
Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Original	rui	F02	103	104	105	100	10/	100	109	1010	FOII	F012	1501	1302
Value	14	8	7	3	3	3	3				3	3	9	9
Scaled	3	2	2	0	0	0	0	0	0	0	0	0	2	2
Value	U	-	-	Ű	Ű	Ű	Ű	Ű	Ŷ	Ű	Ű	Ű	-	-
$1 - 5 \rightarrow 1$ 0 - No Re	,	, 1 - Lo		$0 \rightarrow 2$ , ation, 2	2- Med		1 – 15 elation,		gh Rela	tion				
COURS	E COI	DE	XU	M405							L	Т	Р	С
COURS	E NAN	ЛE	EC	ONON	AICS 1	FOR <b>F</b>	ENGIN	EERS			3	0	0	3
PREREC	QUISI	TES	NI	L							L	Т	Р	Η
C:P:A				4:0:0.1	2						3	0	0	3
COURS											OMAI		LEVEL	
CO1	-			cepts				0	ering a	ind C	ognitive		Underst	and
CO2	Calo	culate d	ind Ex	cplain 1	the Bre	eak-eve	en poin	t and n	nargina	l C	ognitive		Underst	and
	cost	-							_				&Apply	
CO3			e and $U$	Jse val	ue eng	ineerin	g proc	edure f	for cost		ognitive		Underst	
	anal	•	1		1.1						ffective		Receive	
CO4 CO5				nent p			difform	nt matl	ada of		ognitive		Underst Underst	
005		reciatio	-		паке С	se oj	unterei	nt metr	nods of	C	ognitive		Apply	
UNIT I	INT	RODU	CTIO	N TO	ECON	IOMI	CS							8
Flow in	an ecc	onomy,	Law	of sup	ply an	d dem	and, C	Concep	t of E	ngineer	ing Eco	onomics	– Engi	neering
efficiency		-		-				-		-	-		-	-
preparatio				•	-	-		-		• -		-		
UNIT III						-		-						12
Margin												s and	CVP a	
Profit/Vo					-	•	•					5 and	evi u	inary 515,
Social C												te dire	et indire	ect and
external e			•		-		-	•			Culcul	ue une	et, many	Jet und
UNIT III			_							ary 515.				10
Value eng										Jaka	- huu da	aision		10
	0	U		•		U	U	1			•	CISIOII		
Business	-	0					s, Equ	ipment	operat	ing cos	its			7
UNIT IV							1.1	1			6			-
Replacen		-			-	ement	proble	em, de	termin	ation (	of econ	omic li	te of ar	i asset,
Replacen				a new	asset.									
UNIT V														8
Depreciat					-				-		-			
depreciat			-		-			-		-	fund n	ethod of	of depre	ciation,
Annuity 1		l of dep				utput n		-						
LECTU	RE:45		TUI	FORIA	L:0		]	PRAC	TICAI	L:0	[		TOTAL	:45
TEXT B	OOKS	5												
							64			8 th BC	S/BIO	TECH/D	Date: 19.0	08.2021

1.	Sp Gupta, Ajay Sharma & Satish Ahuja, "Cost Accounting", V K Global Publications, Faridabad,
	Haryana, 2012.
2.	S.P.Jain&Narang, "Cost accounting – Principles and Practice", Kalyani Publishers,
	Calcutta, 2012.
3.	PanneerSelvam, R, "Engineering Economics", Prentice Hall of India Ltd, New Delhi,
	2001.
4.	William G.Sullivan, James A.Bontadelli& Elin M.Wicks, "Engineering Economy",
	Prentice Hall International, New York, 2001.
REFER	RENCES
1.	Luke M Froeb / Brian T Mccann, "Managerial Economics - A problem solving approach"
	Thomson learning 2007
2.	Truett&Truett, "Managerial economics- Analysis, problems & cases "Wiley India 8th edition
	2004.
3.	Chan S.Park, "Contemporary Engineering Economics", Prentice Hall of India, 2002.
4.	Donald.G. Newman, Jerome.P.Lavelle, "Engineering Economics and analysis" Engg. Press,
	Texas, 2002

CO Vs PO	CO1	CO2	CO3	CO4	CO5	Total	Scaled to 0,1,2 and 3
PO ₁	1	2	2	1	2	8	2
PO ₂	1	2	2	1	3	9	2
PO ₃	1	1	2	1	2	7	2
PO ₄	1	1	2	0	1	5	1
PO ₅	1	2	2	1	2	8	2
PO ₆	1	2	2	1	3	9	2
PO ₇	1	1	2	1	2	7	2
PO ₈	1	1	2	0	1	5	1
PO ₉	1	2	2	1	2	8	2
<b>PO</b> ₁₀	1	2	2	1	3	9	2
<b>PO</b> ₁₁	1	1	2	1	2	7	2
<b>PO</b> ₁₂	1	1	2	0	1	5	1
PSO ₁	1	2	2	1	2	0	2
					_	8	
PSO ₂	1	2	2	1	3	9	2
TOTAL	14	22	28	11	29	-	-

# Mapping of CO with PO

 $1-5 \rightarrow 1, 6-10 \rightarrow 2, 11-15 \rightarrow 3$ 

0 - No Relation, 1 - Low Relation, 2 - Medium Relation, 3 - High Relation

Course Code	:	XUM 406	L	Т	Р	С
Course Name	:	DISASTER MANAGEMENT	0	0	0	0
Prerequisite	:	NIL	L	Т	Р	Н

С	Р	A						3	0	0	3
3	0	0									
				Afi	ter the completion of the course, students	Dom	ain		I	Level	
will	be d	able i	to			C or P	or A				
CO	1		derstand l types		the concepts of disasters, their significance	Cognitiv	e	U	nders	tand	
CO	2				the relationship between vulnerability, saster prevention and risk reduction	Cognitiv	e	U	nders	tand	
CO.	3				lerstanding of preliminary approaches of k Reduction (DRR)	Cognitiv	e	U	nders	tand	
CO4	4		velop a ntry	aw	vareness of institutional processes in the	Cognitiv	e	A	pplic	ation	
CO	5	sur	roundin	ngs	dimentary ability to respond to their s with potential disaster response in areas ive, with due sensitivity	Cognitiv	e	А	pplic	ation	
CO	UR	SE C	ONTE	EN	Т						
UNI	T I		INTRO	RO	DUCTION TO DISASTERS						6
			Import	rtaı	nce & Significance, Types of Disasters, Clim	ate Chang	e, DM	[ cycle	e		
UNI	T I	I	RISK	K A	ASSESSMENT						12
					Ilnerability, Types of Risk, Risk identification Assessment, Risk modeling.	on, Emerg	ing Ri	sks, R	isk A	sses	sment,
UNI	IT I	II	DISA	AS'	TER MANAGEMENT						10
			System and Di	m, Disa	Cycle of Disaster Management, Institution DM Plan, Community Based DM, Communication aster Monitoring, Disaster Communication I Don'ts in various disasters.	nity health	n and a	safety	, Earl	ly W	arning
UNI	IT I	V	DISAS	ST	TER RISK MANAGEMENT IN INDIA						10
			Sanitat Respor	atic ons	and Vulnerability profile of India, Compon on, Shelter, Health, Waste Management, Ir e and Preparedness), Disaster Manageme plans, programmes and legislation	stitutiona	l arrar	ngeme	nts (	Mitig	gation,
UNI	T V	7	DISAS	ST	TER MANAGEMENT: APPLICATIONS	AND CA	SE ST	TUDI	ES		7
			Infrast	stru	le Hazard Zonation, Earthquake Vulnera acture, Drought Assessment, Coastal Flood ased Inputs for Disaster Mitigation and Man	ing, Fores	t Fire,	Man		-	-
			•				L	Ť	P	1	Total
							45	0	0		45
ТЕХ	XT ]	BOO	KS						I		
	1.	Sing	ghal J.P		Disaster Management, Laxmi Publicatio 78-9380386423	ns, 2010.	ISBN	V-10:	9380	)386	427
					tacharya, Disaster Science and Managem 12. ISBN-10: 1259007367, ISBN-13: 97				ndia	Eduo	cation

- Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk 3. Management, NIDM, New Delhi, 2011
- 4. KapurAnu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010

#### **REFERENCE BOOKS**

- 1. Siddhartha Gautam and K Leelakrisha Rao, "Disaster Management Programmes and Policies", Vista International Pub House, 2012
- 2. Arun Kumar, "Global Disaster Management", SBS Publishers, 2008
- 3. PardeepSahni, AlkaDhameja and Uma medury, "Disaster mitigation: Experiences and reflections", PHI, 2000
- 4. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005
- 5. Government of India, National Disaster Management Policy, 2009

## **E-REFERENCES**

- NIDM Publications at http://nidm.gov.in- Official Website of National Institute of • Disaster Management (NIDM), Ministry of Home Affairs, Government of India
- http://cwc.gov.in, http://ekdrm.net, http://www.emdat.be, http://www.nws.noaa.gov, http://pubs.usgs.gov, http://nidm.gov.ini http://www.imd.gov.ini

# Mapping of COs with POs

		PROGRAM OUTCOMES												
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1			2	1	1		1		1		1	1		
CO2	1	1	3	2	3		1	1						
CO3					2		1		1					
CO4	1	1	2	2	2		1				1	1		
CO5	2	3		2	3		1	2	1			2		
Total	4	5	7	7	11		5	3	3		2	4		
Scaled Value	1	1	2	2	3		1	1	1		1	1		
			1 –	$5 \rightarrow$	1,		6 - 10	$\rightarrow 2$ ,		11	- 15 -	$\rightarrow 3$		
			0-NoRelation,1-Low Relation,2-MediumRelation,3-HighRelation											

COURSE CODE	XBT407		L	Т	Р	С
COURSE NAME	<b>BASIC TRANSPORT</b>	PROCES	SES 0	0	1	1
	LABORATORY					
PREREQUISITES	-		L	Т	Р	Η
C:P:A	2:0.5:0.5		0	0	2	4
<b>LEARNING OBJEC</b>	TIVES		·			
	the existence of transport proc		1			0
experiments of transfer and pro	the characteristics of fluid mechocess control system.		e mechanics	heat	transfer	, mass
experiments of transfer and pro COURSE OUTCOM	the characteristics of fluid mechocess control system. ES	hanics, particle	e mechanics	heat	transfer LEVI	, mass E <b>L</b>
experiments of transfer and pro COURSE OUTCOM	the characteristics of fluid mechocess control system.	hanics, particle	e mechanics	heat	transfer	, mass E <b>L</b>
experiments of transfer and pro COURSE OUTCOM	the characteristics of fluid mechocess control system. ES	hanics, particle	e mechanics	heat	transfer LEVI	, mass E <b>L</b>
experiments of transfer and pro COURSE OUTCOM	the characteristics of fluid mechocess control system. ES	hanics, particle	e mechanics DOMAIN Cognitive	heat	transfer LEVI ndersta	, mass E <b>L</b> nd

		Affective	
CO3	<i>Experiment</i> and <i>Demonstrate</i> Heat Transfer phenomena.	Cognitive	Understand
		Psycomotor	Respond
<b>CO4</b>	<i>Experiment</i> and <i>Demonstrate</i> Mass Transfer phenomena.	Cognitive	Understand
		Psycomotor	Respond
CO5	UnderstandingProcess control system and Aware of	Cognitive	Understand
	MATLAB in Unit operation.	Affective	Respond

S.No		List	of Experiment	ments		COs							
1	I.	Experiment on fluid f	low meter	rs (U tube	6 Experiments	CO1							
		manometer, Orifice meter,	Venturi me	ter, Pitot tube	(9 hrs)								
		meter).											
	II.												
2	I.	8											
	II.												
	III.												
	IV.	Study on Rotary Drum F											
		Press, Size Reduction	Equipment	and Sieve									
		analysis]											
3	I.	Heat Transfer by Conductio	n, Convecti	ion	3 Experiments	CO3							
	II.	Heat Exchanger			(4 hrs)								
4	I.	Simple Extraction			2 Experiments	CO4							
	II.	Batch Adsorption			(4 hrs)								
5	I.	Study on Interacting and not	n-Interactin	ig system	3 Study Experime	ents CO5							
	II.	Introduction to MATLAB a	nd SIMUL	INK	(4hrs)								
Referen	nce:												
McCab	,	arren L., Julian C. Sn	nith, and	Peter Harri	ott, Unit Oper	ations of							
Chemic	ChemicalEngineering,McGraw-Hill, 2010.												
Any Te	en Exp	eriments may choose from	HOURS	TUTORIAL	PRACTICAL	TOTAL							
all COs	5		HOURS	0	30	30							

# Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	1	1	2	2	2	0	0	0	1	3	0	0
CO 2	3	3	2	2	1	2	2	0	0	0	2	2	1	1
CO 3	3	3	2	3	1	2	2	0	0	0	2	3	2	3
CO 4	3	3	2	3	1	2	2	0	0	0	2	2	2	2
CO 5	3	3	2	3	1	2	2	0	0	0	2	3	3	3
	15	15	9	12	6	10	10	0	0	0	9	13	8	9

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

# Mapping of Subjects with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Original Value	15	15	9	12	6	10	10	0	0	0	9	13	8	9
Scaled Value	3	3	2	3	2	2	2	0	0	0	2	3	2	2
$1-5 \rightarrow 1$	l,		6 - 10	$\rightarrow 2$ ,		11	l – 15 ·	$\rightarrow 3$						

COURS	SECOD	E	XBT408			L	Т	Р	C
	SE NAN QUISI		Cell Biology Labora	atory		0	0	2	2
C	P	A				L	Т	Р	Н
1	1	1				0	0	2	6
-	-	ECTIVES				U	U	2	U
			is course, the students						
•	-		a deeper understanding of cell structur	re and how	w it relate	es to cell	functio	ons.	
•			nd how cells grow, divide, and die and						ated
•			nd cell signaling and how it regulates						
			COURSE OUTCOMES			MAIN		LEVEL	,
CO1	Study	and un	Cogniti	ve,	Apply	y, Mecha	nisr		
	-		<i>derstand</i> the origin of eukaryotic c	ens and	Psychon		Respo	ond	
	cens s	specializa	Affectiv						
CO2	D	• .1	Cogniti			and app	ly,		
	-	<i>nize</i> the	Psychon Affectiv			anism			
	Tuncti	oning of	/e	Respo	ond				
CO3					Cogniti	ve	Apply. Mechani		nisr
005	-		ledge on the transport of proteins	between	Psychor		onding		
	intrac	ellular co	mpartments		Affectiv				
CO4				Cognitiv					
	Acqui	i <b>re</b> knowl	edge about cell cycles mitosis and me	viosis		Psychomotor, applying,			
<u> </u>					Affectiv			onding	
CO5	Deser		or 60 ignaling and types of signaling r	acontora	Cognitiv Affectiv		Analy		
	Desci	<i>we</i> cenu	ar 69ignaling and types of signaling r	eceptors	Allectiv	/e	valuir	izing	
List Of	l ' Practi	cal Expe	riments				valuii	18	
			ervation of eukaryotic cells						
			say by trypan blue exclusion method.						
			roplasts from spinach leaves						
		is and To:							
			ids from tissues						
			oteins from tissues						
7.	Separa	tion of pro	oteins by SDS-PAGE electrophoresis						
8.	Study of	of differer	nt stages of mitosis in onion root tip co	ells.					
9.	Study of	of differer	nt stages of meiosis in grasshopper tes	tis cells					
	HOUR	S	LECTURE P	RACTICA	AL	TUTORI	AL	TOTAI	
			0	30		0		30	)
		EBOOK		ard E th		4 57 5			
	10 E. C	ens. Cell	l biology: A Laboratory Handbook.	3 rd Editio	on, Vol.	I, Elsevie	er Aca	demic I	Pres
2006.									

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	0	0	0	1	0	0	0	0	0	1	1	0	0
CO 2	3	1	0	1	1	1	0	0	1	1	0	0	0	0
CO 3	3	1	0	0	1	0	0	0	0	0	1	1	0	0
CO 4	3	1	0	1	1	1	0	0	1	1	1	1	0	0
CO 5	3	1	0	1	1	1	0	0	1	1	1	1	0	0
	15	4	0	3	5	3	0	0	3	3	4	4	0	0

mapping	Mapping of Subjects with 1 Os													
	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Original Value	15	4	0	3	5	3	0	0	3	3	4	4	0	0
Scaled Value	3	1	0	1	1	1	0	0	1	1	1	1	0	0

# Mapping of Subjects with POs

COURSE CODE	XBT 409	L	Т	Р	С
COURSE NAME	IMMUNOLOGY LABORATORY	0	0	1	1
PREREQUISITES		L	Т	Р	Η
C:P:A = 1:1:1		0	0	2	6

## **LEARNING OBJECTIVES**

• To introduce the different types of qualitative and quantitative immunoassays.

• To expose the students to various immunological terms.

• To establish analytical ability to interpret the real time experimental results.

COUR	SE OUTCOMES	DOMAIN	LEVEL
CO1	Demonstrate separation of different components of whole	Cognitive	Remember
	blood using density gradient centrifugation.	Psycomotor	Responds to
		Affective	Phenomena
CO2	Demonstrate and determine the count of each type of	Cognitive	Apply
	blood components present in the blood using dyes.	Psycomotor	Responds to
		Affective	Phenomena
CO3	Demonstrate the ABO blood grouping system and	Cognitive	Remember
	<i>determine</i> the blood group.	Psycomotor	Responds to
		Affective	Phenomena
CO4	Carry out the coupling technique to label the Antibody	Cognitive	Remember
	with Enzyme HRP.	Psycomotor	Responds to
		Affective	Phenomena
CO5	Demonstrate qualitative and quantitative assays for	Cognitive	Remember
	identifying the reaction pattern, similarity pattern,	Psycomotor	Responds to
	unknown concentration, separation of desired antigen.	Affective	Phenomena.

S.No	List of Experiments	COs
1	Collection of Serum from Blood	CO1
2	Isolation of lymphocytes from whole blood	CO1
3	Differential Leukocyte count	CO2
4	Total Leukocyte count	CO2
5	Total and differential count of RBC	CO2
6	Blood Grouping Experiment	CO3
7	Antibody Labelling with HRP	CO4
8	Ouchterlony double diffusion	CO5
9	Single radial immunodifussion	CO5
10	Immunoelectrophoresis	CO5

	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$											
TUTORIAL PRACTICAL TOTAL												
	nunology, 4th Edn., W. B. Saunders Co	, , ,		ului								
Reference: 1. Abbas, K. A., Litchman, A. H. and Pober, J. S. (2007). Cellular and Molecular												
13.	Latex Agglutination			CO5								
12.	Widal test			CO5								
11.	DIRECT Elisa			CO5								

# Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO 1	3	2	2	1	1	1	1				1	1	3	3
CO 2	3	2	2	1		1	1				1	1	2	2
CO 3	2				1								2	1
CO 4	3	2	1										1	2
CO 5	3	2	2	1	1	1	1				1	1	1	1
	14	8	7	3	3	3	3				3	3	9	9

## Mapping of Subjects with POs

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Original Value	14	8	7	3	3	3	3				3	3	9	9
Scaled Value	3	2	2	0	0	0	0	0	0	0	0	0	2	2
$1 - 5 \rightarrow 1, \qquad \qquad 6 - 10 \rightarrow 2,$					11	l – 15 ·	$\rightarrow 3$							

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

## **V** Semester

1 00	mest	UI .					
				L	Т	Р	С
X	BT 5	501		3	0	0	3
			<b>BIOANALYTICAL TOOLS</b>				
С	P	Α		L	Т	Р	H
3	0	0		3	0	0	3
Pre	requ	isite: ]	Physics, Applied Physics				
Lea	rnin	g Obj	ectives:				
Upc	n co	mpleti	on of this course, the students				

- Will be able to understand the principles of instrumentation
- Will be able to impart the knowledge of different techniques and methods in biotechnology
- Will be able to improve the understanding of applications of techniques in the field of • biotechnology

After the completion of the course, students will be able toCO1Explainthe basics and fundamentals of analytical techniques and describe the various calibration techniques Understand the basic measurement methods.CognitiveUnderstand RememberCO2Illustratethe instrumentation and applications of different spectroscopic techniquesCognitiveUnderstand Remember		Course Outcomes	Domain	Level
CO1techniques and <i>describe</i> the various calibration techniques Understand the basic measurement methods.CognitiveUnderstand RememberCO2Illustrate the instrumentation and applications of different CognitiveCognitiveUnderstand Remember	After	the completion of the course, students will be able to		
CO2Illustrate the instrumentation and applications of differentCognitiveUnderstandspectroscopic techniquesBemember		techniques and <i>describe</i> the various calibration techniques Understand the basic measurement methods.		
spectroscopic techniques Remember	CO2	<i>Illustrate</i> the instrumentation and applications of different spectroscopic techniques	Cognitive	Understand Remember

CO3					logical			ve tech	nniques	Cogn	itive		lerstand		
COS		_	-		oiotechi					Ŭ			nember		
CO4		-	-		strume				<i>ions</i> of	Cogn	itive		lerstand		
					es in bi	_				Ű			nember		
CO5					techniq			romato	graphy,	Cogn	itive		lerstand		
Course content     Cognitive													Remember		
					Cour	se con	tent						Hours	5	
I – In								_					9		
												of dete			
				-				on of i	nstrum	ental m	ethods:	External	l, Intern	al and	
					l to No	ise rati	10.								
	<b>_</b>		Techr										9	1	
												ship – B			
	-	-	istrume	ntation	and a	pplica	tions of	of UV-	Visible	e, IR, F	TIR and	d Circu	lar Dich	iroism	
Spectro	1.0					<b>T</b> 1	•								
					<u>active</u>				(51		D 11 1		9	<b>F A</b> \	
												munoas			
			•			0		•		•	<b>.</b> .	Instrun	nentation	n and	
			-					d scinti	llation	counter	s.		0		
					ation T			м.		М			9		
										e - Mas	ss spectr	ometry	and MA	LDI –	
					ture an	alysis:	XRD	and NN	/IK.				0		
			echniqu	les									9		
ATT1n1		1	· ·		· ·	1	0 1		1 4	1	<b>T</b> 1 · ·	1 1	4	1	
	-	-					-					layer ch	-		
(TLC)	),Gas	chron	natogra	nphy	(GC)	andHi	igh-per	forman	ice lie	quid c	hromato	-	romatog (HPL)		
(TLC)	),Gas ophore	chron esis: Ag	natogra	nphy	(GC)	andHi	igh-per rylami	forman de Gel	ice lie		hromato	ography	(HPL		
(TLC)	),Gas ophore Lect	chron esis: Ag	natogra	nphy	(GC)	andHi	igh-per rylami <b>Tut</b> o	forman de Gel orial	ice lie	quid c	hromato	ography	(HPL)		
(TLC) Electr	),Gas ophore Lect 4	chron esis: Ag ure 5	natogra	nphy	(GC)	andHi	igh-per rylami	forman de Gel orial	ice lie	quid c	hromato	ography	(HPL		
(TLC) Electr Text I	),Gas cophore Lect 4 Books:	chron esis: Ag ure 5	natogra garose	nphy Gel and	(GC) d SDS-	andHi Polyac	igh-per rylami <b>Tuto</b> (	forman de Gel orial )	electro	quid c phoresis	hromato 5.	ography	(HPL) Total 45	C) –	
(TLC) Electr	),Gas ophore Lect 4: Books: Robi	chron esis: Ag ure 5 nson, J	natogra garose	iphy Gel and	(GC) d SDS-	andHi Polyac	igh-per rylami <b>Tuto</b> (	forman de Gel orial )	electro	quid c phoresis	hromato 5.	ography	(HPL) Total 45	C) –	
(TLC) Electr Text I 1.	),Gas ophore Lect 49 Books: Robi instru	chron esis: Ag ure 5 : nson, J umenta	natogra garose J. W., F Il analy	Trame, sis.	(GC) d SDS- E. M. S	andHi Polyac	igh-per rylami <b>Tuto</b> ( ne, G.	forman de Gel orial ) M., Eil	electro	quid c phoresis	hromatos.	2005). U	(HPL) Total 45 Undergra	C) –	
(TLC) Electr Text I 1.	),Gas ophore Lect 4: Books: Robi instru Skoo	chron esis: Ag ure 5 nson, J umenta og, D. A	natogra garose J. W., F Il analy	Trame, sis.	(GC) d SDS- E. M. S	andHi Polyac	igh-per rylami <b>Tuto</b> ( ne, G.	forman de Gel orial ) M., Eil	electro	quid c phoresis	hromatos.	ography	(HPL) Total 45 Undergra	C) –	
(TLC) Electr Text I 1. 2.	),Gas ophore Lect 4: Books: Robi instru Skoo learn	chron esis: Ag ure 5 nson, J umenta g, D. A ing.	natogra garose J. W., F Il analy	Trame, sis.	(GC) d SDS- E. M. S	andHi Polyac	igh-per rylami <b>Tuto</b> ( ne, G.	forman de Gel orial ) M., Eil	electro	quid c phoresis	hromatos.	2005). U	(HPL) Total 45 Undergra	C) –	
(TLC) Electr Text I 1. 2. Refer	),Gas ophore Lect 4: Books: Robi instru Skoo learn ence B	chron esis: Ag ure 5 nson, J nson, J umenta g, D. A ing. Books:	natogra garose J. W., F Il analy A., Hol	iphy Gel and Frame, sis. ler, F.	(GC) d SDS- E. M. S J., & C	andHi Polyac	igh-per rylami Tuto ne, G. S. R. (	forman de Gel orial M., Eil 2017).	electro electro een, M Princip	quid c phoresis ., & Sko ples of in	hromatos.	2005). Untal anal	(HPL) Total 45 Undergra	C) –	
(TLC) Electr Text I 1. 2. Refer	),Gas ophore Lect 4: Books: Robi instru Skoo learn ence B Gord	chron esis: Aş ure 5 nson, J umenta g, D. A ing. Books: on, M	natogra garose I. W., F Il analy A., Hol	iphy Gel and Frame, sis. ler, F.	(GC) d SDS- E. M. S J., & C	andHi Polyac	igh-per rylami Tuto ne, G. S. R. (	forman de Gel orial M., Eil 2017).	electro electro een, M Princip	quid c phoresis ., & Sko ples of in	hromatos.	2005). U	(HPL) Total 45 Undergra	C) –	
(TLC) Electr <b>Text I</b> 1. 2. <b>Refer</b> 1.	),Gas ophore Lect 4: Books: Robi instru Skoo learn ence B Gord scien	chron esis: Ag ure 5 nson, J umenta g, D. 4 ing. <b>Books:</b> on, M ces. B	natogra garose J. W., F Il analy A., Hol L. H., I lackie.	Frame, Sis. ler, F.	(GC) d SDS- E. M. S J., & C , R., 8	andHi Polyac S., Fran rouch, z Mac	igh-per rylami Tuto ne, G. S. R. ( Rae,	forman de Gel orial M., Eil 2017). R. (19	een, M Princip 87). Ins	quid c phoresis ., & Ske bles of in strumen	hromato s. elly, F. ( nstrumental tal anal	2005). Untal anal	(HPL) Total 45 Undergra lysis. Ce the biol	C) – aduate engage ogical	
(TLC) Electr <b>Text I</b> 1. 2. <b>Refer</b> 1. 2.	),Gas ophore Lect 4: Books: Robi instru Skoo learn ence B Gord scien Biser	chron essis: Ag ure 5 nson, J umenta g, D. A ing. Books: on, M ces. B n, P. S.	natogra garose J. W., F Il analy A., Hol L. H., I lackie.	Frame, Sis. ler, F.	(GC) d SDS- E. M. S J., & C , R., 8	andHi Polyac S., Fran rouch, z Mac	igh-per rylami Tuto ne, G. S. R. ( Rae,	forman de Gel orial M., Eil 2017). R. (19	een, M Princip 87). Ins	quid c phoresis ., & Ske bles of in strumen	hromato s. elly, F. ( nstrumental tal anal	2005). Untal anal	(HPL) Total 45 Undergra lysis. Ce the biol	C) – aduate engage ogical	
(TLC) Electr <b>Text I</b> 1. 2. <b>Refer</b> 1. 2. <b>E-Ref</b>	),Gas ophore Lect 4: Books: Robi instru Skoo learn ence B Gord scien Biser ference	chron esis: Aş ure 5 nson, J umenta g, D. A ing. Cooks: on, M ces. B n, P. S. es:	natogra garose I. W., F il analy A., Hol I. H., I lackie. , & Sha	Frame, Frame, Sis. ler, F. Macrae	(GC) <u>d SDS-</u> E. M. S J., & C J., & C A. (2012	andHi Polyac 5., Fran rouch, 2 Mac 2). Intr	igh-per rylami <b>Tuto</b> ( me, G. S. R. ( Rae, roductio	forman de Gel orial M., Eil 2017). R. (19 on to in	een, M Princip 87). Ins	quid c phoresis ., & Ske bles of in strumen	hromato s. elly, F. ( nstrumental tal anal	2005). Untal anal	(HPL) Total 45 Undergra lysis. Ce the biol	C) – aduate engage ogical	
(TLC) Electr Text I 1. 2. Refer 1. 2. E-Ref 1.	),Gas ophore Lect 4: Books: Robi instru Skoo learn ence B Gord scien Biser ference https	chron esis: Ag ure 5 nson, J imenta g, D. A ing. Books: on, M ces. B n, P. S. es: ://npte	natogra garose J. W., F Il analy A., Hol L. H., I lackie. , & Sha l.ac.in/	Prame, Frame, sis. ler, F. A Macrae arma, A	(GC) <u>d SDS-</u> E. M. S J., & C , R., & <u>A. (2012</u>	andHi Polyac S., Fran rouch, 2 Mac 2). Intr	igh-per rylami Tuto Tuto ( me, G. S. R. ( Rae, coductio 10810(	forman de Gel orial M., Eil 2017). R. (19 on to in	een, M Princip 87). Ins	quid c phoresis ., & Ske bles of in strumen	hromato s. elly, F. ( nstrumental tal anal	2005). Untal anal	(HPL) Total 45 Undergra lysis. Ce the biol	C) – aduate engage ogical	
(TLC) Electr <b>Text I</b> 1. 2. <b>Refer</b> 1. 2. <b>E-Ref</b> 1. 2.	),Gas ophore Lect 4 Books: Robi instru Skoo learn ence B Gord scien Biser ference https https	chron esis: Ag ure 5 nson, J umenta g, D. A ing. Books: on, M ces. B n, P. S. es: ://npte	natogra garose J. W., F Il analy A., Hol I. H., I lackie. , & Sha I.ac.in/o	Frame, Frame, Tosis. ler, F. Macrae arma, A courses courses	(GC) d SDS- E. M. S J., & C J., & C A. (2012 5/103/10 5/103/10	andHi Polyac S., Fran rouch, 2). Intr 08/103 08/103	igh-per rylami <b>Tuto</b> () me, G. S. R. () Rae, coductio 108100 108100	forman de Gel orial M., Eil 2017). R. (19 on to in	een, M Princip 87). Ins	quid c phoresis ., & Ske bles of in strumen	hromato s. elly, F. ( nstrumental tal anal	2005). Untal anal	(HPL) Total 45 Undergra lysis. Ce the biol	C) – aduate engage ogical	
(TLC) Electr Text I 1. 2. Refer 1. 2. E-Ref 1.	),Gas ophore Lect 4 Books: Robi instru Skoo learn ence B Gord scien Biser ference https https	chron esis: Ag ure 5 nson, J umenta g, D. A ing. Books: on, M ces. B n, P. S. es: ://npte	natogra garose J. W., F Il analy A., Hol I. H., I lackie. , & Sha I.ac.in/o	Frame, Frame, Tosis. ler, F. Macrae arma, A courses courses	(GC) <u>d SDS-</u> E. M. S J., & C , R., & <u>A. (2012</u>	andHi Polyac S., Fran rouch, 2). Intr 08/103 08/103	igh-per rylami <b>Tuto</b> () me, G. S. R. () Rae, coductio 108100 108100	forman de Gel orial M., Eil 2017). R. (19 on to in	een, M Princip 87). Ins	quid c phoresis ., & Ske bles of in strumen	hromato s. elly, F. ( nstrumental tal anal	2005). Untal anal	(HPL) Total 45 Undergra lysis. Ce the biol	C) – aduate engage ogical	
(TLC) Electr Text I 1. 2. Refer 1. 2. E-Ref 1. 2. 3.	),Gas ophore Lect 4: Books: Robi instru Skoo learn ence B Gord scien Biser ference https https https https	chron esis: Ag ure 5 nson, J umenta g, D. A ing. Sooks: on, M ces. B n, P. S. es: ://npte ://npte	natogra garose J. W., F il analy A., Hol . H., I lackie. , & Sha l.ac.in/o l.ac.in/o l.ac.in/o ith PO	Prame, Frame, sis. ler, F. Macrae arma, A courses courses courses	(GC) <u>d SDS-</u> E. M. S J., & C J., & C , R., & A. (2012 5/103/10 5/103/10 5/102/10	andHi Polyac S., Fran rouch, 2). Intr 08/103 08/103	igh-per rylami <b>Tuto</b> ( me, G. S. R. ( Rae, oductio 10810( 10810( 103083)	forman de Gel orial M., Eil 2017). R. (19 on to in 0/ 0/ 3/	een, M Princip 87). Ins	quid c phoresis	hromato s. elly, F. ( nstrumental tal anal	2005). Untal anal	(HPL) Total 45 Undergra lysis. Ce the biol Crc Pres	C) – aduate engage ogical ss.	
(TLC) Electr Text I 1. 2. Refer 1. 2. E-Ref 1. 2. 3.	),Gas ophore Lect 4: Books: Robi instru Skoo learn ence B Gord scien Biser ference <u>https</u> <u>https</u> <u>https</u> <u>https</u>	chron esis: Ag ure 5 nson, J umenta g, D. A ing. Books: on, M ces. B n, P. S. es: ://npte ://npte ://npte	natogra garose J. W., F Il analy A., Hol I. H., I lackie. , & Sha I.ac.in/o I.ac.in/o	arma, A courses courses protections frame, frame, rsis. ler, F Macrae	(GC) d SDS- E. M. S J., & C J., & C J., & C J., & C J., & C J.	andHi Polyac S., Fran rouch, 2 Mac 2). Intr 08/103 08/103 03/102 PO6	igh-per rylami <b>Tuto</b> ( me, G. S. R. ( Rae, coductio 10810( 10810( 103083) PO7	forman de Gel orial M., Eil 2017). R. (19 on to in 0/ 0/ 3/ PO8	een, M Princip 87). Ins strume	quid c phoresis ., & Ske bles of in strumen	hromatos. elly, F. ( nstrumental analy in life sc	2005). Untal anal	(HPL) Total 45 Undergra lysis. Ce the biol Crc Pres PSO1	C) – aduate engage ogical ss.	
(TLC) Electr Text I 1. 2. Refer 1. 2. E-Ref 1. 2. 3.	),Gas ophore Lect 4: Books: Robi instru Skoo learn ence B Gord scien Biser ference https https https https	chron esis: Ag ure 5 nson, J umenta g, D. A ing. Sooks: on, M ces. B n, P. S. es: ://npte ://npte	natogra garose J. W., F il analy A., Hol . H., I lackie. , & Sha l.ac.in/o l.ac.in/o l.ac.in/o ith PO	Prame, Frame, sis. ler, F. Macrae arma, A courses courses courses	(GC) <u>d SDS-</u> E. M. S J., & C J., & C , R., & A. (2012 5/103/10 5/103/10 5/102/10	andHi Polyac S., Fran rouch, c Mac 2). Intr 08/103 08/103 03/102	igh-per rylami <b>Tuto</b> ( me, G. S. R. ( Rae, oductio 10810( 10810( 103083)	forman de Gel orial M., Eil 2017). R. (19 on to in 0/ 0/ 3/	een, M Princip 87). Ins	quid c phoresis	hromatos.	2005). Untal anal	(HPL) Total 45 Undergra lysis. Ce the biol Crc Pres	C) – aduate engage ogical ss.	
(TLC) Electr Text I 1. 2. Refer 1. 2. E-Ref 1. 2. 3. Mappi	),Gas ophore Lect 4: Books: Robi instru Skoo learn ence B Gord scien Biser ference <u>https</u> <u>https</u> <u>https</u> <u>https</u>	chron esis: Ag ure 5 nson, J umenta g, D. A ing. Books: on, M ces. B n, P. S. es: ://npte ://npte ://npte	natogra garose J. W., F Il analy A., Hol L. H., I lackie. , & Sha l.ac.in/o l.ac.in/o l.ac.in/o l.ac.in/o l.ac.in/o l.ac.in/o l.ac.in/o l.ac.in/o	arma, A courses courses protections frame, frame, rsis. ler, F Macrae	(GC) d SDS- E. M. S J., & C J., & C J., & C J., & C J., & C J.	andHi Polyac S., Fran rouch, 2 Mac 2). Intr 08/103 08/103 03/102 PO6	igh-per rylami <b>Tuto</b> ( me, G. S. R. ( Rae, coductio 10810( 10810( 103083) PO7	forman de Gel orial M., Eil 2017). R. (19 on to in 0/ 0/ 3/ PO8	een, M Princip 87). Ins strume	quid c phoresis ., & Sko oles of in strumen ntation	hromatos. elly, F. ( nstrumental analy in life sc	2005). Untal anal ysis in ciences.	(HPL) Total 45 Undergra lysis. Ce the biol Crc Pres PSO1	C) – aduate engage ogical ss. <b>PSO2</b>	
(TLC) Electr Text I 1. 2. Refer 1. 2. E-Ref 1. 2. 3. Mappi CO 1	),Gas ophore Lect 4 Books: Robi instru Skoo learn ence B Gord scien Biser ference https https https https 13	chron esis: Ag ure 5 nson, J umenta g, D. A ing. Books: on, M ces. B n, P. S. es: ://npte ://npte ://npte ://npte	natogra garose J. W., F il analy A., Hol J. H., N lackie. , & Sha l.ac.in/o	Provenses Prame, Prame, Sis. ler, F. A Macrae arma, A courses cours	(GC) <u>d SDS-</u> E. M. S J., & C: , R., & A. (2012) 5/103/10 5/103/10 5/102/10 PO5 0	andHi Polyac S., Fran rouch, c Mac 2). Intr 08/103 08/103 03/102 PO6 0	igh-per rylami <b>Tuto</b> ( me, G. S. R. ( Rae, oductio 10810( 10810( 103083) <b>PO7</b> 1	forman de Gel orial M., Eil 2017). R. (19 on to in 0/ 0/ 3/ PO8 0	een, M Princip 87). Ins strume	quid       c         phoresis       c         , & Ske       c         oles of in       c         strumen       c         ntation       c <b>PO10</b> 0	hromatos. elly, F. ( nstrumental analy in life sc PO11 0	2005). Untal anal ysis in ciences.	(HPL) Total 45 Undergra lysis. Ce the biol Crc Pres PSO1 0	C) – aduate engage ogical ss. PSO2 1	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	2	1	0	0	1	0	0	0	0	2	0	1
CO 2	3	3	2	2	0	0	1	0	0	0	0	0	0	1
CO 3	3	2	2	1	0	0	1	0	0	0	0	0	0	1
CO 4	2	3	2	2	0	0	0	0	0	0	0	1	0	1
CO 5	3	2	3	1	0	0	1	0	0	0	0	1	0	1
	14	12	11	7	0	0	4	0	0	0	0	4	0	5

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
Original Value	14	12	11	7	0	0	4	0	0	0	0	4	0	5	
Scaled Value	3	3	3	2	0	0	2	0	0	0	0	2	0	2	
l – 5 → ) - No F	1, Relation,		6 – 10 w Rela		- Med		l – 15 - elation,		gh Rela	tion					
XB1 <u>C</u> P <u>3</u> 0	502	-		М	OLEC	CULAI	R BIO	LOGY	7		L 3 L 3		P 0 P 0	C 3 H 3	
	ng Obj	 ectives									5	U	U	3	
	complet	<b>ion of</b> have le	<b>this co</b> earnt st earnt ge	ructure ene reg	es of D gulation	NA, R 15	NA and	d its re	plication	on and r	-				
A.C. (1)	1	1		irse O			1 11			Do	main		Level		
CO1	he comp <i>Relate</i> :								role	Cog	gnitive		Jndersta Rememb		
CO2	Explair	<i>i</i> and <i>A</i>	<b>pply</b> ar	nd its re	eplicat	ion and	l repair	•		Cog	gnitive		Jndersta Apply	nd	
CO3	<i>Classify</i> modific		Develoj	ø trans	criptio	n and	post tra	anscrip	tional	Cog	gnitive		Analyze		
CO4	Classify process		Dissect	t trans	slation	and	post	transla	tional		gnitive	U	Jndersta Analyz		
CO5	<i>List</i> and	ł respo	nd gen	e regul	ations					င၀န္	gnitive	I	Rememt	ber	
<b>.</b> .					Course	e conte	ent						Hours	5	
	roduction		Chron	200000	1 0 4 00	nizatio	nofa	<u></u>	Ennotic			anta in	<u>9</u>	aomal	
DNA -	Organi				-		-				rrangem tional el				
	osomes. plicatio	n and	Renai	r									9		
Chemis replicat Types o	try of I on – Pr f DNA o	DNA s okaryc damago	ynthes otic rep e – DN	is – N licatio A repa	n – Eu ir mec	karyot hanisn	ic repli				of repl tions – 7		– Mode f mutati		
	ranscri	-		<b>_</b>		0	1		1				9	. <u>.</u>	
– Tran eukary	scription	nal elo Prokary	ngation yotic R	n (prol NA pr	caryoti ocessii	c & ei ng – E	ikaryot	tic) - 7	Fransci	riptiona	Yranscrip l termin (3'-poly	ation (p	orokaryo	otic &	
	ranslati				-								9		
protein eukary	transla otic) – T	tion (	prokar ation o	yotic d f prote	& euka	aryotic	) – E	longati	on of	protein	A synthe transla – Regul	tion (p	rokaryo	tic &	
v — Kf	gulatio	n vi ge	ne exp	1 C2210	LL L							1	ノ		

Lecture	Tutorial	Practical	Total
45	0	0	45
Text Books:			
1. Verma P.S. (A	uthor), Agarwal V.K. Molecular	r Biology, 2010.	
2. Principles and	Techniques of Biochemistry and	Molecular Biology, Can	nbridge University
Press; Eighth	edition, 2018.		
<b>Reference Books:</b>			
1. Molecular Bi	ology of the Gene, James D. W	Vatson, A. Baker Tania	, P. Bell Stephen, Gann
Alexander, Le	vine Michael, Losick Richard, P	earson Education; Seven	th edition, 2017.
2. Molecular Bi	ology Made Simple and Fun,	David P. Clark (Author	or), Lonnie Dee Russell
(Author), 201	).		
E-References:			
1. https://nptel.ac	.in/courses/102106025/		
2. https://www.e	mbl.de/training/e-learning/		
3. https://swayar	n.gov.in/course/5065-molecular-t	biology	
-	x.ac.uk/admissions/undergraduat	e/courses-listing/biochen	nistry-molecular-and-
cellular?wssl=	1		
5. https://vlab.ar	rita_edu/?sub=3&brch=77		

- 5. https://vlab.amrita.edu/?sub=3&brch=77
- 6. https://www.youtube.com/watch?v=V4CRCQfXUrg

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	1	2	0	1	0	0	1	1	1	1			
CO 2	1	1	2	0	1	0	0	1	1	1	1			
CO 3	1	1	2	0	1	0	0	1	1	1	1			
<b>CO 4</b>	1	1	2	0	1	0	0	1	1	1	1			
CO 5	1	1	2	0	1	0	0	1	1	1	1			
	5	5	10	0	5	0	0	5	5	5	5			

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

#### Mapping of Subjects with POs

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Original Value	5	5	10	0	5	0	0	5	5	5	5			
Scaled Value	1	1	2	0	1	0	0	1	1	1	1			

 $1-5 \rightarrow 1$ ,  $6-10 \rightarrow 2$ ,  $11-15 \rightarrow 3$ 

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

				L	Т	Р	С
X	KBT 5	503		2	1	0	3
			<b>BIOREACTION ENGINEERING</b>				
С	Р	Α		L	Т	Р	Η
2	0	1		3	1	0	4
Lea	arnin	g Obj	ctives:				

#### Upon completion of this course, the students

- Would able to known about the basics of biochemical process.
- Would have understood the concepts of enzyme kinetics.
- Would have knowledge on the kinetic model for biochemical reactions.

		hign a bioreactor for a particul	iar diochemica		
		Course Outcomes		Domai	n Level
After		ne course, students will be ab		~	
CO1		describe the fundamentals	of reaction	Cognitive	Remember
001	kinetics			Affective	Receive
CO2	-	ne production and <i>choose</i> ar	n appropriate	Cognitive	Understand
	1	d based on kinetics.		Coginitive	
CO3	Recognize, perfo	rm and detect various im	mobilization	Cognitive	Understand
COS	techniques for a b	ioreaction process.			
	Identify and sales	t a kinatia model and design	a biorogator	Cognitive	Understand
<b>CO4</b>	••	t a kinetic model and design	a bioreactor	Affective	Responds
	according to a bio	chemical process			
		1 C-H 1 f		Cognitive	I.I. da nata n d
CO5	•••	nd <i>follow</i> a bioreactor for	a particular	Affective	Understand
	process.				Receive
		Course content			Hours
Unit-]	I – Reaction Kinet				6+3
		tion kinetics: Zero, First and	l Second Orde	er reactions	
		- Temperature effect on rate			Ideal Ieactors, Daten
		uction and Its Kinetics	constant		6+3
		inhibition – enzyme stabilit	v& specificity	- factors at	
		ess- Industrial production and			
		s: Cyanaocobalamin – Ribofl		of clizyffics.	u-amylase – cenulase -
		*		with Datah	anouth anoutifuing and
		eling of batch and continu			
		terns and kinetics in batch			
		wth kinetics- Unstructured n			
	-	nuous cultures Definitions ar		tric calculati	ions-elemental balances
		retical predictions of yield co	oefficients		
	III – Immobilizatio	· ·			6+3
•		– Diffusion Effects – Thi			
		hydrolytic enzymes-Immobi		al cells, carr	ier binding, Entrapping
Cross	linking, Advantage	s and disadvantages of immo	bilized cells.		
Unit-	IV – Cell Growth I	Kinetics			6+3
Kineti	ics of cell growth	– Substrate utilization and p	product forma	tion –Struc	tured, Unstructured nor
	-	edict specific growth rate, ce			
		ns-elemental balances, Degr	-		
		animal and plant cell cultivati			
	-V – Bioreactors				<u>6+3</u>
		ctors - Ideal Bioreactors-Typ	a of bioreact	or Airlift bic	
	-	zed bed reactors-trickle bed			_
-			reactors-100p	reactor-Still	eu talik leactors-Dubbik
olulli	<u>i lermenter – Optin</u>	nization and scaleup.			
	<b>T</b> /				
	Lecture	Tutorial	Practi	cal	Total
	30	15	0		45
Tovt 1	Books:				
	Bailey I E and O		ering Fundam	entals, Secon	nd edition. McGraw Hill
	Duncy J.L. and O.	llis D.F, Biochemical Engine	ering i undum		,
	Co, Newyork, 201				, <u>,</u> , , , , , , , , , , , , , , , , ,
1.	Co, Newyork, 201	10.	-	t Edition. Sr	
1. 2.	Co, Newyork, 201 Rajiv Dutta, Fund		-	t Edition, Sp	
1. 2. Refer	Co, Newyork, 201 Rajiv Dutta, Fund rence Books:	10. amentals of Biochemical Eng	gineering, Firs	-	pringer, 2008.
1. <b>2.</b> Refer	Co, Newyork, 201 Rajiv Dutta, Fund ence Books: Jens Nielsen, Joh	10.	gineering, Firs den, Bioreact	ion Enginee	pringer, 2008.

2.	GhasemNajafpour,	Biochemical	Engineering a	and Biotechnolog	y, Elsevier,	2007.
E-Refe	erences:					

## 1. http://nptel.ac.in/courses/103105054/

# Mapping of COs with POs

		PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3										1	1	1	
CO 2	2	3		1					1			1	2	
CO 3		1	3									2	3	1
CO 4		1	2									3	1	2
CO 5	1	2	3	1								2	1	3
	6	7	8	2	0	0	0	0	1	0	1	9	8	6

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation Mapping of Subjects with POs

		J												
	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Original Value	6	7	8	2	0	0	0	0	1	0	1	9	8	6
Scaled Value	2	2	2	1	0	0	0	0	1	0	1	3	2	2
$1-5 \rightarrow 1$	,		6 – 10	$\rightarrow 2$ ,		11	1 – 15	$\rightarrow 3$						

				L	Т	Р	С
XB	Т 504			3	0	0	3
		PLANT BIOTECHNOLOGY				-	
C I	P A			L	Т	P	Η
3	0 0			3	0	0	3
Prere	quisite: (	Cell biology, Genetics and Molecular biology					
	ning Obj						
Upon	complet	ion of this course, the students					
•	Would	have understand the fundamentals of plant cells.					
•	Would	have learn the techniques in Plant Tissue Culture.					
•	Would	have understood various techniques of gene transfer i	n plants.				
•	Would	have learn production of Biomolecules from plants fo	r various ap	plicat	ions.		
		Course Outcomes	Domai	in	]	Level	
After		letion of the course, students will be able to					
C01		e the plant genomeand knows various terminology	Cognitive		Remen		
		to plant tissue culture.			Under		
CO2		e Fundamentals of plantcells and plant tissue	Cognitive		Remen		
		and <i>knows</i> various media for tissue culture.			Under		
CO3	-	re the various gene transfer methods in plants and	Cognitive		Remen		
		ach other with its pros and cons			Under		
CO4	Relate	and Analyze various vectors and genetic	Cognitive		Under		
	-	lation techniques	e		Analyz		
CO5		and <i>Apply</i> Herbicide tolerance pesticide, GMOs and	Cognitive		Under		
	molecu	lar farming.	e		Apply		
TT	T T 4	Course content			1	Hours 9	
		duction to Plant Tissue Culture	of plant the		141100	,	and
		biotechnology – Plasticity and totipotency - History					
compo	SILIOII OI	tissue culture media – Role of plant growth regula					
		76	8 th BOS/BI	OTEC	CH/Date	: 19.08	3.2021

conditions for tissue culture – kinetics of growth and nutrient optimization; viability in the tissue culture; somaclonal variation.

Unit-II – In vitro Propagation

Types of plant tissue culture –Regeneration of plants-Organogenesis and somatic embryogenesis -Culture types: Callus, cell-suspension culture, shoot and root tip culture, hairy root culture, Meristem culture, pollen culture, Anther culture and haploid production – protoplast culture: isolation, fusionsomatic hybrid and cybrid and regeneration of protoplast – Germplasm conservation and cryopreservation.

#### **Unit-III – Plant Breeding Techniques**

Simple and complex inheritance - back cross – selection marker and reporter gene; Molecular Markers: RFLP and PCR based SSR markers - Marker-Assisted selection, Hybrid seeds production - Herbicide tolerant plants: Different strategies to achieve, strategy to generate glyphosate tolerant plants and their related problems – Production of marker free transgenic plants; plastid transformation

#### **Unit-IV – Genetic Transformation of Plants**

Agrobacterium mediated gene transfer – Crown gall disease, Genes involved in DNA transfer, Ti plasmid, Ri plasmid - Binary vector system - Plant viruses and different types of Viral Vectors – Gemini virus, Cauliflower mosaic virus – Direct gene transfer methods – particle gun bombardment, electroporation.Indirect gene transfer techniques.

#### **V** – Applications of Plant Biotechnology

Molecular farming/Pharming of proteins – Bioreactors for recombinant protein, Secondary metabolite production using plant cell culture. Antisense technology in crop improvement - Therapeutic/Industrial applications of plant products - Plant vaccines, custom-made antibodies, Transgenic plants - their issues and solutions.

Lecture	Tutorial	Practical	Total
45	0	0	45

#### **Text Books:**

- 1. Slater A., Nigel W., Scott, and Fowler MR., Plant biotechnology: The Genetic Manipulation of Plants, Oxford University Press, London, 2nd Edition, 2008.
- 2. Neal Stewart, Jr., Plant Biotechnology and Genetics: Principles, Techniques, and Applications. John Wiley & Sons Inc. USA, 2008.

### **Reference Books:**

- 1. Chawla HS. Introduction to Plant Biotechnology, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi, 2nd Edition, 2003.
- 2. Neumann, Karl-Hermann, Ashwani Kumar, and Sudhir K. Sopory. Recent Advances in Plant Biotechnology and Its Applications: Prof. Dr. Karl-Hermann Neumann Commemorative Volume. IK International Pvt Ltd, 2008.
- 3. Hammond, John, Peter McGarvey, and VidadiYusibov, eds. Plant biotechnology: new products and applications. Vol. 240. Springer Science & Business Media, 2012.

## **E-References:**

1. http://www.ncbi.nlm.nih.gov/books/NBK26851/

## Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	0	1	1	2	1	0	0	1	1	1	3	3	3
CO 2	3	2	2	2	3	2	1	1	2	1	1	2	2	2
CO 3	2	1	3	1	2	2	1	0	2	2	1	2	2	2
CO 4	3	2	2	2	2	2	1	1	1	1	0	3	2	2
CO 5	3	3	3	2	3	2	3	2	2	2	2	3	1	1
	13	8	11	8	14	9	5	4	8	7	5	13	10	10

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

9

9

9

9

	<b>PO1</b>	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO
Original Value	13	8	11	8	14	9	5	4	8	7	5	13	10	10
Scaled Value	3	2	3 - 10	2	3	2	1	1	2	2	1	3	2	2
0 - No Re XBT 50	95A	1 - Lo	w Rela					3- Hig		ntion	L 3	T P 0 0	3	
CP30PREREQ	A 0										L 3	T         P           0         0		-
• W • W	npletio ill be oductio ill be a ill be a	n of th able t on able too able to	is cour o undo describ descril	erstand	the a ted ind cted cl	pplicat lustrial	food l	oiotech	nology	gy in a process sses and	ses	-		
• W	ill be a	able to			-	-	of fern	nented	food p	roducts				
				rse Ou						Dom	ain	Lev	vel	_
After the <b>CO1:</b> <i>Kno</i> biotechno	w the								food	Cogn	itive	Reme	mber	
CO2:Des	<i>cribe</i> t	he role	e of mi	crobes	associ	ated w	ith foo	d produ	ucts.	Cogn	itive	Under	stand	
CO3:Out productio		the 1	method	ls for	Gen	etically	/ moc	lified	food	Cogn	itive	Anal	lyze	
CO4:Dise preservati	on and	l packa	iging						food	Cogn		Under		
CO5:Des		-			-		0	ations		Cogn	itive	Eval		-
Unit-I Introducti improve foods: Co	on – nutritic ncept (	Scope onal qu of Preb	and in ality a biotics,	and sh Probic	nce of elf life otics ar	food of co d Nutr	biotecl mmerc	cialized	fruits			s – Fur	ches to actional	
Unit-I				micro	0							9		_
Fermentee and sausa	ges – S	Single	cell pro	otein p	roducti	ion– Co	ocoa, T		-				u, meat	-
Unit-II Herbicide resistant I	tolera	nt Soy	bean –		resist	antCor	n – Alt					9 Canola -	– Virus	1
Unit-IV				ation a						Silo Sull		9		1
Mechanis drying – pasteuriza pressure,	ms of Food tion,	food sj l prese steriliz	poilage ervatio zation	e – Foo n by – Noi	d prese heatin n-therr	ervatio g: dry nal pr	n by lo ving, c eservat	osmotic tion: i	c dehy onizing	dration g radiat	, blanc tion, hi	hing, ca gh hydi	anning, rostatic	

Unit-V	Food safety and reg	gulations	9
Safety of ferm	ented foods - Approv	val process forfood additives – Hazard Ar	alysis Critical Control
Points (HACC	P) – FSSAI		
LECTURE	TUTORIAL	PRACTICAL	TOTAL
45	0	0	45

#### **TEXT BOOKS:**

1. Byong H. Lee., Fundamentals of food biotechnology. John Wiley & Sons, 2014.

#### **REFERENCE BOOKS:**

1. Bhatia, S. C. (2017). Food biotechnology. Wpi Publishing.

2. Ray B., "Fundamental Food Microbiology", Third Edition, CRC Press LLC, 2003.

3. Shetty, Kalidas, et al., eds. Food biotechnology. CRC Taylor & Francis, 2006.

#### **E- REFERENCES**

- 1. http://nptel.ac.in/courses/103107088/
- http://nptel.ac.in/courses/103103029/34 2.

#### Mapping of COs with POs

	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	2	1	3	1	2						3	3	3
CO 2	2	1	3	2	2	2						2	2	2
CO 3	2		3	2	3	1					2	2	2	2
CO 4	2		2	2	3	1					3	3	2	2
CO 5	2		3		3	3						3	1	1
	10	3	12	9	12	9					5	13	10	10

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

#### Mapping of Subjects with POs

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Original Value	10	3	12	9	12	9	0	0	0	0	5	13	10	10
Scaled Value	2	1	3	2	3	2	0	0	0	0	1	3	2	2
$1-5 \rightarrow$	1.		6 – 10	$\rightarrow 2$ ,		1	1 - 15	$\rightarrow 3$						

 $1-5 \rightarrow 1$ ,

				L	Т	Р	С
XBT 505B				3	0	0	3
	AGRICU	<b>ILTURAL BIOTECHNOLOGY</b>	ζ				
C P A				L	Τ	Р	Η
3 0 0				3	0	0	3
PREREQUIS							
Learning Obj							
	on of this course, the						
		he application of biotechnology in			elds		
• Will be	able to describe sele	cted industrial agri biotechnology	r processes				
	Course Ou	400-000	Domain			Leve	1
After the server			Domain			Leve	L
1		students will be able to					
biotechnology.		nes the concepts of Agricultural	Cognitiv	e	Re	mem	ber
	the role of plant bree	eding in agriculture	<i>a</i> :::			1 /	1
	-		Cognitiv			derst	
		ues of genetic engineering	Cognitiv			derst	
		liversity in agricultural field	Cognitiv			derst	
		PR in agricultural products.	Cognitiv	e	E	valua	nte
	Genomes and Gene					9	
		alysis, Genome organization – C	C-Value pa	ra, d	ox, (	Cot c	urves
0	Chromosome behavi						
Unit-II	Agriculture and Pla	ant Breeding				9	
Breeding of o	crops, Heterosis, A	pomixis, Mutations, Polyploidy	in crop	imp	rovei	nent,	and
-	egrated Pest Manage		•	•			
Unit-III	<b>Tools and Techniq</b>	ues of Genetic Engineering				9	
Recombinant	DNA technology;	Concept of Genetic makers;	gene in	terac	tion,	mu	ltiple
allelism,pleiotr	opism and multiple	factor inheritance. Genetic, Chro	mosomal a	and N	Aoleo	cular	map,
-		Genome Analysis: Genome pr	-				
-		arch engines, SequenceAnalysis a	and Molecu	ılar H	Phylo	geny	
	Biodiversity					9	
	•	ersity; Species and Population		•			
		gered plants, endemism and Red	Data Boo	к, В	odiv	ersity	y and
	ns ofplants; Biodiver	· ·				0	
Unit-V	IPR on Agricultura					9	
IDD Interal		De Acres Anno 1997 - Basmati Rice, Tur	meric and			1 A T	
		PRACTICAL			TOI	AL	
IPR Introduction	TUTORIAL 0	0			- 4		

#### **TEXT BOOKS:**

2. Ahindra Nag., Text Book of Agricultural Biotechnology. PHI Learning Publisher New Delhi, 2008.

#### **REFERENCE BOOKS:**

1. Anshuman Singh, Ashutosh Singh, Ashutosh Kumar Srivastava2. Ray B., "Agricultural Biotechnology" Medtech Publisher, Edition-1, 2019

#### **E- REFERENCES**

3. <u>https://nptel.ac.in/content/syllabus_pdf/102103016.pdf</u>

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	2	1	3	1	2						3	3	3
CO 2	2	1	3	2	2	2						2	2	2
CO 3	2		3	2	3	1					2	2	2	2
CO 4	2		2	2	3	1					3	3	2	2
CO 5	2		3		3	3						3	3	1
	10	3	12	9	12	9					5	13	12	10

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

## Mapping of Subjects with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Original Value	10	3	12	9	12	9	0	0	0	0	5	13	12	10
Scaled Value	2	1	3	2	3	2	0	0	0	0	1	3	2	2
$1-5 \rightarrow 1$	1,		6 - 10	$\rightarrow 2$ ,		1	1 - 15	$\rightarrow 3$						

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

		L	Т	P	С
XBT505C	PHARMACEUTICAL BIOTECHNOLOGY	3	0	0	3
C P A		L	Т	P	Н
3 0 0		3	0	0	3

#### Prerequisite: Biochemistry, Immunology, r-DNA technology

## **Learning Objectives:**

#### Upon completion of this course, the students

- Would able to understand principles of biotechnology in pharmaceutical product development. •
- Would apply advanced biotechnology methods in novel drug development
- Would able to review the production processes for antibiotics, vitamins, alkaloids and steroids

	<b>Course Outcomes</b>	Domain	Level
After the	he completion of the course, students will be able to		
CO1	<i>identify</i> the potential avenues and requirements from the biotechnologists in pharmaceutical industries and <i>describe e</i> the scope and applications of biotechnology in pharmacy	Cognitive	Analyze Understand
CO2	<i>Outline</i> thepharmacodynamics, pharmacokinetics of drugs	Cognitive	Analyze Understand
CO3	Describe various adverse effects of drugs	Cognitive	Analyze Understand
CO4	<i>Explain</i> the manufacturing process for various therapeutical products including vaccines, enzymes, interleukins, hormones	Cognitive	Analyze Understand
CO5	<i>Comprehend</i> the methods applied to test the quality of drugs and other biopharmaceuticals	Cognitive	Analyze Understand
I- Intro	oduction		7
Introdu	action to Pharmaceutical industry & development of drugs; types	of therapeuti	ic agents and their
uses. P	harmaceutical Biotechnology and Drug discovery. Scope and a	pplications of	biotechnology in
	81 8 ^{tt}	¹ BOS/BIOTE	ECH/Date: 19.08.202

II- Drugs and	Their Metabolism	-		10
	l properties of dru		rug action	. Pharmacodynamics,
	ics and drug metabolism	•		
	d Their Interaction			10
	6	cology: Reproductive toxicity		
0		rug intolerance, drug aller	<b>U</b> . U	induced side effects.
		ig abuse and drug dependence	2.	11
	n of Biopharmaceutica	<b>Is</b> development, Manufacturing	C1 · 1	11
intibodies, the	rapeutic enzymes and the	growth hormones, growth eir application in health care.	iactors, t	-
V- Testing an	d Analysis of Biopharm	aceuticals		7
and biological	methods, quality assuran	Control: Analysis of pharma ice and control, stability of ph		
Lecture	Tutorial	Practical		Total
45	0	0		45
Text Books:				
	,Kulkarni,Saluja—Pharr	naceutical biotechnology, Ag	cobios publ	shers, 2003
1. Purohit		naceutical biotechnology, Ag adition2 by crommel, Freemar	1	
<ol> <li>Purohit</li> <li>Pharma</li> </ol>			1	
<ol> <li>Purohit</li> <li>Pharma</li> <li>References:</li> <li>Cromm</li> </ol>	elin.D.J.A, Robert D.	dition2 by crommel, Freeman Sindela, Bernd Meibohm	n publishers	, 2004
1. Purohit 2. Pharma References: 1. Cromm fundam	nelin.D.J.A, Robert D. nentals and applications"	dition2 by crommel, Freeman Sindela, Bernd Meibohm Informa Healthcare, 2008.	n publishers "Pharmac	, 2004 eutical Biotechnology:
<ol> <li>Purohit</li> <li>Pharma</li> <li>Pharma</li> <li>References:</li> <li>Crommentation</li> <li>Crommentation</li> <li>Crommentation</li> <li>Pharma</li> </ol>	neeutical biotechnology energy energy and applications" and applications and applications are the second statements and statements and statements are the second statements ar	dition2 by crommel, Freeman Sindela, Bernd Meibohm	n publishers "Pharmac	, 2004 eutical Biotechnology:
<ol> <li>Purohit</li> <li>Pharma</li> <li>References:</li> <li>Cromm fundam</li> <li>Pharma publish</li> </ol>	nelin.D.J.A, Robert D. nentals and applications" neeutical biotechnology ers, 1st edition 2007	dition2 by crommel, Freeman Sindela, Bernd Meibohm Informa Healthcare, 2008. drug discovery and clinica	1 publishers "Pharmac 1 applicat	, 2004 eutical Biotechnology: ions by Kayser,Wiley
<ol> <li>Purohit</li> <li>Pharma</li> <li>Pharma</li> <li>References:</li> <li>Cromm fundam</li> <li>Crommandam</li> <li>Pharma publish</li> <li>Katzun</li> </ol>	nelin.D.J.A, Robert D. nentals and applications" necutical biotechnology ers, 1st edition 2007 g B.G. Basic and Clinica	dition2 by crommel, Freeman Sindela, Bernd Meibohm Informa Healthcare, 2008.	1 publishers "Pharmac 1 applicat	, 2004 eutical Biotechnology: ions by Kayser,Wiley
<ol> <li>Purohit</li> <li>Pharma</li> <li>References:         <ol> <li>Cromm fundam</li> <li>Pharma</li> <li>Pharma</li> <li>Pharma</li> <li>Statzun</li> </ol> </li> <li>Katzun</li> <li>E- References</li> </ol>	iceutical biotechnology energy energy and applications" iceutical biotechnology energy 1st edition 2007 g B.G. Basic and Clinica	dition2 by crommel, Freeman Sindela, Bernd Meibohm Informa Healthcare, 2008. drug discovery and clinica	Publishers "Pharmac al applicat ntice Hall o	, 2004 eutical Biotechnology: ions by Kayser,Wiley

	Program Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	-	1	1	2	2	-	-	1	1	1	1	0	0
CO2	1	1	1	1	2	2	1	2	1	2	2	2	1	0
CO3	2	2	2	2	1	2	2	-	2	2	1	1	2	0
CO4	2	1	3	2	2	3	2	-	1	1	-	-	3	0
CO5	2	3	2	2	3	3	2	2	2	2	1	1	3	0
	9	7	9	8	10	12	7	4	7	8	5	5	9	0

## Mapping of Subject Vs POs

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Original value	9	7	9	8	10	12	7	4	7	8	5	5	9	0
Scaled to 0,1,2,3 scale	2	2	2	2	2	3	2	0	2	2	0	0	2	0

Scale: 3- high, 2 – Medium, 1 - Low, 0 – not related

					L	Т	Р	C
XE	BT 5	507			0	0	1	1
			<b>BIOANALYTICAL TOOLS LABORATO</b>	RY				
С	Р	Α		_	L	Т	P	Η
0.5	1	0.5			0	0	2	6
		0 0	ectives: on of this course, the students					
•			able to understand the principles of instrumentation					
•			able to impart the knowledge of different techniques	and method	s in bi	iotechno	ology	
			Course Outcomes	Domai			Level	
After	r the	e comp	letion of the course, students will be able to			1		
	F	_	the basics and fundamentals of analytical	Cognitiv		A	oplying	g
CO1		-	ues and <i>describe</i> the various calibration techniques.	Psychomo		Guide	-	
	u	ciniq	des and <i>deservoe</i> the various canoration techniques.	Affectiv	-		espond	
	L	Describ	<i>e</i> the spectrophotometric methods and <i>perform</i> the	Cognitiv			oplying	
CO2	·		nents related to spectroscopy.	Psychomo		Guide	-	
	_	I.		Affectiv			espond	
001	L	Inders	tand the immunological techniques and applyit in	Cognitiv			oplying	
CO3			applications in biotechnology.	Psychomo Affectiv		Guide	-	
					-		espond	
<b>CO</b> 4	K	K <b>now</b> t	he principle of instrumentation and <i>applications</i> of	Cognitiv Psychome		Guide	oplying	-
CU4	v	arious	imaging techniques in biological field.	Affectiv			espond	
				Cognitiv			oplying	
CO5		-	uish the various separation techniques, Classify the	Psychome			d Resp	
	V	arious	techniques of Chromatography and Electrophoresis	Affectiv			espond	
							T	
S.N			List of Experiments				CC	)¢

S.No	List of Experim	nents		COs							
1	Validation of accuracy and precision of an inst	rument used in	the laboratory	CO1							
2	Preparation of calibration curve in spectrophot	ometry		CO1							
3	Determination of drug components by Ultravio	olet Spectrophot	ometry	CO2							
4	Interpretation of FTIR spectra										
5	Immunodiffusion assay										
6	Image analysis by electron microscopy										
7	Qualitative analysis of compounds by Thin La	yer Chromatogr	aphy	CO5							
8	Separation of compounds using Column Chron	matography		CO5							
9	9 Separation of nucleic acids by Agarose gel Electrophoresis										
10	Separation of proteins by SDS-Polyacrylamide	e gel Electropho	resis	CO5							
	HOURS	TUTORIAL	PRACTICAL	TOTAL							
	HOUKS	0	30	30							

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	2	1	0	0	1	0	0	0	0	2	0	1
CO 2	3	3	2	2	0	0	1	0	0	0	0	0	0	1
CO 3	3	2	2	1	0	0	1	0	0	0	0	0	0	1
CO 4	2	3	2	2	0	0	0	0	0	0	0	1	0	1

															1
CO 5	3	2	3	1	0	0	1	0	0	0	0	1		0	1
	14		11 Dol	7	$\frac{0}{2 \text{ Mod}}$	0 ium D	4	0 2 Hi	0 Th Dolo	0	0	4		0	5
0 - No R Mappin		,		,	2- Med	ium K	elation,	3- HIŞ	gn Rela	uion					
1.1.upp	PO1		PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO1	1 PC	)12	PSO1	PSO2
Original	14	12	11	7	0	0	4	0	0	0	0		4	0	5
Value Scaled		12		/	U	U	4	U	U	U	U		+	U	5
Value	3	3	3	2	0	0	2	0	0	0	0		2	0	2
$1-5 \rightarrow 0$ - No R	· ·	1 I C		$\rightarrow 2$ ,	) Mod		11 - 15		th Dala	otion					
0 - NO N	ciatioi	I, I - LC		ation, 2	L- Micu	iuiii N	ciation,	5-1112		uion					
COUR	RSE C	ODE				X	BT508				L	Т	]	P	C
COU				Bior	eactio	n Eng	ineerin	g Lab	oratory	y	0	0		2	2
PRER	EQUI	SITES					-				L	Т	]	P	Н
C:P:A				5:1:0.5							0	0		2	6
		OBJE			.1 .	1 /		1.1		1 .1 .	1	1 1		с <b>р</b> '	
-	-						s will t c enzym		<b>.</b> .			0	e oi	f Biorea	iction
engine		menom		RSE O			•		inques		MAI			LEVEL	
Δfter t	he con	nletion					ll be ab	le to							
Alter t										Co	gnitive	2		Apply	
CO1	-	e <b>riment</b> action	and L	emons	trateei	nzyme	kineti	cs M-	M and	Psyc	homot	or (		ed Response	
	LAU										fective		]	Respond	1
CO2		erstand	and	Perform	<i>n</i> enzyı	ne a	ctivity	at di	fferent		gnitive homot		Suid	Apply led Resp	onse
02	prop	erties								-	fective			Respond	
										Co	gnitive	e		Apply	
CO3	Prac	<i>tice</i> and:	Demo	onstrate	e enzyr	neimn	nobiliza	tion			homot			led Resp	
											fective gnitive		_	Respond	1
CO4	Perf	ormand	Deter	mine 9	rowth	kineti	cs				homot		Guid	Apply led Resp	onse
	- 5			2	2						fective			Respond	
~~~	Und	erstand	and	xnerin	<i>ient</i> on	alcol	nol con	centrat	tion in		gnitive		~ • •	Apply	
CO5		e produc		1						Psyc	homot fective			led Resp Respond	
S.No					1	List of	Experi	iments	5	m		/	1	-	Os
1	Stud	y of M-	M kin	etics ar			tion of I			ts.					01
2	Extr	Extraction of enzyme from fruits and vegetable												C	01
3	Effe	ct of ter	nperat	ure on	Enzym	e Act	ivity.							C	02
4		ct of pH	-		-		5							C	02
5	_	-		•		•	nzyme	Activit	y.					C	02
6							dsorptie		~					C	03
7		yme imi												C	03
8	-				·		non-gr	owth a	ssociat	ed prod	ucts			C	04
0	Stud	., 01110	Judetil		5		1011 51	5 m tii u	ssour	ea prou					

10 Refere McGra	Es		MICIO	bial Gr	owth k	kinetics	and es	timat	ion	of Mo	nod pa	rameters	•	0	CO4
		timatio	on of a	lcohol	concer	ntration	in win	e pro	duct	ion.	-			0	205
McGra			•			D.F, 1	Bioche	mica	l Er	nginee	ring Fu	undamer	itals, Se	cond eq	dition,
	w H	ill Co,	Newy	ork, 20	010.					TODI				TOTA	r
							HOU	RS -	10	<u>FORI</u> 0	AL I	PRACTI 30	CAL	TOTA 30	
										U		50			,
apping	g of	COs v	with P	Os											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO	8 1	PO9	PO10	PO11	PO12	PSO1	PSO
CO 1	3	102	105	104	105	100	107	10			1010	1	1	1	150
CO 2	2	3		1						1		1	1	2	
CO 3		1	3										2	3	1
CO 4		1	2										3	1	2
CO 5	1	2	3	1									2	1	3
	6	7	8	2	0	0	0	0		1	0	1	9	8	6
\cdot No R	elati	on, 1 -	Low	Relatio	n, 2- N	<i>l</i> edium	Relation	on, 3-	- Hig	gh Rel	lation				
apping	g of	Subje	cts wi	th POs											
	PO	01 P	O2 P	O3 P	04 P	O5 PC	06 PC	97 F	PO8	PO9	PO10	PO11	PO12	PSO1	PSC
riginal Value		6	7	8	2	0 0) 0		0	1	0	1	9	8	6
Scaled Value		2	2	2	1	0 0) 0		0	1	0	1	3	2	2
$-5 \rightarrow$	1.		6 -	- 10 →	2,		11 – 1	$15 \rightarrow$	3						
· No Re	elati	on, 1 -	Low	Relatio	n, 2- N	<i>l</i> edium	Relation	on, 3-	- Hig	gh Rel	lation				
													L	TP	С
2	XBT	509											0	0 0	1
						INPI	LANT '	TRA	INI	NG -	II				
C	P		A										L	T P	H
0.66	0.6		.66										0	0 0	0
PRE	REQ	UISI	ГЕ:- N	Vil											
COU	RSE	E OUT	COM	ES:											
				Course	Outc	omes					Dom	ain	1	Level	
On th	e su	ccessf				e cours	e, stud	ents 1	will	be abi					
CO1				-	ě.	workpla					Co	g	Un	derstand	
CO2	(Comnly	with F	Factory	discinli	ne, man	agemen	t and			A	f		sponse	
			s practi		anderpri	, man	~5011011	. unu					IXC.	sponse	
	Γ	Demons	strates	teamwo	rk and	time ma	nageme	ent.			A	ff	v	Value	
CO3			e and d	lisplay ł		n exper	n prac	tical	Phy Percepti		ception				
CO3 CO4				during	the pro	gramme								Set	

Марріі	ng CO	s with	POs											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2													
CO2							1	3			1		1	1
CO3									3	1	3		3	3
CO4		1	2	1	3								1	1
CO5				3						3			1	1
Total	2	1	2	4	3	0	1	3	3	4	4		6	6
Scaled	1	1	2	1	1	0	1	1	1	1	1	1	2	2

1 - Low, 2 – Medium, 3 – High

VI Semester

• Would	ANIMAL BIOTECHNOLOGY Nil ective:Upon completion of this course, the students have learnt animal cell culturing techniques have learnt designing animal cell culture lab		L T P C 3 0 0 3 L T P H 3 0 0 3
	have learnt knock-out mechanisms of genes		
	have learnt techniques for production of transgenic ar	imals and cl	loning
	Course Outcomes	Domain	Level
After the comp	letion of the course, students will be able to		
	animal cell culture media and animal cell culture	Cognitive	Understand
CO2: Describe	various gene transfer methods in animal cells.	Cognitive	Evaluate
CO3:Analyze reproduce the	various micromanipulation techniques and m in fertilization technology.	Cognitive Affective	Analyze Respond
U	<i>ish</i> various methods and techniques for production nimals and cloning.	Cognitive	Understand
	<i>e</i> manipulation strategies to improve livestock uding meat and milk production	Cognitive	Understand
Unit-I- Cell C	ulture Techniques		9
Anchorage and 1. Key eve 2. Advant 3. Sub cul 4. Extrace 5. Cell Int 6. Design 7. Design 8. Identifi	a composition and growth conditions; Animal centro non-anchorage dependent cell culture. The entropy of the development of cell and tissue culture age of tissue culture ture of continuous line growth and Cell line Character Ilular Matrix and its role eraction and signalling pathways ing of cell culture laboratory of CO_2 incubator and laminar flow – safety cabinets cation of microbial contamination		ue preservation;
	amination techniques		Δ
	Transfer Techniques	1	9
Kinetics of ce	ll growth; Micro & macro-carrier culture; Hybrid	oma techno	blogy; Stem cell

tee							nimals;	Knock	a-out an	d knock	-in anin	nals.		
							itation	hiolog	v					
U									y				9	
									nsemin	ation. S	uper o	vulation	-	vo
_	echnology; Animal cloning; Transgenic animals; Knock-out and knock-in animals. 10. Growth of animal cells culture 11. Knock-out mechanism using computation biology													
	10. Growth of animal cells culture 11. Knock-out mechanism using computation biology nit-III- Invitro Fertilization and Embryo Transfer 9 wit/iro fullization and its limitations - Artificial insemination, Super ovulation, Embryo litting, Biopsy and Sexing of embryos and Embryo transfer - Embryo cryopreservation chinques - Limitations in embryo transfer - Breeding of farm animals. 9 12. Embryo transfer; https://www.uaex.edu/publications/pdf/fsa-3119.pdf 9 Init-IV- Manipulations for Product Improvement 9 Ianipulation of Growth hormone; Role of Somatotropic and Thyroid hormone in growth - robiotics; anipulation of lactation - Lactogenesis and galactopoiesis, wool growth and rumen microbial gestive system. 9 13. Growth of animal cells in the lab - theoretical and practical 9 rit-V- Transgenic Animals 9 cope and importance of transgenic animal technology - Various strategies for the production of ansgenic animals; pronuclear microinjection, embryonic stem cells and somatic cell nuclear ansfer - Gene knock in and knock out models for studying human disorders - Transgenic firmals as bioreactors for producing pharmaceutically important compounds and therapeutics. Vectore Tutorial Practical Total 45 0 0 45 ext Books: Intervial Fransgenic Animal Cells: A manual of Basic technique, John , Wiley and sons, 6th Edition, 2008. Intervial Approach, Oxford Univer													
U									i				9	
									pic an	d Thyrc	oid horr	none in	growth	
				+								-		
	-				-		-	-		•				
	13. G	rowth	of anir	nal cell	s in the	e lab - t	theoreti	ical and	d practi	cal				
U	nit-V-	Trans	genic A	Animal	s				-				9	
Sc	cope an	d imp	ortance	of trar	nsgenic	anima	l techn	ology ·	- Vario	us strate	gies for	the pro	duction	of
an	imals a	as bior	eactors	for pro	oducing	, pharm	naceutio	cally in	nportan	it compo	ounds an	d therap	peutics.	
	Ι	.ectur	e]	Futori a	al		Р	ractical	l]]	Fotal	
		45				0				0			45	
Te	ext Bo	oks:												
1	Fracht	DOV D	I Cui	lture of	Anima	1 Calls	· 1 ma	nual at	Basic	technicu	10 John	Wiley	and sor	19
1.		•			Amma	II CCIIS	. A ma	liuai Oi	Dasie	teeninqu	ic, joini	, whey	and sor	15,
2				mal Rid	otechno	logy	Recent	Conce	ents and	l Develo	nments	MIh F	Publisher	rc
2.						nogy. I	Recent	Conce	pis and		pineins	, 10150 1	uonsnei	15,
			Lano	n, 2000										
					Cell C	Culture	: Pract	ical A	pproach	n, Oxfor	d Univ	ersity P	ress, Ne	W
		,									~ .			
					n, A.,	Anima	al Bioto	echnol	ogy an	d Ethic	s, Sprin	ger Ve	rlag, Ne	W
_			dition,	1998.										
E						,								
		-							-			-		
										0	C	animal	S	as
			tors:nu	ps://npt	el.ac.in	1/cours	es/102/	103/10	021030.	13/				
			PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
D1	3	2	1	2	2	0	1	1	2	1	1	2	1	2
) 2	3	1	2	1	2	0	0	1	0	2	1	3	2	1
) 3	3	1	2	3	3	2	2	1	2	2	2	3	3	3
) 4	3	2	2	2	3	1	1	1	1	2	2	2	1	2
) 5	3	2	3	1	2	2	1	1	1	2	2	2	1	1
	15	8	10	9	12	5	4	5	6	9	8	12	8	9
	ii ii	0	10	-		0	•	c	Ŭ	-	0		Ŭ	
	PO	I PO	02 PO.	3 PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO
riginal	15	8	10	9	12	5	4	5	6	9	8	12	0	1
lue										-				
aled	3	2	2	2	3	1	1	1	2	2	2	3	0	0
alue														

Scale: 3- high, 2 – Medium, 1 - Low, 0 – not related 0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

				[L	Т	P	С
	квт	602		-	<u> </u>	1	P 0	4
	DI	004	PROCESS BIOTECHNOLOGY		3		U	
С	Р	٨	I KOCESS DIVIECHNOLOGI	-	L	Т	Р	Н
<u> </u>	<u> </u>	A 1		-	<u> </u>	2	P 0	н 5
		isite: -			3	4	U	3
	_		ectives:					
			ion of this course, the students					
°P.		-	be able to identify the parts of a fermenter					
			be knowing about the media components for fermenta	ation proces	S			
			be able to select the parts of a bioreactor for designing	-		uction n	rocess	
			be able to design the scale up procedure of a bioreacto		r prou		1000000	
		······	Course Outcomes	Domai	n	1	Level	
Afte	er th	e comp	bletion of the course, students will be able to	2011111	-			
						D	1	
CO		speration of the second	and <i>identify</i> the basic parts of a fermentor and its ons.	Cognitive		Rement Unders		
	,	dantifi	monoduce and domenstrate the different mode	Cognitive		Remen	ıber	
CO			<i>y</i> , <i>reproduce</i> , and <i>demonstrate</i> the different media nents involved in a fermentation process.	Affective		Value		
		Jompor	lents involved in a termentation process.			Apply		
	1	nternr	et, describe and differentiate various control	Cognitive		Unders	tand	
CO		-	s involved in bioprocess system.	Affective		Receive		
		<u> </u>	1 V					
CO			tize, discuss and measure the various phenomena	Cognitive		Unders		
	1		d in Downstream Processing.	Affective		Respon		
CO			<i>tand</i> the product purifications to <i>Develop</i> a bio	Cognitive		Unders	tand	
T .		product		Affective		Create	0.2	
			on to process Biotechnology	on of forma	nton o	nd onoil	9+3	main
			ments of fermentation processes – basic configuration be monitored and controlled- ; Kinetics of cell grow					
			ctured and unstructured models; Batch, fed-batch and				anu pi	ouuci
			mulation and optimization	continuous	proces	5565	9+3	
			air and media, medium requirements for fermentation	nrocesses (arbon	nitroge		erals
			other complex nutrients, oxygen requirements, sin					
			chniques,	r	r			
			entation and Process Control:				9+3	
-			n, measurement and control of the bioprocess parame	ter such as t	emper	ature, p	ressure	e, pH,
			gen, redox, microbial biomass, flow measurement-		_	_		_
prev	venti	ion of t	foam, Feedback and feed forward control; Types of	controllers	– proj	portiona	l, deriv	vative
and	inte	gral co	ntrol, tuning of controllers			-		
IV	Dow	y <mark>nstrea</mark>	m Processing Methods				9+3	
			embrane filtration, Cell disruption; ultrafiltration; C	•		- 1		
			d sedimentation. Principles of chromatography - ion	exchange,	gel filt	ration, l	nydrop	hobic
			inity, GC, HPLC and FPLC;			1		
			rification and Resolution					
			nethods (with salt, organic solvents, and polymers,					
pha	se e	xtractio	on)- Membrane based separation process, Types of m	embranes, I	viembi	rane pro	cess, t	neory
			88	8 th BOS/B	ΙΟΤΕΟ	CH/Date	: 19.08	3.2021

and types of membrane- Crystallization, theory of crystallization- Freeze drying- Principle, process and application of freeze drying integrated bio-processing- product polishing stages

Lecture	Tutorial	Practical	Total
45	15	0	60
Teet Deeler			

Text Books:

- 1. Schuler and Kargi, Bioprocess engineering. Prentice Hall
- 2. Najafpour, Ghasem. Biochemical engineering and biotechnology. Elsevier, 2015.
- 3. Bailey and Ollis, Biochemical Engineering Fundamentals, McGraw Hill, Co. 2004.

References:

- 1. Pauline Doran, Bioprocess Principles, Academic press, 2004.
- 2. Neilson J and Villadsen J, Biochemical Engineering Principles I ed, Plenum Press, 2000.
- 3. Stanbury P F Whitaker, A and Hall S.J. Principles of Fermentation Technology 2nd ed, Aditya Book Pvt Ltd, 2001.
- 4. Lee J.M, Biochemical Engineering 2nd ed, Prentice Hall, 2000.

E-References:

- 1. http://www.nptel.ac.in/syllabus/syllabus.php?subjectId=102107029
- 2. http://users.ox.ac.uk/~dplb0149/publication/NPRBiocatalysisRev.pdf
- 3. http://link.springer.com/book/10.1007%2F978-1-4684-0324-4

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3											1	2	2
CO 2	2	3	2		1		1		1		3	2	3	3
CO 3	1	2	2	1					1			1	0	0
CO 4	1	3	2	3								1	0	0
CO 5	1	3	2	3	1		1		2		2		1	1
	8	11	8	7	2	0	2	0	4	0	5	5	6	6

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

Mapping of Subjects with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Original Value	8	11	8	7	2	0	2	0	4	0	5	5	6	6
Scaled Value	2	3	2	2	1	0	1	0	1	0	1	1	2	2

 $1-5 \rightarrow 1$, $6-10 \rightarrow 2, \qquad 11-15 \rightarrow 3$

				L	Τ	P	С
XB	Г 603	A		3	0	0	3
			MASS TRANSFER FUNDAMENTALS				
С	P	Α		L	Τ	P	Η
2.5	0	0.5		3	0	0	3
Prei	requ	isites	Nil				
Obj	ectiv	ves:					
) T	'o faci	litate the learners understand the basic concepts and principles	s of	mass	trar	sfer and
	a	pply tl	nem in distillation, absorption adsorption drying and humidification	ion o	pera	tions	
Cou	rse	Outco	mes: At the end of this course, the students should be Dom	ain	L	.evel	
			89 8 th BOS/BIO	DTE	CH/E	Date:	19.08.20

able to)		
CO1	<i>Explain</i> the basic principles in diffusional mass transfer and	Cognitive	Understand
	<i>Calculate</i> the rate of the mass transfer under one dimensional	Affective	Analyse
	steady state diffusion		Receive
CO2	Describe the operations of Distillation and absorption and	Cognitive	Understand
	<i>Calculate</i> number trays for distillation and absorption tower	Affective	Analyse
			Receive
CO3	<i>List</i> situations where liquid–liquid extraction might be preferred	Cognitive	Understand
000	to distillation		Analyse
CO4	Discuss the salient features of Separation by adsorption,	Cognitive	Understand
	chromatographic separation process and <i>Explain</i> the concept of		Analyse
	breakthrough in fixed-bed adsorption.		1 11111 9 5 0
CO5	Describe the salient features and mechanism involved in Drying	Cognitive	Understand
000		coginere	Analyse
	Course Content	1	Hours
Unit-I			9
	y state molecular diffusion in fluids and solids. One dimensional st	eady state ar	1
	ular diffusion through stationary media – molecular diffusion in	•	•
	rements – overall mass transfer coefficients – Diffusion in multi co		
	ion in solids.	Simponeni ga	scous mixtures -
Unit-l			9
	r liquid equilibrium – methods of distillation – simple, steam,	flach distilla	-
	tive and molecular distillation – Continuous distillation –		
EXII ac	and molecular distination – Continuous distination –		
nonch		Meeube	There method
	onsavarit method	Mecube	
Unit-I	onsavarit method III Extraction and Leaching		9
Unit-I	onsavarit method II Extraction and Leaching quilibrium – staged and continuous extraction concepts, Equipme		9
Unit-I L-L eo liquid	onsavarit method II Extraction and Leaching quilibrium – staged and continuous extraction concepts, Equipment equilibria, leaching principles – Equipments for leaching		9 action – Solid -
Unit-I L-L ea liquid Unit-I	onsavarit method III Extraction and Leaching quilibrium – staged and continuous extraction concepts, Equipment equilibria, leaching principles – Equipments for leaching IV Absorption and Adsorption	ents for extr	9 action – Solid - 9
Unit-I L-L ed liquid Unit-I Theory	onsavarit method III Extraction and Leaching quilibrium – staged and continuous extraction concepts, Equipmed equilibria, leaching principles – Equipments for leaching IV Absorption and Adsorption y of absorption – Factors affecting gas absorption-Equilibrium a	ents for extra-	9 action – Solid - 9 g line concept ir
Unit-I L-L ea liquid Unit-I Theory absorp	onsavarit method III Extraction and Leaching quilibrium – staged and continuous extraction concepts, Equipmed equilibria, leaching principles – Equipments for leaching IV Absorption and Adsorption y of absorption – Factors affecting gas absorption-Equilibrium a otion stage determination - Adsorption and its types -sorbents	ents for extra-	9 action – Solid - 9 g line concept ir
Unit-I L-L ed liquid Unit-I Theory absorp kinetic	III Extraction and Leaching quilibrium – staged and continuous extraction concepts, Equipmed equilibria, leaching principles – Equipments for leaching IV Absorption and Adsorption y of absorption – Factors affecting gas absorption-Equilibrium a ption stage determination - Adsorption and its types -sorbents c and transport considerations	ents for extra-	9 action – Solid – 9 g line concept in n consideration-
Unit-I L-L ed liquid Unit-I Theory absorp kinetic Unit-V	III Extraction and Leaching quilibrium – staged and continuous extraction concepts, Equipment equilibria, leaching principles – Equipments for leaching IV Absorption and Adsorption y of absorption – Factors affecting gas absorption-Equilibrium a biton stage determination - Adsorption and its types -sorbents - c and transport considerations V Humidification and Drying	ents for extra- nd operating – equilibriur	9 action – Solid – 9 f line concept ir n consideration 9
Unit-I L-L ed liquid Unit-I Theor absorp kinetic Unit-V Basic	onsavarit method III Extraction and Leaching quilibrium – staged and continuous extraction concepts, Equipments for leaching quilibria, leaching principles – Equipments for leaching V Absorption and Adsorption y of absorption – Factors affecting gas absorption-Equilibrium a biton stage determination - Adsorption and its types -sorbents - and transport considerations V Humidification and Drying terminologies in humidification – psychrometric chart, construe	ents for extrand nd operating – equilibriur ction and us	9 action – Solid – 9 g line concept in n consideration 9 se. Methods of
Unit-I L-L ec liquid Unit-I Theory absorp kinetic Unit-V Basic humid	II Extraction and Leaching III Extraction and Leaching quilibrium – staged and continuous extraction concepts, Equipmed equilibria, leaching principles – Equipments for leaching IV Absorption and Adsorption y of absorption – Factors affecting gas absorption-Equilibrium a otion stage determination - Adsorption and its types -sorbents - e and transport considerations V Humidification and Drying terminologies in humidification – psychrometric chart, constru ification and dehumidification – equipments – spray chamber– construction	ents for extrand nd operating – equilibriur ction and us	9 action – Solid – 9 g line concept in n consideration 9 se. Methods of
Unit-I L-L ec liquid Unit-I Theory absorp kinetic Unit-V Basic humid	Image: Second structure Extraction and Leaching Image: Second structure Extraction and Leaching Image: Second structure Second structure Image: Second structu	ents for extra- nd operating – equilibriur ction and us poling tower	9 action – Solid – 9 g line concept ir n consideration 9 se. Methods of principles, types
Unit-I L-L ec liquid Unit-I Theory absorp kinetic Unit-V Basic humid	onsavarit method Extraction and Leaching quilibrium – staged and continuous extraction concepts, Equipment equilibria, leaching principles – Equipments for leaching V Absorption and Adsorption V Absorption and Adsorption y of absorption – Factors affecting gas absorption-Equilibrium a otion stage determination - Adsorption and its types -sorbents - considerations V Humidification and Drying terminologies in humidification – psychrometric chart, construitification and dehumidification – equipments – spray chamber– construction – Theory and mechanism of drying. Lecture Tutorial Practica	ents for extra nd operating – equilibriur ction and us poling tower	9 action – Solid – 9 g line concept ir n consideration 9 se. Methods of principles, types Total
Unit-I L-L ed liquid Unit-I Theory absorp kinetic Unit-V Basic humid and op	onsavarit method Extraction and Leaching quilibrium – staged and continuous extraction concepts, Equipment equilibria, leaching principles – Equipments for leaching Q Absorption and Adsorption y of absorption – Factors affecting gas absorption-Equilibrium a bion stage determination - Adsorption and its types -sorbents - cand transport considerations V Humidification and Drying terminologies in humidification – equipments – spray chamber– construction and dehumidification – equipments – spray chamber– construction – Theory and mechanism of drying. Lecture Tutorial Practication 45 0 0	ents for extra nd operating – equilibriur ction and us poling tower	9 action – Solid – 9 g line concept in n consideration 9 se. Methods of principles, types
Unit-I L-L ed liquid Unit-I Theor absorp kinetic Unit-V Basic humid and op Text I	onsavarit method Extraction and Leaching quilibrium – staged and continuous extraction concepts, Equipme equilibria, leaching principles – Equipments for leaching V Absorption and Adsorption V Absorption and Adsorption y of absorption – Factors affecting gas absorption-Equilibrium a otion stage determination - Adsorption and its types -sorbents - and transport considerations V Humidification and Drying terminologies in humidification – psychrometric chart, construction and dehumidification – equipments – spray chamber– construction – Theory and mechanism of drying. Lecture Tutorial Practica 45 0 0	ents for extra- nd operating – equilibriur ction and us poling tower	9action – Solid –9g line concept inn consideration9se. Methods orprinciples, typesTotal45
Unit-I L-L ed liquid Unit-I Theory absorp kinetic Unit-V Basic humid and op Text I 1.	onsavarit method Extraction and Leaching quilibrium – staged and continuous extraction concepts, Equipme equilibria, leaching principles – Equipments for leaching V Absorption and Adsorption V Absorption and Adsorption y of absorption – Factors affecting gas absorption-Equilibrium a otion stage determination - Adsorption and its types -sorbents - cand transport considerations V Humidification and Drying terminologies in humidification – psychrometric chart, construitification and dehumidification – equipments – spray chamber– construction – Theory and mechanism of drying. Lecture Tutorial Practica 45 0 0 Books Treybal R.E., "Mass Transfer Operations", Third Edition, McGra	ents for extra- nd operating – equilibriur ction and us poling tower hls	9 action – Solid – 9 g line concept in n consideration 9 se. Methods o principles, types Total 45
Unit-I L-L ed liquid Unit-I Theor absorp kinetic Unit-V Basic humid and op Text I	onsavarit method Extraction and Leaching quilibrium – staged and continuous extraction concepts, Equipment equilibria, leaching principles – Equipments for leaching V Absorption and Adsorption y of absorption – Factors affecting gas absorption-Equilibrium a bion stage determination - Adsorption and its types -sorbents - cand transport considerations V Humidification and Drying terminologies in humidification – equipments – spray chamber – conceration – Theory and mechanism of drying. Lecture Tutorial Practica 45 0 0 Books Treybal R.E., "Mass Transfer Operations", Third Edition, McGra Anantharaman, N. and K.M. MeeraSherifa Begum, "Mass Transfer	ents for extra- nd operating – equilibriur ction and us poling tower hls	9 action – Solid – 9 g line concept in n consideration 9 se. Methods o principles, types Total 45
Unit-I L-L ed liquid Unit-I Theory absorp kinetic Unit-V Basic humid and op Text I 1. 2.	onsavarit method Extraction and Leaching quilibrium – staged and continuous extraction concepts, Equipme equilibria, leaching principles – Equipments for leaching W Absorption and Adsorption y of absorption – Factors affecting gas absorption-Equilibrium a otion stage determination - Adsorption and its types -sorbents - cand transport considerations W Humidification and Drying terminologies in humidification – equipments – spray chamber– conceration – Theory and mechanism of drying. Lecture Tutorial Practication 45 0 0 Books Treybal R.E., "Mass Transfer Operations", Third Edition, McGra Anantharaman, N. and K.M. MeeraSherifa Begum, "Mass Transfer Operations", Third Edition, McGra PHI Learning Private Limited, New Delhi,2011	ents for extra- nd operating – equilibriur ction and us poling tower als w Hill, 1980 nsfer Theory	9 action – Solid – 9 g line concept in n consideration 9 se. Methods o principles, types Total 45
Unit-I L-L ed liquid Unit-I Theor absorp kinetic Unit-V Basic humid and op Text I 1. 2.	onsavarit method Extraction and Leaching quilibrium – staged and continuous extraction concepts, Equipment equilibria, leaching principles – Equipments for leaching V Absorption and Adsorption y of absorption – Factors affecting gas absorption-Equilibrium a bion stage determination - Adsorption and its types -sorbents - cand transport considerations V Humidification and Drying terminologies in humidification – equipments – spray chamber – conceration – Theory and mechanism of drying. Lecture Tutorial Practica 45 0 0 Books Treybal R.E., "Mass Transfer Operations", Third Edition, McGra Anantharaman, N. and K.M. MeeraSherifa Begum, "Mass Transfer	ents for extra- nd operating – equilibriur ction and us poling tower als w Hill, 1980 nsfer Theory	9 action – Solid 9 g line concept in n consideration 9 se. Methods o principles, type Total 45
Unit-I L-L ed liquid Unit-I Theory absorp kinetic Unit-V Basic humid and op Text I 1. 2. 3.	onsavarit method Extraction and Leaching quilibrium – staged and continuous extraction concepts, Equipment equilibria, leaching principles – Equipments for leaching V Absorption and Adsorption y of absorption – Factors affecting gas absorption-Equilibrium a otion stage determination - Adsorption and its types -sorbents - and transport considerations V Humidification and Drying terminologies in humidification – equipments – spray chamber– conceration – Theory and mechanism of drying. Lecture Tutorial Practica 45 0 0 Books Treybal R.E., "Mass Transfer Operations", Third Edition, McGra Anantharaman, N. and K.M. MeeraSherifa Begum, "Mass Transfer" 8 th Edition, Nirali Prakashan, 2010	ents for extra- nd operating – equilibriur ction and us poling tower als w Hill, 1980 nsfer Theory	9 action – Solid 9 g line concept in n consideration 9 se. Methods o principles, type Total 45
Unit-I L-L ed liquid Unit-I Theory absorp kinetic Unit-V Basic humid and op Text I 1. 2. 3. Refere	onsavarit method Extraction and Leaching quilibrium – staged and continuous extraction concepts, Equipment equilibria, leaching principles – Equipments for leaching V Absorption and Adsorption y of absorption – Factors affecting gas absorption-Equilibrium a otion stage determination - Adsorption and its types -sorbents - and transport considerations Y V Humidification and Drying Erreniologies in humidification – psychrometric chart, construitification and dehumidification – equipments – spray chamber – construction – Theory and mechanism of drying. Lecture Tutorial Practica 45 0 0 Books Treybal R.E., "Mass Transfer Operations", Third Edition, McGra Anantharaman, N. and K.M. MeeraSherifa Begum, "Mass Transfer" 8 th Edition, Nirali Prakashan, 2010	ents for extra- nd operating – equilibriur ction and us poling tower ils w Hill, 1980 <i>nsfer Theory</i> 0.	9 action – Solid – 9 g line concept in n consideration 9 se. Methods o principles, type Total 45
Unit-I L-L ed liquid Unit-I Theory absorp kinetic Unit-V Basic humid and op Text I 1. 2. 3. Refere 1.	onsavarit method Extraction and Leaching quilibrium – staged and continuous extraction concepts, Equipment equilibria, leaching principles – Equipments for leaching Absorption and Adsorption y of absorption and Adsorption y of absorption and Adsorption and its types -sorbents - considerations. W Humidification and Drying terminologies in humidification – psychrometric chart, construitification and dehumidification – equipments – spray chamber – construction – Theory and mechanism of drying. Lecture Tutorial Practica 45 Books Treybal R.E., "Mass Transfer Operations", Third Edition, McGra Anantharaman, N. and K.M. MeeraSherifa Begum, "Mass Transfer" 8 th Edition, Nirali Prakashan, 2010 Govers Dutta, B. K., " Principles of mass transfer and separation proces. Delhi, 2007	ents for extra- nd operating – equilibriur ction and us ooling tower als w Hill, 1980 <i>nsfer Theory</i> 0. <i>sses</i> ", Prenti	9 action – Solid - 9 g line concept in n consideration 9 se. Methods o principles, type Total 45 .
Unit-I L-L ec liquid Unit-I Theory absorp kinetic Unit-V Basic humid and op Text I 1. 2. 3. Refere 1. 2.	onsavarit method Extraction and Leaching quilibrium – staged and continuous extraction concepts, Equipme equilibria, leaching principles – Equipments for leaching V Absorption and Adsorption y of absorption and Adsorption y of absorption – Factors affecting gas absorption-Equilibrium a otion stage determination - Adsorption and its types -sorbents - c and transport considerations W Humidification and Drying terminologies in humidification – psychrometric chart, construitification and dehumidification – equipments – spray chamber– conservation – Theory and mechanism of drying. Lecture Tutorial Practica 45 0 0 Books Treybal R.E., "Mass Transfer Operations", Third Edition, McGra Anantharaman, N. and K.M. MeeraSherifa Begum, "Mass Transfer" 8 th Edition, Nirali Prakashan, 2010 Goven K.A "Mass Transfer" 8 th Edition, Nirali Prakashan, 2010 Dutta, B. K., " Principles of mass transfer and separation proces	ents for extra- ind operating – equilibriur ction and us poling tower ils w Hill, 1980 <i>nsfer Theory</i> 0. <i>sses</i> ", Prenti sian Books P	9 action – Solid – 9 g line concept in n consideration 9 se. Methods o principles, type Total 45 ,

Mapping of COs Vs Pos

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<u> </u>										0			2	
CO 1	3	3	1	3	2	1	2	1	1	0	2	2	3	3
CO 2	3	3	1	3	2	1	2	1	1	0	2	2	3	3
CO 3	3	3	1	3	2	1	2	1	1	0	2	2	3	3
CO 4	2	1	1	1	1	1	1	1	1	0	1	1	1	1
CO 5	3	3	1	1	1	1	1	1	1	0	1	1	1	1
	14	13	5	11	8	5	8	5	5	0	8	8	11	11
0 - No	Relati	on, 1 -	Low R	elation	, 2- Me	edium	Relatio	n, 3- H	igh Re	lation				

Mapping of Subject Vs POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Original value	14	13	5	11	8	5	8	5	5	0	8	8	11	11
Scaled Value	3	3	0	3	2	0	2	0	0	0	2	2	3	3

 $1-5 \rightarrow 1$, $6-10 \rightarrow 2$, $11-15 \rightarrow 3$ 0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

					L	Т	Р	С
XBT	603	B			3	0	0	3
			FERMENTATION TECHNOLOGY					
С	Р	Α			L	Т	P	Η
3	0	0			3	0	0	3
Prer	equ	isites	:-					
Obje	ectiv	ves:						
•	Т	'o enh	ance the student's ability of employability through stu	dy the	e co	re pi	ime	targeted
			cess, microbial cum biochemical activities in the fermentat	ion tec	hnol	ogy.		
Courable 1		Outco	omes: At the end of this course, the students should be	Dom	ain	L	evel	
C01	E	Explai	<i>n</i> the microbial for industries and <i>List</i> the applications	Cogn	itive	U	nders	stand
CO2			<i>be</i> the primary and secondary metabolism and <i>Interpret</i> mentation process	Cogn	itive	U	nders	tand
CO3	ŀ		<i>nize</i> the microbial culture and <i>Describe</i> the growth	Cogn	itive	U	nders	tand
CO4			s the isolation and characteristics of microorganismand et the industrial significant.	Cogn	itive	U	nders	tand
CO5		Descril	be the salient features of industrial fermentation.	Cogn	itive	U	nders	tand
			Course Content			-	I	Hours
Unit	-I	In	troduction				(6
Micr Enzy			mass – Microbial Enzymes – Microbial Metabolites – (Comm	ercia	l Ap	plica	ations of
Unit	-II	Pr	imary and Secondary Metabolism				9)

Interrelationship between primary and secondary metabolism – Recombinant products – Transformation processes – History of fermentation industry – The component parts of a fermentation process.

Unit-III	Microbial Growth Kinetics			9
Batch cult	ure – Exponential phase – De	eclaration and st	ationary phases -	Continuous culture -
Feedback s	systems – Comparison of batch a	and continuous cu	lture in industrial p	processes
Unit-IV	Isolation and Improvement of	of Industrially Si	gnificant Microor	ganisms 9
Isolation a	nd characteristics of microorgan	isms - Screening	g methods of micro	organisms – Discovery
processes a	and maximizing gene expression	– Improvement	of Industrial microo	organism
Unit-V	Media for Industrial Fermen	tation		12
Introductio	n – Typical media and media f	ormulation – En	ergy sources – Gro	wth factors – Nutrient
Recycles –	Buffers - Precursors - Inhibito	ors – Inducers – O	Oxygen requiremen	ts – Fast metabolism –
Rheology -	- Antifoams - Animal cell media	a – Development	of basal media.	
	Lecture	Tutorial	Practicals	Total
	45	0	0	45
Text Book	.s			

4. Stanbury.Peter.F, Allan Whitaker, Stephen J. Hall, "Principles of Fermentation Technology", Third Edition, ELSIVER, 2017.

5. Gregory N. Stephanopoulos, Aristos A. Aristidou., Metabolic engineering: Principlesand Methodologies, Jens Nielsen Academic Press, 1st Edition, 1998.

References

4. Sandhu, Sardul Singh. Recombinant DNA technology. IK International Pvt Ltd, 2010.

E-References

1. https://nptel.ac.in/courses/102/105/102105058/

Mapping of COs Vs POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<u> </u>	2	2	1	2		1	2	1	1	0			2	2
CO 1	- 3	- 3	1	- 3	2	1	2	1	1	0	2	2	3	3
CO 2	3	3	1	3	2	1	2	1	1	0	2	2	3	3
CO 3	3	3	1	3	2	1	2	1	1	0	2	2	3	3
CO 4	2	1	1	1	1	1	1	1	1	0	1	1	1	1
CO 5	3	3	1	1	1	1	1	1	1	0	1	1	1	1
	14	13	5	11	8	5	8	5	5	0	8	8	11	11

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

Mapping of Subject Vs POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Original value	14	13	5	11	8	5	8	5	5	0	8	8	11	11
Scaled Value	3	3	0	3	2	0	2	0	0	0	2	2	3	3

 $1 - 5 \rightarrow 1, \qquad 6 - 10 \rightarrow 2, \qquad 11 - 15 \rightarrow 3$

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

XВ	T 60	3C		7	L 3	Т 0	P 0	$\frac{C}{3}$
0			NANOBIOTECHNOLOGY	(T	D	TT
C 3	P 0	<u>A</u> 0			L 3	<u>Т</u> 0	<u>Р</u> 0	<u>Н</u> 3
-	-	-	Bioinstrumentation			Ū	Ū	
Lear	rning	; Obj	ective:					
	n cor	nplet	ion of this course, the students					
•			be able to learn fundamentals of nano technolo					
•	• W	ould	be able to learn the nano particle synthesis and		biote			
			Course Outcomes	Domain		L	evel	
		_	letion of the course, students will be able to					
			e basic concepts characterization techniques he methods of nanoparticles synthesis.	Cognitive			nber stanc	
CO2	2:Con	istruc	<i>t</i> microfluidic devices and <i>relate</i> its	Cognitive	Cı	eate	:	
	ntage		Uı	nder	stanc	1		
CO3	B:Des	ign a	nd <i>Develop</i> theranostics nanoparticles	Cognitive	Cı	eate	5	
CO4	:Out	lines	the environmental applications of	Cognitive	U	nder	stanc	1
	parti							
			nds the Fundamentals of Nanocarriers and lelivery system.	Cognitive	Cı	eate	2	
Unit	-I- I	ntro	luction to Nanoparticles Synthesis and Char	acterization			9	
Nano			- ·		col m	othe	de	1000
vapo Nano Char Ener	opart: orizat: omate acter	icles- ion, erials: rizatic Disper	physical, chemical and biological properties- laser Pyrolysis, ion implantation. Chem sol-gel method. Biological synthesis: usin on techniques: UV- Spectroscopy, Dynamic sive X-Ray Analysis (EDX), Selected Area	Synthesis- Physic nical methods f ng microorganism Light Scattering	for s is, pl g, Ze	syntl ant eta j	nesis extr potei	o acts ntia
vapo Nano Char Ener TEM	oparta orizat omate cacter gy D 1, AF	icles- ion, erials: rizatic Disper M.	physical, chemical and biological properties- laser Pyrolysis, ion implantation. Chem sol-gel method. Biological synthesis: usin on techniques: UV- Spectroscopy, Dynamic	Synthesis- Physic lical methods f g microorganism Light Scattering Diffraction Patter	for s is, pl g, Ze	syntl ant eta j	nesis extr potei	o acts ntia
vapo Nanc Char Ener TEM Unit Conc Mate	oparta orizat omate cacter gy D I, AF -II- I cepts erials	icles- ion, erials: izatic Disper M. Micro and	physical, chemical and biological properties- laser Pyrolysis, ion implantation. Chem sol-gel method. Biological synthesis: usin in techniques: UV- Spectroscopy, Dynamic sive X-Ray Analysis (EDX), Selected Area	Synthesis- Physic nical methods f ng microorganism Light Scattering Diffraction Patter s transport – Stack	For some some some some some som	syntl ant eta AEI	nesis extr poter D), S 9 sealin	o acts ntia EM
vapo Nanc Char Ener <u>TEM</u> Unit Conc Mate modi	opart orizat omate racter gy D 1, AF -II- I cepts erials ificat	icles- ion, erials: izatic Disper M. Micro and and ions.	physical, chemical and biological properties- laser Pyrolysis, ion implantation. Chem sol-gel method. Biological synthesis: usin on techniques: UV- Spectroscopy, Dynamic sive X-Ray Analysis (EDX), Selected Area ofluidics Meets Nano: Lab-on-a-Chip Device advantages of microfluidic devices – Fluid to	Synthesis- Physic nical methods f ng microorganism Light Scattering Diffraction Patter s transport – Stack	For some some some some some som	syntl ant eta AEI	nesis extr poter D), S 9 sealin	acts ntia EN
vapo Nanc Char Ener TEM Unit Conc Mate modi Unit Ther acros	opart orizationate acter acter gy D 1, AF -II- I cepts erials ificat anost ss B1	icles- ion, erials: izatic Disper M. Micro and and ions. Nano tic ag ood I	physical, chemical and biological properties- laser Pyrolysis, ion implantation. Chem sol-gel method. Biological synthesis: usin on techniques: UV- Spectroscopy, Dynamic sive X-Ray Analysis (EDX), Selected Area ofluidics Meets Nano: Lab-on-a-Chip Device advantages of microfluidic devices – Fluid to methods for the manufacture of microfluidic co	Synthesis- Physic lical methods f lag microorganism Light Scattering Diffraction Patter s transport – Stack omponent, fluidic	for shis, pl g, Ze rn (S ing a struct	syntl ant eta AEI nd stures	nesis extr poter), S 9 sealin s, sur 9 to c	or acts ntia EN EN ng rfac
vapo Nanc Char Ener TEM Unit Conc Mate modi Unit Ther acros	opart orizationate acter acter gy D 1, AF -II- I cepts erials ificat anost ss B1 rders-	icles- ion, erials: izatic Disper M. Micro and and ions. Nano tic ag ood I - Alzh	physical, chemical and biological properties- laser Pyrolysis, ion implantation. Chem sol-gel method. Biological synthesis: usin on techniques: UV- Spectroscopy, Dynamic sive X-Ray Analysis (EDX), Selected Area ofluidics Meets Nano: Lab-on-a-Chip Device advantages of microfluidic devices – Fluid to methods for the manufacture of microfluidic com- poparticles As Theranostic Agents gents- properties- advantages- Carbon dots a Brain Barriers- theranostic approach for Cancer	Synthesis- Physic lical methods f lag microorganism Light Scattering Diffraction Patter s transport – Stack omponent, fluidic	for shis, pl g, Ze rn (S ing a struct	syntl ant eta AEI nd stures	nesis extr poter), S 9 sealin s, sur 9 to c	o acts ntia EM
vapo Nanc Char Ener TEM Unit Conc Mate modi Unit Ther acros disor Unit Role remo	opart orizationato acter gy D (1, AF -II- I cepts erials ificat -III- canost ss B1 cders- canost ss B1 conost ss B1 conoss	icles- ion, erials: izatic Disper M. Micro and and ions. Nano tic ag ood I - Alzh Env con oz nano	physical, chemical and biological properties- laser Pyrolysis, ion implantation. Chem sol-gel method. Biological synthesis: usin on techniques: UV- Spectroscopy, Dynamic sive X-Ray Analysis (EDX), Selected Area ofluidics Meets Nano: Lab-on-a-Chip Device advantages of microfluidic devices – Fluid to methods for the manufacture of microfluidic com- particles As Theranostic Agents gents- properties- advantages- Carbon dots a Brain Barriers- theranostic approach for Cance meimer's, Parkinson's disease.	Synthesis- Physic ical methods f ag microorganism Light Scattering Diffraction Patter s transport – Stack omponent, fluidic nd Quantum dots er treatment and	for some struct	syntl ant eta j AEI nd s tures ility odeg	<pre>nesis extr poter), S 9 sealin s, sur 9 to c enera 9 y</pre>	cross activentia
vapo Nanc Char Ener TEM Unit Conc Mate modi Unit Ther acros disor Unit Role remo	opart orizationato acter gy D (, AF -II- I cepts erials ificat -III- anost ss B1 rders- c-IV- of in oval, obios	icles- ion, erials: izatic Disper M. Micro and and ions. Nano tic ag ood I - Alzh Env ron oz nano ensor	physical, chemical and biological properties- laser Pyrolysis, ion implantation. Chem sol-gel method. Biological synthesis: usin on techniques: UV- Spectroscopy, Dynamic sive X-Ray Analysis (EDX), Selected Area ofluidics Meets Nano: Lab-on-a-Chip Device advantages of microfluidic devices – Fluid to methods for the manufacture of microfluidic co oparticles As Theranostic Agents gents- properties- advantages- Carbon dots a Brain Barriers- theranostic approach for Cance meimer's, Parkinson's disease. ironmental Applications of Nanoparticles kide, biopolymers and metal nanoparticles in V filter devices. Role of antimicrobial coating	Synthesis- Physic ical methods f ag microorganism Light Scattering Diffraction Patter s transport – Stack omponent, fluidic nd Quantum dots er treatment and	for some struct	syntl ant eta j AEI nd s tures ility odeg	<pre>nesis extr poter), S 9 sealin s, sur 9 to c enera 9 y</pre>	cross activentia

microcapsules and microspheres- hydrogels- Polymers - Dendrimers- Dendritic Nanoscafold system. pH based targeted delivery- chitosan and alginate. Copolymers- PLA, PLGA. Lipid Based Nanocarriers - Liposomes, niosomes- Cubosomes. Hydrophobic drug delivery.

Lecture	Tutorial	Practical	Total
45	0	0	45
Cart Doolan			

Text Books:

- 1. Niemeyer, Christof M., and Chad A. Mirkin. Nanobiotechnology: concepts, applications and perspectives. Vol. 1. John Wiley & Sons, 2004.
- 2. Mirkin, Chad A., and Christof M. Niemeyer, eds. Nanobiotechnology II: more concepts and applications. John Wiley & Sons, 2007.

References:

- 1. Goodsell, David S. Bionanotechnology: lessons from nature. John Wiley & Sons, 2013.
- 2. Freitas Jr. R.A., "Nanomedicine", First Edition, Volume IIA, Landes Biosciences, 2004.

E- References:

- 1. http://www.chem.latech.edu/~ramu/msnt505/lec_notes/Ji/MSNT505_Ji_notes.htm
- 2. http://nptel.ac.in/courses/118107015/

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO 5	PO 6	PO7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	3	2		2		2					2	1	2
CO 2	2	2	2	2	2	2	2				2	3	2	1
CO 3	1	2			3	3					2	3	3	3
CO 4	2	3	3	3	2	3	3				1	2	1	2
CO 5	1	2			3	2		1				2	1	1
	8	12	7	5	12	10	7	1			5	12	8	9

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

	PO1	PO2	PO 3	PO4	PO 5	PO6	PO 7	PO 8	PO 9	PO10	PO 11	PO12	PSO1	PSO2
Original value	8	12	7	5	12	10	7	2			5	12	8	9
Scaled Value	2	3	2	1	3	2	2	1			1	3	2	2

Scale: 3- high, 2 – Medium, 1 - Low, 0 – not related

COU	RSE CODE	XGS605		L T				
COU	RSE NAME	PROFESSIONAL SKIL	LS	1	0	2	3	
PRER	EQUISITES	NIL		L	Т	Р	Η	
C:P:A	= 2.6:0.4:0	-		1	0	4	5	
COU	RSE OUTCOMES		DOMAIN]	LEV	EL		
CO1	Ability to underst	and communications	Cognitive	R	emer	nber		
CO2	Apply the known	skills for career	Cognitive		App	ly		
CO3	Identifyinner stre	ngth	Cognitive	R	emer	nber		
CO4	Construct the atti	tude as a professional	Cognitive	Create				
	•							

CO5	Pra	c <i>ticing</i> Etiqu	ettes	Psychomotor	Guided Response
UNIT	C I	COMMU	NICATION		9
1.1 -	Brains	torming			
1.2 –	LSRW	I			
UNIT	T II	CAREER	SKILLS		9
2.1 -	Resun	ne & CV pre	paring Skills		
2.2 -	Interv	iew Skills			
2.3 –	Explo	ring Career	Opportunities		
UNIT	TII	TEAM SE	XILLS		9
3.1 -	Listen	ing as a Tea	m Skill		I
3.2 –	Team	Building at	work place		
UNIT	T IV	PROFESS	SIONAL SKILLS		9
4.1 –	Attitu	de and Goal	Setting		
4.2 –	Verba	l and Non V	erbal Communication	S	
UNII	V	PROFESS	SIONAL ETIQUETT	TES	9
5.1 - 5	Social	Etiquettes			
5.2 - 0	Cultur	al Ethics at	work place		
LEC	ГURE	: 45	TUTORIAL: 0	PRACTICAL:0	TOTAL: 45
SUG	GEST	ED READI	NGS	1	
				Dr. A. M. Sheikh Professiona	l Communication Skills
2.	Alan P	nd Publicati annett. <i>Key</i> 1st edition, 2	Skills for Professional	ls: How to Succeed in Profes	ssional Services, Kogan

Total Scaled to													
CO Vs PO	CO1	CO2	CO3	CO4	CO5	Total	Scaled to 0,1,2 and 3						
PO ₁	0	0	0	0	0	0	0						
PO ₂	0	0	0	0	0	0	0						
PO ₃	0	0	0	0	0	0	0						
PO ₄	0	0	0	0	0	0	0						
PO ₅	0	0	0	0	0	0	0						
PO ₆	0	0	0	0	0	0	0						
PO ₇	0	0	0	0	0	0	0						
PO ₈	3	3	3	3	3	12	3						
PO ₉	2	2	2	2	2	10	2						
PO ₁₀	3	3	3	3	3	12	3						
PO11	0	0	0	0	0	0	0						
PO ₁₂	0	0	0	0	0	0	0						
PSO ₁	0	0	0	0	0	0	0						
PSO ₂	0	0	0	0	0	0	0						
TOTAL	8	8	8	8	8	34	8						

Mapping of CO with PO

 $1-5 \rightarrow 1, 6-10 \rightarrow 2, 11-15 \rightarrow 3$

0	se Code	:	XUM 606]	L	Р	С						
Course Name : Cyber security 0 0													
Prere	quisite	:]	LT	Р	Н						
C 3	P A 0 0		NIL		3 0	0	3						
_	se Obje												
	•		dge on the cyber space and its security.										
• To	o unders	tand t	he cyber security structure of organisation										
• Tc	o Under	stand	he security policy of organisation										
• To	o aware	of the	Cyber security initiatives and IT Act.										
• To	o make t	he stu	dents to know cyber security ractices.										
	e Outco e able to		fter the completion of the course, students	Domain C or P or A		Lev	el						
CO1	Under techno		he fundamentals of Cyber Security and the	С	Und	lersta	nd						
CO2		stand	the organizational structure of Cyber	С	Uno	lersta	nd						
CO3		•	the Cyber Security policy development	С	Unc	lersta	nd						
CO4	Under	stand	the Indian IT act and the initiatives	С	Unc	lersta	nd						
CO5	Under	stand	and Apply the Cyber security practices	С	Uno App		nd and						
COU	RSE CO)NTE	NT										
UNIT	-		DUCTION				9						
	C L T E C	yber S aws a echno voluti haller	Security – Cyber Security policy – Domain of and Regulations – Enterprise Policy – Te logy Configuration - Strategy Versus Po on – Productivity – Internet – E commerce ges	echnology Ope olicy – Cyber e – Counter M	eration Secu	s – rity							
UNIT	С Ц Т Е С ` П С	yber S aws a echno voluti hallen YBE I	Security – Cyber Security policy – Domain of and Regulations – Enterprise Policy – Te logy Configuration - Strategy Versus Po on – Productivity – Internet – E commerce ges R SECURITY OBJECTIVES AND GUIDA	echnology Ope olicy – Cyber e – Counter M ANCE	Secu Secu leasure	s – rity s –	9 9						
	C L T E C V II C V C G G C D	yber S aws a echno voluti hallen YBE yber ulnera ontrol uidan yber ocum	Security – Cyber Security policy – Domain of and Regulations – Enterprise Policy – Te logy Configuration - Strategy Versus Po on – Productivity – Internet – E commerce ges	echnology Ope olicy – Cyber e – Counter M ANCE ent Goals – rce Systems – urity Policy Ob o – Policy as a poals – Cyber	Count Indust jective Secu	s – rity s – ing rial es – ect– rity							
	C L T E C V II C V C G C D P	yber S aws a echno voluti hallen YBE yber ulnera ontrol uidan yber ocum olicy 7	Security – Cyber Security policy – Domain of and Regulations – Enterprise Policy – Te logy Configuration - Strategy Versus Po- on – Productivity – Internet – E commerce ges SECURITY OBJECTIVES AND GUID Security Metrics – Security Manageme bilities – SecurityFrameworks – E Commer Systems – Personal Mobile Devices – Security ce for Decision Makers – Tone at the Top Security Management – Arriving at Gentation – The Catalog Approach – Catalog I	echnology Ope olicy – Cyber e – Counter M ANCE ent Goals – rce Systems – urity Policy Ob o – Policy as a poals – Cyber	Count Indust jective Secu	s – rity s – ing rial es – ect– rity							
UNIT	C L T E C V C V C C C V C C C D P C C C D D P C C C C C C C C C	yber S aws a echno voluti hallen YBE yber ulnera ontrol uidan yber ocum olicy 7 YBE yber C opyrig alver cation yber I	Security – Cyber Security policy – Domain of and Regulations – Enterprise Policy – Te logy Configuration - Strategy Versus Po- on – Productivity – Internet – E commerce ges R SECURITY OBJECTIVES AND GUID Security Metrics – Security Manageme Ibilities – SecurityFrameworks – E Commer Systems – Personal Mobile Devices – Secu- ce for Decision Makers – Tone at the Top Security Management – Arriving at Go entation – The Catalog Approach – Catalog I Faxonomy.	echnology Ope olicy – Cyber e – Counter M ANCE ent Goals – rce Systems – urity Policy Ob o – Policy as a oals – Cyber Format – Cybe t Names and N g - Cyber Use – Cyber Crim lectual propert	Count Indust jective a Proje Secu r Secu Jumber r Issue ne – Q y The	ing rial es – rity rial es – rity rity rity rity cs – Geo ft –	9						
UNIT	C L T E C YII C YII C C D P YIII C C C C C C C C C C C C C Si	yber S aws a echno voluti hallen YBE yber ulnera ontrol uidan yber ocum olicy 7 YBE yber C opyrig alver cation yber I cagano	Security – Cyber Security policy – Domain of and Regulations – Enterprise Policy – Te logy Configuration - Strategy Versus Po- con – Productivity – Internet – E commerce ges R SECURITY OBJECTIVES AND GUID Security Metrics – Security Manageme bilities – SecurityFrameworks – E Commer Systems – Personal Mobile Devices – Secu- ce for Decision Makers – Tone at the Top Security Management – Arriving at Go- entation – The Catalog Approach – Catalog I Faxonomy. R SECURITY POLICY CATALOG Fovernance Issues – Net Neutrality – Interne th andTrademarks – Email and Messaging ising - Impersonation –Appropriate Use – Privacy - Cyber Conflict Issues – Intel Espionage – Cyber Sabotage – Cyber Welfard	echnology Ope olicy – Cyber e – Counter M ANCE ent Goals – rce Systems – urity Policy Ob o – Policy as a oals – Cyber Format – Cyber t Names and N g - Cyber Use – Cyber Use – Cyber Crim lectual propert e- Computer F	Count Indust jective a Proje Secu r Secu Jumber r Issue ne – Q y The	ing rial es – rity rial es – rity rity rity rity cs – Geo ft –	9						

	Security Incident Handling, Cyber Security Assuran					
	Attacker-Counter measures ,Web Application			y, D	0	
	Infrastructure Security ,Defensive Programming.				lems	
	Associated with Computer Crime, Introduction to Incid UNIT V SECURITY PRACTICES	dent R	espon	se.		0
UNIT V			1	1		9
	Guidelines to choose web browsers, Secu ,Antivirus ,Email security ,Guidelines for setu password ,Two-steps authentication ,Password Security ,Guidelines for social media security ,Tips safer Social Networking.Basic Security for Wind Password Introduction to mobile Smartphor Security ,IOS Security Online Banking Security Security ,Security of Debit and Credit Card ,UPI Micro ATMs e-wallet Security Guidelines Security	ting and be dows, ne S ity ,M Secur	est pr Usei ecurit Iobile ity S	a Se ager ,V actices Acc y ,And Bar Securit	s for count droid lking cy of	
	of Sales(POS)	-		<u> </u>		
			L	Т	P	Total
			45	0	0	45
	NCE BOOKS	ffrou		-	Ŭ	
1.Jenni "Cyb 2. Rick 3. Cyl Editior 4.Mod 5. Dan Lear 6. Rho McGra	fer L. Bayuk, J. Healey, P. Rohmeyer, Marcus Sachs, Je er Security Policy Guidebook" John Wiley & Sons 2012 Howard "Cyber Security Essentials" Auerbach Publicat per Laws & Information Technology, JothiRathan, Vi January 2019. ern Cyber security Practices by Pascal Ackerman, BPB P Shoemaker Cyber security The Essential Body Of Know ning 2011 des-Ousley, Mark, "Information Security: The Comple w-Hill, 2013.	ions 20 ijayRa Publica vledge,	Schmi 011. than,E tions, 1st eo	dt, Jos Bhrath 2020 d. Cen	seph W Pubis gage	Veiss shers,7 ^t
1.Jenni "Cyb 2. Rick 3. Cyb Editior 4.Mod 5. Dan Lear 6. Rho McGra E-REFEI	fer L. Bayuk, J. Healey, P. Rohmeyer, Marcus Sachs, Je er Security Policy Guidebook" John Wiley & Sons 2012 Howard "Cyber Security Essentials" Auerbach Publicat ber Laws & Information Technology, JothiRathan, Vi a January 2019. ern Cyber security Practices by Pascal Ackerman, BPB P Shoemaker Cyber security The Essential Body Of Know ning 2011 des-Ousley, Mark, "Information Security: The Comple w-Hill, 2013. RENCES	ions 20 ijayRa Publica vledge,	Schmi 011. than,E tions, 1st eo	dt, Jos Bhrath 2020 d. Cen	seph W Pubis gage	Veiss shers,7 ^t
1.Jenni "Cyb 2. Rick 3. Cyl Editior 4.Mod 5. Dan Lear 6. Rho McGra E-REFEI	fer L. Bayuk, J. Healey, P. Rohmeyer, Marcus Sachs, Je er Security Policy Guidebook" John Wiley & Sons 2012 Howard "Cyber Security Essentials" Auerbach Publicat per Laws & Information Technology, JothiRathan, Vi a January 2019. ern Cyber security Practices by Pascal Ackerman, BPB P Shoemaker Cyber security The Essential Body Of Know ming 2011 des-Ousley, Mark, "Information Security: The Comple w-Hill, 2013. RENCES ww.coursera.org/specializations/cyber-security	ions 20 ijayRa Publica vledge,	Schmi 011. than,E tions, 1st eo	dt, Jos Bhrath 2020 d. Cen	seph W Pubis gage	Veiss shers,7 ¹
1.Jenni "Cyb 2. Rick 3. Cyl Editior 4.Mod 5. Dan Lear 6. Rho McGra E-REFEI https://ww www. np	fer L. Bayuk, J. Healey, P. Rohmeyer, Marcus Sachs, Je er Security Policy Guidebook" John Wiley & Sons 2012 Howard "Cyber Security Essentials" Auerbach Publicat ber Laws & Information Technology, JothiRathan, Vi a January 2019. ern Cyber security Practices by Pascal Ackerman, BPB P Shoemaker Cyber security The Essential Body Of Know ming 2011 des-Ousley, Mark, "Information Security: The Comple w-Hill, 2013. RENCES ww.coursera.org/specializations/cyber-security tel.ac.in	2. ijayRa Publica vledge, ete Re	Schmi 011. than,E tions, 1st ec ferenc	dt, Jos Bhrath 2020 d. Cen e", Se	seph W Pubis gage	Veiss shers,7 ^t
1.Jenni "Cyb 2. Rick 3. Cyb Editior 4.Mod 5. Dan Lear 6. Rho McGra E-REFEI https://www.npt http://pro	fer L. Bayuk, J. Healey, P. Rohmeyer, Marcus Sachs, Je er Security Policy Guidebook" John Wiley & Sons 2012 Howard "Cyber Security Essentials" Auerbach Publicat per Laws & Information Technology, JothiRathan, Vi a January 2019. ern Cyber security Practices by Pascal Ackerman, BPB P Shoemaker Cyber security The Essential Body Of Know ming 2011 des-Ousley, Mark, "Information Security: The Comple w-Hill, 2013. RENCES ww.coursera.org/specializations/cyber-security	ions 20 ijayRa Publica vledge, ete Res	Schmi 011. than,E tions, 1st ec ferenc	dt, Jos Bhrath 2020 d. Cen e", Se <u>ty</u>	seph W Pubis gage econd	Veiss shers,7 ^t Edition

			PROGRAM OUTCOMES											
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	0	0	0	0	0	2	0	3	0	0	0	0	0	0
CO2	0	0	0	0	0	0	2	0	1	0	0	0	0	0
CO3	3	0	0	0	0	2	3	0	1	0	0	0	3	0
CO4	0	0	0	0	0	0	0	0	0	2	0	0	0	0
CO5	3	0	0	0	0	0	0	0	0	0	0	0	3	0
Total	6	0	0	0	0	4	5	3	2	2	0	0	6	0
ScaledValue	2	0	0	0	0	1	1	1	1	1	0	0	2	0
		1 -	5 🗆 1	l,		6 -	- 10 [2,		11	- 15	□ 3		
	()-NoF	Relatio	n,1-1	Low R	elatio	n,2-N	lediun	nRela	tion,3-H	HighR	elatio	n	

Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2"Colspan="														
XBT607 PROCESS BIOTECHNOLOGY LABORATORY 0 0 4 4 C P A Image: Control of the state of										L		Γ	Р	C
C P A 0.5 2.5 1 Image: constraint of the second sec	XB	T607	DDO						7					
0.5 2.5 1 0 0 8 8 Prerequisite: Process biotechnology Learning Objectives: Upon completion of this course, the students • Would be able to identify the parts of a fermentar Would be able to design industrial media for fermentation process. • Would be able to design industrial media for fermentation process. Domain Level CO1 Infer the basic parts of a fermentor and its operations. Domain Level C01 Infer the basic parts of a fermentor and its operations. Cognitive Psychomotor Apply fermentation process. Demonstrate the different media components involved in a fermentation process. Cognitive Respond Apply C03 Interpret various control systems involved in bioreactor. Cognitive Respond Apply C04 Measure the various transport phenomena involved in bioprocesses. Cognitive Respond Apply C05 Demostarte the scale up procedure of mixing ,aeration Cognitive Respond Apply 1. Determination of thermal death rate constant for a fermentation process. (CO1) CO2 Apply 2. Cognitive the scale up procedure of mixing ,aeration Somotor Affective Respond Apply Mechan			PRO	ICE88 BI	IOTECHNU	JLUGY		KATORY						
Prerequisite: Process biotechnology Learning Objectives: Upon completion of this course, the students • Would be able to identify the parts of a fermenter • • Would be able to design industrial media for fermentation process. • • Would be able to design a particular production process. • Domain Level Course Outcomes Domain Level Constrate Base of a fermentor and its operations. Psychomotor Mechanism Respond Cool Demonstrate the different media components involved in a fermentation process. Domain a fermentation process. Apply Cool Interpret various control systems involved in bioreactor. Psychomotor Mechanism Affective Respond Apply Cool Measure the various transport phenomena involved in Psychomotor Mechanism Affective Respond Apply Psychomotor Mechanism Respond List of Practical Experiments 1 Determination of thermal death rate constant for a fermentation process. (CO1) CO2 Comparison of bioprocess efficiencies in synthetic and complex industrial media. (CO2) 3 Medium formulation and optimization for microbial production. (CO3) 5 Determination of subgen asstransfer coefficient by Sulphite oxidation method. (CO3) 6 4]	Γ		
Learning Objectives: Upon completion of this course, the students • Would be able to identify the parts of a fermenter • Would be able to design industrial media for fermentation process. • Would be able to design industrial media for fermentation process. • Would be able to design industrial media for fermentation process. • Course Outcomes Domain Level C01 Infer the basic parts of a fermentor and its operations. Psychomotor Affective Respond C02 Demonstrate the different media components involved in fermentation process. Psychomotor Affective Respond C03 Interpret various control systems involved in bioreactor. Psychomotor Affective Respond C04 Measure the various transport phenomena involved in biorecess. Cognitive Apply C05 Demostarte the scale up procedure of mixing ,aeration Psychomotor Affective Respond List of Practical Experiments . . Determination of thermal death rate constant for a fermentation process. (CO1) . CO2) 3. Medium formulation and optimization studies. (CO2) . Sectorial Experiments . 1. Determination of biomass concentration for microbial production. (CO3)<										0)	8	8
 Would be able to identify the parts of a fermenter Would be able to design industrial media for fermentation process. Would be able design a particular production process. Would be able design a particular production process. Course Outcomes Course Outcomes Cognitive Apply Psychomotor Mechanism Affective Respond Cognitive Apply Cognitive Apply Psychomotor Mechanism Affective Respond Cognitive Apply Apply Cosnition of thermal death rate constant for a fermentation process. (CO1) Comparison of biomass concentration fo		-												
 Would be able to design industrial media for fermentation process. Would be able design a particular production process. Course Outcomes Domain Level Cognitive Apply Psychomotor Affective Respond Affective Respond Demonstrate the different media components involved in a fermentation process. Demonstrate the different media components involved in a fermentation process. Demonstrate the different media components involved in a fercetive Respond Cognitive Apply Psychomotor Affective Respond Cognitive Respond Cognitive Respond Mechanism Affective Respond Mecsure the various control systems involved in bioreactor. Measure the various transport phenomena involved in bioprocesses. Demostarte the scale up procedure of mixing ,aeration Demostarte the scale up procedure of mixing ,aeration Cognitive Respond Comparison of bioprocess efficiencies in synthetic and complex industrial media. (CO2) Medium formulation and optimization studies. (CO2) Estimation of biomass concentration for microbial production. (CO3) Determination of drygen mass transfer coefficient by Sulphite oxidation method. (CO3) Yeast cell disruption studies by sonication. High-resolution purification preparative liquid chromatographic techniques. (CO3) Ammonium Sulfate precipitation of protein using yeast cell suspension. (CO4) Crystallization (CO5 Leture Tutorial Practical Total O 0 0 30 30 Text Books: Schuler and Kargi, Bioprocess Principles, Academic press, 2004. E-References: Pauline Doran, Bioprocess Principles, Academic press, 2004. E-References: 	Learn		_					idents						
 Would be able design a particular production process. Course Outcomes Course Outcomes Cognitive Apply Psychomotor Affective Affective Apply Psychomotor Affective Affective Affective Apply Psychomotor Affective Apply Mechanism Affective Respond Cognitive Apply Psychomotor Affective Respond Cognitive Apply Mechanism Affective Respond Cognitive Apply Psychomotor Affective Respond Cognitive Apply Psychomotor Affective<	•			-	-									
Course Outcomes Domain Level CO1 Infer the basic parts of a fermentor and its operations. Cognitive Psychomotor Apply Mechanism Affective Apply CO2 Demonstrate the different media components involved in a fermentation process. Cognitive Psychomotor Apply Mechanism Affective Apply Mechanism CO3 Interpret various control systems involved in bioreactor. Cognitive Psychomotor Apply Mechanism CO4 Measure the various transport phenomena involved in bioprocesses. Cognitive Psychomotor Apply Mechanism Affective CO5 Demostarte the scale up procedure of mixing ,aeration Cognitive Psychomotor Affective Apply Mechanism Respond List of Practical Experiments 1 Determination of thermal death rate constant for a fermentation process. (CO1) Apply 2. Comparison of bioprocess efficiencies in synthetic and complex industrial media. (CO2) Medium formulation and optimization studies. (CO2) 3. Medium formulation and optimization studies. (CO2) Estimation of biognass concentration for microbial production. (CO3) 5. Determination of a product. (CO4) O O 6. Yeast cell disruption studies by sonication. Thigh-resolution purification preparative l	٠	Would t	be able to	design ind	lustrial media	a for fe	rmentatic	n process	•					
CO1 Infer the basic parts of a fermentor and its operations. Cognitive Psychomotor Affective Apply Mechanism Respond CO2 Demonstrate the different media components involved in a fermentation process. Cognitive Psychomotor Apply Mechanism Affective CO3 Interpret various control systems involved in bioreactor. Cognitive Psychomotor Apply Mechanism Affective CO4 Measure the various transport phenomena involved in bioprocesses. Cognitive Psychomotor Apply Mechanism Affective CO5 Demostarte the scale up procedure of mixing ,aeration Cognitive Psychomotor Affective Apply Mechanism Respond List of Practical Experiments 1. Determination of thermal death rate constant for a fermentation process. (CO1) Cognitive Psychomotor Apply Mechanism Respond 2. Comparison of bioprocess efficiencies in synthetic and complex industrial media. (CO2) Medium formulation and optimization studies. (CO2) Estimation of oxygen mass transfer coefficient by Sulphite oxidation method. (CO3) So 5. Determination of a product. (CO4) 0 0 30 30 7. High-resolution purification preparative liquid chromatographic techniques. (CO3) Ammonium Sulfate precipitation of protein using yeast cell suspension. (CO4) CO5 1. Lyophilization (CO5 Int	٠	Would b	e able des	sign a par	ticular produ	ction p	rocess.							
CO1 Infer the basic parts of a fermentor and its operations. Psychomotor Affective Respond Affective Respond CO2 Demonstrate the different media components involved in a fermentation process. Cognitive Psychomotor Affective Respond Apply Psychomotor Affective Respond CO3 Interpret various control systems involved in bioreactor. Cognitive Psychomotor Affective Respond Apply Psychomotor Affective Respond CO3 Measure the various transport phenomena involved in bioprocesses. Cognitive Psychomotor Affective Respond Apply Psychomotor Affective Respond CO5 Demostarte the scale up procedure of mixing ,aeration Cognitive Psychomotor Affective Respond Apply Psychomotor Affective Respond List of Practical Experiments . Determination of thermal death rate constant for a fermentation process. (CO1) Cognitive Respond Respond C Comparison of bioprocess efficiencies in synthetic and complex industrial media. (CO2) Medium formulation and optimization studies. (CO2) Estimation of bioprocess efficiencies in synthetic and complex industrial media. (CO3) S Determination of proper mass transfer coefficient by Sulphite oxidation method. (CO3) Sectomotor Site of the given sample in vacuum tray drier. (CO5) 1. Lettrue Tutorial Practical Total 0 0 30 30 30 2. S		-		Course	Outcomes]	Domaiı	1		Leve	el
CO2 Demonstrate the different media components involved in a fermentation process. Affective Cognitive Apply Psychomotor Mechanism Affective Respond CO3 Interpret various control systems involved in bioreactor. Cognitive Apply Psychomotor Affective Respond CO4 Measure the various transport phenomena involved in bioprocesses. Cognitive Apply Psychomotor Affective Respond CO5 Demostarte the scale up procedure of mixing ,aeration Cognitive Psychomotor Affective Respond 1. Determination of thermal death rate constant for a fermentation process. (CO1) Comparison of bioprocess efficiencies in synthetic and complex industrial media. (CO2) 3. Medium formulation and optimization studies. (CO2) Estimation of biomass concentration for microbial production. (CO3) 5. Determination of oxygen mass transfer coefficient by Sulphite oxidation method. (CO3) Sequentiate precipitation of protein using yeast cell suspension. (CO4) 9. Crystallization of a product. (CO4) 0 30 9. Crystallization of drying time for the given sample in vacuum tray drier. (CO5) 11. Lyophilization (CO5 Lecture Tutorial Practical Practical Total 0 30 30 References: Schuler and Kargi, Bioprocess engineering. Prentice Hall References: Co30												-		
CO2 Demonstrate fermentation process. Apply Apply Psychomotor Affective Apply Psychomotor Affective CO3 Interpret various control systems involved in bioreactor. Cognitive Psychomotor Affective Apply Mechanism Respond CO4 Measure the various transport phenomena involved in bioprocesses. Cognitive Psychomotor Apply Mechanism Affective CO5 Demostarte the scale up procedure of mixing ,aeration Cognitive Psychomotor Affective Apply Psychomotor Mechanism Respond List of Practical Experiments 1. Determination of thermal death rate constant for a fermentation process. (CO1) Cognitive Psychomotor Apply Mechanism Affective 1. Determination of bioprocess efficiencies in synthetic and complex industrial media. (CO2) 4 4. Estimation of bioprocess efficiencies in synthetic and complex industrial media. (CO2) 5 3. Medium formulation and optimization studies. (CO2) 4 4. Estimation of oxygen mass transfer coefficient by Sulphite oxidation method. (CO3) 5. Determination of a product. (CO4) 6 9. Crystallization of a product. (CO4) 30 9. Crystallization of drying time for the given sample in vacuum tray drier. (CO5)	CO1	Infer the	e basic pai	rts of a fei	rmentor and	its oper	ations.				tor			sm
CO2 Demonstrate the different media components involved in a fermentation process. Psychomotor Affective Respond Mechanism Respond CO3 Interpret various control systems involved in bioreactor. Psychomotor Mechanism Affective Respond Apply CO4 Measure the various transport phenomena involved in bioreactor. Cognitive Apply Apply Psychomotor biorocesses. Mechanism Affective Respond Cognitive Apply Mechanism Affective Respond CO5 Demostarte the scale up procedure of mixing ,aeration Cognitive Apply Mechanism Respond List of Practical Experiments 1 Determination of thermal death rate constant for a fermentation process. (CO1) Comparison of bioprocess efficiencies in synthetic and complex industrial media. (CO2) 3. Medium formulation and optimization studies. (CO2) 4 Estimation of oxygen mass transfer coefficient by Sulphite oxidation method. (CO3) 5. Determination of oxygen mass transfer coefficient by Sulphite oxidation method. (CO3) S 8. Ammonium Sulfate precipitation of protein using yeast cell suspension. (CO4) 9 9. Crystallization of a product. (CO4) 0 30 10. Determination of drying time for the given sample in vacuum tray drier. (CO5) 11 Lyophilization (CO5 11. Lyophilization (CO5 Schuler and Kargi, Bioprocess engin													<u> </u>	
CO2 fermentation process. Affective Respond Affective Respond CO3 Interpret various control systems involved in bioreactor. Cognitive Apply Psychomotor Mechanism Affective Respond CO4 Measure the various transport phenomena involved in bioreactor. Cognitive Apply Psychomotor Mechanism Affective Respond CO4 Measure the various transport phenomena involved in bioreactor. Cognitive Apply Psychomotor Mechanism Affective Respond CO4 Measure the various transport phenomena involved in bioreactor. Apply Psychomotor Mechanism Affective Apply Psychomotor Affective Apply Psychomotor Affective Apply Psychomotor Affective <	000	Demons	trate the	different	t media coi	mponer	nts invol	ved in a						
CO3 Interpret various control systems involved in bioreactor. Cognitive Psychomotor Affective bioprocesses. Apply Mechanism Affective Psychomotor Affective Apply Mechanism Respond CO4 Measure the various transport phenomena involved in bioprocesses. Cognitive Psychomotor Affective Apply Mechanism Respond CO5 Demostarte the scale up procedure of mixing ,aeration Cognitive Psychomotor Affective Apply Mechanism Respond List of Practical Experiments 1. Determination of thermal death rate constant for a fermentation process. (CO1) CO2 3. Medium formulation and optimization studies. (CO2) 4. Estimation of biomass concentration for microbial production. (CO3) 5. Determination of oxygen mass transfer coefficient by Sulphite oxidation method. (CO3) 5. 6. Yeast cell disruption studies by sonication. CO3) 8. Ammonium Sulfate precipitation of protein using yeast cell suspension. (CO4) 9. Crystallization of a product. (CO4) 10. 10. 0 30 30 7 Total Practical Total 0 0 30 30 7 High-resolution process engineering. Prentice Hall Ereferences: 8 Pauli	CO2					1			PSy		tor			sm
CO3 Interpret various control systems involved in bioreactor. Psychomotor Affective Mechanism Respond CO4 Measure the various transport phenomena involved in bioreactor. Cognitive Psychomotor Affective Apply Mechanism Respond CO5 Demostarte the scale up procedure of mixing ,aeration Cognitive Psychomotor Affective Apply Mechanism Respond List of Practical Experiments 1. Determination of thermal death rate constant for a fermentation process. (CO1) 2. Comparison of bioprocess efficiencies in synthetic and complex industrial media. (CO2) 3. Medium formulation and optimization studies. (CO2) 4. Estimation of biomass concentration for microbial production. (CO3) 5. Determination of oxygen mass transfer coefficient by Sulphite oxidation method. (CO3) 6. Yeast cell disruption studies by sonication. 7. High-resolution purification preparative liquid chromatographic techniques. (CO3) 8. Ammonium Sulfate precipitation of protein using yeast cell suspension. (CO4) 9. Crystallization of a product. (CO4) 10. Determination (CO5 11. Lyophilization (CO5 Lecture Tutorial Practical 0 30 30 7 Bioprocess engineering. Prentice Hall References: Pauline Doran, Bioprocess Principles, Academic press, 2004. E-References: E-References: Pauline Doran													-	
CO4 Affective Respond CO4 Measure the various transport phenomena involved in bioprocesses. Cognitive Psychomotor Affective Respond Affective Respond CO5 Demostarte the scale up procedure of mixing ,aeration Cognitive Psychomotor Affective Respond Apply Psychomotor Affective Respond List of Practical Experiments . Determination of thermal death rate constant for a fermentation process. (CO1) . Comparison of bioprocess efficiencies in synthetic and complex industrial media. (CO2) 3. Medium formulation and optimization studies. (CO2) . Estimation of bioprocess efficiencies in synthetic and complex industrial media. (CO3) 5. Determination of oxygen mass transfer coefficient by Sulphite oxidation method. (CO3) . . 6. Yeast cell disruption studies by sonication. . . . 7. High-resolution purification preparative liquid chromatographic techniques. (CO3) . . 8. Ammonium Sulfate precipitation of protein using yeast cell suspension. (CO4) . . 9. Crystallization of drying time for the given sample in vacuum tray drier. (CO5) . . 11. Lyophilization (CO5 . . . 22. Constrate termination of drying time for the given sample in vacuum tray drier. (CO5) . . <td< td=""><td>CO3</td><td>Internre</td><th>t various a</th><th>control sv</th><th>stems involv</th><th>ed in hi</th><th>ioreactor</th><th></th><td></td><th>0</th><td>tor</td><th>-</th><td></td><td>m</td></td<>	CO3	Internre	t various a	control sv	stems involv	ed in hi	ioreactor			0	tor	-		m
Measure the various transport phenomena involved in bioprocesses. Cognitive Psychomotor Affective Apply Mechanism Respond CO5 Demostarte the scale up procedure of mixing ,aeration Cognitive Psychomotor Affective Respond Mechanism Respond List of Practical Experiments 1. Determination of thermal death rate constant for a fermentation process. (CO1) 2. Comparison of bioprocess efficiencies in synthetic and complex industrial media. (CO2) 3. Medium formulation and optimization studies. (CO2) 4. Estimation of oxygen mass transfer coefficient by Sulphite oxidation method. (CO3) 5. 5. Determination of a product. (CO4) 9. 9. Crystallization of a product. (CO4) 10. 10. Determination of drying time for the given sample in vacuum tray drier. (CO5) 11. 11. Lyophilization (CO5 11. Lyophilization (CO5) 12. Exetreme Tutorial Practical Total 0 0 30 30 30 19. Exetremecs: Exetremecs: Exetremecs: Exetremecs: 11. Lyophilization, ICO5 Exetremecs: Exetremecs: Exetremecs: 10. Determination of drying time for t	005	шистріє	<i>v</i> unous (control sy			ioreactor.				101			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
CO4 Measure the various transport phenomena involved in psychomotor inprocesses. Psychomotor Affective Mechanism Respond CO5 Demostarte the scale up procedure of mixing ,aeration Cognitive Psychomotor Affective Apply Mechanism Respond List of Practical Experiments 1. Determination of thermal death rate constant for a fermentation process. (CO1) 2. Comparison of bioprocess efficiencies in synthetic and complex industrial media. (CO2) 3. Medium formulation and optimization studies. (CO2) 4. Estimation of biomass concentration for microbial production. (CO3) 5. Determination of oxygen mass transfer coefficient by Sulphite oxidation method. (CO3) 6. 6. Yeast cell disruption studies by sonication. 7. 7. High-resolution purification preparative liquid chromatographic techniques. (CO3) 8. Ammonium Sulfate precipitation of protein using yeast cell suspension. (CO4) 9. Crystallization of a product. (CO4) 10. Determination of drying time for the given sample in vacuum tray drier. (CO5) 11. Lyophilization (CO5 Lecture Tutorial 9. Crystallization of a product. (CO4) 10. Determination of drying time for the given sample in vacuum tray drier. (CO5) <td></td> <td>16</td> <th>.1</th> <th></th> <th></th> <th></th> <th></th> <th></th> <td>Co</td> <th></th> <td></td> <th></th> <td>-</td> <td></td>		16	.1						Co				-	
CO5 Demostarte the scale up procedure of mixing ,aeration Cognitive Psychomotor Affective Respond List of Practical Experiments 1. Determination of thermal death rate constant for a fermentation process. (CO1) 2. Comparison of bioprocess efficiencies in synthetic and complex industrial media. (CO2) 3. Medium formulation and optimization studies. (CO2) 4. Estimation of biomass concentration for microbial production. (CO3) 5. Determination of oxygen mass transfer coefficient by Sulphite oxidation method. (CO3) 6. Yeast cell disruption studies by sonication. 7. High-resolution purification preparative liquid chromatographic techniques. (CO3) 8. Ammonium Sulfate precipitation of protein using yeast cell suspension. (CO4) 9. Crystallization of a product. (CO4) 10. Determination of drying time for the given sample in vacuum tray drier. (CO5) 11. Lyophilization (CO5) Lecture Tutorial Practical Total 0 0 30 30 30 Total References: Schuler and Kargi, Bioprocess engineering. Prentice Hall References: Pauline Doran, Bioprocess Principles, Academic press, 2004. E-References:	CO4			various 1	transport p	henome	ena invo	olved in		-	tor	-		sm
CO5 Demostarte the scale up procedure of mixing ,aeration Psychomotor Affective Mechanism Respond List of Practical Experiments 1. Determination of thermal death rate constant for a fermentation process. (CO1) 2. Comparison of bioprocess efficiencies in synthetic and complex industrial media. (CO2) 3. Medium formulation and optimization studies. (CO2) 4. Estimation of biomass concentration for microbial production. (CO3) 5. 5. Determination of oxygen mass transfer coefficient by Sulphite oxidation method. (CO3) 6. Yeast cell disruption studies by sonication. 7. High-resolution purification preparative liquid chromatographic techniques. (CO4) 9. Crystallization of a product. (CO4) 10. Determination of drying time for the given sample in vacuum tray drier. (CO5) 11. Lyophilization (CO5 Lecture Vertation 0 30 Schuler and Kargi, Bioprocess engineering. Prentice Hall References: Pauline Doran, Bioprocess Principles, Academic press, 2004. E-References: http://38.100.110.143/model/bb/theory.html		Dioproce	esses.						Af	fective		Re	spond	
Affective Respond List of Practical Experiments Affective Respond 1. Determination of thermal death rate constant for a fermentation process. (CO1) 2. Comparison of bioprocess efficiencies in synthetic and complex industrial media. (CO2) 3. Medium formulation and optimization studies. (CO2) 4. Estimation of biomass concentration for microbial production. (CO3) 5. Determination of oxygen mass transfer coefficient by Sulphite oxidation method. (CO3) 6. 6. Yeast cell disruption studies by sonication. 7. 7. High-resolution purification preparative liquid chromatographic techniques. (CO3) 8. Ammonium Sulfate precipitation of protein using yeast cell suspension. (CO4) 9. Crystallization of drying time for the given sample in vacuum tray drier. (CO5) 11. Lyophilization (CO5 Lecture Tutorial Practical Total 0 0 Schuler and Kargi, Bioprocess engineering. Prentice Hall References: Pauline Doran, Bioprocess Principles, Academic press, 2004. E-References: http://38.100.110.143/model/bb/theory.html										0				
List of Practical Experiments 1. Determination of thermal death rate constant for a fermentation process. (CO1) 2. Comparison of bioprocess efficiencies in synthetic and complex industrial media. (CO2) 3. Medium formulation and optimization studies. (CO2) 4. Estimation of biomass concentration for microbial production. (CO3) 5. Determination of oxygen mass transfer coefficient by Sulphite oxidation method. (CO3) 6. Yeast cell disruption studies by sonication. 7. High-resolution purification preparative liquid chromatographic techniques. (CO3) 8. Ammonium Sulfate precipitation of protein using yeast cell suspension. (CO4) 9. Crystallization of a product. (CO4) 10. Determination of drying time for the given sample in vacuum tray drier. (CO5) 11. Lyophilization (CO5 Text Books: Schuler and Kargi, Bioprocess engineering. Prentice Hall References: Pauline Doran, Bioprocess Principles, Academic press, 2004. E-References: http://38.100.110.143/model/bb/theory.html	CO5	Demosta	<i>arte</i> the so	cale up pr	ocedure of m	, nixing	aeration				tor			sm
1. Determination of thermal death rate constant for a fermentation process. (CO1) 2. Comparison of bioprocess efficiencies in synthetic and complex industrial media. (CO2) 3. Medium formulation and optimization studies. (CO2) 4. Estimation of biomass concentration for microbial production. (CO3) 5. Determination of oxygen mass transfer coefficient by Sulphite oxidation method. (CO3) 6. Yeast cell disruption studies by sonication. 7. High-resolution purification preparative liquid chromatographic techniques. (CO3) 8. Ammonium Sulfate precipitation of protein using yeast cell suspension. (CO4) 9. Crystallization of a product. (CO4) 10. Determination of drying time for the given sample in vacuum tray drier. (CO5) 11. Lyophilization (CO5 Excluse Tutorial Practical Total 0 0 30 Schuler and Kargi, Bioprocess engineering. Prentice Hall References: Pauline Doran, Bioprocess Principles, Academic press, 2004. E-References: http://38.100.110.143/model/bb/theory.html									Af	fective		Re	spond	
 2. Comparison of bioprocess efficiencies in synthetic and complex industrial media. (CO2) 3. Medium formulation and optimization studies. (CO2) 4. Estimation of biomass concentration for microbial production. (CO3) 5. Determination of oxygen mass transfer coefficient by Sulphite oxidation method. (CO3) 6. Yeast cell disruption studies by sonication. 7. High-resolution purification preparative liquid chromatographic techniques. (CO3) 8. Ammonium Sulfate precipitation of protein using yeast cell suspension. (CO4) 9. Crystallization of a product. (CO4) 10. Determination of drying time for the given sample in vacuum tray drier. (CO5) 11. Lyophilization (CO5 Lecture Tutorial Practical Total 0 30 30 30 Text Books: Schuler and Kargi, Bioprocess engineering. Prentice Hall References: Pauline Doran, Bioprocess Principles, Academic press, 2004. E-References: http://38.100.110.143/model/bb/theory.html	List o		-		1	- 4 - · · 4 - 6 -				(CO1)				
 Medium formulation and optimization studies. (CO2) Estimation of biomass concentration for microbial production. (CO3) Determination of oxygen mass transfer coefficient by Sulphite oxidation method. (CO3) Yeast cell disruption studies by sonication. High-resolution purification preparative liquid chromatographic techniques. (CO3) Ammonium Sulfate precipitation of protein using yeast cell suspension. (CO4) Crystallization of a product. (CO4) Determination of drying time for the given sample in vacuum tray drier. (CO5) Lyophilization (CO5 Lecture Tutorial Practical Total 0 0 30 30 Text Books: Schuler and Kargi, Bioprocess engineering. Prentice Hall References: Pauline Doran, Bioprocess Principles, Academic press, 2004. E-References: http://38.100.110.143/model/bb/theory.html	1.							-				000		
 4. Estimation of biomass concentration for microbial production. (CO3) 5. Determination of oxygen mass transfer coefficient by Sulphite oxidation method. (CO3) 6. Yeast cell disruption studies by sonication. 7. High-resolution purification preparative liquid chromatographic techniques. (CO3) 8. Ammonium Sulfate precipitation of protein using yeast cell suspension. (CO4) 9. Crystallization of a product. (CO4) 10. Determination of drying time for the given sample in vacuum tray drier. (CO5) 11. Lyophilization (CO5 Lecture Tutorial Practical Total 0 0 30 Schuler and Kargi, Bioprocess engineering. Prentice Hall References: Pauline Doran, Bioprocess Principles, Academic press, 2004. E-References: http://38.100.110.143/model/bb/theory.html		-				•		omplex in	idustr	ial med	1a. (CO_2	2)	
 5. Determination of oxygen mass transfer coefficient by Sulphite oxidation method. (CO3) 6. Yeast cell disruption studies by sonication. 7. High-resolution purification preparative liquid chromatographic techniques. (CO3) 8. Ammonium Sulfate precipitation of protein using yeast cell suspension. (CO4) 9. Crystallization of a product. (CO4) 10. Determination of drying time for the given sample in vacuum tray drier. (CO5) 11. Lyophilization (CO5 Lecture Tutorial Practical Total 0 0 30 Text Books: Schuler and Kargi, Bioprocess engineering. Prentice Hall References: Pauline Doran, Bioprocess Principles, Academic press, 2004. E-References: http://38.100.110.143/model/bb/theory.html				-										
 6. Yeast cell disruption studies by sonication. 7. High-resolution purification preparative liquid chromatographic techniques. (CO3) 8. Ammonium Sulfate precipitation of protein using yeast cell suspension. (CO4) 9. Crystallization of a product. (CO4) 10. Determination of drying time for the given sample in vacuum tray drier. (CO5) 11. Lyophilization (CO5 Lecture Tutorial Practical Total 0 0 30 Text Books: Schuler and Kargi, Bioprocess engineering. Prentice Hall References: Pauline Doran, Bioprocess Principles, Academic press, 2004. E-References: http://38.100.110.143/model/bb/theory.html							-							
 7. High-resolution purification preparative liquid chromatographic techniques. (CO3) 8. Ammonium Sulfate precipitation of protein using yeast cell suspension. (CO4) 9. Crystallization of a product. (CO4) 10. Determination of drying time for the given sample in vacuum tray drier. (CO5) 11. Lyophilization (CO5 Lecture Tutorial Practical Total 0 0 30 30 Text Books: Schuler and Kargi, Bioprocess engineering. Prentice Hall Keferences: Pauline Doran, Bioprocess Principles, Academic press, 2004. E-References: Lecture Lecture http://38.100.110.143/model/bb/theory.html							ent by Su	lphite oxi	datio	n metho	od. (CO3)	
 8. Ammonium Sulfate precipitation of protein using yeast cell suspension. (CO4) 9. Crystallization of a product. (CO4) 10. Determination of drying time for the given sample in vacuum tray drier. (CO5) 11. Lyophilization (CO5 Lecture Tutorial Practical Total 0 0 30 Text Books: Schuler and Kargi, Bioprocess engineering. Prentice Hall References: Pauline Doran, Bioprocess Principles, Academic press, 2004. E-References: http://38.100.110.143/model/bb/theory.html	6.		-		•									
9. Crystallization of a product. (CO4) 10. Determination of drying time for the given sample in vacuum tray drier. (CO5) 11. Lyophilization (CO5 Lecture Tutorial Practical Total 0 0 30 30 Text Books: Schuler and Kargi, Bioprocess engineering. Prentice Hall References: Pauline Doran, Bioprocess Principles, Academic press, 2004. E-References: http://38.100.110.143/model/bb/theory.html 5/2004	7.	High-res	solution p	urificatior	n preparative	liquid o	chromato	graphic te	chnic	lues. (C	:03)			
10. Determination of drying time for the given sample in vacuum tray drier. (CO5) 11. Lyophilization (CO5 Lecture Tutorial Practical Total 0 0 30 30 Text Books: Schuler and Kargi, Bioprocess engineering. Prentice Hall References: Pauline Doran, Bioprocess Principles, Academic press, 2004. E-References: http://38.100.110.143/model/bb/theory.html	8.				_	tein usii	ng yeast o	cell suspen	nsion	(CO4)				
11. Lyophilization (CO5LectureTutorialPracticalTotal003030Text Books:Schuler and Kargi, Bioprocess engineering. Prentice HallReferences:Pauline Doran, Bioprocess Principles, Academic press, 2004.E-References:http://38.100.110.143/model/bb/theory.html	9.	Crystall	zation of	a product	. (CO4)									
LectureTutorialPracticalTotal003030Text Books:Schuler and Kargi, Bioprocess engineering. Prentice HallReferences:Pauline Doran, Bioprocess Principles, Academic press, 2004.E-References:http://38.100.110.143/model/bb/theory.html					ne for the given	ven san	nple in va	cuum tray	drie	r. (CO5)			
003030Text Books:Schuler and Kargi, Bioprocess engineering. Prentice HallReferences:Pauline Doran, Bioprocess Principles, Academic press, 2004.E-References:http://38.100.110.143/model/bb/theory.html	11	. Lyophili	ization (C	05										
Text Books: Schuler and Kargi, Bioprocess engineering. Prentice Hall References: Pauline Doran, Bioprocess Principles, Academic press, 2004. E-References: http://38.100.110.143/model/bb/theory.html		Lecture	e		Tutorial		Р	ractical				Tot	al	
Schuler and Kargi, Bioprocess engineering. Prentice Hall References: Pauline Doran, Bioprocess Principles, Academic press, 2004. E-References: http://38.100.110.143/model/bb/theory.html		•			0			30				30		
References: Pauline Doran, Bioprocess Principles, Academic press, 2004. E-References: http://38.100.110.143/model/bb/theory.html														
Pauline Doran, Bioprocess Principles, Academic press, 2004. E-References: http://38.100.110.143/model/bb/theory.html			rgi, Biopro	ocess engi	ineering. Pre	ntice H	all							
E-References: http://38.100.110.143/model/bb/theory.html			D '	D · · · ·			0004							
http://38.100.110.143/model/bb/theory.html			Bioproces	ss Principl	es, Academi	c press,	, 2004.							
			0 1 4 2 /	dal/bk /41 -	om html									
	mup.//	50.100.11	0.145/110		Jecuare.IIIIII	L								

			PROGRAM OUTCOMES											
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3		2	2								1	2	2
CO2	2	3	2	1	1		1		1		3	2	3	3
CO3	1	3	3	2					1			1	0	0
CO4	1	3	3	2								1	0	0
CO5	1	3	2	2	1		1		2		2		1	1
Total	9	12	12	9	2	0	2	0	4	0	5	5	6	6
ScaledValue	2	3	3	2	1	0	1	0	1	0	1	1	2	2
		1 –	$5 \rightarrow 1$	l,		6 -	- 10 -	→ 2,		11	- 15	$\rightarrow 3$		
	(0-NoR	elatio	n,1-I	Low R	elatio	n,2-M	ledium	nRelat	tion,3-I	HighR	elatio	n	

VII Semester

	L T P C XBT701 3 0 0 3													
X	BT7(01			3	0	0	3						
C	n		Microbial Biotechnology		т	T	п	тт						
C 3	<u>Р</u> 0	A 0			L 3	T 0	P 0	$\frac{\mathrm{H}}{\mathrm{3}}$						
-	-	site: -			5	U	U	3						
	-													
	0	•	ctives:											
Upol		_	on of this course, the students	(1 1°)										
•			e able to explain industrial production of various me		. • 1	1.		1						
•		ould a search	apply the knowledge of process associated mechani	sms in Indu	istrial	biote	chno	logy						
			Course Outcomes	Domair	1	Ι	evel							
After	the	compl	etion of the course, students will be able to											
CO		Outline	the general concepts of microbial system and	Cognitive		Reme								
CO.	d		<i>e</i> the development	Cognitive		Under	stanc	1						
aa			e various mechanisms of medium and discuss the	a		Under	stanc	1						
CO	2 n	nediun	n role in Bioreactor.	Cognitive										
CO.	, <i>L</i>	Discuss	the rDNA concept and <i>explain</i> the related	Comitivo		Reme	mber							
CO.	n		ial processes	Cognitive		Under	stanc	1						
CO4	1 ·	Expla	nins the production of primary metabolites and	Cognitive		Reme	mber							
CO	Û		their interactions.			Under	stanc	1						
CO			is the production of secondary metabolites and	Cognitive		Reme								
CO.	j iu	lentify	their interactions.			Under	stanc	1						
Unit	-I In	trodu	ction and Historical developments in microbial B	iotechnolog	y		9							
Intro	ducti	on ar	nd Historical developments in industrial microl	biology; in	dustri	ally i	mpo	rtant						
micro	obes	and	metabolic pathways; Various Microbial metaboli	ites and th	eir C	Verpr	oduc	tion;						
Isola	tion	and se	lection of industrially important microorganisms; F	reservation	and a	mainte	enanc	e of						
micro	obial	cultur	es.											
mer			n and Bioreactor				9							

		n; Components of microbial f		1
-		tic and submerged fermentat	ions; Desig	gn of laboratory
•••		reactor, bubble column. for microbial processes		9
	e	es for development of indus	trial micro	-
		athway engineering of micro		
	,Screening strategies fo		oos ioi pio	
1 0	n of Microbial primary	1		9
	* *	r's Yeast, Mushroom; Prod	uction of f	ermented foods;
Alcoholic beverage	s- wine, beer, etc.; Produ	uction of Ethanol, Citric acid;	Amino aci	ds and vitamins;
Microbial enzymes	for food, detergent and I	pharma industry; Biopesticide	es and biofe	rtilizers
Unit-VProduction	of microbial secondary	v metabolites		9
Production of Ant	biotics- penicillin and	other antibiotics; Pigments,	Microbial	transformation,
		normones, Bioplastic product		
	recombinant proteins and		, 0	1
Lecture	Tutorial	Practical		Total
45	0	0		45
Text Books:				
1. Process Biot	echnology Fundamental	ls, Satya Narayan Mukhopadl	yay 4th Ed	n, 2018
	01	s, Academic press, 2004.	5 5	
References:		· · · · ·		
5. Neilson J an	d Villadsen J, Biochemi	cal Engineering Principles I e	d, Plenum	Press, 2000.
		Ill S.J, Principles of Fermen		
Aditya Bool	x Pvt Ltd, 2001.	-		
E – References				
· · · ·	* • •	ubus.php?subjectId=10210702		
-		lication/NPRBiocatalysisRev	.pdf	
3 http://link.sr	ringer.com/book/10.100)7%2F978-1-4684-0324-4		

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3											1	2	2
CO 2	2	3	2		1		1		1		3	2	3	3
CO 3	1	2	2	1					1			1	0	0
CO 4	1	3	2	3								1	0	0
CO 5	1	3	2	3	1		1		2		2		1	1
	8	11	8	7	2	0	2	0	4	0	5	5	6	6

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

Mapping of Subjects with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Original Value	8	11	8	7	2	0	2	0	4	0	5	5	6	6
Scaled Value	2	3	2	2	1	0	1	0	1	0	1	1	2	2

 $1 - 5 \rightarrow 1, \qquad 6 - 10 \rightarrow 2, \qquad 11 - 15 \rightarrow 3$

					-	T	D	С			
VD	XBT702 ECOMBINANT DNA TECHNOLOGY										
АВ	1/02		RECOMBINANT DNA TECHNOLOGY								
C F	P A		RECOMBINANT DNA TECHNOLOG	Ĩ	L	Т	Р	Η			
	$\begin{array}{c c} \mathbf{A} \\ 0 \\ 0 \end{array}$				<u> </u>	0	<u>г</u> 0	<u>п</u> 3			
-	0	Genetics I	Molecular biology		5	U	U	5			
	ning Obj										
	<u> </u>		course, the students								
•			ed the concepts of gene cloning and its app	lication.							
•			ed the various techniques involved in Reco		JA Te	chnolog	gy.				
		(Course Outcomes	Domai	n		Level				
After	the comp	letion of the	he course, students will be able to								
CO1			concepts of gene cloning and various odification enzymes	Cognitive		Reme	nber				
CO2	Explain	i and <i>distii</i>	<i>rguish</i> various vector systems	Cognitive		Remer Under					
CO3	Describ involve	· ·	pares and Identifies various techniques	Cognitive		Remended Analy					
CO4		es, Manipection met	<i>pulates</i> and <i>Describes</i> various screening nods.	Cognitive		Under Apply					
CO5	-	a and App Biosafety g	<i>ly</i> the applications of rDNA technology uidelines.	Cognitive		Remer Apply					
			Course content]	Hours				
		^	ene Cloning				9				
			nant DNA technology- Restriction &								
		-	lymerases, Polynucleotide kinases and alka ing, Design of linkers and adaptors.	inne phospi	latases	s, DNA	ngase	s and			
		and Vecto					9				
			g vectors, types of bacterial plasmid vec	tors (pBR3	22. n	UC57	/	1). λ			
			smids, phagemids, yeast artificial chromos								
			l chromosomes as cloning vector. Expression								
vector		•	· · ·					vırus			
	S.							virus			
III – N	Molecula	r Technic					9				
III – N DNA	Molecula labelling	(radioacti	ve and non-radioactive method); DNA seq	•			rt, Sar	igers,			
III – N DNA pyro-s	Molecula labelling sequencir	(radioacti ng, shotgu	ve and non-radioactive method); DNA seq n sequencing method)'; Southern, northe	ern and we	stern	blotting	rt, Sar g- PC	igers, CR –			
III – M DNA pyro-s Princi	Molecula labelling sequencin ple- type	(radioacti ng, shotgu s- applicat	ve and non-radioactive method); DNA seq n sequencing method)'; Southern, northe ions- DNA fingerprinting (RAPD; RFLP, A	ern and we	stern	blotting	rt, Sar g- P(sensor	igers, CR –			
III – M DNA pyro-s Princip IV – S	Molecula labelling sequencin ple- type Screening	(radioacti ng, shotgu s- applicat g and Sele	ve and non-radioactive method); DNA seq n sequencing method)'; Southern, northo ions- DNA fingerprinting (RAPD; RFLP, A ction of Transformants	ern and we AFLP).biose	estern ensing	blotting and bio	rt, Sar g- P(sensor 9	igers, CR –			
III – M DNA pyro-s Princij IV – S Transf	Molecula labelling sequencin ple- type Screening fer of rD	(radioacti ng, shotgu s- applicat g and Sele DNA into o	ve and non-radioactive method); DNA seq n sequencing method)'; Southern, northe ions- DNA fingerprinting (RAPD; RFLP, A ction of Transformants cells- transformation, transfection, Sonopc	ern and we AFLP).biose pration, Mic	estern onsing roinje	blotting and bio	rt, Sar g- PC sensor 9 nd Cal	gers, CR –			
III – M DNA pyro-s Princij IV – S Transf phospl	Molecula labelling sequencin ple- type Screening fer of rD hate met	(radioacti ng, shotgu s- applicat g and Sele PNA into o hods- Gen	ve and non-radioactive method); DNA seq n sequencing method)'; Southern, northo ions- DNA fingerprinting (RAPD; RFLP, A ction of Transformants cells- transformation, transfection, Sonopo omic and cDNA library construction- Sele	ern and we AFLP).biose pration, Mic action and se	estern ensing roinje creeni	blotting and bio ction and ng of re	rt, Sar g- P(sensor 9 nd Cal combi	igers, CR – cium nants			
III – M DNA pyro-s Princij IV – S Transf phospl – nuc	Molecula labelling sequencin ple- types Screening fer of rD hate methe leic acid	(radioacti ng, shotgu s- applicat g and Sele DNA into o hods- Gen l hybridiz	ve and non-radioactive method); DNA seq n sequencing method)'; Southern, northo- ions- DNA fingerprinting (RAPD; RFLP, A ction of Transformants cells- transformation, transfection, Sonopco- omic and cDNA library construction- Sele ation- Grunsteinhogness and benten- Da	ern and we AFLP).biose pration, Mic oction and so vis plaque	roinje metho	blotting and bio ction an ng of re od, imr	rt, Sar g- PC sensor 9 nd Cal combin nunolo	igers, CR – cium nants			
III – M DNA pyro-s Princij IV – S Transf phospl – nuc screen	Molecula labelling sequencing ple- types Screening fer of rD hate methe leic acido ning- Blu	(radioacti ng, shotgu <u>s- applicat</u> g and Sele DNA into o hods- Gen l hybridiz ne – white	ve and non-radioactive method); DNA seq n sequencing method)'; Southern, northe ions- DNA fingerprinting (RAPD; RFLP, A ction of Transformants cells- transformation, transfection, Sonopo omic and cDNA library construction- Sele ation- Grunsteinhogness and benten- Da selection- Reporter gene based selection- G	ern and we AFLP).biose pration, Mic oction and so vis plaque	roinje metho	blotting and bio ction an ng of re od, imr	rt, Sar g- PC sensor 9 nd Cal combin nunolo	igers, CR – cium nants			
$\frac{III - N}{DNA}$ pyro-s Princip $IV - S$ Transf phospl - nuc screen $V - A$	Molecula labelling sequencin ple- type Screening fer of rD hate metheleic acid ning- Blu pplicatio	(radioacti ng, shotgu s- applicat g and Sele NA into o hods- Gen l hybridiz ne – white ons of Ree	ve and non-radioactive method); DNA seq n sequencing method)'; Southern, northo- ions- DNA fingerprinting (RAPD; RFLP, A ction of Transformants cells- transformation, transfection, Sonopco- omic and cDNA library construction- Sele ation- Grunsteinhogness and benten- Da selection- Reporter gene based selection- G combinant DNA Technology	ern and we AFLP).biose pration, Mic ection and se vis plaque US, GFP an	estern ensing roinje creenin metho nd Luc	blotting and bio ction an ng of re od, imr ciferase.	rt, Sar g- P(sensor 9 nd Cal combi nunolo	cium nants			
$\frac{III - N}{DNA}$ pyro-s Princip $IV - S$ Transf phospl - nuc screen $V - A$ Produce	Molecula labelling sequencing ple- types Screening fer of rD hate methe leic acid ning- Blu pplication ction of	(radioacti ng, shotgu s- applicat g and Sele DNA into o hods- Gen l hybridiz ne – white ons of Ree recombina	ve and non-radioactive method); DNA seq n sequencing method)'; Southern, northe ions- DNA fingerprinting (RAPD; RFLP, A ction of Transformants cells- transformation, transfection, Sonopo omic and cDNA library construction- Sele ation- Grunsteinhogness and benten- Da selection- Reporter gene based selection- G	ern and we AFLP).biose pration, Mic action and se vis plaque BUS, GFP and e and gene	roinje creenin metho d Luc thera	blotting and bio ction an ng of re od, imr ciferase. py- ger	rt, San g- P(sensor 9 nd Cal combin nunolo 9 ne siler	cium nants ogical			
III – M DNA pyro-s Princij IV – S Transf phospl – nuc screen V – A Produc using	Molecula labelling sequencing ple- type Screening fer of rD hate metheleic acid hing- Blu pplicatio ction of RNAi. G	(radioacti ng, shotgu s- applicat g and Sele DNA into o hods- Gen l hybridiz ne – white ons of Ree recombina Genetic ma	ve and non-radioactive method); DNA seq n sequencing method)'; Southern, northo- ions- DNA fingerprinting (RAPD; RFLP, A ction of Transformants cells- transformation, transfection, Sonopco- omic and cDNA library construction- Sele ation- Grunsteinhogness and benten- Da selection- Reporter gene based selection- G combinant DNA Technology ant- insulin, human growth factor, vaccin nipulation of animal cells – early methods garding rDNA techniques-	ern and we AFLP).biose pration, Mic action and se vis plaque US, GFP and e and gene and Crispr	roinje creenin metho d Luc thera	blotting and bio ction an ng of re od, imr ciferase. py- ger	rt, San g- P(sensor 9 nd Cal combin nunolo 9 ne siler	cium nants ogical			
III – M DNA pyro-s Princij IV – S Transf phospl – nuc screen V – A Produc using	Molecula labelling sequencing ple- type Screening fer of rD hate metheleic acid hing- Blu pplicatio ction of RNAi. G	(radioacti ng, shotgu s- applicat g and Sele NA into o hods- Gen l hybridiz ne – white ons of Reo recombina denetic ma ioethics re	ve and non-radioactive method); DNA seq n sequencing method)'; Southern, northe ions- DNA fingerprinting (RAPD; RFLP, A ction of Transformants cells- transformation, transfection, Sonopco omic and cDNA library construction- Sele ation- Grunsteinhogness and benten- Da selection- Reporter gene based selection- G combinant DNA Technology int- insulin, human growth factor, vaccin nipulation of animal cells – early methods	ern and we AFLP).biose pration, Mic action and se vis plaque US, GFP and e and gene and Crispr	roinje creenin metho d Luc thera	blotting and bio ction an ng of re od, imr ciferase. py- ger	rt, San g- PC sensor 9 nd Cal combin nunolo 9 ne silen genic p	cium nants ogical			

Text Books:

1. Primrose S.B. and Twymann R.H., "Principles of Gene Manipulation: An Introduction to Genetic Engineering", Sixth Edition, Blackwell Scientific Publications, 2004.

Reference Books:

- 1. Brown T.A., "GeneCloning and DNA Analysis", Fourth Edition, Blackwell Scientific Publications, 2003.
- 2. Glick B.R. and Pasternak J.J., "Molecular Biotechnology", Third Edition, ASM Press, 2003.
- 3. Sandhu, Sardul Singh. Recombinant DNA technology. IK International Pvt Ltd, 2010.

E-References:

1. http://nptel.ac.in/courses/102103013/

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	1	2	1	1	1	0	0	1	0	1	0	0	0
CO 2	3	0	3	2	2	1	0	0	0	0	1	0	1	1
CO 3	3	0	3	1	3	0	0	1	0	2	0	0	1	1
CO 4	3	0	3	1	3	0	0	2	0	1	0	0	1	0
CO 5	3	0	3	2	3	2	3	3	0	1	2	0	1	0
	13	1	14	7	12	4	3	6	1	4	4	0	4	2

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

Mapping of Subjects with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Original Value	13	1	14	7	12	4	3	6	1	4	4	0	0	0
Scaled Value	3	1	3	2	3	1	1	2	1	1	1	0	0	0
$1-5 \rightarrow 1$	l,		6 - 10	$\rightarrow 2$,		11	1 – 15 -	$\rightarrow 3$						

 $6-10 \rightarrow 2$, $1-5 \rightarrow 1$,

			L	T	P	С
XBT703A			2	1	0	3
	STEM CELL BIOTECHNOLOGY					
C P A			L	Т	P	Η
3 0 0			2	1	0	3
Prerequisite:	- Cell biology, Immunology					
Learning Ob	jective:					
Upon comple	tion of this course, the students					
Would	able to explain about various categories of stem cells.					
Would	have learned the application of stem cell technology.					
	Course Outcomes	Domain		Ι	Level	
On the succes	sful completion of the course, students will be able to)				
CO1: Able to	recall and interpret the biology of stem cells.	Cognitive		Reme	mbe	r
				Unde	rstan	d
CO2: Explain	<i>i</i> and develop the embryonic stem cell culturing.	Cognitive		Unde	rstan	d
_		-		Apply	y	
	102 oth				10	00 0

CO4:Explain and evaluate thevarious techniques involved in stem cell assay. Cognitive Understand Evaluate CO5: Discuss and apply the various applications of stem cells. Cognitive Understand I Basics of Stem Cell 6+3 Unique properties of stem cells – embryonic stem cells , history and development, characteristics Adult stem cells. Properies, types, clinical applications umbilical cord stem cells – Similarities ar differences between embryonic and adult stem cells - Properties of stem cells – blastocyst inner cell mass – growing ES cells in lab – laboratory tests to identify ES cells – stimulation E cells for differentiation – properties of ES cells. 6+2 II - Adult Stem Cells , iPSCs 5+2 Somatic stem cells – test for identification of adult stem cells – adult stem cell differentiation trans differentiation – plasticity – different types of adult stem cells. 6+3 Target identification – Manipulating differentiation pathways – stem cell therapy Vs ce protection –Hematopoietic colony forming cell assay- stem cell in cellular assays for screening stem cell based drug discovery, drug screening and toxicology. 9+3 V - Applications of Stem Cells 13 0 45 Text Books 1. 1.3 0 45 Text Books 1. 1.3 0 45 Text Books 1. 1. Total 32 13 0 45	CO3:Discussand	analyze the differentiation o	f stem cells	Cognitive	Unde Anal	erstand vze
cell assay. Evaluate CO5: Discuss and apply the various applications of stem cells. Cognitive Understand I- Basics of Stem Cell 6+3 Unique properties of stem cells – embryonic stem cells , history and development, characteristics ad differences between embryonic and adult stem cells , Properies of stem cells – Similarities ar differences between embryonic and adult stem cells - Properties of stem cells – pluripotency. 6+2 In vitro fertilization – culturing of embryos-isolation of human embryonic stem cells – blastocyst inner cell mass – growing ES cells in lab – laboratory tests to identify ES cells – blastocyst inner cell mass – growing ES cells in lab – laboratory tests to identify ES cells – stimulation E cells for differentiation – properties of ES cells. 6+2 II - Adult Stem Cells , iPSCs 5+2 Somatic stem cells - jastocyst inner cell mass – growing ES cells in lab – laboratory tests to identify ES cells – stimulation E cells for different types of adult stem cells – adult stem cell differentiation trans differentiation – plasticity – different types of adult stem cells – adult stem cell differentiation trans differentiation – plasticity – different types of adult stem cell in cellular assays for screening stem cell based drug discovery, drug screening and toxicology. 9+3 V- Applications of Stem Cells 9+3 Stem cell therapy for Mental disabilities, Diabetes Mellitus – Therapeutic applications Parkinsondisease - Neurological disorder – limb amputation – heart disease - spinal cord injuries diabetes – burns - HLA typing- Alzheimer's disease – tissue engineering application – producti of complete orga	CO4:Explain and	d evaluate thevarious techn	iques involved in stem	Cognitive		
COS: Discuss and apply the various applications of stem cells. Cognitive Understand I. Basics of Stem Cell 6+3 Unique properties of stem cells – embryonic stem cells , history and development, characteristics Adult stem cells , Properies, types, clinical applications umbilical cord stem cells – Similarities at a differences between embryonic and adult stem cells - Properties of stem cells – pluripotency totipotency. 6+2 II - Embryonic Stem Cells 6+2 In vitro fertilization – culturing of embryos-isolation of human embryonic stem cells – blastocyst inner cell mass – growing ES cells in lab – laboratory tests to identify ES cells – stimulation E cells for differentiation – properties of ES cells. 6+2 III - Adult Stem Cells _ test for identification of adult stem cells – adult stem cell differentiation rans differentiation – plasticity – different types of adult stem cells. 6+3 V- Stem Cell in Drug Discovery and Assay 6+3 Target identification o - Manipulating differentiation pathways – stem cell therapy Vs cervote: colony forming cell assay - stem cell therapy Vs cervote: colony forming cell assay - stem cell in cellular assays for screening stem cell based drug discovery, drug screening and toxicology. 9+3 V- Applications of Stem Cells 9+3 9+3 Stem cell therapy for Mental disabilities, Diabetes Mellitus – Therapeutic applications – productio of complete organ - kidney – eyes - heart – brain. 1 Lecture Tutorial Practical	-		1	U	Eval	uate
Unique properties of stem cells – embryonic stem cells , history and development, characteristics Adult stem cells , Properies, types, clinical applications umbilical cord stem cells – Similarities ar differences between embryonic and adult stem cells - Properties of stem cells – blastocyst II- Embryonic Stem Cells 6 4-2 In vitro fertilization – culturing of embryos-isolation of human embryonic stem cells – blastocyst inner cell mass – growing ES cells in lab – laboratory tests to identify ES cells – stimulation E cells for differentiation – properties of ES cells. III - Adult Stem Cells , iPSCs 5+2 Somatic stem cells – test for identification of adult stem cells – adult stem cell differentiation trans differentiation – plasticity – different types of adult stem cells. IV - Stem Cell in Drug Discovery and Assay 6+3 Target identification – Manipulating differentiation pathways – stem cell therapy Vs ce protection –Hematopoietic colony forming cell assay- stem cell in cellular assays for screening stem cell therapy for Mental disabilities, Diabetes Mellitus – Therapeutic applications parkinsondisease - Neurological disorder – limb amputation – heart disease - spinal cord injuries diabetes –burns - HLA typing- Alzheimer's disease – tissue engineering application – productic of complete organ - kidney – eyes - heart – brain. Lecture Tutorial Practical Total 32 13 0 45 Text Books 1. Kursad and Turksen, Embryonic Stem Cells; Humana Press; 2002. 2. Dr. Logeswariselvaraj, Stem Cells MJP Publishers,2015. References 1. Mohan C. Vemuri, Stem Cell Assays, Springer International Edition; 2010. 2. Stem cell and future of regenerative medicine. By committee on the Biological an Biomedical applications of Stem cell Research. 2002. National Academic press. E References 1. http://nptel.ac.in/courses/102103012/41 pping of COs Vs POs	CO5: Discuss and	<i>d apply</i> the various applicat	ions of stem cells.	Cognitive	Unde	erstand
Adult stem cells ,Properies, types, clinical applications umbilical cord stem cells – Similarities ar differences between embryonic and adult stem cells - Properties of stem cells – pluripotency. II Embryonic Stem Cells 6+2 In vitro fertilization – culturing of embryos-isolation of human embryonic stem cells – blastocyst inner cell mass – growing ES cells in lab – laboratory tests to identify ES cells – stimulation E cells for differentiation – properties of ES cells. III - Adult Stem Cells , iPSCs 5+2 Somatic stem cells – test for identification of adult stem cells – adult stem cell differentiation trans differentiation – plasticity – different types of adult stem cells. 6+3 V- Stem Cell in Drug Discovery and Assay 6+3 Target identification – Manipulating differentiation pathways – stem cell therapy Vs ce protection –Hematopotetic colony forming cell assay- stem cell in cellular assays for screening stem cell based drug discovery, drug screening and toxicology. 9+3 Stem cell therapy for Mental disabilities, Diabetes Mellitus – Therapeutic applications parkinsondisease - Neurological disorder – limb amputation – heart disease - spinal cord injuries diabetes –burns - HLA typing- Alzheimer's disease –tissue engineering application – productic of complete organ - kidney – eyes - heart – brain. Lecture Tutorial Practical Total 32 13 0 45 Text Books 1 Nunsa and Turksen, Embryonic Stem Cells; Humana Press; 2002. 2. Dr. LogeswariSelvaraj, Stem Cell	I- Basics of Sten	n Cell				6+3
differences between embryonic and adult stem cells - Properties of stem cells – pluripotency. II-Embryonic Stem Cells III - Adult Stem Cells i PSCs Somatic stem cells – growing ES cells in lab – laboratory tests to identify ES cells – stimulation E cells for differentiation – properties of ES cells. III - Adult Stem Cells, iPSCs Somatic stem cells – test for identification of adult stem cells – adult stem cell differentiation rans differentiation – plasticity – different types of adult stem cells – adult stem cell differentiation rans differentiation – Manipulating differentiation pathways – stem cell therapy Vs ce protection –Hematopoietic colony forming cell assay- stem cell in cellular assays for screening stem cell therapy for Mental disabilities, Diabetes Mellitus – Therapeutic applications Parkinsondisease - Neurological disorder – limb amputation – heart disease - spinal cord injuries diabetes –burns - HLA typing- Alzheimer's disease –tissue engineering application – productic of complete organ - kidney – eyes - heart – brain. Lecture Tutorial Practical Total 32 13 0 45 Cest Books 1. Kursad and Turksen, Embryonic Stem Cells; Humana Press; 2002. 2. Dr. LogeswariSelvaraj, Stem Cell Assay, Springer International Edition; 2010. 2. Stem cell and future of regenerative medicine. By committee on the Biological an Biomedical applications of Stem cell Research. 2002. National Academic press. E References 1. http://nptel.ac.in/courses/102103012/41 pping of COs Vs POs	Unique properties	of stem cells – embryonic	stem cells , history and	developmen	nt, chara	cteristic
totipotency. 6+2 In vitro fertilization – culturing of embryos-isolation of human embryonic stem cells – blastocyst inner cell mass – growing ES cells in lab – laboratory tests to identify ES cells – stimulation E cells for differentiation – properties of ES cells. III - Adult Stem Cells , iPSCs 5+2 Somatic stem cells – test for identification of adult stem cells – adult stem cell differentiation trans differentiation – plasticity – different types of adult stem cells. 5+2 Voit Stem Cell in Drug Discovery and Assay 6+3 Target identification – Manipulating differentiation pathways – stem cell therapy Vs ce protection –Hematopoietic colony forming cell assay- stem cell in cellular assays for screening stem cell based drug discovery, drug screening and toxicology. V - Applications of Stem Cells 9+3 Stem cell therapy for Mental disabilities, Diabetes Mellitus – Therapeutic applications parkinsondisease - Neurological disorder – limb amputation – heart disease - spinal cord injuries diabetes –burns - HLA typing- Alzheimer's disease –tissue engineering application – productic of complete organ - kidney – eyes - heart – brain. Lecture Tutorial Practical Total 32 13 0 45 Test Books 1 Nursen, Embryonic Stem Cells; Humana Press; 2002. 2. Dr. LogeswariSelvaraj, Stem Cell Assays, Springer International Edition; 2010. 2. Stem cell and future of regenerative medicine. By committee on the Biological an Biomedical applications of Stem cell Re	Adult stem cells,	Properies, types, clinical ap	plications umbilical co	rd stem cell	s– Simil	arities a
II- Embryonic Stem Cells 6+2 In vitro fertilization – culturing of embryos-isolation of human embryonic stem cells – blastocyst inner cell mass – growing ES cells in lab – laboratory tests to identify ES cells – stimulation E cells for differentiation – properties of ES cells. 5+2 Somatic stem cells - test for identification of adult stem cells – adult stem cell differentiation rans differentiation – plasticity – different types of adult stem cells. 5+2 Somatic stem cells - test for identification of adult stem cells. 6+3 Target identification – Manipulating differentiation pathways – stem cell therapy Vs ce protection –Hematopoietic colony forming cell assay- stem cell in cellular assays for screening stem cell based drug discovery, drug screening and toxicology. 9+3 Stem cell therapy for Mental disabilities, Diabetes Mellitus – Therapeutic applications Parkinsondisease - Neurological disorder – limb amputation – herat disease - spinal cord injuries diabetes –burns - HLA typing- Alzheimer's disease –tissue engineering application – productic of complete organ - kidney – eyes - heart – brain. Lecture Tutorial Practical Total 32 13 0 45 Text Books 1. Nuksen, Embryonic Stem Cells; Humana Press; 2002. 2. 2. Dr. Logeswariselvaraj, Stem Cell Assays, Springer International Edition; 2010. 2. Stem cell and future of regenerative medicine. By committee on the Biological an Biomedical applications of Stem cell Research. 2002. National Academic press.	differences betwe	en embryonic and adult st	em cells - Properties of	of stem cells	s – pluri	ipotency
In vitro fertilization –culturing of embryos-isolation of human embryonic stem cells – blastocyst inner cell mass – growing ES cells in lab – laboratory tests to identify ES cells – stimulation E cells for differentiation – properties of ES cells. III - Adult Stem Cells , iPSCs 5+2 Somatic stem cells – test for identification of adult stem cells – adult stem cell differentiation trans differentiation – plasticity – different types of adult stem cells. IV- Stem Cell in Drug Discovery and Assay 6+3 Target identification – Manipulating differentiation pathways – stem cell therapy Vs ce protection – Hematopoietic colony forming cell assay- stem cell in cellular assays for screening stem cell based drug discovery, drug screening and toxicology. V- Applications of Stem Cells 9+3 Stem cell therapy for Mental disabilities, Diabetes Mellitus – Therapeutic applications Parkinsondisease - Neurological disorder – limb amputation – heart disease - spinal cord injuries diabetes –burns - HLA typing- Alzheimer's disease – tissue engineering application – productio of complete organ - kidney – eyes - heart – brain. Lecture Tutorial Practical Total 32 13 0 45 Text Books 1. Kursad and Turksen, Embryonic Stem Cells; Humana Press; 2002. 2. Dr. Logeswariselvaraj, Stem Cell Assays, Springer International Edition; 2010. 2. Stem cell and future of regenerative medicine. By committee on the Biological an Biomedical applications of Stem cell Research. 2002. National Academic press. E References 1. http://nptel.ac.in/courses/102103012/41 pping of COs Vs POs						
inner cell mass – growing EŠ cells in lab – laboratory tests to identify ES cells – stimulation E cells for differentiation – properties of ES cells. III - Adult Stem Cells, iPSCs 5+2 Somatic stem cells – test for identification of adult stem cells – adult stem cell differentiation trans differentiation – plasticity – different types of adult stem cells. IV- Stem Cell in Drug Discovery and Assay 6+3 Target identification – Manipulating differentiation pathways – stem cell therapy Vs ce protection –Hematopoietic colony forming cell assay- stem cell in cellular assays for screening stem cell based drug discovery, drug screening and toxicology. V- Applications of Stem Cells Parkinsondisease - Neurological disorder – limb amputation – heart disease - spinal cord injuries diabetes –burns - HLA typing- Alzheimer's disease –tissue engineering application – productio of complete organ - kidney – eyes - heart – brain. Lecture Tutorial Practical Total 32 13 0 45 Text Books 1. Kursad and Turksen, Embryonic Stem Cells; Humana Press; 2002. 2. Dr. LogeswariSelvaraj, Stem Cell Assays, Springer International Edition; 2010. 2. Stem cell and future of regenerative medicine. By committee on the Biological an Biomedical applications of Stem cell Research. 2002. National Academic press. E References 1. http://nptel.ac.in/courses/102103012/41 pping of COS Vs POs	II- Embryonic St	tem Cells				6+2
cells for differentiation – properties of ES cells. III - Adult Stem Cells , iPSCs Somatic stem cells – test for identification of adult stem cells – adult stem cell differentiation trans differentiation – plasticity – different types of adult stem cells. IV- Stem Cell in Drug Discovery and Assay Get3 Target identification – Manipulating differentiation pathways – stem cell therapy Vs ceptotection – Hematopoietic colony forming cell assay- stem cell in cellular assays for screening stem cell based drug discovery, drug screening and toxicology. V- Applications of Stem Cells 9+3 Stem cell therapy for Mental disabilities, Diabetes Mellitus – Therapeutic applications parkinsondisease - Neurological disorder – limb amputation – heart disease - spinal cord injuries diabetes –burns - HLA typing- Alzheimer's disease –tissue engineering application – productio of complete organ - kidney – eyes - heart – brain. Lecture Tutorial Practical Total 32 13 0 Atsm coll and Turksen, Embryonic Stem Cells; Humana Press; 2002. 2. Dr. LogeswariSelvaraj, Stem Cell Assays, Springer International Edition; 2010. 2. Stem cell and future of regenerative medicine. By committee on the Biological an Biomedical applications of Stem cell Research. 2002. National Academic press. ER	In vitro fertilizatio	on -culturing of embryos-is	olation of human embr	yonic stem	cells – b	lastocys
III - Adult Stem Cells, iPSCs 5+2 Somatic stem cells – test for identification of adult stem cells – adult stem cell differentiation trans differentiation – plasticity – different types of adult stem cells. 6+3 IV- Stem Cell in Drug Discovery and Assay 6+3 Target identification – Manipulating differentiation pathways – stem cell therapy Vs ce protection – Hematopoietic colony forming cell assay- stem cell in cellular assays for screening stem cell based drug discovery, drug screening and toxicology. V- Applications of Stem Cells 9+3 Stem cell therapy for Mental disabilities, Diabetes Mellitus – Therapeutic applications Parkinsondisease - Neurological disorder – limb amputation – heart disease - spinal cord injuries diabetes –burns - HLA typing- Alzheimer's disease –tissue engineering application – productic of complete organ - kidney – eyes - heart – brain. Lecture Tutorial Practical Total 32 13 0 45 Text Books 1. Kursad and Turksen, Embryonic Stem Cells; Humana Press; 2002. 2. 1. Mohan C. Vemuri, Stem Cell Assays, Springer International Edition; 2010. 2. Stem cell and future of regenerative medicine. By committee on the Biological an Biomedical applications of Stem cell Research. 2002. National Academic press. E References 1. http://nptel.ac.in/courses/102103012/41				tify ES cells	s – stim	ulation 1
Somatic stem cells – test for identification of adult stem cells – adult stem cell differentiation trans differentiation – plasticity – different types of adult stem cells. Image: Transition - Transition - Plasticity - differentiation pathways - stem cell therapy Vs cells therapy of the therapy of the therapy Vs cell assay - stem cell therapy of the therapy for Mental disabilities, Diabetes Mellitus – Therapeutic applications Parkinsondisease - Neurological disorder – limb amputation – heart disease - spinal cord injuries diabetes – burns - HLA typing- Alzheimer's disease – tissue engineering application – production of complete organ - kidney – eyes - heart – brain. Lecture Tutorial Practical Total 32 13 0 45 Text Books 1. Kursad and Turksen, Embryonic Stem Cells; Humana Press; 2002. 2. 2. 1. Mohan C. Vemuri, Stem Cell Assays, Springer International Edition; 2010. 2. Stem cell and future of regenerative medicine. By committee on the Biological an Biomedical applications of Stem cell Research. 2002. National Academic press. E References 1. http://nptel.ac.in/courses/102103012/41		1 1	ls.			
trans differentiation – plasticity – different types of adult stem cells. IV- Stem Cell in Drug Discovery and Assay 6+3 Target identification – Manipulating differentiation pathways – stem cell therapy Vs ce protection –Hematopoietic colony forming cell assay- stem cell in cellular assays for screening stem cell based drug discovery, drug screening and toxicology. V- Applications of Stem Cells 9+3 Stem cell therapy for Mental disabilities, Diabetes Mellitus – Therapeutic applications Parkinsondisease - Neurological disorder – limb amputation – heart disease - spinal cord injuries diabetes –burns - HLA typing- Alzheimer's disease –tissue engineering application – productio of complete organ - kidney – eyes - heart – brain. Lecture Tutorial Practical Total 32 13 0 Attractical Total 32 Total 32 Total 32 Total Total 32 Total 32 Total </td <td></td> <td></td> <td></td> <td></td> <td></td> <td>-</td>						-
IV- Stem Cell in Drug Discovery and Assay 6+3 Target identification – Manipulating differentiation pathways – stem cell therapy Vs ce protection –Hematopoietic colony forming cell assay- stem cell in cellular assays for screening stem cell based drug discovery, drug screening and toxicology. V- Applications of Stem Cells 9+3 Stem cell therapy for Mental disabilities, Diabetes Mellitus – Therapeutic applications Parkinsondisease - spinal cord injuries diabetes –burns - HLA typing- Alzheimer's disease – tissue engineering application – production of complete organ - kidney – eyes - heart – brain. Total 32 13 0 45 Text Books 1. Kursad and Turksen, Embryonic Stem Cells; Humana Press; 2002. 2. Dr. LogeswariSelvaraj, Stem Cell Assays, Springer International Edition; 2010. 2. Stem cell and future of regenerative medicine. By committee on the Biological an Biomedical applications of Stem cell Research. 2002. National Academic press. E References 1. http://nptel.ac.in/courses/102103012/41 pring of COs Vs POs PO12 PS01				lult stem ce	ll differe	entiation
Target identification – Manipulating differentiation pathways – stem cell therapy Vs ce protection –Hematopoietic colony forming cell assay- stem cell in cellular assays for screening stem cell based drug discovery, drug screening and toxicology. V- Applications of Stem Cells 9+3 Stem cell therapy for Mental disabilities, Diabetes Mellitus – Therapeutic applications Parkinsondisease - Neurological disorder – limb amputation – heart disease - spinal cord injuries diabetes –burns - HLA typing- Alzheimer's disease –tissue engineering application – production of complete organ - kidney – eyes - heart – brain. Lecture Tutorial Practical Total 32 13 0 45 Ext Books 1. Kursad and Turksen, Embryonic Stem Cells; Humana Press; 2002. 2. 2. Dr. Logeswariselvaraj, Stem Cell Assays, Springer International Edition; 2010. 2. 3. Stem cell and future of regenerative medicine. By committee on the Biological an Biomedical applications of Stem cell Research. 2002. National Academic press. E References 1. 1. http://nptel.ac.in/courses/102103012/41	trans differentiation	on – plasticity – different ty	pes of adult stem cells.			
protection –Hematopoietic colony forming cell assay- stem cell in cellular assays for screening stem cell based drug discovery, drug screening and toxicology. V- Applications of Stem Cells 9+3 Stem cell therapy for Mental disabilities, Diabetes Mellitus – Therapeutic applications Parkinsondisease - Neurological disorder – limb amputation – heart disease - spinal cord injuries diabetes –burns - HLA typing- Alzheimer's disease –tissue engineering application – productic of complete organ - kidney – eyes - heart – brain. Lecture Tutorial Practical Total 32 13 0 45 Text Books 1. Kursad and Turksen, Embryonic Stem Cells; Humana Press; 2002. 2. Dr. LogeswariSelvaraj, Stem Cells MJP Publishers,2015. References 1. Mohan C. Vemuri, Stem Cell Assays, Springer International Edition; 2010. 2. Stem cell and future of regenerative medicine. By committee on the Biological an Biomedical applications of Stem cell Research. 2002. National Academic press. E References 1. http://nptel.ac.in/courses/102103012/41 pping of COs Vs POs						6+3
stem cell based drug discovery, drug screening and toxicology. 9+3 V- Applications of Stem Cells 9+3 Stem cell therapy for Mental disabilities, Diabetes Mellitus – Therapeutic applications Parkinsondisease - Neurological disorder – limb amputation – heart disease - spinal cord injuries diabetes –burns - HLA typing- Alzheimer's disease – tissue engineering application – production of complete organ - kidney – eyes - heart – brain. Image: Total information of the second control of the second control of complete organ - kidney – eyes - heart – brain. Lecture Tutorial Practical Total information of the second control of the second conthe second control of the second control of the second control of				11	41	1 7-
V- Applications of Stem Cells 9+3 Stem cell therapy for Mental disabilities, Diabetes Mellitus – Therapeutic applications Parkinsondisease - Neurological disorder – limb amputation – heart disease - spinal cord injuries diabetes –burns - HLA typing- Alzheimer's disease –tissue engineering application – productio of complete organ - kidney – eyes - heart – brain. Lecture Tutorial Practical Total 32 13 0 45 45 Text Books 1. 1. Kursad and Turksen, Embryonic Stem Cells; Humana Press; 2002. 2. 2. Dr. LogeswariSelvaraj, Stem Cell MJP Publishers,2015. References 1. Mohan C. Vemuri, Stem Cell Assays, Springer International Edition; 2010. 2. 2. Stem cell and future of regenerative medicine. By committee on the Biological an Biomedical applications of Stem cell Research. 2002. National Academic press. E References 1. 1. http://nptel.ac.in/courses/102103012/41 pping of COs Vs POs						
Stem cell therapy for Mental disabilities, Diabetes Mellitus – Therapeutic applications Parkinsondisease - Neurological disorder – limb amputation – heart disease - spinal cord injuries diabetes –burns - HLA typing- Alzheimer's disease –tissue engineering application – production of complete organ - kidney – eyes - heart – brain. Lecture Tutorial Practical Total 32 13 0 45 Text Books 1. Kursad and Turksen, Embryonic Stem Cells; Humana Press; 2002. 2. Dr. LogeswariSelvaraj, Stem Cells MJP Publishers,2015. References 1. Mohan C. Vemuri, Stem Cell Assays, Springer International Edition; 2010. 2. Stem cell and future of regenerative medicine. By committee on the Biological an Biomedical applications of Stem cell Research. 2002. National Academic press. E References 1. http://nptel.ac.in/courses/102103012/41	protection –Hema	topoietic colony forming c	ell assay- stem cell in			
Parkinsondisease - Neurological disorder – limb amputation – heart disease - spinal cord injuries diabetes –burns - HLA typing- Alzheimer's disease –tissue engineering application – productic of complete organ - kidney – eyes - heart – brain. <u>Lecture Tutorial Practical Total</u> <u>32</u> <u>13</u> <u>0</u> <u>45</u> <u>Text Books</u> 1. Kursad and Turksen, Embryonic Stem Cells; Humana Press; 2002. 2. Dr. LogeswariSelvaraj, Stem Cells MJP Publishers,2015. <u>References</u> 1. Mohan C. Vemuri, Stem Cell Assays, Springer International Edition; 2010. 2. Stem cell and future of regenerative medicine. By committee on the Biological an Biomedical applications of Stem cell Research. 2002. National Academic press. <u>E References</u> 1. <u>http://nptel.ac.in/courses/102103012/41</u> pping of COs Vs POs	protection –Hema stem cell based dr	topoietic colony forming c ug discovery, drug screening	ell assay- stem cell in			creening
diabetes -burns - HLA typing- Alzheimer's disease -tissue engineering application – production of complete organ - kidney – eyes - heart – brain. Lecture Tutorial Practical Total 32 13 0 45 Text Books 1. Kursad and Turksen, Embryonic Stem Cells; Humana Press; 2002. 2. Dr. LogeswariSelvaraj, Stem Cells MJP Publishers,2015. References 1. Mohan C. Vemuri, Stem Cell Assays, Springer International Edition; 2010. 2. Stem cell and future of regenerative medicine. By committee on the Biological an Biomedical applications of Stem cell Research. 2002. National Academic press. E References 1. http://nptel.ac.in/courses/102103012/41 pping of COs Vs POs	protection –Hema stem cell based dr V- Applications	topoietic colony forming c ug discovery, drug screenin of Stem Cells	ell assay- stem cell in ng and toxicology.	cellular assa	ays for se	creening 9+3
of complete organ - kidney – eyes - heart – brain. Lecture Tutorial Practical Total 32 13 0 45 Text Books 1. Kursad and Turksen, Embryonic Stem Cells; Humana Press; 2002. 2. Dr. LogeswariSelvaraj, Stem Cells MJP Publishers,2015. References 1. Mohan C. Vemuri, Stem Cell Assays, Springer International Edition; 2010. 2. Stem cell and future of regenerative medicine. By committee on the Biological an Biomedical applications of Stem cell Research. 2002. National Academic press. E References 1. http://nptel.ac.in/courses/102103012/41 pping of COs Vs POs PO12	protection –Hema stem cell based dr V- Applications Stem cell therap	topoietic colony forming c ug discovery, drug screenin of Stem Cells by for Mental disabilities	ell assay- stem cell in ng and toxicology. , Diabetes Mellitus -	cellular assa - Therapeut	tys for so	creening 9+3 ications
LectureTutorialPracticalTotal3213045Text Books1. Kursad and Turksen, Embryonic Stem Cells; Humana Press; 2002. 2. Dr. LogeswariSelvaraj, Stem Cells MJP Publishers,2015.References1. Mohan C. Vemuri, Stem Cell Assays, Springer International Edition; 2010. 2. Stem cell and future of regenerative medicine. By committee on the Biological an Biomedical applications of Stem cell Research. 2002. National Academic press.E References1. http://nptel.ac.in/courses/102103012/41 PO12 PS01	protection –Hema stem cell based dr V- Applications Stem cell therap Parkinsondisease	topoietic colony forming c rug discovery, drug screenin of Stem Cells by for Mental disabilities - Neurological disorder – li	ell assay- stem cell in ng and toxicology. , Diabetes Mellitus - mb amputation – heart	cellular assa - Therapeut disease - sp	tic appli	creening 9+3 ications l injuries
32 13 0 45 Text Books 1. Kursad and Turksen, Embryonic Stem Cells; Humana Press; 2002. 2. Dr. LogeswariSelvaraj, Stem Cells MJP Publishers,2015. References 1. Mohan C. Vemuri, Stem Cell Assays, Springer International Edition; 2010. 2. Stem cell and future of regenerative medicine. By committee on the Biological an Biomedical applications of Stem cell Research. 2002. National Academic press. E References 1. http://nptel.ac.in/courses/102103012/41	protection –Hema stem cell based dr V- Applications Stem cell therap Parkinsondisease diabetes –burns -	topoietic colony forming c ug discovery, drug screenin of Stem Cells by for Mental disabilities - Neurological disorder – li HLA typing- Alzheimer's	ell assay- stem cell in ng and toxicology. , Diabetes Mellitus - mb amputation – heart disease –tissue engine	cellular assa - Therapeut disease - sp	tic appli	creening 9+3 ications l injuries
Text Books 1. Kursad and Turksen, Embryonic Stem Cells; Humana Press; 2002. 2. Dr. LogeswariSelvaraj, Stem Cells MJP Publishers,2015. References 1. Mohan C. Vemuri, Stem Cell Assays, Springer International Edition; 2010. 2. Stem cell and future of regenerative medicine. By committee on the Biological an Biomedical applications of Stem cell Research. 2002. National Academic press. E References 1. http://nptel.ac.in/courses/102103012/41 pping of COs Vs POs	protection –Hema stem cell based dr V- Applications Stem cell therap Parkinsondisease diabetes –burns - of complete organ	topoietic colony forming c <u>ug discovery, drug screenin</u> <u>of Stem Cells</u> by for Mental disabilities - Neurological disorder – li HLA typing- Alzheimer's <u>u - kidney – eyes - heart – b</u>	ell assay- stem cell in ng and toxicology. , Diabetes Mellitus - mb amputation – heart disease –tissue engine- rain.	cellular assa - Therapeut disease - sp	iys for so ic appli inal cord ation – j	creening 9+3 ications l injuries producti
 Kursad and Turksen, Embryonic Stem Cells; Humana Press; 2002. Dr. LogeswariSelvaraj, Stem Cells MJP Publishers,2015. References Mohan C. Vemuri, Stem Cell Assays, Springer International Edition; 2010. Stem cell and future of regenerative medicine. By committee on the Biological an Biomedical applications of Stem cell Research. 2002. National Academic press. E References <u>http://nptel.ac.in/courses/102103012/41</u> 	protection –Hema stem cell based dr V- Applications Stem cell therap Parkinsondisease diabetes –burns - of complete organ	topoietic colony forming c <u>ug discovery, drug screenin</u> <u>of Stem Cells</u> by for Mental disabilities - Neurological disorder – li HLA typing- Alzheimer's <u>u - kidney – eyes - heart – b</u>	ell assay- stem cell in ng and toxicology. , Diabetes Mellitus - mb amputation – heart disease –tissue engine- rain.	cellular assa - Therapeut disease - sp	iys for so ic appli inal cord ation – j	creening 9+3 ications l injuries producti
 2. Dr. LogeswariSelvaraj, Stem Cells MJP Publishers,2015. References Mohan C. Vemuri, Stem Cell Assays, Springer International Edition; 2010. 2. Stem cell and future of regenerative medicine. By committee on the Biological an Biomedical applications of Stem cell Research. 2002. National Academic press. E References http://nptel.ac.in/courses/102103012/41 pping of COs Vs POs 	protection –Hema stem cell based dr V- Applications Stem cell therap Parkinsondisease diabetes –burns - of complete organ Lecture	topoietic colony forming c rug discovery, drug screenin of Stem Cells by for Mental disabilities - Neurological disorder – li HLA typing- Alzheimer's a - kidney – eyes - heart – b Tutorial	ell assay- stem cell in ng and toxicology. , Diabetes Mellitus - mb amputation – heart disease –tissue engine- rain. Practical	cellular assa - Therapeut disease - sp	iys for so ic appli inal cord ation – j Tota	creening 9+3 ications l injuries producti al
 2. Dr. LogeswariSelvaraj, Stem Cells MJP Publishers,2015. References Mohan C. Vemuri, Stem Cell Assays, Springer International Edition; 2010. 2. Stem cell and future of regenerative medicine. By committee on the Biological an Biomedical applications of Stem cell Research. 2002. National Academic press. E References http://nptel.ac.in/courses/102103012/41 pping of COs Vs POs 	protection –Hema stem cell based dr V- Applications Stem cell therap Parkinsondisease diabetes –burns - of complete organ Lecture 32	topoietic colony forming c rug discovery, drug screenin of Stem Cells by for Mental disabilities - Neurological disorder – li HLA typing- Alzheimer's a - kidney – eyes - heart – b Tutorial	ell assay- stem cell in ng and toxicology. , Diabetes Mellitus - mb amputation – heart disease –tissue engine- rain. Practical	cellular assa - Therapeut disease - sp	iys for so ic appli inal cord ation – j Tota	creening 9+3 ications l injuries producti al
References 1. Mohan C. Vemuri, Stem Cell Assays, Springer International Edition; 2010. 2. Stem cell and future of regenerative medicine. By committee on the Biological an Biomedical applications of Stem cell Research. 2002. National Academic press. E References 1. <u>http://nptel.ac.in/courses/102103012/41</u> pping of COs Vs POs	protection –Hema stem cell based dr V- Applications Stem cell therap Parkinsondisease diabetes –burns - of complete orgar Lecture 32 Text Books	topoietic colony forming c rug discovery, drug screenin of Stem Cells by for Mental disabilities - Neurological disorder – li HLA typing- Alzheimer's a - kidney – eyes - heart – b Tutorial 13	ell assay- stem cell in ng and toxicology. , Diabetes Mellitus - mb amputation – heart disease –tissue engine- rain. Practical 0	cellular assa - Therapeut disease - sp ering applic	iys for so ic appli inal cord ation – j Tota	creening 9+3 ications l injuries producti al
 2. Stem cell and future of regenerative medicine. By committee on the Biological an Biomedical applications of Stem cell Research. 2002. National Academic press. E References <u>http://nptel.ac.in/courses/102103012/41</u> pping of COs Vs POs 	protection –Hema stem cell based dr V- Applications Stem cell therap Parkinsondisease diabetes –burns - of complete organ Lecture 32 Text Books 1. Kursad and Tur	topoietic colony forming c rug discovery, drug screenin of Stem Cells by for Mental disabilities - Neurological disorder – li HLA typing- Alzheimer's a - kidney – eyes - heart – b Tutorial 13	ell assay- stem cell in ng and toxicology. , Diabetes Mellitus – mb amputation – heart disease –tissue enginerain. Practical 0 ls; Humana Press; 2002	cellular assa - Therapeut disease - sp ering applic	iys for so ic appli inal cord ation – j Tota	creening 9+3 ications l injuries producti al
 2. Stem cell and future of regenerative medicine. By committee on the Biological an Biomedical applications of Stem cell Research. 2002. National Academic press. E References <u>http://nptel.ac.in/courses/102103012/41</u> pping of COs Vs POs 	protection –Hema stem cell based dr V- Applications Stem cell therap Parkinsondisease diabetes –burns - of complete orgar Lecture 32 Text Books 1. Kursad and Tur 2. Dr. Logeswaris	topoietic colony forming c rug discovery, drug screenin of Stem Cells by for Mental disabilities - Neurological disorder – li HLA typing- Alzheimer's a - kidney – eyes - heart – b Tutorial 13	ell assay- stem cell in ng and toxicology. , Diabetes Mellitus – mb amputation – heart disease –tissue enginerain. Practical 0 ls; Humana Press; 2002	cellular assa - Therapeut disease - sp ering applic	iys for so ic appli inal cord ation – j Tota	creening 9+3 ications l injuries producti al
Biomedical applications of Stem cell Research. 2002. National Academic press. E References 1. <u>http://nptel.ac.in/courses/102103012/41</u> pping of COs Vs POs P012 PS01	protection –Hema stem cell based dr V- Applications Stem cell therap Parkinsondisease diabetes –burns - of complete orgar Lecture 32 Text Books 1. Kursad and Tu 2. Dr. Logeswaris References	topoietic colony forming c rug discovery, drug screenin of Stem Cells by for Mental disabilities - Neurological disorder – li HLA typing- Alzheimer's a - kidney – eyes - heart – b Tutorial 13 rksen, Embryonic Stem Cell Selvaraj, Stem Cells MJP P	ell assay- stem cell in ng and toxicology. , Diabetes Mellitus - mb amputation – heart disease –tissue enginer rain. Practical 0 ls; Humana Press; 2002 ublishers,2015.	cellular assa - Therapeut disease - sp ering applic	iys for so ic appli inal cord ation – j Tota	creening 9+3 ications l injuries producti al
E References 1. http://nptel.ac.in/courses/102103012/41 pping of COs Vs PO12 PS01	protection –Hema stem cell based dr V- Applications Stem cell therap Parkinsondisease diabetes –burns - of complete organ Lecture 32 Text Books 1. Kursad and Tur 2. Dr. Logeswaris References 1. Mohan C. Ver	topoietic colony forming c rug discovery, drug screenir of Stem Cells by for Mental disabilities - Neurological disorder – li HLA typing- Alzheimer's a - kidney – eyes - heart – b Tutorial 13 rksen, Embryonic Stem Cell Selvaraj, Stem Cells MJP P nuri, Stem Cell Assays, Spi	ell assay- stem cell in ng and toxicology. , Diabetes Mellitus – mb amputation – heart disease –tissue enginerain. Practical 0 ls; Humana Press; 2002 ublishers,2015. ringer International Edir	cellular assa - Therapeut disease - sp ering applic 2.	tys for so ic appli inal cord ation – j Tota 45	creening 9+3 ications l injuries producti al
1. http://nptel.ac.in/courses/102103012/41 pping of COs Vs PO12 PS01	protection –Hema stem cell based dr V- Applications Stem cell therap Parkinsondisease diabetes –burns - of complete orgar Lecture 32 Text Books 1. Kursad and Tur 2. Dr. Logeswaris References 1. Mohan C. Ver 2. Stem cell an	topoietic colony forming c rug discovery, drug screenin of Stem Cells by for Mental disabilities - Neurological disorder – li HLA typing- Alzheimer's a - kidney – eyes - heart – b Tutorial 13 rksen, Embryonic Stem Cell Selvaraj, Stem Cells MJP P nuri, Stem Cell Assays, Spr d future of regenerative	ell assay- stem cell in ng and toxicology. , Diabetes Mellitus mb amputation heart diseasetissue enginer rain. Practical 0 ls; Humana Press; 2002 ublishers,2015. ringer International Edir medicine. By comm	cellular assa - Therapeut disease - sp ering applic	ivs for so ic appli- inal cord ation – p Tota 45 e Biolo	creening 9+3 ications l injuries producti al
pping of COs Vs POs	protection –Hema stem cell based dr V- Applications Stem cell therap Parkinsondisease diabetes –burns - of complete orgar Lecture 32 Text Books 1. Kursad and Tu: 2. Dr. Logeswaris References 1. Mohan C. Ver 2. Stem cell an Biomedical ap	topoietic colony forming c rug discovery, drug screenin of Stem Cells by for Mental disabilities - Neurological disorder – li HLA typing- Alzheimer's a - kidney – eyes - heart – b Tutorial 13 rksen, Embryonic Stem Cell Selvaraj, Stem Cells MJP P nuri, Stem Cell Assays, Spr d future of regenerative	ell assay- stem cell in ng and toxicology. , Diabetes Mellitus mb amputation heart diseasetissue enginer rain. Practical 0 ls; Humana Press; 2002 ublishers,2015. ringer International Edir medicine. By comm	cellular assa - Therapeut disease - sp ering applic	ivs for so ic appli- inal cord ation – p Tota 45 e Biolo	creening 9+3 ications l injuries producti al
	protection –Hema stem cell based dr V- Applications Stem cell therap Parkinsondisease diabetes –burns - of complete organ Lecture 32 Text Books 1. Kursad and Tu: 2. Dr. Logeswaris References 1. Mohan C. Ver 2. Stem cell an Biomedical ap E References	topoietic colony forming c tug discovery, drug screenin of Stem Cells by for Mental disabilities - Neurological disorder – li HLA typing- Alzheimer's a - kidney – eyes - heart – b Tutorial 13 rksen, Embryonic Stem Cell Selvaraj, Stem Cells MJP P nuri, Stem Cell Assays, Spi d future of regenerative plications of Stem cell Rese	ell assay- stem cell in ng and toxicology. , Diabetes Mellitus mb amputation heart diseasetissue enginer rain. Practical 0 ls; Humana Press; 2002 ublishers,2015. ringer International Edir medicine. By comm earch. 2002. National A	cellular assa - Therapeut disease - sp ering applic	ivs for so ic appli- inal cord ation – p Tota 45 e Biolo	creening 9+3 ications l injuries producti al
	protection –Hema stem cell based dr V- Applications Stem cell therap Parkinsondisease diabetes –burns - of complete organ Lecture 32 Text Books 1. Kursad and Tu: 2. Dr. Logeswaris References 1. Mohan C. Ver 2. Stem cell an Biomedical ap E References	topoietic colony forming c tug discovery, drug screenin of Stem Cells by for Mental disabilities - Neurological disorder – li HLA typing- Alzheimer's a - kidney – eyes - heart – b Tutorial 13 rksen, Embryonic Stem Cell Selvaraj, Stem Cells MJP P nuri, Stem Cell Assays, Spi d future of regenerative plications of Stem cell Rese	ell assay- stem cell in ng and toxicology. , Diabetes Mellitus mb amputation heart diseasetissue enginer rain. Practical 0 ls; Humana Press; 2002 ublishers,2015. ringer International Edir medicine. By comm earch. 2002. National A	cellular assa - Therapeut disease - sp ering applic	ivs for so ic appli- inal cord ation – p Tota 45 e Biolo	creening 9+3 ications l injuries producti al
POI DOI DOI DOI DOI DOI DOI DOI DOI POIL POIL PSOI	protection –Hema stem cell based dr V- Applications Stem cell therap Parkinsondisease diabetes –burns - of complete organ Lecture 32 Text Books 1. Kursad and Tur 2. Dr. Logeswaris References 1. Mohan C. Ver 2. Stem cell an Biomedical ap E References 1. <u>http://npte</u>	topoietic colony forming c rug discovery, drug screenin of Stem Cells by for Mental disabilities - Neurological disorder – li HLA typing- Alzheimer's a - kidney – eyes - heart – b Tutorial 13 rksen, Embryonic Stem Cell Selvaraj, Stem Cells MJP P nuri, Stem Cell Assays, Spr d future of regenerative plications of Stem cell Res d.ac.in/courses/102103012/	ell assay- stem cell in ng and toxicology. , Diabetes Mellitus mb amputation heart diseasetissue enginer rain. Practical 0 ls; Humana Press; 2002 ublishers,2015. ringer International Edir medicine. By comm earch. 2002. National A	cellular assa - Therapeut disease - sp ering applic	ivs for so ic appli- inal cord ation – p Tota 45 e Biolo	creening 9+3 ications l injuries producti al
	protection –Hema stem cell based dr V- Applications Stem cell therap Parkinsondisease diabetes –burns - of complete organ Lecture 32 Text Books 1. Kursad and Tur 2. Dr. Logeswaris References 1. Mohan C. Ver 2. Stem cell an Biomedical ap E References 1. <u>http://npte</u>	topoietic colony forming c rug discovery, drug screenin of Stem Cells by for Mental disabilities - Neurological disorder – li HLA typing- Alzheimer's a - kidney – eyes - heart – b Tutorial 13 rksen, Embryonic Stem Cell Selvaraj, Stem Cells MJP P nuri, Stem Cell Assays, Spr d future of regenerative plications of Stem cell Res d.ac.in/courses/102103012/	ell assay- stem cell in ng and toxicology. , Diabetes Mellitus mb amputation heart diseasetissue enginer rain. Practical 0 ls; Humana Press; 2002 ublishers,2015. ringer International Edir medicine. By comm earch. 2002. National A	cellular assa - Therapeut disease - sp ering applic	ivs for so ic appli- inal cord ation – p Tota 45 e Biolo	creening 9+3 ications l injuries producti al

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	2	1	2	1			2	2	2	2	3	2
CO 2	2	2	2	2	3	3	2	1				3	1	1
CO3	3	3	2	2	2				1	1	2	2	2	3
CO4	2			3	2							1	1	2
CO5	3	3	2	3	2	2	2	1	2	2	1	1	1	1
	13	10	8	11	11	6	4	2	5	5	5	9	0	0

Mapping of Subject Vs POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Original value	13	10	8	11	11	6	4	2	5	5	5	9	0	0
Scaled Value	3	2	2	3	3	2	0	0	0	0	0	2	0	0

Scale: 3- high, 2 – Medium, 1 - Low, 0 – not related

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

XBT703B CANCER BIOLOGY	-	L T P C 2 1 0 3 L T P H 2 1 0 2
2.5 0 0.5 Prerequisite: Cell biology molecular biology		2 1 0 3
 Learning Objective: Upon completion of this course, the students Would have learn about carcinogenesis. Would have learn about a comparative approach to mechanisms and signaling. 	understand t	he differences ir
Course Outcomes	Domain	Level
After the completion of the course, students will be able to		
CO1 : <i>Outline</i> the regulation and modulation of cell cycle in cancer by various signal switches	Cognitive	Understand
CO2: <i>Explain</i> and <i>compare</i> various types of carcinogenesis and its metabolism	Cognitive	Understand Analyze
	Cognitive	Understand
CO3 : <i>Illustrate</i> the role of activation of kinases, <i>identification</i> of oncogenes, and <i>conforms</i> the role of telomere.	Affective	Analyze Responds to Phenomena
	Affective	Analyze Responds to
oncogenes, and <i>conforms</i> the role of telomere. CO4: <i>Explain</i> metastasis and its significant clinical markers for	Affective Cognitive	Analyze Responds to Phenomena

Cancer: Causes, characteristics and types – Cell cycle phases, cyclins and CDKs, check points, modulation of cell cycle in cancer - Effects on receptor, signal switches, signaling pathways – Telomerase and its role in cancer – Apoptosis, Extrinsic and intrinsic pathways, apoptosome and caspases - mutations that leads to cancer.

II- Carcinogenesis

Theory of carcinogenesis – Types: Physical, chemical and radiation carcinogenesis, Direct acting and indirect acting carcinogens, Metabolism of carcinogens, CYP450 reductase mechanism; Mechanism of radiation carcinogenesis, ionizing and non ionizing radiation, Retroviruses - RSV life cycle and its role in cancer, Identification of carcinogens, Long and short term bioassays.

9

III-	Mole	ecular	and Ce	ll Biolo	gy of (Cancer							6+3	
ider rela	ntifica ted to	tion ar transf	nd detec formatio	tion of on - epic	oncoge lermal	enes, or growth	ncogene factor	es and j (EGF)	proto c , plate	oncogen	e activit ved grov	Ras, Bcl- cy - Grow wth factor genes.	wth fact	ors
IV-	Inva	sion a	nd Met	astasis									9	
hete Epi	eroger thelial	neity of l- me	f metast	atic phe mal tr	notype ansitio	e, Signit n, stro	ficance omal	of prot signals	eases	in basen	nent me	ction an mbrane in and	disrupti	on,
V-	Diag	nosis a	nd The	rapy									6+3	
diag tech – Ir	gnosis mique mmun	of ca es. Trea o thera	ancer, l atment: apy – A	Disease Chemo Antigen	stagir therapy specifi	ng - F y – Top c and A	ISH, I poisome Adaptiv	DNA r erase ir ve thera	nicroai hibito apy – ;	rrays, S rs – Rae	SNPs, C diothera ell thera	ar tools CGH and py – Ge py - Use	d imagione thera	ing apy
	Lect	ture		Tut	orial			Prac	tical			Tota	l	
	3	9			6			()			45		
Ref 1. I Hel Wil 2. I Onc 3. J Pub 4. O USA	ncisco erenc DeVita lman, kins F an F.T cology Peleng lishin Gareth A, 200 Benjan Refere	e, CA, res: a Jr, V. and F Philade Fannoc 7, 4th E garisA. g, USA a Thom A. nin Lev nces:	1st Edit T., Law Rosenbe Iphia, P k, Rich Edition, ,and M A. 2006. nas.,Me	ion, 200 vrence, ¹ rg's Car PA, 9th I ard P. H The Mc I. Khan dicinal enes VII	D6. T.S., R ncer: F Edition Hill, Ro Graw- (Eds) Chemi (I, Inter	Rosenbe Principle , 2011. obert G Hill Co)., The stry – rnationa	erg, S.A es and . Bristo ompanie Moleo An Int al Editie	A., DeP Practic Dw and es, Inc. cular E troduct	inho, H ce of (Lea H New J Biology ion, 1s rson P	Oncolog Iarringto Iersey,20 7 of Ca 8t Editic	l Weint y, Lipp on., The 005. uncer, N	berg, R.A incott W Basic S Wiley - N Wiley w Delhi	Villiams Sciences Blackw and So	& of vell
ER		v.mm1.0)rg.tw/r	<u>чпкі_</u> А			/1110/110	10310.						
E R 1.		Cos V	s POs	1	1			1		1			DCO1	
ER 1.	ng of PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	
E R 1.	ng of PO1 3	PO2 2	PO3 2	1	2	1			PO9 2	PO10 2	PO11 2	2	3	2
ER 1.	ng of PO1	PO2	PO3				PO7 2	PO8						2
E R 1.	ng of PO1 3 2 3 2	PO2 2 2 3	PO3 2 2 2	1 2 2 3	2 3 2 2	1 3	2	1	2	2	2	2 3 2 1	3 1 2 1	3 2
E R 1.	ng of PO1 3 2 3	PO2 2 2	PO3 2 2	1 2 2	2 3 2	1			2	2	2	2 3 2	3 1 2	2 1 3

106

Mapping of Subject Vs POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Original value	13	10	8	11	11	6	4	2	5	5	5	9	0	0
Scaled Value	3	2	2	3	3	2	1	1	1	1	1	2	0	0

Scale: 3- high, 2 – Medium, 1 - Low, 0 – not related

XBT	703C	55					T 1	P 0	C 3	
CI	P A	DE	SIGN OF BIOPROCESS E	QUIPMENTS	L	,	Т	Р	H	
2 () 1				2		1	0	3	
		Course	e Outcomes	Domain			Level			
After	the comple	etion of the	course, students will be able	to						
CO1	Interpre	ts and Diff	ferentiateProcess and	Cognitive	Underst	and,	Apply	7		
	Bioproc			Affective	Guided Response					
CO2	Interpre	ts and Des	<i>ign</i> Pressure units	Cognitive	Understand, Apply					
	-			Affective	Guided Response					
CO3	Interpre	ts and Des	<i>ign</i> Supporting parts	Cognitive	Underst	-		7		
				Affective	Guided					
CO4	Interpre	ts and Des	ignHeat and Mass Transfer	Cognitive	Underst			7		
	Equipme			Affective	Guided	Rest	onse			
CO5	1 1		and <i>Design</i> the Fermenter uni	t Cognitive	Underst			7		
			0	Affective	Guided Response					
					•	•				
			Course content	ţ					Hour	
Unit-l	I Proce	ess and Bi	oprocess						6	
Materia	al of const	ruction for	process and bioprocess plants	s – Mechanical d	esign of pi	roces	s equi	pment		
Unit-l	II Desig	n of Press	ure Unit						6	
Design			oherical vessel under internal a	and external pres	sure					
		n of Enclo		*					6+3	
Select	ion and de	esign of fla	at plate, formed heads, torisp	herical and hemi	spherical	head	s, Star	ndard	flange	
	ozzles.	-			-				-	
Unit-l	IV Desig	n of heat	and mass transfer units						6+6	
Desig			louble pipe heat exchangers -	- Design of perfo	rated plate	e dist	illatio	n colu	mn an	
perfor	ated plate	packed tov	vers.							
Unit-	V Desig					6+6				
Basic	functions	of a fern	nener – Service provisions f	for a fermentation	on plant -	- Ge	ometri	ical ra	tios o	
			three bladed impellers – Safe							
constr	uction ma	terials – Ty	pes of fermenter – Design pa	rameters of ferm	enter.		•			
	Lecture		Tutorial	Practical			То	tal		
	30		15	-			4	5		

- 1. Mass Transfer Operations by Rober E Treybal, McGraw Hill, 1981.
- 2. Process Equipment Design Vessel Design by Brownell & Young, John Willey, 1951.
- 3. Chemical Engineering by J. M. Coulson & J. F. Richardson, Vol 6, Pregman Press, 1993.

Reference Books:

1.Stanbury.Peter.F, Allan Whitaker, Stephen J. Hall, "Principles of Fermentation Technology", Third Edition, ELSIVER, 2017.

2. Process equipment and mechanical aspect, B C Bhattacharya.

E-References:

- 1.https://nptel.ac.in/courses/103/107/103107143/
- 2.https://nptel.ac.in/courses/103/107/103107207/
- 3.https://nptel.ac.in/courses/103/103/103103027/

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	1	1	2	2	2	0	0	0	1	3	0	0
CO 2	3	3	2	2	1	2	2	0	0	0	2	2	1	1
CO 3	3	3	2	3	1	2	2	0	0	0	2	3	2	3
CO 4	3	3	2	3	1	2	2	0	0	0	2	2	2	2
CO 5	3	3	2	3	1	2	2	0	0	0	2	3	3	3
	15	15	9	12	6	10	10	0	0	0	9	13	8	9

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

Mapping of Subjects with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Original Value	15	15	9	12	6	10	10	0	0	0	9	13	8	9
Scaled Value	3	3	2	3	2	2	2	0	0	0	2	3	6	6
$1-5 \rightarrow 1$	l.,		$6-10 \rightarrow 2$,			$11 - 15 \rightarrow 3$								

 $11-15 \rightarrow 3$

Course Code :			:	XES 705	L	Т	P	С			
Course Name :		:	ENVIRONMENTAL STUDIES	0	0	0	0				
Prerequisite		:			L	Т	Р	Η			
С	P	P A		NIL	3	0	0	3			
2.5	0	0.5		INIL .							
	Course Outcome: After the completion of the course, students Domai						Level				
will	will be able to					C or P or A					
CO1 Describet			the	significance of natural resources and <i>explain</i>	Cognitive	gnitive R		Rememberand			
	anthropogenic impacts.							understand			
CO ₂	2 Ill	ustrat	e the	Cognitive	itive Under		derstar	nd			
	natural geo bio chemical cycles for maintaining ecological										
		lance.									
CO3	<i>Identify</i> the facts, consequences, preventive measures of Cognit							RememberRec			
	major pollutions and <i>recognize</i> the disaster phenomenon Affective								eive		

CO4	<i>Explain</i> the socio-economic, policy dynamics and <i>practice</i> the control measures of global issues for sustainable development	Cognitive	Understand and Analyse
CO5	<i>Recognize</i> the impact of population and <i>apply</i> theEnvironmental ethics towards environmental protection.	Cognitive	Understand And Apply
COUF	RSE CONTENT		
UNI	FI INTRODUCTION TO ENVIRONMENTAL STUE RESOURCES	DIES AND	12
	Use and over-exploitation, deforestation, case studi dams and their effects on forests and tribal people – utilization of surface and ground water, flood, droug benefits and problems – Mineral resources: Use a effects of extracting and using mineral resources, o World food problems, changes caused by agricultu modern agriculture, fertilizer-pesticide problems, wate – Energy resources: Growing energy needs, renewa sources, use of alternate energy sources, case studie resource, land degradation, man induced landslides, s Role of an individual in conservation of natural resource	Water resource off, conflicts of nd exploitation case studies – are and overge er logging, sal able and non– s – Land reso oil erosion and	es: Use and over- over water, dams- on, environmental - Food resources: razing, effects of inity, case studies renewable energy ources: Land as a d desertification –
	for sustainable lifestyles.		
UNIT	-		8
UNIT	-	osystem – Eco amids – Int the (a) Fores atic ecosystem odiversity – D rns and globa ed and endemi ildlife, man	tem – Producers, logical succession roduction, types, st ecosystem (b) (ponds, streams, efinition: genetic, l biodiversity hot c species of India wildlife conflicts,
UNIT	TII ECOSYSTEMS AND BIODIVERSITY Concept of an ecosystem – Structure and function consumers and decomposers – Energy flow in the eco – – Food chains, food webs and ecological pyr characteristic features, structure and function of Grassland ecosystem (c) Desert ecosystem (d) Aqua lakes, rivers, oceans, estuaries) – Introduction to Bio species and ecosystem diversity - Biodiversity patter spots. India as a mega-biodiversity nation; Endangere Threats to biodiversity: Habitat loss, poaching of web biological invasions; Conservation of biodiversity: I of biodiversity.	osystem – Eco amids – Int the (a) Fores atic ecosystem odiversity – D rns and globa ed and endemi ildlife, man	tem – Producers, logical succession roduction, types, st ecosystem (b) (ponds, streams, efinition: genetic, l biodiversity hot c species of India wildlife conflicts,

	IV SOCIAL ISSUES AND THE ENVIRONMENT 9										
	Urban problems related to energy – Water conservation, rain water harvesting watershed management – Resettlement and rehabilitation of people; its problems and concerns, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, Wasteland reclamation – Consumerism and waste products – Environment Protection Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Fores Conservation Act – International agreements: Montreal and Kyoto protocols and convention on Biological Diversity (CBD).Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.Issues involved in enforcement of environmental legislation – Public awareness.										
J NIT	V HUMAN POPULATION AND THE ENVIRONMENT 8										
	Resettlement and rehabilitation of project affected persons; case studies. Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan. Environmental ethics: Role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).										
	L T P Total										
	45 0 0 45										
	Press, 2019 BharuchaErach, Textbook of Environmental Studies for Undergraduate Courses, Orient Blackswan Pvt Ltd, 2018 Anubha Kaushik, C.P. Kaushik, Perspectives in Environmental Studies, New Age										
5.	International Pvt Ltd Publishers,2018 Divan Shyam,Environmental Law and Policy in India, OUP India,2019 Varun DuttSharma,S.K. Pandey,Vimal Kumar sharma, Environmental Education and Disaster Management, CBS Publishers & Distributors,2019 RENCE BOOKS										
5. REFE	Divan Shyam,Environmental Law and Policy in India, OUP India,2019 Varun DuttSharma,S.K. Pandey,Vimal Kumar sharma, Environmental Education and Disaster Management, CBS Publishers & Distributors,2019 RENCE BOOKS										
5. REFE	Divan Shyam,Environmental Law and Policy in India, OUP India,2019 Varun DuttSharma,S.K. Pandey,Vimal Kumar sharma, Environmental Education and Disaster Management, CBS Publishers & Distributors,2019 RENCE BOOKS M.V. Subba Rao, Natural Resources, Conservation, Management and Health Care,										
5. REFE 1.	Divan Shyam,Environmental Law and Policy in India, OUP India,2019 Varun DuttSharma,S.K. Pandey,Vimal Kumar sharma, Environmental Education and Disaster Management, CBS Publishers & Distributors,2019 RENCE BOOKS										
5. REFE 1. 2.	Divan Shyam,Environmental Law and Policy in India, OUP India,2019 Varun DuttSharma,S.K. Pandey,Vimal Kumar sharma, Environmental Education and Disaster Management, CBS Publishers & Distributors,2019 RENCE BOOKS M.V. Subba Rao, Natural Resources, Conservation, Management and Health Care, Discovery Publishing Pvt.Ltd,2020 Masters Gilbert M. Introduction to Environmental Engineering 3rd Edition , Pearson										
5. REFE 1. 2. 3.	Divan Shyam,Environmental Law and Policy in India, OUP India,2019 Varun DuttSharma,S.K. Pandey,Vimal Kumar sharma, Environmental Education and Disaster Management, CBS Publishers & Distributors,2019 RENCE BOOKS M.V. Subba Rao, Natural Resources, Conservation, Management and Health Care, Discovery Publishing Pvt.Ltd,2020 Masters Gilbert M. Introduction to Environmental Engineering 3rd Edition , Pearson Education India, 3rd edition ,2015.										
5. REFE 1. 2. 3. 4.	Divan Shyam,Environmental Law and Policy in India, OUP India,2019 Varun DuttSharma,S.K. Pandey,Vimal Kumar sharma, Environmental Education and Disaster Management, CBS Publishers & Distributors,2019 RENCE BOOKS M.V. Subba Rao, Natural Resources, Conservation, Management and Health Care, Discovery Publishing Pvt.Ltd,2020 Masters Gilbert M. Introduction to Environmental Engineering 3rd Edition , Pearson Education India, 3rd edition ,2015. P.D. Sharma, Ecology and Environment Thirteenth Edition, Rastogi Publications,2017 Dr. Avneesh Gaur, Environmental Engineering and Disaster Management, Vayu Education										
5. REFE 1. 2. 3. 4.	 Divan Shyam, Environmental Law and Policy in India, OUP India, 2019 Varun DuttSharma, S.K. Pandey, Vimal Kumar sharma, Environmental Education and Disaster Management, CBS Publishers & Distributors, 2019 RENCE BOOKS M.V. Subba Rao, Natural Resources, Conservation, Management and Health Care, Discovery Publishing Pvt.Ltd, 2020 Masters Gilbert M. Introduction to Environmental Engineering 3rd Edition, Pearson Education India, 3rd edition, 2015. P.D. Sharma, Ecology and Environment Thirteenth Edition, Rastogi Publications, 2017 Dr. Avneesh Gaur, Environmental Engineering and Disaster Management, Vayu Education Of India, 2021 										
5. REFE 1. 2. 3. 4. 5.	Divan Shyam,Environmental Law and Policy in India, OUP India,2019 Varun DuttSharma,S.K. Pandey,Vimal Kumar sharma, Environmental Education and Disaster Management, CBS Publishers & Distributors,2019 RENCE BOOKS M.V. Subba Rao, Natural Resources, Conservation, Management and Health Care, Discovery Publishing Pvt.Ltd,2020 Masters Gilbert M. Introduction to Environmental Engineering 3rd Edition , Pearson Education India, 3rd edition ,2015. P.D. Sharma, Ecology and Environment Thirteenth Edition, Rastogi Publications,2017 Dr. Avneesh Gaur, Environmental Engineering and Disaster Management, Vayu Education Of India,2021 E-REFERENCES										

8. <u>https://www.learner.org/courses/envsci/unit/unit_vis.php?unit=4</u>

9. http://bookboon.com/en/pollution-prevention-and-control-ebook http://www.e-booksdirectory.com/details.php?ebook=8557 http://www.e-booksdirectory.com/details.php?ebook=6804 http://bookboon.com/en/atmospheric-pollution-ebook http://www.e-booksdirectory.com/details.php?ebook=3749 http://www.e-booksdirectory.com/details.php?ebook=2604 http://www.e-booksdirectory.com/details.php?ebook=2116 http://www.e-booksdirectory.com/details.php?ebook=1026 http://www.faadooengineers.com/threads/7894-Environmental-Science

Mapping of COs with POs

			PROGRAM OUTCOMES												
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	
CO1															
CO2	2					2	1			1		1			
CO3	2	1	3			3	1		2	1		1			
CO4	1	1	2			3	2	3				1			
CO5	2	1	1			3						1			
Total	10	3	6			11	4	3	2	2		5			
ScaledValue	2	1	2			3	1	1	1	1	1	1			
		1 –	$1-5 \rightarrow 1$, $6-10 \rightarrow 2$, $11-15 \rightarrow 3$												
	()-NoF	Relatio	on,1-	Low R	elatio	n,2-N	lediun	nRela	tion,3-I	HighR	elatio	n		

				L	Т	P	С		
XB	T706	DECOMDINANT DNA TECHNICI CCI	7	0	0	2	2		
		RECOMBINANT DNA TECHNOLOGY LABORATORY	Ĺ						
CI	P A	LADUKATUKI		L	Т	Р	Η		
1 1	L 0			0	0	2	6		
Prere	quisite: (Genetics, Molecular biology							
Learn	ning Obj	ectives:							
Upon	complet	ion of this course, the students							
•	Would	have learned the concepts of gene cloning and its app	lication.						
•		have learned the various techniques involved in Reco		JA Teo	chnolog	y.			
		Course Outcomes	Domai	n	Level				
After	the comp	letion of the course, students will be able to							
CO1	Study d	and Understand the basic concepts isolation and	Cognitive		Understand				
COI	digestio	n.	Psychomo	tor	Perception				
CO2	Explain	and Analyze gel electrophoresis and Southern	Cognitive		UnderstandPerce				
02	blotting		Psychomo	tor	ption				
			Cognitive		Remen	nber			
CO3	Explain	and Analyze SDS PAGE and Western blotting.	Psychomo	tor	Analy	ze			
			rsycholilo	101	Percep	otion			
CO4	Discuss	es, and Distinguish digested DNA and genomic	Cognitive		Apply				
04	DNA.		Psychomo	tor	Percep	otion			
CO5 <i>Explain</i> and <i>Apply</i> the cell preparation and selection of Cognitive Understand									
005	recomb	inants.	Psychomo	tor	Apply				
Recor	nbinant	DNA Technology Lab							
			oth - o						

List of Practical Experiments

- 1. Isolation of Plasmid and Genomic DNA. (CO1)
- 2. Restriction enzyme digestion. (CO1)
- 3. Agarose gel Electrophoresis. (CO2)
- 4. Southern blotting (CO2)
- 5. SDS PAGE. (CO3)
- 6. Western blotting. (CO3)
- 7. Purification of digested DNA. (CO4)
- 8. Ligation of restricted vector and genomic DNA (CO4)
- 9. Competent cell preparation- calcium chloride method (CO5)
- 10. Screening and selection of recombinants(CO5)

Lecture	Tutorial	Practical	Total
00	00	30	30
Text Books:			
1. Primrose S	.B. and Twymann R.H., "Princ	ciples of Gene Manipulation	on: An Introduction to
Genetic Er	gineering", Sixth Edition, Blac	ckwell Scientific Publicati	ons, 2004.
Reference Books:			
1. Brown	T.A., "GeneCloning and DN	IA Analysis", Fourth Edi	tion, Blackwell Scientific
Public	tions, 2003.		
2. Glick	B.R. and Pasternak J.J., "Mol	ecular Biotechnology", T	Third Edition, ASM Press,
2003.			
3. Sandh	ı, Sardul Singh. Recombinant l	DNA technology. IK Inter	national Pvt Ltd, 2010.
E-References:			
http://nptel.ac.in/c	ourses/102103013/		

Mapping of COs with Pos

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	1	2	1	1	1	0	0	1	0	1	0	0	0
CO 2	3	0	3	2	2	1	0	0	0	0	1	0	0	0
CO 3	3	0	3	1	3	0	0	1	0	2	0	0	0	0
CO 4	3	0	3	1	3	0	0	2	0	1	0	0	0	0
CO 5	3	0	3	2	3	2	3	3	0	1	2	0	0	0
	13	1	14	7	12	4	3	6	1	4	4	0	0	0

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

Mapping of Subjects with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Original Value	13	1	14	7	12	4	3	6	1	4	4	0	0	0
Scaled Value	3	1	3	2	3	1	1	2	1	1	1	0	0	0
$1 - 5 \to 1, \qquad \qquad 6 - 10 \to 2$				$\rightarrow 2$,		1	1 – 15 -	$\rightarrow 3$						

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

X/T					L	T	P 1	C
Af	3T707		BIOINFORMATICS	-	1	0	1	2
С	P A	1	DIGINIORMATICS		L	Т	Р	H
0.5		.5			1	0	2	6
Prerec	quisite:-							
	ing Obj							
Upon	-		of this course, the students					
•			ble identify different databases and will be able t		out the	e applic	ation of	f the
	DIOIIIIO	гша	tics for data retrieval and for drug designing and de Course Outcomes	Domai	n		Level	
After t	he comr	oleti	on of the course, students will be able to	Doman				
CO1	Expla		the importance and basic concepts in	Cognitive		Unders	tand	
001	-		atics and differentiate various databases.	Psychomo	tor	Percep		
CO2	Unde	rsta	nds the significance of sequence analysis and	Cognitive		Apply		
	-		sequence alignment.	Psychomo	tor	Guided	l respon	se
CO3	-		and Construct phylogenetic trees to study	Cognitive		Unders	tand	
	phylog	gene	etic relationships	Psychomo	tor	Guided	l respon	se
CO4			nd Analysis the protein structure and molecular	Cognitive		Create		
~~~~	dockii			Psychomo	tor	mechai		
<u>CO5</u>			nd the steps involved in drug discovery process.	Affective		Receiv		
-			o Bioinformatics	ations of Di	ainfor	mation	3	2000
			ttions - aims and tasks of Bioinformatics - application - Biological databases - Classification of biological					
			ce and structure databases, Specialized databases- r					luar y
			to Computational Biology and Sequence Analysi				3	
			nt, Pairwise alignment, Multiple sequence alignme		rations	Local		lobal
			man and Wunsch algorithm, Smith Waterman algo					
-	A and B			,				υ
III- Pł	nylogen	etics	5				3	
Introdu	uction t	o P	hylogenetics, Molecular Evolution and Molecula	ar Phyloger	netics,	Phylog	genetic	tree,
			epresentation, Rooted and un-rooted trees, Phylo	0				nods:
			ethods- NJ, UPGMA, Character based methods -	-Maximum	Parsi	nony, I	Phyloge	
progra	me Daa					•		netic
			apping.					netic
IV- Pr	otein St	truc	ture, Modelling and Simulations				3	
<b>IV- Pr</b> Protein	otein St structur	t <b>ruc</b> e ba	ture, Modelling and Simulations asics, Protein structural visualization and comparis		ary sti	ructure	predicti	on-
<b>IV- Pr</b> Protein Chau-Fa	<b>otein St</b> structur asman,	t <b>ruc</b> e ba GC	<b>ture, Modelling and Simulations</b> asics, Protein structural visualization and comparis PR, Neural networks, Protein tertiary structure		ary sti	ructure	predicti	on-
IV- Pr Protein Chau-Fa Fhreadi	otein St structur asman, ng and H	t <b>ruc</b> e ba GC Fold	<b>ture, Modelling and Simulations</b> asics, Protein structural visualization and comparison R, Neural networks, Protein tertiary structure recognition.		ary sti	ructure	predicti modeli	on-
IV- Pr Protein Chau-Fa Threadi V- Rol	otein St structur asman, ng and H le of Bio	t <b>ruc</b> e ba GC Fold	<b>ture, Modelling and Simulations</b> asics, Protein structural visualization and comparis PR, Neural networks, Protein tertiary structure recognition. <b>prmatics in Drug Discovery</b>	prediction	ary sti Hor	ructure nology	predicti modeli 3	on- ing,
IV- Pr Protein Chau-Fa Threadi V- Rol Drug c	rotein St structur asman, ng and I le of Bio designing	t <b>ruc</b> e ba GC Fold oinfo g- o	ture, Modelling and Simulations asics, Protein structural visualization and comparis PR, Neural networks, Protein tertiary structure recognition. Drmatics in Drug Discovery bjectives- Rational drug design- Computer assisted	prediction	ary str Hor n and	ructure nology drug d	predicti model <u>3</u> evelopn	on- ing,
IV- Pr Protein Chau-Fa Threadi V- Rol Drug c Molect	otein St structur asman, ng and H le of Bio designing ular doc	t <b>ruc</b> e ba GC Fold <b>oinf</b> g- o king	ture, Modelling and Simulations asics, Protein structural visualization and comparis PR, Neural networks, Protein tertiary structure recognition. Drmatics in Drug Discovery bjectives- Rational drug design- Computer assisted g and its applications- QSAR, In Silico drug desig	prediction d drug design- role of st	ary str Hor n and	ructure nology drug d	predicti model <u>3</u> evelopn	on- ing,
IV- Pr Protein Chau-Fa Threadi V- Rol Drug c Molect drug d	rotein St structur asman, ng and I le of Bio designin ular doc esign an	t <b>ruc</b> e ba GC Fold <b>oinfo</b> g- o king d de	ture, Modelling and Simulations asics, Protein structural visualization and comparis PR, Neural networks, Protein tertiary structure recognition. Drmatics in Drug Discovery bjectives- Rational drug design- Computer assisted	prediction d drug design- role of st	ary str Hor n and	ructure nology drug d	predicti model <u>3</u> evelopn	on- ing,
IV- Pr Protein Chau-Fa Threadi V- Rol Drug d Molecu drug d List of	rotein St structur asman, ng and I le of Bio designing ular doc esign an f Experi	truc e ba GC Fold oinfe g- o king d de mei	ture, Modelling and Simulations asics, Protein structural visualization and comparis PR, Neural networks, Protein tertiary structure recognition. <b>Drmatics in Drug Discovery</b> bjectives- Rational drug design- Computer assisted g and its applications- QSAR, In Silico drug designevelopment- Pharmacogenomics- prospects and use	d drug design- role of st	ary str Hor n and ructur	ructure nology drug d al bioin	predicti model 3 evelopn formati	on- ing, nent- cs in
IV- Pr Protein Chau-Fa Threadi V- Rol Drug C Molecu drug de List of 1.	rotein St structur asman, ng and I le of Bio designin ular doc esign an f Experi Access and wo	truc e ba GC Fold <b>binfe</b> g- 0 king d de <b>men</b> ion rkir	ture, Modelling and Simulations asics, Protein structural visualization and comparis PR, Neural networks, Protein tertiary structure recognition. <b>Drmatics in Drug Discovery</b> bjectives- Rational drug design- Computer assisted g and its applications- QSAR, In Silico drug designevelopment- Pharmacogenomics- prospects and use <b>nts(30 hrs)</b> and retrieval of data from various biological databation g with terminal.	drug design- role of st s.	ary sta Hor n and ructur	ructure nology drug d al bioin basic op	predicti model 3 evelopn formati	on- ing, nent- cs in s
IV- Pr Protein Chau-Fa Threadi V- Rol Drug C Molecu drug de List of 1.	rotein St structur asman, ng and I le of Bio designing ular doc esign an f Experi Access and wo Perl pro	truc e ba GC Fold <b>binf</b> g- o king d de <b>men</b> ion rkin	ture, Modelling and Simulations asics, Protein structural visualization and comparis PR, Neural networks, Protein tertiary structure recognition. <b>Drmatics in Drug Discovery</b> bjectives- Rational drug design- Computer assisted g and its applications- QSAR, In Silico drug designevelopment- Pharmacogenomics- prospects and use <b>hts(30 hrs)</b> and retrieval of data from various biological databation by with terminal. The second structure of the programs using Operators, Control Structure the second second structure of the programs using Operators, Control Structure of the second	drug design- role of st s.	ary sta Hor n and ructur	ructure nology drug d al bioin basic op	predicti model 3 evelopn formati	on- ing, nent- cs in s
IV- Pr Protein Chau-Fa Threadi V- Rol Drug d Molecu drug d List of 1. 2.	rotein St structur asman, ng and H le of Bio designing ular doc esign an f Experi Access and wo Perl pro a static	truc e ba GC Fold <b>oinf</b> d g- 0 king d de <b>men</b> ion rkin ogra HT	ture, Modelling and Simulations asics, Protein structural visualization and comparis PR, Neural networks, Protein tertiary structure recognition. <b>Drmatics in Drug Discovery</b> bjectives- Rational drug design- Computer assisted g and its applications- QSAR, In Silico drug designevelopment- Pharmacogenomics- prospects and use <b>hts(30 hrs)</b> and retrieval of data from various biological databation g with terminal. and solve solve solve a perl Program.	prediction l drug desig n- role of st s. ses.Unix/Li uctures, Sul	ary sta Hor n and ructur nux –	ructure nology drug d al bioin basic op	predicti model 3 evelopn formati	on- ing, nent- cs in s
IV- Pr Protein Chau-Fa Threadi V- Rol Drug C Molecu drug du List of 1. 2. 3.	rotein St structur asman, ng and I le of Bio designin ular doc esign an f Experi Access and wo Perl pro a static Heurist	truc e ba GC Fold g- o king d de men ion rkir ogra HT ic n	ture, Modelling and Simulations asics, Protein structural visualization and comparis PR, Neural networks, Protein tertiary structure recognition. <b>Drmatics in Drug Discovery</b> bjectives- Rational drug design- Computer assisted g and its applications- QSAR, In Silico drug designevelopment- Pharmacogenomics- prospects and use <b>hts(30 hrs)</b> and retrieval of data from various biological databation by with terminal. The second structure of the programs using Operators, Control Structure the second second structure of the programs using Operators, Control Structure of the second	prediction d drug design- role of st s. ses.Unix/Li uctures, Sub gous sequer	ary sta Hor n and ructur nux – proutir nces	ructure nology drug d al bioin basic op nes, Has	predicti model 3 evelopm formati peration h, Crea	on- ing, nent- cs in s ting

alignment.Gene prediction methods (ORF Finder).

- 5. Phylogenetic tree building using Phylip.
- 6. Protein Secondary structure prediction.Homology Modeling.Molecular Visualization and 3D structural studies using Rasmol Commands, Domain identification.
- 7. Molecular Visualization and 3D structural studies using Chimera.
- 8. Small molecule building, using ISIS Draw and CHEM SKETCH Tutorial

5. Shan molecule bunding, using isib blaw and enterin skel ten - tutonal												
Lecture	Tutorial	Practical	Total									
15	0	30	45									
Text Books:												

- 1. David W. Mount Bioinformatics: Sequence and Genome Analysis, Cold Spring Harbor Laboratory Press, Second Edition, 2004
- 2. Ghosh, Zhumur, and BibekanandMallick. Bioinformatics: Principles and Applications. Oxford University Press, 2008.
- 3. S. Harisha, "Fundamentals of Bioinformatics", I. K. International Pvt Ltd, 2010

#### **References:**

- 1. Arthur M. Lesk, Introduction to Bioinformatics by Oxford University Press, 2008
- 2. T K Attwood, D J parry-Smith, Introduction to Bioinformatics, Pearson Education, 1st Edition, 11th Reprint 2005
- 3. Stephen A. Krawetz, David D. Womble, Introduction To Bioinformatics A Theoretical and Practical Approach, Humana Press, 2003

#### **E-References:**

- 1. http://nptel.ac.in/courses/102103044/40
- 2. vlab.amrita.edu/?sub=3&brch=273

Mapping of Cos Vs PO s

	PO1				PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1			1		2				2					
CO 2		2	2	1	3								1	
CO 3		2	1	1	2							3	3	1
CO 4	1	3	3	1	3						3	1	2	3
CO 5	1	2	3		3						2	1	1	1
	2	9	10	3	13				2		5	4	7	5

### 0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Original Value	2	9	10	3	13	0	0	0	2	0	5	4	7	5
Scaled Value	3	1	3	2	3	1	1	2	1	0	1	1	1	1

Scale: 3- high, 2 – Medium, 1 - Low, 0 – not related, 0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

					Ĺ	T	P	C
X	BT 7(	)8			0	0	2	2
			<b>PROJECT WORK PHASE-I</b>					
С	Р	Α			L	Т	Р	Η
1.5	0.5	0.5			0	0	6	6
PRE	REQ	UISI	ГЕ: - Nil					
COU	JRSE	OUI	COMES:					
			Course Outcomes 1	Doma	in	]	Leve	l
On ti	he su	ccessf	ful completion of the course, students will be able to					

CO1	<i>Identify</i> the engineering problem relevant to the domain interest.	Cog	Analyze
CO2	<i>Interpret</i> and infer literature survey for its worthiness.	Cog	Analyze Apply
CO3	<i>Analyse</i> and <i>identify</i> an appropriate technique for solve the problem.	Cog	Analyze Apply
CO4	<i>Perform</i> experimentation /Simulation/Programming/Fabrication, <i>Collect</i> and <i>interpret</i> data.	Phy Cog	Comp. Overt Resp., Create, Apply
CO5	<i>Record</i> and report the technical findings as a document.	Cog	Remember, Understand

# Mapping of COs with POs

	CO1	CO2	CO3	CO4	CO5	Total
<b>PO1</b>	3	2	1	2	1	9
PO2	3	2	1	2	1	9
PO3	-	-	1	3	1	5
PO4	-	1	2	3	1	6
PO5	-	-	2	3	1	6
PO6	1	-	1	1	-	3
<b>PO7</b>	1		1	1	-	3
PO8	1	-	1	1	-	3
<b>PO9</b>	-	-	-	-	2	2
PO10	-	-	-	-	3	3
PO12	-	-	-	-	2	2
PO12	1	-	-	-	3	4
PSO1	1	1	1	1	1	5
PSO2	1	1	1	1	1	5

1 – Low, 2 – Medium, 3 – High

V	DT 700			L	T         P         C           0         2         2					
Λ	BT 709	INPLANT TRAINING - III		0	U	2	2			
С	P A			L	Т	P	Η			
1.33	1.33 1.33			0	0 0 2 2					
PRER	EQUISITE:	- Nil								
COUR	RSE OUTCO	MES:								
		Course Outcomes	Doma	ain		Leve	1			
On the	e successful co	ompletion of the course, students will be able to								
CO1	Relate class	sroom theory with workplace practice	Cog	2	Understand					
CO2	<i>Comply</i> with practices.	h factory discipline, management and business	Aff	2	Re	espor	ise			
CO3	Demonstra	tes teamwork and time management.	Aff		,	Value	e			
CO4	<b>Describe</b> ar	nd <i>display</i> hands-on experience on practical skills	Phy	/	Pe	rcept Set	ion			
	•	115 8	th BOS/E	BIOTE	ECH/I	Date:	19.0			

	obtained during the programme.		
CO5	<i>Summarize</i> the tasks and activities done by technical documents and oral presentations.	Cog	Evaluate

# Mapping COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2													
CO2							1	3			1		1	1
CO3									3	1	3		3	3
CO4		1	2	1	3								1	1
CO5				3						3			1	1
Total	2	1	2	4	3	0	1	3	3	4	4	0	6	6
Scaled	1	1	2	1	1	0	1	1	1	1	1	1	2	2

## **VIII Semester**

								i
					L	Т	P	C
XB	<b>ST8</b> 0	<b>1</b> A	INTRODUCTION TO QUANTUM BIOLO	· · ·	2	1	0	3
			ARTIFICIAL INTELLIGENCE (AI) AND D	DATA				
C	P	Α	SCIENCE		L	Т	Р	H
3	0	0			2	1	0	3
Obje	ectiv	ves: St	udents able to inspire on Quantum biology, AI and I	Data Science	e to con	tribute	in em	nerging
techi	nolog	gy.						
			Course Outcomes	Doma	in		Leve	1
Afte	r the	comp	letion of the course, students will be able to					
<b>CO1</b>	I	nterpr	ets and RealizeQuantum mechanics in biology.	Cognitive		Unde	rstand	
						Reme	ember	
CO ₂	2 I	nterpr	ets and RealizeQuantum Biology Applications.	Cognitive		Unde	rstand	
						Reme	ember	
CO3	3 I	nterpr	ets and Realize Artificial Intelligence in	Cognitive		Unde	rstand	
	E	Engine	ering.			Reme	ember	
CO4	I	nterpr	ets and RealizeData Science in Engineering.	Cognitive		Unde	rstand	
						Reme	ember	
CO5	5 0	Dutlin	es the Resources for AI and Data Science, etc.	Cognitive		Unde	rstand	
						Reme	ember	
			Course content				]	Hours
Unit	:-I	Intr	oduction to Quantum Biology					6
Gener	ral ir	ntrodu	ction on quantum mechanics – How plant use quantu	m mechani	cs – qua	antum	mecha	nics in
respir	atio	n – nu	cleotides separation by 0.3 nm deal with UV photons	s – transfer	of elect	rons ai	nd pro	tons in
cells.								
Unit		Qua	ntum Biology Applications					6
			- DNA mutation - Quantum vision implicatio	ns – Enzy	me ac	tivity	as qu	lantum
bioch	emis	stry – A	Antibodies surface proteins on microorganisms.					
			oduction to Artificial Intelligence					6+3
Intro	duct	ion to	AI concept - History of AI - Concept of AI in Drug	s and Vacc	ination	– Heal	th Ca	e Data
Anal	lysis	– Plar	nt Genome Studies – Gene Editing – Enzyme Compos	sitions.				
			oduction to Data Science					6+6
App	licati	ion of	Data Science – Requirements for Data Science – Intro	oduction to	R Progr	am and	l R-St	udio.
			116	oth DOC/D	IOTEC		. 10.0	0 2021
			116	8 th BOS/B	IOTEC	H/Date	e: 19.0	8.2021

Unit-V	Resources			6+6
Relations	hip between AI,	Data Science, Machine Lear	ning and Deep Learning -	- Open Resources.
L	ecture	Tutorial	Practical	Total
	30	15	-	45
Text Boo	oks:			
1. Gr	aham R Flemin	g, Gregory D.Scholes "Quant	tum Effects in Biology" (	Cambridge University Pres
20	14.			
2. St	uart J. Russell a	and Peter Norvig – "Artificia	al Intelligence – A Mod	ern Approach" 3 rd Edition
Pe	arson Publisher,	2015.		
3. R.	Ragunathan and	N. Shankar, "Data Science for	or Engineers"	
Referenc	e Books:			
D	avy Cielen, Arn	o D.B. Meysman, and Mohan	ned Ali, "Introducing Dat	a Science" Manning
P	ublications, 201	5.	_	_
E-Refere	ences:			
<u>h</u>	ttps://doi.org/10.1	017/CBO9780511863189.003		
<u>ht</u>	tps://royalsociet	ypublishing.org/doi/10.1098/	rsif.2018.0640	
<u>ht</u>	tps://nptel.ac.in/	<u>/courses/106/102/106102220/</u>		
<u>ht</u>	ttps://nptel.ac.in/	<u>/courses/106/106/106106179/</u>	-	

## Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	1	1	2	2	2	0	0	0	1	3	0	0
CO 2	3	3	2	2	1	2	2	0	0	0	2	2	1	1
CO 3	3	3	2	3	1	2	2	0	0	0	2	3	2	3
CO 4	3	3	2	3	1	2	2	0	0	0	2	2	2	2
CO 5	3	3	2	3	1	2	2	0	0	0	2	3	3	3
	15	15	9	12	6	10	10	0	0	0	9	13	8	9

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

## Mapping of Subjects with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Original Value	15	15	9	12	6	10	10	0	0	0	9	13	8	9
Scaled Value	3	3	2	3	2	2	2	0	0	0	2	3	2	2

 $1-5 \rightarrow 1$ ,  $6-10 \rightarrow 2$ ,  $11-15 \rightarrow 3$ 0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

							L	Τ	P	С
XBI	<b>[801</b>	B					2	1	0	3
		1.	ENZYMI	E ENGINEERIN	G				_	T
C	P	Α					L	Т	Р	H
3	0	0					2	1	0	3
		isites	-							
Obj			.1 . 1 . 1 . 1 . 1		•1•1 1		1.1			
•			nance the student's ability	ty of employab	ility through	n stuc	iy ti	ne c	ore	enzyn
Cou			eristics and products. <b>mes:</b> At the end of this co	wroa the student	a should be	Dom	ain	T	evel	
able		Outco	mes. At the end of this co	Juise, the student	s should be	Dom	am		ever	
COI		Frnlai	$\mathbf{n}$ the enzyme principles and $\mathbf{x}$	Study the properti	<b>A</b> C	Cogr	itive	II	nders	stand
COI		элрши	the enzyme principles and	bindy the properti	<b>C</b> 5.	Cogi				and
CO2	2 1	Descrit	e the extraction and Inter	mret the properti	es with the	Cogr	itive	U	nders	stand
001		pioproc		prov die properd		0051			1401	, cuira
CO3		Recogn		types and <b>D</b> e	scribe the	Cogr	itive	U	nders	stand
000		echniq		.)F		8-				
CO4			the kinetic properties and <i>I</i>	<i>nterpret</i> withthe t	echniques.	Cogr	itive	U	nders	stand
CO5			<i>e</i> the salient features o	<u>.</u>	<b>^</b>	U			nders	stand
	e	enzyme	<b>.</b>			Ū				
		-	Cour	se Content					]	Hours
Unit	<b>-I</b>	In	troduction						•	5+3
Enzy	/me	cataly	sis principles – Enzyme cat	alysis – Enzyme	kinetics – In	pact o	f pH	and	Ten	nperatu
– Im	moł	oilizati	on types.							
Unit	-II	En	zyme Extraction						•	5+3
Extr	actio	on of	crude enzyme from plan	nt, animal and s	sources of r	nicrob	ials	– P	urifi	cation
Char	acte	erizatio	n – Enzyme activity – Deve	elopment of enzyr	ne assay.					
Unit			mobilization Techniques							5+3
			ption – Matrix Entrapment				Cov	alen	t bin	ding aı
			<ul> <li>Advantage and disadvant</li> </ul>		tion techniqu	ies.				
			netic Properties of Enzym		<u> </u>	<b>T</b> (0		11.00		5+3
			stability of immobilized en						ision	– Ma
			hiometry measurement – R	ole of effector mo	lecules in en	zyme l	sinet	ICS.		<u> </u>
Unit			plications		<u> </u>	•	1			5+3
			oplications of immobilized	enzyme system -	Concise ove	rview	on la	rge	scale	enzyn
prou	ucu	011 – E	nzyme products. Lecture	Tutorial	Practical	20		,	Fota	1
			<u>30</u>	15	0	1 5			<u>10ta</u> 45	1
Text	Bo	oks	50	15	U				43	
			C. price and Lewis stevens, '	"Fundamentals of	enzymology	" Oxf	ord I	Inive	rsity	Press
			Peter.F, Allan Whitaker, S						-	
]	Thire	d Editi	on, ELSIVER, 2017.	,						
Refe										
		-	nd Bucke, "Enzyme techno	•••••••••••••••••••••••••••••••••••••••	•					•-
4			iley, David Ollis, "Bioche	mical Engineering	g Fundament	als", 2	2nd E	d., ]	McG	raw H
	2duc	cation,	2017.							
F	e									
E-R			tel.ac.in/courses/102/102/10	00100000/						

# Mapping of COs Vs POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	1	3	2	1	2	1	1	0	2	2	3	3
CO 2	3	3	1	3	2	1	2	1	1	0	2	2	3	3
CO 3	3	3	1	3	2	1	2	1	1	0	2	2	3	3
CO 4	2	1	1	1	1	1	1	1	1	0	1	1	1	1
CO 5	3	3	1	1	1	1	1	1	1	0	1	1	1	1
	14	13	5	11	8	5	8	5	5	0	8	8	11	11

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

## Mapping of Subject Vs POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Original value	14	13	5	11	8	5	8	5	5	0	8	8	11	11
Scaled Value	3	3	0	3	2	0	2	0	0	0	2	2	9	3

 $1-5 \rightarrow 1$ ,  $6-10 \rightarrow 2$ ,  $11-15 \rightarrow 3$ 0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

o no relation, i Low Relation, 2 Weedulli Relation, 5 Then Relation

					L	Т	Р	С
X	BT8	01C	WASTE MANAGEMENT AND BY-PRODU	ICTS	2	1	0	3
		1	UTILIZATION					
С	P	Α			L	Τ	P	H
3	0	0			2	1	0	3
PR	ERE	QUISI	TE: Nil					
Lea	rnin	g Obje	ctives:Upon completion of this course, the students					
	• V	Vill be	able to understand the origin and type of wa	ste and b	у р	rodu	cts,	waste
	ic	lentific	ation, classification and composition.					
	• V	Vill be	able to describe the need for treatment and utilization	of waste				
	• V	Vill be	able to know the legal and statutory requirements for	waste hand	lling	, trea	tmer	nt and
	d	isposal						
			Course Outcomes	Domain		]	Leve	1
Afte	er the	compl	etion of the course, students will be able to					
CO	1:Ac	<i>quire</i> th	e knowledge of waste generation and the factors					
for	wast	e accu	mulation and <i>Differentiates</i> the waste disposal vs	Cognitive	e	Re	men	ber
		nagem						
CO	2: <i>Ch</i>	aracter	<i>ize</i> the type and categories of several wastes	Cognitive	e	Re	men	lber
CO	3: <i>Ou</i>	<i>tlines</i> t	he methods for waste management and disposal	Cognitive	e	А	naly	ze
CO	4: <i>Di</i> s	s <i>cuss</i> a	nd <i>compiles</i> the various methods of waste and by-	Cognitive		А	naly	ze
proc	lucts	utilizat	tion from different sources	Cognitive	5	Un	derst	and
		s <i>cribe</i> anagem	the importance of safety and regulations regarding	Cognitive	e	Re	merr	ber
	Unit-		Introduction				6+3	
			aste – Waste handling – Factors affecting waste ge	eneration –	Wa	ste d	ispo	sal vs
۰			<u> </u>				-	

Mapping	<u>рог С</u>	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
Manning													
	of C	Oc wit	h PAs										
3. <u>http</u>	://eco	ursesor	<u>iline.ia</u>	<u>sri.res.</u>	in/cou	rse/viev	w.php'	<u>'id=518</u>	<u>8</u>				
	-	tel.ac.ii											
	-	tel.ac.ii											
E- REFE													
-		nic Pres	- ·							<u> </u>			
					. ,		, 0				v	v	iomass.
										Susiness		ock for	enzyme
												ustrial i	residues
		eatmer	•	,	· ·								
											ental bio	otechnol	ogy for
REFERI						, v			•				
-		vannis,	I. S. (2	2010).	Waste i	manag	ement j	for the	food ir	ıdustrie	s. Acade	emic Pre	ss.
press.		. (2000	)	10 1110111	iergenne	in pro	0110051		ipui, ii				in ene
			). Was	te man	ageme	ent pra	ctices:	munic	ipal. h	azardou	s. and i	ndustria	al. CRC
TEXT B	OOK	S:											
30			15					0				45	
LECTU	RE	TU	TORL	AL			PRAC	-	L			<u>TOTAI</u> 45	4
managem					1				<b>.</b>		1	TOTA	
Research				onal S	Scenari	o: Wo	orld H	ealth	Organi	zation	(WHO)	guideli	nes on
board) gi					-			-			-		
Legal asp		•		0		nent ar	nd hand	dling ru	ules, C	PCB (C	entral p		
Unit-V		Safety				p1044			1110005			6+	3
products :											115 01	mzation	OI Uy
utilizatio													
Introduct Utilizatio		• •				-		-		-		-	-
Unit-I		Waste						•	1, 1	1	<u>,                                     </u>	<u>6+</u>	-
(Sources,								l in Bic	omedic	al waste	manage		
Direct co									-				gement
Unit-I	II	Waste	mana	gemen	nt							6+	3
Radioacti											,		,
Agrıcultu											iste, Bio		
	- wast	e - C	'ategor	ies of	solid	waste	s (Doi	nestic	waste	Marke	et waste		
Unit-I Types of		Waste	Unara	icieriz	ation							6+	-3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	0	0	2	0	1	2	0	3	0	0	1	1	0	0
CO 2	0	0	2	0	1	2	0	3	0	0	1	1	0	0
CO 3	3	3	1	2	1	0	3	1	2	1	1	1	0	3
CO 4	3	3	1	3	1	0	3	1	2	1	1	1	3	3
CO 5	0	0	2	0	1	3	0	3	2	1	1	1	0	0
	6	6	8	5	5	7	6	11	6	3	5	5	3	6

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO1	2 P	SO1	PSO
iginal alue	6	6	8	5	5	7	6	11	6	3	5	5		3	6
aled alue	3	1	0	1	1	1	0	0	1	1	1	1		0	0
		6-10— on, 1-1	,		, 2- Me	edium	Relatic	on, 3-H	igh Re	lation					
											L	Т	Р	C	
X	BT 8	04									0	0	9	9	
	D			P	PROJE	CT W	ORK	PHAS	E-II		T		D	<b>T</b> T	
C 6	P 3	A 3									L 0	T 0	<u>Р</u> 9	H 18	
	REREQUISITE: - Nil							U	U	,	10				
CO	URSE	OUT			Outco	omes				Do	main		Leve	el	
On	the su	ccessfi					e, stud	ents wi	ill be a				Lett		
CO	I Ide		he Eng	gineeri			elevant				log	I	Analy	/ze	
CO	2 Int	terpret	and In	fer Lite	erature	survey	y for its	s worth	iness.	C	og		Analy App		
CO.		nalyse a e probl		entify a	in appr	opriate	e techni	ique fo	r solve	C	log		Analy App		
CO	/ <b>S</b>	rform imulati erpret	on/Pro			bricati	ion, Co	ollect a	nd		'hy Cog		Resp	Overt )., Apply	
CO	5 Re	1	nd Rep	ort the	techni	ical fin	dings a	as a		C	log	Re	men	nber,	

	CO1	CO2	CO3	CO4	CO5	Total
PO1	3	2	1	2	1	9
PO2	3	2	1	2	1	9
PO3	-	-	1	3	1	5
PO4	-	1	2	3	1	7
PO5	-	-	2	3	1	6
PO6	1	-	1	1	-	3
PO7	1		1	1	-	3
PO8	1	-	1	1	-	3
PO9	-	-	-	-	2	2
PO10	-	-	-	-	3	3
PO11	-				2	2
PO12	1				3	4

PSO1	1	1	1	1	1	5
PSO2	1	1	1	1	1	5
	1	1		2 11.	, I	5

1 - Low, 2 – Medium, 3 – High

# **Open Electives**

Х	втое	21		10	L	T	P	C
			INTELLECTUAL PROPERTY RIGHT	S	3	0	0	3
С	Р	Α			L	Т	Р	Η
3	0	0						
					3	0	0	3
	quisite							
	0	jective						
Upon	_		this course, the students					
•			inderstood the various types of IPR.	tand	filing	nroco		
•			earnt to search the database, drafting the paten inderstood about the IPR audit and related disp		ming	proces	58.	
•			earned knowledge on IPR and earned certificat		m W/I	DO N	DTEI	and
•		portals.	amed knowledge on IFK and earned certificat	65 110	111 VV 1	FU, N	FILL	anu
•		-	o identify new GI, protect copyright, design an	d filir	ng a na	itent		
Cours	se Outc				nain		evel	
<b>CO1</b>			the significance of IPR and <i>identify</i> various		nitive		ndersta	nd
001		s of IPR	-	005			1401500	ina
<b>CO2</b>	• 1		the process of <i>registration and</i> infer the	Cog	nitive	U	ndersta	ind
	valu	ation of	1 0 V	U				
CO3	Und	erstand	the legal framework and <i>infer</i> legislative	Cog	nitive	U	ndersta	und
	-		ndia, selected countries and WIPO					
CO4			the international commitment and <i>imply</i>	Cog	nitive	U	ndersta	ind
	suita	able mar	ket for the registered IP.					
CO5	App	<i>ly</i> your	understandingand <i>create</i> a new GI, filing	Cog	nitive	U	ndersta	nd
	-		el design or copyright and recognition or					
			ization of the IPR					
I - Int	roduct	ion to I	PR					9
Creati Proper WIPO distand Distan 1. 2.	roduct vity, Ir rty; His IPR - ce learr ice Lear DL-G e-Tuto	ion to I nvention story an - advan ning cou rning Co eneral C orial on		India biodi e of c 2101E	an Gov versity ost)	vernme vernme	ent tov	vai
			[DLIPP PanoramaE21] er on Intellectual Property [DL001E20]					
			nts (Open) [DL3010E19S2]					
			right and Related Rights (Open) [DL2010E19	)				
			-India (Need to submit a page report)	L				
•			gov in/index htm					

7. https://ipindia.gov.in/index.htm
 8. <u>https://ipindiaonline.gov.in/trademarkefiling/user/frmloginNew.aspx</u>Optional Courses

(registration co 9. https://e-learnin	ng.iptse.com/		
	on and Valuation of IPR (I		9
Integrated Circuits an Diversity – Plant Varie	nd Layout Design – Geogeties and Farmers Rights – T	e Marks – Industrial Designs – graphical Indications of Goods rade Secrets / undisclosed inform	s – Biological
	ourse in WIPO and study narks, Industrial Designs and	naterial in IPR-India l Geographical Indications (Oper	1)
GATE way in 1	IPR-India		
	gov.in/designs.htm		
	Practice and submit a two particles and submit a	ages report)	
12. https://ipindias	ervices.gov.in/publicsearch		
III- Legal and Legis	ation Framework in India		9
		nternational Treaties – Tradition	nal Knowledge
Digital Library (TKD) Capital Development. Study material to learn 13. http://tkdl.res.i	L) – Commercialization of 1 n TKDL, Patent Act 1970 (N n/tkdl/langdefault/common/2	IPR – Enforcement and Adjudic leed to submit a page report)	0
IV- International Co	nventions and Treaties		9
		t of WIPO – General Agreemen	
Tariff (GATT) – TRIP			
		oduction to the Patent Cooperati	on Treaty
[PCT101E19]	C	Ĩ	2
	ents who are interested c	an carry out the following co	ourse and earn
-	ich is signed from WHO, WI	• •	
16. DL701 Promot	ing Access to Medical Tech	nologies and Innovation – WHO	, WIPO, WTO
Executive Cou	rse on the intersections betw	een public health, intellectual pro-	operty and
trade [DL7011	ENT19S2]		
V - IPR Managemen	nt		9
Transfer of Rights – II Reading the material a and WIPO.	P training and education – IP and submission of a page n	idit-IP asset management – IF valuation – Agreement Drafting ote; Optional: earning certificate	Ţ.
17. https://nptel.ac	.in/noc/courses/noc21/SEM	<u>l/noc21-hs14/</u>	
18. <u>https://www.w</u>	ipo.int/sme/en/ip_audit/		
· · · · · · · · · · · · · · · · · · ·	ipo.int/ipadvantage/en/		
	236.140/e-gateways.htm#co		
_		istered in your place; Filing I l; Copyright of your work registe	
Lecture	Tutorial	Practical	Total
45	0	0	45
Text Books			
	"Handbook of Indian Pa	tent Law and Practice ", S.	Viswanathan
	Publishers) Pvt. Ltd., 1998.	,	
(Primers and P	uulisheis) I vi. Liu., 1990.		
,	uolisheis) 1 vi. Liu., 1996.		
E-References 1. Neeraj Pandey	,	ectual Property Rights, PHI Pr	rivate Limited,
<b>E-References</b> 1. Neeraj Pandey Delhi, 2014.	, KhushdeepDharni, Intello	ectual Property Rights, PHI Property Rights, PHI Property States of the second	

3. Using the Internet for non-patent prior art searches, Derwent IP Matters, July 2000. [www.ipmatters.net/features/000707_gibbs.html.

#### **E Resources**

- 1. http://www.wipo.int/patentscope/en/
- 2. <u>http://www.ipindia.nic.in/</u>
- 3. http://www.uspto.gov/
- 4. https://www.epo.org/index.html
- 5. https://www.jpo.go.jp/

## **Mapping Of Cos and POs**

		Program Outcomes												
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	0	2	0	2	3	1	3	3	0	2	3	0	0
CO2	2	0	2	0	2	3	1	3	3	0	2	3	0	0
CO3	2	0	2	0	2	3	1	3	3	0	2	3	0	0
CO4	2	0	2	0	2	3	1	3	3	0	2	3	0	0
CO5	2	0	2	0	2	3	1	3	3	0	2	3	0	0
	10	0	10	0	10	15	5	15	15	0	10	15	0	0

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

## **Mapping of Subject Vs POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Original value	10	0	10	0	10	15	5	15	15	0	10	15	0	0
Scaled	2	0	2	0	2	3	0	3	3	0	2	3	0	0
Value $1-5 \rightarrow 1$	l 1,		6 – 10	$\rightarrow 2$ ,		11	- 15 -	→ 3						

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

X	втое	2		L	Т	Р	С
			<b>BIOSAFETY MANAGEMENT</b>	3	0	0	3
С	Р	Α		L	Т	Р	Η
3	0	0					
				3	0	0	3

Prerequisite: -

Learning Objectives:

Upon completion of this course, the students

- Would have understood the various types of safety aspects.
- Would have learnt to behave with precautions.
- Would have understood about the Biosafety requirements in all areas.
- Would have earned knowledge on Biosafety system to set in their working place to avoid the risks.

Course	Outcomes	Domain	Level
CO1	<i>Understand</i> the significance of Safety and <i>identify</i> Various types of Safety.	Cognitive	Understand
CO2	<i>Understand</i> the Biosafety and <i>infer</i> with the Management.	Cognitive	Understand
CO3	<i>Understand</i> the Guidelines of Biosafety and <i>infer</i> with the Various Safety Committee.	Cognitive	Understand

CO4	<i>Understand</i> the Hazards and <i>imply</i> the Analysis System.	Cognitive	Understa	and
CO5	Understand the risk and Imply the various safety Risk	Cognitive	Understa	and
	Analysis.			
	Course Content			Hours
Unit-I	Introduction to Safety			9
	nena of safety -Types of Hazards: Physical, Chemical, Bio	logical, Ergo	nomics and	d noise
	- Concept of Industrial safety apply over Biosafety.			
Unit-II	J J			9
	cal Background of Biological Safety - Primary Contami		-	•
	ction to Microorganisms - Biosafety Level of Specific M		s - Emerg	ging o
	ty in global – Level of Infectious Agents and Infectious Ani	mals		
Unit-II	I Guidelines of Biosafety			9
Guideli	nes from Goverment of India - Definitions of GMOs & I	LMOs – Role	es of Instit	utiona
Biosafe	ty Committee, RCGM, GEAC - Roles of GMO in Food, A	gricultural a	nd Environ	menta
Sectors		-		
Unit-IV	V Hazard Analysis			9
Hazard	identification and control – HAZOP, job safety analysis –	Fault tree ana	lysis _ Eve	nt tre
	M = M = M = M = M = M = M = M = M = M =	i aun noc ana	uvoio = Lvc	
analysis	s - Failure modes and effect analysis and relative ranking			
analysis Safety S	s – Failure modes and effect analysis and relative ranking Survey – Plant inspection – Past accident analysis.		– Safety a	audit -
analysis Safety S <b>Unit-V</b>	s – Failure modes and effect analysis and relative ranking Survey – Plant inspection – Past accident analysis. Risk Analysis	g techniques	– Safety a	audit - 9
analysis Safety S Unit-V Risk A	s – Failure modes and effect analysis and relative ranking Survey – Plant inspection – Past accident analysis. Risk Analysis Assessment, Management and Communication –Overview	g techniques of National	– Safety a	audit - 9 ns and
analysis Safety S Unit-V Risk A Relevar	s – Failure modes and effect analysis and relative ranking Survey – Plant inspection – Past accident analysis. Risk Analysis ssessment, Management and Communication –Overview and International Agreements Including Cartagena Protocol –	g techniques of National - Safety Proc	– Safety a Regulation cedures: Ha	audit - 9 ns and
analysis Safety S Unit-V Risk A Relevan and Sto	s – Failure modes and effect analysis and relative ranking Survey – Plant inspection – Past accident analysis. Risk Analysis Assessment, Management and Communication –Overview International Agreements Including Cartagena Protocol brage of Chemicals, Fire Chemistry and its Control – Persona	g techniques of National – Safety Proc al Protections	– Safety a Regulation cedures: Ha	audit - <b>9</b> ns and andling
analysis Safety S Unit-V Risk A Relevan and Sto	s – Failure modes and effect analysis and relative ranking Survey – Plant inspection – Past accident analysis. Risk Analysis Assessment, Management and Communication –Overview and International Agreements Including Cartagena Protocol- brage of Chemicals, Fire Chemistry and its Control – Persona Lecture Tutorial Pract	g techniques of National - Safety Proc al Protections tical	– Safety a Regulation cedures: Ha <b>To</b>	audit - 9 ns and andling tal
analysis Safety S Unit-V Risk A Relevan and Sto I	s – Failure modes and effect analysis and relative ranking Survey – Plant inspection – Past accident analysis. Risk Analysis sessment, Management and Communication –Overview and International Agreements Including Cartagena Protocol- brage of Chemicals, Fire Chemistry and its Control – Persona Lecture Tutorial Pract 45 0 0 0	g techniques of National - Safety Proc al Protections tical	– Safety a Regulation cedures: Ha	audit - 9 ns and andling tal
analysis Safety S Unit-V Risk A Relevan and Sto I Text Ba	s – Failure modes and effect analysis and relative ranking Survey – Plant inspection – Past accident analysis. Risk Analysis Assessment, Management and Communication –Overview International Agreements Including Cartagena Protocol arage of Chemicals, Fire Chemistry and its Control – Persona Lecture Tutorial Pract 45 0 0 0 ooks	g techniques of National – Safety Proc al Protections tical	– Safety a Regulation cedures: Ha	audit - 9 ns and andling tal 5
analysis Safety S Unit-V Risk A Relevan and Sto I Text Ba 1.Fl	s – Failure modes and effect analysis and relative ranking Survey – Plant inspection – Past accident analysis. Risk Analysis assessment, Management and Communication –Overview and International Agreements Including Cartagena Protocol- arage of Chemicals, Fire Chemistry and its Control – Persona Lecture Tutorial Pract 45 0 0 0 ooks leming and Hunt, "Biological Safety, Principles and Practic	g techniques of National – Safety Proc al Protections tical	– Safety a Regulation cedures: Ha	audit - 9 ns and andling tal 5
analysis Safety S Unit-V Risk A Relevan and Sto I Text Be 1.Fl 201	s – Failure modes and effect analysis and relative ranking Survey – Plant inspection – Past accident analysis. Risk Analysis Assessment, Management and Communication –Overview International Agreements Including Cartagena Protocol- brage of Chemicals, Fire Chemistry and its Control – Persona Lecture Tutorial Pract 45 0 0 ooks leming and Hunt, "Biological Safety, Principles and Practic 7.	g techniques of National - Safety Proc al Protections tical ces" 5th edit	- Safety a Regulation cedures: Ha	audit - 9 ns and andling tal 5 Press
analysis Safety S Unit-V Risk A Relevan and Sto I Text Be 1.Fl 201 2.D	s – Failure modes and effect analysis and relative ranking Survey – Plant inspection – Past accident analysis. Risk Analysis Assessment, Management and Communication –Overview at International Agreements Including Cartagena Protocol- brage of Chemicals, Fire Chemistry and its Control – Persona Lecture Tutorial Pract 45 0 0 ooks leming and Hunt, "Biological Safety, Principles and Praction 7. eshmukh, L.M., "Industrial Safety Management (Hazard id	g techniques of National - Safety Proc al Protections tical ces" 5th edit	- Safety a Regulation cedures: Ha	audit - 9 ns and andling tal 5 Press
analysis Safety S Unit-V Risk A Relevan and Sto I Text Ba 1.Fl 201 2.D TA	s – Failure modes and effect analysis and relative ranking Survey – Plant inspection – Past accident analysis. Risk Analysis assessment, Management and Communication –Overview at International Agreements Including Cartagena Protocol- arage of Chemicals, Fire Chemistry and its Control – Persona Lecture Tutorial Pract 45 0 0 0 ooks leming and Hunt, "Biological Safety, Principles and Practic 7. eshmukh, L.M., "Industrial Safety Management (Hazard id TA McGraw Hill, 2008.	g techniques of National - Safety Proc al Protections tical ces" 5th edit	- Safety a Regulation cedures: Ha	audit - 9 ns and andling tal 5 Press
analysis Safety S Unit-V Risk A Relevan and Sto I Text Be 1.Fl 201 2.D TAT	s – Failure modes and effect analysis and relative ranking Survey – Plant inspection – Past accident analysis. Risk Analysis Assessment, Management and Communication –Overview and International Agreements Including Cartagena Protocol- arage of Chemicals, Fire Chemistry and its Control – Persona Lecture Tutorial Pract 45 0 0 ooks leming and Hunt, "Biological Safety, Principles and Praction 7. eshmukh, L.M., "Industrial Safety Management (Hazard id TA McGraw Hill, 2008. Inces	g techniques of National – Safety Proc al Protections tical ces" 5th edit entification a	Safety a     Regulation     cedures: Ha     .     To     tion, ASM     und risk con	audit - 9 ns and andling tal 5 Press
analysis Safety S Unit-V Risk A Relevan and Sto I Text B 1.Fl 201 2.D TA <b>Referen</b> 1.R	s – Failure modes and effect analysis and relative ranking Survey – Plant inspection – Past accident analysis. Risk Analysis assessment, Management and Communication –Overview International Agreements Including Cartagena Protocol- brage of Chemicals, Fire Chemistry and its Control – Persona Lecture Tutorial Pract 45 0 0 0 ooks leming and Hunt, "Biological Safety, Principles and Practic 7. eshmukh, L.M., "Industrial Safety Management (Hazard id TA McGraw Hill, 2008. nces aghavan, K.V. and Khan, A.A., "Methodologies in Hazard I	g techniques of National - Safety Proc al Protections tical ces" 5th edit entification a dentification	- Safety a Regulation cedures: Ha	audit - 9 ns and andling tal 5 Press ntrol)"
analysis Safety S Unit-V Risk A Relevan and Sto I Text B 1.Fl 201 2.D TA <b>Referen</b> 1.R	s – Failure modes and effect analysis and relative ranking Survey – Plant inspection – Past accident analysis. Risk Analysis Assessment, Management and Communication –Overview and International Agreements Including Cartagena Protocol- arage of Chemicals, Fire Chemistry and its Control – Persona Lecture Tutorial Pract 45 0 0 ooks leming and Hunt, "Biological Safety, Principles and Praction 7. eshmukh, L.M., "Industrial Safety Management (Hazard id TA McGraw Hill, 2008. Inces	g techniques of National - Safety Proc al Protections tical ces" 5th edit entification a dentification	- Safety a Regulation cedures: Ha	audit - 9 ns and andling tal 5 Press ntrol)"
analysis Safety S Unit-V Risk A Relevar and Sto I Text Bo 1.Fl 201 2.D TA ⁷ Referen 1.Rt 2.ht	s – Failure modes and effect analysis and relative ranking Survey – Plant inspection – Past accident analysis. Risk Analysis Assessment, Management and Communication –Overview and International Agreements Including Cartagena Protocol- arage of Chemicals, Fire Chemistry and its Control – Persona Lecture Tutorial Pract 45 0 0 ooks leming and Hunt, "Biological Safety, Principles and Praction 7. eshmukh, L.M., "Industrial Safety Management (Hazard id TA McGraw Hill, 2008. nces aghavan, K.V. and Khan, A.A., "Methodologies in Hazard I ttps://www.who.int/publications-detail-redirect/92415465	g techniques of National - Safety Proc al Protections tical ces" 5th edit entification a dentification	- Safety a Regulation cedures: Ha	audit - 9 ns and andling tal 5 Press ntrol)"
analysis Safety S Unit-V Risk A Relevan and Sto I Text Ba 1.Fl 201 2.D TAT Referen 1.Ra 2.ht E Reso	s – Failure modes and effect analysis and relative rankin, Survey – Plant inspection – Past accident analysis. Risk Analysis assesment, Management and Communication –Overview at International Agreements Including Cartagena Protocol- arage of Chemicals, Fire Chemistry and its Control – Persona Lecture Tutorial Pract 45 0 0 0 ooks leming and Hunt, "Biological Safety, Principles and Praction 7. eshmukh, L.M., "Industrial Safety Management (Hazard id TA McGraw Hill, 2008. nces aghavan, K.V. and Khan, A.A., "Methodologies in Hazard I ttps://www.who.int/publications-detail-redirect/92415465 urces	g techniques of National - Safety Proc al Protections tical ces" 5th edit entification a dentification	- Safety a Regulation cedures: Ha	audit - 9 ns and andling tal 5 Press ntrol)"
analysis Safety S Unit-V Risk A Relevar and Sto I Text Bo 1.Fl 201 2.D TAT Referen 1.Ri 2.ht E Reso 1.ht	s – Failure modes and effect analysis and relative ranking Survey – Plant inspection – Past accident analysis. Risk Analysis assesment, Management and Communication –Overview at International Agreements Including Cartagena Protocol- arage of Chemicals, Fire Chemistry and its Control – Persona Lecture Tutorial Pract 45 0 0 0 ooks leming and Hunt, "Biological Safety, Principles and Praction 7. eshmukh, L.M., "Industrial Safety Management (Hazard id TA McGraw Hill, 2008. nces aghavan, K.V. and Khan, A.A., "Methodologies in Hazard I ttps://www.who.int/publications-detail-redirect/92415465 urces tp://www.geacindia.gov.in/resource-documents/13_2-	g techniques of National - Safety Proc al Protections tical ces" 5th edit entification a dentification	- Safety a Regulation cedures: Ha	audit - 9 ns and andling tal 5 Press ntrol)"
analysis Safety S Unit-V Risk A Relevar and Sto I Text Bo 1.Fl 201 2.D TA ⁷ Referen 1.Ri 2.ht E Reso 1.ht Reg	s – Failure modes and effect analysis and relative rankin, Survey – Plant inspection – Past accident analysis. Risk Analysis assesment, Management and Communication –Overview at International Agreements Including Cartagena Protocol- arage of Chemicals, Fire Chemistry and its Control – Persona Lecture Tutorial Pract 45 0 0 0 ooks leming and Hunt, "Biological Safety, Principles and Praction 7. eshmukh, L.M., "Industrial Safety Management (Hazard id TA McGraw Hill, 2008. nces aghavan, K.V. and Khan, A.A., "Methodologies in Hazard I ttps://www.who.int/publications-detail-redirect/92415465 urces	g techniques of National – Safety Proc al Protections tical ces" 5th edit entification a dentification 506 (Manual	- Safety a Regulation redures: Ha - To - 4 tion, ASM and risk con and Risk from WH0	audit - 9 ns and andling tal 5 Press ntrol)"

## Mapping Of Cos and POs

		Program Outcomes												
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	0	2	0	2	3	1	3	3	0	2	3	0	0
CO2	2	0	2	0	2	3	1	3	3	0	2	3	0	0
CO3	2	0	2	0	2	3	1	3	3	0	2	3	0	0
CO4	2	0	2	0	2	3	1	3	3	0	2	3	0	0
CO5	2	0	2	0	2	3	1	3	3	0	2	3	0	0
	10	0	10	0	10	15	5	15	15	0	10	15	0	0

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

# Mapping of Subject Vs POs

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO11		)12	PSO1	PS		
ginal ue	10	0	10	0	10	15	5	15	15	0	10		5	0	(		
led ue	2	0	2	0	2	3	0	3	3	0	2		3	0			
$5 \rightarrow 1$ No Re			6 – 10 w Rela	,	- Mediu	11 um Rel	– 15 – ation, 3		Relati	on							
	хвто	E3									L	Т	P	С			
					DI	GITAI	L HEA	LTH		-	3	0	0	3			
С	Р	A								-	L	Т	Р	H			
3	3     0     0       3     0     0																
	equisit										3	0	0	3			
•	Stud Stud	lents w lents w	ill get a ill lear	aware c n analy	of Digit tical sk	student tal Hea cill on c pility op	lth ligital o										
Cour		tcomes		•	- •	· · ·	-	-		Dom	ain	Level					
C01				0		of I vability	0			0	itive	Ur	nders	rstand			
CO2	Un Dig	dersta gital H	<i>nd</i> the ealth M	function fanage	ons and ment.	d goals	and <i>i</i>	nfer w	ith the	Cogr		Ur	nders	erstand			
CO3	the	e servic	es.	-		ligital l											
CO4			nd the sis Sys	-	l Heal	th App	olicatio	ns and	imply	Cogr	itive	Ur	nders	tand			
CO5		<i>dersta</i> treprer			-	health.		Imply	the	Cogr	itive	Ur	nders				
Unit	T I	Funda	montel	ls of Di		urse C	ontent	t						Hour 9	S		
Intro Healt	ductior h Info matics:	n to He rmatica ; Curre	ealthcar s; Soft nt trend	e; App ware d ds in H	lication levelop ealth Ii	n of Te ment f nforma	or imp tics.			ne; Info ncare; F				logy fo			
Unit						gital H								9			
outco	•		•		-					egy to h; patie	-		-	•			
Unit	·III	Digital	Healt	h Prod	ucts a	nd Ser	vices							9			
intell	igence	- Artif	icial Ir	ntellige	nce an		ness Ii	ntellige	nce, p	n excha redictiv	e mod	eling	, He	alth an	ıd		
***						S 10											

Digitized health record platforms, Patient -physician-patient portals, Decision support systems, Imaging, Personalized and Precision Medicine.

#### Unit-IV Applications of Digital Health

Diagnosis, Treatment, Prevention and Wellness, Rehabilitation, Behavioral Health, Disease Management, Public Health.

#### **Unit-V** Innovation and Entrepreneurship in Digital Health

9

9

Intellectual Property Protection, Regulatory Issues, Business Models, Financing Digital Health Startup Ventures, Leading High-Performance digital Health Teams, Product and Customer Development, Startup Methodologies, Clinical Validation and Translational Research, Data Security and Confidentiality.

Lecture	Tutorial	Practical	Total
45	0	0	45
Tort Doole			

#### **Text Books**

1. Ronquillo Y., Meyers A., and Korvek S.J., "Digital Health" StatpearlsPulishing, Treasure Island (FL), 2021.

#### References

1. Rivas H., "Digital Health: Scaling Healthcare to the world (Health Informatics)", Springer Publisher, 2018.

#### **E Resources**

1.<u>https://www.coursera.org/learn/introduction-to-digital-health</u>

2.https://www.who.int/docs/default-

3.source/documents/gs4dhdaa2a9f352b0445bafbc79ca799dce4d.pdf

## Mapping Of Cos and POs

		Program Outcomes												
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	0	2	0	2	3	1	3	3	0	2	3	0	0
CO2	2	0	2	0	2	3	1	3	3	0	2	3	0	0
CO3	2	0	2	0	2	3	1	3	3	0	2	3	0	0
CO4	2	0	2	0	2	3	1	3	3	0	2	3	0	0
CO5	2	0	2	0	2	3	1	3	3	0	2	3	0	0
	10	0	10	0	10	15	5	15	15	0	10	15	0	0

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

### Mapping of Subject Vs POs

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Original value	10	0	10	0	10	15	5	15	15	0	10	15	0	0
Scaled Value	2	0	2	0	2	3	0	3	3	0	2	3	0	0

 $1-5 \rightarrow 1$ ,  $6-10 \rightarrow 2$ ,  $11-15 \rightarrow 3$ 0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

#### **Department of Biotechnology Faculty of Engineering and Technology** Periyar Nagar, Vallam, Thanjavur - 613 403, Tamil Nadu, India Phone: +91 - 4362 - 264600 Fax: +91- 4362 - 264660 Email: headxxx@pmu.edu Web: www. pmu.edu





# APPENDIX A Value Added Course

8thBoard of Studies for the programmeB.Tech Biotechnology was conducted on 19.Aug.2021. The following newvalue added courses were introduced and recommended for ACM approval.

### 1. R Program and R Studio for Biotechnologist

	Course Description								
S.No	Торіс	Hrs							
1.	R and Rstudio Installation and Operation	3							
2.	Variables and Data Types	3							
3.	Data Frames	3							
4.	Recasting and Joining of Data Frames	3							
5.	Arithmetic, Logical and Matrix Operation in R and Rstudio	3							
6.	R Functions	6							
7.	Control Structures	3							
8.	Basic Data Visualization	3							
9.	Introduction to apply on Biotechnology Domain	3							
10.	Report Submission	-							
	TOTAL	30							

### **References:**

R.Ragunathan and N. Shankar, "Data Science for Engineers" NPTEL, CSE, IIT Madras.

## 2. Python for Biotechnologist

	Course Description							
S.No	Торіс	Hrs						
1.	Python Installation and Operation	3						
2.	Fundamentals of the Program – An Introduction	3						
3.	Variables and Expressions	3						
4.	Math Module	3						
5.	Statements and Type	3						
6.	Functions	3						
7.	Code organizations	3						
8.	Conditionals and Exercise	3						
9.	Introduction to Biopython	3						
10.	Installation of Biopython and Guide to do program in Online	3						
11.	Report Submission	-						
	TOTAL	30						

## **References:**

https://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1004867 http://biopython.org/DIST/docs/tutorial/Tutorial.html

## 3. Training on Hospital's Clinical Research Lab

	Course Description	
S.No	Торіс	Days
1.	Clinical Data Management	3
2.	Clinical Research	3
3.	Pharmacovigilance	3
4.	Anatomy and Physiology	3
5.	Infectious Diseases	3
6.	Bacterial Infection Treatment	3
7.	Viral Infection Treatment	3
8.	Fungai Infection Treatment	3
9.	Basic Training on Hospital Equipments for Diagnosis	3
	Combine with Deepam Hospitals – Tambaram (West)	
	Chennai	
	TOTAL	27

### **References:**

Materials Provides by Trainers

# 4. Downstream Manufacturing (Microbial)

Course Description							
S.No	Торіс	Hrs					
1.	Basic Requirements	3					
2.	Initiating	3					
3.	Microbial Medium preparations	3					
4.	Conditions Maintenance	3					
5.	Loading and Operating	3					
6.	Trouble Shooting	3					
7.	Product Yielding	3					
8.	Purification	3					
9.	Quality and Quantity Analysis	3					
10.	Operating Test and Report Writing	3					
	Exclusive training on Labscale fermenter Imported from						
	Bioengineering Swizerland						
	TOTAL	30					

## **References:**

Bioengineering Fermenter Manual Book

# 4. Curriculum and Syllabus of the programme – After revision

_	Semeste	er I										
S.No.	AICTE	Course	Courses			edits					Iours	<u>.</u>
5.110.	Code	Code	Courses	L	Τ	P	C	: I	[]	Т	Р	Total
1.	BSC	XMA101	Calculus and Linear Algebra	3	1	0	4	. 4	4	1	0	5
2.	ESC	XCP102	Programming for Problem Solving	3	0	0	3		3	0	0	3
3.	BSC	XAP103	Applied Physics for Engineers	3	1	0	4		3	1	0	4
4.	ESC	XBT104	Biology for Engineers	3	0	0	3		3	0	0	3
5	HSMC	XGS105	Speech Communication	0	0	3	3	(	)	0	3	3
6	MC	XUM106	Constitution of India *#	0	0	0	0		2	0	0	2
7	ESC	XCP107	Programming for Problem Solving Laboratory	0	0	1	1	(	)	0	3	3
8	BSC	XAP108	Applied Physics for Engineers Laboratory	0	0	2	2	. (	)	0	3	3
			Total	12	2	6	20	) 1	4	2	9	25
	Semeste	er II							I			
S.No.	AICTE Code	Course Code	Courses	I		Cred T	its P	С	L	Т	Hours P	Total
1.	BSC	XMA201	Calculus, Ordinary Differentia Equations and Complex Variable	ıl g		1	<b>r</b>	<u> </u>	3	1	0	
2.	ESC	XBE202	Electrical and Electroni Engineering Systems		3	1	0	4	3	1	0	4
3.	BSC	XAC203	Applied Chemistry for Engineer	s 3	3	1	0	4	3	1	0	4
4	HSMC	XGS204	Technical Communication	2		0	0	2	2	0	0	2
5	ESC	XWP205	Workshop Practices	1		0	2	3	1	0	3	4
6	ESC	XBT206	Chemical Engineerin Thermodynamics	g 2	2	1	0	3	2	1	0	3
7	ESC	XBE207	Electrical and Electroni Engineering Systems Laboratory		)	0	1	1	0	0	3	3
8	BSC	XAC208	Applied Chemistry for Engineer Laboratory	C		0	1	1	0	0	3	3
			Total	1	4	4	4	22	14	4	9	27
	Semeste		1									
S.No.	AICTE	Course Code	Courses			Crec		T~			Hou	
	Code					T	P	C			T I	
1. 2.	BSC	XPS301	Probability and statistics		3 2	0	0 0	3	3		$\begin{array}{c c} 0 & 0 \\ \hline 1 & 0 \end{array}$	-
	PCC	XBT302	Biochemistry		3			3	3			
3.	PCC PCC	XBT303	Microbiology		5 2	0	0	3	$\frac{3}{2}$		$\frac{0}{1}$	
4. 5.		XBT304 XBT305	Material and Energy Balances		2	1	0	3	2	_	1 (	) 3
	PCC		Genetics and Evolutionar Biology		3	0	0	3	3		0 0	_
6.	HSMC	XUM306	Entrepreneurship Development		2	0	0	2	2		0 (	) 2
7	MC (HSMC)		Universal Human Values 2: Understanding Harmony		2	1	0	3	2		1 (	_
8	PCC	XBT308	Biochemistry Laboratory		)	0	2	2	0		0 6	
9	PCC	XBT309	Microbiology Laboratory	(	)	0	2	2	0		0 6	
10	PROJ	XBT310	In-plant Training - I			-	1	1	-	$\square$	- 2	
			Total	1	7	3	5	25	18	3	3 1	4 35

	AICTE	~			0		Cr	edits			I	Iours	
S.No.	Code	C	ode		Courses	L	Τ	P	С	L	Τ	Р	Tota
1.	PCC	XBT4	401	Basi	ic Transport Processes	2	1	0	3	2	1	0	3
2.	PCC	XBT4	102		energetics and abolism	¹ 2	1	0	3	2	1	0	3
3.	PCC	XBT4	403	Cell	Biology	3	0	0	3	3	0	0	3
4.	PCC	XBT4	104	Imn	unology	3	0	0	3	3	0	0	3
5.	HSMC	XUM	405	Eco	nomics for Engineers	3	0	0	3	3	0	0	3
6	MC	XUM	406	Disa	ster Management ^{*#}	0	0	0	0	2	0	0	2
7	PCC	XBT4	407	Basi Lab	ic Transport Processes oratory	° 0	0	1	1	0	0	4	4
8	PCC	XBT4	108	Cell Biology Laboratory			0	2	2	0	0	8	8
9	PCC	XBT4	109	Imn	unology Laboratory	0	0	1	1	0	0	4	4
				Tota	al	13	2	4	19	15	2	16	33
	Semeste	r V											
S.No.	AICTE	Cod	le		Courses			edits				Iours	1
	Code					L	Τ	P	С	L	Τ	P	Tota
1	PCC	XBT50			alytical Tools	3	0	0	3	3	0	0	3
2	PCC	XBT50			ular Biology	3	0	0	3	3	0	0	3
3	PCC	XBT50			action Engineering	2	1	0	3	3	1	0	4
4	PCC	XBT50			Biotechnology	3	0	0	3	3	0	0	3
5	PEC	XBT50			Biotechnology	3	0	0	3	3	0	0	3
		XBT50		_	Iltural Biotechnology	3	0	0	3	3	0	0	3
		XBT50	05C	Pharm	aceutical Biotechnology	3	0	0	3	3	0	0	3
6	OE	XOE1			Open Elective Courses			0	3	3	0	0	3
7	PCC	XBT50	)7	Bioana	alytical Tools Laboratory	0	0	1	1	0	0	6	6
8	PCC	XBT50		Bio Labora		0	0	2	2	0	0	8	8
9	PROJ	XBT50			nt Training - II	-	-	1	1	-	-	2	2
10	PMC	XBTM			Course I ^{*#}	0	0	0	0	0	0	2	2
				Total		17	1	4	22	18	1	18	37
	Semeste				ſ								
S.I		CTE	Course	Code	Courses		<b>T</b>	Cred		<u>a</u>		Hours	-
	PCC	ode	XBT601		Animal Biotechnology		L 3					<b>Γ Ρ</b> ) 0	Total 3
1							3			_		$\frac{1}{2}$ 0	3
1 2	PCC	2	XBT602		Process Biotechnology Upstream	_	1	1	0	2	•		
	PCC PCC		XBT602 XBT603		Process Biotechnology Upstream Process Biotechnology Downstream	_	1					2 0	3
2		2			Upstream Process Biotechnology	- - als	_	1	0	2	1 2	2 0 0 0	3
2 3		2	XBT603	A	Upstream Process Biotechnology Downstream Mass Transfer Fundamenta Fermentation Technology	- als	1 3 3	1	0 1 0 1 0 1	2 3 3	1 2 3 (		
2 3 4	PCC PEC	2	XBT603 XBT604 XBT604 XBT604	A B C	Upstream Process Biotechnology Downstream Mass Transfer Fundamenta Fermentation Technology Nanobiotechnology	– als	1 3	1 0 0	0 1 0 1 0 1	2 3 3	1 2 3 ( 3 (	) 0	3
2 3	PCC	2	XBT603 XBT604 XBT604	A B C	Upstream Process Biotechnology Downstream Mass Transfer Fundamenta Fermentation Technology	_ als	1 3 3	1 0 0 0 0 0	0 0 0 1 0 1	2 3 3 3	1 2 3 ( 3 ( 3 ( 3 (	) 0 ) 0	33
2 3 4 5 6	PCC PEC OE HSM	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	XBT603 XBT604 XBT604 XBT604 XBT604 XBTOE: XGS606	A B C 2	Upstream Process Biotechnology Downstream Mass Transfer Fundamenta Fermentation Technology Nanobiotechnology Open Elective Courses Professional Skills	als	1 3 3 3 3 1	1 ( 0 ( 0 ( 0 ( 0 ( 0 ( 0 ( 0 ( 0 (	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	2 3 3 3 3 3 3	1 2 3 0 3 0 3 0 3 0 1 0	0     0       0     0       0     0       0     0       0     0       0     0       0     0       0     0       0     4	3 3 3 3 5
2 3 4 5 6 7	PCC PEC OE HSM MC	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	XBT603 XBT604 XBT604 XBT604 XBT0E XGS606 XUM60	A B C 2	Upstream Process Biotechnology Downstream Mass Transfer Fundamenta Fermentation Technology Nanobiotechnology Open Elective Courses Professional Skills Cyber Security ^{*#}		1 3 3 3 3 3	1 ( 0 ( 0 ( 0 ( 0 ( 0 ( 0 ( 0 ( 0 (	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	2 3 3 3 3 3 3	1 2 3 ( 3 ( 3 ( 3 ( 3 ( 1 (	0         0           0         0           0         0           0         0           0         0           0         0	3 3 3 3
2 3 4 5 6	PCC PEC OE HSM	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	XBT603 XBT604 XBT604 XBT604 XBT604 XBTOE: XGS606	A B C 2 7	Upstream Process Biotechnology Downstream Mass Transfer Fundamenta Fermentation Technology Nanobiotechnology Open Elective Courses Professional Skills		1 3 3 3 3 1		0 0 0 0 0 2 0 4	2 3 3 3 3 3 0 4	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	0     0       0     0       0     0       0     0       0     0       0     0       0     0       0     0       0     4	3 3 3 3 5

S	Semester	VII												
S.No.	AICTE	Course Code	Courses			dits		Hours						
<b>D</b> •1 <b>10</b> •	Code	course code	courses	L	Т	Р	С	L	Т	Р	Total			
1	PCC	XBT701	Microbial Biotechnology	3	0	0	3	3	0	0	3			
2	PCC	XBT702	Recombinant DNA Technology	3	0	0	3	3	0	0	3			
3	PEC	XBT703A	A. Stem Cell Biotechnology	2	1	0	3	2	1	0	3			
		XBT703B	B. Cancer Biology	2	1	0	3	2	1	0	3			
		XBT703C	C. Design of Bioprocess Equipments	2	1	0	3	2	1	0	3			
4	OE	XOE3	Open Elective Courses	3	0	0	3	3	0	0	3			
5	MC	XES705	Environmental studies ^{*#}	0	0	0	0	3	0	0	3			
6	PCC	XBT706	Recombinant DNA Technology Laboratory	0	0	2	2	0	0	6	6			
7	PCC	XBT707	Bioinformatics	1	0	1	2	1	0	5	6			
8	PROJ	XBT708	Project Work (Phase-I)	0	0	2	2	0	0	6	6			
9	PROJ	XBT709	In-plant Training – III	-	-	2	2	-	-	2	2			
10	PMC	XBTMO3	Minor Course III ^{*#}	0	0	0	0	0	0	2	2			
			Total	12	1	7	20	15	1	21	37			

## Semester VIII

S.No.	AICTE	Course Code	Courses		Cre	dits			Η	ours	
5.110.	Code	Course Code	Courses	L	Т	Р	С	L	Т	Р	Total
1	PEC	XBT801A	A. Introduction to Quantum Biology, AI and Data Science	2	1	0	3	2	1	0	3
		XBT801B	B. Enzyme Engineering	2	1	0	3	2	1	0	3
		XBT801C	C. Bio waste and Bio products Utilization	2	1	0	3	2	1	0	3
2	OE	XOE4	Open Elective Courses	3	0	0	3	3	0	0	3
3	OE	XOE5	Open Elective Courses	3	0	0	3	3	0	0	3
4	PROJ	XBT804	Project Work (Phase-II)	0	0	9	9	0	0	18	18
5	PMC	XBTMO4	Minor Course IV ^{*#}	0	0	0	0	0	0	2	2
			Total	8	1	9	18	8	1	20	29
		Cront Total C	nadita, 166								

Grant Total Credits: 166 In Plant Training of 30 days in the vacation periods is mandatory to complete the graduation. LIST OF SKILL ORIENTED MINOR COURSES

Sl	Category	Name of the Course	Credit
no			
1.	PMC	Training on GC-MS, HPLC	0
2.	PMC	Training on AFM, SEM	0
3.	PMC	Training on PCR and	0
		Electrophoresis	
4.	PMC	MATLAB Basics for	0
		Biotechnology researchers	
5.	PMC	Training on Lab Scale	0
		Fermentor	

## LIST OF OPEN ELECTIVE COURSES OFFERED FROM BIOTECHNOLOGY

Sl	Category	Name of the Course	Credit
no			
1.	OE	Intellectual Property	3
		Rights	
2.	OE	<b>Biosafety Management</b>	3
3.	OE	Digital Health	3

Sl	Category	Name of the Course	Components
no			
1.	PMC	R Program and R Studio for	Employability
		Biotechnologist	
2.	PMC	Python for Biotechnologist	Employability
3.	PMC	Training on Hospital's	Research Skill
		Clinical Research Lab	and Employability
4.	PMC	Downstream Manufacturing	Employability
		(Microbial)	

## LIST OF VALUE ADDED COURSES SUGGESTED

#### Note

## L – Lecture, T – Tutorial, P – Practical, C - Credit

Each faculty made presentation on their suggestions on the courses allotted to them before the Board of studies members.

## Summary of the credits and hours

Year	Semester	Total Credits	Total Hours / Week	No. of courses	Value Addition Suggested
т	Ι	20	25	8	No
1	II	22	27	8	No
II	III	25	33	10	Yes
11	IV	19	33	9	Yes
III	V	22	35	10	Yes
111	VI	20	32	9	Yes
IV	VII	20	35	10	Yes
IV	VIII	18	29	5	Yes
	I – VIII	166	248	69	

			I Semester				
COURS	E COD	ЭE	XMA 101	L	Т	Р	С
COURS	E NAN	ſE	Mathematics I (Calculus and Linear Algebra)	3	1	0	4
С	Р	A		L	Т	Р	Η
3	0.5	0.5		3	1	0	4
PREREC	QUISI'	FE: Di	fferentiation and Integration				
COURS	E OUI	COM	ES:				
Course o	utcom	es:		Don	nain	Le	vel
CO1		y the o lical for	rthogonal transformation to reduce quadratic form to rms.	Cog	nitive	_	member ply
CO2			ver series to tests the convergence of the and series and Half range Fourier sine and cosine	0	nitive chomoto	Ap Gu	member oply iided sponse
CO3			erivative of composite functions and implicit uler's theorem and Jacobian	Psyc r	nitive chomoto	Re Gu	member iided sponse
CO4	findin	ig max	functions of two variables by Taylor's expansion, by ima and minima with and without constraints using Method Directional derivatives, Gradient, Curl and	Cog	nitive		member iderstand

	Divergence.			Affective	Receive
CO5	<b>Apply</b> Differential an Curvature and to imprope	d Integral calculus to no printegrals.	otions of	Cognitive	Apply
UNIT -I	Matrices				12
Linear Tr	ansformation - Eigen valu	es and Eigen vectors -Propertie	es of Eigen	values and Ei	gen vectors
	-	nalisation of Matrices – Real N	-		-
	U	ic form – canonical form - Nat	•		
•	<b>-</b>	o Canonical form (Orthogonal	-		
	Sequences and series		•		12
Sequence	s: Definition and example	S-Series: Types and convergen	ce- Series c	of positive terr	ms – Tests o
converge	nce: comparison test, Integ	ral test and D'Alembert's ratio	test Four	rier series: Ha	lf range sine
and cosin	e series- Parseval's Theor	em.			_
UNIT -	Multivariable Calculu	s: Partial Differentiation			12
III					
Limits an	d continuity –Partial differ	rentiation – Total Derivative –	Partial diffe	erentiation of	Composite
Functions	: Change of Variables – D	ifferentiation of an Implicit Fu	nction - Eu	ler's Theoren	n- Jacobian.
UNIT -	Multivariable Calculu	s: Maxima and Minima and	Vector Cal	lculus	12
IV					
		o variables- Maxima, Minima			
		s Method of Undetermined Mu	ıltipliers – l	Directional D	erivatives -
	Divergence and Curl.				
	Differential and Integ				12
		of definite and improper integr			
their prop	**	inite integrals to evaluate surfa	ice areas an		
	LECTURE	TUTORIAL		ТО	TAL
	45	15			60
<b>T</b> . <b>( D</b> .		15			60
Text Boo		nearing Mathematics" Tata M	Crow Ui	1 Now Dolh:	11th Donni
		neering Mathematics", Tata M	ICOTAW HII	i new Delni,	i i ui Keprii
20	)15. (Unit-1, Unit-3 and U	) <b>nit-4).</b>			

- 5. N.P. Bali and Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, Reprint, 2014. (Unit-2).
- B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40th Edition, 2010. (Unit-5).

### **Reference Books:**

- 5. G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9th Edition, Pearson, Reprint, 2002.
- 6. Veerarajan T., "Engineering Mathematics for first year", Tata McGraw-Hill, New Delhi, 2008.
- 7. D. Poole, "Linear Algebra: A Modern Introduction", 2nd Edition, Brooks/Cole, 2005.
- 8. Erwin kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.

#### Cos versus GA mapping

			Graduates Attributes									
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2			2					1		2
CO2	3	1								1		1
CO3	3	1								1		1
CO4	3	2								1		1
CO5	3	2			1					1		2

Total	15	8	0	0	3	0	0	0	0	5	0	7
Scaled Value	3	2			1					1		
0	) - No	Relati	on, 1 -	Low	/ Relati	on, 2-1	Mediu	ım Rela	tion,	3- High	Relat	ion
		1 – 5 -	$\rightarrow 1$ ,		6	- 10 -	→ 2,		11	$-15 \rightarrow$	3	

	seCode		XCP102		L	Т	Р	C
	seName	<u>,</u>	PROGRAMMINGFORPROBLEMSOLVING	r	3	0	0	3
Prere	quisite		BasicUnderstandingSkills		L	Т	Р	H
С	P	A			3	0	0	3
3	0	0						
Cour	seObjeo	ctive	S					
• To	olearnpr	ogra	mminglanguagebasicsand syntax					
• To	oignite l	ogic	althinking					
• To	ounderst	and	structured programmingapproach					
• To	odealwit	h us	erdefined datatypes					
• To	o knowa	ibou	datastorage in secondarymemory					
Cours	xeOutco	me.	fterthecompletionofthecourse, studentswillbe	Doma	in		Leve	
able t			green needing tenenegine eeu se, suudenis mine e	Doma				•
CO1	-	e t	rogramming fundamentals and Solve	Cognitiv	ve	App	olv	
001	j	-	impleprogramsusingI/O statements				)	
CO2	Expla		simple programs using	Cognitiv	ve	Uno	lersta	nd
	-		cturesandarrays	U				
CO3	Expla	in	the simple programs using functions	Cognitiv	ve	Unc	lersta	nd
	andpo	inte		-				
<b>CO4</b>	Expla	in s	mple programs using structures and unions	Cognitiv	ve	Uno	dersta	nd
CO5	Expla	in s	mpleprograms usingfiles and Build simpleprojects	Cognitiv	ve	Uno	dersta	nd
COU	RSECC	)NT	ENT					
UNII	<b>]-I</b>	PR	OGRAMMINGFUNDAMENTALSANDI/OSTAT	<b>TEMEN</b>	ГS			9
Introc	luction t	:0 C(	mponentsofa computersystem, Program–Flowchart –	Pseudo co	ode-	Softv	vare	
– Int	roductio	n t	C language – Character set – Tokens: Identif	iers, Key	wor	ds, C	Consta	nts
andO	perators	_	sample program structure -Header files – Data '	Types- V	/aria	bles	- Ou	tpu
staten	nents –I		statements.					
UNIT	-II	CC	NTROLSTRUCTURE ANDARRAYS					9
~	olStruct	ure	-ConditionalControlstatements:Branching,Looping-					
Contr	nditiona	lcor	trolstructures:switch,break,continue,gotostatements-					
	s:OneD	ime	nsionalArray–Declaration					
Unco		I-A	cessingArrayElements-Searching-Sorting-TwoDim	ensionala	array	s-Dec	larati	on
Unco Array			rixOperations-MultiDimensionalArrays-Declaration	–Initializ	ation	.Stor	age	
Unco Array –Initia Initial	alizatior lization-	-Ma	•					
Unco Array –Initia Initial classe	alizatior lization- es:auto -	-Ma -exte	rn-static.Strings:Basicoperationsonstrings.					-
Unco Array –Initia Initial	alizatior lization- es:auto -	-Ma -exte	•					9
Uncon Array –Initia Initial classe <b>UNIT</b> Funct	alizatior lization- es:auto - <b>C-III</b> ions:Bu	-Ma -exto FU ilt-i	rn–static.Strings:Basicoperationsonstrings. NCTIONS ANDPOINTERS Ifunctions–UserDefinedFunctions-Parameterpassing					9
Uncon Array –Initial classe UNIT Funct Passin	alizatior lization- s:auto - <b>: -III</b> ions:Bu ngarrays	-Ma -exto FU ilt-i stoft	rn–static.Strings:Basicoperationsonstrings. NCTIONS ANDPOINTERS	s.Pointers				9

CallbyvalueC	•	rays-UseofPointersitself-refe	rentialstructure
Notionoflink			
UNIT -IV	STRUCTURESANDUNIONS		9
Structuresand	lUnions-Givingvaluestomembers-Initializ	zingstructure-Functionsandstr	ructures
	turetoelementstofunctions-Passingentire f	function ofunction's-Arrayso	fstructure-
	nin a structureandUnion.		
UNIT -V	FILES		9
	FilemanagementinC-Fileoperationfunct		
	Closingafile-The get and put fur	nctions-The print &scan	functions-
	seekfunction-FilesandStructures.		
L	Т	Р	Total
45	0	0	45
TEXTBOOI			
3. ByronGo	ottfried,"ProgrammingwithC",IIIEdition,(	IndianAdaptedEdition),TMH	[publications,2]
010			
4. Yeshwai	ntKanethker, "LetusC",BPBPublications,2	2008	
REFERENC			
4. E.Balagi	uruswamy, ProgramminginANSIC,TataM	cGraw-Hill.7 th edition2017.	
v	Kernighanand	· · · · · · · · · · · · · · · · · · ·	
	I.Ritchie, "TheCProgrammingLanguage", I	PearsonEducationInc.2005	
6. Johnson	paughR.andKalinM.,"ApplicationsProgram	mminginANSIC",	
	n,Pearson EducationIndia,2003	5	
E-REFERE			
4. https://w	ww.indiabix.com/c-programming/questio	ons-and-answers/	
-	ww.javatpoint.com/c-programming-langu		
-		-	

6. https://www.w3schools.in/c-tutorial/

				111	appm	5010			0.					
			PROGRAM OUTCOMES											
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	0	0	3	0	0	0	0	0	2	3	2	0
CO2	3	2	0	0	2	0	0	0	0	0	2	3	2	0
CO3	2	2	1	2	2	0	0	0	0	0	2	2	2	0
CO4	2	2	1	2	2	0	0	0	0	0	2	2	2	0
CO5	2	2	1	0	2	0	0	1	0	2	2	2	2	0
Total	12	10	3	4	11	0	0	1	0	2	10	12	10	0
ScaledValue	3	2	1	1	3	0	0	1	0	1	2	3	2	0
$1-5 \rightarrow 1, \qquad 6-10 \rightarrow 2, \qquad 11-15 \rightarrow 3$														
	(	)-NoR	elatio	n,1-I	Low Re	elatior	n,2-M	edium	Relat	ion,3-F	lighR	elatio	1	

### Mapping of CO's with PO:

	SE CODE	<b>XAP103</b>			L         T         P         C           3         1         0         4           L         T         P         H							
	SE NAME		<b>PHYSICS FOR E</b>	NGINEERS								
C	:P:A	2.8:0.8:0.	4		L	Т		Р	Н			
PRERE	QUISITE:	Basic Ph	ysics in HSC level		3	1		0	4			
COURS	E OUTCON	MES	•		Ι	oma	in	L	evel			
	••	d <i>determi</i>	ne its significance	<i>plain</i> the principles of in engineering systems		Cogni	tive:	Reme Unde	ember, rstand anism			
	electromagn	etic induc		, magneto-statics and atebasic applications of	f Psy	Cogni chon Affec		Analy	anism			
CO3Understandthe fundamental phenomena in optics by measurement and describe the working principle and application of various lasers and fibre optics.Cognitive: PsychomotorUnderstand, Apply Mechanism Receive												
CO4	Analyseener	ov hande	in solide <i>disc</i>	use and use physics				Unde	rstand			
principles of latest technology using semiconductor devices. Psychomotor : Affective: Affective: Receive												
	-	U	- ·	y and solveSchrodinger	. (	Cogni	tive:	Unde	rstand,			
	equation for	<u> </u>				20511		Appl				
	MECHANIC			k and energy - impulse				9+	-			
conservat Elasticity couple ar determina UNIT -II Laws of internal fi equation polarized polarized	ion of energy : Stress - Str at torque - Tation of Young ELECTRON electrostatics eld – Clausiu - Plane electr light - quart light.	and mome rain - Hool orsion pene g's modulus <u>MAGNET</u> - Electrost sMossotti E romagnetic ter and hal	ntum - Friction. ke's law - Stress str lulum - Application <u>C THEORY</u> atic field and potent equation - Laws of r waves; their transve f wave plates - pro-	ain diagram - Classificat s of torsion pendulum - and non-uniform bending. tial of a dipole; Dielectric nagnetism - Ampere's Far- erse nature - expression for oduction and detection of	ion of Bendir c Polar aday's I or plan	elasti g of isatio aw; L e, circ	c mod beams n, Die Lenz's C cularly	lulus - - Exp lectric law - N and el and el	Moment, erimental -3 constant, Maxwell's lliptically lliptically			
UNIT –I	II OPTICS, I	LASERS A	ND FIBRE OPTIC	S				9+	-3			
a prism- I LASER: Fibre Op of optical	nterference of Introduction - tics: Principle	f light in the - Population e and propa optic comm	n films: air wedge - n inversion -Pumping gation of light in op unication system (B	- Determination of refrac Diffraction: grating. g - Laser action - Nd-YAC tical fibre - Numerical ape lock diagram).	laser ·	· CO ₂	laser -	Applic	cations e - Types			
semicond semicond <b>Diodes a</b>	uctors - Con- uctors - P type <b>nd Transisto</b>	cept of Fe e and N typ ors: P-N ju	rmi level - Intrinsion e semiconductors - Inction diode - Forw	rgy band diagram of g semiconductors - Conc Hall effect. yard bias and reverse bias on diodes - PNP and N	ept of s - Rea	holes ctifica	- doj tion a	ping - ction o	Extrinsic f diode -			

configurations - Advantages of common emitter configuration - working of NPN transistor as an amplifier in common emitter configuration.

#### **UNIT –V QUANTUM PHYSICS**

Introduction to quantum physics, black body radiation, Compton effect, de Broglie hypothesis, wave – particle duality, uncertainty principle, Schrodinger wave equation (Time dependent and Time independent), particle in a box, Extension to three dimension - Degeneracy.

#### **TEXT BOOKS**

1. Gaur R. K. and Gupta S. L., "Engineering Physics", Dhanpat Rai Publications, 2009.

2. Avadhanulu M. N. "Engineering Physics" (Volume I and II), S. Chand & Company Ltd., New Delhi, 2010. **REFERENCE BOOKS** 

1. Palanisamy P. K., "Engineering Physics", Scitech Publications (India) Pvt. Ltd, Chennai.

2. Arumugam M., "Engineering Physics" (Volume I and II), Anuradha Publishers, 2010.

3. Senthil Kumar G., "Engineering Physics", 2nd Enlarged Revised Edition, VRB Publishers, Chennai, 2011.

4. Mani P., "Engineering Physics", Dhanam Publications, Chennai, 2007.

#### **E RESOURCES**

NPTEL, Engineering Physics, Prof. M. K. Srivastava, Department of Physics, IIT, Roorkee.

	LECTURE	TUTORIAL	PRACTICAL	TOTAL HOURS
Hours	45	15	-	60

#### Mapping of CO's with PO:

			PROGRAM OUTCOMES											
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	2	2	1	-	-	-	1	-	-	1		
CO2	3		1		1	-	-	-		-	-	1		
CO3	3	2	2	2	1	-	-	-	1	-	-	1		
<b>CO4</b>	3	2	2	2	1	-	-	-	1	-	-	1		
CO5	3		2			-	-	-		-	-	1		
CO6														
Total	15	6	9	6	4				3			5		
ScaledValue	3	2	2	2	1	-	-	-	1	-	-	1		
	$1 - 5 \rightarrow 1, \qquad \qquad 6 - 10 \rightarrow 2, \qquad \qquad 11 - 15 \rightarrow 3$													
	0-NoRelation, 1-Low Relation, 2-MediumRelation, 3-HighRelation													

9+3

X	BT1	04		`L	Т	Р	C
С	Р	Α	BIOLOGY FOR ENGINEERS	3	0	0	3
			<b>BIOLOGI FOR ENGINEERS</b>				
3	0	0		L	Т	Р	H
				3	0	0	3
Cou	irse (	outc	ome	Doma	in	Leve	el
CO	1	De	scribe how biological observations of 18th Century	Cognit	ive	Unders	tand
		tha	t lead to major discoveries.				
CO	2	Ex	<i>plain</i> the cell morphology and their functions	Cognit		Unders	tand
CO.			<i>plain</i> the Human anatomy and Physiology	Cognit		Unders	
CO			call the types of Tissue and its functions	Cognit		Unders	
CO			Istrate the essential of Amino Acids DNA/RNA	Cognit	ive	Unders	tand
UNI	IT I		Introduction				6
			Fundamental differences between science and engineering		-	-	
			between eye and camera, Bird flying and aircraft Why				
			Biological observations of 18th Century that lead to major				
			Brownian motion and the origin of thermodynamics	by refer	ring to	the orig	inal
			observation of Robert Brown and Julius Mayor.			I	
UN	IT II		Cell Biology				9
			Introduction to the cell biology – Cell size and shape - Che				
			of cell and its properties; structure of Cell membrane and c	ellular or	ganelle	s; Cell cyc	le; Cell
			signaling, Transport across cell membrane				
UNI	IT II		Human physiology and anatomy				9
			Introduction to Human Anatomy and Physiology-Ana				
			Organization of the Human Body-Skin and the Integum				
			Muscular Systems -Nervous System-Cardiovascular Systems		Jympha	tic and I	mmune
TINI			System-Respiratory System- Digestive System -Urinary Sy Biomolecules	stem			9
UNI			Molecules of life - Monomeric units and polymeric structu		ana ah		-
			· ·			-	
			and cellulose. Amino acids and proteins. Nucleotides an	d DNA/I	KINA.	I wo cardo	on units
TINI	T V		and lipids. Modern Applications from Piclogical Sciences				12
UNI			Modern Applications from Biological Sciences Principles and Application of Biosensor; Basics of Biochip	Dio f	ortilizor	Dioinfo	
			– Bio fuel – Introduction to Bio mechanics - Neural Netv				
			Stem Cell; Introduction to Genetics; Genetic Engineerin			0	. ,
			Hazardous Effect.	g and n	з дррп	cation, D	losalety
			LECTURE TUTORIAL			TOTAL	
			45 0			45	
Tev	t Bo	oks.				Ъ	
			gy: A global approach: Campbell, N. A.; Reece, J. B.; Urry	Lisa C:	ain. M	.: Wasse	rman
			Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd	, 115u, Cl	~***, 1 <b>*1</b> , 1	, usso	
			-	Iour F 1	antion	find: N	ow
2			ohini Singh and Dr. Tanu Allen, "Biology for Engineers", V	ayu Edu	cation (	n maia, N	ew
	L	Jelhi	, 2014.				

#### **References Books:**

- 6. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons
- 7. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
- 8. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
- 9. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers
- 10. Biology for Engineers (ISBN: 9781121439931), TMH

#### **Online References:**

- 4. www.bio12.com/ch3/RaycroftNotes.pdf
- 5. www.engineering.uiowa.edu/bme050/cvb-solids.pdf
- 6. www.biologyjunction.com/mendelian_genetics.html

#### Mapping Of Course Outcomes with Program Outcomes

			PROGRAM OUTCOMES												
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	
CO1	3	3	2	2	3	1	2	1	2	2	3	0	1	1	
CO2	2	3	2	2	3	2	2	1	1	2	3	1	1	1	
CO3	2	2	1	1	3	2	2	1	1	2	3	1	0	1	
CO4	3	2	1												
CO5	3	3	2	3	3	2	3	1	1	2	3	0	1	2	
Original	14	14	9	11	17	10	12	6	7	10	16	3	5	7	
Value	14	14	9	11	17	10	12	0	/	10	10	5	5	/	
Scaled	3	2	2	2	2	2	3	2	2	2	2	1	1	2	
Value	3     3     2     3     2     3     2     2     3     1     1     2														
	$1-5 \rightarrow 1$ , $6-10 \rightarrow 2$ , $11-15 \rightarrow 3$														
	0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation														

2	XGS1(	)5		Speech Commun	ication		-	L 0	<u>Т</u> 0	P 3	SS 0	C 3
С	Р	Α		Specen Commun	ication		-	L	T	P	SS	H
2.6	0.4	0					ŀ	0	0	3	0	3
Cours able to		tcomes	: Aft	er completion of the course,	students	will be	Dom	ain		L	evel	
CO1	A	bility to	recall	the types of speeches		Cogniti	ve		R	eme	mber	
CO2	A	oply the	techr	iques in public speaking		Cogniti	ve			App	oly	
CO3	Id	entify th	e con	nmon patterns in organizing a	speech	Cogniti	ve		R	eme	mber	
<b>CO4</b>				ature and style of speaking	•	Cogniti	ve			Crea	ate	
CO5	Pr	acticing	the s	peaking skills		Psycho	motor	G	uide	d Re	spons	e
UNIT	'-I	Ty	pes of	f Speeches							9	
1.1 – mater		ypes of	spee	ches- $1.2$ – Analyzing the au	dience-1.	3 - Deve	loping	g ide	eas a	nd s	uppor	ting
UNIT		Pu	blic S	Speaking							9	
				c Speaking							-	
				ed for successful speech makir	ng							
				yday life situations	0							
UNIT		<u> </u>		ation of Speech							9	
3.1 -	Develo			h out line - 3.2 - Organizing	the speecl	n- 3.3 – I	[ntrod	uctio	on - 0	level	lopme	nt –
conclu		1 0		0 0	1						1	
UNIT	-IV	Pr	esent	ation							9	
4.1 - 7	Tips for	r prepar	ing th	e draft speech								
4.2 – 2	Presen	tation te	chniq	ues using ICT tools								
4.3 –	Using	example	s froi	n different sources								
UNIT	C-V	Ac	tivitie	28							9	
5.1 –	Readin	g activit	ies -5	5.2 – Creative presentations -5	.3 – Media	a present	ation t	echr	nique	s		
	LECI	URE		TUTORIAL	PRAC	CTICAL	1			T	OTAI	
	0			0		45					45	
				Michael Swan. <i>Practical Eng</i> shp Lata. <i>Communication Ski</i>				ess.	2011			

Mapping Of Course Outcomes with Program Outcomes

			PROGRAM OUTCOMES											
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	0	0	0	0	0	2	0	1	0	0	0	0	0
CO2	2	0	0	0	0	0	2	0	1	0	0	0	0	0
CO3	1	0	0	0	0	0	1	0	1	0	0	0	0	0
CO4	2	0	0	0	0	0	1	0	1	0	0	0	0	0
CO5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	7	0	0	0	0	0	6	0	4	0	0	0	0	0
ScaledValue	2	0	0	0	0	0	2	0	1	0	0	0	0	0
	$1-5 \rightarrow 1, \qquad 6-10 \rightarrow 2, \qquad 11-15 \rightarrow 3$													
	0-NoRelation,1-Low Relation,2-MediumRelation,3-HighRelation													

r														т	T	P	C		
X	UM 1	06						TION	0.5.1					L	T	P	C		
					C	CONS	STITU	TION	OF L	NDIA				0	0	0 D	0		
C	P	A												<u>L</u>	T	P	H		
3	0	0		<b>.</b>	1.1		C .1				11 1	11 .		3	0	0	3		
			nes : Af					ourse,	stude	ents wi	ll be			oma	ain	TT	Level		
CO			l <b>y</b> Histo	•								Cogr							
CO		-	l <b>ain</b> the									Cogn	nitive	•		Ur	derstand		
CO			tify the		1		U	lature				Cogr	nitive	•		Ur	derstand		
CO			lysis th									Cogr	nitive	•		A	Analyse		
CO	)5	Expl	lain the	Centr	e State	e Rela	ation					Cogr	nitive	;		Ur	derstand		
Co	urse (	Conte	nt														Hours		
	IT-I																9		
Cor	nstitut	ional H	History	- The	Constit	tutior	nal Rig	hts- P	reamb	ole- Fui	ndame	ental Rig	ghts-	Func	lame	ntal l	Duties-		
		-	iples of	State	Policy														
UN	IT –I	Ι															9		
								·	rs and	l functi	ions)-	Vice-Pr	reside	ent o	f Ind	lia-Tł	ne Council		
of N	Minist	ers-Pri	ime Mi	nister-	Powe	rs an	d Func	tions.											
	IT-II																9		
																	ya Sabha-		
			cedure	in Ind	ia- Imp	oortai	nt Com	mittee	es of I	Lok Sal	oha- S	peaker o	of the	e Lol	c Sał	oha.	1		
	IT-IV																9		
						e Sup	oreme (	Court-	Origi	inal Jur	isdict	ion- Apj	pelete	e juri	isdic	tions	Advisory		
		on- Ju	dicial r	eview															
	IT-V																9		
								-	-			ctions of	Chie	ef Mi	niste	r-Leg	gislative		
Ass			e Judicia	ary- Po					e Higl										
	LE	CTU	RE			TUT	ORIA	L		PF		TICAL			]	ΓΟΤ	AL		
		45					0				0					45			
		ENCE																	
							<b>.</b>					8.1.Publi							
												lishing H		e, 19	77.				
									Lonc	ion:Ma	cmill	on, 1995	).						
			emocra																
5.0	Jopal	K.Puri	i- Cons							'4L D		<b>0</b> (							
				Map	ping C	лСа	ourse (				<u> </u>	m Outo		es					
								PR	UGR	CAM C	DUTC	COMES	IES						
			1	2	3	4	5	6	7	8	9	10	11 12 PSO1 PSO2						
	CO1		2	0	0	1	0	0	0	0	0	0	0	0		0	0		
0	C <b>O2</b>		2	0	0	1	0	0	0	0	0	0	0	0		0	0		

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

 $6-10 \rightarrow 2,$ 

 $11 - 15 \rightarrow 3$ 

 $1-5 \rightarrow 1$ ,

CO3

**CO4** 

**CO5** 

Total

Scaled value

8th BOS/BIOTECH/Date: 19.08.2021

COUR	RSECC	DDE	XCP107		L	Т	Р	С
COUR	RSENA	ME	Programming For ProblemSolvingLaboratory		0	0	1	1
PRER	EQUI	SITES	BasicUnderstandingSkills		L	Т	Р	Н
С	Р	Α			0	0	2	3
0.75	1	0.25			U	U	4	5
LEAR	NING	OBJEC	TIVES					
• To	learnpr	ogramm	inglanguagebasicsand syntax					
• To	ignitelo	ogicalthi	nking					
• To	underst	tandstru	ctured programmingapproach					
• To	dealwit	huserde	fined datatypes					
• To	knowa	boutdat	astorage in secondarymemory					
COUR	RSEOU	JTCOM	IES	DO	MAI	N	LEV	EL
CO1	Solve	simpler	programs using I/Ostatements	Cog	nitive	e A	Apply	
				Psyc	comot	tor R	lespon	ıd
CO2	Solve	prograr	ns usingcontrolstructuresandarrays	Cog	nitive	e A	Apply	
				Psyc	comot	tor R	lespon	nd
CO3	Solve	program	ns usingfunctionsandpointers	Cog	nitive	A	Apply	
				Psyc	comot	tor R	lespon	nd
CO4	Solve	program	ns usingstructures	Cog	nitive	A	Apply	
				Psyc	comot	tor R	lespor	nd
CO5	Solve	program	ns usingfiles	Cog	nitive		Apply	
				Psyc	comot	tor R	lespor	ıd

S.No.	ListofExperiments	COs
1	ProgramtodisplayaLeave Letterasperproperformat	CO1
2	iii. Programforaddition oftwonumbers iv. Programtosolveanymathematicalformula.	CO1
3	Programtofindgreatestof3numbersusingBranchingStatements	CO2
4	Programtodisplaydivisiblenumbersbetweenn1andn2usinglooping Statement	CO2
5	Programtosearchanarrayelementinanarray.	CO2
6	Programtofindlargest/smallestelementinanarray.	CO2
7	Programtoperformstringoperations.	CO3
8	Programtofind areaof a rectangle of agiven numberuse fourfunction types.	CO3
9	Programstopassandreceivearrayandpointersusingfourfunction types	CO3
10	ProgramsusingRecursion forfindingfactorial of anumber	CO3
11	Programtoreadanddisplaystudentmarksheetofastudentstructures Withvariables	CO4

12	Programtoreadanddisplaystudentma	rksofaclassusing	gstructures	CO4
	Witharrays			
13	Programtocreatelinked listusingstrue	ctureswithpointe	ers	CO4
14	Programforcopyingcontents of one fi	leto anotherfile.		CO5
15	Programusingfilestostoreanddisplay Structureswith array	studentmarklisto	ofaclass using	CO5
	HOURS	TUTORIAL	PRACTICAL	TOTAL
	HOUKS	0	30	30

# MappingofCOwithPO's

		PROGRAM OUTCOMES												
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	0	0	3	0	0	0	0	0	2	3	2	0
CO2	3	2	0	0	2	0	0	0	0	0	2	3	2	0
CO3	2	2	1	2	2	0	0	0	0	0	2	2	2	0
CO4	2	2	1	2	2	0	0	0	0	0	2	2	2	0
CO5	2	2	1	0	2	0	0	1	0	2	2	2	2	0
Total	12	10	3	4	11	0	0	1	0	2	10	12	10	0
ScaledValue	3	2	1	1	3	0	0	1	0	1	2	3	2	0
$1-5 \rightarrow 1, \qquad 6-10 \rightarrow 2, \qquad 11-15 \rightarrow 3$														
0-NoRelation,1-Low Relation,2-MediumRelation,3-HighRelation														

COURSE CODE		XAP108	L		Т	Р	С		
COURSE NAME		APPLIED PHYSICS FOR ENGINEERS LABORATORY	0		0	2	2		
C:P:A		0:2:0	L		Т	Р	Н		
PR	EREQUISITE:	Basic Physics in HSC level	0		0	3	3		
COURSE OUTCOMES				Domain			Level		
CO1 <i>Determine</i> the significance of elasticity in engineering systems and technological advances.					otor	Me	Mechanism		
CO	CO2 <i>use</i> and <i>locate</i> basic applications of electromagnetic induction to technology.				otor: tive:		Mechanism Respond		
CO	CO3 <i>Describe</i> the working principle and application of various lasers and fibre optics.				otor	Me	Mechanism		
CO	CO4 <i>use</i> physics principles of latest technology using semiconductor devices.				otor	Me	Mechanism		
	·	LABORATORY							
1. Torsional Pendulum - determination of moment of inertia and rigidity modulus of the given material of the wire.									
2.	. Uniform Bending - Determination of the Young's Modulus of the material of the beam.								
3. Non-Uniform Bending - Determination of the Young's Modulus of the material of the beam.									
4. Meter Bridge - Determination of specific resistance of the material of the wire.									
5. Spectrometer - Determination of dispersive power of the give prism.									

6.	Spectrometer - Determination of wavelength of various colours in Hg source using grating.
7.	Air wedge - Determination of thickness of a given thin wire.
8.	Laser - Determination of wavelength of given laser source and size of the given micro particle using
	Laser grating.
9.	Post office Box - Determination of band gap of a given semiconductor.
10.	PN Junction Diode - Determination of V-I characteristics of the given diode.
REF	ERENCE BOOKS:
2	4. Samir Kumar Ghosh, "A text book of Advanced Practical Physics", New Central Agency (P) Ltd,
	2008.
4	5. Arora C.L., "Practical Physics", S. Chand & Company Ltd., New Delhi, 2013.
6	5. UmayalSundari AR., "Applied Physics Laboratory Manual", PMU Press, Thanjavur, 2012.

	LECTURE	TUTORIAL	PRACTICAL	TOTAL HOURS
Hours	0	0	30	30

# Mapping Of Course Outcomes with Program Outcomes

			8 -			PR	OGR	AM (	)UTC	COMES	5			
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	2	2	1	-	-	-	1	-	-	1		
CO2	3		1		1	-	-	-		-	-	1		
CO3	3	2	2	2	1	-	-	-	1	-	-	1		
CO4	3	2	2	2	1	-	-	-	1	-	-	1		
Total	12	6	7	6	4				3			5		
ScaledValue	3	2	2	2	1				1			1		
		1 –	$1-5 \rightarrow 1$ , $6-10 \rightarrow 2$ , $11-15 \rightarrow 3$											
	(	)-NoR	lelatio	n,1-I	Low R	elatio	n,2-M	ledium	Relat	ion,3-H	lighR	elatio	n	

#### **II Semester**

CO	URSE (	CODE	COURSE NAME		L	Т	Р	С
XM	[A201		Calculus, Ordinary Differential Equations and Complex Variable		3	1	0	4
С	Р	Α			L	Т	Р	Η
3	0.5	0.5			3	1	0	4
PRI	EREQU	ISITE: N	Aathematics I (Calculus and Linear Algebra)				•	
CO	URSE (	OUTCON	ÆS:					
Cou	ırse out	comes:		Do	main		Lev	el
CO	1	Find dou	ble and triple integrals and to find line, surface and volume	Co	gnitiv	e	Apply	
		of an int	egral by Applying Greens, Gauss divergence and Stokes				Remen	nber
		theorem.						
CO	2		st order differential equations of different types which are	Co	gnitiv	e	Apply	
			for p, y, x and Clairaut's type.					
CO	3		econd order ordinary differential equations with variable	Co	gnitiv	e	Apply	
		coefficie	nts using various methods.					
CO	4		equations to verify analytic functions and to find harmonic	Co	gnitiv	e	Remen	nber
		functions	and harmonic conjugate.				Apply	
		Conform		Psv	chom		Guideo	1
		transform	nation.					

			tor		Response
CO5	Apply Cauchy residu	ue theorem to evaluate contour inte	grals Cog	nitive	Apply
		sine function and to state Cauchy int	egral		
	formula, Liouvilles the				
		of analytic functions, singularities, Laur	ent's Affe	ctive	Receive
Unit -I	series.	a (Integration)			12
	Multivariable Calculu			1	
-		grals (Cartesian) - change of order of i	U U		0
•		polar) - Triple integrals (Cartesian), So		•	
-	-	vector surface integrals - Theorems of G	reen, Gauss	and Sto	
Unit -II	First order ordinary o	-		<u> </u>	12
		uations - Euler's equations - Equations		st degre	ee: equation
		or y- equations solvable for x and Clairau	ut's type.		10
Unit -III	•	equations of higher orders			12
		uations with variable coefficients- meth			•
-	-	es solutions- Legendre polynomials- Bess	sel functions	of the	first kind an
their prop					
Unit -IV	Complex Variable – I	Differentiation			12
Differenti	ation-Cauchy-Riemann	equations- analytic functions-harmoni	c function	s-findin	ig harmoni
conjugate	- elementary analytic fu	nctions (exponential, trigonometric, lo	ogarithm) ai	nd thei	r properties
Conforma	l mappings- Mobius trans	formations and their properties			
Unit -V	Complex Variable – I	ntegration			12
Contour i	ntegrals - Cauchy-Gours	at theorem (without proof) - Cauchy In	tegral form	ula (wi	thout proof)
Liouville'	s theorem (without proof	f)- Taylor's series- zeros of analytic fu	nctions- sing	gulariti	es- Laurent'
series - R	esidues- Cauchy Residue	e theorem (without proof)- Evaluation of	f definite int	egral in	nvolving sin
and cosine	e- Evaluation of certain in	proper integrals using the Bromwich cor	ntour.		
	LECTURE	TUTORIAL	Т	OTAL	
	45	15		60	
Text Bool	k: B.S. Grewal, "Higher H	Engineering Mathematics", Khanna Publi	shers, 40th th	Editior	n, 2008.
Reference					
1.G.B. Th	omas and R.L. Finney, "C	Calculus and Analytic geometry", 9th Edit	ion, Pearson	, Repr	int, 2002.
		neering Mathematics", 9th Edition, John V			<b>ó</b> .
	5	"Elementary Differential Equations and	l Boundary	Value	Problems'
	iley India, 2009.				
		ns", 3 rd Ed., Wiley India, 1984.	,• TT 11	т 1'	1005
	<b>U</b>	on to Ordinary Differential Equations", P	rentice Hall	India,	1995.
	•	Equations", Dover Publications, 1958.	7th Ed McC	1	11:11 2004
		"Complex Variables and Applications", text book of Engineering Mathematics".			Hill, 2004.
	in and manish Goyal, A	text book of Engineering Mathematics	, laxiiii P	uuncall	ons, reprin
2008.					

						Grad	luates	s Attrib	outes			
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2			2					1		2
CO2	3	1								1		1
CO3	3	1								1		1
CO4	3	2								1		1
CO5	3	2			1					1		2
Total	15	8	0	0	3	0	0	0	0	5	0	7
Scaled Value	3	2			1					1		
0	) - No	Relati	on, 1 -	Low	/ Relati	on, 2-	Mediu	ım Rela	ation,	3- High	Relati	ion
		1-5-	$\rightarrow 1$ ,		6	- 10 -	→ 2,		11	$-15 \rightarrow$	<b>3</b>	

#### **COURSE CODE COURSE NAME** Т Р L С **ELECTRICAL AND ELECTRONICS XBE202** 3 1 0 4 **ENGINEERING SYSTEMS Prerequisites Physics** L Т Р Н C:P: A 3:0:0 3 0 4 1 **Course Outcomes** Domain Level Cognitive Understand **CO1 Relate** the fundamentals of electrical parameters and build and explain AC, DC circuits by Using measuring devices **Explain** the operation of DC and AC machines. **CO2** Cognitive Understand **CO3** Illustrate various semiconductor devices and their Cognitive Understand and displays applications the input output characteristics of basic semiconductor devices. **CO4** Cognitive Explain the number systems and logic gates. Understand Construct the different digital circuit. **CO5 Outline the** different types of microprocessors and Cognitive Understand their applications. UNIT-I: FUNDAMENTALS OF DC AND AC CIRCUITS, 9+3 **MEASUREMENTS** Fundamentals of DC- Ohm's Law - Kirchhoff's Laws - Sources - Voltage and Current Relations -Star/Delta Transformation - Fundamentals of AC - Average Value, RMS Value, Form Factor - AC power and Power Factor, Phasor Representation of sinusoidal quantities - Simple Series, Parallel, Series Parallel Circuit - Operating Principles of Moving coil and Moving Iron Instruments (Ammeter, Voltmeter) and Dynamometer type meters (Watt meter and Energy meter). UNIT -II: ELECTRICAL MACHINES 9 + 3Construction, Principle of Operation, Basic Equations, Types and Application of DC Generators, DC motors - Basics of Single-Phase Induction Motor and Three Phase Induction Motor- Construction, Principle of Operation of Single-Phase Transformer, Three phase transformers, Auto transformer.

#### Cos versus GA mapping

UNIT- III: SEMICONI			9 + 3
		peration and Characteristics	
	istors, Field Effect Transisto	ors and Silicon Controlled R	ectifier –
Applications.			
UNIT- IV: DIGITAL E			9 + 3
		Gates, Boolean Algebra,	
		ops, Up/Down counters, Shif	ft Registers.
<b>UNIT- V: MICROPRO</b>			9+3
		ing and control unit, regist	
	•	classification of instruction	s, addressing modes,
Interfacing Basics: Data	transfer concepts - Simple 1		
LECTURE	TUTORIAL	ТОТА	L
45	60		
TEXT BOOKS			
1. Metha V.K, Rohit Me	hta, 2020. Principles of Elec	ctronics,12 th ed, S Chand Pul	blishing.
2. Albert Malvino, David	1 J.Bates., 2017. Electronics	Principles. 7th ed, Tata Mc	Graw-Hill. New
Delhi.		-	
3. Rajakamal, 2014. Digi	ital System-Principle & Des	ign. 2nd ed. Pearson educati	ion.
•	Digital Design. Prentice Hall	-	
		tecture, Programming and it	s Applications with
	Penram International Publica		
<b>REFERENCE BOOKS</b>			
1. Corton, H. 2004 Elect	rical Technology. CBS Publ	ishers & Distributors.	
	Electrical Circuits. Schaum		
-		ectronics Devices, New Dell	hi: McGraw-Hill.
	$15. \cup \cup \cup 17/2$ . Integrated E	lectronics: Analog and Digi	tal Circuits and
	-	Electronics: Analog and Digit	tal Circuits and
Systems, Tokyo: McGrav	w-Hill, Kogakusha Ltd.		
Systems, Tokyo: McGrav 5. Mohammed Rafiquzza	w-Hill, Kogakusha Ltd. aman, 1999. Microprocessor	Electronics: Analog and Digitsrs - Theory and Applications	
Systems, Tokyo: McGrav 5. Mohammed Rafiquzza Prentice Hall Internation	w-Hill, Kogakusha Ltd. aman, 1999. Microprocessor		
Systems, Tokyo: McGrav 5. Mohammed Rafiquzza Prentice Hall Internation <b>E-REFERENCES</b>	w-Hill, Kogakusha Ltd. aman, 1999. Microprocesson al.	rs - Theory and Applications	s: Intel and Motorola.
Systems, Tokyo: McGrav 5. Mohammed Rafiquzza Prentice Hall Internation <b>E-REFERENCES</b> 1. NTPEL, Basic Electric	w-Hill, Kogakusha Ltd. aman, 1999. Microprocesson al. cal Technology (Web Cours		s: Intel and Motorola.
Systems, Tokyo: McGrav 5. Mohammed Rafiquzza Prentice Hall Internation <b>E-REFERENCES</b> 1. NTPEL, Basic Electric Prof. G.D. Roy, IIT Khar	w-Hill, Kogakusha Ltd. aman, 1999. Microprocesson al. cal Technology (Web Cours ragpur.	rs - Theory and Applications re), Prof. N. K. De, Prof. T. I	:: Intel and Motorola. K. Bhattacharya and
Systems, Tokyo: McGrav 5. Mohammed Rafiquzza Prentice Hall Internation <b>E-REFERENCES</b> 1. NTPEL, Basic Electric Prof. G.D. Roy, IIT Khan 2. Prof.L.Umanand, http:	w-Hill, Kogakusha Ltd. aman, 1999. Microprocesson al. cal Technology (Web Cours ragpur.	rs - Theory and Applications	:: Intel and Motorola. K. Bhattacharya and
Systems, Tokyo: McGrav 5. Mohammed Rafiquzza Prentice Hall Internation <b>E-REFERENCES</b> 1. NTPEL, Basic Electric Prof. G.D. Roy, IIT Khar 2. Prof.L.Umanand, http: Bangalore.	w-Hill, Kogakusha Ltd. aman, 1999. Microprocesson al. cal Technology (Web Cours ragpur. ://freevideolectures.com/Co	rs - Theory and Applications be), Prof. N. K. De, Prof. T. I urse/2335/Basic-Electrical-T	s: Intel and Motorola. K. Bhattacharya and Fechnology#, IISc
Systems, Tokyo: McGrav 5. Mohammed Rafiquzza Prentice Hall Internation <b>E-REFERENCES</b> 1. NTPEL, Basic Electric Prof. G.D. Roy, IIT Khar 2. Prof.L.Umanand, http: Bangalore. 3. http://nptel.ac.in/Onlin	w-Hill, Kogakusha Ltd. aman, 1999. Microprocesson al. cal Technology (Web Cours ragpur. ://freevideolectures.com/Co necourses/Nagendra/, Dr. Na	rs - Theory and Applications re), Prof. N. K. De, Prof. T. I urse/2335/Basic-Electrical-T agendra Krishnapura, IIT Ma	<ul> <li>S: Intel and Motorola.</li> <li>K. Bhattacharya and</li> <li>Fechnology#, IISc</li> <li>adras.</li> </ul>
Systems, Tokyo: McGrav 5. Mohammed Rafiquzza Prentice Hall Internation <b>E-REFERENCES</b> 1. NTPEL, Basic Electric Prof. G.D. Roy, IIT Khar 2. Prof.L.Umanand, http: Bangalore. 3. http://nptel.ac.in/Onlin	w-Hill, Kogakusha Ltd. aman, 1999. Microprocesson al. cal Technology (Web Cours ragpur. ://freevideolectures.com/Co necourses/Nagendra/, Dr. Na	rs - Theory and Applications be), Prof. N. K. De, Prof. T. I urse/2335/Basic-Electrical-T	<ul> <li>S: Intel and Motorola.</li> <li>K. Bhattacharya and</li> <li>Fechnology#, IISc</li> <li>adras.</li> </ul>

# Mapping of COs with Pos

						PR	OGR	AM C	OUTC	COMES	5			
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	1	1	1	1			1	1	1		3	3
CO2	3	3	1	1	1	1			1	1	1		3	3
CO3	2	2	2	1	2	2	1	1	1	1	1		3	3
CO4	2	2	1	1	1	1	1	1	1	1	1		3	3
CO5	2	2	1	1	1	1	1	1	1	1	1		3	3
Total	12	12	6	5	6	6	3	3	5	5	5		15	15
ScaledValue	3	3	2	1	2	2	1	1	1	1	1		5	5
		1 –	$5 \rightarrow 1$	.,		6 –	10 -	> 2,	•	11	- 15 -	$\rightarrow 3$	•	
	(	)-NoR	elatio	n,1-I	Low Re	elatior	n,2-M	ledium	Relat	ion,3-H	lighR	elation	n	

COUR	RSE CODE	XAC203		L	Τ	P	С	
COUR	RSE NAME	Applied Chemistry For Engineers		3	1	0	4	
PRER	EQUISITES	Nil		L	Τ	Р	Н	
C:P:A		3.5:1.0:0.5		3	1	0	4	
COUR	RSE OUTCOME	S	DOM	<b>IAIN</b>		LEVEL		
C01	electron affinit	riodic properties such as ionization energy, y, oxidation states and electro negativity. rious water quality parameters like hardness	Cogn	itive		Un	derstand	
CO2	-	<i>leasure</i> microscopic chemistry in terms of ar orbitals and intermolecular forces.	Cogn Psych		tor	Understar Set		
CO3	<i>Interpret</i> but thermodynamic	k properties and processes using and kinetic considerations.	Cogn Psych		tor	Apj Me	ply chanism	
<b>CO4</b>	· ·	<i>rate and Discuss</i> the chemical reactions that ynthesis of molecules.	Cogn	itive			derstand alyze	
CO5	electromagnetic	<i>re</i> and <i>Distinguish</i> the ranges of the spectrum used for exciting different y levels in various spectroscopic techniques	Cogn Psych		tor	Ap	member ply chanism	
UNIT		C PROPERTIES AND WATER CHEMIST e, penetration of orbitals, variations of s, p, d					+3	

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries hard soft acids and bases, molecular geometries. **Water Chemistry**-Water quality parameters Definition and explanation of hardness, determination of hardness by EDTA method-Introduction to alkalinity.

Thermodynan	SE OF FREE I	ENERGY IN C	HEMICAL EQUILI	BRIA	12+3
•			nd free energy. Estim		
Free energy a			Nernst equation and	1.	Ū.
			on-Types, factors aff		
			metallurgy through		
			el and copper on Print	0 0	U U
			R STRUCTURE		10+3
Schrodinger e nanoparticles. Equations for field theory a Band structure Intermolecula Ionic, dipolar Potential ener UNIT-IV S Principles of types of elec Vibrational spectroscopy shift and appl UNIT-V S Representatio symmetry an conformationa Organic react Introduction	equation. Particle Molecular or atomic and mo and the energy e of solids and the ar forces and po and Vander wa gy surfaces of H PECTROSCOI spectroscopy ar ctronic transitic spectroscopy-ty of diatomic mo ications-magnet TEREOCHEM ns of 3 dimension d chirality, ena al analysis. Isom tions and synthe to reactions and rin	e in a box solut bitals of diaton plecular orbitals. level diagrams the role of doping tential energy s als interactions. I ₃ , H ₂ F and HCN PIC TECHNIQ of selection rule on and applicat pes of vibrat lecules. Nuclean ic resonance ima ISTRY AND ( onal structures, ntiomers, diasted perism in transiti esis of a drug ma involving subs	ion and their application mic molecules and . Energy level diagra for transition metal is g on band structures. <i>urfaces</i> Equations of state of N and trajectories on t <u>UES AND APPLIC</u> es. Electronic spectro tion. Fluorescence a ions, Instrumentation r magnetic resonance aging. Diffraction and <b>DRGANIC REACTI</b> structural isomers and ereomers, optical actional metal compound	plots of the m ms of diatomic ons and their m real gases and c hese surfaces. ATIONS scopy-chromoph and its applicat on and applic spectroscopy-co d scattering. ONS d stereoisomers, ivity, absolute ls	ated molecules and ulticenter orbitals molecules. Crysta agnetic properties critical phenomena 7+3 nore, auxochromes ions in medicine ations. Rotationa oncept of chemica 8+3 configurations and configurations and
Aspirin and p				TOTAL	
	LECTURE	TUTORIAL	PRACTICAL	ТОТА	L HOURS
Hours TEXT BOOI	45	15	0		60
			inciples of Inorganic		<b>i</b>

16. P. S. Kalsi, Stereochemistry: Conformation and mechanism, (9th Edition), New Age International Publishers, 2017.

#### **REFERENCE BOOKS**

- 2. Puri B R Sharma L R and Madan S Pathania, "Principles of Physical Chemistry", Vishal publishing Co., Edition 2004
- 2. Kuriocose, J C and Rajaram, J, "Engineering Chemistry", Volume I/II, Tata McGraw-Hill Publishing Co. Ltd. New Delhi, 2000

### **E Resources -** MOOCs:

- 7. http://www.mooc-list.com/course/chemistry-minor-saylororg
- 8. https://www.canvas.net/courses/exploring-chemistry
- 9. http://freevideolectures.com/Course/2263/Engineering-Chemistry-I
- 10. http://freevideolectures.com/Course/3001/Chemistry-I
- 11. http://freevideolectures.com/Course/3167/Chemistry-II
- 12. http://ocw.mit.edu/courses/chemistry/

						PR	OGR	AM C	DUTC	OMES	•			
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	0	0	0	0	0	2	3	3	0	0	0	0	0
CO2	2	0	0	0	0	0	1	2	2	0	0	0	0	0
CO3	3	0	0	0	0	0	2	3	3	0	0	0	0	0
CO4	3	0	0	0	0	0	3	3	3	0	0	0	0	0
CO5	3	0	0	0	0	0	2	2	3	0	0	0	0	0
Total	14	0	0	0	0	0	10	13	14	0	0	0	0	0
ScaledValue	3	0	0	0	0	0	2	3	3	0	0	0	0	0
		1 –	$1-5 \rightarrow 1$ , $6-10 \rightarrow 2$ , $11-15 \rightarrow 3$											
	(	)-NoR	elatio	n,1-l	Low R	elatio	n,2-M	ledium	Relati	ion,3-H	lighR	elation	n	

#### Mapping of CO's with PO's:

						L	Т	Р	SS	C
XG	S204	۱ I				2	0	0	0	2
			<b>Technical Comm</b>	unication						
-	P	Α				L	Т	<b>P</b>	SS	Η
3	0	0	~ ~ ~			2	0	0	2	
			Course Outcomes		Domain			Le	vel	
After con	mplet	tion of th	ne course, students will be able	to						
CO1	Ass	ociate th	ne basic principles of Technica	l writing.	Cognitiv	e	1	Unde	erstan	d
CO2	Ide	ntitythe	Special techniques in writing.		Cognitiv	e		A	pply	
CO3	Exp	olainthe	communicative styles of writin	ng.	Cognitiv	e		Eva	luate	
CO4	Cla	ssify the	enature of Report writing.		Cognitiv	e	1	erstand		
Course	Cont	ent							Ho	ours
UNIT-I		Basic	c Principles							8
		-	of Technical Writing							
•			echnical Writing							
1.3 – Laı	<u> </u>	-								
UNIT –I			niques							8
			ues used in writing							
		1	scription of mechanism2.3 – I	Description- C	lassificatio	n-In	terpr	etati	1	
UNIT-II			munication							7
			ment in style of writing 3.2 - N	New letter wri	ting format	S				
UNIT-IV			ort writing							7
	_	_	writing 4.2 – Project writing f							
LE	СТІ	J <b>RE</b>	TUTORIAL	PRACT	ICAL		Τ	OT		
	30		0	0				30		

# **TEXT BOOKS:** Suggested Readings:

(iii) John Sealy, Writing and Speaking Author; Oxford University Press, New Delhi, 2009

(iv) Williams K.S, Communicating Business. Engage Learning India Pvt Ltd, 2012

# Mapping of COs with POs

			PROGRAM OUTCOMES											
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	0	0	3	0	0	0	0	0	2	3	2	0
CO2	3	2	0	0	2	0	0	0	0	0	2	3	2	0
CO3	2	2	1	2	2	0	0	0	0	0	2	2	2	0
CO4	2	2	1	2	2	0	0	0	0	0	2	2	2	0
CO5	2	2	1	0	2	0	0	1	0	2	2	2	2	0
Total	12	10	3	4	11	0	0	1	0	2	10	12	10	0
ScaledValue	3	2	1	1	3	0	0	1	0	1	2	3	2	0
		$1-5 \rightarrow 1$ , $6-10 \rightarrow 2$ , $11-15 \rightarrow 3$												
	0-NoRelation,1-Low Relation,2-MediumRelation,3-HighRelation													

	RSE CODE	COURSE NAME		L	Р	C			
	KWP205	Workshop Practice	es	1	0	2	3		
C P	Α			L	Т	P	Η		
1.0 2.0				1	0	3	4		
PRE RE	EQUISITE: NIL								
	Cour	se outcomes:	Domain						
CO1:		machining methods and	Cognitive	Understand					
	Practice machin		Psychomoto			respon	se		
CO2:		al casting process, moulding	Cognitive		lemem				
		relates Casting and Smithy	Psychomoto	r P	ercepti	ion			
~ ~ ~	applications.		~						
CO3:		pentry and fitting operation and	Cognitive		pplyG				
~ ~ .		try and fitting operations.	Psychomoto		espons				
CO4:		al joining operation and <i>Practice</i>	Cognitive		Inderst				
<u> </u>	welding operation		Psychomoto			respon	se		
CO5:		electrical and electronics basics	Cognitive		Inderst				
	and <i>Makes</i> appr	opriate electrical connections.	Psychomoto		lemem				
COUDO				C	Juided	respon	se		
	SE CONTENT			C					
EXP.N		TITLE		CO RELATION CO1					
$\frac{1}{2}$		Introduction to machining process							
$\frac{2}{3}$		g using lathe operation	200		<u> </u>				
4		about CNC machining and machi	nes		CO1 CO1				
5		on of plain turning using CNC tal casting operation							
6		ion of moulding process							
7									
8		ithy operation							
<u> </u>	Study of car								
<u> </u>		nt – Carpentry Tenon joint – Carpentry							
10	Study of fitt								
11	Square fittin	6							
12	Triangular f								
13	Study of we								
14		joint - welding							
15	Tee joint – V								
10									
17	Introduction to house wiringCO5One lamp controlled by one switchCO5								
10									
20	Staircase wi								
TEXT BOOKS									
		y I,II,III, by S K Hajra, Chou	dhary and A	KC	haoudi	ary N	Medi		
		y I,II,III, by S К пајга, Chou Pvt. Ltd., Bombay	unary allu P	IN U	naouul	iary. I	vicul		
		by Manchanda Vol. I,II,III India I	Publishing Uo	1160 Io	landha	r			
2. WUIK	shop reenhology		uonsning 110	use, ja	anuna				

# REFERENCES

1. Manual on Workshop Practice by K Venkata Reddy, KL Narayana et al; MacMillan India Ltd.

- 2. Basic Workshop Practice Manual by T Jeyapoovan; Vikas Publishing House (P) Ltd., New Delhi
- 3. Workshop Technology by B.S. Raghuwanshi, Dhanpat Rai and Co., New Delhi.
- 4. Workshop Technology by HS Bawa, Tata McGraw Hill Publishers, New Delhi.
- E RESOURCES http://nptel.ac.in/courses/112107145/

						PR	OGR	AM C	OUTC	COMES	5			
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	1	1	1	1	1	-	1	1	-	1	2	0	0
CO2	2	1	1	1	1	1	-	1	1	-	1	2	0	0
CO3	2	1	1	1	1	1	-	1	1	-	1	2	0	0
CO4	2	1	1	1	1	1	-	1	1	-	1	2	0	0
CO5	2	1	1	1	1	1	-	1	1	-	1	2	0	0
Total	10	5	5	5	5	5	-	5	5	-	5	10	0	0
ScaledValue	2	1	1	1	1	1	-	1	1	-	1	2	0	0
		1 –	$1-5 \to 1$ , $6-10 \to 2$ , $11-15 \to 3$											
	(	)-NoR	elatio	n,1-I	Low R	elatio	n,2-M	ledium	Relat	ion,3-H	lighR	elatio	n	

### Mapping of CO's with PO'S:

XBT	206	CHEMICAL ENGINEERING THERMODYNA	AMICS	L 2	T 1	P 0	C 3			
	<u> </u>	CHEMICAL ENGINEERING THERIODINA	AMICS							
C P	A			L	T	P	H			
3 0	0	Course Outcourse	D !	2	1	0	3			
		Course Outcomes	Domain	1		Lev	vei			
After c	omple	tion of the course, students will be able to								
CO1	Sta	te the basic laws of thermodynamics and the	Cognitiv	e	R	Reme	mber			
	fun	damentals of thermodynamics.	-		U	Inder	stand			
CO2	Int	erpret the PVT relationship for various systems.	Cognitiv	e	Int	erpro	etation			
CO3	Est	imate the thermodynamic relations and the	Cognitiv	e	F	Reme	mber			
	the	modynamic properties.	-		U	Understand				
CO4	Ap	ply the phase equilibrium in various systems like	Cognitiv	e		Ap	oly			
	mis	cible and immiscible systems.								
CO5	Kn	ows the chemical equilibrium for industrial	Cognitiv	e	F	Reme	mber			
	reactions									
Course	e Cont	ent					Hours			
UNIT-	Ι	Fundamentals Of Thermodynamics					6+3			
Definit	Definitions of System, Surroundings and Processes, Open and Closed systems, State properties,									
Intensi	ve and	Extensive Properties, State and Path functions, eq	uilibrium	state	e and	l Pha	ase Rule,			

	ble processes, Overall view		6+3				
	elationships for Gases and fluids-Equations of state ar						
-	-						
reactions.	of state for real gases -Co	ompressionity charts –ne	at effects off chemica				
	n Thermodynamics		6+3				
	dynamic properties –relati	ionship on thermodynami					
	– properties of solution –						
	otential - fugacity in solution						
mixing processes.	otential - lugaenty in som	utions - Activity in solut	ions – neat cheets o				
<u> </u>	Equilibria		6+3				
	ilibria, phase equilibria	in multi-component sys					
	pour-Liquid Equilibria, P-2						
	inary or ternary compon						
	coefficients using Van laa	•	-				
Liquid-Liquid Equilibriu			Ĩ				
UNIT-V Reaction	n Equilibria		6+3				
Reaction stoichiometry	– Criteria of chemical R	agation Equilibrium E	and the strength of the streng				
Reaction stoichiometry – Criteria of chemical Reaction Equilibrium – Equilibrium Constant – Equilibrium constant and standard free Energy change – Effect of temperature on equilibrium							
Equilibrium constant an							
	nd standard free Energy c	change – Effect of tempe	erature on equilibriun				
constant - Effect of pre	nd standard free Energy c ssure on equilibrium – Fa	change – Effect of temperators affecting equilibrium	erature on equilibriun m conversion - Liquic				
constant – Effect of pre phase reactions – Ligat	nd standard free Energy c ssure on equilibrium – Fa nd binding – Membrane	change – Effect of temperators affecting equilibrium	erature on equilibriun m conversion - Liquic				
constant - Effect of pre	nd standard free Energy c ssure on equilibrium – Fa nd binding – Membrane	change – Effect of temperators affecting equilibrium	erature on equilibriun m conversion - Liquic				
constant – Effect of pre phase reactions – Liga Oxidation and reduction	nd standard free Energy c ssure on equilibrium – Fa nd binding – Membrane reactions.	change – Effect of temper actors affecting equilibrium potential – Energetics of	erature on equilibriun m conversion - Liquic f metabolic pathways				
constant – Effect of pre phase reactions – Liga Oxidation and reduction LECTURE	nd standard free Energy c ssure on equilibrium – Fa nd binding – Membrane reactions. TUTORIAL	change – Effect of temper actors affecting equilibrium potential – Energetics of	erature on equilibriun m conversion - Liquic f metabolic pathways TOTAL				
constant – Effect of pre phase reactions – Liga Oxidation and reduction LECTURE 30 TEXT BOOKS:	nd standard free Energy c ssure on equilibrium – Fa nd binding – Membrane reactions. TUTORIAL	change – Effect of temper actors affecting equilibrium potential – Energetics of <b>PRACTICAL</b>	erature on equilibriun m conversion - Liquic f metabolic pathways TOTAL 45				
constant – Effect of prephase reactions – Liga Oxidation and reduction LECTURE 30 TEXT BOOKS: 3. Narayanan K.V.A	nd standard free Energy c ssure on equilibrium – Fa nd binding – Membrane reactions. TUTORIAL 15 A textbook of Chemical En	change – Effect of temper actors affecting equilibrium potential – Energetics of <b>PRACTICAL</b>	erature on equilibriun m conversion - Liquic f metabolic pathways TOTAL 45 ics'', PHI 2006.				
constant – Effect of prephase reactions – Ligar Oxidation and reduction LECTURE 30 TEXT BOOKS: 3. Narayanan K.V.A 4. Smith, J.M., Van	nd standard free Energy c ssure on equilibrium – Fa nd binding – Membrane reactions. TUTORIAL 15 A textbook of Chemical En Ness HC and Abbott MM	change – Effect of temperators affecting equilibrium potential – Energetics of PRACTICAL Ingineering Thermodynami 1.2005. Introduction to Chemical International Internati	erature on equilibrium m conversion - Liquic f metabolic pathways TOTAL 45 ics'', PHI 2006. emical Engineering				
constant – Effect of prephase reactions – Ligar Oxidation and reduction LECTURE 30 TEXT BOOKS: 3. Narayanan K.V.A 4. Smith, J.M., Van	nd standard free Energy c ssure on equilibrium – Fa nd binding – Membrane reactions. TUTORIAL 15 A textbook of Chemical En	change – Effect of temperators affecting equilibrium potential – Energetics of PRACTICAL Ingineering Thermodynami 1.2005. Introduction to Chemical International Internati	erature on equilibrium m conversion - Liquic f metabolic pathways TOTAL 45 ics'', PHI 2006. emical Engineering				
constant – Effect of prephase reactions – Ligar Oxidation and reduction LECTURE 30 TEXT BOOKS: 3. Narayanan K.V.A 4. Smith, J.M., Van	nd standard free Energy c ssure on equilibrium – Fa nd binding – Membrane reactions. TUTORIAL 15 A textbook of Chemical En Ness HC and Abbott MM	change – Effect of temperators affecting equilibrium potential – Energetics of PRACTICAL Ingineering Thermodynami 1.2005. Introduction to Chemical International Internati	erature on equilibrium m conversion - Liquic f metabolic pathways TOTAL 45 ics'', PHI 2006. emical Engineering				
constant – Effect of prephase reactions – Ligar Oxidation and reduction LECTURE 30 TEXT BOOKS: 3. Narayanan K.V.A 4. Smith, J.M., Van Thermodynamics REFERENCES:	nd standard free Energy c ssure on equilibrium – Fa nd binding – Membrane reactions. TUTORIAL 15 A textbook of Chemical En Ness HC and Abbott MM	change – Effect of temper actors affecting equilibrium potential – Energetics of <b>PRACTICAL</b> agineering Thermodynami 1.2005. Introduction to Che I International Edition,200	erature on equilibriun m conversion - Liquid f metabolic pathways TOTAL 45 ics'', PHI 2006. emical Engineering 05				
constant – Effect of prephase reactions – Ligat Oxidation and reduction LECTURE 30 TEXT BOOKS: 3. Narayanan K.V.A 4. Smith, J.M., Van Thermodynamics REFERENCES: 4. S.I.Sandler, Cher	nd standard free Energy c ssure on equilibrium – Fa nd binding – Membrane reactions. TUTORIAL 15 A textbook of Chemical En Ness HC and Abbott MM s, 7 th Edition, McGraw-Hil	change – Effect of temper actors affecting equilibrium potential – Energetics of <b>PRACTICAL</b> agineering Thermodynami 1.2005. Introduction to Che I International Edition,200	erature on equilibriun m conversion - Liquid f metabolic pathways TOTAL 45 ics'', PHI 2006. emical Engineering 05				
constant – Effect of prephase reactions – Ligar Oxidation and reduction LECTURE 30 TEXT BOOKS: 3. Narayanan K.V. 4. Smith, J.M., Van Thermodynamics REFERENCES: 4. S.I.Sandler, Cher India, 2006.	nd standard free Energy c sssure on equilibrium – Fa nd binding – Membrane reactions. TUTORIAL 15 A textbook of Chemical En Ness HC and Abbott MM s, 7 th Edition, McGraw-Hil mical, Biochemical and En	change – Effect of temper actors affecting equilibrium potential – Energetics of <b>PRACTICAL</b> agineering Thermodynami 1.2005. Introduction to Che 1 International Edition,200 gineering Thermodynamic	rature on equilibriun m conversion - Liquic f metabolic pathways TOTAL 45 ics'', PHI 2006. emical Engineering 05 cs, 4 th Edition, Wiley				
constant – Effect of prephase reactions – Ligat Oxidation and reduction LECTURE 30 TEXT BOOKS: 3. Narayanan K.V.A 4. Smith, J.M., Van Thermodynamics REFERENCES: 4. S.I.Sandler, Cher India, 2006. 5. Rao., Y.V.C., Ch	nd standard free Energy c ssure on equilibrium – Fa nd binding – Membrane reactions. TUTORIAL 15 A textbook of Chemical En a Ness HC and Abbott MM s, 7 th Edition, McGraw-Hil mical, Biochemical and En	change – Effect of temper actors affecting equilibrium potential – Energetics of PRACTICAL agineering Thermodynami (2005. Introduction to Cha I International Edition,200 gineering Thermodynamic odynamics, University Pr	ress, Hyderabad, 2005.				
constant – Effect of prephase reactions – Ligar Oxidation and reduction LECTURE 30 TEXT BOOKS: 3. Narayanan K.V. 4. Smith, J.M., Van Thermodynamics REFERENCES: 4. S.I.Sandler, Cher India, 2006. 5. Rao., Y.V.C., Ch 6. Lehninger Princi	nd standard free Energy c ssure on equilibrium – Fa nd binding – Membrane reactions. TUTORIAL 15 A textbook of Chemical En Ness HC and Abbott MM s, 7 th Edition, McGraw-Hil mical, Biochemical and En nemical engineering Therm ples of Biochemistry, Davi	change – Effect of temper actors affecting equilibrium potential – Energetics of <b>PRACTICAL</b> agineering Thermodynami 1.2005. Introduction to Che 1 International Edition,200 gineering Thermodynamic addynamics, University Pr id L. Nelson and Michael	retature on equilibriun m conversion - Liquic f metabolic pathways TOTAL 45 ics'', PHI 2006. emical Engineering 05 cs, 4 th Edition, Wiley ress, Hyderabad, 2005. M. Cox, W. H.				
constant – Effect of prephase reactions – Ligat Oxidation and reduction LECTURE 30 TEXT BOOKS: 3. Narayanan K.V.A 4. Smith, J.M., Van Thermodynamics REFERENCES: 4. S.I.Sandler, Cher India, 2006. 5. Rao., Y.V.C., Ch 6. Lehninger Princi Freeman; 6th edi	nd standard free Energy c ssure on equilibrium – Fa nd binding – Membrane reactions. TUTORIAL 15 A textbook of Chemical En a Ness HC and Abbott MM s, 7 th Edition, McGraw-Hil mical, Biochemical and En memical engineering Therm ples of Biochemistry, Davi tion (13 February 2013), 1	change – Effect of temper actors affecting equilibrium potential – Energetics of <b>PRACTICAL</b> agineering Thermodynami 1.2005. Introduction to Che 1 International Edition,200 gineering Thermodynamic addynamics, University Pr id L. Nelson and Michael	retature on equilibriun m conversion - Liquid f metabolic pathways TOTAL 45 ics'', PHI 2006. emical Engineering 05 cs, 4 th Edition, Wiley ress, Hyderabad, 2005. M. Cox, W. H.				
constant – Effect of prephase reactions – Ligar Oxidation and reduction LECTURE 30 TEXT BOOKS: 3. Narayanan K.V.A 4. Smith, J.M., Van Thermodynamics REFERENCES: 4. S.I.Sandler, Chen India, 2006. 5. Rao., Y.V.C., Ch 6. Lehninger Princi Freeman; 6th edi 13: 978-1464109	nd standard free Energy c ssure on equilibrium – Fa nd binding – Membrane reactions. TUTORIAL 15 A textbook of Chemical En A textbook of Chemical En Ness HC and Abbott MM s, 7 th Edition, McGraw-Hil mical, Biochemical and En nemical engineering Therm ples of Biochemistry, Davi tion (13 February 2013), 1 2621.	change – Effect of temper actors affecting equilibrium potential – Energetics of <b>PRACTICAL</b> agineering Thermodynami 2.2005. Introduction to Che 1 International Edition,200 gineering Thermodynamic odynamics, University Pr id L. Nelson and Michael 158 pages ISBN-10: 1464	retature on equilibriun m conversion - Liquic f metabolic pathways TOTAL 45 ics'', PHI 2006. emical Engineering 05 cs, 4 th Edition, Wiley ress, Hyderabad, 2005. M. Cox, W. H.				
constant – Effect of prephase reactions – Ligat Oxidation and reduction LECTURE 30 TEXT BOOKS: 3. Narayanan K.V.A 4. Smith, J.M., Van Thermodynamics REFERENCES: 4. S.I.Sandler, Cher India, 2006. 5. Rao., Y.V.C., Ch 6. Lehninger Princi Freeman; 6th edi 13: 978-1464109 EREFERENCES:Ther	nd standard free Energy c ssure on equilibrium – Fa nd binding – Membrane reactions. TUTORIAL 15 A textbook of Chemical En A textbook of Chemical En Ness HC and Abbott MM s, 7 th Edition, McGraw-Hil mical, Biochemical and En nemical engineering Therm ples of Biochemistry, Davi tion (13 February 2013), 1 0621.	change – Effect of temper actors affecting equilibrium potential – Energetics of PRACTICAL Approximation of the second second preserve of the second second second second second second	ress, Hyderabad, 2005. M. Cox, W. H. 4109621, ISBN-				
constant – Effect of prephase reactions – Ligat Oxidation and reduction LECTURE 30 TEXT BOOKS: 3. Narayanan K.V.A 4. Smith, J.M., Van Thermodynamics REFERENCES: 4. S.I.Sandler, Cher India, 2006. 5. Rao., Y.V.C., Ch 6. Lehninger Princi Freeman; 6th edi 13: 978-1464109 EREFERENCES:Ther	nd standard free Energy c ssure on equilibrium – Fa nd binding – Membrane reactions. TUTORIAL 15 A textbook of Chemical En A textbook of Chemical En Ness HC and Abbott MM s, 7 th Edition, McGraw-Hil mical, Biochemical and En nemical engineering Therm ples of Biochemistry, Davi tion (13 February 2013), 1 2621.	change – Effect of temper actors affecting equilibrium potential – Energetics of PRACTICAL Approximation of the second second preserve of the second second second second second second	ress, Hyderabad, 2005. M. Cox, W. H. 4109621, ISBN-				

# Mapping of COs with POs

						PR	OGR	AM C	OUTC	COMES	5			
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	0	0	0	0	0	0	0	0	2	2	0	2
CO2	3	3	2	2	1	0	2	0	0	0	2	2	3	2
CO3	3	3	2	2	1	0	2	0	0	0	2	2	3	2
CO4	3	3	2	3	1	1	2	0	0	0	2	2	2	2
CO5	3	3	3	3	1	1	2	1	1	0	2	3	3	3
	1	1	1		1	1		1			1	1	1	1
Total	16	15	10	10	5	3	8	2	1	0	11	12	12	12
ScaledValue	3	3	2	2	1	1	2	1	1	0	3	3	3	3
		1 –	$1-5 \rightarrow 1, \qquad 6-10 \rightarrow 2, \qquad 11-15 \rightarrow 3$											
	(	)-NoR	elatio	n,1-L	ow Re	elatior	,2-M	edium	Relat	ion,3-H	lighR	elation	n	

COURSE CODE	COURSE NAME	L	Т	Р	С
<b>XBE207</b>	ELECTRICAL AND ELECTRONICS ENGINEERING SYSTEMS LABORATORY	0	0	1	1
Prerequisite	Physics	L	Т	Р	Н
<b>C</b> : <b>P</b> : <b>A</b>	1.5 : 1 : 0.5	0	0	3	3

### **COURSE OBJECTIVES:**

The course helps to Learn the basic concepts of electrical and electronics components. d. Understand the basic wiring methods and connection.

- e. Study the characteristics of diodes, Zener diodes, NPN transistors.
- f. Verify the working of simple logic gates, adders and subtractors.

Course	Dutcomes:	Domain	Level
	Apply the fundamental electrical concepts and	Cognitive	Understand
CO1	<b>Apply</b> the fundamental electrical concepts and <b>differentiate</b> the various electronic components.	Psychomotor	Set
	unrerentiate the various electronic components.	Affective	Valuing
	Implement and execute the different types of wining	Cognitive	Understand
CO2	<b>Implement</b> and <b>execute</b> the different types of wiring connections.	Psychomotor	Set
	connections.	Affective	Valuing
	Domonstrate the Electroscent lange connection with	Cognitive	Understand
CO3	<b>Demonstrate</b> the Fluorescent lamp connection with choke.	Psychomotor	Set
	choke.	Affective	Valuing
	Characterize and display the basic knowledge on the	Cognitive	Understand
CO4	working of PN junction and Zener diode.	Psychomotor	Set
	working of Fiv junction and Zener diode.	Affective	Valuing
	Implement and avagute the various digital electronic	Cognitive	Understand
CO5	<b>Implement</b> and <b>execute</b> the various digital electronic circuits such as Adders and Subtractors.	Psychomotor	Set
	circuits such as Adders and Subfractors.	Affective	Valuing

#### **List of Experiments:**

- 11. Study of Electrical Symbols, Tools and Safety Precautions, Power Supplies.
- 12. Study of Active and Passive elements Resistors, Inductors and Capacitors, Bread Board.
- 13. Testing of DC Voltage and Current in series and parallel resistors which are connected in breadboard by using Voltmeter, Ammeter and Multimeter.
- 14. Fluorescent lamp connection with choke.
- 15. Staircase Wiring
- 16. Forward and Reverse bias characteristics of PN junction diode.
- 17. Forward and Reverse bias characteristics of zener diode.
- 18. Input and Output Characteristics of NPN transistor.
- 19. Construction and verification of simple logic gates.
- 20. Construction and verification of adders and subtractors.

PRACTICAL	TOTAL	
30	30	

						Grad	luates	s Attrik	outes			
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	3	1	1	1	1			1	1	1	
CO2	3	3	1	1	1	1			1	1	1	
CO3	2	2	2	1	2	2	1	1	1	1	1	
<b>CO4</b>	2	2	1	1	1	1	1	1	1	1	1	
CO5	2	2	1	1	1	1	1	1	1	1	1	
Total	12	12	6	5	6	6	3	3	5	5	5	
Scaled Value	3	3	2	1	2	2	1	1	1	1	1	
(	) - No	Relati	elation, 1 - Low Relation, 2- Medium Relation, 3- High Relation									
		1 – 5 -	$\rightarrow 1$ ,		6	- 10 -	→ 2,		11	$-15 \rightarrow$	3	

#### Cos versus GA mapping

COUR	SE CODE	XAC208	L	Т	P	С		
COUR	SE NAME	Applied Chemistry For Engineers	0	0	1	1		
PRER	EQUISITES	laboratory Nil	L	Т	P	Н		
C:P:A	<b>.</b>	3.5:1.0:0.5	0	0	3	3		
COUR	SE OUTCOM	ES	DOM	DOMAIN LE				
CO1	electron affini	eriodic properties such as ionization energy, ty, oxidation states and electro negativity. arious water quality parameters like hardness	-	Cognitive Und Psychomotor Pere				
CO2	Explain and N	Measure microscopic chemistry in terms of	Cogn			erstand		
~~~~		lar orbitals and intermolecular forces.		omotor	Set			
CO3	<i>Interpret</i> but thermodynamic	lk properties and processes using e and kinetic considerations.	Cogn Psych Affec	omotor	App Mec Rece	hanisn		
CO4	are used in the	<i>trate and Discuss</i> the chemical reactions that synthesis of molecules.	Cogn Psych Affec	omotor	Und Ana	erstand lyze		
CO5	electromagneti	are and Distinguish the ranges of the c spectrum used for exciting different gy levels in various spectroscopic techniques	Cogn Psych	itive iomotor	App Mec	ly hanisn		
Labora	atory Part				30 hrs	5		
Experi	ments :							
11.		of chloride ion present in the water sampl	e by A	Argentom	etric	CO1		
	method.					CO1		
12.	Determination EDTA method.	of total, temporary and permanent hardness	of wat	er sample	e by	CO2		
13.		of cell constant and conductance of solutions.				CO2		
		determination of redox potentials and emfs.				CO3		
15.	Determination of	of surface tension and viscosity.						
16.	Adsorption of a	cetic acid by charcoal.				CO3		
17.	Determination of	of the rate constant of a reaction.				CO4		
		on by colorimetric method.				CO4		
	Synthesis of a p					CO5		
20	Saponification	acid value of oil.				CO5		
20.						005		

- 5. Garland, C. W.; Nibler, J. W.; Shoemaker, D. P. "Experiments in Physical Chemistry", 8th Ed.; McGraw-Hill: New York, 2003.
- 6. **E Resources -** MOOCs:

1.http://freevideo	1.http://freevideolectures.com/Course/2380/Chemistry-Laboratory-Techniques									
2. http://freevideo	2. http://freevideolectures.com/Course/2941/Chemistry-1A-General-Chemistry-Fall-2011									
3.http://ocw.mit.edu/cour	rses/chemistry/5-301-chem	nistry-laboratory-technique	es							
LECTURE TUTORIAL PRACTICAL TOTAL HOURS										
0 0 45 45										

Mapping of CO's with PO's:

						PR	OGR	RAM C	OUTC	OMES	5			
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	0	0	0	0	0	2	3	3	0	0	0	0	0
CO2	2	0	0	0	0	0	1	2	2	0	0	0	0	0
CO3	3	0	0	0	0	0	2	3	3	0	0	0	0	0
CO4	3	0	0	0	0	0	3	3	3	0	0	0	0	0
CO5	3	0	0	0	0	0	2	2	3	0	0	0	0	0
Total	14	0	0	0	0	0	10	13	14	0	0	0	0	0
ScaledValue	3	0	0	0	0	0	2	3	3	0	0	0	0	0
		1 –	$5 \rightarrow 1$	1,		6 -	- 10 -	×2,		11 -	- 15 -	→ 3		
	()-NoF	Relatio	n,1-1	Low R	elatio	n,2-M	ledium	Relati	ion,3-H	lighR	elatio	n	

III Semester

COU	JRSE C	ODE	XPS301	L	Т	Р	С
COU	JRSE N	AME	PROBABILITY AND STATISTICS	3	0	0	3
С	Р	Α		L	Т	Р	Η
2.5	0.5	0		3	0	0	3
PRE	PREREQUISITE:Nil						

Learning Objectives

- 5. Appreciate the importance of probability and statistics in computing and research.
- 6. Develop skills in presenting quantitative data using appropriate diagrams, tabulations and summaries and to use appropriate statistical method in the analysis of simple datasets.
- 7. Interpret and clearly present output from statistical analyses in a clear concise and understandable manner.
- 8. The main objective of this course is to provide students with the foundations of probabilities and statistical analysis mostly used in varied applications in engineering and science like disease modeling, climate prediction and computer networks etc.

COUR	SE OUTCOMES:		
Course	e outcomes:	Domain	Level
CO1	Explain conditional probability, independent events; find expected	Cognitive	Understand
	values and Moments of Discrete random variables with properties.		
CO2	Find distribution function, Marginal density function, conditional	Cognitive	Remember
	density function, Define density function of conditional distribution		
	functions normal, exponential and gamma distributions.		
CO3	Find measures of central tendency, statistical parameters of	Cognitive	Remember

	Binomial, Poisson and Normal, correlation, regression. Rank Correlation coefficient of two variables. Moments, Skewness and Kurtosis		
		Psychomotor	Guided Response
CO4	Explain large sample test for single proportion, difference of proportion, single mean, difference of means and difference of standard deviations with simple problems.	Cognitive	Understand
CO5	Explain small sample test for single mean, difference of mean and correlation coefficients, variance test, chi-square test with simple Problems.	Cognitive	Understand

UNIT I: Basic Probability			9
Probability spaces, conditional probability, indep	endence, Discre	te random varia	bles, Independent
random variables, the multinomial distribution, Po	11		
infinite sequences of Bernoulli trials, sums of inde			ctation of Discrete
Random Variables, Moments, Variance of a sum, Ch	· ·		
UNIT II: Continuous Probability Distributions & Biv	variate Distribution	ons	9
Continuous random variables and their properti	es, distribution	functions and	densities, normal,
exponential and gamma densities. Bivariate distribut quotients, conditional densities.	itions and their p	properties, distrib	ution of sums and
UNIT III: Basic Statistics			9
Measures of Central tendency: Moments, Skewness	s and Kurtosis -	Probability distri	butions: Binomial.
Poisson and normal - evaluation of statistical parar		•	
regression – Rank correlation.			
UNIT IV: Applied Statistics			9
Curve fitting by the method of least squares- fitting	of straight lines	second degree n	arabolas and more
general curves. Test of significance: Large sample t	0	0 1	
		oportion, unicici	
single mean, difference of means, and difference of s		-	ice of proportions,
• • • •		-	9
single mean, difference of means, and difference of s	standard deviatio	ns.	9
single mean, difference of means, and difference of s UNIT V: Small Samples	standard deviation	ns.	9
single mean, difference of means, and difference of s UNIT V: Small Samples Test for single mean, difference of means and corre	standard deviation	ns.	9
single mean, difference of means, and difference of s UNIT V: Small Samples Test for single mean, difference of means and corre	standard deviation elation coefficien attributes.	ns. ts, test for ratio o	9 of variances - Chi-
single mean, difference of means, and difference of s UNIT V: Small Samples Test for single mean, difference of means and corre square test for goodness of fit and independence of a TEXTBOOKS	standard deviation elation coefficien attributes. LECTURE 45	ns. ts, test for ratio of TUTORIAL 0	9 of variances - Chi- TOTAL 45
single mean, difference of means, and difference of s UNIT V: Small Samples Test for single mean, difference of means and corres square test for goodness of fit and independence of a TEXTBOOKS 1.Veerarajan T., "Probability, Statistics and Random	standard deviation elation coefficien attributes. LECTURE 45 a Processes", Tata	ts, test for ratio of TUTORIAL 0 a McGraw-Hill, N	9 of variances - Chi- TOTAL 45 New Delhi,2010
single mean, difference of means, and difference of s UNIT V: Small Samples Test for single mean, difference of means and corre square test for goodness of fit and independence of a TEXTBOOKS	standard deviation elation coefficien attributes. LECTURE 45 a Processes", Tata	ts, test for ratio of TUTORIAL 0 a McGraw-Hill, N	9 of variances - Chi- TOTAL 45 New Delhi,2010
 single mean, difference of means, and difference of s UNIT V: Small Samples Test for single mean, difference of means and corres square test for goodness of fit and independence of a TEXTBOOKS 1.Veerarajan T., "Probability, Statistics and Random 2. B.S. Grewal, "Higher Engineering Mathematics", 	standard deviation elation coefficien attributes. LECTURE 45 a Processes", Tata	ts, test for ratio of TUTORIAL 0 a McGraw-Hill, N	9 of variances - Chi- TOTAL 45 New Delhi,2010
single mean, difference of means, and difference of s UNIT V: Small Samples Test for single mean, difference of means and corres square test for goodness of fit and independence of a TEXTBOOKS 1.Veerarajan T., "Probability, Statistics and Random 2. B.S. Grewal, "Higher Engineering Mathematics", REFERENCES	standard deviation elation coefficien attributes. LECTURE 45 a Processes", Tata Khanna Publisho	ts, test for ratio of TUTORIAL 0 a McGraw-Hill, Ners, 43 rd Edition,	9 of variances - Chi- TOTAL 45 New Delhi,2010 2015.
 single mean, difference of means, and difference of s UNIT V: Small Samples Test for single mean, difference of means and corres square test for goodness of fit and independence of a TEXTBOOKS 1. Veerarajan T., "Probability, Statistics and Random 2. B.S. Grewal, "Higher Engineering Mathematics", REFERENCES 1. Erwin Kreyszig, "Advanced Engineering Mathematics" 	standard deviation elation coefficien attributes. LECTURE 45 A Processes", Tata Khanna Publishe aatics", 9 th Edition	ns. ts, test for ratio of TUTORIAL 0 a McGraw-Hill, N ers, 43 rd Edition, n, John Wiley & S	9of variances - Chi-TOTAL45New Delhi,20102015.Sons, 2006.
 single mean, difference of means, and difference of s UNIT V: Small Samples Test for single mean, difference of means and corres square test for goodness of fit and independence of a TEXTBOOKS 1. Veerarajan T., "Probability, Statistics and Random 2. B.S. Grewal, "Higher Engineering Mathematics", REFERENCES 1. Erwin Kreyszig, "Advanced Engineering Mathem 2. P. G. Hoel, S. C. Port and C. J. Stone, "Introduction 	standard deviation elation coefficien attributes. LECTURE 45 A Processes", Tata Khanna Publishe aatics", 9 th Edition	ns. ts, test for ratio of TUTORIAL 0 a McGraw-Hill, N ers, 43 rd Edition, n, John Wiley & S	9 of variances - Chi- TOTAL 45 New Delhi,2010 2015. Sons, 2006.
 single mean, difference of means, and difference of s UNIT V: Small Samples Test for single mean, difference of means and corres square test for goodness of fit and independence of a TEXTBOOKS 1. Veerarajan T., "Probability, Statistics and Random 2. B.S. Grewal, "Higher Engineering Mathematics", REFERENCES 1. Erwin Kreyszig, "Advanced Engineering Mathem 2. P. G. Hoel, S. C. Port and C. J. Stone, "Introduction Stall, 2003 (Reprint). 	standard deviation elation coefficien attributes. LECTURE 45 A Processes", Tata Khanna Publishe matics", 9 th Edition on to Probability	ts, test for ratio of TUTORIAL 0 a McGraw-Hill, Ners, 43 rd Edition, n, John Wiley & S Theory", University	9 of variances - Chi- TOTAL 45 New Delhi,2010 2015. Sons, 2006.
 single mean, difference of means, and difference of s UNIT V: Small Samples Test for single mean, difference of means and corres square test for goodness of fit and independence of a TEXTBOOKS 1. Veerarajan T., "Probability, Statistics and Random 2. B.S. Grewal, "Higher Engineering Mathematics", REFERENCES 1. Erwin Kreyszig, "Advanced Engineering Mathem 2. P. G. Hoel, S. C. Port and C. J. Stone, "Introduction Stall, 2003 (Reprint). 3. S. Ross, "A First Course in Probability", 6th Ed., F 	standard deviation elation coefficien attributes. LECTURE 45 A Processes", Tata Khanna Publisho matics", 9 th Edition on to Probability Pearson Educatio	ns. ts, test for ratio of TUTORIAL 0 a McGraw-Hill, N ers, 43 rd Edition, h, John Wiley & S Theory", Universion n India, 2002.	9 of variances - Chi- TOTAL 45 New Delhi,2010 2015. Sons, 2006. sal Book
 single mean, difference of means, and difference of s UNIT V: Small Samples Test for single mean, difference of means and corres square test for goodness of fit and independence of a TEXTBOOKS 1. Veerarajan T., "Probability, Statistics and Random 2. B.S. Grewal, "Higher Engineering Mathematics", REFERENCES 1. Erwin Kreyszig, "Advanced Engineering Mathem 2. P. G. Hoel, S. C. Port and C. J. Stone, "Introduction Stall, 2003 (Reprint). 	standard deviation elation coefficien attributes. LECTURE 45 A Processes", Tata Khanna Publishe atics", 9 th Edition on to Probability Pearson Education and its Applicat	ts, test for ratio of TUTORIAL 0 a McGraw-Hill, Ners, 43 rd Edition, n, John Wiley & S Theory", Universion n India, 2002. ions", Vol. 1, 3 rd	9 of variances - Chi- TOTAL 45 New Delhi,2010 2015. Sons, 2006. sal Book Ed., Wiley, 1968.

Reprint, 2010.

E – REFERENCE nptel

Probability and Statistics by Prof.Someshkumar, Department of Mathematics, IIT Kharagpur. (http://nptel.ac.in/noc/noc_courselist.php)

				(Cos vei	rsus G	A ma	pping				
			Graduates Attributes									
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2	1						1	1		1
CO2	3	2	1						1	1		1
CO3	3	2	1	1					1	1		1
CO4	3	2	1	1	1	1			1	1	1	1
CO5	3	2	1	1	1	1	1		1	1	1	1
Total	15	10	5	3	2	2	1		5	5	2	5
Scaled Value	3	2	1	1	1	1	1		1	1	1	1
C) - No	Relati	Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation									
		1 – 5 -	$\rightarrow 1$,		6	- 10 -	<i>→</i> 2,		11	$-15 \rightarrow$	• 3	

				L	Т	P	С
X	BT302			2	1	0	3
		BIOCHEMISTRY					
С	P A			L	Т	Р	Η
3	0 0			3	1	0	4
Prere	quisite: -						
Learr	ning Object	ives:					
Upon	completion	of this course, the students					
•	Would have	ve learn the fundamentals of biomolecules.					
•	Would have	ve learn the functions of proteins and biosignalling.					
		Course Outcomes	Domai	Domain Le			
After	the complet	ion of the course, students will be able to					
C01	Recognize	and Understand about role of water and amino	Cognitive		Remen	nber	
COI	acids.						
CO2	Recognize	and Understand proteins and their structures.	Cognitive		Recall		
02	Also, will	learn about enzymes.					
CO3	Recognize	and Understand about carbohydrate and glycol	Cognitive		Under	stand	
005	biology.						
CO4	Recognize	and Understand about Nucleotides and Nucleic	Cognitive		Under	stand	
004	acids.						
CO5	Recognize	and Understand lipids and biosignalling.	Cognitive		Under	etand	
05					Under	stanu	

I – Water, Amino acids	and Proteins		6+3
Water, Weak Interaction	s in Aqueous Systems, Ioni	zation of Water, Weak	Acids, and Weak Bases,
Buffering against pH cha	anges in biological systems.	Water as a reactant. Amin	no acids, structures of 20
common acids and proj	perties, Peptides, Proteins,	Genetic codon. Structur	e of Proteins- Primary,
	ture and Quaternary Structure		
II – Protein Function an	nd Enzymes		6+3
Reversible Binding of a	Protein to a Ligand: Oxyge	en-Binding Proteins: Cor	nplementary Interactions
between Proteins and Ligation	ands: Protein Interactions Mo	odulated by Chemical En	ergy: Actin, Myosin, and
Molecular Motors: An I	Introduction to Enzymes: H	Iow Enzymes Work, M	echanism, Examples of
Enzymatic Reactions, Reg	gulatory Enzymes.		
III – Carbohydrates and	d Glycobiology		6+3
	saccharides: Polysaccharides	: Glycoconiugates: Prote	oglycans, Glycoproteins,
	ohydrates as Informational		
Carbohydrates.	,	6	8
IV – Nucleotides and Nu	ucleic acids		6+3
Fundamentals of nucleoti	ides and nucleic acids: Nucle	ic Acid Structure: Nuclei	c Acid Chemistry: Other
Functions of Nucleotides.			
V – Lipids, biological m	embranes and transport		6+3
Storage Lipids: Structura			and Diamanta Washing
	a Lipius in Memoranes. Lipi	ids as Signals, Cofactors,	and Pigments: working
with Lipids: Biological	membranes and transport: solute transport across memb	Composition and arch	
with Lipids: Biological	membranes and transport:	Composition and arch	
with Lipids: Biological membrane dynamics and	membranes and transport: solute transport across memb	Composition and arch pranes.	itecture of membranes,
with Lipids: Biological membrane dynamics and Lecture 30 Text Books:	membranes and transport: solute transport across memb Tutorial 15	Composition and arch pranes. Practical 0	itecture of membranes, Total 45
with Lipids: Biological membrane dynamics and Lecture 30 Text Books: 4. Lehninger Princip 6th edition (13 Fe 5. Biochemistry, Do 91410-6.	membranes and transport: solute transport across memb Tutorial 15 bles of Biochemistry, David bruary 2013), 1158 pages ISF onald Voet, Judith G. Voet	Composition and arch pranes. Practical 0 L. Nelson and Michael M BN-10: 1464109621, ISB 4 th Edition, 2011, 1520	Total 45 1. Cox, W. H. Freeman; SN-13: 978-1464109621. pages ISBN: 978-0-470-
with Lipids: Biological membrane dynamics and Lecture 30 Text Books: 4. Lehninger Princip 6th edition (13 Fe 5. Biochemistry, Do 91410-6. 6. Branden C. and	membranes and transport: solute transport across memb Tutorial 15 bles of Biochemistry, David bruary 2013), 1158 pages ISF onald Voet, Judith G. Voet Tooze J., "Introduction to	Composition and arch pranes. Practical 0 L. Nelson and Michael M BN-10: 1464109621, ISB 4 th Edition, 2011, 1520	Total 45 1. Cox, W. H. Freeman; SN-13: 978-1464109621. pages ISBN: 978-0-470-
 with Lipids: Biological membrane dynamics and Lecture 30 Text Books: 4. Lehninger Princip 6th edition (13 Fe 5. Biochemistry, Do 91410-6. 6. Branden C. and Publishing, NY, U 	membranes and transport: solute transport across memb Tutorial 15 bles of Biochemistry, David bruary 2013), 1158 pages ISF onald Voet, Judith G. Voet Tooze J., "Introduction to	Composition and arch pranes. Practical 0 L. Nelson and Michael M BN-10: 1464109621, ISB 4 th Edition, 2011, 1520	Total 45 1. Cox, W. H. Freeman; SN-13: 978-1464109621. pages ISBN: 978-0-470-
 with Lipids: Biological membrane dynamics and Lecture 30 Text Books: 4. Lehninger Princip 6th edition (13 Fe 5. Biochemistry, Do 91410-6. 6. Branden C. and Publishing, NY, U Reference Books: 	membranes and transport: solute transport across memb Tutorial 15 bles of Biochemistry, David bruary 2013), 1158 pages ISH onald Voet, Judith G. Voet Tooze J., "Introduction to JSA, 1999.	Composition and arch pranes. Practical 0 L. Nelson and Michael M BN-10: 1464109621, ISB 4 th Edition, 2011, 1520 Protein Structured, Se	Total 45 1. Cox, W. H. Freeman; N-13: 978-1464109621. pages ISBN: 978-0-470- cond Edition", Garland
with Lipids: Biological membrane dynamics and Lecture 30 Text Books: 4. Lehninger Princip 6th edition (13 Fe 5. Biochemistry, Do 91410-6. 6. Branden C. and Publishing, NY, U Reference Books: 5. Introduction to Pression 1975 1975 1975 1975 1975 1975 1975 1975	membranes and transport: solute transport across memb Tutorial 15 bles of Biochemistry, David 1 bruary 2013), 1158 pages ISH onald Voet, Judith G. Voet 4 Tooze J., "Introduction to JSA, 1999.	Composition and arch pranes. Practical 0 L. Nelson and Michael M BN-10: 1464109621, ISB 4 th Edition, 2011, 1520 Protein Structured, Se rl Branden and John Toor	Total 45 I. Cox, W. H. Freeman; N-13: 978-1464109621. pages ISBN: 978-0-470- econd Edition", Garland ze, Garland Press, 1999.
 with Lipids: Biological membrane dynamics and Lecture 30 Text Books: 4. Lehninger Princip 6th edition (13 Fe 5. Biochemistry, Do 91410-6. 6. Branden C. and Publishing, NY, U Reference Books: 5. Introduction to Prince 6. Structure and Medition 	membranes and transport: solute transport across memb Tutorial 15 oles of Biochemistry, David bruary 2013), 1158 pages ISH onald Voet, Judith G. Voet Tooze J., "Introduction to JSA, 1999. otein structure, 2nd Ed by Ca chanism in Protein Science, A	Composition and arch pranes. Practical 0 L. Nelson and Michael M BN-10: 1464109621, ISB 4 th Edition, 2011, 1520 Protein Structured, Sec rl Branden and John Toor Man Fersht, Freeman, 199	Total 45 1. Cox, W. H. Freeman; N-13: 978-1464109621. pages ISBN: 978-0-470- cond Edition", Garland ze, Garland Press, 1999. 9.
 with Lipids: Biological membrane dynamics and Lecture 30 Text Books: 4. Lehninger Princip 6th edition (13 Fe 5. Biochemistry, Do 91410-6. 6. Branden C. and Publishing, NY, U Reference Books: 5. Introduction to Pr 6. Structure and Med 7. Protein engineering 	membranes and transport: solute transport across memb Tutorial 15 bles of Biochemistry, David 1 bruary 2013), 1158 pages ISH onald Voet, Judith G. Voet 4 Tooze J., "Introduction to JSA, 1999.	Composition and arch pranes. Practical 0 L. Nelson and Michael M BN-10: 1464109621, ISB 4 th Edition, 2011, 1520 Protein Structured, Sec rl Branden and John Toor Man Fersht, Freeman, 199	Total 45 1. Cox, W. H. Freeman; N-13: 978-1464109621. pages ISBN: 978-0-470- cond Edition", Garland ze, Garland Press, 1999. 9.
 with Lipids: Biological membrane dynamics and Lecture 30 Text Books: 4. Lehninger Princip 6th edition (13 Fe 5. Biochemistry, Do 91410-6. 6. Branden C. and Publishing, NY, U Reference Books: 5. Introduction to Pr 6. Structure and Med 7. Protein engineerir Publishers, 2002. 	membranes and transport: solute transport across memb Tutorial 15 bles of Biochemistry, David 1 bruary 2013), 1158 pages ISH onald Voet, Judith G. Voet 4 Tooze J., "Introduction to JSA, 1999. otein structure, 2nd Ed by Ca chanism in Protein Science, A ng in Industrial biotechnology	Composition and arch pranes. Practical 0 L. Nelson and Michael M BN-10: 1464109621, ISB 4 th Edition, 2011, 1520 p Protein Structured, Sec rl Branden and John Toom Alan Fersht, Freeman, 199 7, Ed. Lilia Alberghina, H	Total 45 1. Cox, W. H. Freeman; N-13: 978-1464109621. pages ISBN: 978-0-470- cond Edition", Garland ze, Garland Press, 1999. 9.
 with Lipids: Biological membrane dynamics and Lecture 30 Text Books: 4. Lehninger Princip 6th edition (13 Fe 5. Biochemistry, Do 91410-6. 6. Branden C. and Publishing, NY, U Reference Books: 5. Introduction to Pr 6. Structure and Med 7. Protein engineerir Publishers, 2002. 8. Creighton T.E. Pr 	membranes and transport: solute transport across memb Tutorial 15 oles of Biochemistry, David bruary 2013), 1158 pages ISH onald Voet, Judith G. Voet Tooze J., "Introduction to JSA, 1999. otein structure, 2nd Ed by Ca chanism in Protein Science, A	Composition and arch pranes. Practical 0 L. Nelson and Michael M BN-10: 1464109621, ISB 4 th Edition, 2011, 1520 p Protein Structured, Sec rl Branden and John Toom Alan Fersht, Freeman, 199 7, Ed. Lilia Alberghina, H	Total 45 1. Cox, W. H. Freeman; N-13: 978-1464109621. pages ISBN: 978-0-470- cond Edition", Garland ze, Garland Press, 1999. 9.
with Lipids: Biological membrane dynamics and Lecture 30 Text Books: 4. Lehninger Princip 6th edition (13 Fe 5. Biochemistry, Do 91410-6. 6. Branden C. and Publishing, NY, U Reference Books: 5. Introduction to Pr 6. Structure and Med 7. Protein engineerir Publishers, 2002. 8. Creighton T.E. Pr E-References:	membranes and transport: solute transport across memb Tutorial 15 oles of Biochemistry, David bruary 2013), 1158 pages ISF onald Voet, Judith G. Voet Tooze J., "Introduction to JSA, 1999. otein structure, 2nd Ed by Ca chanism in Protein Science, A ng in Industrial biotechnology oteins, Freeman WH, Second	Composition and arch pranes. Practical 0 L. Nelson and Michael M BN-10: 1464109621, ISB 4 th Edition, 2011, 1520 p Protein Structured, Sec rl Branden and John Toom Alan Fersht, Freeman, 199 7, Ed. Lilia Alberghina, H	Total 45 1. Cox, W. H. Freeman; N-13: 978-1464109621. pages ISBN: 978-0-470- cond Edition", Garland ze, Garland Press, 1999. 9.
with Lipids: Biological membrane dynamics and Lecture 30 Text Books: 4. Lehninger Princip 6th edition (13 Fe 5. Biochemistry, Do 91410-6. 6. Branden C. and Publishing, NY, U Reference Books: 5. Introduction to Pr 6. Structure and Mea 7. Protein engineerin Publishers, 2002. 8. Creighton T.E. Pr E-References: 3. http://vlab.amrita.	membranes and transport: solute transport across memb Tutorial 15 bles of Biochemistry, David 1 bruary 2013), 1158 pages ISH onald Voet, Judith G. Voet 4 Tooze J., "Introduction to JSA, 1999. otein structure, 2nd Ed by Ca chanism in Protein Science, A ng in Industrial biotechnology	Composition and arch pranes. Practical 0 L. Nelson and Michael M BN-10: 1464109621, ISB 4 th Edition, 2011, 1520 p Protein Structured, Sec rl Branden and John Toor Man Fersht, Freeman, 199 J, Ed. Lilia Alberghina, H l Edition, 1993.	Total 45 1. Cox, W. H. Freeman; N-13: 978-1464109621. pages ISBN: 978-0-470- cond Edition", Garland ze, Garland Press, 1999. 9.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	1	2	0	1	0	0	1	1	1	1	3	2	3
CO 2	1	1	2	0	1	0	0	1	1	1	1	0	3	2
CO 3	1	1	2	0	1	0	0	1	1	1	1	2	2	1
CO 4	1	1	2	0	1	0	0	1	1	1	1	0	1	0
CO 5	1	1	2	0	1	0	0	1	1	1	1	2	0	0
	5	5	10	0	5	0	0	5	5	5	5	7	8	6

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

Mapping of Subjects with POs

1. In pp III	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1	PSO	PSO
	1	2	3	4	5	6	7	8	9	0	1	2	1	2
Origin														
al	5	5	10	0	5	0	0	5	5	5	5	7	8	6
Value														
Scaled	3	3	6	0	3	0	0	2	2	0	2	4	5	2
Value	3	3	6	0	3	0	0	3	3	0	3	4	3	3
$1-5 \rightarrow$	1,		6 –	$10 \rightarrow 10$	2,		11 -	$15 \rightarrow$	3					

 $1-5 \rightarrow 1$, $6-10 \rightarrow 2$, $11-15 \rightarrow 3$ 0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

v	CBT 3	02		L	Т	Р	С
Δ	DI J	03	MICDODIOLOCY	3	0	0	3
С	Р	Α	MICROBIOLOGY	L	Т	Р	Н
3	0	0		3	0	0	3
PR	EREQ	UISI	TE: Biology				

Learning Objectives:

Upon completion of this course, the students will be able to understand the existence of microbial world through the study of the characteristics of microorganisms, their classification, their interaction with various environments, growth in different media and their control.

	Course Outcomes	Domain	Level
After	the completion of the course, students will be able to		
CO1	<i>Comprehend</i> knowledge about historical perspective of microbiology and its developments. <i>Recognize</i> the fundamental concepts in the structure and functioning of a prokaryotic cell. <i>Perform</i> staining techniques to observe microorganisms		Understand Remember
CO2	<i>Acquire</i> knowledge about microbial taxonomy and microbial classification methods	Cognitive	Understand Remember

CO3	-	ge about microbial ecosystem and their	Cognitive	Understand
		ferent environments		Remember
	-	ge on the bacterial growth, growth curve		
CO4		tritional requirements, Perform culturing	Cognitive	Understand
00.	-	solate microorganisms, Choose the		Remember
		for the cultivation of microorganisms		
		e mechanisms of various antimicrobial		Understand
CO5		hogens applications of microorganisms,	Cognitive	Remember
		ge on the drug resistance of pathogens		
		DUCTION TO MICROBIOLOGY		7
		Microbiology – Overview of Prokaryo		
		l wall, Flagella, Capsule – Study of mi		e: Microscopy (light,
		, electron), Staining techniques (simple and		
		IFICATION OF MICROORGANISMS		9
		nomial Nomenclature – Five Kingdom cla		
0		- Three Domain classification system: Ba		•
		gical characteristics, Physiological and m		
	, U	cal characteristics, Molecular characte	eristics – Viru	ises: Structure and
Classi	fication.			1
Ī		DBIAL ECOLOGY AND	MICROBIA	AL 11
				11
	INTER	ACTIONS		
Micro	bial Ecology: Mi	croorganisms in Marine Ecosystems,		osystems, Terrestrial
Micro Ecosy	bial Ecology: Mi stems – Microbial	croorganisms in Marine Ecosystems, nteractions: Microbe-Microbe interactions		bsystems, Terrestrial be interactions.
Micro Ecosy	bial Ecology: Mi stems – Microbial I IV MICRO	croorganisms in Marine Ecosystems, nteractions: Microbe-Microbe interactions DBIAL GROWTH AND NUTRITION	, Human-Micro	osystems, Terrestrial be interactions. 11
Micro Ecosy Micro	bial Ecology: Mi stems – Microbial I IV MICRO bial Growth: Grow	croorganisms in Marine Ecosystems, nteractions: Microbe-Microbe interactions DBIAL GROWTH AND NUTRITION th curve (lag, exponential, stationary, deat	h phase), Measu	osystems, Terrestrial be interactions. 11 rement (cell number,
Micro Ecosy Micro cell m	bial Ecology: Mi stems – Microbial I IV MICRO bial Growth: Grow hass), Factors influe	croorganisms in Marine Ecosystems, nteractions: Microbe-Microbe interactions DBIAL GROWTH AND NUTRITION th curve (lag, exponential, stationary, deat encing growth (water activity, pH, temper	h phase), Measu ature, oxygen, j	osystems, Terrestrial be interactions. 11 rement (cell number, pressure, radiation) –
Micro Ecosy Micro cell m Micro	bial Ecology: Mi stems – Microbial D IV MICRO bial Growth: Grow hass), Factors influe bial Nutrition: Cul	croorganisms in Marine Ecosystems, nteractions: Microbe-Microbe interactions DBIAL GROWTH AND NUTRITION th curve (lag, exponential, stationary, deat	h phase), Measu ature, oxygen, j	osystems, Terrestrial be interactions. 11 rement (cell number, pressure, radiation) –
Micro Ecosy Micro cell m	bial Ecology: Mi stems – Microbial I IV MICRO bial Growth: Grow hass), Factors influe bial Nutrition: Cul blate).	croorganisms in Marine Ecosystems, interactions: Microbe-Microbe interactions DBIAL GROWTH AND NUTRITION th curve (lag, exponential, stationary, deat encing growth (water activity, pH, temper ture media (defined, complex), Culture te	h phase), Measu ature, oxygen, j chniques (sprea	osystems, Terrestrial be interactions. 11 rement (cell number, pressure, radiation) –
Micro Ecosy Micro cell m Micro pour p	bial Ecology: Mi stems – Microbial I IV MICRO bial Growth: Grow hass), Factors influe bial Nutrition: Cul blate). V ANTIB	croorganisms in Marine Ecosystems, interactions: Microbe-Microbe interactions BIAL GROWTH AND NUTRITION th curve (lag, exponential, stationary, deat encing growth (water activity, pH, temper ture media (defined, complex), Culture to IOTICS AND ANTIMICROBIAL RES	h phase), Measu h phase), Measu rature, oxygen, j echniques (sprea	psystems, Terrestrial be interactions. 11 rement (cell number, pressure, radiation) – id plate, streak plate, 7
Micro Ecosy Micro cell m Micro pour p Antibi	INTERbialEcology:Mistems – MicrobialIIVMICRObialGrowth:GrowbialGrowth:GrowbialNutrition:CulbialNutrition:Culbiate).VANTIBiotics:Antibacteria	croorganisms in Marine Ecosystems, interactions: Microbe-Microbe interactions DBIAL GROWTH AND NUTRITION th curve (lag, exponential, stationary, deat encing growth (water activity, pH, temper ture media (defined, complex), Culture te IOTICS AND ANTIMICROBIAL RESI I, Antifungal, Antiviral, Antiprotozoan, A	h phase), Measu h phase), Measu rature, oxygen, j echniques (sprea	psystems, Terrestrial be interactions. 11 rement (cell number, pressure, radiation) – id plate, streak plate, 7
Micro Ecosy Micro cell m Micro pour p Antibi Resist	INTERbialEcology:Mistems – MicrobialIIVMICRObialGrowth:GrowbialGrowth:GrowbialNutrition:CulbialNutrition:Culblate).ANTIBiotics:Antibacteriaance:Mechanisms	croorganisms in Marine Ecosystems, interactions: Microbe-Microbe interactions DBIAL GROWTH AND NUTRITION th curve (lag, exponential, stationary, deat encing growth (water activity, pH, temper ture media (defined, complex), Culture te IOTICS AND ANTIMICROBIAL RESI I, Antifungal, Antiviral, Antiprotozoan, A of resistance, Prevention of resistance.	h phase), Measu h phase), Measu rature, oxygen, j echniques (sprea	psystems, Terrestrial be interactions. 11 rement (cell number, pressure, radiation) – id plate, streak plate, 7 rugs – Antimicrobial
Micro Ecosy Micro cell m Micro pour p Antibi Resist	bial Ecology: Mi stems – Microbial I IV MICRO bial Growth: Grow hass), Factors influe bial Nutrition: Cul bial Nutrition: Cul blate). V ANTIB iotics: Antibacteria ance: Mechanisms LECTURE	croorganisms in Marine Ecosystems, interactions: Microbe-Microbe interactions DBIAL GROWTH AND NUTRITION th curve (lag, exponential, stationary, deat encing growth (water activity, pH, temper ture media (defined, complex), Culture te IOTICS AND ANTIMICROBIAL RESI I, Antifungal, Antiviral, Antiprotozoan, A of resistance, Prevention of resistance. TUTORIAL	h phase), Measu h phase), Measu rature, oxygen, j echniques (sprea	psystems, Terrestrial be interactions. 11 rement (cell number, pressure, radiation) – d plate, streak plate, 7 rugs – Antimicrobial TOTAL
Micro Ecosy Micro cell m Micro pour p Antibi Resist	INTER bial Ecology: Mirstems – Microbial I IV MICRO bial Growth: Grow hass), Factors influe bial Nutrition: Cul biate). V ANTIB iotics: Antibacteria ance: Mechanisms LECTURE 45	croorganisms in Marine Ecosystems, interactions: Microbe-Microbe interactions DBIAL GROWTH AND NUTRITION th curve (lag, exponential, stationary, deat encing growth (water activity, pH, temper ture media (defined, complex), Culture te IOTICS AND ANTIMICROBIAL RESI I, Antifungal, Antiviral, Antiprotozoan, A of resistance, Prevention of resistance.	h phase), Measu h phase), Measu rature, oxygen, j echniques (sprea	osystems, Terrestrial be interactions. 11 rement (cell number, pressure, radiation) – id plate, streak plate 7 rugs – Antimicrobia
Micro Ecosy Micro cell m Micro pour p Antibi Resist	bial Ecology: Mi stems – Microbial I IV MICRO bial Growth: Grow hass), Factors influe bial Nutrition: Cul bial Nutrition: Cul bial Nutrition: Cul biate). V ANTIB iotics: Antibacteria ance: Mechanisms LECTURE 45 TBOOKS:	croorganisms in Marine Ecosystems, interactions: Microbe-Microbe interactions DBIAL GROWTH AND NUTRITION th curve (lag, exponential, stationary, deat encing growth (water activity, pH, temper ture media (defined, complex), Culture te IOTICS AND ANTIMICROBIAL RESI I, Antifungal, Antiviral, Antiprotozoan, A of resistance, Prevention of resistance. TUTORIAL 0	h phase), Measu rature, oxygen, j echniques (sprea ISTANCE antihelminthic da	psystems, Terrestrial be interactions. 11 rement (cell number, pressure, radiation) – id plate, streak plate, 7 rugs – Antimicrobial TOTAL 45
Micro Ecosy Micro cell m Micro pour p Antibi Resist	bial Ecology: Mi stems – Microbial I IV MICRO bial Growth: Grow hass), Factors influe bial Nutrition: Cul bial Nutrition: Cul bial Nutrition: Cul biate). V ANTIB iotics: Antibacteria ance: Mechanisms LECTURE 45 TBOOKS: Prescott, L. M., H	croorganisms in Marine Ecosystems, interactions: Microbe-Microbe interactions DBIAL GROWTH AND NUTRITION th curve (lag, exponential, stationary, deat encing growth (water activity, pH, temper ture media (defined, complex), Culture te IOTICS AND ANTIMICROBIAL RESI I, Antifungal, Antiviral, Antiprotozoan, A of resistance, Prevention of resistance. TUTORIAL	h phase), Measu rature, oxygen, j echniques (sprea ISTANCE antihelminthic da	psystems, Terrestrial be interactions. 11 rement (cell number, pressure, radiation) – id plate, streak plate, 7 rugs – Antimicrobial TOTAL 45
Micro Ecosy Micro cell m Micro pour p Antibi Resist TEXT 2.	INTER bial Ecology: Mi stems – Microbial I IV MICRO bial Growth: Grow hass), Factors influe bial Nutrition: Cul bial Nutrition: Cul bial Nutrition: Cul biate). V ANTIB iotics: Antibacteria ance: Mechanisms LECTURE 45 FBOOKS: Prescott, L. M., H Education, 2005.	croorganisms in Marine Ecosystems, interactions: Microbe-Microbe interactions DBIAL GROWTH AND NUTRITION th curve (lag, exponential, stationary, deat encing growth (water activity, pH, temper ture media (defined, complex), Culture te IOTICS AND ANTIMICROBIAL RESI I, Antifungal, Antiviral, Antiprotozoan, A of resistance, Prevention of resistance. TUTORIAL 0	h phase), Measu rature, oxygen, j echniques (sprea ISTANCE antihelminthic da	psystems, Terrestrial be interactions. 11 rement (cell number, pressure, radiation) – id plate, streak plate. 7 rugs – Antimicrobial TOTAL 45
Micro Ecosy Micro cell m Micro pour p Antibi Resista TEXT 2. REFE	INTER bial Ecology: Mi stems – Microbial I IV MICRO bial Growth: Grow bial Growth: Grow bial Mutrition: Cul bial Nutrition: Cul bial Nutrition: Cul bial Nutrition: Cul bial State V ANTIB iotics: Antibacteria ance: Mechanisms LECTURE 45 T BOOKS: Prescott, L. M., H Education, 2005. ERENCES:	croorganisms in Marine Ecosystems, interactions: Microbe-Microbe interactions DBIAL GROWTH AND NUTRITION th curve (lag, exponential, stationary, deat encing growth (water activity, pH, temper ture media (defined, complex), Culture te IOTICS AND ANTIMICROBIAL RESI I, Antifungal, Antiviral, Antiprotozoan, A of resistance, Prevention of resistance. TUTORIAL 0 farley, J. P., and Klein, D. A. Microbiology	h phase), Measu ature, oxygen, j echniques (sprea STANCE ISTANCE Intihelminthic da	psystems, Terrestrial be interactions. 11 rement (cell number, pressure, radiation) – d plate, streak plate 7 rugs – Antimicrobia TOTAL 45 <i>Hill Higher</i>
Micro Ecosy Micro cell m Micro pour p Antibi Resista TEXT 2. REFE	INTER bial Ecology: Mi stems – Microbial I IV MICRO bial Growth: Grow bial Growth: Grow bial Mutrition: Cul bial Nutrition: Cul biate). V ANTIB iotics: Antibacteria ance: Mechanisms LECTURE 45 F BOOKS: Prescott, L. M., H Education, 2005. CRENCES: Morcello, J. A., M	croorganisms in Marine Ecosystems, interactions: Microbe-Microbe interactions DBIAL GROWTH AND NUTRITION th curve (lag, exponential, stationary, deat encing growth (water activity, pH, temper ture media (defined, complex), Culture te IOTICS AND ANTIMICROBIAL RESI I, Antifungal, Antiviral, Antiprotozoan, A of resistance, Prevention of resistance. TUTORIAL 0 farley, J. P., and Klein, D. A. Microbiology fizer, H. E., &Granato, P. A. Laboratory m	h phase), Measu ature, oxygen, j echniques (sprea STANCE ISTANCE Intihelminthic da	psystems, Terrestrial be interactions. 11 rement (cell number, pressure, radiation) – d plate, streak plate 7 rugs – Antimicrobia TOTAL 45 <i>Hill Higher</i>
Micro Ecosys Micro cell m Micro pour p Antibi Resists TEXT 2. REFE 5.	bial Ecology: Mi stems – Microbial I IV MICRO bial Growth: Grow hass), Factors influe bial Nutrition: Cul- bial Nu	croorganisms in Marine Ecosystems, interactions: Microbe-Microbe interactions DBIAL GROWTH AND NUTRITION th curve (lag, exponential, stationary, deat encing growth (water activity, pH, temper ture media (defined, complex), Culture te IOTICS AND ANTIMICROBIAL RESI I, Antifungal, Antiviral, Antiprotozoan, A of resistance, Prevention of resistance. TUTORIAL 0 farley, J. P., and Klein, D. A. Microbiology lizer, H. E., &Granato, P. A. Laboratory m plication to patient care, 2003	h phase), Measu rature, oxygen, j echniques (sprea ISTANCE ISTANCE Intihelminthic dr	psystems, Terrestrial be interactions. 11 rement (cell number, pressure, radiation) – d plate, streak plate 7 rugs – Antimicrobia TOTAL 45 <i>Hill Higher</i> book in
Micro Ecosys Micro cell m Micro pour p Antibi Resists TEXT 2. REFE 5. 6.	bial Ecology: Mi stems – Microbial I \overline{IV} MICRO bial Growth: Grow hass), Factors influe bial Nutrition: Cul- bial Nutrition: Cul- Nutrition:	croorganisms in Marine Ecosystems, interactions: Microbe-Microbe interactions DBIAL GROWTH AND NUTRITION th curve (lag, exponential, stationary, deat encing growth (water activity, pH, temper ture media (defined, complex), Culture to IOTICS AND ANTIMICROBIAL RESI I, Antifungal, Antiviral, Antiprotozoan, A of resistance, Prevention of resistance. TUTORIAL 0 farley, J. P., and Klein, D. A. Microbiology fizer, H. E., &Granato, P. A. Laboratory m plication to patient care, 2003 arley, J. P., & Klein, D. A. Laboratory exe	h phase), Measu ature, oxygen, j echniques (sprea STANCE ISTANCE Intihelminthic da or 5th. <i>McGrawJ</i> annual and workl	be interactions. 11 rement (cell number, pressure, radiation) – d plate, streak plate 7 rugs – Antimicrobia TOTAL 45 <i>THill Higher</i> book in iology, 2002.
Micro Ecosys Micro cell m Micro pour p Antibi Resists TEXT 2. REFE 5. 6. 7.	INTER bial Ecology: Mi stems – Microbial I IV MICRO bial Growth: Grow bial Growth: Grow bial Growth: Grow bial Nutrition: Cul bial Nutrition: Cul bial Nutrition: Cul bial Nutrition: Cul bial State V ANTIB iotics: Antibacteria ance: Mechanisms LECTURE 45 F BOOKS: Prescott, L. M., H Education, 2005. CRENCES: Morcello, J. A., M Microbiology: Ap Prescott, L. M., H Black, Jacquelyn	croorganisms in Marine Ecosystems, interactions: Microbe-Microbe interactions DBIAL GROWTH AND NUTRITION th curve (lag, exponential, stationary, deat encing growth (water activity, pH, temper ture media (defined, complex), Culture te IOTICS AND ANTIMICROBIAL RESI I, Antifungal, Antiviral, Antiprotozoan, A of resistance, Prevention of resistance. TUTORIAL 0 farley, J. P., and Klein, D. A. Microbiology fizer, H. E., &Granato, P. A. Laboratory m plication to patient care, 2003 arley, J. P., & Klein, D. A. Laboratory exe G. <i>Microbiology: principles and exploration</i>	h phase), Measu ature, oxygen, j echniques (sprea STANCE ISTANCE Intihelminthic di v. 5th. <i>McGrawJ</i> annual and workl arcises in microb	be interactions. 11 rement (cell number, pressure, radiation) – d plate, streak plate 7 rugs – Antimicrobia TOTAL 45 <i>Hill Higher</i> book in iology, 2002. & Sons, 2008.
Micro Ecosys Micro cell m Micro pour p Antibi Resists TEXT 2. REFE 5. 6.	bial Ecology: Mi stems – Microbial I IV MICRO bial Growth: Grow hass), Factors influe bial Nutrition: Cul bial Nutrition: Cul	croorganisms in Marine Ecosystems, interactions: Microbe-Microbe interactions DBIAL GROWTH AND NUTRITION th curve (lag, exponential, stationary, deat encing growth (water activity, pH, temper ture media (defined, complex), Culture to IOTICS AND ANTIMICROBIAL RESI I, Antifungal, Antiviral, Antiprotozoan, A of resistance, Prevention of resistance. TUTORIAL 0 farley, J. P., and Klein, D. A. Microbiology fizer, H. E., &Granato, P. A. Laboratory m plication to patient care, 2003 arley, J. P., & Klein, D. A. Laboratory exe G. <i>Microbiology: principles and exploration</i> , Berdell R. Funke, Christine L. Case, and	h phase), Measu rature, oxygen, j echniques (sprea STANCE ISTANCE Intihelminthic du or 5th. <i>McGrawJ</i> annual and work rcises in microb ons. John Wiley Ted R. Johnson	be interactions. 11 rement (cell number, pressure, radiation) - d plate, streak plate 7 rugs – Antimicrobia TOTAL 45 <i>Hill Higher</i> book in iology, 2002. & Sons, 2008.
Micro Ecosy Micro cell m Micro pour p Antibi Resista TEXT 2. REFE 5. 6. 7. 8.	INTER bial Ecology: Mi stems – Microbial I IV MICRO bial Growth: Grow hass), Factors influe bial Nutrition: Cul bial Nutrition: Cul bial Nutrition: Cul bial State V ANTIB iotics: Antibacteria ance: Mechanisms LECTURE 45 T BOOKS: Prescott, L. M., H Education, 2005. CRENCES: Morcello, J. A., N Microbiology: Ap Prescott, L. M., H Black, Jacquelyn Tortora, Gerard J. introduction. Vol.	croorganisms in Marine Ecosystems, interactions: Microbe-Microbe interactions DBIAL GROWTH AND NUTRITION th curve (lag, exponential, stationary, deat encing growth (water activity, pH, temper ture media (defined, complex), Culture te IOTICS AND ANTIMICROBIAL RESI I, Antifungal, Antiviral, Antiprotozoan, A of resistance, Prevention of resistance. TUTORIAL 0 farley, J. P., and Klein, D. A. Microbiology fizer, H. E., &Granato, P. A. Laboratory m plication to patient care, 2003 arley, J. P., & Klein, D. A. Laboratory exe G. <i>Microbiology: principles and exploration</i>	h phase), Measu rature, oxygen, j echniques (sprea STANCE ISTANCE Intihelminthic du or 5th. <i>McGrawJ</i> annual and work rcises in microb ons. John Wiley Ted R. Johnson	be interactions. 11 rement (cell number pressure, radiation) - d plate, streak plate 7 rugs – Antimicrobia TOTAL 45 <i>Hill Higher</i> book in iology, 2002. & Sons, 2008.
Micro Ecosy Micro cell m Micro pour p Antibi Resist TEXT 2. REFE 5. 6. 7. 8. E-RE	INTER bial Ecology: Mi stems – Microbial I IV MICRO bial Growth: Grow hoial Growth: Grow bial Mutrition: Cul bial Nutrition: Cul biate). V ANTIB iotics: Antibacteria ance: Mechanisms LECTURE 45 FBOOKS: Prescott, L. M., H Education, 2005. CRENCES: Morcello, J. A., M Microbiology: Ap Prescott, L. M., H Black, Jacquelyn Tortora, Gerard J. introduction. Vol. FERENCES:	croorganisms in Marine Ecosystems, interactions: Microbe-Microbe interactions DBIAL GROWTH AND NUTRITION th curve (lag, exponential, stationary, deat encing growth (water activity, pH, temper ture media (defined, complex), Culture to IOTICS AND ANTIMICROBIAL RESI I, Antifungal, Antiviral, Antiprotozoan, A of resistance, Prevention of resistance. TUTORIAL 0 farley, J. P., and Klein, D. A. Microbiology fizer, H. E., &Granato, P. A. Laboratory m plication to patient care, 2003 arley, J. P., & Klein, D. A. Laboratory exe G. <i>Microbiology: principles and exploration</i> , Berdell R. Funke, Christine L. Case, and	h phase), Measu rature, oxygen, j echniques (sprea STANCE ISTANCE Intihelminthic du or 5th. <i>McGrawJ</i> annual and work rcises in microb ons. John Wiley Ted R. Johnson	be interactions. 11 rement (cell number, pressure, radiation) – d plate, streak plate 7 rugs – Antimicrobia TOTAL 45 <i>Hill Higher</i> book in iology, 2002. & Sons, 2008.

5. http://www.uwyo.edu/molb2210_lect/lecture/lectures.html

6. http://nptel.ac.in/courses/102103012/

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES

						PROG	RAM	OUTC	OMES					
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	1	1	1	0	1	0	1	1	1	1	0	0
CO2	3	3	1	1	1	2	2	1	1	1	1	1	0	0
CO3	3	1	2	3	1	2	1	0	1	1	1	1	2	0
CO4	3	3	2	0	1	0	2	0	1	1	1	1	0	2
CO5	3	2	2	3	1	2	2	1	1	0	1	1	2	2
	15	12	8	8	5	6	8	2	5	4	5	5	4	2

 $1-5 \rightarrow 1, 6-10 \rightarrow 2, 11-15 \rightarrow 3$

No relation, 1-Low Relation, 2- Medium Relation, 3-High Relation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
Origina l Value	15	12	8	8	5	6	8	2	5	4	5	5	4	2
Scaled Value	6	4	3	3	2	2	3	1	1	1	1	1	0	1
$1-5 \rightarrow$	1,		6 –	$10 \rightarrow$	2,		11 –	$15 \rightarrow$	3					

				L	Т	P	С
Σ	KBT30)4		2	1	0	3
			MATERIAL AND ENERGY BALANCES				
С	Р	Α		L	Т	Р	Η
3	0	0		2	1	0	3

	Course Outcomes	Domain	Level
After t	the completion of the course, students will be able to		
CO1	<i>Interpret</i> different unit systems and <i>Express</i> the composition gas liquid and solid systems	Cognitive	Understand Remember
CO2	<i>Compute</i> the material balances across different unit operations	Cognitive	Understand Analyse
CO3	Compute the material balances across chemical reactors	Cognitive	Understand Analyse
CO4	<i>Explain</i> the energy balance calculations for systems with and without chemical reactions	Cognitive	Understand
CO5	Describe the Biotechnology stoichiometry system	Cognitive	Understand Receive
	Course Content		Hours
Unit-I	Stoichiometric Principles and Basic Calculations		6+3
Introdu	ctory concepts of units, physical quantities in chemical engine	ering, dimension	lless groups, "basis"

of calculations - Methods of expression, compositions of mixture and solutions. Gases, Vapors and Liquids: Equations of state, Vapor pressure, Clausius-Clapeyron equation, Cox chart, Duhring's plot, Raoult's law.

Unit-II	Material Bal	ances for Non-Reacting Syst	tem		6+3
Material b	alances to diffe	erent unit operations - recyc	ele - bypass and purging.	Distillation, ex	straction,
nixing, dry	ying, crystalliza	tion, evaporation, adsorption	and absorption, Material	balance for mult	iple unit
Unit-III	Material Bal	ances for Reacting System			6+3
Material	balances with	chemical reaction - Limitin	g and excess reactants	– Combustion	– Yield,
conversion	n and selectivity	y calculations, Material balan	ce for multiple unit		
Unit-IV	Energy Balan	ices			6+3
Heat capa	city of solids,	liquids, gases and solutions,	, use of mean heat capac	city in heat calc	ulations,
problems	involving sens	ible heat and latent heats. H	Energy balances with che	emical reaction:	Heat of
reaction, I	Heat of combus	tion.			
Unit-V	Biological St	oichiometry			6+3
Stoichiom	etry growth a	nd product formation, Deg	ree of reduction, Electr	on balance, Th	eoretical
Oxygen de	emand.				
L	ecture	Tutorial	Practical	Total	
	30	15	0	45	
Text Boo					
	V.Narayanan a	nd Lakshmikutty, <i>Chemical I</i>	Process Calculations, Pre	ntice Hall, 2004.	
		-			
		lau and J. B. Riggs, Ba	sic Principles and Cal		
En	igineering , Pea	rson India Education Services	sic Principles and Cal s, 8 th Edition, 2015.	culations in C	Chemical
<i>En</i> 7. B.	ngineering , Pea I. Bhatt and		sic Principles and Cal s, 8 th Edition, 2015.	culations in C	Chemical
<i>En</i> 7. B. 4 th	ngineering , Pea I. Bhatt and Edition, 2004.	rson India Education Services S.M. Vora, Stoichiometry	sic Principles and Cal s, 8 th Edition, 2015. , Tata McGraw Hill Pu	<i>culations in C</i> blishing Compa	C hemical any Ltd,
<i>En</i> 7. B. 4 th 8. Rie	ngineering, Pea I. Bhatt and Edition, 2004. chard M. Feldo	rson India Education Services S.M. Vora, Stoichiometry , er and Ronald W. Rousseau,	sic Principles and Cal s, 8 th Edition, 2015. , Tata McGraw Hill Pu	<i>culations in C</i> blishing Compa	C hemical any Ltd,
En 7. B. 4 th 8. Rie Jol	ngineering, Pea I. Bhatt and Edition, 2004. chard M. Felde hn Wiley & Sou	rson India Education Services S.M. Vora, Stoichiometry	sic Principles and Cal s, 8 th Edition, 2015. , Tata McGraw Hill Pu	<i>culations in C</i> blishing Compa	C hemical any Ltd,
En 7. B. 4 th 8. Rie Joi Reference	ngineering, Pea I. Bhatt and Edition, 2004. chard M. Felde hn Wiley & Son e Books:	rson India Education Services S.M. Vora, Stoichiometry er and Ronald W. Rousseau, ns, INC. 3 rd Edition, 2000.	sic Principles and Cal s, 8 th Edition, 2015. , Tata McGraw Hill Pu , <i>Elementary Principles</i>	<i>culations in C</i> blishing Compa of Chemical P	Themical any Ltd, rocesses,
En 7. B. 4 th 8. Rie Join Reference 4. V.	ngineering, Pea I. Bhatt and Edition, 2004. chard M. Felde hn Wiley & Son e Books: Venkataraman	rson India Education Services S.M. Vora, Stoichiometry er and Ronald W. Rousseau ns, INC. 3 rd Edition, 2000.	sic Principles and Cal s, 8 th Edition, 2015. , Tata McGraw Hill Pu , <i>Elementary Principles</i>	<i>culations in C</i> blishing Compa of Chemical P	Themical any Ltd, rocesses,
En 7. B. 4 th 8. Rie Joi Reference 4. V. Pro-	ngineering, Pea I. Bhatt and Edition, 2004. chard M. Felde hn Wiley & Son e Books: Venkataraman entice Hall of In	rson India Education Services S.M. Vora, Stoichiometry , er and Ronald W. Rousseau, ns, INC. 3 rd Edition, 2000.	sic Principles and Cal s, 8 th Edition, 2015. , Tata McGraw Hill Pu , <i>Elementary Principles</i> gum, K. M. MeeraSherif	<i>culations in C</i> blishing Compa of Chemical P	Themical any Ltd, rocesses,
En 7. En 4 th 8. Rie Joi Reference 4. V. Pro 5. D.	<i>igineering</i> , Pea I. Bhatt and Edition, 2004. chard M. Feldo hn Wiley & Son Books: Venkataraman entice Hall of In C. Sikdar, Che	rson India Education Services S.M. Vora, Stoichiometry , er and Ronald W. Rousseau, as, INC. 3 rd Edition, 2000. i, N. Anantharaman, and Be- ndia, 2nd Edition. mical Process Calculations, P	sic Principles and Cal s, 8 th Edition, 2015. , Tata McGraw Hill Pu , <i>Elementary Principles</i> gum, K. M. MeeraSherif Prentice Hall of India.	<i>culations in C</i> ablishing Compa <i>of Chemical Pa</i> fa, Process Calc	Themical any Ltd, rocesses,
En 7. En 4 th 8. Rie Joi Reference 4. V. Pro 5. D. 6. Ba	ngineering, Pea I. Bhatt and Edition, 2004. chard M. Felde hn Wiley & Son e Books: Venkataraman entice Hall of In C. Sikdar, Che niley and Ollis,	rson India Education Services S.M. Vora, Stoichiometry , er and Ronald W. Rousseau, ns, INC. 3 rd Edition, 2000.	sic Principles and Cal s, 8 th Edition, 2015. , Tata McGraw Hill Pu , <i>Elementary Principles</i> gum, K. M. MeeraSherif Prentice Hall of India.	<i>culations in C</i> ablishing Compa <i>of Chemical Pa</i> fa, Process Calc	Themical any Ltd, rocesses,
ErReference ErRef	<i>igineering</i> , Pea I. Bhatt and Edition, 2004. chard M. Felde in Wiley & Son Books: Venkataraman entice Hall of In C. Sikdar, Che iley and Ollis, nces:	rson India Education Services S.M. Vora, Stoichiometry , er and Ronald W. Rousseau, as, INC. 3 rd Edition, 2000. i, N. Anantharaman, and Be- ndia, 2nd Edition. mical Process Calculations, P	sic Principles and Cal s, 8 th Edition, 2015. , Tata McGraw Hill Pu , <i>Elementary Principles</i> gum, K. M. MeeraSherif Prentice Hall of India.	<i>culations in C</i> ablishing Compa <i>of Chemical Pa</i> fa, Process Calc	Themical any Ltd, rocesses,

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	2	3	2	0	2	0	0	0	0	0	2	2
CO 2	3	3	2	3	2	0	2	0	0	0	0	0	2	2
CO 3	3	3	2	3	2	0	2	0	0	0	0	0	2	2
CO 4	3	3	2	3	2	0	2	0	0	0	0	0	2	2
CO 5	3	3	2	3	2	0	2	0	0	0	0	0	2	2
	15	15	10	15	10	0	10	0	0	0	0	0	10	10

Mapping of Subjects with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
Origina l Value	15	15	10	15	10	0	10	0	0	0	0	0	10	10
Scaled Value	3	3	2	3	2	0	2	0	0	0	0	0	7	6

 $1-5 \rightarrow 1$, $6-10 \rightarrow 2$, $11-15 \rightarrow 3$ 0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

Х	BT3	05	GENETICS AND EVOLUTIONARY BIOL	OCV	L 3	Т 0	P 0	C 3
С	Р	Α	GENETICS AND EVOLUTIONART BIOL	561	L	Т	Р	Η
3	0	0			3	0	0	3
Pre	requ	isite: 1	Biochemistry and Microbiology					
			ectives:					
Upo	on co	mplet	ion of this course, the students					
	• V	Vould	have learnt the fundamentals of genetics					
	• V	Vould	have learnt the gene mutations					
			Course Outcomes	Domai	n]	Level	
Afte		-	letion of the course, students will be able to					
CO			and <i>Interpret</i> Reproduction as the basis of heredity ne interactions	Cognitive		Remen Under	,	
CO		<i>xplain</i> egrega	and <i>Apply</i> principles of dominance and tion	Cognitive		Under Apply	stand,	
CO	3 C	<u> </u>	v and <i>Develop</i> Quantitative traits and polygenic	Cognitive		Analyz	ze	
CO			<i>v</i> and <i>Dissect</i> linking the inheritance of genes to somes and chromosomes as arrays of genes	Cognitive		Under Analyz	,	
CO			l respond DNA Replication and Transcription	Cognitive		Remen		
			Course content			I	Iours	
I –N	Aend	lelian	Principles of Genetics and Gene Interactions				9	
The	relati	onship	b between genes and traits, the branches of genetics e principle of independent assortment, application					
inter	actio	ns that	produce new phenotypes, epistasis.			•	•	
			enetics and quantitative Inheritance				9	
Mic	robia	l gen	etics - transformation, transduction and conjugat					
inhe	eritan	ce: O	ements; Quantitative traits, polygenic inheritance, her rganization of extranuclear genomes, role of extr	anuclear in	nherita	ince, ex	kample	
extr	anuc	lear in	heritance, maternal effect, genomic imprinting; Gene	interaction;	Com	olement	ation.	

III – Chr	omos	somal	Basis	of Inh	eritan	ice and	d Link	age						9
Experime	ental	eviden	ce lin	king t	he inh	eritan	ce of	genes	to chr	omosor	nes, ch	romoso	mes as	arrays o
genes, no	on-dis	sjuncti	on as	proof	of th	e chr	omoso	me th	eory,	the chr	omosoi	mal bas	sis of l	Mendelia
principles	;Chro	omoso	mal va	riation	n;Extra	a chror	nosom	al inhe	eritanc	e;				
IV –Gen	etics	and So	ociety											9
Genetic d	lisord	ers;Po	pulatio	on scre	ening	for ge	netic c	lisease	s, Ethi	cal issu	es invo	lved in	medica	l genetics
Human g	enom	e proje	ect and	l its pr	actical	impli	cations	s, Euge	enic an	d dysge	enic effe	ects.		
V – Evol	ution	ary bi	ology											9
Basic Pri	incipl	es of	Evolu	tion a	nd Po	pulatio	on Gei	netics;	Popula	tion ge	enetics:	factors	detern	nining th
composit	ion a	nd cha	ange i	n allal	e and	genot	ype fr	equen	cies.; l	Epigene	etics; So	election	and in	heritance
Adaptive	and	neutra	l evolu	ution;	Geneti	ic drift	t; Spec	cies an	d spec	ciation.	Phylog	eny: m	ethods	to analys
evolution	ary re	latedn	less be	tween	popula	ations								
L	ectu	e			Tute	orial			Pra	actical			Tota	l
	45				()				0			45	
Text Boo	ks:													
2. Le	ewin's	s Lewi	n's Ge	nes Xl	I, Joce	elyn E.	Krebs	s, Ellic	tt S. C	Goldstein	n, Stepł	nen T. k	Kilpatric	k, 2017.
Referenc														
					npproa	ch / B	SCS. I	Dubuqı	ie, IA,	Kenda	ll/Hunt	Pub. Co	o., c199	9. 147 p.
-		.B305												
	-				-		-			•			New Y	ork,
-	-			-					-	ns-R. V				
		-		Sara E	Benum	Gene	tic nut	ritione	ering.	Los An	geles, I	Keats P	ub., c19	99. 272
-		5.B59								~ .				
													l physic	al
-										0 p. QF			.	•.
								diseas	e. Bali	timore,	Johns F	lopkins	Univer	sity
		:1999.	-					Б	41-1			0	1	Mallan
					-	-				edical g	enetics.	Oxford	ı, Eng.,	Malden,
		lackwe				-				ing Edi	tod have	A		n d Devaler
			-	-					-	105. Eul	-	-	Jarke a	nd Evely
			IOIK	, St. W		Fless,	, 1997.	272 p	. UN	209.CJ	5 1997	•		
E-Refere		nptel.a	a in/a	llabua	/10210	07020	/							
$\frac{1}{1}$ bt	108.77	-	-			57030/								
	-	20111 m	it adu	laoura	va/bial	$-\alpha v/7$	012 :-	troduc	tion to	hiolog	f_{011}		daa	
5. ht	tps://					ogy/7-	012-in	troduc	tion-to	o-biolog	y-fall-2	2004/vie	deo-	
5. ht le	tps://	s/lectu	re-6-g	enetics	-1/					-	-			res/
5. ht le 6. ht	tps:// ctures tps://	s/lectur cosmo	re-6-g learnir	enetics	-1/					-	-		deo- eo-lectu	res/
5. ht le	tps:// ctures tps:// ing o	s/lectur cosmo f COs	re-6-g learnir with l	enetics 1g.org/ P Os	-1/ /course	es/prin	ciples-	mende	elian-n	nolecula	ar-genet	cics/vide	eo-lectu	
5. ht le 6. ht Mapp	tps:// ctures tps:// ing o PO1	s/lectur cosmo f COs PO2	re-6-g learnin with l PO3	enetics ng.org/ POs PO4	-1/ /course PO5	es/prin PO6	ciples- PO7	mende	elian-n PO9	nolecula PO10	ar-genet PO11	rics/vide	eo-lectu PSO1	res/
5. ht le 6. ht Mapp CO 1	tps:// ctures tps:// ing o PO1	s/lectur cosmo f COs PO2 1	re-6-g learnin with 1 PO3 2	enetics ng.org/ POs PO4 0	-1/ /course PO5 1	es/prin PO6	ciples- PO7	mende PO8 1	elian-n PO9	PO10	PO11	cics/vide	PSO1	PSO2
5. ht le 6. ht Mapp CO 1 CO 2	tps:// ctures tps:// ing o PO1	s/lectur cosmo f COs PO2	re-6-g learnin with l PO3 2 2	enetics ng.org/ POs PO4 0 0	-1/ /course PO5 1 1	es/prin PO6	PO7 0 0	mende	elian-n PO9	nolecula PO10	ar-genet PO11	rics/vide	eo-lectu PSO1	PSO2 1 2
5. ht le 6. ht Mapp CO 1 CO 2 CO 3	tps:// ctures tps:// ing o PO1	s/lectur cosmo f COs PO2 1	re-6-g learnin with 1 PO3 2	enetics ng.org/ POs PO4 0 0 0	-1/ /course PO5 1 1 1	es/prin PO6	ciples- PO7	mende PO8 1	elian-n PO9	PO10	PO11	tics/vide PO12 1	PSO1 1 2	PSO2
5. ht le 6. ht Mapp CO 1 CO 2 CO 3 CO 4	tps:// ctures tps:// ing o PO1 1	s/lectur cosmo f COs PO2 1 1	re-6-g learnin with l PO3 2 2	enetics ng.org/ POs PO4 0 0	-1/ /course PO5 1 1	PO6 0	PO7 0 0	•mende PO8 1 1 1	elian-n PO9 1 1	nolecula PO10 1 1	PO11 1	rics/vide PO12 1 1 1	eo-lectu PSO1 1 1	PSO2 1 2
5. ht le 6. ht Mapp CO 1 CO 2 CO 3	tps:// ctures tps:// ing o PO1 1 1 1	s/lectur cosmo f COs PO2 1 1 1 1	re-6-g learnin with 1 PO3 2 2 2 2 2	enetics ng.org/ POs PO4 0 0 0	-1/ /course PO5 1 1 1	PO6 0 0	PO7 0 0 0	PO8 1 1 1 1	PO9 1 1 1	PO10 1 1 1 1	PO11 1 1	PO12 1 2	PSO1 1 2	PSO2 1 2 3

 5
 5
 10
 0
 5
 0
 0
 5
 5
 5
 5

 0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

Mapping of Subjects with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
Origina l Value	5	5	10	0	5	0	0	5	5	5	5	8	8	9
Scaled Value	3	3	4	0	2	0	0	1	1	1	1	3	3	2

 $1-5 \rightarrow 1, \qquad 6-10 \rightarrow 2, \qquad \qquad 11-15 \rightarrow 3$

Subj	ject C	ode	XUM 306	L	Т	F		С
Subj	ect N	ame		2	0	0)	2
С	Р	Α	Entrepreneurship Development	L	Т	P	• SS	H
2.7	0	0.3		2	0	0) 1	3
Prere	quisi	te	NIL					
		ectives scours	ethestudentswill					
• Ur	nderst	andthe	Entrepreneurial motivation and inclination					
• Ide	ea abo	out the	market assessment					
	ogetfa evelop		ngovernment policies and global opportunitie	es for E	ntrepre	eneursł	nip	
		tcome	•	Don	nain		Level	
CO1		0	and <i>describe</i> the role of innovation and for an entrepreneur.	Cogn	tive	K2	Unders	tand
CO2	•		s and <i>appraise</i> your entrepreneurship th your chosen entrepreneur.	Cogn	tive	K2	Unders	tand
CO3	Out	<i>line</i> th	e importance of generation of new ideas for urship and <i>illustrate</i> market assessment.	Cogn	tive	K2	Unders	tand
CO4	Exp	-	the competition in business and	Cogn	itive/	K2	Unders	tand
	sket	ch/den	nonstrate/comply business model for			K3	Apply	
	deal	ing wi	th competition.	Affec	tive	A3	Value	
						A2	Respon	ise
CO5			and <i>Explain</i> venture creation and launching	Cogn	tive	K1	Remen	ıber
	of s	mall b	usiness and its management.			K2	Unders	tand
CO6			and Discuss various government policies	Cogn	tive/	K1	Remen	
	and Dev	glot elopm				K2	Unders	tand
COU	RSE	CONI	ENT					

Definition of Innovation, Creativity and Entrepreneurship; role of innovation in entrepreneurship development - Entrepreneurial motivation - Competencies and trait of an entrepreneur -Role of Family and Society; Entrepreneurship as a career and it role in national development UNIT -II SELF ASSESSMENT OF ENTREPRENEURIAL INCLININATION Self-assessment of entrepreneurial inclination -Presentation by students on thei entrepreneurial inclination rating -Case study of successful entrepreneurs UNIT-III NEW IDEA GENERATION TO MARKET ASSESSMENT Importance of Idea generation-filtering-refinement - opportunity recognition Description of chosen idea - value proposition, customer-problem-Solution statemen -benefits; development status; IP ownership -Market Validation- Technology
of an entrepreneur -Role of Family and Society; Entrepreneurship as a career and it role in national development UNIT -II SELF ASSESSMENT OF ENTREPRENEURIAL INCLININATION Self-assessment of entrepreneurial inclination -Presentation by students on their entrepreneurial inclination rating -Case study of successful entrepreneurs UNIT-III NEW IDEA GENERATION TO MARKET ASSESSMENT Importance of Idea generation-filtering-refinement - opportunity recognition Description of chosen idea - value proposition, customer-problem-Solution statement
role in national development UNIT -II SELF ASSESSMENT OF ENTREPRENEURIAL INCLININATION Self-assessment of entrepreneurial inclination -Presentation by students on their entrepreneurial inclination rating -Case study of successful entrepreneurs UNIT-III NEW IDEA GENERATION TO MARKET ASSESSMENT Importance of Idea generation-filtering-refinement - opportunity recognition Description of chosen idea - value proposition, customer-problem-Solution statement
UNIT -II SELF ASSESSMENT OF ENTREPRENEURIAL INCLININATION 4 Self-assessment of entrepreneurial inclination -Presentation by students on their entrepreneurial inclination rating -Case study of successful entrepreneurs 6 UNIT-III NEW IDEA GENERATION TO MARKET ASSESSMENT 9 Importance of Idea generation-filtering-refinement - opportunity recognition 9 Description of chosen idea - value proposition, customer-problem-Solution statement 9
Self-assessment of entrepreneurial inclination -Presentation by students on their entrepreneurial inclination rating -Case study of successful entrepreneurs UNIT-III NEW IDEA GENERATION TO MARKET ASSESSMENT Importance of Idea generation-filtering-refinement - opportunity recognition Description of chosen idea - value proposition, customer-problem-Solution statement
entrepreneurial inclination rating -Case study of successful entrepreneurs UNIT-III NEW IDEA GENERATION TO MARKET ASSESSMENT 9 Importance of Idea generation-filtering-refinement - opportunity recognition 9 Description of chosen idea - value proposition, customer-problem-Solution statement 9
UNIT-III NEW IDEA GENERATION TO MARKET ASSESSMENT 9 Importance of Idea generation-filtering-refinement - opportunity recognition 9 Description of chosen idea - value proposition, customer-problem-Solution statement 9
Importance of Idea generation-filtering-refinement - opportunity recognition Description of chosen idea - value proposition, customer-problem-Solution statemen
Description of chosen idea - value proposition, customer-problem-Solution statemen
-benefits; development status; IP ownership -Market Validation- Technology
user/decision makers/ partners -market need; segmentation -market TAM,SAM and SOM -case study on market segmentation by popular companies
Som case study on market segmentation by popular companies
UNIT -IV CUSTOMER – COMPETITION- BUSINESS MODEL
Customer-Target primary customer research, Decision making unit/ process-Beach
head market; Cost of Customer Acquisition - Competition- comparative analysis
competitive advantages-; -Business model -Financial planning -Pitch documentation
and presentation
UNIT - V VENTURE CREATION AND LAUNCHING OF SMALL BUSINESS
AND ITS MANAGEMENT
New enterprise creation - organizational and legal matters -Operational plan -Sale
and distribution plan - Accounting -Team recruitment and management -Fund raising
and management -Profile of a startup – case studies
UNIT-VI GOVERNMENT INITIATIVES AND GLOBAL
OPPORTUNITIES
Incubators and accelerators - capacity building -Startup policies- Startup India
Support for MSME; GeM Portal. Funding-national and international sources-Bilatera
programmes by Govt. of India -Global reach for promoting cross-cultura
entrepreneurship (1)
L T P SS Total
30 15 45
REFERENCE BOOKS
7. A.P.Aruna, "Lecture Notes on Entrepreneurship Development", available as softcopy @
www.brain.net
8. Thomas W. Zimmerer, Norman M. Scarborough, "Essentials of Entrepreneurship and Smal
Business Management", Pearson; 3rd edition, 2001.
9. John Burnett, "Introducing Marketing", Open Text Book available a
http://solr.bccampus.ca:8001/bcc/file/ddbe3343-9796-4801-a0cb-

7af7b02e3191/1/Core%20Concepts%20of%20Marketing.pdf

- 10. Toubia, Olivier. "Idea Generation, Creativity, and Incentives", Marketing Science. Vol. 25. pp.411-425. 10.1287/mksc.1050.0166, 2006.
- 11. Alexander Osterwalder and Yves Pigneur, "Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers", Wiley; 1st edition, 2010.
- 12. Gerardus Blokdyk,"3C's model The Ultimate Step-By-Step Guide"5starcooks, 2018.

						PR	OGR	AM C	OUTC	COMES	5			
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	1	0	1	0	1	1	1	0	0	0	0	0	1	0
CO2	1	0	1	0	1	1	1	0	0	0	0	0	1	0
CO3	1	0	1	0	1	1	1	0	0	0	0	0	1	0
CO4	1	0	1	0	1	1	1	0	0	0	0	0	1	0
CO5	1	0	1	0	1	1	1	0	0	0	0	0	``1	0
CO 6	1	0	1	0	1	1	1	0	0	0	0	0	`1	0
Total	6	0	6	0	6	6	6	0	0	0	0	0	6	0
ScaledValue	2	0	2	0	2	2	2	0	0	0	0	0	2	0
		$1-5 \rightarrow 1$, $6-10 \rightarrow 2$, $11-15 \rightarrow 3$												
	()-NoF	Relatio	n,1-1	Low R	elatio	n,2-M	ledium	Relat	ion,3-H	lighR	elatio	n	

Sub	ject C	ode	XUM 307	L	Т	Р	С						
Sub	ject N	ame	UNIVERSAL HUMAN VALUES 2:	2	1	0	3						
С	Р	Α	UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY	L	Т	P	Н						
3	0	0	UNDERSTANDING HARMONY	2	1	0	3						
Pre	erequi	site	None. Universal Human Value	None. Universal Human Values 1 (desirable)									
Cour	rse Ob	jectiv	e: 1. Development of a holistic perspective bas	sed or	n self-ez	xplorat	ion about						
.1	1	(1											

themselves (human being), family, society and nature/existence.

2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence

3. Strengthening of self-reflection.

4. Development of commitment and courage to act.

Course	Outcome:	Domain	Level
CO1	Present sustainable solutions to the problems in society	Cognitive	Understand
	and nature. They are also able to see that these solutions		
	are practicable and draw roadmaps to achieve them		
CO2	Grasp the right utilization of their knowledge in their	Cognitive	Understand
	streams of Technology/Engineering/Management/any		
	other area of study to ensure mutual fulfillment. Ex.		
	mutually enriching production system with rest of nature.		

entrepreneurship and illustrate market assessment. 6+3 JNIT - 1 : Course Introduction - Need, Basic Guidelines, Content and Process for Value Education 6+3 Purpose and motivation for the course, recapitulation from Universal Human Values I - elif-Exploration-what is it? - Its content and process; 'Natural Acceptance' and experiential Validation- as the process for self-exploration - Continuous Happiness and trosperity - A look at basic Human Aspirations - Right understanding, Relationship and thysical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority - Understanding Happiness and Prosperity correctly - A critical praisal of the current scenario - Method to fulfil the above human aspirations: inderstanding and living in harmony at various levels. Ivaricice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as rbitrariness in choice based on liking-disliking. IVIT I I Understanding Harmony in the Human Being - Harmony in Myself Inderstanding the meeds of Self ('1') and 'Body' - happiness and physical facility - Inderstanding the Body as an instrument of '1' (I being the doer, seer and enjoyer) - Juderstanding the Body as an instrument of '1' (I being the doer, seer and enjoyer) - Juderstanding of Prosperity in detail - Programs to ensure Sanyam and Health. 'ratcice sessions to discuss the role others have played in making material goods available on me. Identifying from one's own life. Differentiate between prosperity and accumulation. Diderstanding the thracelex of self relationship - Understanding the meaning of Trust; Dif		
INIT - I: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education 6+3 Purpose and motivation for the course, recapitulation from Universal Human Values I - Its content and process; 'Natural Acceptance' and Edi-Exploration-what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration - Continuous Happiness and Prosperity - A look at basic Human Aspirations - Right understanding, Relationship and thysical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority - Understanding Happiness and Prosperity correctly - A critical praisal of the current scenario - Method to fulfil the above human aspirations: nderstanding and living in harmony at various levels. Practice sessions to discuss natural acceptance in human being as the innate acceptance for iving with responsibility (living in relationship, harmony and co-existence) rather than as rbitrariness in choice based on liking-disliking. INIT - II : Understanding Harmony in the Human Being - Harmony in 6+3 Myself Myself Inderstanding the needs of Self ('I') and 'Body' - happiness and physical facility - Inderstanding the Body as an instrument of 'I' (I being the docr, scer and cijoyer) - Juderstanding the Body: as an instrument of 'I' (I being the docr, scer and cijoyer) - Juderstanding of I vosperity in detail - Programs to ensure Sanyam and Health. Practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease		
Process for Value Education Purpose and motivation for the course, recapitulation from Universal Human Values I - burpose and motivation for the course, recapitulation from Universal Human Values I - elf-Exploration—what is it? - Its content and process; 'Natural Acceptance' and ixperiential Validation—as the process for self-exploration - Continuous Happiness and Prosperity - A look at basic Human Aspirations - Right understanding, Relationship and thysical Facility- the basic requirements for fulfilment of aspirations of every human being pariasal of the current scenario - Method to fulfil the above human aspirations: inderstanding and living in harmony at various levels. A critical pratial of the current scenario - Method to fulfil the above human aspirations: inderstanding and living in harmony at various levels. INIT - II: Understanding Harmony in the Human Being as the innate acceptance for iving with responsibility (living in relationship, harmony and co-existence) rather than as rbitrariness in choice based on liking-disliking. INIT - II: Understanding Harmony in the Human Being - Harmony in Orderstanding the needs of Self ('1) and 'Body' - happiness and physical facility - Juderstanding the Body as an instrument of '1' (I being the doer, seer and enjoyer) - Juderstanding the characteristics and activitics of '1' and harmony in '1' - Understanding he harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, neeaning of Prosperity in detail - Programs to ensure Sanyam and Health. Tactice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease 5+3 INII - III		
Turpose and motivation for the course, recapitulation from Universal Human Values I - left-Explorationwhat is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration - Continuous Happiness and Prosperity - A look at basic Human Aspirations - Right understanding, Relationship and Prosperity - A look at basic Human Aspirations of apprinces and Prosperity - A look at basic Human Aspirations of fulfil the above human aspirations: nederstanding and living in harmony at various levels. Practice sessions to discuss natural acceptance in human being as the innate acceptance for iving with responsibility (living in relationship, harmony and co-existence) rather than as rbitrariness in choice based on liking-disliking. INIT - II : [Understanding Harmony in the Human Being - Harmony in 6+3 Inderstanding human being as a co-existence of the sentient 'I' and the material 'Body' - Juderstanding the needs of Self ('I') and 'Body' - happiness and physical facility - Juderstanding the characteristics and activities of 'I' and harmony in 'I' - Understanding he harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, neaning of Prosperity in detail - Programs to ensure Sanyam and Health. Tartice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health wa dealing with disease JINT - III Understanding Harmony in the Family and Society- 5+3 Martice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program	UNIT - I :	
elf-Explorationwhat is it? - Its content and process; 'Natural Acceptance' and xperiential Validation- as the process for self-exploration - Continuous Happiness and trosperity - A look at basic Human Aspirations - Right understanding, Relationship and hysical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority - Understanding Happiness and Prosperity correctly - A critical ppraisal of the current scenario - Method to fulfil the above human aspirations: inderstanding and living in harmony at various levels. INIT - II : Understanding Harmony in the Human Being - Harmony in factice sessions to discuss natural acceptance in human being as the innate acceptance for iving with responsibility (living in relationship, harmony and co-existence) rather than as rbitrariness in choice based on liking-disliking. INIT - II : Understanding Harmony in the Human Being - Harmony in facility - Inderstanding the needs of Self ('1') and 'Body' - happiness and physical facility - Inderstanding the needs of Self ('1') and 'Body' - happiness and physical facility - Inderstanding the characteristics and activities of '1' and harmony in '1' - Understanding the characteristics and activities of '1' and harmony in '1' - Understanding the characteristics and activities of '1' and harmony in '1' - Understanding be harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, neaning of Prosperity in detail - Programs to ensure Sanyam and Health. Tractice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease JNIT - III Understanding Harmony in the Family and Society- [1'] </td <td></td> <td></td>		
ExperientialValidation- as the process for self-exploration - Continuous Happiness and rosperity - A look at basic Human Aspirations - Right understanding, Relationship and hysical Facility- the basic requirements for fulfilment of aspirations of every human being and prosperity correctly - Understanding Happiness and Prosperity correctly - A critical ppraisal of the current scenario - Method to fulfil the above human aspirations: inderstanding and living in harmony at various levels. Practice sessions to discuss natural acceptance in human being as the innate acceptance for ving with responsibility (living in relationship, harmony and co-existence) rather than as rbitrariness in choice based on liking-disliking.JNIT - II :Understanding Harmony in the Human Being - Harmony in MyselfInderstanding the needs of Self ('1') and 'Body' - happiness and physical facility - Inderstanding the Body as an instrument of '1' (1 being the doer, seer and enjoyer) - Inderstanding the Body as an instrument of '1' (1 being the doer, seer and enjoyer) - Inderstanding of Prosperity in detail - Programs to ensure Sanyam and Health, ractice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with diseaseJNIT - IIIUnderstanding Harmony in the Family and Society- Harmony in Human-Human Relationship5+3Jnference between intention and competence - Understanding the meaning of Trust; Difference between intention and competence - Understanding the meaning of Trust; Difference between intention and competence - Understanding the meaning of Trust; Difference between respect and differentiation; the other salient values in relationship - Inderstanding the harmony in the society	-	
Prosperity - A look at basic Human Aspirations - Right understanding, Relationship and hysical Facility - the basic requirements for fulfilment of aspirations of every human being priatal of the current scenario - Method to fulfil the above human aspirations: nderstanding and living in harmony at various levels.Tractice sessions to discuss natural acceptance in human being as the innate acceptance for tving with responsibility (living in relationship, harmony and co-existence) rather than as rbitrariness in choice based on liking-disliking.JNT - II :Understanding Harmony in the Human Being - Harmony in MyselfInderstanding the needs of Self ('1') and 'Body' - happiness and physical facility - Jnderstanding the needs of Self ('1') and 'Body' - happiness and physical facility - Jnderstanding the characteristics and activities of '1' and harmony in '1' - Understanding he characteristics and activities of '1' and harmony in '1' - Understanding he facility in detail - Programs to ensure Sanyam and Health. Prosperity in detail - Programs to ensure Sanyam and Health. Practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease5+3INT - IIIUnderstanding Harmony in the Family and Society- harmony in Human-Human Relationship. Harmony in the and in program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship. Human selient values in relationship. Addressentanding the harmony in the society (society being an extension of family): tesolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals Visualizing a universal harmonious order in society- Undivided Society, Univers	1	1 · · · · ·
Physical Facility- the basic requirements for fulfilment of aspirations of every human being vith their correct priority - Understanding Happiness and Prosperity correctly - A critical ppraisal of the current scenario - Method to fulfil the above human aspirations: inderstanding and living in harmony at various levels. Practice sessions to discuss natural acceptance in human being as the innate acceptance for iving with responsibility (living in relationship, harmony and co-existence) rather than as rbitrariness in choice based on liking-disliking. INIT - II : Understanding Harmony in the Human Being - Harmony in 6+3 Myself 6+3 Understanding the needs of Self ('1') and 'Body' - happiness and physical facility - Juderstanding the needs of Self ('1') and 'Body' - happiness and physical facility - Juderstanding the Body as an instrument of '1' (I being the doer, seer and enjoyer) - Juderstanding the characteristics and activities of '1' and harmony in '1' - Understanding he harmony of Prosperity in detail - Programs to ensure Sanyam and Health. Practice sessions to discuss the role others have played in making material goods available one. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease 5+3 UNT - III Understanding Harmony in the Family and Society- I Harmony in Human-Human Relationship 5+3 Understanding Harmony in the society (society being an extension of family): tesolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals Visualizing a universal harmonious order in society- Understanding the meaning of Trust; Difference between intention and competen	1	1 1 11
with their correct priority - Understanding Happiness and Prosperity correctly - A critical ppraisal of the current scenario - Method to fulfil the above human aspirations: inderstanding and living in harmony at various levels. tractice sessions to discuss natural acceptance in human being as the innate acceptance for twing with responsibility (living in relationship, harmony and co-existence) rather than as rbitrariness in choice based on liking-disliking.INIT - II :Understanding Harmony in the Human Being - Harmony in Myself6+3Juderstanding human being as a co-existence of the sentient 'I' and the material 'Body' - Inderstanding the needs of Self ('I') and 'Body' - happiness and physical facility - Juderstanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) - Juderstanding the characteristics and activities of 'I' and harmony in 'I' - Understanding he harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, neaning of Prosperity in detail - Programs to ensure Sanyam and Health. Tractice sessions to discuss the role others have played in making material goods available to one. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease5+3JNIT - IIIUnderstanding Harmony in the Family and Society- Harmony in Human-Human Relationship: Difference between respect and differentiation; the other salient values in relationship - Understanding the meaning of Trust; Difference between respect and differentiation; the other salient values in relationship. Juderstanding the harmony in the society (society being an extension of family); Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals Visualizing a universal harmonious order in society- Undivided Society, Universal Order- rom		
ppraisal of the current scenario - Method to fulfil the above human aspirations: inderstanding and living in harmony at various levels. Practice sessions to discuss natural acceptance in human being as the innate acceptance for iving with responsibility (living in relationship, harmony and co-existence) rather than as rbitrariness in choice based on liking-disliking. JINT - II : Understanding Harmony in the Human Being - Harmony in 6+3 Myself 6+3 Understanding human being as a co-existence of the sentient 'I' and the material 'Body' - Juderstanding the needs of Self ('I') and 'Body' - happiness and physical facility - Juderstanding the characteristics and activities of 'I' (I being the doer, seer and enjoyer) - Juderstanding the characteristics and activities of 'I' and harmony in 'I' - Understanding he harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, neaning of Prosperity in detail - Programs to ensure Sanyam and Health. tractice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease INIT - III Understanding Harmony in the Family and Society- fs+3 Harmony in Human-Human Relationship 5+3 Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals Visualizing a universal harmonious order in society- Undivided Society, Universal Order-rom family to word family. Partifere	•	
Practice sessions to discuss natural acceptance in human being as the innate acceptance for iving with responsibility (living in relationship, harmony and co-existence) rather than as rbitrariness in choice based on liking-disliking.JNIT - II :Understanding Harmony in the Human Being - Harmony in Myself6+3Inderstanding human being as a co-existence of the sentient 'I' and the material 'Body' - Juderstanding the needs of Self ('I') and 'Body' - happiness and physical facility - Juderstanding the characteristics and activities of 'I' and harmony in 'I' - Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, neaning of Prosperity in detail - Programs to ensure Sanyam and Health. Tractice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease5+3INIT - IIIUnderstanding Harmony in the Family and Society- Harmony in Human-Human Relationship5+3Inderstanding values in human-human relationship; meaning of Justice (nine universal alues in relationships) and program for its fulfilment to ensure mutual happiness; Trust and despect as the foundational values of relationship - Understanding the meaning of Trust; Difference between intention and competence - Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship - Inderstanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals Visualizing a universal harmonice order in society- Undivided Society, Universal Order- rom family to world family. Practice sessions to reflect		
iving with responsibility (living in relationship, harmony and co-existence) rather than as rbitrariness in choice based on liking-disliking.INIT - II :Understanding Harmony in the Human Being - Harmony in Myself6+3Understanding human being as a co-existence of the sentient 'I' and the material 'Body' - Inderstanding the needs of Self ('I') and 'Body' - happiness and physical facility - Inderstanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) - Inderstanding the characteristics and activities of 'I' and harmony in 'I' - Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, neaning of Prosperity in detail - Programs to ensure Sanyam and Health. Practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease5+3UNIT - IIIUnderstanding Harmony in the Family and Society- Harmony in Human-Human Relationship5+3Understanding values in human-numan relationship: neaning of Justice (nine universal alues in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship - Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship - Juderstanding the harmony in the society (society being an extension of family): esolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals Visualizing a universal harmonicus order in society- Undivided Society, Universal Order- rom family. ractice sessions to reflect on relationships in family, hostel and institute as extended amily, real life examples, teacher-stud		
Thitrariness in choice based on liking-disliking. INIT - II : Understanding Harmony in the Human Being - Harmony in Myself Inderstanding human being as a co-existence of the sentient 'I' and the material 'Body' - Juderstanding the needs of Self ('I') and 'Body' - happiness and physical facility - Juderstanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) - Juderstanding the characteristics and activities of 'I' and harmony in 'I' - Understanding he harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, neaning of Prosperity in detail - Programs to ensure Sanyam and Health. Tractice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease JNIT - III Understanding Harmony in the Family and Society- Harmony in relationship 5+3 Understanding values in human-Human Relationship - Understanding of Trust; Difference between respect and differentiation; the other salient values in relationship - Understanding the meaning of Trust; Difference between respect and differentiation; the other salient values in relationship - Inderstanding the harmony in the society (society being an extension of family). Partecte sessions to reflect on relationships in family, hostel and institute as extended amily, real life examples, teacher-student relationship, goal of education etc. Gratitude as a niversal value in relationships. Discuss with scenarios. Elicit examples from students' lives		
JNIT - II :Understanding Harmony in the Human Being - Harmony in Myself6+3Understanding human being as a co-existence of the sentient 'I' and the material 'Body' - Juderstanding the needs of Self ('I') and 'Body' - happiness and physical facility - Juderstanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) - Juderstanding the characteristics and activities of 'I' and harmony in 'I' - Understanding the characteristics and activities of 'I' and harmony in 'I' - Understanding the characteristics and activities of 'I' and harmony in 'I' - Understanding he harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, neaning of Prosperity in detail - Programs to ensure Sanyam and Health. tractice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease5+3JNIT - IIIUnderstanding Harmony in the Family and Society- Harmony in Human-Human Relationship5+3Understanding values in human-human relationship - Understanding the meaning of Trust; Difference between intention and competence - Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship - Understanding the harmony in the society (society being an extension of family): Practice sessions to reflect on relationships in family, hostel and institute as extended amily, real life examples, teacher-student relationship, goal of education etc. Gratitude as a niversal value in relationships. Discuss with scenarios. Elicit examples from students' lives JNIT - IV Understanding Harmony in the Nature and Existence - Whole A+2	-	
MyselfUnderstanding human being as a co-existence of the sentient 'I' and the material 'Body' - Understanding the needs of Self ('I') and 'Body' - happiness and physical facility - Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) - Understanding the characteristics and activities of 'I' and harmony in 'I' - Understanding he harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, neaning of Prosperity in detail - Programs to ensure Sanyam and Health. Practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with diseaseVNTT - IIIUnderstanding Harmony in the Family and Society- Harmony in Human-Human Relationship5+3Understanding values in human-human relationship; meaning of Justice (nine universal alues in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship - Understanding the meaning of Respect, Difference between intention and competence - Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship - Inderstanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals Visualizing a universal harmonious order in society- Undivided Society, Universal Order- rom family to world family. Practice sessions to reflect on relationships in family, hostel and institute as extended amily, real life examples, teacher-student relationship, goal of education etc. Gratitude as a niversal value in relationships. Discuss with scenarios. Elicit examples from students' lives JNIT -		
Inderstanding human being as a co-existence of the sentient 'I' and the material 'Body' - Juderstanding the needs of Self ('I') and 'Body' - happiness and physical facility - Juderstanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) - Juderstanding the characteristics and activities of 'I' and harmony in 'I' - Understanding he harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, neaning of Prosperity in detail - Programs to ensure Sanyam and Health. Practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease5+3JNIT - IIIUnderstanding Harmony in the Family and Society- Harmony in Human-Human Relationship5+3Juderstanding values in human-human relationship : meaning of Justice (nine universal alues in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship - Understanding the meaning of Respect, Jufference between respect and differentiation; the other salient values in relationship - Juderstanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals Visualizing a universal harmonious order in society- Undivided Society, Universal Order- rom family. Practice sessions to reflect on relationships in family, hostel and institute as extended amily, real life examples, teacher-student relationship, goal of education etc. Gratitude as a niversal value in relationships. Discuss with scenarios. Elicit examples from students' lives JNIT - IVUnderstanding Harmony in the Nature and Existence - Whole existence as Coexistence <td>UNIT - II :</td> <td></td>	UNIT - II :	
Understandingthe needs of Self ('I') and 'Body' - happiness and physical facility - Juderstanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) - Juderstanding the characteristics and activities of 'I' and harmony in 'I' - Understanding he harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, neaning of Prosperity in detail - Programs to ensure Sanyam and Health. Tractice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease5+3JNTT - IIIUnderstanding Harmony in the Family and Society- Harmony in Human-Human Relationship5+3Onderstanding values in human-human relationship; meaning of Justice (nine universal alues in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship - Understanding the meaning of Trust; Difference between respect and differentiation; the other salient values in relationship - Juderstanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals Visualizing a universal harmonious order in society- Undivided Society, Universal Order- rom family to world family. Practice sessions to reflect on relationships in family, hostel and institute as extended amily, real life examples, teacher-student relationship, goal of education etc. Gratitude as a niversal value in relationships. Discuss with scenarios. Elicit examples from students' lives JNT - IVUnderstanding Harmony in the Nature and Existence - Whole existence as Coexistence		·
Harmony in Human-Human RelationshipUnderstanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship - Understanding the meaning of Trust; Difference between intention and competence - Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship - Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals Visualizing a universal harmonious order in society- Undivided Society, Universal Order- rom family to world family. Practice sessions to reflect on relationships in family, hostel and institute as extended amily, real life examples, teacher-student relationship, goal of education etc. Gratitude as a niversal value in relationships. Discuss with scenarios. Elicit examples from students' livesJNIT - IVUnderstanding Harmony in the Nature and Existence - Whole existence as Coexistence	Understandin the harmony meaning of P Practice sessi to me. Identif	g the characteristics and activities of 'I' and harmony in 'I' - Understanding of I with the Body: Sanyam and Health; correct appraisal of Physical needs, rosperity in detail - Programs to ensure Sanyam and Health. ons to discuss the role others have played in making material goods available fying from one's own life. Differentiate between prosperity and accumulation.
Jnderstanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship - Understanding the meaning of Trust; Difference between intention and competence - Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship - Inderstanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals Visualizing a universal harmonious order in society- Undivided Society, Universal Orderrom family to world family. Practice sessions to reflect on relationships in family, hostel and institute as extended amily, real life examples, teacher-student relationship, goal of education etc. Gratitude as a niversal value in relationships. Discuss with scenarios. Elicit examples from students' lives JNIT - IVUnderstanding Harmony in the Nature and Existence - Whole existence as Coexistence4+2	UNIT - III	Understanding Harmony in the Family and Society- 5+3
alues in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship - Understanding the meaning of Trust; Difference between intention and competence - Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship - Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals Visualizing a universal harmonious order in society- Undivided Society, Universal Order- rom family to world family. Practice sessions to reflect on relationships in family, hostel and institute as extended amily, real life examples, teacher-student relationship, goal of education etc. Gratitude as a niversal value in relationships. Discuss with scenarios. Elicit examples from students' livesJNIT - IVUnderstanding Harmony in the Nature and Existence - Whole existence as Coexistence4+2	:	Harmony in Human-Human Relationship
	values in rela Respect as th Difference be Understandin Resolution, P - Visualizing from family t Practice sess family, real li	tionships) and program for its fulfilment to ensure mutual happiness; Trust and he foundational values of relationship - Understanding the meaning of Trust; etween intention and competence - Understanding the meaning of Respect, etween respect and differentiation; the other salient values in relationship - g the harmony in the society (society being an extension of family): prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals a universal harmonious order in society- Undivided Society, Universal Order- o world family. ions to reflect on relationships in family, hostel and institute as extended ife examples, teacher-student relationship, goal of education etc. Gratitude as a ue in relationships. Discuss with scenarios. Elicit examples from students' lives Understanding Harmony in the Nature and Existence - Whole 4+2
Inderstanding the harmony in the Nature 1 - Interconnectedness and mutual fulfilment	:	existence as Coexistence
more thanks the marmony in the reaction interconnected host and matual fulfillent	Understandin	g the harmony in the Nature 1 - Interconnectedness and mutual fulfilment

among the four orders of nature- recyclability and self regulation in nature - Understanding Existence as Co-existence of mutually interacting units in all-pervasive space - Holistic perception of harmony at all levels of existence.

Practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

UNIT - V : Implications of the above Holistic Understanding of Harmony 7+3 on Professional Ethics

Natural acceptance of human values - Definitiveness of Ethical Human Conduct - Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order -Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of peoplefriendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. - Case studies of typical holistic technologies, management models and production systems -Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations - Sum up. Practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. to discuss the conduct as an engineer or scientist etc.

LECTURE	TUTORIAL	TOTAL
28	14	42+3(SS)

TEXT BOOKS:

Human Values and Professional Ethics - R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010.

REFERENCE BOOKS :

- 15. Jeevan VidyaEk- Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
- 16. Human Values A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
- 17. Leonard, Annie. 2011. The Story of Stuff. New York, NY: Simon & Schuster.
- 18. The Story of My Experiments with Truth Mohandas Karamchand Gandhi
- 19. AICTE Model Curriculum in Humanities, Social Science and Management Courses (UG Engineering & Technology)
- 20. Small is Beautiful E. F Schumacher.
- 21. Slow is Beautiful Cecile Andrews.
- 22. Economy of Permanence J C Kumarappa.
- 23. Bharat Mein Angreji Raj PanditSunderlal.
- 24. Rediscovering India by Dharampal.
- 25. Hind Swaraj or Indian Home Rule by Mohandas K. Gandhi.
- 26. India Wins Freedom Maulana Abdul Kalam Azad
- 27. Vivekananda Romain Rolland (English)
- 28. Gandhi Romain Rolland (English)

Mapping of COs with POs

						PR	OGR	AM C	OUTC	COMES	5			
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	1	1	2	0	1	0	0	1	1	1	1	3	2	3
CO2	1	1	2	0	1	0	0	1	1	1	1	0	3	2
CO3	1	1	2	0	1	0	0	1	1	1	1	2	2	1
Total	3	3	6	0	3	0	0	3	3	3	3	5	7	6
ScaledValue	1	1	1	0	1	0	0	1	1	1	1	1	2	2
		1 –	$1-5 \rightarrow 1, \qquad 6-10 \rightarrow 2, \qquad 11-15 \rightarrow 3$											
	()-NoR	NoRelation, 1-Low Relation, 2-MediumRelation, 3-HighRelation											

COUI	RSECOD	E	XBT308	L	Т	Р	С	
-	RSE NAN REQUISI		Biochemistry Laboratory	0	0	2	2	
	P	A		L	Т	Р	Н	
1	2	1	-	0	0	2	6	
	RSE OBJ		ES			•		
	ourse will		as in using Pisshamistry I sh					
			ce in using Biochemistry Lab					
			inderstanding on research.					
0.			URSE OUTCOMES	DOMA	LEV	EL		
CO1	Apply t	heoretic	al knowledge to perform experiment	Cognitive,		Apply,		
			principles.	Psychomo	tor	Mechani	ism,	
		5	1 1	,Affective		Respond	1	
CO2	Practice	e on han	dling chemicals for the Biochemistry			Apply		
	experim	nents.		Psychomo	tor	Mechanism		
				,Affective		Respond	1	
CO3	Getting	trained	on analytical calculations from the	Cognitive,		Apply.		
	result of	f bioche	mistry experiments.	Psychomo	tor	Mechani		
			• •	,Affective		Respond	1	
CO4		-	the Biochemistry Phenomena through			Apply.		
	the prac	tical exp	perience.	Psychomo	tor	Mechani		
				,Affective	Respond	1		
CO5		the prac	ctical knowledge to make scientific					
	report.			Psychomo	tor	Mechani		
				,Affective		Respond	1	

11. Buffer preparation and calculation of molar extinction coefficient

- 12. Separation of Amino Acids by Thin Layer Chromatography
- 13. Qualitative/Qualitative analysis of proteins
- 14. Qualitative/Qualitative analysis of Carbohydrates
- 15. Determination of β -carotene, Flavonoid
- 16. Estimation and purity of DNA
- 17. Acid hydrolysis and action of salivary amylase on starch
- 18. Detection of Adulteration in Milk
- 19. Titration Curves of Aminoacids
- 20. Quantitative estimation of serum cholesterol by Zak's method
- 11. Estimation of Saponification Value of Fats/Oils

HOURS	LECTURE	PRACTICAL	TUTORIAL	TOTAL
HOUKS	0	30	0	30

REFERENCE BOOK

2. Lehninger Principles of Biochemistry, David L. Nelson and Michael M. Cox, W. H. Freeman; 6th edition edition (13 February 2013), 1158 pages ISBN-10: 1464109621, ISBN-13: 978-1464109621.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	1	2	0	1	0	0	1	1	1	1	3	2	3
CO 2	1	1	2	0	1	0	0	1	1	1	1	0	3	2
CO 3	1	1	2	0	1	0	0	1	1	1	1	2	2	1
CO 4	1	1	2	0	1	0	0	1	1	1	1	0	1	0
CO 5	1	1	2	0	1	0	0	1	1	1	1	2	0	0
	5	5	10	0	5	0	0	5	5	5	5	7	8	6

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

Mapping of Subjects with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
Origina l Value	5	5	10	0	5	0	0	5	5	5	5	7	8	6
Scaled Value	3	3	6	0	3	0	0	3	3	0	3	4	5	3

 $1-5 \rightarrow 1$, $6-10 \rightarrow 2$, $11-15 \rightarrow 3$ 0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

COUR	SE CODE	XBT 309		L	Т	Р	С		
COUR	SE NAME	MICROBIOLOGY LAB		0	0	2	2		
PRER	EQUISITES	-		L	Т	Р	Н		
C:P:A	:1:1.5:0.5			0	0	2	6		
LEAR	NING OBJECT	TIVES							
	completion of the	their k	nowle	dge of	f microb	iology to			
demon	strate aseptic mi	crobiological techniques in the laboratory							
	C	DURSE OUTCOMES		NR // A T	T	I EX			
	C	DC	DMAI	N	LEV	VEL			
After tl	ne completion of	course the students will be able to							
		d <i>Demonstrate</i> media preparation and	Cogr	nitive,	I	Apply, M	echanism,		
CO1	sterilization teo	1 1		homoto	or I	Respond			
	stermzation tex	liniques	,	ctive					
CO2	Understand an	d <i>Perform</i> staining techniques,	•	iitive, homoto		Apply, Mechani			
02	antimicrobial a	and cell counting assays		ctive		Respond			
			,	nitive,	I	Apply, M	echanism,		
CO3	Practice and D	emonstrate different culturing techniques		homoto	or I	Respond			
			,	ctive		A 1 3 4	1 .		
CO4	Parform and I	Determine the characteristics of bacteria	•	nitive,		.	echanism,		
0.04		setermine the characteristics of bacteria	Psychomotor Respond ,Affective						
	Understand or	d <i>Experiment</i> on isolation of microbes for	-	nitive,	I	Apply, M	echanism,		
CO5	metabolites pro	-		homoto	or I	Respond			
	incluoones pro		,Affe	ective					

S.No	List of Experim	nents		COs
1	Media preparation and Sterilization			CO1
2	Preparation of slants /plates and aseptic transfe	er of microbial c	ultures	C01
3	Staining and identification of microbes using s	imple and differ	ential staining	CO2
4	Isolation of microbes using spread plate metho	d		CO3
5	Isolation of microbes using streak plate method	d		CO3
6	Isolation of microbes using pour plate method			CO3
7	Microbial growth control using Kirby-Bauer m	nethod		CO2
8	Cell counting			CO2
9	Biochemical characterization of microbes			CO4
10	Screening of microorganisms for enzyme prod	uction		CO5
	HOURS	TUTORIAL	PRACTICAL	TOTAL
	HOCKS	0	30	30

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES

						PROG	GRAM (DUTCO	MES					
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	1	1	1	0	1	0	1	1	1	1	0	0
CO2	3	3	1	1	1	2	2	1	1	1	1	1	0	0
CO3	3	1	2	3	1	2	1	0	1	1	1	1	2	0
CO4	3	3	2	0	1	0	2	0	1	1	1	1	0	2
CO5	3	2	2	3	1	2	2	1	1	0	1	1	2	2
	15	12	8	8	5	6	8	2	5	4	5	5	4	2

 $1-5 \rightarrow 1, 6-10 \rightarrow 2, 11-15 \rightarrow 3$

No relation, 1-Low Relation, 2- Medium Relation, 3-High Relation

Mapping of Subjects with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
Origina l Value	15	12	8	8	5	6	8	2	5	4	5	5	4	2
Scaled Value	6	4	3	3	2	2	3	1	1	1	1	1	0	1
$1-5 \rightarrow$	1,		6 –	$10 \rightarrow 10$	2,		11 –	$15 \rightarrow$	3					

			L	Т	Р	SS	С
XBT 310			0	0	0	0	1
	INPLANT TRAINING - I						
C P A			L	Т	P	SS	Η
1 1 1			0	0	0	0	0
PREREQUISI	ГЕ: Nil						
COURSE OUT	COMES:						
	Course Outcomes	Don	nain]	Level	
After the compl	etion of the course, students will be able to						
CO1:Relate cla	ssroom theory with workplace practice	Cogniti	ve	Ţ	Jnde	rstand	l
CO2: Comply w practices.	<i>with</i> Factory discipline, management and business	Affec	ctive	I	Respo	ond	
CO3:Demonstr	ates teamwork and time management	Affec	ctive	V	/alue)	
CO4: Describe	and Display hands-on experience on practical	Psycho	moto	r I	Perce	ption	
skills obtained d	luring the programme.			5	Set	-	
	<i>ize</i> the tasks and activities done by technical oral presentations.	Cognit	ive	I	Evalu	iate	

Mapping COs with POs

11	0													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	2													
CO2							1	3			1		1	1
CO3									3	1	3		3	3
CO4		1	2	1	3								1	1
CO5				3						3			1	1
Total	2	1	2	4	3		1	3	3	4	4	0	6	6
Scale d	1	1	2	1	1	0	1	1	1	1	1	1	2	2

IV Semester

				L	Т	Р	С
	XBT4	01		2	1	0	3
			Basic Transport Processes				
С	Р	Α		L	Т	Р	Η
3	0	0		2	1	0	3

	Cou	rse Outcomes	Domain	Lev	vel
After the	e completion of the	course, students will be able t	0		
CO1	Apply the fluid tra	ansport properties in flow of flu	uids Cognitive	Understan	nd
CO2	Apply the particle	transport properties in flow of	fluids Cognitive	Apply	
CO3	<i>Describe</i> the heat	and mass transfer equipments	Cognitive	Understan	nd
CO4	<i>Compute</i> the heat	transport properties in flow of	fluids Cognitive	Apply	
CO5	<i>Determine</i> the m fluids	ass transport properties in fle	ow of Cognitive	Apply	
Unit-I	Fluid Transpo	ort			6+3
	,	wtonian and non-Newtonian , Hagen-Poiseuille equation,	Fluids, Laminar and	turbulent flow, Co	ontinuity
Unit-II					6+3
- power c	consumption in mix	s shape and size, Size reduction ing, Mixing in bioreactors, Mi		•	
Unit-II	L				6+3
		heat transfer, LMTD, Overall	heat transfer coefficient	t, Heat exchangers.	
Unit-IV	1				6+3
Molecul	ar diffusion and fi	Im theory, Mass transfer coeff	ficients, Oxygen transfe	er and uptake in bio	oreactor,
$k_{L}a$ and	its measurement, N	lass transfer operations.			
Unit-V	•	al Tools for the Transport Pr			6+3
Introduc	tion to Computation	n – Excel – MATLAB – Rpro		1	
	Lecture	Tutorial	Practical	Total	
	30	15	-	45	
Text Bo	oks:				

- 5. McCabe, Warren L., Julian C. Smith, and Peter Harriott, Unit Operations of Chemical Engineering,McGraw-Hill, 2010.
- 6. Warren, L. M., C. S. Julian, and H. Peter, Unit operations of chemical engineering, McGraw Hill Book Company, 2005.
- 7. Geankoplis, Christie John, Allen H. Hersel, and Daniel H. Lepek, Transport processes and separation process principles, prentice hall, 2018.
- 8. Welty J, Rorrer GL, Foster DG., Fundamentals of Momentum, Heat, and Mass Transfer, Wiley, Revised 6th Edition; 2014.

Reference Books:

- 3. Benitez, Jaime, Principles and modern applications of mass transfer operations, John Wiley & Sons, 2016.
- 4. Ravi, R., R. Vinu, and Sathyanarayana N. Gummadi, eds. Coulson and Richardson's Chemical Engineering: Volume 3A: ,Chemical and Biochemical Reactors and Reaction Engineering, Butterworth-Heinemann, 2017.

E-References:

- 5. https://nptel.ac.in/courses/103/103/103103037/
- 6. http://ce-iitb.vlabs.ac.in/List%20of%20experiments.html?domain=Chemical%20Engineering
- 7. http://uorepc-nitk.vlabs.ac.in/#
- 8. http://iitg.vlab.co.in/?sub=58

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	1	1	2	2	2	0	0	0	1	3	0	0
CO 2	3	3	2	2	1	2	2	0	0	0	2	2	1	1
CO 3	3	3	2	3	1	2	2	0	0	0	2	3	2	3
CO 4	3	3	2	3	1	2	2	0	0	0	2	2	2	2
CO 5	3	3	2	3	1	2	2	0	0	0	2	3	3	3
	15	15	9	12	6	10	10	0	0	0	9	13	8	9

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

Mapping of Subjects with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
Origina l Value	15	15	9	12	6	10	10	0	0	0	9	13	8	9
Scaled Value	3	3	2	3	2	2	2	0	0	0	2	3	2	2

 $1 - 5 \rightarrow 1, \qquad 6 - 10 \rightarrow 2, \qquad 11 - 15 \rightarrow 3$

					L	Т	Р	C
XB	T 402				2	1	0	3
]	BIOENERGETICS AND METABOLIS	SM				
C I	P A				L	Т	Р	H
3 (0 0				2	1	0	3
Prere	quisite: -							
	ning Obje							
Upon	completi	on of this	course, the students					
•			various metabolic pathways.					
•	Would h		how all the metabolic pathways related to					
			ourse Outcomes	Doma	in		Level	
	^		e course, students will be able to	1		1		
CO1	Discuss pathway		<i>member</i> fundamental and metabolism	Cognitive		Reme	mber	
CO2	Discuss choleste		nember biosynthesis of fatty acid and	Cognitive		Recall		
CO3	Discuss		<i>nember</i> oxidative phosphorylation and ion	Cognitive		Reme	mber	
CO4		and Rem	ember biosynthesis of amino acids and	Cognitive		Reme	mber	
CO5			nember report on metabolic order and	Cognitive		Create	;	
	disease							
	disease		Course content]	Hours	
I – Bi	oenereget		Course content				Hours 6+3	
I – Bi Bioene Reduct Pathwa	oenereget ergetics an tion Reac ay, The Ci	nd Therm tions, met tric Acid (lycolytic pathways odynamics, Phosphoryl Group Transfe abolic pathways: Glycolysis, Gluconeo Cycle.			logical	6+3 Oxida Phos	
I – Bi Bioene Reduct Pathwa II – F	oenereget ergetics an tion Reac ay, The Ci atty acid,	nd Therm tions, met tric Acid (Cholestr	Hycolytic pathways odynamics, Phosphoryl Group Transfe abolic pathways: Glycolysis, Gluconeo Cycle. ol, Lipid and amino acid metabolism	genesis, and	l the	logical Pentose	6+3 Oxida Phosp 6+3	phat
I – Bi Bioene Reduct Pathwa II – F Biosyn Biosyn	oenereget ergetics an tion Reac ay, The Ci atty acid, thesis of f thesis of	nd Therm tions, met tric Acid (Cholestr fatty acids Cholestere	 lycolytic pathways odynamics, Phosphoryl Group Transfe abolic pathways: Glycolysis, Gluconeo Cycle. ol, Lipid and amino acid metabolism Oxidation of fatty acid – beta oxidation ol, Biosynthesis of phospholipids and gl 	genesis, and	the	logical Pentose	6+3 Oxida Phosp 6+3 one Bo	phat odie
I – Bi Bioene Reduct Pathwa II – F Biosyn Biosyn Broups	oenereget ergetics at tion Reac ay, The Ci atty acid , thesis of f thesis of s, Pathway	nd Therm tions, met tric Acid (Cholestr fatty acids Cholester //s of Amir	 lycolytic pathways odynamics, Phosphoryl Group Transfe abolic pathways: Glycolysis, Gluconeo Cycle. ol, Lipid and amino acid metabolism oxidation of fatty acid – beta oxidation ol, Biosynthesis of phospholipids and gl ao Acid Degradation. 	genesis, and	the	logical Pentose	6+3 Oxida Phosp 6+3 one Bo	phat odie:
I – Bi Bioene Reduct Pathwa II – F Biosyn Biosyn Broups III – C	oenereget ergetics an tion Reac ay, The Ci atty acid, thesis of f thesis of s, Pathway Oxidative	nd Therm tions, met tric Acid (Cholestr fatty acids Cholestere ys of Amir phospho	 lycolytic pathways odynamics, Phosphoryl Group Transfe abolic pathways: Glycolysis, Gluconeo Cycle. ol, Lipid and amino acid metabolism Oxidation of fatty acid – beta oxidation ol, Biosynthesis of phospholipids and gl 	genesis, and and omega o ycolipids, M	l the oxidati letabol	logical Pentose on, Keto lic Fates	6+3 Oxida Phosp 6+3 one Bc s of A 6+3	phat odie: min
I – Bi Bioene Reduct Pathwa II – F Biosyn Biosyn Broups III – C Electr	oenereget ergetics an tion Reac ay, The Ci atty acid, thesis of f thesis of s, Pathway Oxidative on-Transf	nd Therm tions, met tric Acid (Cholestr fatty acids Cholester ys of Amir phospho fer Reaction	 lycolytic pathways odynamics, Phosphoryl Group Transfe abolic pathways: Glycolysis, Gluconeo Cycle. ol, Lipid and amino acid metabolism oxidation of fatty acid – beta oxidation b), Biosynthesis of phospholipids and gl acid Degradation. rylation and photophoshorylation 	genesis, and and omega o ycolipids, M	l the oxidati letabol	logical Pentose on, Keto lic Fates	6+3 Oxida Phosp 6+3 one Bc s of A 6+3	phat odie: min
I – Bi Bioene Reduct Pathwa II – F Biosyn Biosyn Biosyn Broups III – Gener	oenereget ergetics an tion Reac ay, The Ci atty acid , thesis of f thesis of s, Pathway Oxidative on-Transf cal Feature	nd Therm tions, met tric Acid (Cholestr fatty acids Cholestere /s of Amir phospho fer Reactic s of Photo	 Iycolytic pathways odynamics, Phosphoryl Group Transfe abolic pathways: Glycolysis, Gluconeo Cycle. ol, Lipid and amino acid metabolism Oxidation of fatty acid – beta oxidation ol, Biosynthesis of phospholipids and gl to Acid Degradation. rylation and photophoshorylation ns in Mitochondria, ATP Synthesis, Reg 	genesis, and and omega o ycolipids, M	l the oxidati letabol	logical Pentose on, Keto lic Fates	6+3 Oxida Phosp 6+3 one Bc s of A 6+3	phat odie min
I - Bi Bioene Reduct Pathwa II - F Biosyn Biosyn Broups III - C Electr Gener IV - I Overv nucleo Nucle	oenereget ergetics an tion Reac ay, The Ci atty acid , thesis of f thesis of f thesis of s, Pathway Oxidative con-Transf cal Feature Biosynthe view of N otides – I otide-Nuc	nd Therm tions, met tric Acid (Cholestr fatty acids Cholestere // of Amir phospho er Reactic es of Photo sis of ami Nitrogen M De Novo	 Iycolytic pathways odynamics, Phosphoryl Group Transfe abolic pathways: Glycolysis, Gluconeo Cycle. ol, Lipid and amino acid metabolism o Acid and fatty acid – beta oxidation of, Biosynthesis of phospholipids and gluo Acid Degradation. rylation and photophoshorylation ons in Mitochondria, ATP Synthesis, Regiphosphorylation – Photosystem I and II. 	genesis, and and omega o ycolipids, M ulation of O ds, biosynth ucleotide B	l the oxidati letabol xidativ essis a iosyntl	logical Pentose on, Keta lic Fates /e Phosp nd deg hesis –	6+3 Oxida Phosp 6+3 one Bo s of A 6+3 phoryla 6+3 radatio Pyrim	phat odies min ation on c
I – Bi Bioene Reduct Pathwa II – F Biosyn Biosyn Biosyn Biosyn Biosyn Biosyn Biosyn Biosyn Biosyn Biosyn Diosyn Bi	oenereget ergetics an tion Reac ay, The Ci atty acid, thesis of f thesis of s, Pathway Oxidative con-Transf cal Feature Biosynthe view of N otides – I otide-Nuc ge Pathwa	nd Therm tions, met tric Acid (Cholestr fatty acids Cholester // of Amir phospho er Reactic // of Amir phospho // of Amir // of Amir	Iycolytic pathways odynamics, Phosphoryl Group Transfe abolic pathways: Glycolysis, Gluconeo Cycle. ol, Lipid and amino acid metabolism ol, Oxidation of fatty acid – beta oxidation ol, Biosynthesis of phospholipids and gl oo Acid Degradation. rylation and photophoshorylation ons in Mitochondria, ATP Synthesis, Reg ophosphorylation – Photosystem I and II. no acids and nucleotides Metabolism, Biosynthesis of amino acid Purine Nucleotide synthesis – Purine Nucleotide synthesis – Purine and	genesis, and and omega o ycolipids, M ulation of O ds, biosynth ucleotide B	l the oxidati letabol xidativ essis a iosyntl	logical Pentose on, Keta lic Fates /e Phosp nd deg hesis –	6+3 Oxida Phosp 6+3 one Bo s of A 6+3 choryla 6+3 radatio Pyrim estricte	phat odie min ation on c
I - Bi Bioenee Reduct Pathwa II - F Biosyn Biosyn Biosyn Biosyn Biosyn Biosyn Coupse III - C Electr Gener IV - I Overv nucleo Nucleo Salvaş V - N	oenereget ergetics an tion Reac ay, The Ci atty acid, thesis of f thesis of s, Pathway Oxidative on-Transf cal Feature Biosynthe view of N otides – I otide-Nuc ge Pathwa Ietabolic	nd Therm tions, met tric Acid (Cholestr fatty acids Cholestere ys of Amir phospho fer Reactic sis of Photo sis of ami Vitrogen M De Novo eleotide M ys. disorders	Iycolytic pathways odynamics, Phosphoryl Group Transfe abolic pathways: Glycolysis, Gluconeo Cycle. ol, Lipid and amino acid metabolism , Oxidation of fatty acid – beta oxidation ol, Biosynthesis of phospholipids and gl io Acid Degradation. rylation and photophoshorylation ons in Mitochondria, ATP Synthesis, Reg phosphorylation – Photosystem I and II. no acids and nucleotides Metabolism, Biosynthesis of amino acid Purine Nucleotide synthesis – Purine Nucleotide synthesis – Purine and and diseases	genesis, and and omega o ycolipids, M ulation of O ds, biosynth ucleotide B I Pyrimidine	l the oxidati letabol xidativ esis a iosyntl e base	logical Pentose on, Kete lic Fates //e Phosp ind deg hesis – s are re	6+3 Oxida Phosp 6+3 one Bo s of A 6+3 phoryla 6+3 radatio Pyrim estricte 6+3	phat odie min ation idir d b
I - Bi Bioene Reduct Pathwa II - F Biosyn Biosyn Biosyn Biosyn Biosyn Biosyn Biosyn Diosyn Biosyn Biosyn Biosyn Diosyn Biosyn Diosyn Biosyn Biosyn Diosyn Diosyn Biosyn Diosyn Diosyn Biosyn Diosyn Diosyn Diosyn Biosyn Dios	oenereget ergetics an tion Reac ay, The Ci atty acid , thesis of f thesis of f thesis of s, Pathway Oxidative con-Transf al Feature Biosynthe view of N otides – I otide-Nuc ge Pathwa Ietabolic Il view or	nd Therm tions, met tric Acid (Cholestr fatty acids Cholestere /s of Amir phospho er Reactic /s of Photo sis of ami Nitrogen M De Novo eleotide M .ys. disorders n enegetic	Iycolytic pathways odynamics, Phosphoryl Group Transfe abolic pathways: Glycolysis, Gluconeo Cycle. ol, Lipid and amino acid metabolism , Oxidation of fatty acid – beta oxidation ol, Biosynthesis of phospholipids and gl to Acid Degradation. rylation and photophoshorylation ons in Mitochondria, ATP Synthesis, Reg ophosphorylation – Photosystem I and II. no acids and nucleotides Metabolism, Biosynthesis of amino acid Purine Nucleotide synthesis – Purine N tonophosphates-Ribosomal – Purine and and diseases s of metabolic pathways - Qualitative an	genesis, and and omega o ycolipids, M ulation of O ds, biosynth ucleotide B I Pyrimidine d quantitativ	l the Dividati letabol xidativ esis a iosyntl base re anal	logical Pentose on, Kete lic Fates ve Phosp nd deg hesis – s are re ysis of	6+3 Oxida Phosp 6+3 one Bo s of A 6+3 phoryla 6+3 radatio Pyrim estricte 6+3	phat odie min ation idir d b
I - Bi Bioene Reduct Pathwa II - F Biosyn Biosyn Biosyn Biosyn Biosyn Biosyn Biosyn Diosyn Biosyn Biosyn Diosyn Biosyn Diosyn Diosyn Diosyn Biosyn Dios	oenereget ergetics an tion Reac ay, The Ci atty acid , thesis of f thesis of f thesis of s, Pathway Oxidative con-Transf al Feature Biosynthe view of N otides – I otide-Nuc ge Pathwa Ietabolic Il view or	nd Therm tions, met tric Acid (Cholestr fatty acids Cholestere /s of Amir phospho fer Reactic s of Photo sis of ami Vitrogen M De Novo eleotide M ys. disorders n enegetic ease and c	Iycolytic pathways odynamics, Phosphoryl Group Transfe abolic pathways: Glycolysis, Gluconeo Cycle. ol, Lipid and amino acid metabolism , Oxidation of fatty acid – beta oxidation ol, Biosynthesis of phospholipids and gl io Acid Degradation. rylation and photophoshorylation ons in Mitochondria, ATP Synthesis, Reg phosphorylation – Photosystem I and II. no acids and nucleotides Metabolism, Biosynthesis of amino acid Purine Nucleotide synthesis – Purine Nucleotide synthesis – Purine and and diseases	genesis, and and omega o ycolipids, M ulation of O ds, biosynth ucleotide B l Pyrimidine d quantitativ orders or dis	l the Dividati letabol xidativ esis a iosyntl base re anal	logical Pentose on, Kete lic Fates ve Phosp nd deg hesis – s are re ysis of	6+3 Oxida Phosp 6+3 one Bo s of A 6+3 phoryla 6+3 radatio Pyrim estricte 6+3 metabo	phat odies min- natior on c idin d b

Text Books:

- 4. Lehninger Principles of Biochemistry, David L. Nelson and Michael M. Cox, W. H. Freeman; 6th edition edition (13 February 2013), 1158 pages ISBN-10: 1464109621, ISBN-13: 978-1464109621.
- 5. Biochemistry, Donald Voet, Judith G. Voet 4th Edition, 2011, 1520 pages ISBN: 978-0-470-91410-6.
- 6. Branden C. and Tooze J., "Introduction to Protein Structured, Second Edition", Garland Publishing, NY, USA, 1999.

Reference Books:

- 5. Introduction to Protein structure, 2nd Ed by Carl Branden and John Tooze, Garland Press, 1999.
- 6. Structure and Mechanism in Protein Science, Alan Fersht, Freeman, 1999.
- 7. Protein engineering in Industrial biotechnology, Ed. Lilia Alberghina, Harwood Academic Publishers, 2002.
- 8. Creighton T.E. Proteins, Freeman WH, Second Edition, 1993.

E-References:

2. https://nptel.ac.in/courses/102104063/

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	1	2	0	1	0	0	1	1	1	1	1	3	2
CO 2	1	1	2	0	1	0	0	1	1	1	1	2	2	3
CO 3	1	1	2	0	1	0	0	1	1	1	1	3	1	2
CO 4	1	1	2	0	1	0	0	1	1	1	1	2	1	1
CO 5	1	1	2	0	1	0	0	1	1	1	1	1	1	1
	5	5	10	0	5	0	0	5	5	5	5	9	8	9

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

Mapping of Subjects with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
Origina l Value	5	5	10	0	5	0	0	5	5	5	5	9	8	9
Scaled Value	1	1	2	0	1	0	0	1	1	1	1	2	2	2

				L	Т	Р	C	
XBT	403			3	0	0	3	
		CELL BIOLOGY				÷	-	
C P	A			L	Т	Р	H	
$\frac{1}{3}$ 0				3	0	0	3	
Prerequ	uisite:-			-		-		
	ng Obje	ctives:						
		on of this course, the students						
-	-	levelop a deeper understanding of cell structure and h	now it relates	to cel	ll funct	ions.		
•	Would	understand how cells grow, divide, and die and	how these in	mport	ant pro	ocesses	s ar	
1	regulate	d.		1	-			
•	Would u	inderstand cell signaling and how it regulates cellular	functions.					
		Course Outcomes	Domain		Ι	Level		
After th	e compl	etion of the course, students will be able to						
	Study a	nd <i>understand</i> the origin of eukaryotic cells and			Unders	tand		
	-	cialization	Cognitive		Remen	ıber		
	cens spe				Apply			
	Recogni	ze the fundamental concepts in the structure and	~		Unders			
		ing of a eukaryotic cell.	Cognitive		Remen	iber		
					Apply			
	_	knowledge on the transport of proteins between	Cognitive	Understand				
i	intracell	ular compartments			Remember			
			Cognitive		Unders			
CO4	Acquire	knowledge about cell cycles mitosis and meiosis			Remen	ıber		
CO5	Describe	cellular 182ignaling and types of signaling	Comitivo		Unders	tand		
	receptor		Cognitive		Remen	ıber		
	s and T					9		
•		rsity of Cells – Origin of Eukaryotic cells – Plant c			-			
-	a, Conn	ective tissue, Nervous tissue, Muscle – Cells as e	xperimental	mode	ls - E	xtrace	llula	
Matrix.								
		rganization and Membrane Transport	1 1 5 1			9	1	
		ukaryotic cell structure: Cytoplasmic matrix, Endo	-		-		-	
		Chloroplast, Nucleus – Functions of cell organelles			-			
system.	transpor	t – Sodium/potassium pumps, Ca2+, ATPase pum	ips, Omport,	Sym	port all	lu All	.ipo	
•	tracellu	lar Protein Trafficking				9		
		l from the Nucleus – Transport Across Membranes –	Vesicular T	rafficl	ing Re			
		mpartments	, colcular 1					
		ion and Control				9		
The cel	l cycle -	- General description and different stages of mitosis		s (Inte	rphase	-	has	
wietaph		phase, Telophase) – Cell Growth Control: Apoptosis	b			9		
V – Cel	Signol					U U		

Cell Signaling: Types of Cell Signaling, General Principles of Cell Signaling – Receptors in Signaling: Types of Receptors, Signaling via G-Protein-linked Cell Surface Receptors, Signaling via Enzymelinked Cell-Surface Receptors.

Lecture	Tutorial	Practical	Total									
45	0	0	45									
Text Books:		·										
2. Bolsover, S. F	2. Bolsover, S. R., Shephard, E. A., White, H. A., and Hyams, J. S. Cell biology: a short course.											

2. Bolsover, S. R., Shephard, E. A., White, H. A., and Hyams, J. S. *Cell biology: a short course*. John Wiley & Sons, 2011.

References:

- 4. Sadava, D. E. *Cell biology: organelle structure and function*. Jones & Bartlett Learning, 1993.
- 5. Alberts, Bruce, Dennis Bray, Karen Hopkin, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter. *Essential cell biology*. Garland Science, 2013.
- 6. Julio E. Celis. *Cell biology: A Laboratory Handbook*. 3rd Edition, Vol. 1, Elsevier Academic Press, 2006.

E-References:

- 3. http://nptel.ac.in/courses/102103012/
- 4. https://cellbiology.med.unsw.edu.au/cellbiology/index.php/Cell_Biology_Introduction

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	0	0	0	1	0	0	0	0	0	1	1	0	0
CO 2	3	1	0	1	1	1	0	0	1	1	0	0	0	0
CO 3	3	1	0	0	1	0	0	0	0	0	1	1	0	0
CO 4	3	1	0	1	1	1	0	0	1	1	1	1	0	0
CO 5	3	1	0	1	1	1	0	0	1	1	1	1	0	0
	15	4	0	3	5	3	0	0	3	3	4	4	0	0

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

Mapping of Subjects with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
Origina l Value	15	4	0	3	5	3	0	0	3	3	4	4	0	0
Scaled Value	3	1	0	1	1	1	0	0	1	1	1	1	0	0
$1-5 \rightarrow$	1,		6 –	$10 \rightarrow 10$	2,		11 -	$15 \rightarrow$	3					

			L	Т	P	С	
XB	Т 404		-	3	0	0	3
C	P A	IMMUNOLOGY	-	L	Т	Р	H
2.5	$\begin{array}{c c} \mathbf{r} & \mathbf{A} \\ \hline 0 & 0.5 \end{array}$	-	_	<u>L</u> 3	0	г 0	<u> </u>
		Consting		5	Ū	U	
	-	Genetics					
	ing Obj complet	con of this course, the students					
•	-	be able to explain role of immune cells and their me	chanism in 1	nreve	nting	the ł	bod
·		reign attack and infectious disease, cancer and other d			-	the t	Jou
٠		apply the knowledge of immune associated mechan		-		chno	log
	researc						U
		Domain		Ι	Level		
After t	-	letion of the course, students will be able to					
CO1		<i>e</i> the general concepts of immune system and <i>be</i> the cells and organs of the immune system	Cognitive		Reme Evalu		
CO2		<i>ns</i> the properties of antigens and antibodies and <i>y</i> their interactions via various tests.	Cognitive		Under Perce		
CO3		<i>be</i> various mechanisms of antigen presentation and s the role of MHC in Ag Presentation.	Cognitive Affective	Rememb Respond			
CO4		the different types of hypersensitive reactions blain the autoimmune diseases.	Cognitive	 Phenomena Analyze Understand 			
CO5	Comp	<i>rehend</i> the types, mechanism of vaccines and <i>d</i> to the various immunization techniques	Cognitive		Under		
I- Imr	nune Sy					9	
function Dendr	ons of in itic cell,	f the immune system – Types of immune system: Inna portant immune cells: T cell, B cell development, Ma Stem cells – Immune organs: Bone marrow, Spleen, associated Lymphoid tissue (MALT & CALT).	acrophage, I	Neuti	ophil,	NK	cel
II- An	tigens a	nd Antibodies				9	
Classe antibic Precip	s and otics,Mo itation a	unogenicity, Antigenicity, Epitope, haptens and Ad Biological Activities;Molecular basis of an oclonal antibodies – Antigen-antibody reaction: Cro nd agglutination reactions. Immunotechniques: E phoresis, Western Blotting	tibody div ss-Reactivit	versity y, Af	y; P finity	olycl , Avi	ona dity
		Antigen Presentation				9	
Major respon	Histoco	mpatibility Complex: Structure, Function and classe to MHC – Antigen processing and presentation: Endo genous antigens (The Endocytic Pathway)					

IV- Complement, Hypersensitivity and Autoimmunity 9 Regulation of immune response; Complement System: Functions, Components, Activation and Regulation of complement system – Allergy and hypersensitivity: Types of hypersensitivity – Autoimmunity, Auto immune disorders; immune tolerance; Graft versus host reaction.

V- Vaccines and Cancer Immunology

9

Vaccines: Active and Passive Immunization, Whole-Organism Vaccines, Purified Macromolecules as Vaccines, Recombinant-Vector Vaccines, DNA and Multivalent Subunit Vaccines. Tumors of the Immune System - Tumor Antigens - Immune Response to Tumors - Cancer immunotheraphy.

Lecture	Tutorial	Practical	Total
45	0	0	45

Text Books:

2. Janes Kuby., Immunology, WH Freeman and Company, Newyork.,7th Edition, 2013.

2. Roitt, I., Essential Immunology, Blackwell Scientific Publications, Oxford, 12th Edition, 2011.

References:

- 3. Abbas, K. A., Litchman, A. H. and Pober, J. S. (2007). Cellular and Molecular Immunology, 4th Edn., W. B. Saunders Co., Pennsylvania, USA.
- 4. Tizard, R.I. (2007). Immunology: An Introduction 1st Edition (English) 4th Edition, Brooks/Cole publishers.

E - References:

- 4. http://www.raymondcheong.com/Year1/immuno.html
- 5. http://ocw.mit.edu/courses/health-sciences-and-technology/hst-176-cellular-andmolecular immunology-fall-2005/lecture-notes/
- 6. http://www.umich.edu/~bmsteach/lopatin/Immunology/Immunology.html

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO 1	3	2	2	1	1	1	1				1	1	3	3
CO 2	3	2	2	1		1	1				1	1	2	2
CO 3	2				1								2	1
CO 4	3	2	1										1	2
CO 5	3	2	2	1	1	1	1				1	1	1	1
	14	8	7	3	3	3	3				3	3	9	9
Mappir	ng of Su	bjects	with PC)s										
	PO) PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1	PSO	PSO
	1	2	3	4	5	6	7	8	9	0	1	2	1	2
Origina l Value	14	8	7	3	3	3	3				3	3	9	9
Scaled Value	3	2	2	0	0	0	0	0	0	0	0	0	2	2

 $1-5 \rightarrow 1$, $6-10 \rightarrow 2$, $11 - 15 \rightarrow 3$

COURS	E CODE	XUM405	L	Т	P	C			
COURS	E NAME	ECONOMICS FOR ENGINEERS	3	0	0	3			
PREREC	QUISITES	NIL	L	Т	Р	Н			
C:P:A	-	2.64:0:0.12	3	0	0	3			
COURS	E OUTCOM	IES	DOMA	IN	LEVE	L			
CO1	Explain th	e concepts of economics in engineering and	Cogniti	ve	Unders	stand			
	identify ele	ment of cost to prepare cost sheet							
CO2	Calculate d	and Explain the Break-even point and	Cogniti	ve	Unders	derstand			
	marginal costing & Apply								
CO3	0 01 0								
	cost analys		Affectiv		Receiv				
CO4	Estimate re	eplacement problem	Cogniti	ve	Unders	stand			
CO5	Compute.	Explain and make Use of different methods	Cogniti	ve	Unders	tand &			
000	of deprecia		008		Apply				
UNIT I	-	JCTION TO ECONOMICS				8			
			6 5 .	•		-			
		y, Law of supply and demand, Concept							
-	-	y, Economic efficiency, Scope of engineering	-	nics- t	-	-			
						C 1			
element of	of costs, prep	aration of cost sheet and estimation, Margina	al cost, M	arginal	Revenue	e, Suni			
	of costs, prep portunity cost	-	al cost, M	arginal	Revenue	e, Suni			
cost, Opp	portunity cost	-		-	Revenue	$\frac{12}{12}$			
cost, Opp UNIT II	oortunity cost BREAK-EV		IT ANAI	LYSIS		12			
cost, Opp UNIT II Margin o	bortunity cost BREAK-EV of Safety, Pr	EN ANALYSIS&SOCIAL COST BENEF	IT ANAI ix decisio	LYSIS ns and		12			
cost, Opp UNIT II Margin o Profit/Vo	bortunity cost BREAK-EV of Safety, Probleme Ratio (EN ANALYSIS&SOCIAL COST BENEF ofit, Cost & Quantity analysis-Product Mi P/V Ratio), Application of Marginal costing,	IT ANAI ix decisio Limitatic	LYSIS ns and ons	CVP at	12 nalysis			
cost, Opp UNIT II Margin o Profit/Vo Social C	bortunity cost BREAK-EV of Safety, Pro- blume Ratio (bost Benefit	EN ANALYSIS&SOCIAL COST BENEF rofit, Cost & Quantity analysis-Product Mi P/V Ratio), Application of Marginal costing, Analysis: compare different project alterna	IT ANAI ix decisio Limitatic atives, Ca	CYSIS ns and ons ilculate	CVP at	12 nalysis			
cost, Opp UNIT II Margin o Profit/Vo Social C and exter	bortunity cost BREAK-EV of Safety, Pro- blume Ratio (cost Benefit mal effects; N	EN ANALYSIS&SOCIAL COST BENEF rofit, Cost & Quantity analysis-Product Mi P/V Ratio), Application of Marginal costing, Analysis : compare different project alternation Monetizing effects; Result of a social cost ber	IT ANAI ix decisio Limitatic atives, Ca	CYSIS ns and ons ilculate	CVP at	12 nalysis			
cost, Opp UNIT II Margin o Profit/Vo Social C and exter UNIT II	bortunity cost BREAK-EV of Safety, Pro- plume Ratio (cost Benefit mal effects; N I VALUE E	EN ANALYSIS&SOCIAL COST BENEF rofit, Cost & Quantity analysis-Product Mi P/V Ratio), Application of Marginal costing, Analysis: compare different project alterna Monetizing effects; Result of a social cost ber NGINEERING &COST ACCOUNTING:	IT ANAI ix decisio Limitatic atives, Ca aefit analy	CYSIS ns and ons alculate rsis.	CVP and direct, i	12 nalysis			
cost, Opp UNIT III Margin o Profit/Vo Social C and exter UNIT III Value en	bortunity cost BREAK-EV of Safety, Pro- blume Ratio (cost Benefit rnal effects; N I VALUE El gineering – F	EN ANALYSIS&SOCIAL COST BENEF rofit, Cost & Quantity analysis-Product Mi P/V Ratio), Application of Marginal costing, Analysis : compare different project alterna Monetizing effects; Result of a social cost ber NGINEERING &COST ACCOUNTING: Function, aims, Value engineering procedure	IT ANAI ix decisio Limitatic atives, Ca nefit analy - Make or	CYSIS ns and ons ilculate rsis.	CVP and direct, i	12 nalysis			
cost, Opp UNIT II Margin o Profit/Vo Social C and exter UNIT II Value en Business	bortunity cost BREAK-EV of Safety, Pro- blume Ratio (cost Benefit rnal effects; N I VALUE El gineering – F operating co	EN ANALYSIS&SOCIAL COST BENEF ofit, Cost & Quantity analysis-Product Mi P/V Ratio), Application of Marginal costing, Analysis: compare different project alterna Ionetizing effects; Result of a social cost ber NGINEERING &COST ACCOUNTING: Function, aims, Value engineering procedure sts, Business overhead costs, Equipment ope	IT ANAI ix decisio Limitatic atives, Ca nefit analy - Make or	CYSIS ns and ons ilculate rsis.	CVP and direct, i	12 nalysis ndirec 10			
cost, Opp UNIT III Margin of Profit/Vo Social C and exter UNIT III Value en Business UNIT IV	bortunity cost BREAK-EV of Safety, Pro- plume Ratio (cost Benefit rnal effects; N I VALUE El gineering – F operating co V REPLACE	EN ANALYSIS&SOCIAL COST BENEF rofit, Cost & Quantity analysis-Product Mi P/V Ratio), Application of Marginal costing, Analysis: compare different project alterna Monetizing effects; Result of a social cost ber NGINEERING &COST ACCOUNTING: Function, aims, Value engineering procedure sts, Business overhead costs, Equipment ope MENT ANALYSIS	IT ANAI ix decisio Limitatic atives, Ca hefit analy - Make on rating cos	LYSIS ns and ons ilculate sis.	CVP and direct, in the constant of the constan	12 nalysis indirec 10 7			
cost, Opp UNIT III Margin of Profit/Vo Social C and exter UNIT III Value en Business UNIT IV	bortunity cost BREAK-EV of Safety, Pro- plume Ratio (cost Benefit rnal effects; N I VALUE El gineering – F operating co V REPLACE	EN ANALYSIS&SOCIAL COST BENEF ofit, Cost & Quantity analysis-Product Mi P/V Ratio), Application of Marginal costing, Analysis: compare different project alterna Ionetizing effects; Result of a social cost ber NGINEERING &COST ACCOUNTING: Function, aims, Value engineering procedure sts, Business overhead costs, Equipment ope	IT ANAI ix decisio Limitatic atives, Ca hefit analy - Make on rating cos	LYSIS ns and ons ilculate sis.	CVP and direct, in the constant of the constan	12 nalysis indirec 10 7			
cost, Opp UNIT II Margin o Profit/Vo Social C and exter UNIT II Value en Business UNIT IV Replacen	bortunity cost BREAK-EV of Safety, Pro- blume Ratio (cost Benefit rnal effects; N I VALUE El gineering – F operating co 7 REPLACE nent analysis	EN ANALYSIS&SOCIAL COST BENEF rofit, Cost & Quantity analysis-Product Mi P/V Ratio), Application of Marginal costing, Analysis: compare different project alterna Monetizing effects; Result of a social cost ber NGINEERING &COST ACCOUNTING: Function, aims, Value engineering procedure sts, Business overhead costs, Equipment ope MENT ANALYSIS	IT ANAI ix decisio Limitatic atives, Ca hefit analy - Make on rating cos	LYSIS ns and ons ilculate sis.	CVP and direct, in the constant of the constan	12 nalysis indirec 10 7			
cost, Opp UNIT III Margin of Profit/Vo Social C and exter UNIT III Value en Business UNIT IV Replacen Replacen	bortunity cost BREAK-EV of Safety, Pro- olume Ratio (cost Benefit rnal effects; N I VALUE El gineering – F operating co 7 REPLACE nent analysis	EN ANALYSIS&SOCIAL COST BENEF rofit, Cost & Quantity analysis-Product Mi P/V Ratio), Application of Marginal costing, Analysis: compare different project alterna Monetizing effects; Result of a social cost ber NGINEERING &COST ACCOUNTING: Function, aims, Value engineering procedure sts, Business overhead costs, Equipment ope MENT ANALYSIS –Types of replacement problem, determinat set with a new asset.	IT ANAI ix decisio Limitatic atives, Ca hefit analy - Make on rating cos	LYSIS ns and ons ilculate sis.	CVP and direct, in the constant of the constan	12 nalysis indirec 10 7 n asset			
cost, Opp UNIT II Margin o Profit/Vo Social C and exter UNIT II Value en Business UNIT IV Replacen Replacen UNIT V	bortunity cost BREAK-EV of Safety, Pro- olume Ratio (cost Benefit rnal effects; N I VALUE El gineering – F operating co 7 REPLACE nent analysis nent of an ass DEPRECIA	EN ANALYSIS&SOCIAL COST BENEF rofit, Cost & Quantity analysis-Product Mi P/V Ratio), Application of Marginal costing, Analysis: compare different project alterna Monetizing effects; Result of a social cost ber NGINEERING &COST ACCOUNTING: Function, aims, Value engineering procedure sts, Business overhead costs, Equipment ope MENT ANALYSIS -Types of replacement problem, determinat set with a new asset.	IT ANAI ix decisio Limitatic atives, Ca nefit analy - Make or rating cos ion of ecc	CYSIS ns and ons ilculate rsis.	CVP and direct, in the constant of the constan	12 nalysis ndirec 10 7 n asset 8			
cost, Opp UNIT III Margin of Profit/Vo Social C and exter UNIT III Value en Business UNIT IV Replacen Replacen UNIT V Deprecia	bortunity cost BREAK-EV of Safety, Pro- plume Ratio (cost Benefit mal effects; M I VALUE El gineering – F operating co 7 REPLACE nent analysis nent of an ass DEPRECIA tion- Introdu	EN ANALYSIS&SOCIAL COST BENEF rofit, Cost & Quantity analysis-Product Mi P/V Ratio), Application of Marginal costing, Analysis: compare different project alterna Analysis: compare different project alterna Analysis: compare different project alterna Monetizing effects; Result of a social cost ber NGINEERING &COST ACCOUNTING: Function, aims, Value engineering procedure sts, Business overhead costs, Equipment ope MENT ANALYSIS –Types of replacement problem, determinat set with a new asset. TION action, Straight line method of depreciation	IT ANAI ix decisio Limitatic atives, Ca hefit analy - Make on rating cos ion of ecc n, declini	LYSIS ns and ons alculate sis. buy de ts onomic	CVP and direct, in the constant of the constan	12 nalysis indirec 10 7 n asset 8 hod o			
cost, Opp UNIT III Margin o Profit/Vo Social C and exter UNIT III Value en Business UNIT IV Replacen Replacen UNIT V Deprecia depreciat	bortunity cost BREAK-EV of Safety, Pro- olume Ratio (cost Benefit rnal effects; N I VALUE El gineering – F operating co V REPLACE nent analysis nent of an ass DEPRECIA tion- Introdu	EN ANALYSIS&SOCIAL COST BENEF rofit, Cost & Quantity analysis-Product Mi P/V Ratio), Application of Marginal costing, Analysis: compare different project alterna Monetizing effects; Result of a social cost ber NGINEERING &COST ACCOUNTING: Function, aims, Value engineering procedure sts, Business overhead costs, Equipment ope MENT ANALYSIS —Types of replacement problem, determinat set with a new asset. TION action, Straight line method of depreciation he year's digits method of depreciation, sink	IT ANAI ix decisio Limitatic atives, Ca hefit analy - Make or rating cos ion of eco h, declini ing fund r	LYSIS ns and ons alculate sis. buy de ts onomic	CVP and direct, in the constant of the constan	12 nalysis indirec 10 7 n asset 8 hod o			
cost, Opp UNIT II Margin o Profit/Vo Social C and exter UNIT II Value en Business UNIT IV Replacen Replacen UNIT V Deprecia depreciat Annuity	bortunity cost BREAK-EV of Safety, Pro- olume Ratio (cost Benefit rnal effects; N I VALUE El gineering – F operating co V REPLACE nent analysis nent of an ass DEPRECIA tion- Introdu ion-Sum of te method of de	EN ANALYSIS&SOCIAL COST BENEF rofit, Cost & Quantity analysis-Product Mi P/V Ratio), Application of Marginal costing, Analysis: compare different project alterna Aonetizing effects; Result of a social cost ber NGINEERING &COST ACCOUNTING: Function, aims, Value engineering procedure sts, Business overhead costs, Equipment ope EMENT ANALYSIS –Types of replacement problem, determinate set with a new asset. TION action, Straight line method of depreciation he year's digits method of depreciation, sink preciation, service output method of depreciation	IT ANAI ix decisio Limitatic atives, Ca hefit analy - Make or rating cos ion of ecc h, declinit ing fund r	LYSIS ns and ons alculate sis. buy de ts onomic	CVP and direct, if ecision	12 nalysis indirec 10 7 n asset 8 hod or ciation			
cost, Opp UNIT II Margin o Profit/Vo Social C and exter UNIT II Value en Business UNIT IV Replacen Replacen UNIT V Deprecia depreciat	bortunity cost BREAK-EV of Safety, Pro- olume Ratio (cost Benefit rnal effects; N I VALUE El gineering – F operating co V REPLACE nent analysis nent of an ass DEPRECIA tion- Introdu ion-Sum of te method of de	EN ANALYSIS&SOCIAL COST BENEF rofit, Cost & Quantity analysis-Product Mi P/V Ratio), Application of Marginal costing, Analysis: compare different project alterna Monetizing effects; Result of a social cost ber NGINEERING &COST ACCOUNTING: Function, aims, Value engineering procedure sts, Business overhead costs, Equipment ope MENT ANALYSIS —Types of replacement problem, determinat set with a new asset. TION action, Straight line method of depreciation he year's digits method of depreciation, sink	IT ANAI ix decisio Limitatic atives, Ca hefit analy - Make or rating cos ion of ecc h, declinit ing fund r	LYSIS ns and ons alculate sis. buy de ts onomic	CVP and direct, in the constant of the constan	12 nalysis indirec 10 7 n asset 8 hod or ciation			
cost, Opp UNIT II Margin o Profit/Vo Social C and exter UNIT II Value en Business UNIT IV Replacen Replacen UNIT V Deprecia depreciat Annuity f	bortunity cost BREAK-EV of Safety, Pro- olume Ratio (ost Benefit mal effects; N I VALUE El gineering – F operating co 7 REPLACE nent analysis nent of an ass DEPRECIA tion- Introdu ion-Sum of t method of de RE:45	EN ANALYSIS&SOCIAL COST BENEF rofit, Cost & Quantity analysis-Product Mi P/V Ratio), Application of Marginal costing, Analysis: compare different project alterna Aonetizing effects; Result of a social cost ber NGINEERING &COST ACCOUNTING: Function, aims, Value engineering procedure sts, Business overhead costs, Equipment ope EMENT ANALYSIS –Types of replacement problem, determinate set with a new asset. TION action, Straight line method of depreciation he year's digits method of depreciation, sink preciation, service output method of depreciation	IT ANAI ix decisio Limitatic atives, Ca hefit analy - Make or rating cos ion of ecc h, declinit ing fund r	LYSIS ns and ons alculate sis. buy de ts onomic	CVP and direct, if ecision	12 nalysis indirec 10 7 n asset 8 hod o ciation			
cost, Opp UNIT II Margin o Profit/Vo Social C and exter UNIT II Value en Business UNIT IV Replacen Replacen UNIT V Deprecia depreciat Annuity T LECTU	bortunity cost BREAK-EV of Safety, Pro- blume Ratio (ost Benefit mal effects; N I VALUE El gineering – F operating co V REPLACE nent analysis nent of an ass DEPRECIA tion- Introdu ion-Sum of t method of de RE:45 OOKS	EN ANALYSIS&SOCIAL COST BENEF ofit, Cost & Quantity analysis-Product Mi P/V Ratio), Application of Marginal costing, Analysis: compare different project alterna Analysis: compare different project alterna Function, aims, Value engineering procedure sts, Business overhead costs, Equipment ope MENT ANALYSIS —Types of replacement problem, determinat set with a new asset. ATION action, Straight line method of depreciation he year's digits method of depreciation, sinki preciation, service output method of depreciation he year's digits method of depreciation, sinki preciation, service output method of depreciation PRACTICAL: O	IT ANAI ix decisio Limitatic atives, Ca hefit analy - Make or rating cos ion of ecc h, decliniting fund r ation. 0	LYSIS ns and ons ilculate sis. buy de ts onomic ng bala nethod	CVP and direct, in the constraint of depresent the constraint of t	12 nalysis indirec 10 7 n asset 8 hod o ciation L: 45			
cost, OppUNIT IIIMargin GProfit/VoSocial Cand exterUNIT IIIValue enBusinessUNIT IVReplacenReplacenUNIT VDepreciadepreciatAnnuity ILECTUITEXT B1.	bortunity cost BREAK-EV of Safety, Pro- blume Ratio (cost Benefit mal effects; M I VALUE El gineering – F operating co 7 REPLACE nent analysis nent of an ass DEPRECIA tion- Introdu ion-Sum of t method of de RE:45 OOKS Sp Gupta, A	EN ANALYSIS&SOCIAL COST BENEF rofit, Cost & Quantity analysis-Product Mit P/V Ratio), Application of Marginal costing, Analysis: compare different project alternation Support Function, aims, Value engineering procedure sts, Business overhead costs, Equipment ope MENT ANALYSIS -Types of replacement problem, determination action, Straight line method of depreciation he year's digits method of depreciation, sinkip preciation, service output method of depreciation jay Sharma & Satish Ahuja, "Cost Account	IT ANAI ix decisio Limitatic atives, Ca hefit analy - Make or rating cos ion of ecc h, decliniting fund r ation. 0	LYSIS ns and ons ilculate sis. buy de ts onomic ng bala nethod	CVP and direct, in the constraint of depresent the constraint of t	12 nalysis indirec 10 7 n asset 8 hod o ciation L: 45			
cost, OppUNIT IIIMargin GProfit/VoSocial Cand exterUNIT IIIValue enBusinessUNIT IVReplacenReplacenUNIT VDepreciadepreciatAnnuity ILECTUITEXT B1.	bortunity cost BREAK-EV of Safety, Pro- blume Ratio (cost Benefit mal effects; M I VALUE El gineering – F operating co 7 REPLACE nent analysis nent of an ass DEPRECIA tion- Introdu ion-Sum of t method of de RE:45 OOKS Sp Gupta, A Faridabad, H	EN ANALYSIS&SOCIAL COST BENEF ofit, Cost & Quantity analysis-Product Mi P/V Ratio), Application of Marginal costing, Analysis: compare different project alterna Analysis: compare different project alterna Function, aims, Value engineering procedure sts, Business overhead costs, Equipment ope MENT ANALYSIS —Types of replacement problem, determinat set with a new asset. ATION action, Straight line method of depreciation he year's digits method of depreciation, sinki preciation, service output method of depreciation he year's digits method of depreciation, sinki preciation, service output method of depreciation PRACTICAL: O	IT ANAI ix decisio Limitatic atives, Ca hefit analy - Make on rating cos ion of ecc h, decliniting ing fund r ation. 0	LYSIS ns ns and ans allculate rsis. buy dets conomic ng bala nethod K Glob	CVP and direct, if direct, if direct, if direct direct, if direct di di direct direct direct direct direct direct direct	12 nalysis indirec 10 7 n asset 8 hod or ciations			

3.	PanneerSelvam, R, "Engineering Economics", Prentice Hall of India Ltd, New Delhi,
	2001.
4.	William G.Sullivan, James A.Bontadelli& Elin M.Wicks, "Engineering Economy",
	Prentice Hall International, New York, 2001.
REFE	RENCES
1.	Luke M Froeb / Brian T Mccann, "Managerial Economics – A problem solving approach"
	Thomson learning 2007
2.	Truett&Truett, "Managerial economics- Analysis, problems & cases "Wiley India 8th
	edition 2004.
3.	Chan S.Park, "Contemporary Engineering Economics", Prentice Hall of India, 2002.
4.	Donald.G. Newman, Jerome.P.Lavelle, "Engineering Economics and analysis" Engg.
	Press, Texas, 2002

CO Vs PO	CO1	CO2	CO3	CO4	CO5	Total	Scaled to 0,1,2 and 3
PO ₁	1	2	2	1	2	8	2
PO ₂	1	2	2	1	3	9	2
PO ₃	1	1	2	1	2	7	2
PO ₄	1	1	2	0	1	5	1
PO ₅	1	2	2	1	2	8	2
PO ₆	1	2	2	1	3	9	2
PO ₇	1	1	2	1	2	7	2
PO ₈	1	1	2	0	1	5	1
PO ₉	1	2	2	1	2	8	2
PO ₁₀	1	2	2	1	3	9	2
PO ₁₁	1	1	2	1	2	7	2
PO ₁₂	1	1	2	0	1	5	1
DEO	1	2	2	1	2		2
PSO ₁						8	
PSO ₂	1	2	2	1	3		2
r50 ₂						9	
TOTAL	14	22	28	11	29	_	-

Mapping of CO with PO

Cour	se Co	de	:	XUM 406		L	Т	Р	С
Cour	se Na	me	:	DISASTER MANAGEMENT		0	0	0	0
Prere	equisi	te	:			L	Т	Р	Н
С	Р	Α		NIL		3	0	0	3
3	0	0							
Cour. be ab		tcome	: Afi	er the completion of the course, students will	Domain C or P or A		I	Level	
CO1	Un typ		nd tl	ne concepts of disasters, their significance and	Cognitive	Un	ders	stand	
CO2				ne relationship between vulnerability, disasters, ntion and risk reduction	Cognitive	Un	ders	stand	
CO3				standing of preliminary approaches of Disaster on (DRR)	Cognitive	Un	ders	stand	
CO4	De	velop	awai	reness of institutional processes in the country	Cognitive	Ap	plic	ation	
CO5	sur		ings	dimentary ability to respond to their with potential disaster response in areas where a due sensitivity	Cognitive	Ap	plic	ation	
COU	RSE	CON	ΓEN	Т		•			
UNI	ГΙ	IN	TR	ODUCTION TO DISASTERS					6
		In	port	ance & Significance, Types of Disasters, Climate	e Change, DM cy	vcle			
UNI	ΓII	R	ISK	ASSESSMENT					12
				Vulnerability, Types of Risk, Risk identification ge Assessment, Risk modeling.	n, Emerging Risl	ks, Ri	sk A	ssess	sment,
UNI	ΓIII	D	ISA	STER MANAGEMENT					10
		Sy an	sten d Di	, Cycle of Disaster Management, Institution n, DM Plan, Community Based DM, Commun saster Monitoring, Disaster Communication, Re on'ts in various disasters.	ity health and sa	afety,	Earl	y Wa	arning
UNI	ΓIV	D	ISAS	STER RISK MANAGEMENT IN INDIA					10
		Sa Re	inita espoi	and Vulnerability profile of India, Compone tion, Shelter, Health, Waste Management, In use and Preparedness), Disaster Management Ac programmes and legislation	stitutional arrang	gemen	ts (Mitig	ation,
UNI	ΓV	D	[SAS	STER MANAGEMENT: APPLICATIONS A	ND CASE STU	DIES			7
		In	frast	ide Hazard Zonation, Earthquake Vulnerab ructure, Drought Assessment, Coastal Floodin Based Inputs for Disaster Mitigation and Manag	ng, Forest Fire,	Man 1			

											L	Т	Р	To	tal
											45	0	0	4	5
ГЕХТ В	BOOKS														
	Singhal J ISBN-13				0	, Laxm	i Pub	lications	s, 201	0. ISB	N-1(0: 93	80380	5427	
	Tushar B Pvt. Ltd.							0				Ind	ia Edu	cation	
	Gupta Ai NIDM, N				ir. Envi	ronme	ntal K	nowled	ge foi	: Disas	ster F	Risk	Mana	gement.	,
	Kapur An Publisher					ograpł	nical S	tudy of	Disas	sters, I	IAS	and	Sage		
REFER	ENCE B	OOKS													
	Siddhartl Policies"						-	isaster	Manag	gemen	t Pro	ograr	nmes	and	
7. 4	Arun Ku	mar, "(Global	Disa	ster Ma	nagem	ent",	SBS Pu	blishe	rs, 20	08				
	PardeepS reflection	-			ja and U	Jma m	edury	, "Disas	ter m	itigatio	on: E	xper	ience	s and	
9. (Govt. of	India:	Disaste	er Ma	anagem	ent Act	t, Gov	vernmen	nt of I	ndia, I	New	Delh	ni, 200	5	
10. (Governm	nent of	India,	Natio	onal Dis	aster N	Manag	ement l	Policy	, 2009)				
E-REFE	ERENCE	S													
	NIDM P Manager			-		0							itute c	f Disas	ter
	http://cw	0				· •				-	www	v.nws	s.noaa	.gov ,	
	http://pul	0	0	1	//nidm.g	gov.ini	http://	/www.ii	nd.go	v.ini					
Map	ping of (COs w	ith PO	S		DD				MFS	1				
	1	2	3	4	5	6			9			11	12	PSO1	PS
	1	4	2	-	1	U		0	,	10		11	14	1001	10

 $6-10 \rightarrow 2$,

0-NoRelation, 1-Low Relation, 2-MediumRelation, 3-HighRelation

 $11 - 15 \rightarrow 3$

CO2

CO3

CO4

CO5

Total

Scaled

Value

 $1-5 \rightarrow 1$,

COUR	SE CODE			XBT407			L	Т	Р	С
COUR	SE NAME	BASIC	TRAN	SPORT	PROCES	SES	0	0	1	1
		LABORA'	TORY							
PRERI	EQUISITES			-			L	Т	Р	Н
C:P:A		2:0.5:0.5					0	0	2	4
LEAR	NING OBJECT	FIVES								
•	To understand	the existence	e of trans	port proce	esses involved	l in ur	nit ope	ration	s throug	gh the
	experiments of	the character	ristics of	fluid mech	nanics, particle	e mecl	nanics,	heat t	ransfer,	mass
	transfer and pro	cess control	system.							
COUR	SE OUTCOM	ES				DO	MAIN	[LEVE	EL
CO1	<i>Experiment</i> an	nd <i>Demonstr</i>	ate Fluid	Flow Sys	tem	Cogi	nitive	U	nderstar	nd
						Psyc	omoto	r Re	espond	
CO2	Experiment	and Demo	onstrate	Particle	Mechanics	Cogi	nitive	U	nderstar	nd
	phenomena					2	omoto	r Re	espond	
						Affe	ctive			
CO3	<i>Experiment</i> an	nd <i>Demonstr</i>	rate Heat	Transfer p	henomena.	Cogi	nitive	U	nderstar	nd
						Psyc	omoto	r Re	espond	
CO4	<i>Experiment</i> an	nd <i>Demonstr</i>	<i>ate</i> Mass	Transfer	phenomena.	Cogi	nitive	U	nderstar	nd
						Psyc	omoto	r Re	espond	
CO5	Understanding	-		ystem and	d Aware of	0	nitive	U	nderstar	nd
	MATLAB in U	Unit operatio	n.			Affe	ctive	Re	espond	

S.No		List	of Experi	ments		COs
1	III.	Experiment on fluid f	low meter	rs (U tube	6 Experiments	CO1
		manometer, Orifice meter,	Venturi me	ter, Pitot tube	(9 hrs)	
		meter).				
	IV.	Centrifugal and Reciprocating	ng pumps c	haracteristics		
2	V.	Settling and Sedimentation	of the partic	eles	3 Experiments	CO2
	VI.	Experiment on Centrifugation	on process		5 Study Experime	nts
	VII.	Determination of Mixing po			(9 hrs)	
	VIII.	Study on Rotary Drum F	ilter, Leaf	Filter, Filter		
		Press, Size Reduction	Equipment	and Sieve		
		analysis]				
3	III.	Heat Transfer by Conductio	n, Convecti	on	3 Experiments	CO3
	IV.	Heat Exchanger			(4 hrs)	
4	III.	Simple Extraction			2 Experiments	CO4
	IV.	Batch Adsorption			(4 hrs)	
5	III.	Study on Interacting and nor	n-Interactin	g system	3 Study Experime	nts CO5
	IV.	Introduction to MATLAB at	nd SIMULI	NK	(4hrs)	
Refere	nce:					
McCab	e, Wa	rren L., Julian C. Smith,	and Peter	Harriott, Un	it Operations of	Chemical
Engine	ering,M	lcGraw-Hill, 2010.				
Any To	en Exp	eriments may choose from	HOURS	TUTORIAL	PRACTICAL	TOTAL
all CO	5		HOURS	0	30	30

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	1	1	2	2	2	0	0	0	1	3	0	0
CO 2	3	3	2	2	1	2	2	0	0	0	2	2	1	1
CO 3	3	3	2	3	1	2	2	0	0	0	2	3	2	3
CO 4	3	3	2	3	1	2	2	0	0	0	2	2	2	2
CO 5	3	3	2	3	1	2	2	0	0	0	2	3	3	3
	15	15	9	12	6	10	10	0	0	0	9	13	8	9

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

Mapping of Subjects with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
Origina l Value	15	15	9	12	6	10	10	0	0	0	9	13	8	9
Scaled Value	3	3	2	3	2	2	2	0	0	0	2	3	2	2

COURSE			XBT408			L	Т	Р	C
COURSE			Cell Biology Laborator	v		0	0	2	2
PREREQ				J		-	Ť		
С	P	Α				L	Т	Р	H
1	1	1				0	0	2	6
• W • W	mpletio Yould de Yould un Yould un Study specia	n of thi evelop a nderstan derstan and <i>un</i> ilization	s course, the students deeper understanding of cell structure a d how cells grow, divide, and die and h d cell signaling and how it regulates cel COURSE OUTCOMES derstand the origin of eukaryotic cells a	ow these i llular func	import tions. De Cogn Psych Affec Cogn	OMAIN itive, nomotor ctive itive,	cesses A , N R A	are reg LEV pply, fechanis espond pply an	T <mark>EL</mark>
CO3	functi Acqui	oning of	e fundamental concepts in the struct f a eukaryotic cell. wledge on the transport of proteins ompartments		Affec Cogn Psych	itive, 10motor	, N	pply, Iechanis espond pply. Iechanis	sm
CO4			vledge about cell cycles mitosis and met	iosis	Affec Cogn Psych Affec	itive, 10motor	, A	espondi nalysin pplying, espondi	g and
CO5	Descr recept		llular 192ignaling and types of s	signaling	Cogn Affec		0	nalysin rganizin aluing	
10. Co 11. Is 12. O 13. E: 14. E: 15. So 16. St	taining a ell viab olation smosis xtractio xtractio eparatio tudy of	and obse ility assi of chlor and Tor n of lipi n of pro differen	ervation of eukaryotic cells ay by trypan blue exclusion method. oplasts from spinach leaves						
			I I	RACTICA	L	TUTO	RIAL	TO	TAL
Н	OURS		0	30		-	0		30
		E. Celis	. Cell biology: A Laboratory Handbo	ok. 3 rd Ec	lition,	Vol. 1	, Elsev	vier Ac	ademi

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	0	0	0	1	0	0	0	0	0	1	1	0	0
CO 2	3	1	0	1	1	1	0	0	1	1	0	0	0	0
CO 3	3	1	0	0	1	0	0	0	0	0	1	1	0	0
CO 4	3	1	0	1	1	1	0	0	1	1	1	1	0	0
CO 5	3	1	0	1	1	1	0	0	1	1	1	1	0	0
	15	4	0	3	5	3	0	0	3	3	4	4	0	0

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

Mapping of Subjects with POs

CO4

CO5

with Enzyme HRP.

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
Origina l Value	15	4	0	3	5	3	0	0	3	3	4	4	0	0
Scaled Value	3	1	0	1	1	1	0	0	1	1	1	1	0	0

COUR	SE CODE		XBT 409		L	Т	P	С
COUR	SE NAME	IMMUNOL	OGY LABORAT	ORY	0	0	1	1
PRER	EQUISITES				L	Т	Р	Η
C:P:A	= 1:1:1				0	0	2	6
LEAR	NING OBJECT	TIVES						
•	To introduce the	e different types of q	ualitative and quar	ntitativ	e immunoas	says.		
•	To expose the s	tudents to various in	nmunological terms	5.				
٠	To establish ana	lytical ability to inte	erpret the real time	experi	mental resul	ts.		
COUR	SE OUTCOMI	ES			DOMAIN	I	LEVEI	
CO1		eparation of differen	1	vhole	Cognitive		emember	
	blood using de	nsity gradient centri	fugation.		Psycomoto		esponds	to
					Affective	Ph	enomena	l
CO2		and <i>determine</i> the	• •	pe of	Cognitive	-	oply	
	blood compon	ents present in the bl	lood using dyes.		Psycomoto	r Re	esponds	to
					Affective	Ph	enomena	l
CO3	Demonstrate	the ABO blood	grouping system	and	Cognitive	Re	emember	
	<i>determine</i> the	blood group.			Psycomoto		sponds	to
					Affective	Ph	enomena	l

Cognitive

Affective

Cognitive

Affective

Psycomotor

Psycomotor

Remember

Phenomena

Remember

Phenomena.

Responds

to

to

Responds

Carry out the coupling technique to label the Antibody

Demonstrate qualitative and quantitative assays for

identifying the reaction pattern, similarity pattern,

unknown concentration, separation of desired antigen.

S.No	List of Experiments	COs
1	Collection of Serum from Blood	CO1
2	Isolation of lymphocytes from whole blood	CO1
3	Differential Leukocyte count	CO2
4	Total Leukocyte count	CO2
5	Total and differential count of RBC	CO2
6	Blood Grouping Experiment	CO3
7	Antibody Labelling with HRP	CO4
8	Ouchterlony double diffusion	CO5
9	Single radial immunodifussion	CO5
10	Immunoelectrophoresis	CO5
11.	DIRECT Elisa	CO5
12.	Widal test	CO5
13.	Latex Agglutination	CO5
Referen	ce:	

1. Abbas, K. A., Litchman, A. H. and Pober, J. S. (2007). Cellular and Molecular Immunology, 4th Edn., W. B. Saunders Co., Pennsylvania, USA.

HOURS	TUTORIAL	PRACTICAL	TOTAL
HOUKS	0	30	30

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO 1	3	2	2	1	1	1	1				1	1	3	3
CO 2	3	2	2	1		1	1				1	1	2	2
CO 3	2				1								2	1
CO 4	3	2	1										1	2
CO 5	3	2	2	1	1	1	1				1	1	1	1
	14	8	7	3	3	3	3				3	3	9	9

Mapping of Subjects with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
Origina l Value	14	8	7	3	3	3	3				3	3	9	9
Scaled Value	3	2	2	0	0	0	0	0	0	0	0	0	2	2

V Semester

					T	Т	Р	С
V	BT	501			L 3	<u> </u>	P 0	C 3
Δ	BI .	501	BIOANALYTICAL TOOLS		3	U	U	3
С	P	•	BIOANALTIICAL TOOLS		L	Т	Р	Н
3	P 0	A 0			L 3	0	r 0	<u>п</u> 3
	-		Physics, Applied Physics		3	U	U	3
			ectives:					
			on of this course, the students					
C po		-	able to understand the principles of instrumentation					
			able to impart the knowledge of different techniques	and method	s in hi	otechno	logy	
			e able to improve the understanding of application					d of
			nology		inque	<i>s</i> III ti		u oi
	ι		Course Outcomes	Domain	n	1	Level	
Afte	r th	e comn	letion of the course, students will be able to	Doman	L			
1110			the basics and fundamentals of analytical					
CO		-	ues and <i>describe</i> the various calibration techniques	Cognitive		Under		
		1	and the basic measurement methods.	Coginere		Remen	nber	
~~~	1		<i>te</i> the instrumentation and applications of different	~		Under	stand	
CO2			scopic techniques	Cognitive		Remen		
	1		tand the immunological and radioactive techniques	a		Under		
CO3			r applications in biotechnology.	Cognitive		Remen		
CO	1		he principle of instrumentation and <i>applications</i> of	<b>a</b> :/:		Under	stand	
CO4			imaging techniques in biological field.	Cognitive		Remen	nber	
CO	(		the various techniques of Chromatography,	<b>O ! !</b>		Under	stand	
COS	)   I	Elabora	<i>tte</i> the importance of electrophoresis	Cognitive		Remen	nber	
			Course content			I	Iours	
I – I	ntr	oductio	)n				9	
Class	ifica	ation of	f instrumental methods - Concepts of accuracy, prec	ision – Lim	its of	detectio	on (LO	D) –
Types	s of	errors	: Random and Systematic – Calibration of instrument	ntal methods	s: Ext	ernal, I	nternal	l and
			n methods –Signal to Noise ratio.					
	_		opic Techniques				9	
			omagnetic radiation – Absorption, Transmittance and		-			
		-	e, Instrumentation and applications of UV-Visible,	IR, FTIR	and C	Circular	Dichr	oism
Spect		1 7						
			ogical and Radioactive Techniques				9	
			- Enzyme-Linked Immunosorbent Assay (ELISA), F			• • •		
		•	- Immunoblotting - Flow cytommetry- Principle,	Instrumenta	tion a	ind app	lication	ns of
-			counter, Solid & Liquid scintillation counters.					
		0 0	and Characterization Techniques				9	DI
		0	ron Microscope – Transmission Electron Microscope	– Mass spe	ctrom	etry and	1 MAL	.DI –
			- Crystalline structure analysis: XRD and NMR.				0	
	-		n Techniques	manha Ti'	a 1		9	
AIII	nity	-based	separations – Chromatography: Column chromatog	grapny, Thi	n-laye	er chroi	natogr	apny

(TLC), Gas chromatography (GC) and High-performance liquid chromatography (HPLC) Electrophoresis: Agarose Gel and SDS-Polyacrylamide Gel electrophoresis.

Lecture	Tutorial	Total
45	0	45
Torrt Doolan		

#### **Text Books:**

- 3. Robinson, J. W., Frame, E. M. S., Frame, G. M., Eileen, M., & Skelly, F. (2005). Undergraduate instrumental analysis.
- 4. Skoog, D. A., Holler, F. J., & Crouch, S. R. (2017). Principles of instrumental analysis. Cengage learning.

### **Reference Books:**

- 3. Gordon, M. H., Macrae, R., & Mac Rae, R. (1987). Instrumental analysis in the biological sciences. Blackie.
- 4. Bisen, P. S., & Sharma, A. (2012). Introduction to instrumentation in life sciences. Crc Press.

#### **E-References:**

- 4. https://nptel.ac.in/courses/103/108/103108100/
- 5. https://nptel.ac.in/courses/103/108/103108100/
- 6. https://nptel.ac.in/courses/102/103/102103083/

#### Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	2	1	0	0	1	0	0	0	0	2	0	1
CO 2	3	3	2	2	0	0	1	0	0	0	0	0	0	1
CO 3	3	2	2	1	0	0	1	0	0	0	0	0	0	1
CO 4	2	3	2	2	0	0	0	0	0	0	0	1	0	1
CO 5	3	2	3	1	0	0	1	0	0	0	0	1	0	1
	14	12	11	7	0	0	4	0	0	0	0	4	0	5

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

#### Mapping of Subjects with POs

<b>FF</b>	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
Origina l Value	14	12	11	7	0	0	4	0	0	0	0	4	0	5
Scaled Value	3	3	3	2	0	0	2	0	0	0	0	2	0	2
$1-5 \rightarrow$	1,		6 –	$10 \rightarrow$	2,		11 –	$15 \rightarrow$	3					

 $1-5 \rightarrow 1$ ,

					L	Т	Р	С
XB	Т 502				3	0	0	3
			<b>MOLECULAR BIOL</b>	OGY		Ű	v	-
C 1	P A				L	Т	Р	Η
3 (	0 0				3	0	0	3
Learr	ning Obje	ectives:					•	
Upon	complet	ion of this	course, the students					
•	Would	have learn	t structures of DNA, RNA and	its replication and re	epair			
•	Would		t gene regulations					
			Course Outcomes		main		Level	
After	the comp	letion of the	ne course, students will be able	to				
CO1	Relate a	and <i>Interp</i>	ret DNA and RNA structure an	d its role Cog	nitive	Re	derstar memb	er
CO2	Explain	and Appl	y and its replication and repair	Cog	nitive		derstar Apply	nd
CO3	Classify modific		elop transcription and post tran	nscriptional Cog	nitive	Ā	nalyze	•
CO4	Classify process		ssect translation and post tr	anslational Cog	nitive	-	derstar .nalyze	
CO5	-		gene regulations	Cog	nitive		membe	
			Course content			l	Hours	
I – In	troductio	on					9	
Defin	ition of C	Gene – Chi	romosomal organization of ger	ne – Functional rear	rangemen	ts in ch	romos	omal
	-	zing cellul	ar DNA into chromosome – M	orphology and funct	tional eler	nents of	feukar	yotic
	nosomes.					1		
		n and Re			0 11		9	1 0
			nesis – Modes of DNA repli					
			replication – Eukaryotic replic	ation – DNA mutat	1000  mm - 1  y	pes of 1	mutatio	ons –
			DNA repair mechanisms <b>RNA processing</b>				9	
		•	olymerase enzymes (prokaryotic	c & eukarvotic) – T	ranscrintig	n initia		ctors
			tion (prokaryotic & eukaryotic					
			c RNA processing – Eukaryoti					
	-	-	ng, mRNA splicing).		(° F - )		, -	
			regulation				9	
			ery (t-RNA, m-RNA, ribosom	es, aminoacyl tRNA	syntheta	ises) – I	Initiatio	on of
protei	n transla	tion (prok	aryotic & eukaryotic) – Elo	ngation of protein	translatio	on (pro	karyot	ic &
eukar	yotic) – T	'ermination	n of protein translation (prokary	yotic & eukaryotic)	– Regulat	ion of ti	anslati	ion.
	0	0	expression				9	
		-	tion (activator, inducer & rep	-	tic gene	regulati	on (hi	stone
modif			fication & chromatin remodelli					
	Lectur	e	Tutorial	Practical		Tot		
	45		0	0		4	0	

**Text Books:** 

- 3. Verma P.S. (Author), Agarwal V.K. Molecular Biology, 2010.
- 4. Principles and Techniques of Biochemistry and Molecular Biology, Cambridge University Press; Eighth edition, 2018.

### **Reference Books:**

- 3. Molecular Biology of the Gene, James D. Watson, A. Baker Tania, P. Bell Stephen, Gann Alexander, Levine Michael, Losick Richard, Pearson Education; Seventh edition, 2017.
- 4. Molecular Biology Made Simple and Fun, David P. Clark (Author), Lonnie Dee Russell (Author), 2010.

#### **E-References:**

- 7. https://nptel.ac.in/courses/102106025/
- 8. https://www.embl.de/training/e-learning/
- 9. https://swayam.gov.in/course/5065-molecular-biology
- 10. https://www.ox.ac.uk/admissions/undergraduate/courses-listing/biochemistry-molecular-and-cellular?wssl=1
- 11. https://vlab.amrita.edu/?sub=3&brch=77
- 12. https://www.youtube.com/watch?v=V4CRCQfXUrg

### Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	1	2	0	1	0	0	1	1	1	1			
CO 2	1	1	2	0	1	0	0	1	1	1	1			
CO 3	1	1	2	0	1	0	0	1	1	1	1			
CO 4	1	1	2	0	1	0	0	1	1	1	1			
CO 5	1	1	2	0	1	0	0	1	1	1	1			
	5	5	10	0	5	0	0	5	5	5	5			

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

#### Mapping of Subjects with POs

	PO 1	PO 2	PO 3	РО 4	PO 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
Origina l Value	5	5	10	0	5	0	0	5	5	5	5			
Scaled Value	1	1	2	0	1	0	0	1	1	1	1			

 $1-5 \rightarrow 1, \qquad 6-10 \rightarrow 2, \qquad 11-15 \rightarrow 3$ 

					т	т	п	C
VD	т <i>г</i> лэ				L 2	T 1	P 0	C 3
	Т 503		DIADE A CHIAN ENCIMEEDING		2		U	3
			<b>BIOREACTION ENGINEERING</b>		т		р	TT
_		<u>\</u>				T	P	H
_	•	1			3	1	0	4
			ectives:					
Upon	-		ion of this course, the students					
•			able to known about the basics of biochemical process	8.				
•			have understood the concepts of enzyme kinetics.					
•			have knowledge on the kinetic model for biochemical					
•	Woi	ıld	able to design a bioreactor for a particular biochemica			T		
			Course Outcomes	Domai	n		Level	
After			letion of the course, students will be able to			T		
C01			tand and describe the fundamentals of reaction	Cognitive		Remen		
	kine			Affective		Receiv	ve	
CO2			the enzyme production and <i>choose</i> an appropriate ion method based on kinetics.	Cognitive		Under	stand	
CO3			<i>ize</i> , <i>perform</i> and <i>detect</i> various immobilization ues for a bio reaction process.	Cognitive		Under	stand	
			and <i>select</i> a kinetic model and design a bioreactor	Cognitive		Under		
CO4			ng to a biochemical process	Affective		Respo	nds	
CO5	<i>Iden</i> proc		v, select and follow a bioreactor for a particular.	Cognitive Affective		Under Receiv		
			Course content			]	Hours	
Unit-	I – Re	act	tion Kinetics				6+3	
Rate la	aw – (	Ord	er of reaction kinetics: Zero, First and Second Orde	er reactions	– Ide	eal react	tors: B	atch,
Mixed	flow,	anc	l Plug flow - Temperature effect on rate constant.					
			mes Production and Its Kinetics				6+3	
			- enzyme inhibition - enzyme stability& specificity	- factors a	ffecti	ng react	ion ra	tes –
			ction process- Industrial production and applications			-		
proteas	se – lij	oase	e, Vitamins: Cyanaocobalamin – Riboflavin.					
– Mor	nod N	lod	el – modeling of batch and continuous cell grow	wth Batch	grow	th-quan	tifying	cell
concen	ntratio	1, g	growth patterns and kinetics in batch culture, envir	onmental o	condit	ions aff	fect gr	owth
kinetic	s. Qu	anti	ifying growth kinetics- Unstructured non segregated	models to	pred	ict spec	ific gr	owth
rate, co	ell gro	wt	h in continuous cultures Definitions and stoichiomet	ric calculat	ions-e	elementa	al bala	nces,
Degree	e of re	duc	tion, Theoretical predictions of yield coefficients					
			nobilization System				6+3	
Enzyr	me In	nmo	obilization - Diffusion Effects - Thiele modulus,	Effectiver	less f	actor, I	Damko	ehler
			lication of hydrolytic enzymes-Immobilized microbia	l cells, car	rier bi	inding,	Entrap	ping,
		-	Advantages and disadvantages of immobilized cells.					
Unit-	IV – (	Cell	Growth Kinetics				6+3	
			ll growth - Substrate utilization and product forma					
segreg	gated	mo	dels to predict specific growth rate, cell growth in a	continuous	cultur	es Defi	nitions	and

stoichiometric calculations-elemental balances, Degree of reduction, Theoretical predictions of yield coefficients - Microbial, animal and plant cell cultivation –factors affecting the growth.

6+3

#### **Unit -V – Bioreactors**

Microbial and enzyme reactors - Ideal Bioreactors-Type of bioreactor-Airlift bioreactors-Airlift pressure cycle bioreactors—Fluidized bed reactors-trickle bed reactors-loop reactor-Stirred tank reactors-Bubble column fermenter – Optimization and scale up.

Lecture	Tutorial	Practical	Total
30	15	0	45

#### **Text Books:**

3. Bailey J.E. and Ollis D.F, Biochemical Engineering Fundamentals, Second edition, McGraw Hill Co, Newyork, 2010.

4. Rajiv Dutta, Fundamentals of Biochemical Engineering, First Edition, Springer, 2008.

#### **Reference Books:**

- 3. Jens Nielsen, John Villadsen and Gunnar Liden, Bioreaction Engineering Principles, Second edition, Kluwer Academic/Plenum Publishers, Newyork, 2003.
- 4. GhasemNajafpour, Biochemical Engineering and Biotechnology, Elsevier, 2007.

#### **E-References:**

2. http://nptel.ac.in/courses/103105054/

#### Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3										1	1	1	
CO 2	2	3		1					1			1	2	
CO 3		1	3									2	3	1
CO 4		1	2									3	1	2
CO 5	1	2	3	1								2	1	3
	6	7	8	2	0	0	0	0	1	0	1	9	8	6

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

#### Mapping of Subjects with POs

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Original Value	6	7	8	2	0	0	0	0	1	0	1	9	8	6
Scaled Value	2	2	2	1	0	0	0	0	1	0	1	3	2	2
$1-5 \rightarrow 1$	1,		6 – 1	$10 \rightarrow 2$	2,		11 -	$15 \rightarrow$	• 3					

					L	Т	Р	С
v	BT £	504			<u> </u>	0	<u>г</u> 0	<u>C</u>
Δ	ы.		PLANT BIOTECHNOLOGY		5	v	U	5
C	Р	A			L	Т	Р	Н
3	0	0			3	0	0	3
	÷	-	Cell biology, Genetics and Molecular biology		•	v	U	J
			ectives:					
			ion of this course, the students					
		_	have understand the fundamentals of plant cells.					
	• V	Vould	have learn the techniques in Plant Tissue Culture.					
	• V	Vould	have understood various techniques of gene transfer i	n plants.				
	• V	Vould	have learn production of Biomolecules from plants fo	r various ap	plicat	ions.		
			Course Outcomes	Domai	n	]	Level	
Afte	er the	e comp	letion of the course, students will be able to					
CO			e the plant genome and knows various terminology	Cognitive		Remen	nber	
CO.	r		to plant tissue culture.	_		Under		
CO	, ,		e Fundamentals of plant cells and plant tissue	Cognitive		Remei		
	C		and <i>knows</i> various media for tissue culture.			Under		
CO	•	-	re the various gene transfer methods in plants and	Cognitive		Remei		
	K		each other with its pros and cons	6		Under		
CO	1	Relate	and <i>Analyze</i> various vectors and genetic	Cognitive		Under		
			lation techniques			Analy: Under		
CO			and <i>Apply</i> Herbicide tolerance pesticide, GMOs lecular farming.	Cognitive		Apply		
	a		Course content				Hours	
Uni	t-I _	Intro	duction to Plant Tissue Culture				9	
			biotechnology – Plasticity and totipotency - History	of plant ti	ssue c	ulture –	Types	s and
			tissue culture media – Role of plant growth regul					
			issue culture – kinetics of growth and nutrient optimized					
		al vari			•			
Uni	t-II -	– In vi	tro Propagation				9	
• -		-	tissue culture -Regeneration of plants-Organogen			-	-	
			Callus, cell-suspension culture, shoot and root tip c					
			culture, Anther culture and haploid production - p					
		•	and cybrid and regeneration of protoplast	– Germp	lasm	conserv	ation	and
		rvatio					0	
			nt Breeding Techniques	1		<i>I</i> - 1 1	<u>9</u>	1
			mplex inheritance - back cross – selection marker and					
			R based SSR markers - Marker-Assisted selection, H Different strategies to achieve, strategy to generate	•	-			
		-	ns – Production of marker free transgenic plants; plast	0.1		-	is and	the fi
	-		netic Transformation of Plants		mation		9	
			mediated gene transfer – Crown gall disease, Ge	enes involv	ed in	DNA 1	-	r. Ti
			smid - Binary vector system - Plant viruses and differ					
-		-	ower mosaic virus – Direct gene transfer metho	• •				
<u>.</u>			<u> </u>		<u> </u>	-		

electroporation. Indirect gene transfer techniques.

V – Applications of Plant Biotechnology

Molecular farming/ Pharming of proteins – Bioreactors for recombinant protein, Secondary metabolite production using plant cell culture. Antisense technology in crop improvement - Therapeutic/Industrial applications of plant products - Plant vaccines, custom-made antibodies, Transgenic plants - their issues and solutions.

9

Lecture	Tutorial	Practical	Total
45	0	0	45

#### **Text Books:**

- 3. Slater A., Nigel W., Scott, and Fowler MR., Plant biotechnology: The Genetic Manipulation of Plants, Oxford University Press, London, 2nd Edition, 2008.
- 4. Neal Stewart, Jr., Plant Biotechnology and Genetics: Principles, Techniques, and Applications. John Wiley & Sons Inc. USA, 2008.

### **Reference Books:**

- 4. Chawla HS. Introduction to Plant Biotechnology, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi, 2nd Edition, 2003.
- 5. Neumann, Karl-Hermann, Ashwani Kumar, and Sudhir K. Sopory. Recent Advances in Plant Biotechnology and Its Applications: Prof. Dr. Karl-Hermann Neumann Commemorative Volume. IK International Pvt Ltd, 2008.
- 6. Hammond, John, Peter McGarvey, and VidadiYusibov, eds. Plant biotechnology: new products and applications. Vol. 240. Springer Science & Business Media, 2012.

### **E-References:**

2. http://www.ncbi.nlm.nih.gov/books/NBK26851/

## Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	0	1	1	2	1	0	0	1	1	1	3	3	3
CO 2	3	2	2	2	3	2	1	1	2	1	1	2	2	2
CO 3	2	1	3	1	2	2	1	0	2	2	1	2	2	2
CO 4	3	2	2	2	2	2	1	1	1	1	0	3	2	2
CO 5	3	3	3	2	3	2	3	2	2	2	2	3	1	1
	13	8	11	8	14	9	5	4	8	7	5	13	10	10

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

### Mapping of Subjects with POs

	PO	PO	PO	PO	PO	PO	РО	PO	PO	PO1	<b>PO1</b>	PO1	PSO	PSO
	1	2	3	4	5	6	7	8	9	0	1	2	1	2
Origina l Value	13	8	11	8	14	9	5	4	8	7	5	13	10	10
Scaled Value	3	2	3	2	3	2	1	1	2	2	1	3	2	2
$1-5 \rightarrow$	$1 - 5 \rightarrow 1, \qquad \qquad 6 - 10 \rightarrow 2,$						11 -	$15 \rightarrow$	3					

	BT 5(	)5A	FC	OOD BIOTECHNOLOGY		L         T         P         C           3         0         0         3						
С	Р	Α	-		1							
3 DD1		0	<u> </u> TF.			3 0 0 3						
			TE: - ectives:									
			on of this course, the	students								
C po		-		the application of biotechnolog	gy in animal	plant and food						
		oduct		······································	8,	, <b>F</b>						
(	-			cted industrial food biotechnolog	y processes							
				cted classical fermentation proces		scribe how						
			ation can deliver nut	-								
Will be able to understand safety aspects of fermented food products												
Course Outcomes         Domain         Level												
After the completion of the course, students will be able to												
<b>CO1:</b> <i>Know</i> the principles and <i>defines</i> the concepts of food biotechnology. Cognitive Remember												
CO	2: De	scribe	the role of microbes	s associated with food products.	Cognitive	Understand						
	3: 0 luctio		s the methods fo	r Genetically modified food	Cognitive	Analyze						
			and <i>compiles</i> th d packaging	ne various methods of food	Cognitive	Understand						
CO	5: De	scribe	the importance of fo	ood quality and regulations	Cognitive	Evaluate						
τ	J <b>nit-l</b>	[ ]	Introduction to foo	d biotechnology		9						
				nce of food biotechnology - B								
imp				elf life of commercialized fruits	and vegetab	oles – Functiona						
-				otics and Nutraceuticals.								
food			Utilization of micro			9						
food U	nit-I	Unit-IIUtilization of microorganisms in food industries9Fermented dairy products: Cheese, Yoghurt –Fermented food products – Natto, Miso, Sufu, meat										
food U Ferr	nente	d dair	y products: Cheese,									
food U Ferr and	nente sausa	d dair .ges –	y products: Cheese, Single cell protein p	roduction-Cocoa, Tea and Coffe		n.						
food U Ferr and U	nente sausa <b>nit-I</b>	d dair ges – II	y products: Cheese, Single cell protein p Genetically modifie	roduction– Cocoa, Tea and Coffe ed food products	e fermentatio	n. 9						
food U Ferr and U Herl	nente sausa <b>nit-I</b> bicide	d dair ges – II – tolera	y products: Cheese, Single cell protein p Genetically modific ant Soybean – Insect	roduction– Cocoa, Tea and Coffe ed food products t resistant Corn – Altered fatty ac	e fermentatio	n9						
food U Ferr and U Herl resis	nente sausa <b>nit-I</b> bicide stant l	d dair ges – II – tolera Plum –	y products: Cheese, Single cell protein p Genetically modific ant Soybean – Insect - Vitamin enriched C	roduction– Cocoa, Tea and Coffe ed food products t resistant Corn – Altered fatty act Golden rice – Faster maturation Co	e fermentatio	n. 9 n Canola – Viru						
food U Ferr and U Herl resis	nente sausa <b>nit-I</b> bicide stant l <b>nit-I</b>	d dair ges – II   tolera Plum – V	y products: Cheese, Single cell protein p Genetically modifie ant Soybean – Insect - Vitamin enriched C Food Preservation	roduction– Cocoa, Tea and Coffe ed food products t resistant Corn – Altered fatty ac Golden rice – Faster maturation Co and Packaging	e fermentatio id compositio oho Salmon.	n. 9 n Canola – Viru 9						
food U Ferr and U Herl resis U Med	nente sausa <b>nit-I</b> bicide stant l <b>nit-I</b> chanis	d dair ges – II – tolera Plum – V – Sms of	y products: Cheese, Single cell protein p Genetically modifie ant Soybean – Insect - Vitamin enriched C Food Preservation	roduction– Cocoa, Tea and Coffe ed food products t resistant Corn – Altered fatty act Golden rice – Faster maturation Co and Packaging od preservation by low-temp: Refi	e fermentatio id compositio oho Salmon. rigeration, fre	n. 9 n Canola – Viru 9 ezing and freeze						
food U Ferr and U Herl resis U Mec dryi	nente sausa <b>nit-I</b> bicide stant l nit-IV chanis ng –	d dair ges – II tolera Plum – V W Foo	y products: Cheese, Single cell protein p Genetically modifie ant Soybean – Insect - Vitamin enriched C Food Preservation a food spoilage – Foo d preservation by	roduction– Cocoa, Tea and Coffe ed food products t resistant Corn – Altered fatty ac Golden rice – Faster maturation Co and Packaging od preservation by low-temp: Refi heating: drying, osmotic dehy	e fermentatio id compositio oho Salmon. rigeration, fre /dration, blau	n. 9 n Canola – Viru 9 ezing and freeze nching, canning						
food U Ferr and U Herl resis U Mec dryii	nente sausa <b>nit-II</b> bicide stant l nit-IV chanis ng – euriza	d dair ges – II – tolera Plum – V – Too Foo ation,	y products: Cheese, Single cell protein p Genetically modifie ant Soybean – Insect - Vitamin enriched C Food Preservation a food spoilage – Foo d preservation by sterilization – No	roduction– Cocoa, Tea and Coffe ed food products t resistant Corn – Altered fatty ac Golden rice – Faster maturation Co and Packaging od preservation by low-temp: Refn heating: drying, osmotic dehy n-thermal preservation: ionizing	e fermentatio id compositio oho Salmon. rigeration, fre /dration, blan g radiation,	n. 9 on Canola – Viru 9 ezing and freeze nching, canning high hydrostatio						
food U Ferr and U Herl resis U Mec dryii past pres	nente sausa <b>nit-II</b> bicide stant l nit-IV chanis ng – euriza	d dair ges – II – tolera Plum – V – Too ation, pulsec	y products: Cheese, Single cell protein p Genetically modifie ant Soybean – Insect - Vitamin enriched C Food Preservation a food spoilage – Foo d preservation by sterilization – No	roduction– Cocoa, Tea and Coffe ed food products t resistant Corn – Altered fatty act Golden rice – Faster maturation Co and Packaging od preservation by low-temp: Refi heating: drying, osmotic dehy n-thermal preservation: ionizing kaging of foods: packaging mater	e fermentatio id compositio oho Salmon. rigeration, fre /dration, blan g radiation,	n. 9 on Canola – Viru 9 ezing and freeze nching, canning high hydrostatio						
food U Ferr and U Herl resis U Mec dryii past pres	nente sausa <b>nit-I</b> bicide stant I <b>nit-I</b> chanis ng euriza sure, <b>Jnit-V</b>	d dair ges – II   tolera Plum – V   Sms of Foo ation, pulsec	y products: Cheese, Single cell protein p Genetically modifie ant Soybean – Insect - Vitamin enriched C Food Preservation so food spoilage – Foo d preservation by sterilization – No d electric field – Pacl Food safety and reg	roduction– Cocoa, Tea and Coffe ed food products t resistant Corn – Altered fatty act Golden rice – Faster maturation Co and Packaging od preservation by low-temp: Refi heating: drying, osmotic dehy n-thermal preservation: ionizing kaging of foods: packaging mater	e fermentatio id compositio oho Salmon. rigeration, fre /dration, blan g radiation, ials, packagin	n. 9 n Canola – Viru 9 ezing and freeze nching, canning high hydrostation g atmosphere 9						
food U Ferr and U Herl resis U Mec dryi past pres U Safe	nente sausa <b>nit-I</b> bicide stant l <b>nit-I</b> chanis ng – euriza sure, <b>Jnit-V</b> cty of	d dair ges – II   tolera Plum – V   Sms of Food ation, pulsec 7   ferm	y products: Cheese, Single cell protein p Genetically modifie ant Soybean – Insect - Vitamin enriched C Food Preservation so food spoilage – Foo d preservation by sterilization – No d electric field – Pacl Food safety and reg	roduction– Cocoa, Tea and Coffe ed food products t resistant Corn – Altered fatty ac Golden rice – Faster maturation Co and Packaging od preservation by low-temp: Refi heating: drying, osmotic dehy n-thermal preservation: ionizing kaging of foods: packaging mater gulations	e fermentatio id compositio oho Salmon. rigeration, fre /dration, blan g radiation, ials, packagin	n. 9 n Canola – Viru 9 ezing and freeze nching, canning high hydrostation g atmosphere 9						
food U Ferr and U Herl resis U Mec dryi past pres Safe Con	nente sausa <b>nit-I</b> bicide stant l <b>nit-I</b> chanis ng – euriza sure, <b>Jnit-V</b> cty of	d dair ges – II   tolera Plum – V   ms of Food ation, pulsec 7   ferm coints (	y products: Cheese, Single cell protein p Genetically modifie ant Soybean – Insect - Vitamin enriched C Food Preservation a food spoilage – Foo d preservation by sterilization – No d electric field – Pact Food safety and reg ented foods – App	roduction– Cocoa, Tea and Coffe ed food products t resistant Corn – Altered fatty ac Golden rice – Faster maturation Co and Packaging od preservation by low-temp: Refi heating: drying, osmotic dehy n-thermal preservation: ionizing kaging of foods: packaging mater gulations	e fermentatio id compositio oho Salmon. rigeration, fre /dration, blan g radiation, ials, packagin	n. 9 n Canola – Viru 9 ezing and freeze nching, canning high hydrostation g atmosphere 9						

#### **TEXT BOOKS:**

3. Byong H. Lee., Fundamentals of food biotechnology. John Wiley & Sons, 2014.

**REFERENCE BOOKS:** 

1. Bhatia, S. C. (2017). Food biotechnology. Wpi Publishing.

2. Ray B., "Fundamental Food Microbiology", Third Edition, CRC Press LLC, 2003.

3. Shetty, Kalidas, et al., eds. Food biotechnology. CRC Taylor & Francis, 2006.

### **E- REFERENCES**

- 4. http://nptel.ac.in/courses/103107088/
- 5. http://nptel.ac.in/courses/103103029/34

## Mapping of COs with POs

	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	2	1	3	1	2						3	3	3
CO 2	2	1	3	2	2	2						2	2	2
CO 3	2		3	2	3	1					2	2	2	2
CO 4	2		2	2	3	1					3	3	2	2
CO 5	2		3		3	3						3	1	1
	10	3	12	9	12	9					5	13	10	10

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

## Mapping of Subjects with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
Origina l Value	10	3	12	9	12	9	0	0	0	0	5	13	10	10
Scaled Value	2	1	3	2	3	2	0	0	0	0	1	3	2	2
$1-5 \rightarrow$	$1-5 \rightarrow 1$ ,			$10 \rightarrow$	2,		11 -	$15 \rightarrow$	3					

x	BT 5	05B				L 3	Т 0	P 0	C 3				
	DIJ	050	AGRICI	<b>JLTURAL BIOTECHNOLOGY</b>	7	5	U	v	5				
С	P	Α	-		-	L	Т	P	Н				
3	0	0				3	0	0	3				
PR	ERE	QUIS	<b>ITE:</b> -										
Lea	rnin	g Obj	ectives:										
Upo	on co	mpleti	on of this course, the	e students									
	• V	Vill be	able to understand t	he application of biotechnology in	Agricult	ural fi	elds						
	• V	Vill be	able to describe sele	cted industrial agri biotechnology	y processe	s							
			Course Ou	Itcomes	Domai	in	]	Level					
Aft	er the	comp	letion of the course,	students will be able to									
CO	<b>CO1:</b> <i>Know</i> the principles and <i>defines</i> the concepts of Agricultural biotechnology.CognitiveRemember												
CO2:Describe the role of plant breeding in agriculture.CognitiveUnderstand													
<b>CO3</b> : <i>Outlines</i> the tools and techniques of genetic engineering Cognitive Understand													
<b>CO4:</b> <i>Discuss</i> and <i>compiles</i> the biodiversity in agricultural field Cognitive Understand													
CO	5:De	scribe	the importance of IF	PR in agricultural products.	Cognit	ive	Evaluate		te				
	Unit-		Genomes and Gene					9					
				alysis, Genome organization - C	C-Value p	oara, c	lox, (	Cot c	urves				
	<u> </u>	i i	Chromosome behav										
τ	U <b>nit-</b> I	Π	Agriculture and Pla	ant Breeding				9					
Bre	eding	g of o	crops, Heterosis, A	pomixis, Mutations, Polyploidy	in crop	o imp	rover	nent,	and				
Prir	nciple	s of ir	tegrated Pest Manag										
	J <b>nit-</b> ]			ues of Genetic Engineering				9					
				oncept of Genetic makers; gene									
-	-		_	inheritance. Genetic, Chromo					-				
	-			g; Genome Analysis: Genome p									
				earch engines, Sequence Analysis	and Mole	ecular	Phylo		/.				
	J <b>nit-l</b>		Biodiversity					9					
				ersity; Species and Population									
			•	ngered plants, endemism and Red	l Data Bo	ook, B	Biodiv	ersity	y and				
			ns of plants; Biodive										
	Unit-		IPR on Agricultura		•			9					
				o Indian Flora- Basmati Rice, Tur	meric and	I Neer							
	ECTU	JKE	TUTORIAL	PRACTICAL			TOT						
	45		0	0			4	•					
-													

## **TEXT BOOKS:**

4. Ahindra Nag., Text Book of Agricultural Biotechnology. PHI Learning Publisher New Delhi, 2008.

## **REFERENCE BOOKS:**

1. Anshuman Singh, Ashutosh Singh, Ashutosh Kumar Srivastava2. Ray B., "Agricultural Biotechnology" Medtech Publisher, Edition-1, 2019

## **E- REFERENCES**

https://nptel.ac.in/content/syllabus_pdf/102103016.pdf 6.

### Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	2	1	3	1	2						3	3	3
CO 2	2	1	3	2	2	2						2	2	2
CO 3	2		3	2	3	1					2	2	2	2
CO 4	2		2	2	3	1					3	3	2	2
CO 5	2		3		3	3						3	3	1
	10	3	12	9	12	9					5	13	12	10

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

### Mapping of Subjects with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
Origina l Value	10	3	12	9	12	9	0	0	0	0	5	13	12	10
Scaled Value	2	1	3	2	3	2	0	0	0	0	1	3	2	2
$1-5 \rightarrow$		6 –	$10 \rightarrow$	2,		11 –	$15 \rightarrow$	3						

 $6-10 \rightarrow 2$ ,  $1-5 \rightarrow 1$ ,

XBT505C	PHARMACEUTICAL BIOTECHNOLOG	GY	L 3 L	T 0 T	P 0 P	C 3 H							
3 0 0		-	3	0	0	3							
	Biochemistry, Immunology, r-DNA technology		•	U	Ū								
Learning Ob													
	<b>tion of this course, the students</b> I able to understand principles of biotechnology in pharm	magautical	produ	ot									
	pment.		produ	Cl									
	apply advanced biotechnology methods in novel drug	developmer	nt										
	able to review the production processes for antibiotics.	-		ids an	d								
steroi	1 1	, vituiliiis, t	anturo	ius un	u								
	Course Outcomes	Domain	L	L	evel								
After the com	pletion of the course, students will be able to		1										
CO1 <i>ident</i> biote	<i>ify</i> the potential avenues and requirements from the chnologists in pharmaceutical industries and <i>describe</i>	Cognitive		Analy: Under		l							
CO2 Outl	<i>e</i> the scope and applications of biotechnology in pharmacy												
CO3 Desc	<i>ribe</i> various adverse effects of drugs	Cognitive		Analy: Under		l							
thera	<i>uin</i> the manufacturing process for various peutical products including vaccines, enzymes, eukins, hormones	Cognitive		Analy: Under		1							
	<i>prehend</i> the methods applied to test the quality of and other biopharmaceuticals	Cognitive		Analy: Under		1							
I- Introducti					7								
	o Pharmaceutical industry & development of drugs; t	• •	-	-									
	Pharmaceutical Biotechnology and Drug discovery.												
pharmaceutic	v in pharmacy, biological /research advances an	iu approv	eu b	lologi	cals	ior							
<b>A</b>	<b>I Their Metabolism</b>				10								
	al properties of drugs, factors modifying drug	action Pl	harms		lynan	nics							
•	tics and drug metabolism.			u	Jinai								
*	nd Their Interaction				10								
0	cts of drugs and drug toxicology: Reproductive	toxicity a	and	Terato	ogeni	city,							
	Carcinogenicity, Drug tolerance, Drug intolerance, d phylaxis, biological effects of drug abuse and drug dep		, dru	g indu	iced	side							
	on of Biopharmaceuticals				11								
	itical and biological drug development, Manufac	cturing of	biop	harma	aceut	ical,							
	roteins and peptides. Recombinant growth hormone	-	facto	rs, th	erape	eutic							
monoclonal a	ntibodies, therapeutic enzymes and their application in h	nealth care.											
V- Testing a	nd Analysis of Biopharmaceuticals				7								

Pharmaceutical Testing, Analysis and Control: Analysis of pharmaceuticals using physical, chemical and biological methods, quality assurance and control, stability of pharmaceutical products

Lecture	Tutorial	Practical	Total
45	0	0	45

#### **Text Books:**

- 3. Purohit, Kulkarni, Saluja—Pharmaceutical biotechnology, Agrobios publishers, 2003
- 4. Pharmaceutical biotechnology edition2 by crommel, Freeman publishers, 2004

### **References:**

- 4. Crommelin.D.J.A, Robert D. Sindela, Bernd Meibohm "Pharmaceutical Biotechnology: fundamentals and applications", Informa Healthcare, 2008.
- 5. Pharmaceutical biotechnology:drug discovery and clinical applications by Kayser,Wiley publishers, 1st edition 2007

6. Katzung B.G. Basic and Clinical Pharmacology,(6th Ed) Prentice Hall of Intl., 1995

## **E- References:**

2. https://archive.org/details/PharmaceuticalBiotechnology/page/n111

## Mapping Of COs and POs

	Program Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	-	1	1	2	2	-	-	1	1	1	1	0	0
CO2	1	1	1	1	2	2	1	2	1	2	2	2	1	0
CO3	2	2	2	2	1	2	2	-	2	2	1	1	2	0
CO4	2	1	3	2	2	3	2	-	1	1	-	-	3	0
CO5	2	3	2	2	3	3	2	2	2	2	1	1	3	0
	9	7	9	8	10	12	7	4	7	8	5	5	9	0

## **Mapping of Subject Vs POs**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
Origina l value	9	7	9	8	10	12	7	4	7	8	5	5	9	0
Scaled to 0,1,2,3 scale	2	2	2	2	2	3	2	0	2	2	0	0	2	0

Scale: 3- high, 2 – Medium, 1 - Low, 0 – not related

					L	Т	Р	С		
XB	BT 5	507			0	0	1	1		
			<b>BIOANALYTICAL TOOLS LABORATO</b>	RY	-	-				
С	Р	Α			L	Т	Р	Η		
0.5	1	0.5			0	0	2	6		
			ectives:							
Upon		-	on of this course, the students							
٠			able to understand the principles of instrumentation							
•	V	Vill be	able to impart the knowledge of different techniques			T	01			
A C	41		Course Outcomes	Domai	in		Level			
After	the	comp	letion of the course, students will be able to	<u> </u>		•	1 .			
CO1	E	xplain	the basics and fundamentals of analytical	Cogniti Psychom			pplying d Resp			
COI	te	echniqu	ues and <i>describe</i> the various calibration techniques.	Affecti			espond			
				Cogniti			oplying			
CO2			<i>e</i> the spectrophotometric methods and <i>perform</i> the	Psychom			d Resp			
	e	xperim	ents related to spectroscopy.	Affecti			espond			
	I	ndore	tand the immunological techniques and apply it in	Cogniti	ive	A	pplying	5		
CO3			applications in biotechnology.	Psychom			d Resp			
	v	unous	applications in oloceennology.	Affecti			espond			
<b>a a a</b>	K	<b>now</b> t	he principle of instrumentation and <i>applications</i> of	Cogniti			pplying			
CO4			imaging techniques in biological field.	Psychom			d Resp			
				Affecti Cogniti			espond			
CO5		-	uish the various separation techniques, Classify the	Psychom			pplying d Resp			
005	various techniques of Chromatography and Electrophoresis Affective									
	1			1110011			espond	-		
S.N	0		List of Experiments				CC	)s		
1		Valida	ation of accuracy and precision of an instrument used	in the labo	ratory		CC	<b>)</b> 1		
2		Preparation of calibration curve in spectrophotometry								
2		Datas		4 4			CO1			

$\begin{array}{c c} \mathbf{HOURS} & 0 & 30 \end{array}$											
	HOURS	TUTORIAL	PRACTICAL	TC	DTAL						
10 Separation of proteins by SDS-Polyacrylamide gel Electrophoresis											
9	Separation of nucleic acids by Agarose gel Ele	ctrophoresis			CO5						
8	Separation of compounds using Column Chron	natography			CO5						
7	7 Qualitative analysis of compounds by Thin Layer Chromatography										
6	6 Image analysis by electron microscopy										
5	Immuno diffusion assay				CO3						
4	Interpretation of FTIR spectra				CO2						
3	Determination of drug components by Ultravic	olet Spectrophoto	ometry		CO2						
Z	Preparation of canoration curve in spectrophot	ometry			COI						

## Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	2	1	0	0	1	0	0	0	0	2	0	1
CO 2	3	3	2	2	0	0	1	0	0	0	0	0	0	1
CO 3	3	2	2	1	0	0	1	0	0	0	0	0	0	1
<b>CO 4</b>	2	3	2	2	0	0	0	0	0	0	0	1	0	1
CO 5	3	2	3	1	0	0	1	0	0	0	0	1	0	1
	14	12	11	7	0	0	4	0	0	0	0	4	0	5

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

### Mapping of Subjects with POs

	PO 1	PO 2	PO 2	PO 4	PO 5	PO	PO 7	PO	PO	PO1	PO1	PO1	PSO 1	PSO 2
Origina l Value	14	12	11	4 7	0	0	4	0	0	0	0	4	0	5
Scaled	3	3	3	2	0	0	2	0	0	0	0	2	0	2
	1			10 .			11	15 .	2					

COUR	SE CODE	XB	BT508			L	Т	Р	С
COUR	SE NAME	Bio reaction Engi	ineering	Laboratory		0	0	2	2
	EQUISITES		-			L	Т	Р	Н
C:P:A		0.5:1:0.5				0	0	2	6
Upon c	-	<b>FIVES</b> his course, the students a to demonstrate aseptic			-		-	ge of Bi	oreaction
	С	OURSE OUTCOMES			D	OMAI	N	LE	VEL
After th	ne completion o	f course the students will	l be able	to					
CO1	<i>Experiment</i> a Extraction	nd <i>Demonstrate</i> enzyme	e kinetic	s M-M and	Psy	ognitiv chomo ffective	or	Guided	ply Response pond
CO2	<b>Understand</b> a properties	and <i>Perform</i> enzyme a	activity	at different	Psy	ognitive chomo ffective	or	Guided	ply Response pond
CO3	<i>Practice</i> and <i>L</i>	<b>Demonstrate</b> enzyme imm	nobiliza	tion	Psy	ognitivo chomo ffectivo	or	Guided	ply Response pond
CO4	<i>Perform</i> and <i>I</i>	Determine growth kinetic	cs		Psy	ognitivo chomo ffectivo	or	Guided 1	ply Response pond
CO5	<b>Understand</b> a wine production	nd <i>Experiment</i> on alcol on	hol conc	entration in	Psy	ognitive chomo ffective	or	Guided 1	ply Response pond
S.No		List of	Experin	nents					COs
1	Study of M-M	kinetics and determinat	ion of M	I-M constants					CO1
2	Extraction of e	enzyme from fruits and v	egetable	e					CO1
3	Effect of temp	erature on Enzyme Activ	vity.						CO2
4	Effect of pH o	n Enzyme Activity.							CO2
5	Effect of subst	rate concentration on Er	nzyme A	ctivity.					CO2
6	Enzyme immo	bilization by physical ac	lsorption	1.					CO3
7	Enzyme immo	bilization by Gel Entrap	ment.						CO3
8	Study of Prod	uction of growth and/or 1	non-grov	wth associated	d pro	ducts.			CO4
9	Study of Micr	obial Growth kinetics an	d estima	tion of Mono	d pa	rameter	s.		CO4
10	Estimation of	alcohol concentration in	wine pr	oduction.					CO5
	nce:1. Bailey . w Hill Co, New	J.E. and Ollis D.F, Bio york, 2010.	ochemica	al Engineerin	ng F	undame	ntals,	Second	d edition
	7	•	OUDS	TUTORIA	[ ]	PRACT	ICA	L TO	ГAL
		Н	OURS	0		3	)		30

## Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3										1	1	1	
CO 2	2	3		1					1			1	2	
CO 3		1	3									2	3	1
CO 4		1	2									3	1	2
CO 5	1	2	3	1								2	1	3
	6	7	8	2	0	0	0	0	1	0	1	9	8	6

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

## Mapping of Subjects with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Original Value	6	7	8	2	0	0	0	0	1	0	1	9	8	6
Scaled Value	2	2	2	1	0	0	0	0	1	0	1	3	2	2

 $1-5 \rightarrow 1$ ,

 $6-10 \rightarrow 2, \qquad \qquad 11-15 \rightarrow 3$ 

C 0.66 PRER	BT 509 P A 0.66 0.66 EQUISITE:- RSE OUTCOI		- II	L         T         P         C           0         0         0         1		
		Course Outcomes	Domain	Level		
On the	successful co	mpletion of the course, students will be a	ible to			
CO1	Relate classr	oom theory with workplace practice	Cog	Understand		
CO2	Comply with business prac	Factory discipline, management and trices.	Aff	Response		
CO3	Demonstrate	s teamwork and time management.	Aff	Value		
CO4		display hands-on experience on practical d during the programme.	Phy	Perception Set		
CO5		he tasks and activities done by technical nd oral presentations.	Cog	Evaluate		

## Mapping COs with POs

mapp														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	2													
CO2							1	3			1		1	1
CO3									3	1	3		3	3
CO4		1	2	1	3								1	1
CO5				3						3			1	1
Total	2	1	2	4	3	0	1	3	3	4	4		6	6
Scale	1	1	2	1	1	0	1	1	1	1	1	1	2	2
d														

1 - Low, 2 – Medium, 3 – High

# **VI Semester**

XBT601		01		L 3	<u>Т</u> 0	<u>Р</u> 0	C 3			
			ANIMAL BIOTECHNOLOGY	0	U	U				
С	P	Α		L	Т	Р	Η			
2.5	0	0.5		3	0	0	3			
Prerequisite: Nil										
	_		ective: Upon completion of this course, the student	S						
<ul> <li>Would have learnt animal cell culturing techniques</li> </ul>										
<ul> <li>Would have learnt designing animal cell culture lab</li> </ul>										
<ul> <li>Would have learnt knock-out mechanisms of genes</li> </ul>										
<ul> <li>Would have learnt techniques for production of transgenic animals and cloning</li> </ul>										
			Course Outcomes	Domain		Level				
Afte	r the	comp	letion of the course, students will be able to							
		_	animal cell culture media and animal cell culture	Cognitive	U	nder	stand	1		
tech	niqu	es.		U U						
<b>CO2:</b> <i>Describe</i> various gene transfer methods in animal cells. Cognitive						valua	ate			
CO	3:An	alyze	various micromanipulation techniques and	Cognitive	A	Analyze				
<b>reproduce</b> them in fertilization technology. Affective						Respond				
<b>CO4</b> : <i>Distinguish</i> various methods and techniques for production Cognitive						Understand				
			nimals and cloning.							
CO5: Describe manipulation strategies to improve livestock Cognitive						Understand				
production including meat and milk production										
			Culture Techniques	11 1 .1			9			
			a composition and growth conditions; Animal ce	ell and tise	sue	prese	ervat	ion;		
			l non-anchorage dependent cell culture.							
			ents in the development of cell and tissue culture							
15. Advantage of tissue culture										
16. Sub culture of continuous line growth and Cell line Characterization										
17. Extracellular Matrix and its role 18. Cell Interaction and signalling pathways										
<ol> <li>18. Cell Interaction and signalling pathways</li> <li>19. Designing of cell culture laboratory</li> </ol>										
20. Design of $CO_2$ incubator and laminar flow – safety cabinets										
$20.$ Design of $CO_2$ incubator and raminal now – safety cabinets 21. Identification of microbial contamination										
22. Decontamination techniques										
Unit-II- Gene Transfer Techniques							9			
Kinetics of cell growth; Micro & macro-carrier culture; Hybridoma technology; Stem cell										
technology; Animal cloning; Transgenic animals; Knock-out and knock-in animals.										
23. Growth of animal cells culture										
24. Knock-out mechanism using computation biology										
			tro Fertilization and Embryo Transfer				9			
<i>invitro</i> fertilization and its limitations - Artificial insemination, Super ovulation, Embryo										
splitting, Biopsy and Sexing of embryos and Embryo transfer- Embryo cryopreservation										
techniques – Limitations in embryo transfer - Breeding of farm animals.										

	bryo	transf	er; htt	ps://ww	ww.ua	ex.edu/	/public	ations	/pdf/fs	a-3119.	.pdf				
25. Embryo transfer; https://www.uaex.edu/publications/pdf/fsa-3119.pdfUnit-IV- Manipulations for Product Improvement9												9			
Manipula	ation o	of Gro	wth h	ormon	e; Rol	le of S	Somato	tropic	and 7	Гhyroid	l hormo	one in	growth	-	
Probiotic	es as g	rowth	prom	oters;	Ideal of	charact	eristic	s, Mo	de of	action	and use	es of pr	robiotic	s;	
Manipula			tion –	Lacto	genesi	s and g	galacto	poiesi	s, woo	ol grow	th and a	rumen 1	nicrobi	al	
digestive	•														
					he lab	- theor	retical	and pr	actical						
Unit-V-													9		
Scope an															
transgeni															
transfer -														ic	
animals a			s for p	oducii			utically	<i>impo</i>			nds and				
Lecture				Tutorial				Practical				Total			
	45				0					0		4	45		
Text Boo	oks:														
3. Freshr	ney. R.	I., Cu	lture o	f Anin	nal Ce	lls: A r	nanual	of Ba	sic tec	hniaue.	John .	Wileva	and son	s.	
6th Ed	•										, ,			-,	
. Rama	,		mal B	iotech	nology	: Rece	ent Coi	ncepts	and D	Develop	ments.	MJb Pi	ublisher	s.	
Chenn					8,			r		- · · · · ·	,			~,	
	,		,												
Reference 2 Most		D W	Anima		Cultu	rat Dre	oction	Annre	ach (	Ovford	Univer	sity Pre	No. No.		
		k. w., dition,			Cunu	lie. Fla	actical	Арри	Jacii, V	Oxioiu	Univer	Sity FIG	ess, me	w	
4.Holla	·	,			Anii	mal Di	iotoohr		and	Ethios	Spring	or Vorl	ag Na	***	
		lition,		011, A.	, Am	nai Di		lology	anu	Lunes,	Spring		ag, ne	w	
E Refere		inition,	1770.												
		ww hie	otechn	പിറും	lu com	n/questi	ion ha	nk au	estion	answe	r html				
	IPTEL				mate	-			Coulon						
			COUITS			-man	or	-		sgenic	2	nimals	:	15	
bi	ioreaci		cours	-			or )2/103/	1	Tran	sgenic	8	nimals	;	as	
		ors:htt		-		rses/10		1	Tran	0	8	nimals		as	
COs T		ors:htt		-				1	Tran	0	a PO11	nimals PO12	PSO1		
	Vs PC	ors:htt <b>)s</b>	ps://nj	otel.ac.	in/cou	rses/10	)2/103/	n /10210	Tran )3013/					PSC	
COs	Vs PC PO1	ors:htt )s PO2	ps://nj PO3	ptel.ac.	in/cou PO5	PO6	)2/103, PO7	n /10210 PO8	Tran )3013/ <b>PO9</b>	PO10	P011	PO12	PSO1	<b>PSC</b> 2	
COs CO1	<b>Vs PC</b> <b>PO1</b> 3	ors:htt Ds PO2 2	ps://np PO3	<b>PO4</b> 2	in/cou PO5 2	PO6 0	<b>PO7</b>	n /10210 PO8 1	Tran )3013/ PO9 2	<b>PO10</b>	<b>PO11</b>	<b>PO12</b> 2	<b>PSO1</b>	<b>PSC</b> 2 1	
COs 7 CO 1 CO 2	Vs PC PO1 3 3	ors:htt           Ds           PO2           2           1	<b>PO3</b> 1 2	<b>PO4</b> 2 1	in/cou PO5 2 2	<b>PO6</b> 0 0	<b>PO7</b> 1 0	n /10210 PO8 1 1	Tran 03013/ PO9 2 0	<b>PO10</b> 1 2	<b>PO11</b> 1 1	<b>PO12</b> 2 3	<b>PSO1</b> 1 2	<b>PS</b> (2) 1 3	
COs 7 CO 1 CO 2 CO 3	Vs PC PO1 3 3 3	ors:htt           Ds           PO2           2           1	<b>PO3</b> 1 2 2	<b>PO4</b> 2 1 3	in/cou PO5 2 2 3	<b>PO6</b> 0 0 2	<b>PO7</b> 1 0 2	PO8 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Tran )3013/ PO9 2 0 2	<b>PO10</b> 1 2 2	PO11 1 2	PO12 2 3 3	<b>PSO1</b> 1 2 3	PS0 2 1 3 2	
COs CO 1 CO 2 CO 3 CO 4	Vs PC PO1 3 3 3 3 3	ors:htt           Ds           PO2           2           1           2           1           2	<b>PO3</b> 1 2 2 2	<b>PO4</b> 2 1 3 2	in/cou PO5 2 2 3 3	<b>PO6</b> 0 0 2 1	PO7 1 0 2 1	PO8 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Tran )3013/ PO9 2 0 2 1	<b>PO10</b> 1 2 2 2 2	PO11 1 1 2 2	PO12 2 3 3 2	<b>PSO1</b> 1 2 3 1	PS0 22 11 33 22 11	
COs CO 1 CO 2 CO 3 CO 4	Vs PC PO1 3 3 3 3 3 3	ors:htt           Ds           PO2           2           1           2           2           3           2           8	PO3 1 2 2 3 10	PO4 2 1 3 2 1 9	in/cou PO5 2 2 3 3 2 12	<b>PO6</b> 0 2 1 2 5	PO7         1           0         2           1         1           4         1	PO8 1 1 1 1 1 1 1	Tran )3013/ PO9 2 0 2 1 1	PO10 1 2 2 2 2 2	PO11 1 1 2 2 2 2	PO12 2 3 3 2 2	<b>PSO1</b> 1 2 3 1 1 1 1	PS0 2 1 3 2 1 9	
COs CO 1 CO 2 CO 3 CO 4	Vs PC PO1 3 3 3 3 3 3 15 PO	ors:htt           Ds           PO2           2           1           2           3           2           3           3	PO3 1 2 2 3 10	PO4 2 1 3 2 1 9	in/cou PO5 2 2 3 3 2 12	<b>PO6</b> 0 2 1 2 5	PO7         1           0         2           1         1           4         1	PO8 1 1 1 1 5	Tran )3013/ PO9 2 0 2 1 1 6	PO10 1 2 2 2 2 9	PO11 1 1 2 2 2 8	PO12 2 3 2 2 12	PSO1 1 2 3 1 1 1 8	as PSC 2 1 3 2 1 9 PSC 1	
COs CO 1 CO 2 CO 3 CO 4 CO 5 Original	Vs PC PO1 3 3 3 3 3 3 15 PO	PO2         2           1         1           2         2           1         2           2         8           1         PO2	PO3 1 2 2 3 10 2 PO3	PO4 2 1 3 2 1 9 8 PO4	PO5 2 2 3 3 2 12 4 PO5	PO6 0 2 1 2 5 7 9 PO6	PO7         1           0         2           1         1           0         2           1         4           PO7         PO7	PO8 1 1 1 1 1 5 PO8	Tran )3013/ PO9 2 0 2 1 1 6 PO9	PO10 1 2 2 2 2 9 PO10	PO11 1 1 2 2 2 8 PO11	PO12 2 3 2 2 12 PO12	PSO1 1 2 3 1 1 1 8 PSO1	PS4 22 11 33 22 11 99 PS4	

Scale: 3- high, 2 – Medium, 1 - Low, 0 – not related 0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

				•		D				
XBT602					T 1	P 0	C 2			
			XBT602 Process Biotechnology – Upstream	– Upstream						
C	D			Т	Т	D	тт			
C 3	<u>Р</u> 0	A 0		L 1	T 2	P	H			
	2	0	3							
		isite: -								
		0	ectives: Upon completion of this course, the students							
			be able to identify the parts of a fermenter							
			know about the media components for fermentation process							
			be able to select the parts of a bioreactor for designing a par	ticular produ	action p	process.	•			
	• \	Nould	be able to design the scale up procedure of a bioreactor.	<b>D</b> •		T a al				
			Course Outcomes	Domain		Level				
CO	1	Recall t	Cognitive	Re	Remember					
CO	/	<i>Demon</i> erment	Ар	Apply						
CO	1	<b><i>Differe</i></b> ystem.	Ap	Apply						
CO	4	<i>leasur</i>	Ар	Apply						
bioprocesses.Explain the scale up procedure of mixing, aeration and know the applicationsCognitiveUnc										
I –			on to process Biotechnology	I		6+3				
			ments of fermentation processes – basic configuration of	fermenter a	nd anci					
			e monitored and controlled- ; Kinetics of cell growth, su							
_			tured and unstructured models; Batch, fed-batch and contin							
<b>II</b> –	Me	dia for	mulation and optimization			6+3				
Steri	lizat	ion of a	air and media, medium requirements for fermentation process	sses, carbon,	nitrog	en, min	erals,			
vitar	nins	and c	ther complex nutrients, oxygen requirements, simple a	and comple	x med	ia, Me	dium			
optir	nizat	tion tec	hniques,							
III – Instrumentation and Process Control:6+3										
Instrumentation, measurement and control of the bioprocess parameter such as temperature, pressure, pH,										
			en, redox, microbial biomass, flow measurement-Agitati							
-			oam, Feedback and feed forward control; Types of control	ollers – prop	ortiona	ıl, deriv	vative			
			ntrol, tuning of controllers Phenomena in Bioreactors		1					
	<b>D</b> ·	6+3								
Flow properties of Fermentation Broths, Factors affecting broth viscosity. Mixing in a Bioreactor – Flow										
-			ver Requirements for Mixing, Un gassed Newtonian Flu			-	-			
Mixing in Fermenters, and Effect of Rheological Properties on Mixing. Application of heat transfer in										
-		-	Heat transfer in Bioreactors, Oxygen requirements of micro	Joial culture	s .Dete	rmnati	10 1101			
	-		ansfer coefficient by various methods. <b>ns to Biological Systems</b>			612				
	uidanat:	6+3								
			deration for constant K La, shear forces, mixing time-Biop ant cell cultures. Case studies on Single Cell protein Produc							
_		_			_	_	_			

on Applications of Bioprocess Engineering.

on repridections of Biopre	Jeess Lingmeering.		
Lecture	Tutorial	Practical	Total
30	15	0	45

#### **Text Books:**

- 4. Schuler and Kargi, Bioprocess engineering. Prentice Hall
- 5. Najafpour, Ghasem. Biochemical engineering and biotechnology. Elsevier, 2015.
- 6. Bailey and Ollis, Biochemical Engineering Fundamentals, McGraw Hill, Co. 2004.

#### **References:**

- 7. Pauline Doran, Bioprocess Principles, Academic press, 2004.
- 8. Neilson J and Villadsen J, Biochemical Engineering Principles I ed, Plenum Press, 2000.
- 9. Stanbury P F Whitaker, A and Hall S.J, Principles of Fermentation Technology 2nd ed, Aditya Book Pvt Ltd, 2001.
- 10. Lee J.M, Biochemical Engineering 2nd ed, Prentice Hall, 2000.

#### **E-References:**

- 4. http://www.nptel.ac.in/syllabus/syllabus.php?subjectId=102107029
- 5. http://users.ox.ac.uk/~dplb0149/publication/NPRBiocatalysisRev.pdf
- 6. http://link.springer.com/book/10.1007%2F978-1-4684-0324-4

						Pl	ROG	RAM	OUI	ГСОМ	ES			
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
<b>CO1</b>	3											1	2	2
<b>CO2</b>	2	3	2		1		1		1		3	2	3	3
<b>CO3</b>	1	2	2	1					1			1	0	0
<b>CO4</b>	1	3	2	3								1	0	0
CO5	1	3	2	3	1		1		2		2		1	1
Total	8	11	8	7	2	0	2	0	4	0	5	5	6	6
ScaledValue	2	3	2	2	1	0	1	0	1	0	1	1	2	2
		1 –	$5 \rightarrow$	1,		6	- 10	$\rightarrow 2$ ,		1	1 – 1	$5 \rightarrow 3$	3	
		0-NoF	Relatio	on,1-	Low I	Relation	on,2-	Mediu	mRe	lation,3	-Higl	hRelat	ion	

X							T	Т	Р	С
~	BT6	<b>603</b>					1	1	<b>10</b>	2
			XBT6	03 PROCESS BIOTECHNOLOG	$\mathbf{F}\mathbf{Y} - \mathbf{Do}$	wnstream		1	v	-
С	Р	Α					L	Т	Р	Η
3	0	0					1	2	0	3
_		isite: -					-		v	
				pon completion of this course, the	student	S				
		<b>U U</b>		identify the parts of a fermenter						
				it the media components for fermen	tation pr	ocess.				
				select the parts of a bioreactor for de	-		rodu	ction p	rocess.	
				design the scale up procedure of a b				1		
				Course Outcomes		Domain		]	Level	
Afte	er the	comp	letion of th	ne course, students will be able to						
CO			the funda recovery	mentals of downstream processir	ng for	Cognitive	I	Remen	nber	
CO	$\begin{array}{c c} 2 & n \\ A \\ \end{array}$	nulti-fa A <b>pply</b>	ctorial m	roblem solving techniques requir anufacturing unit by physical me of various unit operations us essing	ethods.	Cognitive	1	Apply		
CO	4	nalyz roduct		ferent methods involved in iso	olation	Cognitive	1	Analyz	e	
CO	4 E	xplain	the princ	iples of chromatography techniques		Cognitive	I	Unders	tand	
CO			te the dry tion of pro	ving time for various dryers used ducts.	in the	Cognitive	1	Apply		
Uni				M PROCESSING					6+3	
Intro	oduct	tion to	downstrear	n processing principles characteristic	s of bion	nolecules and	biopr	ocesses	s. Cell	
			roduct relea	ase – mechanical, enzymatic and cher	mical me	thods. Pretrea	tmen	t and st	abilizat	tion
		oducts								
				ETHODS OF SEPERATION	<u> </u>				6+3	
				quid separation - filtration and centri	fugation.	,			(.)	
				OF PRODUCTS	ion mar	brono comort	ion	ultrof 1	6+3	and
				xtraction, aqueous two-phase extraction of proteins by different r			1011–	uiuaiiii	u ation a	anu
-				URIFICATION	inculous.				6+3	
				ples, instruments (GC, HPLC and F	FPLC) ar	d practice, ad	lsorpt	ion. re		bhase.
			• • •	ion, hydrophobic interaction, and bi		· · · · · · · · · · · · · · · · · · ·				
tech	nique	es.		•		•		-		•
		V FINA TION		UCT FORMULATION AND FIN	NISHIN	G	T		6+3	
				Lyophilization in final product form	ulation.		I			
		Lectur		Tutorial	Prac	tical		Τ	otal	
		30		15	0				45	

#### **Text Books:**

- 1. Nooralabettu Krishna Prasad,Downstream Process Technology, A New Horizon in Biotechnology,PHI Pvt Ltd,2nd Edition, 2012.
- 2. Sivasankar, B. Biosperations: Principles and Techniques. PHI Learning Pvt. Ltd., 2005.

#### **References:**

- 1. Hatti-Kaul, Rajni, and Bo Mattiasson. "Downstream processing in biotechnology." Basic biotechnology. Cambridge University Press, Cambridge, 2001.
- 2. Roger G. Harrison, Paul W. Todd, Scott R. Rudge, Demetri P. Petrides1, "Bioseparations Science and Engineering, oxford University Press, 2015.
- **3.** J. A.Wesselingh, Johannes Krijgsman, "Downstream Processing in Biotechnology", Delft Academic Press/VSSD, 2013.

## **E-References:**

- 1. http://vlab.amrita.edu/?sub=2&brch=191&sim=341&cnt=1
- 2. http://vlab.amrita.edu/?sub=2&brch=191&sim=1547&cnt=1
- 3. http://vlab.amrita.edu/?sub=2&brch=190&sim=606&cnt=1
- 4. vlab.amrita.edu/?sub=3&brch=273

						PI	ROG	RAM	OUT	ГСОМ	ES			
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3		2	1		1	1		1					1
<b>CO2</b>	2	3	2	1		1			1			1	1	1
<b>CO3</b>	2	3	1	2					1			1	1	2
<b>CO4</b>	2	1	3	2			3		1			1	2	1
CO5	2	2	3	1		2	1		1		2	2	3	3
Total	11	9	11	7		4	5		5		2	5	7	8
ScaledValue	3	2	3	2	0	1	1	0	1	0	1	1	2	2
		1 –	$5 \rightarrow 1$	1,		6	- 10	$\rightarrow 2$ ,		1	1 - 1	$5 \rightarrow 3$	3	
	(	)-NoF	Relatio	n,1-1	Low F	Relatio	on,2-1	Mediu	mRe	lation,3	-Higl	nRelat	tion	

				L	Τ	P	С
XBT604	A			3	0	0	3
		MASS TRANSFER FUNDAMENTALS					
C P	Α			L	Т	Ρ	Η
2.5 0	0.5			3	0	0	3
Prerequ	isites :	Nil					
Objectiv	ves:						
		itate the learners understand the basic concepts and prin					
а	pply th	em in distillation, absorption adsorption drying and humic	lificatio	on o	pera	tions	•
	Outco	mes: At the end of this course, the students should be	Doma	in	I	level	
able to			~ .		-		
		the basic principles in diffusional mass transfer and	Cogni				rstand
		the the rate of the mass transfer under one dimensional	Affect	ive		naly	
	•	state diffusion				lecei	
		e the operations of Distillation and absorption and	Cogni				rstand
	Calcula	tte number trays for distillation and absorption tower	Affect	ive		naly	
	<b>r •</b> , •		<u> </u>			lecei	
		ations where liquid–liquid extraction might be preferred	Cogni	tive			rstand
	o distil		Carri	4:		naly	rstand
		the salient features of Separation by adsorption,	Cogni	live	-		
		tographic separation process and <i>Explain</i> the concept of rough in fixed-bed adsorption.			P	naly	se
		e the salient features and mechanism involved in Drying	Cogni	tive	T	Inde	rstand
		e the satisfit features and meenanism involved in Drying	Cogiii	uve		naly	
		Course Content			1		Hours
Unit-I	M	ass Transfer and Diffusion					9
		blecular diffusion in fluids and solids. One dimensional sto	eady sta	ate a	nd u	inste	ady sta
		usion through stationary media – molecular diffusion ir					
		– overall mass transfer coefficients – Diffusion in multi co					
Diffusio	n in so	lids.	_				
Unit-II		stillation					9
Vapour	liquid	equilibrium - methods of distillation - simple, steam, f	flash di	still	atioı	ı, az	eotropi
		molecular distillation – Continuous distillation –	McCab	e -	Th	iele	metho
1	1	method					
		traction and Leaching				-	9
-		n – staged and continuous extraction concepts, Equipme	ents for	ext	racti	on -	- Solid
		a, leaching principles – Equipments for leaching				<u> </u>	0
Unit-IV		sorption and Adsorption	1		1'		9
		proprion – Factors affecting gas absorption-Equilibrium and determination Advantage and its turge sorbents					
-	-	ge determination - Adsorption and its types -sorbents - asport considerations	- equili	UTIU	1111 C	UIISI	ueratioi
Unit-V		imidification and Drying					9
		ogies in humidification – psychrometric chart, construct	rtion ar	nd i	150	-	
		and dehumidification – equipments – spray chamber– co					
		- Theory and mechanism of drying.	Shing it		- PII		<b></b> , typ

Lecture	Tutorial	Practicals	Total
45	0	0	45
Text Books			-

- 6. Treybal R.E., "Mass Transfer Operations", Third Edition, McGraw Hill, 1980.
- 7. Anantharaman, N. and K.M. MeeraSherifa Begum, "Mass Transfer Theory and Practice", PHI Learning Private Limited, New Delhi,2011
- 8. Gavhane K.A "Mass Transfer" 8th Edition, Nirali Prakashan, 2010.

#### References

- 5. Dutta, B. K., "Principles of mass transfer and separation processes", Prentice Hall of India, Delhi, 2007
- 6. Coulson and Richardson, "Chemical Engineering" Vol. I & II, Asian Books Pvt.ltd., 1998.
- 7. McCabe, W.L., J.C. Smith and P. Harriott, "Unit Operations of Chemical Engineering", 7/e, McGraw-Hill International Edition, 2005.

#### Mapping of COs Vs Pos

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	1	3	2	1	2	1	1	0	2	2	3	3
CO 2	3	3	1	3	2	1	2	1	1	0	2	2	3	3
CO 3	3	3	1	3	2	1	2	1	1	0	2	2	3	3
CO 4	2	1	1	1	1	1	1	1	1	0	1	1	1	1
CO 5	3	3	1	1	1	1	1	1	1	0	1	1	1	1
	14	13	5	11	8	5	8	5	5	0	8	8	11	11

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

## Mapping of Subject Vs POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
Origina l value	14	13	5	11	8	5	8	5	5	0	8	8	11	11
Scaled Value	3	3	0	3	2	0	2	0	0	0	2	2	3	3

 $6-10 \rightarrow 2$ ,  $1-5 \rightarrow 1$ ,  $11 - 15 \rightarrow 3$ 0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

						L	Τ	P	С
XBT6	604	B				3	0	0	3
•			FERMENTAT	TION TECHNO	LOGY				
	P	A				L	Τ	Р	Η
•	0	0				3	0	0	3
Prere	_		-						
Objec •	Т	o enh	ance the student's ability ess, microbial cum biochem	1 0 0	•	•	-		targete
Cours able to		Outco	omes: At the end of this co	urse, the student	ts should be	Domain	L	evel	
CO1	E	xplaiı	n the microbial for industries	s and <i>List</i> the app	olications	Cognitive	e U	nders	stand
CO2	tł	ne fern	be the primary and seconda nentation process	-	-	Cognitive			stand
CO3	k	inetics			0	Cognitive	U	nders	stand
CO4			s the isolation and character et the industrial significant.		rganism and	Cognitive	e U	nders	stand
CO5	D	escrib	be the salient features of indu	ustrial fermentation	on.	Cognitive	e U	nders	stand
				se Content					Hours
Unit-l			troduction						6
Micro Enzyn			mass – Microbial Enzymes	– Microbial M	etabolites – (	Commerci	al Aj	oplica	ations (
Unit-l	Π	Pr	imary and Secondary Met	abolism				9	9
Transf fermer	fori nta	natior tion pi	ip between primary and n processes – History of rocess. <b>icrobial Growth Kinetics</b>						rts of
Batch	cu	lture	– Exponential phase – De ems – Comparison of batch a		~ 1				
Unit-l			plation and Improvement of			-		9	9
Isolati	on	and c	haracteristics of microorgan	isms – Screening	g methods of	microorga	nism		
			maximizing gene expression		of Industrial r	nicroorgar	nism		
Unit-			edia for Industrial Fermen			~	-		12
Introd			Typical media and media f ffers – Precursors – Inhibito						
			tifoams – Animal cell media						
Recyc	ogy	/ 111							
Recyc	ogy	<u>, 111</u>	Lecture	Tutorial	Practical	ls		Tota	1

- 9. Stanbury.Peter.F, Allan Whitaker, Stephen J. Hall, "Principles of Fermentation Technology", Third Edition, ELSIVER, 2017.
- 10. Gregory N. Stephanopoulos, Aristos A. Aristidou., Metabolic engineering: Principlesand Methodologies, Jens Nielsen Academic Press, 1st Edition, 1998.

### References

8. Sandhu, Sardul Singh. Recombinant DNA technology. IK International Pvt Ltd, 2010.

## **E-References**

2. https://nptel.ac.in/courses/102/105/102105058/

## Mapping of COs Vs POs

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	1	3	2	1	2	1	1	0	2	2	3	3
CO 1 CO 2	3	3	1	3	2	1	2	1	1	0	2	2	3	3
CO 3	3	3	1	3	2	1	2	1	1	0	2	2	3	3
CO 4	2	1	1	1	1	1	1	1	1	0	1	1	1	1
CO 5	3	3	1	1	1	1	1	1	1	0	1	1	1	1
	14	13	5	11	8	5	8	5	5	0	8	8	11	11

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

## Mapping of Subject Vs POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
Origina l value	14	13	5	11	8	5	8	5	5	0	8	8	11	11
Scaled Value	3	3	0	3	2	0	2	0	0	0	2	2	3	3

 $1-5 \rightarrow 1$ ,  $6-10 \rightarrow 2$ ,  $11-15 \rightarrow 3$ 

XBT 60           C         P           3         0	4C A 0	NANOBIOTECHNOLOGY		L         T         P         C           3         0         0         3
Prerequis	site: I	Bioinstrumentation		
• W	<b>nplet</b> i ould	<b>ion of this course, the students</b> be able to learn fundamentals of nano technolog	-	
• W	ould	be able to learn the nano particle synthesis and i		
After the	00000	Course Outcomes	Domain	Level
CO1: Red	c <i>all</i> th	letion of the course, students will be able to ne basic concepts characterization techniques the methods of nanoparticles synthesis.	Cognitive	Remember Understand
CO2: Con advantage		ct microfluidic devices and relate its	Cognitive	Create Understand
CO3: Des	sign a	and <i>Develop</i> theranostics nanoparticles	Cognitive	Create
CO4: Ou nanoparti		the environmental applications of	Cognitive	Understand
nanopartie CO5: Un	cles <i>dersta</i>	the environmental applications of <i>ands</i> the Fundamentals of Nanocarriers and lelivery system.	Cognitive Cognitive	Understand Create
nanopartio CO5: Un design a c	cles <i>dersta</i> drug d	ands the Fundamentals of Nanocarriers and	Cognitive	
nanopartia CO5: Un design a c Unit-I- I Nanoparti vaporizati Nanomate Character	cles dersta drug d introd icles- ion, erials: izatio Dispers	ands the Fundamentals of Nanocarriers and lelivery system.	Cognitive Cognitive Acterization Synthesis- Physical methods g microorganism Light Scatterin	Create 9 cal methods: laser for synthesis of ns, plant extracts g, Zeta potential,
nanopartie CO5: Un design a c Unit-I- I Nanoparti vaporizati Nanomate Character Energy D TEM, AF	cles dersta drug d ntrod icles- ion, erials: izatio Disper: M.	ands the Fundamentals of Nanocarriers and lelivery system. Inction to Nanoparticles Synthesis and Chara physical, chemical and biological properties- laser Pyrolysis, ion implantation. Chemic sol-gel method. Biological synthesis: using n techniques: UV- Spectroscopy, Dynamic	Cognitive Cognitive Cognitive Synthesis- Physical methods g microorganism Light Scatterin Diffraction Patter	Create 9 cal methods: lase for synthesis of as, plant extracts g, Zeta potential
nanopartia CO5: Uni design a c Unit-I- I Nanoparti vaporizati Nanomate Character Energy D TEM, AF Unit-II- M Concepts	cles dersta drug d ntrod icles- ion, erials: izatio Dispers M. Micro and and r	ands the Fundamentals of Nanocarriers and lelivery system. Inction to Nanoparticles Synthesis and Chara physical, chemical and biological properties- laser Pyrolysis, ion implantation. Chemic sol-gel method. Biological synthesis: using n techniques: UV- Spectroscopy, Dynamic sive X-Ray Analysis (EDX), Selected Area E	Cognitive Cognitive Acterization Synthesis- Physical methods cal methods for cal methods for cal methods for cal methods for cal methods for cal methods for cal methods for cal methods for cal methods for cal methods for c	Create 9 cal methods: laser for synthesis of ns, plant extracts g, Zeta potential rn (SAED), SEM 9 ing and sealing -
nanopartia CO5: Un design a c Unit-I- I Nanoparti vaporizati Nanomate Character Energy D TEM, AF Unit-II- M Concepts Materials modificat	cles dersta drug d ntrod icles- ion, erials: izatio Dispers M. Micro and and r ions.	ands the Fundamentals of Nanocarriers and lelivery system. Inction to Nanoparticles Synthesis and Chara physical, chemical and biological properties- laser Pyrolysis, ion implantation. Chemic sol-gel method. Biological synthesis: using n techniques: UV- Spectroscopy, Dynamic sive X-Ray Analysis (EDX), Selected Area D ofluidics Meets Nano: Lab-on-a-Chip Devices advantages of microfluidic devices – Fluid tr	Cognitive Cognitive Acterization Synthesis- Physical methods cal methods for cal methods for cal methods for cal methods for cal methods for cal methods for cal methods for cal methods for cal methods for cal methods for c	Create 9 cal methods: laser for synthesis of ns, plant extracts g, Zeta potential, rn (SAED), SEM 9 ing and sealing –
nanopartia CO5: Un design a c Unit-I- I Nanoparti vaporizati Nanomate Character Energy D TEM, AF Unit-II- M Concepts Materials modificat Unit-III- Theranost across Bl	cles dersta drug d introd icles- ion, erials: izatio Dispers M. Vicro and and r ions. Nanc tic ag ood F	ands the Fundamentals of Nanocarriers and lelivery system. Inction to Nanoparticles Synthesis and Chara physical, chemical and biological properties- S laser Pyrolysis, ion implantation. Chemic sol-gel method. Biological synthesis: using n techniques: UV- Spectroscopy, Dynamic sive X-Ray Analysis (EDX), Selected Area E ofluidics Meets Nano: Lab-on-a-Chip Devices advantages of microfluidic devices – Fluid tr nethods for the manufacture of microfluidic cor	Cognitive Cognitive Cognitive Cognitive Contention Cont	Create 9 cal methods: laser for synthesis of as, plant extracts g, Zeta potential, rn (SAED), SEM, 9 ing and sealing – structures, surface 9 s- ability to cross

Role of iron oxide, biopolymers and metal nanoparticles in Waste water treatment- heavy metal removal, nanofilter devices. Role of antimicrobial coating in infectious disease prevention. Nanobiosensors for environmental monitoring.

#### Unit-V- Nanoparticles and Novel Drug Delivery Systems

9

Fundamentals of Nanocarriers - Size, Surface, Magnetic and Optical Properties, Pharmacokinetics and Pharmacodynamics of Nano drug carriers. Drug delivery systemsmicrocapsules and microspheres- hydrogels- Polymers - Dendrimers- Dendritic Nanoscafold system. pH based targeted delivery- chitosan and alginate. Copolymers- PLA, PLGA. Lipid Based Nanocarriers - Liposomes, niosomes- Cubosomes. Hydrophobic drug delivery.

Lecture	Tutorial	Practical	Total
45	0	0	45

## **Text Books:**

- 3. Niemeyer, Christof M., and Chad A. Mirkin. Nanobiotechnology: concepts, applications and perspectives. Vol. 1. John Wiley & Sons, 2004.
- 4. Mirkin, Chad A., and Christof M. Niemeyer, eds. Nanobiotechnology II: more concepts and applications. John Wiley & Sons, 2007.

## **References:**

- 3. Goodsell, David S. Bionanotechnology: lessons from nature. John Wiley & Sons, 2013.
- 4. Freitas Jr. R.A., "Nanomedicine", First Edition, Volume IIA, Landes Biosciences, 2004.

## **E- References:**

- 3. http://www.chem.latech.edu/~ramu/msnt505/lec_notes/Ji/MSNT505_Ji_notes.htm
- 4. http://nptel.ac.in/courses/118107015/

## Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO 5	PO 6	PO7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	3	2		2		2					2	1	2
CO 2	2	2	2	2	2	2	2				2	3	2	1
CO 3	1	2			3	3					2	3	3	3
CO 4	2	3	3	3	2	3	3				1	2	1	2
CO 5	1	2			3	2		1				2	1	1
	8	12	7	5	12	10	7	1			5	12	8	9

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

	PO1	PO2	PO 3	PO4	РО 5	PO6	<b>PO</b> 7	PO 8	PO 9	PO10	PO 11	PO12	PSO1	PSO2
Original value	8	12	7	5	12	10	7	2			5	12	8	9
Scaled Value	2	3	2	1	3	2	2	1			1	3	2	2

Scale: 3- high, 2 – Medium, 1 - Low, 0 – not related 0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

COUI	RSE CODE	XGS606		L	Τ	P	C			
COUI	RSE NAME	PROFESSIONAL SK	ILLS	1	0	2	3			
	REQUISITES	NIL		L	Τ	P	Η			
C:P:A	<b>A= 2.6:0.4:0</b>	-		1	0	4	5			
COUI	RSE OUTCOMI	ES	DOMAIN							
CO1	Ability to under	stand communications	Cognitive	R	Remember					
CO2	Apply the know	n skills for career	Cognitive		App	ly				
CO3	<i>Identify</i> inner st	trength	Cognitive	R	emer	nber				
CO4	<i>Construct</i> the a	ttitude as a professional	Cognitive		Crea	ite				
CO5	<b>Practicing</b> Etiq	uettes	Psychomotor	Guid	ed R	espoi	nse			
UNIT					9					
1.1 - I 1.2 - I	Brainstorming LSRW									
UNIT	II CAREER	SKILLS					9			
2.1 - I	Resume & CV pro	eparing Skills								
	Interview Skills									
2.3 – I	Exploring Career	Opportunities								
UNIT	III TEAM SH	KILLS					9			
3.1 – I	Listening as a Tea	am Skill								
3.2 – 7	Feam Building at	work place								
UNIT	IV PROFESS	SIONAL SKILLS					9			
4.1 — A	Attitude and Goal	Setting								
		Verbal Communications								
UNIT	V PROFESS	SIONAL ETIQUETTES					9			
5.1 - S	Social Etiquettes	<b>L</b>								
5.2 - 0	Cultural Ethics at	work place								
LECT	<b>TURE: 45</b>	TUTORIAL: 0	PRACTICAL:0		TO	ГAL	: 45			
SUGG	GESTED READ	INGS								
	r. A. K. Jain, Dr. . Chand Publicati	Pravin S. R. Bhatia, Dr. A	. M. Sheikh Professional C	Communi	cation	ı Ski	lls			
2. A	Alan Pannett. <i>Kev</i>	Skills for Professionals: H	low to Succeed in Profession	onal Serv	ices.	Koga	n			

CO Vs PO PO1 PO2 PO3	CO1 0 0	CO2 0 0	<b>CO3</b>	<b>CO4</b>	<b>CO5</b>	Total	Scaled to 0,1,2 and 3
PO ₁ PO ₂	0 0	0					
PO ₂	0		0	0	0		and 5
PO ₂	0		0	0	0		
		0		, s	U	0	0
PO ₃	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
PO ₄	0	0	0	0	0	0	0
PO ₅	0	0	0	0	0	0	0
PO ₆	0	0	0	0	0	0	0
PO ₇	0	0	0	0	0	0	0
PO ₈	3	3	3	3	3	12	3
PO ₉	2	2	2	2	2	10	2
PO ₁₀	3	3	3	3	3	12	3
PO ₁₁	0	0	0	0	0	0	0
PO ₁₂	0	0	0	0	0	0	0
PSO ₁	0	0	0	0	0	0	0
PSO ₂	0	0	0	0	0	0	0
TOTAL	8	8	8	8	8	34	8

Mapping of CO with PO

 $1-5 \rightarrow 1, 6-10 \rightarrow 2, 11-15 \rightarrow 3$ 

Cou	rse (	Code	:	XUM 607		L	Т	Р	С		
		Name	:	Cyber security		0	0	0	0		
Prer	equ	isite	:			L	Т	Р	H		
С	P	Α		NIL		3	0	0	3		
3	0	0									
Cou	rse (	Object	ives								
• 7	lo e	give kn	owle	edge on the cyber space and its security.							
• 7	[o u	ndersta	nd t	he cyber security structure of organisation							
• 7	Γο U	Inderst	and	he security policy of organisation							
• ]	Гo a	ware of	f the	Cyber security initiatives and IT Act.							
• ]	lo n	hake the	e stu	dents to know cyber security ractices.							
	Course Outcome: After the completion of the course, students Domain Level will be able to C or P or A										
CO1		Underst: echnolo		the fundamentals of Cyber Security and the	С		Und	ersta	tand		
CO2	2 U			the organizational structure of Cyber	С		Und	ersta	stand		
CO3			and	the Cyber Security policy development	С		Und	ersta	tand		
CO4	l U	Inderst	and	the Indian IT act and the initiatives	С		Und	ersta	nd		
CO5	; U	Underst	and	and Apply the Cyber security practices	С		Und App		nd and		
COU	JRS	E CO	NTE	NT				-			
UNI	ΤI	IN	ГRC	DUCTION					9		
		Law Tec Eve Cha	vs a hno plutie allen		echnology O olicy – Cyb e – Counter	pera er S	tions Secur	ity			
UNI	T II	CY	BE	R SECURITY OBJECTIVES AND GUID	ANCE				9		
		Vul Con Gui Cyt Doe	lnera ntrol idan oer cum	Security Metrics – Security Manageme bilities – SecurityFrameworks – E Comme Systems – Personal Mobile Devices – Secu ce for Decision Makers – Tone at the Top Security Management – Arriving at G entation – The Catalog Approach – Catalog Faxonomy.	rce Systems arity Policy C o – Policy as oals – Cybe	– In Objec a F er S	dustr ctives Projec Secur	ial 5 – ct– ity			
UNI	T II			R SECURITY POLICY CATALOG				-	9		
		_		Governance Issues – Net Neutrality – Internet	et Names and	Nur	nbers	s —	-		

www. npt http://pro									
E-REFER https://wv	ENCES ww.coursera.org/specializations/cyber-security								
McGrav	w-Hill, 2013.								
	ning 2011 des-Ousley, Mark, "Information Security: The Complete Reference", Second	Editior							
	Shoemaker Cyber security The Essential Body Of Knowledge, 1st ed. Cengage								
4.Mode	rn Cyber security Practices by Pascal Ackerman, BPB Publications, 2020								
-	er Laws & Information Technology, JothiRathan, VijayRathan, Bhrath Pubis January 2019.	shers,7							
2. Rick	Howard "Cyber Security Essentials" Auerbach Publications 2011.	. –							
	fer L. Bayuk, J. Healey, P. Rohmeyer, Marcus Sachs, Jeffrey Schmidt, Joseph Wer Security Policy Guidebook" John Wiley & Sons 2012.	eiss							
REFERE	NCE BOOKS								
	L T P 45 0 0	Tota 45							
Security, Guidelines for social media security, Tips and best practices for safer Social Networking.Basic Security for Windows, User Account Password Introduction to mobile Smartphone Security, Android Security, IOS Security Online Banking Security, Mobile Banking Security, Security of Debit and Credit Card, UPI Security Security of Micro ATMs e-wallet Security Guidelines Security Guidelines for Point of Sales(POS)									
	Guidelines to choose web browsers, Securing web browser ,Antivirus ,Email security ,Guidelines for setting up a Secure password ,Two-steps authentication ,Password Manager ,Wi-Fi								
UNIT V	UNIT V SECURITY PRACTICES	9							
	Counter Cyber Security Initiatives in India, Cyber Security Excercsie, Cyber Security Incident Handling, Cyber Security Assurance, IT Act, Hackers- Attacker-Counter measures ,Web Application Security, Digital Infrastructure Security ,Defensive Programming. Traditional Problems Associated with Computer Crime, Introduction to Incident Response.								
UNIT IV	UNIT IVCYBER SECURITY INITIATIVES AND IT ACT	9							
	Malvertising - Impersonation –Appropriate Use – Cyber Crime – Geo location – Privacy - Cyber Conflict Issues – Intellectual property Theft – Cyber Espionage – Cyber Sabotage – Cyber Welfare- Computer Forensics – Steganography								

			PROGRAM OUTCOMES											
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	0	0	0	0	0	2	0	3	0	0	0	0	0	0
CO2	0	0	0	0	0	0	2	0	1	0	0	0	0	0
CO3	3	0	0	0	0	2	3	0	1	0	0	0	3	0
CO4	0	0	0	0	0	0	0	0	0	2	0	0	0	0
CO5	3	0	0	0	0	0	0	0	0	0	0	0	3	0
Total	6	0	0	0	0	4	5	3	2	2	0	0	6	0
ScaledValue	2	0	0	0	0	1	1	1	1	1	0	0	2	0
		1 -	$1-5 \Box 1$ , $6-10 \Box 2$ , $11-15 \Box 3$											
0-NoRelation,1-Low Relation,2-MediumRelation,3-HighRelation														

				Ι			С
X	BT60	8	PROCESS BIOTECHNOLOGY LABORATORY	0	) (	) 4	4
C	Р	A		I		ГР	H
0.5	2.5	1		0	) (	) 8	8
Prer	equis	ite: I	Process biotechnology				
Lear	ning	Obje	ectives: Upon completion of this course, the students				
•	W	ould	be able to identify the parts of a fermenter				
•	W	ould	be able to design industrial media for fermentation process.				
•	W	ould	be able design a particular production process.				
			Course Outcomes	Dom	ain	Lev	el
				Cogniti	ve	Apply	
CO1	Inf	fer th	e basic parts of a fermentor and its operations.	Psychomotor		Mechanism	
				Affectiv		Respond	1
	De	mon	strate the different media components involved in a	Cogniti		Apply	
CO2			ation process.	Psycho		Mechan	
			F	Affectiv		Respond	1
001	T			Cogniti		Apply Mechan	•
CO3		erpre	et various control systems involved in bioreactor.	Psychon Affectiv		Respond	
				Cogniti		Apply	l
CO4		easur	1 1	Psychor		Mechan	ism
001	bic	proc	esses.	Affectiv		Respond	
				Cogniti		Apply	
CO5	De	most	arte the scale up procedure of mixing, aeration	Psycho		Mechan	ism
				Affectiv	ve	Respond	1
			al Experiments				
1	2. De	term	nation of thermal death rate constant for a fermentation pro	cess. (CO	D1)		

13. Comparison of bioprocess efficiencies in synthetic and complex industrial media. (CO2)

14. Medium formulation and optimization studies. (CO2)

15. Estimation of biomass concentration for microbial production. (CO3)

16. Determination of oxygen mass transfer coefficient by Sulphite oxidation method. (CO3)

17. Yeast cell disruption studies by sonication.

18. High-resolution purification preparative liquid chromatographic techniques. (CO3)

19. Ammonium Sulfate precipitation of protein using yeast cell suspension. (CO4)

20. Crystallization of a product. (CO4)

21. Determination of drying time for the given sample in vacuum tray drier. (CO5)

22. Lyophilization (CO5

Lecture	Tutorial	Practical	Total
0	0	30	30

#### **Text Books:**

Schuler and Kargi, Bioprocess engineering. Prentice Hall

**References:** 

Pauline Doran, Bioprocess Principles, Academic press, 2004.

**E-References:** 

http://38.100.110.143/model/bb/theory.html

http://38.100.110.143/model/bb/procedure.html

			PROGRAM OUTCOMES											
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3		2	2								1	2	2
CO2	2	3	2	1	1		1		1		3	2	3	3
CO3	1	3	3	2					1			1	0	0
CO4	1	3	3	2								1	0	0
CO5	1	3	2	2	1		1		2		2		1	1
Total	9	12	12	9	2	0	2	0	4	0	5	5	6	6
ScaledValue	2	3	3	2	1	0	1	0	1	0	1	1	2	2
		1 –	$1-5 \rightarrow 1, \qquad 6-10 \rightarrow 2, \qquad 11-15 \rightarrow 3$											
	(	0-NoR	NoRelation, 1-Low Relation, 2-MediumRelation, 3-HighRelation											

## **VII Semester**

						<u> </u>	_				
	_				L	T	P	C			
X	BT7	01			3	0	0	3			
9	-		Microbial Biotechnology		-		<b>D</b>				
C	<u>P</u>	A	_			T	P	H			
3	0	0			3	0	0	3			
Prer											
			ectives:								
Upo		_	ion of this course, the students	1 14							
•			be able to explain industrial production of various met								
•			apply the knowledge of process associated mechanis	sms in Indu	istrial	biote	chno	logy			
	re	searc									
A C	.1		Course Outcomes	Domair	1	L	<i>evel</i>				
Afte			bletion of the course, students will be able to			<u>D</u>	1				
CO	CO1 <i>Outline</i> the general concepts of microbial system and <i>describe</i> the development Cognitive Regulation Under Cognitive										
			<i>ibe</i> various mechanisms of medium and <i>discuss</i> the			Under					
CO	•		m role in Bioreactor.	Cognitive		Under	stanc	1			
000	- 1	lieuit									
CO	2 I	Discu	ss the rDNA concept and explain the related	Cognitive							
CU.	r		bial processes	Cognitive		Understand					
CO			lains the production of primary metabolites and	Cognitive		Remember					
	l		fy their interactions.			Understand					
CO		-	ins the production of secondary metabolites and	Cognitive		Reme					
000	i	denti	fy their interactions.			Under	stanc	1			
Unit	-I h	ntrod	uction and Historical developments in microbial Bi	otechnolog	<b>y</b>		9				
			and Historical developments in industrial microb								
			metabolic pathways; Various Microbial metabolic								
			selection of industrially important microorganisms; P	reservation	and	mainte	enanc	e of			
micr	obial	culti	ires.								
Unit	-II N	<b>ledi</b> u	im and Bioreactor				9				
Micr	obia	lsub	strates and Media formulation; Components of microb	ial ferment	ation	proce	ss; T	ypes			
			processes- Solid state, Static and submerged ferme	entations; I	Desigi	n of l	abora	ntory			
biore	eacto	r;Typ	es of Bioreactor: Stirred tank reactor, bubble column.								
Uni	t-III	Reco	mbinant DNA technologies for microbial processes				9				
Intro	duct	ion t	o rDNA technology, Strategies for development of in	ndustrial m	icrob	ial str	ains	with			
scale	up	produ	ction capacities; metabolic pathway engineering of m	icrobes for	prod	uction	of n	ovel			
prod	uct fo	or inc	lustry ,Screening strategies for new products.								
-			uction of Microbial primary Metabolites				9				
			Microbial Biomass - Baker's Yeast, Mushroom; F					-			
			erages- wine, beer, etc.; Production of Ethanol, Citric a					nins;			
Micr	obia	enz	mes for food, detergent and pharma industry; Biopest	icides and b	oiofert	tilizers	5				

Unit-VProduction of microbial secondary metabolites       9											
Production of Antibiotics- penicillin and other antibiotics; Pigments, Microbial transformation, Production of Insulin, Interleukin, growth hormones, Bioplastic production, Large scale production and purification of recombinant proteins and metabolites;											
Lecture	Tutorial	Practical		Total							
45 0 0 45											
Text Books:	Text Books:										
3. Process Biot	technology Fundamental	ls, Satya Narayan Mukhopadh	yay 4th Ed	n , 2018							
4. Pauline Dor	an, Bioprocess Principle	s, Academic press, 2004.									
References:											
11. Neilson J and Villadsen J, Biochemical Engineering Principles I ed, Plenum Press, 2000.											
12. Stanbury P F Whitaker, A and Hall S.J, Principles of Fermentation Technology 2nd ed,											
Aditya Book Pvt Ltd, 2001.											

#### **E** – **References**

- 4. <u>http://www.nptel.ac.in/syllabus/syllabus.php?subjectId=102107029</u>
- 5. http://users.ox.ac.uk/~dplb0149/publication/NPRBiocatalysisRev.pdf
- 6. http://link.springer.com/book/10.1007%2F978-1-4684-0324-4

## Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3											1	2	2
CO 2	2	3	2		1		1		1		3	2	3	3
CO 3	1	2	2	1					1			1	0	0
CO 4	1	3	2	3								1	0	0
CO 5	1	3	2	3	1		1		2		2		1	1
	8	11	8	7	2	0	2	0	4	0	5	5	6	6

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

### Mapping of Subjects with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
Origina l Value	8	11	8	7	2	0	2	0	4	0	5	5	6	6
Scaled Value	2	3	2	2	1	0	1	0	1	0	1	1	2	2

 $1-5 \rightarrow 1, \qquad 6-10 \rightarrow 2, \qquad 11-15 \rightarrow 3$ 

				L	Т	P	С
XB	ST702			<u> </u>	0	0	3
		RECOMBINANT DNA TECHNOLOGY	Z	5	U	v	5
C 1	P A			L	Т	Р	Н
	$\frac{1}{0}$	-		3	0	0	3
-	v v	Genetics, Molecular biology		•	v	U	J
		jectives:					
-	0	tion of this course, the students					
•	-	have learned the concepts of gene cloning and its app	lication.				
•		have learned the various techniques involved in Reco		VA Te	chnolog	v.	
		1					
		Course Outcomes	Domai	n		Level	
After	the com	pletion of the course, students will be able to					
C01		the basic concepts of gene cloning and various tion and modification enzymes	Cognitive		Reme	nber	
CO2	Explai	<i>n</i> and <i>distinguish</i> various vector systems	Cognitive		Remer Under		
CO3	<i>Descri</i> involve	bes, Compares and Identifies various techniques ed.	Cognitive		Remen Analy		
CO4		ses, Manipulates and Describes various screening ection methods.	Cognitive		Under Apply		
CO5		<i>n</i> and <i>Apply</i> the applications of rDNA technology Biosafety guidelines.	Cognitive		Remen Apply		
		Course content			]	Hours	
		cepts Of Gene Cloning				9	
		o recombinant DNA technology- Restriction & I, DNA polymerases, Polynucleotide kinases and alka					
		ction mapping, Design of linkers and adaptors.	1 1		,	U	
		and Vectors				9	
vector	rs, M13 <i>Iammali</i>	s of cloning vectors, types of bacterial plasmid vec vectors, cosmids, phagemids, yeast artificial chromoso an artificial chromosomes as cloning vector. Expression	ome, bacter	ial arti	ificial c	hromos	some
		ar Techniques				9	
pyro-s	sequenci	g (radioactive and non-radioactive method); DNA sequencing method)'; Southern, northe	ern and we	estern	blotting	g- PC	CR –
		es- applications- DNA fingerprinting (RAPD; RFLP, A	FLP).biose	ensing	and bio	-	
		and Selection of Transformants				9	•
phosp – nuc	hate me cleic aci	DNA into cells- transformation, transfection, Sonopo thods- Genomic and cDNA library construction- Sele d hybridization- Grunsteinhogness and benten- Da ue – white selection- Reporter gene based selection- G	ction and so vis plaque	creenii metho	ng of re od, imr	combin nunolo	nants
L							

#### V – Applications of Recombinant DNA Technology

Production of recombinant- insulin, human growth factor, vaccine and gene therapy- gene silencing using RNAi. Genetic manipulation of animal cells – early methods and Crispr-Cas9. Transgenic plants and animals. Bioethics regarding rDNA techniques-

Lecture	Tutorial	Practical	Total
45	0	0	45

### **Text Books:**

2. Primrose S.B. and Twymann R.H., "Principles of Gene Manipulation: An Introduction to Genetic Engineering", Sixth Edition, Blackwell Scientific Publications, 2004.

#### **Reference Books:**

- 4. Brown T.A., "GeneCloning and DNA Analysis", Fourth Edition, Blackwell Scientific Publications, 2003.
- 5. Glick B.R. and Pasternak J.J., "Molecular Biotechnology", Third Edition, ASM Press, 2003.

6. Sandhu, Sardul Singh. Recombinant DNA technology. IK International Pvt Ltd, 2010.

#### **E-References:**

2. http://nptel.ac.in/courses/102103013/

## Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	1	2	1	1	1	0	0	1	0	1	0	0	0
CO 2	3	0	3	2	2	1	0	0	0	0	1	0	1	1
CO 3	3	0	3	1	3	0	0	1	0	2	0	0	1	1
CO 4	3	0	3	1	3	0	0	2	0	1	0	0	1	0
CO 5	3	0	3	2	3	2	3	3	0	1	2	0	1	0
	13	1	14	7	12	4	3	6	1	4	4	0	4	2

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

## Mapping of Subjects with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
Origina l Value	13	1	14	7	12	4	3	6	1	4	4	0	0	0
Scaled Value	3	1	3	2	3	1	1	2	1	1	1	0	0	0
$1-5 \rightarrow$	1,		6 –	$10 \rightarrow$	2,		11 –	$15 \rightarrow$	3					

							L	Т	Р	С		
X	BT70	34					2	1	0	<u> </u>		
21	<b>JI</b> / <b>U</b>	JA		STEM CELL BIOTE	CHNOLOGY			L	U	5		
С	Р	Α					L	Т	Р	Н		
3	0	0					2	1	0	3		
	v	isite:	- Cell bi	ology, Immunology				-	Ŭ			
			jective:									
		-	-	is course, the students								
•		-		xplain about various catego	ries of stem cells.							
				rned the application of stem								
				Course Outcomes	0.	Domain		]	Leve	l		
On	the s	ucces	sful com	pletion of the course, stude	nts will be able to	)						
				d interpret the biology of st		Cognitive		Reme	embe	r		
						U		Unde	rstan	d		
CC	2: Ex	xplair	<i>i</i> and <b>dev</b>	elop the embryonic stem ce	ll culturing.	Cognitive		Unde	rstan	d		
								Appl	у			
CC	93: Di	iscuss	s and <i>anal</i>	<i>lyze</i> the differentiation of ste	em cells	Cognitive		Unde	rstan	d		
								Analy				
		-		aluate the various techniq	ues involved in	Cognitive		Unde		d		
	n cell					~	]	Evalı	iate			
CC	)5: Di	iscuss	s and app	ly the various applications of	of stem cells.	Cognitive		Unde	rstan	d		
I-	Basic	s of S	Stem Cell						6+3			
				em cells – embryonic stem o								
			-	ries, types, clinical applicat								
			etween en	nbryonic and adult stem ce	ells - Properties o	of stem cell	s –	pluri	poter	ncy –		
	poten											
			ic Stem C		<u> </u>	•	11	1.1	6+2			
				lturing of embryos-isolatio						-		
				ing ES cells in lab – labora	atory tests to iden	tilly ES cell	<u>s</u> –	stimu	natio	n es		
				- properties of ES cells.					5+2			
			em Cells	,	ult stem cells – adult stem cell differentiation $\frac{3+2}{1-3+2}$							
				lasticity – different types of		iun stem ce	in u	incie	mai	1011 -		
			-	g Discovery and Assay	adult stelli cells.				6+3			
				- Manipulating differentia	tion nathways _	stem cel	l th	erant		cell		
	-			etic colony forming cell as								
-			-	scovery, drug screening and	•	contana asse	1 y S 1			mε		
			ons of Ste		tomeology.				9+3			
				r Mental disabilities, Dia	betes Mellitus –	Therapeu	tic	appli		ns –		
			1.	rological disorder – limb ar		-						
				typing- Alzheimer's diseas								
				ney – eyes - heart – brain.		0 11		Г				
	-	Lectu	*	Tutorial	Practica	al		]	otal			
		32		13	0				45			

#### **Text Books**

1. Kursad and Turksen, Embryonic Stem Cells; Humana Press; 2002.

2. Dr. LogeswariSelvaraj, Stem Cells MJP Publishers, 2015.

#### References

3. Mohan C. Vemuri, Stem Cell Assays, Springer International Edition; 2010.

4. Stem cell and future of regenerative medicine. By committee on the Biological and Biomedical applications of Stem cell Research. 2002. National Academic press.

#### **E References**

2. http://nptel.ac.in/courses/102103012/41

### Mapping of COs Vs POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	2	1	2	1			2	2	2	2	3	2
CO 2	2	2	2	2	3	3	2	1				3	1	1
CO3	3	3	2	2	2				1	1	2	2	2	3
CO4	2			3	2							1	1	2
CO5	3	3	2	3	2	2	2	1	2	2	1	1	1	1
	13	10	8	11	11	6	4	2	5	5	5	9	0	0

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

## Mapping of Subject Vs POs

	PO 1	PO 2	PO 3	<b>PO</b> 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
Origina l value	13	10	8	11	11	6	4	2	5	5	5	9	0	0
Scaled Value	3	2	2	3	3	2	0	0	0	0	0	2	0	0

Scale: 3- high, 2 – Medium, 1 - Low, 0 – not related 0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

XI C 2.5	BT70. P 0	3B A 0.5		L         T         P         C           2         1         0         3           L         T         P         H           2         1         0         3	
Prer	requis	ite: C	ell biology molecular biology		
	n con We We	n <b>pleti</b> ould h ould	ctive: on of this course, the students ave learn about carcinogenesis. have learn about a comparative approach to u sms and signaling.	nderstand th	e differences in
			Course Outcomes	Domain	Level
CO1	l:Outi	<i>line</i> th	etion of the course, students will be able to e regulation and modulation of cell cycle in cancer ignal switches	Cognitive	Understand
CO2 r	2:Exp	<i>lain</i> a olism	nd <i>compare</i> various types of carcinogenesis and its	Cognitive	Understand Analyze
			the role of activation of kinases, <i>identification</i> of and <i>conforms</i> the role of telomere.	Cognitive Affective	Understand Analyze Responds to Phenomena
i	nvasio	on and	netastasis and its significant clinical markers for l metastasis	Cognitive	Understand
			and <i>compiles</i> molecular tool for early diagnosis of rent forms of cancer therapy.	Cognitive Affective	Understand Responds to Phenomena
I- C	Cell C	ycle a	nd Cancer		9
moo Tele	dulati omera	on of use and	s, characteristics and types – Cell cycle phases, cyc cell cycle in cancer - Effects on receptor, signal s d its role in cancer – Apoptosis, Extrinsic and intrin ations that leads to cancer.	witches, sign	aling pathways -
II- (	C <mark>arc</mark> ir	nogen	esis		9
and Mec	indiro hanisi	ect ac m of 1	nogenesis – Types: Physical, chemical and radiation eting carcinogens, Metabolism of carcinogens, C radiation carcinogenesis, ionizing and non ionizing s role in cancer, Identification of carcinogens, Long a	YP450 reduct radiation, Re	etase mechanism etroviruses - RSV
III-	Mole	cular	and Cell Biology of Cancer		6+3
ident relat	tificat ed to	ion ar transf	nd cancer, activation of kinases – Oncogenes - type ad detection of oncogenes, oncogenes and proto onco- formation - epidermal growth factor (EGF), platelet of bowth factor (TGF), src and myc; RAS cycle – Tumor	gene activity derived grow	- Growth factor th factor (PDGF)

#### **IV-** Invasion and Metastasis

Clinical significances and three step theory of Invasion, Metastasis – Introduction and cascade, heterogeneity of metastatic phenotype, Significance of proteases in basement membrane disruption, Epithelial- mesenchymal transition, stromal signals, Role of cadherin and integrin, metalloproteinases in cell invasion, Ras like GTPases.

## V- Diagnosis and Therapy

6+3

9

Diagnosis: Detection using biochemical assays, tumor markers - Molecular tools for early diagnosis of cancer, Disease staging - FISH, DNA microarrays, SNPs, CGH and imaging techniques.

Treatment: Chemotherapy – Topoisomerase inhibitors – Radiotherapy – Gene therapy – Immuno therapy – Antigen specific and Adaptive therapy – Stem cell therapy - Use of signal targets towards therapy of cancer – New Genomic and proteomic technologies.

Lecture	Tutorial	Practical	Total
39	6	0	45

### **Text Books:**

1. Weinberg, R.A., The Biology of Cancer, Garland Science Taylor and Francis Group, New York, 1st Edition, 2007.

2. Kleinsmith. L.J., Principles of Cancer Biology, Pearson Education Inc., San Francisco, CA, 1st Edition, 2006.

## **References:**

1. DeVita Jr, V.T., Lawrence, T.S., Rosenberg, S.A., DePinho, R.A. and Weinberg, R.A., DeVita, Hellman, and Rosenberg's Cancer: Principles and Practice of Oncology, Lippincott Williams & Wilkins Philadelphia, PA, 9th Edition, 2011.

2. Ian F.Tannock, Richard P. Hill, Robert G. Bristow and Lea Harrington., The Basic Sciences of Oncology, 4th Edition, The McGraw-Hill Companies, Inc. New Jersey, 2005.

3. PelengarisA., and M. Khan (Eds)., The Molecular Biology of Cancer, Wiley - Blackwell Publishing, USA. 2006.

4. Gareth Thomas., Medicinal Chemistry – An Introduction, 1st Edition, John Wiley and Sons, USA, 2004.

5. Benjamin Lewin., Genes VIII, International Edition, Pearson Prentice Hall, New Delhi. 2004. **E References:** 

2. www.nhri.org.tw/NHRI_ADM/userfiles/file/1010510.pdf

## Mapping of Cos Vs POs

	<b>PO1</b>	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	2	1	2	1			2	2	2	2	3	2
CO 2	2	2	2	2	3	3	2	1				3	1	1
CO 3	3	3	2	2	2				1	1	2	2	2	3
CO 4	2			3	2							1	1	2
CO 5	3	3	2	3	2	2	2	1	2	2	1	1	1	1
	13	10	8	11	11	6	4	2	5	5	5	9	0	0

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

## Mapping of Subject Vs POs

	PO 1	<b>PO</b> 2	PO 3	<b>PO</b> 4	PO 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
Origina l value	13	10	8	11	11	6	4	2	5	5	5	9	0	0
Scaled Value	3	2	2	3	3	2	1	1	1	1	1	2	0	0

Scale: 3- high, 2 – Medium, 1 - Low, 0 – not related 0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

							L	Т	P	С				
X	BT7	03C					2	1	0	3				
			D	ESIGN OF BIOPROCESS E	QUIPMENTS									
С	Р	Α	-				L	Т	P	H				
2	0	1					2	1	0	3				
			~					-						
A C	.1			e Outcomes	Domain			Leve	L					
				e course, students will be able		TT 1		1 4 1						
CO				fferentiate Process and	Cognitive			id, Apply	1					
CO		Biopro		aiga Drassuna unita	Affective			esponse						
CO		Interp	reis and De	sign Pressure units	Cognitive Affective			id, Apply	/					
CO	2	Intown	rate and Da	sign Supporting parts	Cognitive			esponse id, Apply	7					
	5	Interp	reis and De	sign Supporting parts	Affective			esponse	/					
CO		Intom	nate and De	sign Heat and Mass Transfer				-	7					
	CO4Interprets and Design Heat and Mass Transfer EquipmentsCognitive AffectiveUnderstand, ApplyCO5Outlines, Interpret and Design the FermenterCognitiveUnderstand, Apply													
CO														
			es, interpro	a and <i>Design</i> the Fermenter	-			·	/					
		um			Allective	Oui		esponse						
				Course content	t				1	Hours				
Uni	it-T	Pro	cess and B		C					6				
				r process and bioprocess plant	s – Mechanical de	esign o	of pro	cess equi	pment					
	it-II		ign of Pres				<u>, pro</u>	coss equi		6				
	-		0	pherical vessel under internal	and external press	ure				Ū				
	-		ign of Enc		1					6+3				
Sel	ectio		0	lat plate, formed heads, torisp	oherical and hemis	spheri	cal he	ads, Star	ndard f	langes				
	it-IV		ion of heat	and mass transfer units						6+6				
			0	double pipe heat exchangers -	– Design of perfor	ated r	late d	istillatio	n colur					
			e packed to		0 1	1								
Uni	it-V	Des	ign of Feri	nenter						6+6				
Bas	ic f	unction	s of a fer	mener – Service provisions	for a fermentatio	n pla	nt – (	Geometr	ical rat	tios of				
ferr	nent	er with	single and	three bladed impellers - Safe	ety precautions –	Ferme	enter l	ody con	structi	on and				
con				ypes of fermenter – Design pa		enter.								
		Lectur	·e	Tutorial	Practical				tal					
		30		15	-			4	5					
		ooks:												
			-	erations by Rober E Treybal, N				1051						
				t Design -Vessel Design by Br					0.2					
D. 4				ring by J. M. Coulson & J. F. I	Kichardson, Vol 6	, Preg	man I	ress, 19	93.					
Kei		nce Boo		lley Wikitakan Stankan I Hal	1 "Duinainlag of I	7		. Tashu	1	Thind				
		-		llan Whitaker, Stephen J. Hal	i, Finciples of I	ermei	111101	i recnno	Jogy',	, inira				
		,	SIVER, 20	Ind mechanical aspect, B C Bh	attacharva									
	<b>2.1</b> I	uuss t	quipinent a	ina menamear aspect, D C DI	iaitachai ya.									
L														

#### **E-References:**

1.<u>https://nptel.ac.in/courses/103/107/103107143/</u>

2.<u>https://nptel.ac.in/courses/103/107/103107207/</u>

3.<u>https://nptel.ac.in/courses/103/103/103103027/</u>

## Mapping of COs with POs

	<b>PO1</b>	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	1	1	2	2	2	0	0	0	1	3	0	0
CO 2	3	3	2	2	1	2	2	0	0	0	2	2	1	1
CO 3	3	3	2	3	1	2	2	0	0	0	2	3	2	3
CO 4	3	3	2	3	1	2	2	0	0	0	2	2	2	2
CO 5	3	3	2	3	1	2	2	0	0	0	2	3	3	3
	15	15	9	12	6	10	10	0	0	0	9	13	8	9

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

## Mapping of Subjects with POs

	PO 1	PO 2	PO 3	РО 4	PO 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
Origina l Value	15	15	9	12	6	10	10	0	0	0	9	13	8	9
Scaled Value	3	3	2	3	2	2	2	0	0	0	2	3	6	6

 $1-5 \rightarrow 1$ ,  $6-10 \rightarrow 2$ ,  $11-15 \rightarrow 3$ 0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

Cou	rse (	Code	:	XES 705		L	T	Р	С						
Cou	rse N	Name	:	ENVIRONMENTAL STUDIES		0	0	0	0						
Prer	equi	isite	:			L	Т	Р	H						
С	P	Α		NIL		3	0	0	3						
2.5	0	0.5													
			<b>e:</b> A	fter the completion of the course, students	Domain		Le	vel							
will	be ał	ble to			C or P or	r A									
COI				significance of natural resources and <i>explain</i> ic impacts.	Cognitive	e	_	memb lerstar	er and nd						
CO2	na			e significance of ecosystem, biodiversity and bio chemical cycles for maintaining ecological	Cognitive	2	Un	dersta	nd						
CO3		•••	entify the facts, consequences, preventive measures of ajor pollutions and <i>recognize</i> the disaster phenomenon Affective Receive												
CO4	th	-	rol r	socio-economic, policy dynamics and <i>practice</i> neasures of global issues for sustainable t	Cognitive	2		dersta I Ana							
COS				ne impact of population and <i>apply</i> the tal ethics towards environmental protection.	Cognitive	9		dersta							
							An	d App	bly						
COL	JRSE	E CON	TEN	NT											
UN	IT I			DDUCTION TO ENVIRONMENTAL STUD URCES	DIES AND			1	2						
		<b>RESOURCES</b> 12         Definition, scope and importance – Need for public awareness – Forest resources:       Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, flood, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies													

	<ul> <li>Energy resources: Growing energy needs, renewable and non-renewable sources, use of alternate energy sources, case studies – Land resources: La resource, land degradation, man induced landslides, soil erosion and desertific Role of an individual in conservation of natural resources – Equitable use of r for sustainable lifestyles.</li> </ul>	and as a ication –
UNIT II	ECOSYSTEMS AND BIODIVERSITY	8
	Concept of an ecosystem – Structure and function of an ecosystem – Pr consumers and decomposers – Energy flow in the ecosystem – Ecological su – Food chains, food webs and ecological pyramids – Introduction characteristic features, structure and function of the (a) Forest ecosys Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystem (ponds, lakes, rivers, oceans, estuaries) – Introduction to Biodiversity – Definition: species and ecosystem diversity - Biodiversity patterns and global biodiver spots. India as a mega-biodiversity nation; Endangered and endemic species Threats to biodiversity: Habitat loss, poaching of wildlife, manwildlife c biological invasions; Conservation of biodiversity: In-situ and Ex-situ cons of biodiversity.	ccession , types, tem (b) streams, genetic, rsity hot of India conflicts,
UNIT III	ENVIRONMENTAL POLLUTION	8
	Definition – Causes, effects and control measures of: (a) Air pollution (b pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) pollution (g) Nuclear hazards – Solid waste management: Causes, effects and measures of urban and industrial wastes – Role of an individual in preve pollution – Pollution case studies – Disaster management: flood, earthquake, and landslide.	Thermal d control ention of
UNIT IV	SOCIAL ISSUES AND THE ENVIRONMENT	9
	Urban problems related to energy – Water conservation, rain water has watershed management – Resettlement and rehabilitation of people; its proble concerns, climate change, global warming, acid rain, ozone layer depletion, accidents and holocaust, Wasteland reclamation – Consumerism and waste pre Environment Protection Act – Air (Prevention and Control of Pollution) Act (Prevention and control of Pollution) Act – Wildlife Protection Act – Conservation Act – International agreements: Montreal and Kyoto protoc Convention on Biological Diversity (CBD).Nature reserves, tribal population rights, and human wildlife conflicts in Indian context. Issues involved in enfor- of environmental legislation – Public awareness.	ems and nuclear oducts – - Water - Forest cols and

UNIT V	HUMAN POPULATION AND THE ENVIRONM           Human population growth: Impacts on environm		ıman	healtl	n and	8 welfare
	Resettlement and rehabilitation of project at					
	Environmental movements: Chipko, Silent va					
	Environmental ethics: Role of Indian and ot	•				
	environmental conservation. Environmental comm		-			
	case studies (e.g., CNG vehicles in Delhi).			- F		
			L	Т	Р	Total
			45	0	0	45
TEXT BO	OKS					
6. Ma	huaBasu,S. Xavier, Fundamentals of Environmental S	tudies,	Camb	ridge	Unive	rsity
Pre	ess, 2019			-		-
7. Bh	aruchaErach, Textbook of Environmental Studies for U	ndergra	aduate	e Cour	ses, O	rient
	nckswan Pvt Ltd, 2018	U			,	
	ubha Kaushik, C.P. Kaushik, Perspectives in Environn	nental S	Studies	s. Nev	v Age	
	ernational Pvt Ltd Publishers,2018	lentar S	, each and	, 1 (0)	80	
	van Shyam, Environmental Law and Policy in India, OU	IP Indi	a 2010	a)		
	run DuttSharma,S.K. Pandey,Vimal Kumar sharma, E				ation a	nd
	saster Management, CBS Publishers & Distributors,20		icitai	Luuc	ation a	na
	NCE BOOKS	17				
	NCE BOOKS					
10. M.	V. Subba Rao, Natural Resources, Conservation, Mana	gement	t and ]	Health	n Care,	
	scovery Publishing Pvt.Ltd,2020	0				
	sters Gilbert M. Introduction to Environmental Engine	ering 3	rd Ed	ition .	Pearso	on
	ucation India, 3rd edition ,2015.	U		,		
	D. Sharma, Ecology and Environment Thirteenth Edition	n Rast	ogi Pi	ublica	tions 2	017
	Avneesh Gaur, Environmental Engineering and Disas		0			
	India,2021		ngen		uju L	aacatio
	REFERENCES					
	p://www.e-booksdirectory.com/details.php?ebook=105	26				
	ps://www.free-ebooks.net/ebook/Introduction-to-Envir		- 1			
	-					
	encehttps://www.free-ebooks.net/ebook/What-is-Biod					
17. <u>nu</u>	ps://www.learner.org/courses/envsci/unit/unit_vis.php?					
10 1.44	p://bookboon.com/en/pollution-prevention-and-control	-edook				
	v.e-booksdirectory.com/details.php?ebook=8557					
nttp://www	v.e-booksdirectory.com/details.php?ebook=8557 v.e-booksdirectory.com/details.php?ebook=6804					

http://bookboon.com/en/atmospheric-pollution-ebook

http://www.e-booksdirectory.com/details.php?ebook=3749

http://www.e-booksdirectory.com/details.php?ebook=2604

http://www.e-booksdirectory.com/details.php?ebook=2116

http://www.e-booksdirectory.com/details.php?ebook=1026

http://www.faadooengineers.com/threads/7894-Environmental-Science

			PROGRAM OUTCOMES											
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1														
CO2	2					2	1			1		1		
CO3	2	1	3			3	1		2	1		1		
CO4	1	1	2			3	2	3				1		
CO5	2	1	1			3						1		
Total	10	3	6			11	4	3	2	2		5		
ScaledValue	2	1	2			3	1	1	1	1	1	1		
		1 –	$5 \rightarrow$	1,		6 -	- 10 -	→ 2,		11	- 15	$\rightarrow 3$		
	(	)-NoF	Relatio	on,1-1	Low F	elatio	n,2-N	Iediun	nRela	tion,3-l	HighR	elatic	n	

XBT706       RECOMBINANT DNA TECHNOLOGY       0       0       2       2         I       1       0       0       0       2       2         I       1       0       0       0       2       2         I       1       0       0       0       2       2         I       1       0       0       0       2       2         I       1       0       0       0       2       2         I       1       0       0       2       0       0       2       2         I       1       0       0       2       2       0       0       2       2         Iterning Objectives:       Iterning Objectives:       Iterning Objectives:       Iterning Objectives:       Upon completion of this course, students will be able to       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0<								L	Т	P	С						
C       P       A         LABORATORY       L       T       P       H         0       0       2       6         Prerequisite: Genetics, Molecular biology       L       T       P       H         0       0       2       6         Prerequisite: Genetics, Molecular biology       L       T       P       H         0       0       1       1       0       0       2       6         Prerequisite: Genetics, Molecular biology       Learning Objectives:       Upon completion of this course, the students       0       0       1       1       0       0       2       6         Would have learned the concepts of gene cloning and its application.       Would have learned the various techniques involved in Recombinant DNA Technology.       Understand       Perception         Cost       Study and Understand the basic concepts isolation and Analyze gel electrophoresis and Southern Orginitive Understand Psychomotor       Perception       Remember Analyze         CO3       Explain and Analyze SDS PAGE and Western blotting.       Cognitive Psychomotor       Perception       Perception         Cost       Explain and Analyze SDS PAGE and Western blotting.       Cognitive Psychomotor       Apply       Perception         Cost       Explain and	х	KRT	706								2						
C       P       A       L       T       P       H         1       1       0       0       0       2       6         Perequisite: Genetics, Molecular biology         Learning Objectives:         Upon completion of this course, the students         •       Would have learned the concepts of gene cloning and its application.         •       Would have learned the concepts will be able to         Course Outcomes       Domain       Level         After the completion of the course, students will be able to       Study and Understand the basic concepts isolation and Cognitive Psychomotor       Understand Perception         CO1       Study and Analyze gel electrophoresis and Southern Cognitive Bychomotor       Perception       Perception         CO3       Explain and Analyze SDS PAGE and Western blotting.       Cognitive Psychomotor       Perception         CO4       Discusses, and Distinguish digested DNA and genomic Cognitive DNA.       Analyze Perception       Cognitive Perception         CO5       Explain and Analyze Main digestion. (CO1)       11. Restriction Experiments       10. Isolation of Plasmid and Genomic DNA. (CO1)         11. Restriction Experiments       10. Isolation of digested DNA. (CO4)       18. Competent cell preparation. calcium chloride method (CO5)       10. Screening and selection of recombina			/00				Y		Ū	_	_						
1       1       0       0       0       2       6         Prerequisite: Genetics, Molecular biology         Learning Objectives:         Upon completion of this course, the students         •       Would have learned the concepts of gene cloning and its application.         •       Would have learned the various techniques involved in Recombinant DNA Technology.         Course Outcomes         After the completion of the course, students will be able to         Course Outcomes         Outcomes         Outcomes         Course Outcomes         Course Outcomes         Conse Outcomes         Conse Outcomes         Conse Outcomes         Conse Outcomes         Conse Outcomes         Conse Outcomes         Consecoutcomes         Consecoutcomes         Consecoutcomes         Consecoutcomes         Consecoutcomes         Consecoutcomes         Consecoutcomes         Consecoutcomes         Constinant Analyze pel electrophoresis and Southen	C	Р	Α		LABORATOR	Y		L	Т	P	Η						
Learning Objectives:         Upon completion of this course, the students         •       Would have learned the concepts of gene cloning and its application.         •       Would have learned the various techniques involved in Recombinant DNA Technology.         Course Outcomes       Domain       Level         After the completion of the course, students will be able to       Cognitive       Understand         CO1       Study and Understand the basic concepts isolation and digestion.       Cognitive       Understand         C02       Explain and Analyze gel electrophoresis and Southern botting.       Cognitive       Perception         C03       Explain and Analyze SDS PAGE and Western blotting.       Cognitive Analyze Perception       Perception         C04       Discusses, and Distinguish digested DNA and genomic Cognitive DNA.       Apply       Perception         C05       Explain and Apply the cell preparation and selection of Perception       Cognitive Apply       Apply         DNA.       Extland Particle Experiments       Understand Psychomotor       Apply         Recombinant DNA Technology Lab       List of Practical Experiments       Understand Psychomotor       Apply         10. Isolation of Plasmid and Genomic DNA. (CO1)       11. Restriction enzyme digestion. (CO1)       12. Agarose gel Electrophoresis. (CO2)       13. Southern blotting. (CO3)											6						
Learning Objectives:         Upon completion of this course, the students         •       Would have learned the concepts of gene cloning and its application.         •       Would have learned the various techniques involved in Recombinant DNA Technology.         Course Outcomes       Domain       Level         After the completion of the course, students will be able to       Cognitive       Understand         CO1       Study and Understand the basic concepts isolation and digestion.       Cognitive       Understand         C02       Explain and Analyze gel electrophoresis and Southern       Cognitive       Perception         C03       Explain and Analyze SDS PAGE and Western blotting.       Cognitive       Perception         C04       Discusses, and Distinguish digested DNA and genomic       Cognitive       Apply         PSychomotor       Perception       Cognitive       Apply         DNA.       Explain and Apply the cell preparation and selection of       Cognitive       Apply         Psychomotor       Perception       Apply       Perception         C05       Explain and Apply the cell preparation and selection of       Cognitive       Apply         DNA.       Explain of Plasmid and Genomic DNA. (CO1)       11. Restriction enzyme digestion. (CO1)       12. Agarose gel Electrophoresis. (CO2) <td< td=""><td>Pre</td><td>req</td><td>uisite: (</td><td>Genetics, N</td><td>Aolecular biology</td><td></td><td></td><td></td><th></th><th></th><td>1</td></td<>	Pre	req	uisite: (	Genetics, N	Aolecular biology						1						
<ul> <li>Would have learned the concepts of gene cloning and its application.</li> <li>Would have learned the various techniques involved in Recombinant DNA Technology.         <ul> <li>Course Outcomes</li> <li>Domain</li> <li>Level</li> </ul> </li> <li>After the completion of the course, students will be able to</li> <li>Course, students will be able to</li> <li>Explain and Analyze gel electrophoresis and Southern blotting.</li> <li>Explain and Analyze SDS PAGE and Western blotting.</li> <li>Cognitive Perception</li> <li>Psychomotor</li> <li>Perception</li> <li>Coord</li> <li>Discusses, and Distinguish digested DNA and genomic Cognitive DNA.</li> <li>Coord Explain and Apply the cell preparation and selection of Cognitive Perception</li> <li>Recombinant DNA Technology Lab</li> <li>List of Practical Experiments</li> <li>10. Isolation of Plasmid and Genomic DNA. (CO1)</li> <li>11. Restriction enzyme digestion. (CO1)</li> <li>12. Agarose gel Electrophoresis. (CO2)</li> <li>13. Southern blotting (CO3)</li> <li>15. Western blotting. (CO3)</li> <li>16. Purification of digested DNA. (CO4)</li> <li>17. Ligation of restricted vector and genomic DNA (CO4)</li> <li>18. Competent cell preparation- calcium chloride method (CO5)</li> <li>10. Scoreening and selection of recombinants(CO5)</li> <li>Lecture</li> <li>Tutorial</li> <li>Practical</li> <li>Total</li> <li>00</li> <li>00</li> <li>30</li> <li>30</li> <li>30</li> <li>30</li> <li>Text Books:</li> <li>2. Primrose S.B. and Twymann R.H., "Principles of Gene Manipulation: An Introduction to Genetic Engineering", Sixth Edition, Blackwell Scientific Publications, 2004.</li> <li>Reference Books:</li> <li>4. Brown T.A., "Gene Cloning and DNA Analysis"</li></ul>																	
<ul> <li>Would have learned the various techniques involved in Recombinant DNA Technology.         <ul> <li>Course Outcomes</li> <li>Domain</li> <li>Level</li> </ul> </li> <li>After the completion of the course, students will be able to         <ul> <li>Cou</li> <li>Study and Understand the basic concepts isolation and digestion.</li> <li>Con</li> <li>Explain and Analyze gel electrophoresis and Southern blotting.</li> <li>Cognitive Perception</li> <li>Perception</li> </ul> </li> <li>Co3</li> <li>Explain and Analyze gel electrophoresis and Southern blotting.</li> <li>Cognitive Perception</li> <li>Perception</li> <li>Cognitive Psychomotor Perception</li> <li>Perception</li> <li>Co4</li> <li>Discusses, and Distinguish digested DNA and genomic Cognitive Psychomotor Perception</li> <li>Co5</li> <li>Explain and Apply the cell preparation and selection of recombinant DNA Technology Lab</li> <li>List of Practical Experiments</li> <li>Io. Isolation of Plasmid and Genomic DNA. (CO1)</li> <li>Agarose gel Electrophoresis. (CO2)</li> <li>I. Southern blotting. (CO3)</li> <li>I. Severn blotting. (CO3)</li> <li>Severn bl</li></ul>	Up	on c	omplet	ion of this	course, the students												
Course Outcomes         Domain         Level           After the completion of the course, students will be able to             CO1         Study and Understand the basic concepts isolation and digestion.         Cognitive         Parception           CO2         Explain and Analyze gel electrophoresis and Southern blotting.         Cognitive         Perception           CO3         Explain and Analyze SDS PAGE and Western blotting.         Cognitive         Perception           CO4         Discusses, and Distinguish digested DNA and genomic DNA.         Cognitive         Apply           DNA.         Explain and Apply the cell preparation and selection of Cognitive recombinants.         Perception         Perception           CO5         Explain and Apply the cell preparation and selection of Psychomotor         Perception         Perception           Recombinant DNA Technology Lab         List of Practical Experiments         Understand         Apply           10. Isolation of Plasmid and Genomic DNA. (CO1)         11. Restriction enzyme digestion. (CO1)         12. Agarose gel Electrophoresis. (CO2)         13. Southern blotting. (CO3)         16. Purification of digested DNA. (CO4)         17. Ligation of restricted vector and genomic DNA (CO4)         18. Competent cell preparation - calcium chloride method (CO5)         10. Screening and selection of recombinants(CO5)           Lecture         Tutorial         Pr		•	Would	have learn	ed the concepts of gene clonin	ng and its app	lication.										
After the completion of the course, students will be able to       Image: Construct of the course, students will be able to         COI       Study and Understand the basic concepts isolation and digestion.       Cognitive Psychomotor Perception         CO2       Explain and Analyze gel electrophoresis and Southern Cognitive Psychomotor Perception       Understand Psychomotor Perception         CO3       Explain and Analyze SDS PAGE and Western blotting.       Cognitive Psychomotor Perception Perception         CO4       Discusses, and Distinguish digested DNA and genomic Cognitive DNA.       Perception         CO5       Explain and Apply the cell preparation and selection of Cognitive DNA.       Perception Perception         CO5       Explain and Apply the cell preparation and selection of Psychomotor Perception       Apply         Recombinant DNA Technology Lab       Understand Psychomotor Apply       Perception         List of Practical Experiments       10. Isolation of Plasmid and Genomic DNA. (CO1)       11. Restriction enzyme digestion. (CO1)       12. Agarose gel Electrophoresis. (CO2)       13. Southern blotting. (CO3)         15. Western blotting.       (CO3)       15. Western blotting. (CO3)       16. Purification of digested DNA. (CO4)       17. Ligation of digested DNA. (CO4)         18. Competent cell preparation - calcium chloride method (CO5)       10. Screening and selection of recombinants(CO5)       10. Screening and selection of recombinants(CO5)         19. L		•	Would	have learn	ed the various techniques invo	olved in Reco	mbinant DI	NA Te	chnolog	gy.							
CO1         Study and Understand the basic concepts isolation and digestion.         Cognitive Psychomotor         Understand Perception           CO2         Explain and Analyze gel electrophoresis and Southern blotting.         Cognitive Perception         Perception           CO3         Explain and Analyze SDS PAGE and Western blotting.         Cognitive Psychomotor Perception         Remember Analyze Perception           CO4         Discusses, and Distinguish digested DNA and genomic Cognitive Perception         Remember Analyze Perception           CO5         Explain and Apply the cell preparation and selection of recombinants.         Cognitive Perception         Apply           Recombinant DNA Technology Lab         Estist of Practical Experiments         Understand Psychomotor         Apply           10. Isolation of Plasmid and Genomic DNA. (CO1)         11. Restriction enzyme digestion. (CO1)         12. Agarose gel Electrophoresis. (CO2)         13. Southern blotting. (CO3)         16. Purification of digested DNA. (CO4)         17. Ligation of restricted vector and genomic DNA (CO4)         18. Competent cell preparation- calcium chloride method (CO5)         10. Screening and selection of recombinants(CO5)         20. Screening and selection of recombinants(CO5)           Lecture         Tutorial         Practical         Total         00         30         30           18. Competent cell preparation- calcium chloride method (CO5)         10. Screening and selection of recombinants(CO5)<							Doma	in		Level							
CO1       digestion.       Psychomotor       Perception         CO2       Explain and Analyze gel electrophoresis and Southern blotting.       Cognitive Psychomotor       Perception         CO3       Explain and Analyze SDS PAGE and Western blotting.       Cognitive Psychomotor       Remember Analyze Perception         CO4       Discusses, and Distinguish digested DNA and genomic DNA.       Cognitive Psychomotor       Perception         CO5       Explain and Apply the cell preparation and selection of cognitive DNA.       Cognitive Perception       Apply Perception         CO5       Explain and Apply the cell preparation and selection of Psychomotor       Perception       Apply Perception         CO5       Explain and Apply the cell preparation and selection of Cognitive DNA.       Apply Perception       Apply Perception         Recombinant DNA Technology Lab       List of Practical Experiments       Understand Psychomotor       Apply         10. Isolation of Plasmid and Genomic DNA. (CO1)       11. Restriction enzyme digestion. (CO1)       12. Agarose gel Electrophoresis. (CO2)       13. Southern blotting. (CO3)       16. Purification of digested DNA. (CO4)       17. Ligation of restricted vector and genomic DNA (CO4)       18. Competent cell preparation- calcium chloride method (CO5)       10. Screening and selection of recombinants(CO5)         Lecture       Tutorial       Practical       Total         00       00	Aft	-	-				1		n								
digestion.       Psychomotor       Perception         CO2       Explain and Analyze gel electrophoresis and Southern blotting.       Cognitive Psychomotor       Understand Psychomotor         CO3       Explain and Analyze SDS PAGE and Western blotting.       Cognitive Psychomotor       Remember Analyze Perception         CO4       Discusses, and Distinguish digested DNA and genomic DNA.       Cognitive Perception       Apply Perception         CO5       Explain and Apply the cell preparation and selection of recombinants.       Cognitive Psychomotor       Apply         Recombinant DNA Technology Lab       Estilian and Genomic DNA. (CO1)       Understand Psychomotor       Apply         10. Isolation of Plasmid and Genomic DNA. (CO1)       11. Restriction enzyme digestion. (CO1)       12. Agarose gel Electrophoresis. (CO2)       13. Southern blotting. (CO3)         15. Western blotting. (CO3)       15. Western blotting. (CO3)       16. Purification of digested DNA. (CO4)       17. Ligation of restricted vector and genomic DNA (CO4)         17. Ligation of restricted vector and genomic DNA (CO4)       18. Competent cell preparation- calcium chloride method (CO5)       10. Screening and selection of recombinants(CO5)         Lecture       Tutorial       Practical       Total         00       00       30       30         2. Primrose S.B. and Twymann R.H., "Principles of Gene Manipulation: An Introduction to Genetic Engineering", Si	CO		•		rstand the basic concepts is	solation and											
CO2       blotting.       Psychomotor       Perception         CO3       Explain and Analyze SDS PAGE and Western blotting.       Cognitive Psychomotor       Remember Analyze Perception         CO4       Discusses, and Distinguish digested DNA and genomic DNA.       Cognitive Psychomotor       Apply Perception         CO5       Explain and Apply the cell preparation and selection of recombinants.       Cognitive Psychomotor       Apply         Recombinant DNA Technology Lab       Understand Psychomotor       Apply         List of Practical Experiments       Io. Isolation of Plasmid and Genomic DNA. (CO1)       II. Restriction enzyme digestion. (CO1)         12. Agarose gel Electrophoresis. (CO2)       I3. Southern blotting. (CO3)       I6. Purification of digested DNA. (CO4)         13. Southern blotting. (CO3)       I6. Purification of digested DNA. (CO4)       I8. Competent cell preparation- calcium chloride method (CO5)         10. Screening and selection of recombinants(CO5)       Lecture       Total         00       00       30       30         Text Books:       2. Primrose S.B. and Twymann R.H., "Principles of Gene Manipulation: An Introduction to Genetic Engineering", Sixth Edition, Blackwell Scientific Publications, 2004.         Reference Books:       4. Brown T.A., "Gene Cloning and DNA Analysis", Fourth Edition, Blackwell Scientifif Publications, 2003.         5. Glick B.R. and Pasternak J.J., "Molecular Biotechnology", Third		(	<u> </u>					otor	•								
biotting.       Psychomotor       Perception         CO3       Explain and Analyze SDS PAGE and Western blotting.       Cognitive Psychomotor       Remember Analyze Perception         CO4       Discusses, and Distinguish digested DNA and genomic DNA.       Cognitive Psychomotor       Apply Perception         CO5       Explain and Apply the cell preparation and selection of recombinants.       Cognitive Psychomotor       Apply         Recombinant DNA Technology Lab       Understand Apply         List of Practical Experiments       10. Isolation of Plasmid and Genomic DNA. (CO1)       11. Restriction enzyme digestion. (CO1)         12. Agarose gel Electrophoresis. (CO2)       13. Southern blotting (CO3)       16. Purification of digested DNA. (CO4)         13. Southern blotting. (CO3)       16. Purification of restricted vector and genomic DNA (CO4)       17. Ligation of restricted vector and genomic DNA (CO4)         14. SDS PAGE.       Tutorial       Practical       Total         00       00       30       30         Text Books:       2. Primrose S.B. and Twymann R.H., "Principles of Gene Manipulation: An Introduction to Genetic Engineering", Sixth Edition, Blackwell Scientific Publications, 2004.         Reference Books:       4. Brown T.A., "Gene Cloning and DNA Analysis", Fourth Edition, Blackwell Scientifif Publications, 2003.         5. Glick B.R. and Pasternak J.J., "Molecular Biotechnology", Third Edition, ASM Press <td>CO</td> <td></td> <td>-</td> <td></td> <td><i>alyze</i> gel electrophoresis ar</td> <td>nd Southern</td> <td>0</td> <td></td> <th></th> <th></th> <td></td>	CO		-		<i>alyze</i> gel electrophoresis ar	nd Southern	0										
CO3       Explain and Analyze SDS PAGE and Western blotting.       Cognitive Psychomotor       Analyze Perception         CO4       Discusses, and Distinguish digested DNA and genomic DNA.       Cognitive Perception       Analyze Perception         CO5       Explain and Apply the cell preparation and selection of recombinants.       Cognitive Psychomotor       Apply Perception         Recombinant DNA Technology Lab       Understand Psychomotor       Apply         List of Practical Experiments       0. Isolation of Plasmid and Genomic DNA. (CO1)       11. Restriction enzyme digestion. (CO1)       12. Agarose gel Electrophoresis. (CO2)         13. Southern blotting (CO3)       16. Purification of digested DNA. (CO4)       17. Ligation of restricted vector and genomic DNA (CO4)       18. Competent cell preparation- calcium chloride method (CO5)       10. Screening and selection of recombinants(CO5)         Lecture       Tutorial       Practical       Total         00       00       30       30         Text Books:       2. Primrose S.B. and Twymann R.H., "Principles of Gene Manipulation: An Introduction to Genetic Engineering", Sixth Edition, Blackwell Scientific Publications, 2004.         Reference Books:       4. Brown T.A., "Gene Cloning and DNA Analysis", Fourth Edition, Blackwell Scientifif Publications, 2003.       5. Glick B.R. and Pasternak J.J., "Molecular Biotechnology", Third Edition, ASM Press		blotting.     Psychomotor     Perception       Cognitive     Remember															
CO3       Explain and Analyze SDS PACE and western biotting.       Psychomotor       Parception         CO4       Discusses, and Distinguish digested DNA and genomic       Cognitive       Apply         DNA.       Psychomotor       Perception         CO5       Explain and Apply the cell preparation and selection of recombinants.       Cognitive       Understand         Recombinant DNA Technology Lab       Explain and Genomic DNA. (CO1)       11.       Restriction enzyme digestion. (CO1)         11.       Restriction enzyme digestion. (CO1)       12.       Agarose gel Electrophoresis. (CO2)         13.       Southern blotting. (CO3)       16.       Purification of digested DNA. (CO4)         15.       Western blotting. (CO3)       16.       Purification of digested DNA. (CO4)         17.       Ligation of restricted vector and genomic DNA (CO4)       18.       Competent cell preparation- calcium chloride method (CO5)         10.       Screening and selection of recombinants(CO5)       Ecture       Total         00       00       30       30         7       Primorse S.B. and Twymann R.H., "Principles of Gene Manipulation: An Introduction to Genetic Engineering", Sixth Edition, Blackwell Scientific Publications, 2004.         Reference Books:       4.       Brown T.A., "Gene Cloning and DNA Analysis", Fourth Edition, Blackwell Scientifi Publications, 2003. <td></td> <td colspan="14">blotting.PsychomotorPerceptionCO3Explain and Analyze SDS PAGE and Western blotting.Cognitive PsychomotorRemember Analyze</td>		blotting.PsychomotorPerceptionCO3Explain and Analyze SDS PAGE and Western blotting.Cognitive PsychomotorRemember Analyze															
CO4       Discusses, and Distinguish digested DNA and genomic Dog mitive DNA.       Perception         CO5       Explain and Apply the cell preparation and selection of cognitive recombinants.       Perception         Recombinant DNA Technology Lab       Understand Apply         List of Practical Experiments       10. Isolation of Plasmid and Genomic DNA. (CO1)       11. Restriction enzyme digestion. (CO1)         11. Restriction enzyme digestion. (CO1)       12. Agarose gel Electrophoresis. (CO2)       13. Southern blotting. (CO3)         16. Purification of digested DNA. (CO4)       15. Western blotting. (CO3)       16. Purification of restricted vector and genomic DNA (CO4)         17. Ligation of restricted vector and genomic DNA (CO4)       18. Competent cell preparation- calcium chloride method (CO5)       10. Screening and selection of recombinants(CO5)         10. Screening and selection of recombinants(CO5)       10. Screening and selection of necombinants(CO5)       10. Screening and selection of necombinants(CO5)         10. Screening and selection of Recombinants(CO5)       10. Screening and selection of recombinants(CO5)       10. Screening and selection of recombinants(CO5)         12. Primrose S.B. and Twymann R.H., "Principles of Gene Manipulation: An Introduction to Genetic Engineering", Sixth Edition, Blackwell Scientific Publications, 2004.         Reference Books:       4. Brown T.A., "Gene Cloning and DNA Analysis", Fourth Edition, Blackwell Scientifi Publications, 2003.         5. Glick B.R. and Pasternak J.J., "Molecul	CO	CO3 Explain and Analyze SDS PAGE and Western blotting. Analyze															
CO4       DNA.       Psychomotor       Perception         CO5       Explain and Apply the cell preparation and selection of recombinants.       Psychomotor       Understand Apply         Recombinant DNA Technology Lab       Understand       Psychomotor       Apply         Recombinant DNA Technology Lab       Understand       Apply         List of Practical Experiments       10. Isolation of Plasmid and Genomic DNA. (CO1)       11. Restriction enzyme digestion. (CO1)         12. Agarose gel Electrophoresis. (CO2)       13. Southern blotting (CO2)       14. SDS PAGE. (CO3)         15. Western blotting. (CO3)       16. Purification of digested DNA. (CO4)       17. Ligation of restricted vector and genomic DNA (CO4)         18. Competent cell preparation- calcium chloride method (CO5)       10. Screening and selection of recombinants(CO5)         Lecture       Tutorial       Practical       Total         00       00       30       30         Text Books:       2. Primrose S.B. and Twymann R.H., "Principles of Gene Manipulation: An Introduction to Genetic Engineering", Sixth Edition, Blackwell Scientific Publications, 2004.         Reference Books:       4. Brown T.A., "Gene Cloning and DNA Analysis", Fourth Edition, Blackwell Scientifif Publications, 2003.       5. Glick B.R. and Pasternak J.J., "Molecular Biotechnology", Third Edition, ASM Press		-		and T	istinguigh disected DNA		-										
CO5         Explain and Apply the cell preparation and selection of recombinants.         Cognitive Psychomotor         Understand Apply           Recombinant DNA Technology Lab	CO	4															
COS       recombinants.       Psychomotor       Apply         Recombinant DNA Technology Lab       List of Practical Experiments       10. Isolation of Plasmid and Genomic DNA. (CO1)         11. Restriction enzyme digestion. (CO1)       12. Agarose gel Electrophoresis. (CO2)       13. Southern blotting (CO2)         14. SDS PAGE. (CO3)       15. Western blotting. (CO3)       16. Purification of digested DNA. (CO4)         17. Ligation of restricted vector and genomic DNA (CO4)       18. Competent cell preparation- calcium chloride method (CO5)         10. Screening and selection of recombinants(CO5)       Iceture       Total         00       00       30       30         Text Books:         2. Primrose S.B. and Twymann R.H., "Principles of Gene Manipulation: An Introduction to Genetic Engineering", Sixth Edition, Blackwell Scientific Publications, 2004.         Reference Books:         4. Brown T.A., "Gene Cloning and DNA Analysis", Fourth Edition, Blackwell Scientific Publications, 2003.         5. Glick B.R. and Pasternak J.J., "Molecular Biotechnology", Third Edition, ASM Press																	
Recombinant DNA Technology Lab         List of Practical Experiments         10. Isolation of Plasmid and Genomic DNA. (CO1)         11. Restriction enzyme digestion. (CO1)         12. Agarose gel Electrophoresis. (CO2)         13. Southern blotting (CO2)         14. SDS PAGE. (CO3)         15. Western blotting. (CO3)         16. Purification of digested DNA. (CO4)         17. Ligation of restricted vector and genomic DNA (CO4)         18. Competent cell preparation- calcium chloride method (CO5)         10. Screening and selection of recombinants(CO5)         Lecture       Tutorial         00       00         30       30         Text Books:         2. Primrose S.B. and Twymann R.H., "Principles of Gene Manipulation: An Introduction to Genetic Engineering", Sixth Edition, Blackwell Scientific Publications, 2004.         Reference Books:         4. Brown T.A., "Gene Cloning and DNA Analysis", Fourth Edition, Blackwell Scientifif Publications, 2003.         5. Glick B.R. and Pasternak J.J., "Molecular Biotechnology", Third Edition, ASM Press																	
List of Practical Experiments         10. Isolation of Plasmid and Genomic DNA. (CO1)         11. Restriction enzyme digestion. (CO1)         12. Agarose gel Electrophoresis. (CO2)         13. Southern blotting (CO2)         14. SDS PAGE. (CO3)         15. Western blotting. (CO3)         16. Purification of digested DNA. (CO4)         17. Ligation of restricted vector and genomic DNA (CO4)         18. Competent cell preparation- calcium chloride method (CO5)         10. Screening and selection of recombinants(CO5)         Lecture       Tutorial         00       00         30       30         30       30         Reference Books:         4. Brown T.A., "Gene Cloning and DNA Analysis", Fourth Edition, Blackwell Scientific Publications, 2003.         5. Glick B.R. and Pasternak J.J., "Molecular Biotechnology", Third Edition, ASM Press	Rec				mology Lab		1 sycholik		rippij								
10. Isolation of Plasmid and Genomic DNA. (CO1)         11. Restriction enzyme digestion. (CO1)         12. Agarose gel Electrophoresis. (CO2)         13. Southern blotting (CO2)         14. SDS PAGE. (CO3)         15. Western blotting. (CO3)         16. Purification of digested DNA. (CO4)         17. Ligation of restricted vector and genomic DNA (CO4)         18. Competent cell preparation- calcium chloride method (CO5)         10. Screening and selection of recombinants(CO5)         Lecture       Tutorial         00       00         30       30         30       30         Reference Books:         4. Brown T.A., "Gene Cloning and DNA Analysis", Fourth Edition, Blackwell Scientiff Publications, 2003.         5. Glick B.R. and Pasternak J.J., "Molecular Biotechnology", Third Edition, ASM Press																	
11. Restriction enzyme digestion. (CO1)         12. Agarose gel Electrophoresis. (CO2)         13. Southern blotting (CO2)         14. SDS PAGE. (CO3)         15. Western blotting. (CO3)         16. Purification of digested DNA. (CO4)         17. Ligation of restricted vector and genomic DNA (CO4)         18. Competent cell preparation- calcium chloride method (CO5)         10. Screening and selection of recombinants(CO5)         Lecture       Tutorial         Practical       Total         00       00         30       30         Reference Books:         2. Primrose S.B. and Twymann R.H., "Principles of Gene Manipulation: An Introduction to Genetic Engineering", Sixth Edition, Blackwell Scientific Publications, 2004.         Reference Books:         4. Brown T.A., "Gene Cloning and DNA Analysis", Fourth Edition, Blackwell Scientifi Publications, 2003.         5. Glick B.R. and Pasternak J.J., "Molecular Biotechnology", Third Edition, ASM Press						)											
<ul> <li>13. Southern blotting (CO2)</li> <li>14. SDS PAGE. (CO3)</li> <li>15. Western blotting. (CO3)</li> <li>16. Purification of digested DNA. (CO4)</li> <li>17. Ligation of restricted vector and genomic DNA (CO4)</li> <li>18. Competent cell preparation- calcium chloride method (CO5)</li> <li>10. Screening and selection of recombinants(CO5)</li> <li>Lecture Tutorial Practical Total</li> <li>00 00 30 30</li> <li>Text Books:</li> <li>2. Primrose S.B. and Twymann R.H., "Principles of Gene Manipulation: An Introduction to Genetic Engineering", Sixth Edition, Blackwell Scientific Publications, 2004.</li> <li>Reference Books:</li> <li>4. Brown T.A., "Gene Cloning and DNA Analysis", Fourth Edition, Blackwell Scientifi Publications, 2003.</li> <li>5. Glick B.R. and Pasternak J.J., "Molecular Biotechnology", Third Edition, ASM Press</li> </ul>																	
14. SDS PAGE. (CO3)         15. Western blotting. (CO3)         16. Purification of digested DNA. (CO4)         17. Ligation of restricted vector and genomic DNA (CO4)         18. Competent cell preparation- calcium chloride method (CO5)         10. Screening and selection of recombinants(CO5)         Lecture       Tutorial         Practical       Total         00       00         30       30         Text Books:		12.	Agaros	e gel Electi	rophoresis. (CO2)												
<ul> <li>15. Western blotting. (CO3)</li> <li>16. Purification of digested DNA. (CO4)</li> <li>17. Ligation of restricted vector and genomic DNA (CO4)</li> <li>18. Competent cell preparation- calcium chloride method (CO5)</li> <li>10. Screening and selection of recombinants(CO5)</li> <li>Lecture Tutorial Practical Total</li> <li>00 00 30 30</li> <li>Text Books:</li> <li>2. Primrose S.B. and Twymann R.H., "Principles of Gene Manipulation: An Introduction to Genetic Engineering", Sixth Edition, Blackwell Scientific Publications, 2004.</li> <li>Reference Books:</li> <li>4. Brown T.A., "Gene Cloning and DNA Analysis", Fourth Edition, Blackwell Scientific Publications, 2003.</li> <li>5. Glick B.R. and Pasternak J.J., "Molecular Biotechnology", Third Edition, ASM Press</li> </ul>		13.	Souther	n blotting	(CO2)												
<ul> <li>16. Purification of digested DNA. (CO4)</li> <li>17. Ligation of restricted vector and genomic DNA (CO4)</li> <li>18. Competent cell preparation- calcium chloride method (CO5)</li> <li>10. Screening and selection of recombinants(CO5)</li> <li>Lecture Tutorial Practical Total</li> <li>00 00 30 30</li> <li>Text Books:</li> <li>2. Primrose S.B. and Twymann R.H., "Principles of Gene Manipulation: An Introduction to Genetic Engineering", Sixth Edition, Blackwell Scientific Publications, 2004.</li> <li>Reference Books:</li> <li>4. Brown T.A., "Gene Cloning and DNA Analysis", Fourth Edition, Blackwell Scientific Publications, 2003.</li> <li>5. Glick B.R. and Pasternak J.J., "Molecular Biotechnology", Third Edition, ASM Press</li> </ul>					·												
<ul> <li>17. Ligation of restricted vector and genomic DNA (CO4)</li> <li>18. Competent cell preparation- calcium chloride method (CO5)</li> <li>10. Screening and selection of recombinants(CO5)</li> <li>Lecture Tutorial Practical Total</li> <li>00 00 30 30</li> <li>Text Books:</li> <li>2. Primrose S.B. and Twymann R.H., "Principles of Gene Manipulation: An Introduction to Genetic Engineering", Sixth Edition, Blackwell Scientific Publications, 2004.</li> <li>Reference Books: <ul> <li>4. Brown T.A., "Gene Cloning and DNA Analysis", Fourth Edition, Blackwell Scientific Publications, 2003.</li> <li>5. Glick B.R. and Pasternak J.J., "Molecular Biotechnology", Third Edition, ASM Press</li> </ul> </li> </ul>				0													
18. Competent cell preparation- calcium chloride method (CO5)         10.       Screening and selection of recombinants(CO5)         Lecture       Tutorial       Practical       Total         00       00       30       30         Text Books:         2.       Primrose S.B. and Twymann R.H., "Principles of Gene Manipulation: An Introduction to Genetic Engineering", Sixth Edition, Blackwell Scientific Publications, 2004.         Reference Books:         4.       Brown T.A., "Gene Cloning and DNA Analysis", Fourth Edition, Blackwell Scientifit Publications, 2003.         5.       Glick B.R. and Pasternak J.J., "Molecular Biotechnology", Third Edition, ASM Press				0													
10.       Screening and selection of recombinants(CO5)         Lecture       Tutorial       Practical       Total         00       00       30       30         Text Books:         2.       Primrose S.B. and Twymann R.H., "Principles of Gene Manipulation: An Introduction to Genetic Engineering", Sixth Edition, Blackwell Scientific Publications, 2004.         Reference Books:         4.       Brown T.A., "Gene Cloning and DNA Analysis", Fourth Edition, Blackwell Scientifit Publications, 2003.         5.       Glick B.R. and Pasternak J.J., "Molecular Biotechnology", Third Edition, ASM Press			0		0	· ,											
LectureTutorialPracticalTotal00003030Text Books:2. Primrose S.B. and Twymann R.H., "Principles of Gene Manipulation: An Introduction to Genetic Engineering", Sixth Edition, Blackwell Scientific Publications, 2004.Reference Books:4. Brown T.A., "Gene Cloning and DNA Analysis", Fourth Edition, Blackwell Scientific Publications, 2003.5. Glick B.R. and Pasternak J.J., "Molecular Biotechnology", Third Edition, ASM Press			-	-	-												
00       00       30       30         Text Books:         2. Primrose S.B. and Twymann R.H., "Principles of Gene Manipulation: An Introduction to Genetic Engineering", Sixth Edition, Blackwell Scientific Publications, 2004.         Reference Books:         4. Brown T.A., "Gene Cloning and DNA Analysis", Fourth Edition, Blackwell Scientific Publications, 2003.         5. Glick B.R. and Pasternak J.J., "Molecular Biotechnology", Third Edition, ASM Press		10.					ical		Tet	tal							
<ul> <li>Text Books:         <ol> <li>Primrose S.B. and Twymann R.H., "Principles of Gene Manipulation: An Introduction to Genetic Engineering", Sixth Edition, Blackwell Scientific Publications, 2004.</li> </ol> </li> <li>Reference Books:         <ol> <li>Brown T.A., "Gene Cloning and DNA Analysis", Fourth Edition, Blackwell Scientific Publications, 2003.</li> <li>Glick B.R. and Pasternak J.J., "Molecular Biotechnology", Third Edition, ASM Press</li> </ol> </li> </ul>				C													
<ol> <li>Primrose S.B. and Twymann R.H., "Principles of Gene Manipulation: An Introduction to Genetic Engineering", Sixth Edition, Blackwell Scientific Publications, 2004.</li> <li>Reference Books:         <ul> <li>4. Brown T.A., "Gene Cloning and DNA Analysis", Fourth Edition, Blackwell Scientific Publications, 2003.</li> <li>5. Glick B.R. and Pasternak J.J., "Molecular Biotechnology", Third Edition, ASM Press</li> </ul> </li> </ol>	Тез	rt R			00	50			5	0							
<ul> <li>Genetic Engineering", Sixth Edition, Blackwell Scientific Publications, 2004.</li> <li>Reference Books: <ul> <li>4. Brown T.A., "Gene Cloning and DNA Analysis", Fourth Edition, Blackwell Scientific Publications, 2003.</li> <li>5. Glick B.R. and Pasternak J.J., "Molecular Biotechnology", Third Edition, ASM Press</li> </ul> </li> </ul>	104			nrose S.B.	and Twymann R.H., "Princip	les of Gene N	Ianipulation	n: An	[ntroduo	ction to	)						
Reference Books:         4. Brown T.A., "Gene Cloning and DNA Analysis", Fourth Edition, Blackwell Scientifi Publications, 2003.         5. Glick B.R. and Pasternak J.J., "Molecular Biotechnology", Third Edition, ASM Press		·			•		-										
<ol> <li>Brown T.A., "Gene Cloning and DNA Analysis", Fourth Edition, Blackwell Scientifi Publications, 2003.</li> <li>Glick B.R. and Pasternak J.J., "Molecular Biotechnology", Third Edition, ASM Press</li> </ol>	Ref	ferei			, , , , , , , , , , , , , , , , ,			, .									
Publications, 2003. 5. Glick B.R. and Pasternak J.J., "Molecular Biotechnology", Third Edition, ASM Press					A., "Gene Cloning and DNA	Analysis", I	Fourth Edit	ion, B	lackwel	ll Scier	ntific						
					-	-											
2002			5.	Glick B.R	. and Pasternak J.J., "Molec	ular Biotechn	ology", Th	ird Ec	lition, A	ASM P	Press,						
2003.				2003.													

Sandhu, Sardul Singh. Recombinant DNA technology. IK International Pvt Ltd, 2010. 6.

**E-References:** 

http://nptel.ac.in/courses/102103013/

## Mapping of COs with Pos

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	1	2	1	1	1	0	0	1	0	1	0	0	0
CO 2	3	0	3	2	2	1	0	0	0	0	1	0	0	0
CO 3	3	0	3	1	3	0	0	1	0	2	0	0	0	0
CO 4	3	0	3	1	3	0	0	2	0	1	0	0	0	0
CO 5	3	0	3	2	3	2	3	3	0	1	2	0	0	0
	13	1	14	7	12	4	3	6	1	4	4	0	0	0

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

## Mapping of Subjects with POs

	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1	PSO	PSO
	l	2	- 3	4	5	6	1	8	9	0	1	2	L	2
Origina l Value	13	1	14	7	12	4	3	6	1	4	4	0	0	0
Scaled Value	3	1	3	2	3	1	1	2	1	1	1	0	0	0
$1-5 \rightarrow$	$1-5 \rightarrow 1$ ,			$10 \rightarrow 10$	2,		11 –	$15 \rightarrow$	3					

XI C	<b>BT707</b>	,						
C					1	0	1	2
U	P	A	BIOINFORMATICS	-	L	Т	Р	H
0.5	<b>r</b>	A 0.5		-	<u> </u>	0	<u>r</u> 2	<u>п</u> 6
Prerec					1	U	-	U
Learn			ives:					
	-	-	of this course, the students					
٠			ble identify different databases and will be able t		ut the	applic	ation o	f the
	bioin	forma	atics for data retrieval and for drug designing and de					
	1	1.4	Course Outcomes	Domain	l		Level	
			ion of the course, students will be able to the importance and basic concepts in	Comitivo		I In dans	tand	
CO1	Exp		the importance and basic concepts in attics and <b>differentiate</b> various databases.	Cognitive Psychomote		Unders Percep		
CO2			ands the significance of sequence analysis and	Cognitive		Apply	uon	
			s sequence alignment.	Psychomote			l respon	ise
CO3			and <b>Construct</b> phylogenetic trees to study	Cognitive		Unders		
	_		etic relationships					
CO4	Pre	dict a	and Analysis the protein structure and molecular	Cognitive		Create		
	docl		• 1	or	mechanism			
CO5			<b>nd</b> the steps involved in drug discovery process.	Affective		Receive		
-			o Bioinformatics				3	
			utions - aims and tasks of Bioinformatics - application					
			- Biological databases- Classification of biologica					idary
			ce and structure databases, Specialized databases- r			ntrez- 3		
			to Computational Biology and Sequence Analysi		<u></u>		3	1 1 1
-		0	ent, Pairwise alignment, Multiple sequence alignme eman and Wunsch algorithm, Smith Waterman algorithm	11				
FAST.				Innin, Datao		main	scaren	.mg ·
III- Pł							3	
	• •		hylogenetics, Molecular Evolution and Molecula	or Dhylogen	otics	Dhylor		traa
			epresentation, Rooted and un-rooted trees, Phylo					
			nethods- NJ, UPGMA, Character based methods -	0				
			apping.					
IV- Pr	otein	Stru	cture, Modelling and Simulations				3	
Prot	tein st	ructu	re basics, Protein structural visualization and comp	parison, Seco	ondary	y struct	ure pre	dicti
			GOR, Neural networks, Protein tertiary struct		•		-	
Thr	eading	g and	Fold recognition.					
V- Ro	le of B	Bioinf	formatics in Drug Discovery				3	
0	0	0	objectives- Rational drug design- Computer assisted	0 0		0	-	
			g and its applications- QSAR, In Silico drug desig		ructura	al bioin	formati	cs ir
-	-		evelopment- Pharmacogenomics- prospects and use	s.			(201	(
List of			nts and retrieval of data from various biological databa	cec Univ/I in	v 1	hasic o	( <b>30 l</b> peration	

and working with terminal.

- 10. Perl programs Simple programs using Operators, Control Structures, Subroutines, Hash, Creating a static HTML file by a Perl Program.
- 11. Heuristic methods (BLAST, FASTA) of searching for homologous sequences
- 12. Pair-wise (Needleman Wunch Algorithm & Smith waterman Algoritghm) and Multiple sequence alignment.Gene prediction methods (ORF Finder).
- 13. Phylogenetic tree building using Phylip.
- 14. Protein Secondary structure prediction. Homology Modeling. Molecular Visualization and 3D structural studies using Rasmol - Commands, Domain identification.
- 15. Molecular Visualization and 3D structural studies using Chimera.
- 16. Small molecule building, using ISIS Draw and CHEM SKETCH Tutorial

Lecture	Tutorial	Practical	Total
15	0	30	45
Text Books:			

- 4. David W. Mount Bioinformatics: Sequence and Genome Analysis, Cold Spring Harbor Laboratory Press, Second Edition, 2004
- 5. Ghosh, Zhumur, and Bibekanand Mallick. Bioinformatics: Principles and Applications. Oxford University Press, 2008.
- 6. S. Harisha, "Fundamentals of Bioinformatics", I. K. International Pvt Ltd, 2010

#### **References:**

- 4. Arthur M. Lesk, Introduction to Bioinformatics by Oxford University Press, 2008
- 5. T K Attwood, D J parry-Smith, Introduction to Bioinformatics, Pearson Education, 1st Edition, 11th Reprint 2005
- 6. Stephen A. Krawetz, David D. Womble, Introduction To Bioinformatics A Theoretical and Practical Approach, Humana Press, 2003

#### **E-References:**

- 3. http://nptel.ac.in/courses/102103044/40
- 4. vlab.amrita.edu/?sub=3&brch=273

## Manning of Cos Vs PO s

					PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1			1		2				2					
CO 2		2	2	1	3								1	
CO 3		2	1	1	2							3	3	1
CO 4	1	3	3	1	3						3	1	2	3
CO 5	1	2	3		3						2	1	1	1
	2	9	10	3	13				2		5	4	7	5

#### 0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

	PO 1	PO 2	<b>PO</b> 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
Origina l Value	2	9	10	3	13	0	0	0	2	0	5	4	7	5
Scaled Value	3	1	3	2	3	1	1	2	1	0	1	1	1	1

Scale: 3- high, 2 - Medium, 1 - Low, 0 - not related, 0 - No Relation, 1 - Low Relation, 2-Medium Relation, 3- High Relation

						1					
				L	Т	P	С				
XB	Г 708			0	02TP06LevelAnalyzeAnalyzeAnalyzeAnalyzeAnalyze		2				
		<b>PROJECT WORK PHASE-I</b>									
С	P A			L	Τ	P	Η				
1.5 0	).5 0.5		0 0 6 6								
PRER	EQUISIT	TE: - Nil									
COUR	RSE OUT	COMES:									
		Course Outcomes	Doma	nin	Level						
On the	e successf	ul completion of the course, students will be able to	)								
CO1	<i>Identify</i> interest.	the engineering problem relevant to the domain	Cog		Analyze		e				
CO2	Interpre	and infer literature survey for its worthiness.	Cog		Analyz Analyz Apply Analyz Apply Comp. O						
CO3	Analyse	and <i>identify</i> an appropriate technique for solve	Cog		An	alyz	e				
	the prob		U		A	pply					
<b>CO4</b>	Perforn	<i>i</i> experimentation				D. ON	vert				
		tion/Programming/Fabrication, Collect and	Cog		R	esp.,					
	interpre	<i>t</i> data.	_	(	Create	e, Ap	oply				
CO5	Record	and report the technical findings as a document.	Cog		Rem	emb	er,				
		-	-		Und	ersta	nd				

	CO1	CO2	CO3	CO4	CO5	Total
PO1	3	2	1	2	1	9
PO2	3	2	1	2	1	9
PO3	-	-	1	3	1	5
PO4	-	1	2	3	1	6
PO5	-	-	2	3	1	6
<b>PO6</b>	1	-	1	1	-	3
<b>PO7</b>	1		1	1	-	3
<b>PO8</b>	1	-	1	1	-	3
<b>PO9</b>	-	-	-	-	2	2
PO10	-	-	-	-	3	3
PO12	-	-	-	-	2	2
PO12	1	-	-	-	3	4
PSO1	1	1	1	1	1	5
PSO2	1	1	1	1	1	5

^{1 –} Low, 2 – Medium, 3 – High

				L	Т	P	С					
X	BT 709			0	0	2	2					
		<b>INPLANT TRAINING - III</b>										
С	P A		L T P									
1.33	1.33 1.33		0 0 2 2									
PRER	EQUISITE: ·	Nil										
COUR	SE OUTCON	MES:										
		Course Outcomes Domain Le										
On the	successful co	mpletion of the course, students will be able to										
CO1	Relate class	room theory with workplace practice	Cog	5	Understand							
CO2	<i>Comply</i> with practices.	h factory discipline, management and business	Aff		Re	espon	se					
CO3	Demonstrat	es teamwork and time management.	Aff		Understan Response Value Perception		e					
CO4		d <i>display</i> hands-on experience on practical skills ring the programme.	Phy	7	Per	rcept Set	ion					
CO5		the tasks and activities done by technical and oral presentations.	Cog	<b>,</b>	E	valua	te					

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	2													
CO2							1	3			1		1	1
CO3									3	1	3		3	3
CO4		1	2	1	3								1	1
CO5				3						3			1	1
Total	2	1	2	4	3	0	1	3	3	4	4	0	6	6
Scale d	1	1	2	1	1	0	1	1	1	1	1	1	2	2

# **VIII Semester**

							L	Т	Р	С
XE	5T801A	INT	<b>FRODUCT</b>	ION TO QUAN	TUM BIOLO	GY,	2	1	0	3
		ART	TIFICIAL I	NTELLIGENC	E (AI) AND D	ATA				
C	P A			SCIENCE			L	Т	Р	Η
3	0 0						2	1	0	3
Obj	ectives: St	udents abl	e to inspire	on Quantum bio	logy, AI and I	Data Science	e to con	tribute	in em	erging
tech	nology.		_							
		(	Course Out	comes		Doma	nin		Level	
Afte	r the comp	letion of tl	he course, st	udents will be ab	ole to					
CO				tum mechanics in		Cognitive		Unde	rstand	
	-					-		Reme	mber	
CO2	Interpr	ets and Re	e <b>alize</b> Quant	tum Biology App	lications.	Cognitive		Unde	rstand	
	_							Reme	mber	
CO3	Interpr	rets and	Realize	Artificial Inte	elligence in	Cognitive		Unde	rstand	
	Engine	ering.						Reme	mber	
CO4Interprets and Realize Data Science in Engineering.CognitiveUnderstand										
Remember										
COS	<b>Outline</b>	es the Reso	ources for A	I and Data Scien	ce, etc.	Cognitive		Unde	rstand	
								Reme	mber	
				Course conte	ent				H	Iours
Unit	-I Intr	oduction	to Quantun	n Biology						6
Gene	al introdu	ction on q	uantum mec	chanics – How pl	ant use quantu	ım mechani	cs – qua	antum 1	nechai	nics in
respir	ation – nu	cleotides s	eparation b	y 0.3 nm deal wi	th UV photons	s – transfer	of elect	rons ar	nd prot	ons in
cells.										
Unit			logy Applic							6
				– Quantum visi		ns – Enz	yme ac	tivity	as qu	antum
bioch	emistry – A	Antibodies	surface pro	oteins on microor	ganisms.					
				l Intelligence						6+3
			•	of AI - Concept	-		ination	– Heal	th Care	e Data
Ana	ysis – Plar	nt Genome	Studies – C	Gene Editing – Er	nzyme Compos	sitions.				
Unit	-IV Intr	oduction	to Data Sci	ence						6+6
		Data Scier	nce – Requi	rements for Data	Science – Intro	oduction to	R Progr	am and	l R-Stu	idio.
Unit		ources								6+6
Rela	tionship be	etween AI,		ce, Machine Lear		-	– Open I			
	Lectur	e	T	utorial	Practi	cal		Tot	al	
	30			15	-			4	5	
	Books:									
4	Graham 2014.	R Fleming	g, Gregory l	D.Scholes "Quan	tum Effects in	Biology" (	Cambrid	ge Uni	versity	Press
5		Russell a Publisher,		orvig – "Artifici	al Intelligence	e – A Mod	ern App	roach"	3 rd E	dition,
6				, "Data Science f	or Engineers"					
	rence Boo			,						

Davy Cielen, Arno D.B. Meysman, and Mohamed Ali, "Introducing Data Science" Manning Publications, 2016.

#### **E-References:**

https://doi.org/10.1017/CBO9780511863189.003 https://royalsocietypublishing.org/doi/10.1098/rsif.2018.0640 https://nptel.ac.in/courses/106/102/106102220/ https://nptel.ac.in/courses/106/106/106106179/

# Mapping of COs with POs

	<b>PO1</b>	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	1	1	2	2	2	0	0	0	1	3	0	0
CO 2	3	3	2	2	1	2	2	0	0	0	2	2	1	1
CO 3	3	3	2	3	1	2	2	0	0	0	2	3	2	3
CO 4	3	3	2	3	1	2	2	0	0	0	2	2	2	2
CO 5	3	3	2	3	1	2	2	0	0	0	2	3	3	3
	15	15	9	12	6	10	10	0	0	0	9	13	8	9

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

### Mapping of Subjects with POs

	PO 1	PO 2	PO 3	РО 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
Origina l Value	15	15	9	12	6	10	10	0	0	0	9	13	8	9
Scaled Value	3	3	2	3	2	2	2	0	0	0	2	3	2	2

							L	Т	P	С
XBI	<b>F80</b> 1	1B					2	1	0	3
		1	ENZYME	E ENGINEERING						1
C	P	Α				_	L	Т	P	Η
3	0	0					2	1	0	3
		isites	:-							
Obj G		Го en	hance the student's abilit eristics and products.	y of employabilit	y through	n study	y tł	ne c	ore	enzym
Cou able		Outco	omes: At the end of this co	urse, the students s	hould be	Doma	in	Le	evel	
<b>CO</b> 1	1	Explai	<i>n</i> the enzyme principles and	Study the properties	5.	Cogni	tive	Uı	nders	tand
CO2			be the extraction and Inter-	pret the properties	with the	Cogni	tive	Uı	nders	stand
CO3	3 1		<i>tize</i> the Immobilization	types and <b>Descr</b>	<i>ribe</i> the	Cogni	tive	Uı	nders	stand
CO4		Discus technic	s the kinetic properties ues.	and <i>Interpret</i> w	with the	Cogni	tive	Uı	nders	stand
CO		Descri enzym	<i>be</i> the salient features of e.	f industrial applica	tions of	Cogni	tive	Uı	nders	tand
			Cours	se Content					]	Hours
Unit			troduction							5+3
-		-	vsis principles – Enzyme cat	alysis – Enzyme kin	etics – Im	pact of	рН	and	Ten	peratur
			on types.							
Unit			nzyme Extraction							5+3
		erizati	crude enzyme from plan on – Enzyme activity – Deve			nicrobia	als	– P	urifi	cation
Unit			nmobilization Techniques							5+3
			rption – Matrix Entrapment – Advantage and disadvanta				Cov	alent	bin	ding an
Unit		1	inetic Properties of Enzyme		n teeningt					5+3
			stability of immobilized en		partition –	Effect	of	diffi		
			chiometry measurement – Ro							
Unit			pplications			<i>, , , ,</i>			(	5+3
			pplications of immobilized	enzyme system - Co	oncise over	rview o	n la	rge		
			Enzyme products.	5 5				0.		5
•			Lecture	Tutorial	Practical	's		r.	Fota	l
			30	15	0	İ			45	
Text	t Bo	oks								
2	2.Sta	anbury	C. price and Lewis stevens, " Peter.F, Allan Whitaker, S on, ELSIVER, 2017.							

#### References

3. Chaplin and Bucke, "Enzyme technology", Cambridge Univerity Press.

4.James Bailey, David Ollis, "Biochemical Engineering Fundamentals", 2nd Ed., McGraw Hill Education, 2017.

### **E-References**

1.https://nptel.ac.in/courses/102/102/102102033/

### Mapping of COs Vs POs

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	1	3	2	1	2	1	1	0	2	2	3	3
CO 2	3	3	1	3	2	1	2	1	1	0	2	2	3	3
CO 3	3	3	1	3	2	1	2	1	1	0	2	2	3	3
CO 4	2	1	1	1	1	1	1	1	1	0	1	1	1	1
CO 5	3	3	1	1	1	1	1	1	1	0	1	1	1	1
	14	13	5	11	8	5	8	5	5	0	8	8	11	11

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

# Mapping of Subject Vs POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
Origina l value	14	13	5	11	8	5	8	5	5	0	8	8	11	11
Scaled Value	3	3	0	3	2	0	2	0	0	0	2	2	9	3

		1	L T	P	С								
<b>XBT801C</b>			$\frac{1}{2}$ 1	0	3								
11210010	WASTE MANAGEMENT AND BY-PRODU	JCTS –		Ū	U								
C P A	- UTILIZATION		L T	Р	Н								
3 0 0			2 1	0	3								
PREREQUIS	TE: Nil	I											
Learning Obj	ectives: Upon completion of this course, the students												
	e able to understand the origin and type of wa	ste and by	produ	icts,	waste								
	cation, classification and composition.		1	,									
	able to describe the need for treatment and utilization	of waste											
• Will be	able to know the legal and statutory requirements for	waste handli	ng, tre	atmer	nt and								
disposa	• • •		U,										
	Course Outcomes	Domain		Leve	1								
After the comp	letion of the course, students will be able to												
CO1:Acquiret	he knowledge of waste generation and the factors												
for waste accu	mulation and <i>Differentiates</i> the waste disposal vs	Cognitive	R	emem	ber								
waste manager	waste management												
CO2:Characte	Cognitive	R	emem	ber									
CO3:Outlines	the methods for waste management and disposal	Cognitive		Analy	ze								
	<b>O4</b> ·Discuss and compiles the various methods of waste and by-												
	ation from different sources	Cognitive		Analyze Understand									
CO5:Describe	the importance of safety and regulations regarding	Comitivo	D		han								
		Cognitive	K	emem	lber								
waste management													
Unit-I	Introduction			6+3									
Unit-I Definition of v	<b>Introduction</b> waste – Waste handling – Factors affecting waste ge		Vaste										
Unit-I Definition of waste manage	Introduction waste – Waste handling – Factors affecting waste ge ment – Rural waste vs Urban waste – Waste vs Polluti		Vaste										
Unit-I Definition of Waste manage Unit-II	Introduction waste – Waste handling – Factors affecting waste ge ment – Rural waste vs Urban waste – Waste vs Polluti Waste Characterization	on.		dispos 6+3	sal v								
Unit-I Definition of waste manage Unit-II Types of was	Introduction waste – Waste handling – Factors affecting waste ge ment – Rural waste vs Urban waste – Waste vs Polluti Waste Characterization te – Categories of solid wastes (Domestic waste,	on. Market wa	ste, Fo	dispos 6+3 bod v	sal v vaste								
Unit-IDefinition of waste manageUnit-IITypes of wasAgricultural waste	Introduction waste – Waste handling – Factors affecting waste ge ment – Rural waste vs Urban waste – Waste vs Polluti Waste Characterization te – Categories of solid wastes (Domestic waste, aste, e-Waste, Industrial inert waste, Industrial hazard	on. Market wa	ste, Fo	dispos 6+3 bod v	sal v vaste								
Unit-I Definition of waste manage Unit-II Types of was Agricultural w Radioactive wa	Introduction waste – Waste handling – Factors affecting waste ge ment – Rural waste vs Urban waste – Waste vs Polluti Waste Characterization te – Categories of solid wastes (Domestic waste, aste, e-Waste, Industrial inert waste, Industrial hazard aste, Plastic waste – Next Generation Waste.	on. Market wa	ste, Fo	dispos 6+3 bod v lical v	sal v								
Unit-I Definition of Waste manage Unit-II Types of was Agricultural w Radioactive wa Unit-III	Introduction waste – Waste handling – Factors affecting waste ge ment – Rural waste vs Urban waste – Waste vs Polluti Waste Characterization te – Categories of solid wastes (Domestic waste, aste, e-Waste, Industrial inert waste, Industrial hazard aste, Plastic waste – Next Generation Waste. Waste management	on. Market wa lous waste, E	ste, Fo	$\frac{6+3}{1000}$	sal v waste vaste								
Unit-I Definition of waste manage Unit-II Types of was Agricultural w Radioactive wa Unit-III Direct combus	Introduction waste – Waste handling – Factors affecting waste ge- ment – Rural waste vs Urban waste – Waste vs Polluti Waste Characterization te – Categories of solid wastes (Domestic waste, aste, e-Waste, Industrial inert waste, Industrial hazard aste, Plastic waste – Next Generation Waste. Waste management stion of solid waste – Effluent treatment and disponent	on. Market wa lous waste, E osal – Biowa	ste, Fo Biomec	$\frac{6+3}{6+3}$	sal v waste vaste								
Unit-I Definition of waste manage Unit-II Types of was Agricultural w Radioactive wa Unit-III Direct combus (Sources, Cate	Introduction waste – Waste handling – Factors affecting waste ge- ment – Rural waste vs Urban waste – Waste vs Polluti Waste Characterization te – Categories of solid wastes (Domestic waste, aste, e-Waste, Industrial inert waste, Industrial hazard aste, Plastic waste – Next Generation Waste. Waste management stion of solid waste – Effluent treatment and dispo- gories, Impacts on health, Steps involved in Biomedica	on. Market wa lous waste, E osal – Biowa	ste, Fo Biomec	6+3       ood       vical       6+3       anage       nt)	sal v waste vaste								
Unit-I Definition of v Waste manage Unit-II Types of was Agricultural w Radioactive wa Unit-III Direct combus (Sources, Cate Unit-IV	Introduction waste – Waste handling – Factors affecting waste ge- ment – Rural waste vs Urban waste – Waste vs Polluti Waste Characterization te – Categories of solid wastes (Domestic waste, aste, e-Waste, Industrial inert waste, Industrial hazard aste, Plastic waste – Next Generation Waste. Waste management stion of solid waste – Effluent treatment and dispo- gories, Impacts on health, Steps involved in Biomedica Waste and By-products utilization	on. Market wa lous waste, E osal – Biowa al waste mana	ste, Fo Biomec aste m	$\frac{6+3}{6+3}$ $\frac{6+3}{6+3}$ $\frac{6+3}{6+3}$	sal v waste vaste emen								
Unit-IDefinition of waste manageUnit-IITypes of wasAgricultural wasAgricultural wasAgricultural wasDirect combuse(Sources, Cate)Unit-IVIntroduction to	Introduction waste – Waste handling – Factors affecting waste ge- ment – Rural waste vs Urban waste – Waste vs Polluti Waste Characterization te – Categories of solid wastes (Domestic waste, aste, e-Waste, Industrial inert waste, Industrial hazard aste, Plastic waste – Next Generation Waste. Waste management stion of solid waste – Effluent treatment and dispo- gories, Impacts on health, Steps involved in Biomedica Waste and By-products utilization by-products and waste generation in agricultural	on. Market wa lous waste, E osal – Biowa al waste mana production a	ste, Fe Biomed	$\frac{6+3}{6+3}$ $\frac{6+3}{6+3}$ $\frac{6+3}{6+3}$ $\frac{6+3}{6+3}$	sal v waste vaste emen								
Unit-IDefinition of waste manageUnit-IITypes of wasAgricultural wasRadioactive wasUnit-IIIDirect combusts(Sources, Cate)Unit-IVIntroduction toUtilization of was	Introduction waste – Waste handling – Factors affecting waste ge- ment – Rural waste vs Urban waste – Waste vs Polluti Waste Characterization te – Categories of solid wastes (Domestic waste, aste, e-Waste, Industrial inert waste, Industrial hazard aste, Plastic waste – Next Generation Waste. Waste management stion of solid waste – Effluent treatment and dispe- gories, Impacts on health, Steps involved in Biomedica Waste and By-products utilization by-products and waste generation in agricultural waste from fruit and vegetable processing – Fish, Mea	on. Market wa lous waste, E osal – Biowa al waste mana production a t and Poultry	aste magemen	6+3ood vical v6+3anagent)6+3ocessitry's	sal v vaste vaste emer								
Unit-IDefinition of waste manageUnit-IITypes of wasAgricultural wasAgricultural wasAgricultural wasOunit-IIIDirect combus(Sources, Cate)Unit-IVIntroduction toUtilization of wasutilization - U	Introduction waste – Waste handling – Factors affecting waste ge- ment – Rural waste vs Urban waste – Waste vs Polluti Waste Characterization te – Categories of solid wastes (Domestic waste, aste, e-Waste, Industrial inert waste, Industrial hazard aste, Plastic waste – Next Generation Waste. Waste management stion of solid waste – Effluent treatment and dispo- gories, Impacts on health, Steps involved in Biomedica Waste and By-products utilization by-products and waste generation in agricultural vaste from fruit and vegetable processing – Fish, Mea tilization of by-products from wheat, rice, corn and	on. Market wa lous waste, E osal – Biowa al waste mana production a t and Poultry dal mills –	aste magemen	6+3ood vical v6+3anagent)6+3ocessitry's	waste waste emen ing								
Unit-IDefinition of wWaste manageUnit-IITypes of wasAgricultural wRadioactive waUnit-IIIDirect combus(Sources, Cate)Unit-IVIntroduction toUtilization of wutilization - Uproducts from	Introduction waste – Waste handling – Factors affecting waste ge- ment – Rural waste vs Urban waste – Waste vs Polluti Waste Characterization te – Categories of solid wastes (Domestic waste, aste, e-Waste, Industrial inert waste, Industrial hazard aste, Plastic waste – Next Generation Waste. Waste management stion of solid waste – Effluent treatment and dispe- gories, Impacts on health, Steps involved in Biomedica Waste and By-products utilization o by-products and waste generation in agricultural vaste from fruit and vegetable processing – Fish, Mea tilization of by-products from wheat, rice, corn and oil mills – Utilization of by-products from dairy indust	on. Market wa lous waste, E osal – Biowa al waste mana production a t and Poultry dal mills –	aste magemen	dispos 6+3 bod v lical v 6+3 anage nt) 6+3 ocessit try's tion c	sal v vaste vaste emer								
Unit-IDefinition of vWaste manageUnit-IITypes of wasAgricultural wRadioactive waUnit-IIIDirect combus(Sources, Cate)Unit-IVIntroduction toUtilization of vutilization - Uproducts fromUnit-V	Introduction waste – Waste handling – Factors affecting waste ge- ment – Rural waste vs Urban waste – Waste vs Polluti- Waste Characterization te – Categories of solid wastes (Domestic waste, aste, e-Waste, Industrial inert waste, Industrial hazard aste, Plastic waste – Next Generation Waste. Waste management stion of solid waste – Effluent treatment and dispo- gories, Impacts on health, Steps involved in Biomedica Waste and By-products utilization by-products and waste generation in agricultural waste from fruit and vegetable processing – Fish, Mea tilization of by-products from wheat, rice, corn and oil mills – Utilization of by-products from dairy indust Safety and regulations	on. Market wa lous waste, E osal – Biowa al waste mana production a production a t and Poultry dal mills – T	aste magemen and provide and provide a sterio de la seconda de la second	$\frac{6+3}{6+3}$ $\frac{6+3}{6+3}$ $\frac{6+3}{6+3}$ $\frac{6+3}{6+3}$	waste waste emer ing wast								
Unit-IDefinition of vWaste manageUnit-IITypes of wasAgricultural wRadioactive waUnit-IIIDirect combus(Sources, Cate)Unit-IVIntroduction toUtilization of vutilization - Uproducts fromUnit-VLegal aspects:	Introduction waste – Waste handling – Factors affecting waste ge- ment – Rural waste vs Urban waste – Waste vs Polluti Waste Characterization te – Categories of solid wastes (Domestic waste, aste, e-Waste, Industrial inert waste, Industrial hazard aste, Plastic waste – Next Generation Waste. Waste management stion of solid waste – Effluent treatment and dispo- gories, Impacts on health, Steps involved in Biomedica Waste and By-products utilization by-products and waste generation in agricultural vaste from fruit and vegetable processing – Fish, Mea tilization of by-products from wheat, rice, corn and oil mills – Utilization of by-products from dairy indust Safety and regulations Biomedical waste management and handling rules, Cl	on. Market wa lous waste, E osal – Biowa al waste mana production a t and Poultry dal mills – T ry. PCB (Central	aste magemen v indus Utiliza	$\frac{6+3}{6+3}$ $\frac{6+3}{6+3}$ $\frac{6+3}{6+3}$ $\frac{6+3}{6+3}$ $\frac{6+3}{6+3}$ $\frac{6+3}{6+3}$	sal v waste vaste emer ing wast of by								
Unit-IDefinition of waste manageUnit-IITypes of wasAgricultural wasAgricultural wasAgricultural wasMathematical and the second	Introduction waste – Waste handling – Factors affecting waste ge- ment – Rural waste vs Urban waste – Waste vs Polluti Waste Characterization te – Categories of solid wastes (Domestic waste, aste, e-Waste, Industrial inert waste, Industrial hazard aste, Plastic waste – Next Generation Waste. Waste management stion of solid waste – Effluent treatment and dispe- gories, Impacts on health, Steps involved in Biomedica Waste and By-products utilization o by-products and waste generation in agricultural vaste from fruit and vegetable processing – Fish, Mea tilization of by-products from wheat, rice, corn and oil mills – Utilization of by-products from dairy indust Safety and regulations Biomedical waste management and handling rules, Classical waste management and handling rules, guide	on. Market wa lous waste, E osal – Biowa al waste mana production a t and Poultry dal mills – T ary. PCB (Central line of BAR	ste, Fe Biomec aste m agemen und pr v indus Utiliza pollut C (Ba	dispos 6+3 bod v lical v 6+3 anage 1) 6+3 ocessition co 6+3 ion co ba At	ing waste waste waste wast of by								
Unit-IDefinition of vWaste manageUnit-IITypes of wasAgricultural wRadioactive waUnit-IIIDirect combus(Sources, Cate)Unit-IVIntroduction toUtilization of vutilization - Uproducts fromUnit-VLegal aspects:board) guideliaResearch Cen	Introduction waste – Waste handling – Factors affecting waste ge- ment – Rural waste vs Urban waste – Waste vs Polluti Waste Characterization te – Categories of solid wastes (Domestic waste, aste, e-Waste, Industrial inert waste, Industrial hazard aste, Plastic waste – Next Generation Waste. Waste management stion of solid waste – Effluent treatment and dispo- gories, Impacts on health, Steps involved in Biomedica Waste and By-products utilization by-products and waste generation in agricultural vaste from fruit and vegetable processing – Fish, Mea tilization of by-products from wheat, rice, corn and oil mills – Utilization of by-products from dairy indust Safety and regulations Biomedical waste management and handling rules, Cl nes, Safe disposal of radioactive waste rules, guide tre), International Scenario: World Health Organiz	on. Market wa lous waste, E osal – Biowa al waste mana production a t and Poultry dal mills – T ary. PCB (Central line of BAR	ste, Fe Biomec aste m agemen und pr v indus Utiliza pollut C (Ba	dispos 6+3 bod v lical v 6+3 anage 1) 6+3 ocessition co 6+3 ion co ba At	ing - waste								
Unit-IDefinition of waste manageUnit-IITypes of wasAgricultural wasAgricultural wasAgricultural wasMathematical and the second	Introduction waste – Waste handling – Factors affecting waste ge- ment – Rural waste vs Urban waste – Waste vs Polluti Waste Characterization te – Categories of solid wastes (Domestic waste, aste, e-Waste, Industrial inert waste, Industrial hazard aste, Plastic waste – Next Generation Waste. Waste management stion of solid waste – Effluent treatment and dispo- gories, Impacts on health, Steps involved in Biomedica Waste and By-products utilization by-products and waste generation in agricultural vaste from fruit and vegetable processing – Fish, Mea tilization of by-products from wheat, rice, corn and oil mills – Utilization of by-products from dairy indust Safety and regulations Biomedical waste management and handling rules, Cl nes, Safe disposal of radioactive waste rules, guide tre), International Scenario: World Health Organiz	on. Market wa lous waste, E osal – Biowa al waste mana production a t and Poultry dal mills – T ary. PCB (Central line of BAR	ste, Fe Biomed aste m agemen und pr indus Utiliza pollut C (Ba D) gui	dispos 6+3 bod v lical v 6+3 anage 1) 6+3 ocessition co 6+3 ion co ba At	ing - waste								

#### **TEXT BOOKS:**

1.Pichtel, J. (2005). Waste management practices: municipal, hazardous, and industrial. CRC press.

2. Arvanitoyannis, I. S. (2010). Waste management for the food industries. Academic Press.

### **REFERENCE BOOKS:**

- 4. Sayler, G. S., Fox, R., & Blackburn, J. (Eds.). (2013). *Environmental biotechnology for waste treatment* (Vol. 41). Springer Science & Business Media.
- 5. Nigam, P. S. N., & Pandey, A. (Eds.). (2009). *Biotechnology for agro-industrial residues* utilisation: utilisation of *agro-residues*. Springer Science & Business Media.
- 6. Dhillon, G. S., & Kaur, S. (Eds.). (2016). Agro-industrial wastes as feedstock for enzyme production: apply and exploit the emerging and valuable use options of waste biomass. Academic Press.

### **E- REFERENCES**

1.<u>https://nptel.ac.in/courses/120/108/120108005/</u>

2.<u>https://nptel.ac.in/courses/105/106/105106056/</u>

3.<u>http://ecoursesonline.iasri.res.in/course/view.php?id=518</u>

### Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	0	0	2	0	1	2	0	3	0	0	1	1	0	0
CO 2	0	0	2	0	1	2	0	3	0	0	1	1	0	0
CO 3	3	3	1	2	1	0	3	1	2	1	1	1	0	3
CO 4	3	3	1	3	1	0	3	1	2	1	1	1	3	3
CO 5	0	0	2	0	1	3	0	3	2	1	1	1	0	0
	6	6	8	5	5	7	6	11	6	3	5	5	3	6

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

#### Mapping of Subjects with POs

	PO 1	PO 2	PO 3	РО 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
Origina l Value	6	6	8	5	5	7	6	11	6	3	5	5	3	6
Scaled Value	3	1	0	1	1	1	0	0	1	1	1	1	0	0

 $1 - 5 \rightarrow 1, 6 - 10 \rightarrow 2, 11 - 15 \rightarrow 3$ 

No relation, 1-Low Relation, 2- Medium Relation, 3-High Relation

			L	Т	Р	С	
XB	Т 804		0	0	9	9	
	<b>PROJECT WORK PHASE-II</b>						
С	P A		L	Т	P	Η	
6	3 3		0	0	9	18	
PRER	EQUISITE: - Nil						
COUI	RSE OUTCOMES:						
	Course Outcomes	Doma	in		Leve	l	
On the	e successful completion of the course, students will be ab	le to					
CO1	Identify the Engineering Problem relevant to the	Cog			nolu	70	
	domain interest.			F	Analyz	Le	
CO2	Interpret and Infer Literature survey for its worthiness.	Cog		A	Analyz	ze	
		_			Apply	/	
CO3	Analyse and identify an appropriate technique for solve	Cog		A	Analyz	ze	
	the problem.	- 0			Apply		
CO4	Perform experimentation	Phy			np. O		
	/Simulation/Programming/Fabrication, Collect and	Cog			Resp.		
	interpret data.	0			Create, Apply		
CO5	Record and Report the technical findings as a	Cog Remember,					
	document.	Understand			,		

# Mapping of COs with Pos

	C01	CO2	CO3	CO4	CO5	Total
PO1	3	2	1	2	1	9
PO2	3	2	1	2	1	9
PO3	-	-	1	3	1	5
PO4	-	1	2	3	1	7
PO5	-	-	2	3	1	6
PO6	1	-	1	1	-	3
PO7	1		1	1	-	3
PO8	1	-	1	1	-	3
PO9	-	-	-	-	2	2
PO10	-	-	-	-	3	3
PO11	-				2	2
PO12	1				3	4
PSO1	1	1	1	1	1	5
PSO2	1	1	1	1	1	5

1 - Low, 2 – Medium, 3 – High

#### **Open Electives**

X	втое	1		L	Т	Р	С
			INTELLECTUAL PROPERTY RIGHT	S 3	0	0	3
С	Р	Α		L	Т	Р	Η
3	0	0					
				3	0	0	3
Prere	quisite:	-					
Learn	ing Ob	jective	6:				
Upon	comple	etion of	this course, the students				
•	Would	d have u	nderstood the various types of IPR.				
•	Would	l have l	earnt to search the database, drafting the patent	t and filing	g proces	s.	
•	Would	d have u	nderstood about the IPR audit and related disp	utes.			
•	Would	l have e	arned knowledge on IPR and earned certificate	es from W	TPO, N	PTEL	and
	other	portals.					
•	Would	d able to	identify new GI, protect copyright, design and	d filing a j	patent		
Cours	e Outc	omes		Domain	Le	vel	
C01		<i>erstand</i> s of IPR	the significance of IPR and <i>identify</i> various	Cognitiv	e Ur	Idersta	nd
CO2		<b>erstand</b> ation of	the process of <i>registration and infer the IP</i> .	Cognitiv	e Ur	Idersta	nd
CO3			the legal framework and <i>infer</i> legislative india, selected countries and WIPO	Cognitiv	e Ur	Idersta	nd
CO4			the international commitment and <i>imply</i> ket for the registered IP.	Cognitiv	e Ur	Idersta	nd
CO5	pater	nt, nov	understandingand <i>create</i> a new GI, filing el design or copyright and recognition or zation of the IPR	Cognitiv	e Ur	idersta	nd
I - Int	roduct	ion to I	PR				9

Creativity, Invention, Innovations; Importance of Intellectual Property; Types of Intellectual Property; History and development of IPR in India – Initiatives by Indian Government towards& WIPO IPR – advancement in S&T, traditional knowledge and biodiversity resources. WIPO distance learning courses in WIPO.

Distance Learning Courses in WIPO (Any three courses; all are free of cost)

21. DL-General Course on Intellectual Property (version 2) [DL101E20S4]

- 22. e-Tutorial on using Patent Information (DL-177) [DL177E20S2]
- 23. IP Panorama [DLIPP PanoramaE21]
- 24. DL-001 Primer on Intellectual Property [DL001E20]
- 25. DL-301 Patents (Open) [DL301OE19S2]
- 26. DL-201 Copyright and Related Rights (Open) [DL201OE19] Study material inIPR -India (Need to submit a page report)
- 27. https://ipindia.gov.in/index.htm

28. <u>https://ipindiaonline.gov.in/trademarkefiling/user/frmloginNew.aspx</u>Optional Courses

(registration cost is required)

29. https://e-learning.iptse.com/

II- Types, Registration and Valuation of IPR (India/Pct)

Patents – Copyrights and related rights – Trade Marks – Industrial Designs – Protection of Integrated Circuits and Layout Design – Geographical Indications of Goods – Biological Diversity – Plant Varieties and Farmers Rights – Trade Secrets / undisclosed information.

### Distance Learning Course in WIPO and study material in IPR-India

 DL302 Trademarks, Industrial Designs and Geographical Indications (Open) [DL3020E19]

GATE way in IPR-India

31. https://ipindia.gov.in/designs.htm

Patent Search (Practice and submit a two pages report)

32. https://ipindiaservices.gov.in/publicsearch

### III- Legal and Legislation Framework in India

9

9

9

IPR Laws – Owner's Rights – Negotiation of International Treaties – Traditional Knowledge Digital Library (TKDL) – Commercialization of IPR – Enforcement and Adjudication – Human Capital Development.

Study material to learn TKDL, Patent Act 1970 (Need to submit a page report)

- 33. http://tkdl.res.in/tkdl/langdefault/common/Abouttkdl.asp?GL=Eng
- **34.** https://www.indiacode.nic.in/bitstream/123456789/1392/3/a1970-39.pdf

### **IV- International Conventions and Treaties**

WTO - International conventions – Establishment of WIPO – General Agreement on Trade and Tariff (GATT) - TRIPS - PCT.

35. DL101PCT Distance Learning Course: Introduction to the Patent Cooperation Treaty [PCT101E19]

Optional: students who are interested can carry out the following course and earn certificate (which is signed from WHO, WIPO and WTO).

36. DL701 Promoting Access to Medical Technologies and Innovation – WHO, WIPO, WTO Executive Course on the intersections between public health, intellectual property and trade [DL7011ENT19S2]

# V - IPR Management

Drafting patent specification – Claims- IPR audit-IP asset management – IP Litigations – Transfer of Rights – IP training and education – IP valuation – Agreement Drafting.

Reading the material and submission of a page note; Optional: earning certificate from NPTEL and WIPO.

37. https://nptel.ac.in/noc/courses/noc21/SEM1/noc21-hs14/

38. https://www.wipo.int/sme/en/ip_audit/

39. https://www.wipo.int/ipadvantage/en/

40. http://164.100.236.140/e-gateways.htm#comprehensive-e-filing

Optional: Identify a GI need to be registered in your place; Filing patent of your innovation; Novel Design need to protected; Copyright of your work registered

Lecture	Tutorial	Practical	Total
45	0	0	45
Text Books			

**2.** SubbaramN.R."Handbook of Indian Patent Law and Practice ", S. Viswanathan (Printers and Publishers) Pvt. Ltd., 1998.

#### **E-References**

- 5. Neeraj Pandey, KhushdeepDharni, Intellectual Property Rights, PHI Private Limited, Delhi, 2014.
- 6. Intellectual Property Today : Volume 8, No. 5, May 2001, [www.iptoday.com].
- 7. Using the Internet for non-patent prior art searches, Derwent IP Matters, July 2000. [www.ipmatters.net/features/000707_gibbs.html.

#### **E Resources**

- 6. <u>http://www.wipo.int/patentscope/en/</u>
- 7. http://www.ipindia.nic.in/
- 8. <u>http://www.uspto.gov/</u>
- 9. https://www.epo.org/index.html
- 10. https://www.jpo.go.jp/

# Mapping Of Cos and POs

	Program Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	0	2	0	2	3	1	3	3	0	2	3	0	0
CO2	2	0	2	0	2	3	1	3	3	0	2	3	0	0
<b>CO3</b>	2	0	2	0	2	3	1	3	3	0	2	3	0	0
CO4	2	0	2	0	2	3	1	3	3	0	2	3	0	0
CO5	2	0	2	0	2	3	1	3	3	0	2	3	0	0
	10	0	10	0	10	15	5	15	15	0	10	15	0	0

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

# Mapping of Subject Vs POs

	PO	<b>PO1</b>	PO1	PO1	PSO	PSO								
	1	2	3	4	5	6	7	8	9	0	1	2	1	2
Origina	10	0	10	0	10	15	5	15	15	0	10	15	0	0
l value														
Scaled	2	0	2	0	2	3	0	3	3	0	2	3	0	0
Value														

Х	BTO	E <b>2</b>		L					
			<b>BIOSAFETY MANAGEMENT</b>	3	0	0	3		
С	Р	Α		L	Т	Р	Η		
3	0	0							
				3	0	0	3		
	quisite								
		ojective							
Upon	_		this course, the students						
٠			inderstood the various types of safety aspects.						
٠			earnt to behave with precautions.						
٠			inderstood about the Biosafety requirements in						
•			earned knowledge on Biosafety system to set ir	their work	ing pla	ace to	avoid		
	the ris								
Cours	e Outo	comes		Domain	Le	evel			
CO1	Una	lerstand	the significance of Safety and <i>identify</i>	Cognitive	U	ndersta	ınd		
	Var	ious typ	es of Safety.						
CO2	Una	lerstand	the Biosafety and <i>infer</i> with the	Cognitive	U	ndersta	ınd		
		nagemer							
CO3	Una	lerstand	the Guidelines of Biosafety and <i>infer</i> with	Cognitive	U	ndersta	und		
			Safety Committee.						
CO4	Una	lerstand	the Hazards and <i>imply</i> the Analysis System.	Cognitive	U	ndersta	und		
CO5	Una	lerstand	the risk and <i>Imply</i> the various safety Risk	Cognitive	U	ndersta	ınd		
	Ana	lysis.							
			Course Content			•	Hours		
Unit-			tion to Safety				9		
			-Types of Hazards: Physical, Chemical, Bio	logical, Erg	onom	ics and	1 noise		
hazaro		_	Industrial safety apply over Biosafety.						
Unit-			tion to Biosafety				9		
		-	nd of Biological Safety – Primary Contami		-		•		
			oorganisms – Biosafety Level of Specific M		ns -	Emerg	ging of		
			Level of Infectious Agents and Infectious Ani	mals					
Unit-l	II G	uidelin	es of Biosafety				9		
Guide	lines fi	com Go	verment of India – Definitions of GMOs & I	LMOs – Ro	les of	Instit	utional		
Biosat	ety Co	mmittee	e, RCGM, GEAC – Roles of GMO in Food, A	gricultural	and E	nviron	mental		
Sector	s.								
Unit-	<b>V</b> H	l <mark>azard</mark> A	Analysis				9		
Hazar	d ident	ification	and control – HAZOP, job safety analysis – l	Fault tree ar	nalysis	– Eve	ent tree		
analys	is – F	ailure n	nodes and effect analysis and relative ranking	g technique	s – S	afety a	audit –		
Safety	Surve	y – Plan	t inspection – Past accident analysis.						
Unit-		isk Ana	v				9		
Risk	Assesn	nent, M	anagement and Communication -Overview	of Nationa	1 Reg	ulatio	ns and		
			al Agreements Including Cartagena Protocol -	•		es: Ha	ndling		
and CA	orana	of Cham	icals, Fire Chemistry and its Control - Persona	Drotaction					

Lecture	Tutorial	Practical	Total
45	0	0	45
Torrt Doolrg			

#### **Text Books**

1.Fleming and Hunt, "Biological Safety, Principles and Practices" 5th edition, ASM Press, 2017.

2.Deshmukh, L.M., "Industrial Safety Management (Hazard identification and risk control)", TATA McGraw Hill, 2008.

#### References

1.Raghavan, K.V. and Khan, A.A., "Methodologies in Hazard Identification and Risk 2.<u>https://www.who.int/publications-detail-redirect/9241546506</u> (Manual from WHO)

#### **E Resources**

1.http://www.geacindia.gov.in/resource-documents/13_2-

<u>Regulatory_Framework_for_GE_Plants_in_India.pdf</u>

2.<u>https://ibkp.dbtindia.gov.in/Content/Commitee?AspxAutoDetectCookieSupport=1</u>

### Mapping Of Cos and POs

	Program Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	0	2	0	2	3	1	3	3	0	2	3	0	0
CO2	2	0	2	0	2	3	1	3	3	0	2	3	0	0
<b>CO3</b>	2	0	2	0	2	3	1	3	3	0	2	3	0	0
<b>CO4</b>	2	0	2	0	2	3	1	3	3	0	2	3	0	0
CO5	2	0	2	0	2	3	1	3	3	0	2	3	0	0
	10	0	10	0	10	15	5	15	15	0	10	15	0	0

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

### Mapping of Subject Vs POs

	PO 1	PO 2	PO 3	РО 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
Origina l value	10	0	10	0	10	15	5	15	15	0	10	15	0	0
Scaled Value	2	0	2	0	2	3	0	3	3	0	2	3	0	0

	KBTOI	E <b>3</b>		L	T P	C
			DIGITAL HEALTH	3	0 0	3
С	P	Α		L	T P	Η
3	0	0				
<b>D</b>	• • /			3	0 0	3
	quisite		~			
	-	bjective	s: this course, the students			
Opon	_		get aware of Digital Health			
			learn analytical skill on digital data			
•			develop employability opportunity			
	se Out		develop employaemey opportunity	Domain	Level	
$\frac{0001}{CO1}$			the significance of Digital health and	Cognitive	Unders	stand
COI			ious types employability from digital health	Cognitive	Unders	stand
CO2			the functions and goals and <i>infer</i> with the	Cognitive	Unders	stand
00-			th Management.	coginere	Chaon	Juna
<b>CO3</b>			the products of digital health and <i>infer</i> with	Cognitive	Unders	stand
		services		C		
<b>CO4</b>	Und	lerstand	the Digital Health Applications and <i>imply</i>	Cognitive	Unders	stand
	the	Analysis	s System.			
CO5	Uno	lerstand	the innovations and <i>Imply</i> the	Cognitive	Unders	stand
000			rship from digital health.	coginere	Chaon	Juna
		_1	Course Content	1		Hour
Unit-	I F	undame	entals of Digital Health			9
			hcare; Application of Technology in Medicin			
			Software development for improving healthd	care; Public	policy fo	r Healt
Inform	natics;	Current	trends in Health Informatics.			
I Init_	II F	unction	and Goals of Digital Health			9
			and Goals of Digital Health	y to improv	ve the a	9 uality o
The o	objectiv	ves of c	ligital health products and services- strateg		-	uality o
outco	objectiv mes of	ves of c			-	uality o
The outcom dispar	objectiv mes of rities.	ves of c digital h	ligital health products and services- strateg ealth products and services; population health		-	uality of the second se
The outcom dispar	objectiv mes of rities.	ves of c digital h	ligital health products and services- strateg		-	uality o
The outcos outcos dispar <b>Unit-</b> 2	objectiv mes of rities.	ves of a digital h Digital H	ligital health products and services- strateg ealth products and services; population health	; patient exp	erience ar	uality of healt
The outcom dispar <b>Unit</b> -2 Remo	objectiv mes of rities. III D te sens	ves of c digital h <b>bigital H</b> ing and	ligital health products and services- strateg health products and services; population health <b>fealth Products and Services</b>	; patient expo exchange, I	erience ar	uality of healt
The coutcost dispar <b>Unit</b> - Remo intelli wellno	objectivmes offities.IIIIIIIIIgence-essbel	ves of c digital h <b>bigital H</b> ing and Artifici havior	ligital health products and services- strateg health products and services; population health <b>Tealth Products and Services</b> wearables, Telemedicine, health information al Intelligence and Business Intelligence, pro- modification tools, Bioinformatics tools(-or	; patient experies ; patient exp	erience ar Data analy leling, He cal social	9 ytics an l media
The coutcourdispar Unit- Remo intelli wellno Digiti	bjectiv mes of rities. III D te sens gence- ess bel zed he	ves of c digital h <b>bigital H</b> ing and Artifici havior the alth reco	ligital health products and services- strateg health products and services; population health <b>Tealth Products and Services</b> wearables, Telemedicine, health information al Intelligence and Business Intelligence, pro- modification tools, Bioinformatics tools(-or ord platforms, Patient -physician-patient ports	; patient experies ; patient exp	erience ar Data analy leling, He cal social	9 ytics an l media
The coutcourdispar Unit- Remo intelli wellno Digiti	bjectiv mes of rities. III D te sens gence- ess bel zed he	ves of c digital h <b>bigital H</b> ing and Artifici havior the alth reco	ligital health products and services- strateg health products and services; population health <b>Tealth Products and Services</b> wearables, Telemedicine, health information al Intelligence and Business Intelligence, pro- modification tools, Bioinformatics tools(-or	; patient experies ; patient exp	erience ar Data analy leling, He cal social	9 ytics an l media
The coutcondispar <b>Unit</b> - Remo intelli wellno Digiti Imagi	bjectiv mes of ities. III D te sens gence- ess bel zed he ng, Per	ves of c digital h <b>bigital H</b> ing and Artifici havior to alth reco	ligital health products and services- strateg health products and services; population health <b>cealth Products and Services</b> wearables, Telemedicine, health information al Intelligence and Business Intelligence, pro- modification tools, Bioinformatics tools(-or ord platforms, Patient -physician-patient ports d and Precision Medicine.	; patient experies ; patient exp	erience ar Data analy leling, He cal social	9 ytics an alth an l media systems
The coutcondispar <b>Unit</b> -2 Remo intelli wellno Digiti Imagi	objectivemes ofrities.IIIDte sensegence-essbelzedheatng, PerIVA	ves of c digital h <b>bigital H</b> ing and Artifici havior t alth reco sonalize	ligital health products and services- strateg health products and services; population health <b>cealth Products and Services</b> wearables, Telemedicine, health information al Intelligence and Business Intelligence, pro- modification tools, Bioinformatics tools(-or ord platforms, Patient -physician-patient ports d and Precision Medicine.	; patient expo exchange, I edictive mod nics), Medic als, Decision	Data analy Data analy leling, He cal social support	9 ytics an alth an l media system
The coutcondispan dispan Unit-2 Remo intelli wellno Digiti Imagi Unit-2 Diagn	Dbjectivmes offities.IIIDte sensgence-essbelzedheng, PerIVAnosis, T	ves of c digital h <b>bigital H</b> ing and Artifici havior t alth reco sonalize	ligital health products and services- strateg health products and services; population health <b>Tealth Products and Services</b> wearables, Telemedicine, health information al Intelligence and Business Intelligence, pro- modification tools, Bioinformatics tools(-or ord platforms, Patient -physician-patient porta d and Precision Medicine. <b>Tons of Digital Health</b> t, Prevention and Wellness, Rehabilitation, Bel	; patient expo exchange, I edictive mod nics), Medic als, Decision	Data analy Data analy leling, He cal social support	9 ytics an alth an l media system

Unit-V	Innovation	and Entrepreneurship in	Digital Health	9
Intellectua	al Property F	Protection, Regulatory Issue	s, Business Models, Financia	ng Digital Health
Startup V	ventures, Lea	ading High-Performance d	igital Health Teams, Produ	ct and Customer
Developm	nent, Startup	Methodologies, Clinical	Validation and Translational	l Research, Data
Security a	nd Confident	tiality.		
Leo	cture	Tutorial	Practical	Total
2	45	0	0	45
Text Bool	ks			
1.	Ronquillo Y	Y., Meyers A., and Korve	k S.J., "Digital Health" Sta	tpearls Pulishing,
	Ronquillo Y easure Island	· · ·	k S.J., "Digital Health" Sta	tpearls Pulishing,
	easure Island	· · ·	k S.J., "Digital Health" Sta	tpearls Pulishing,
Tr Reference	easure Island	(FL), 2021.	k S.J., "Digital Health" Sta ealthcare to the world (Hea	
Tr <b>Reference</b> 1.	easure Island	Digital Health: Scaling He		
Tr <b>Reference</b> 1.	easure Island es Rivas H., " pringer Publis	Digital Health: Scaling He		
Tr Reference 1. Sp E Resour	easure Island es Rivas H., " pringer Publis ces	Digital Health: Scaling He	ealthcare to the world (Hea	
Tr Reference 1. Sp E Resour 1. <u>1</u>	easure Island es Rivas H., " oringer Publis ces attps://www.e	Digital Health: Scaling Health: 2018.	ealthcare to the world (Hea	

# **Mapping Of Cos and POs**

	Program Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	0	2	0	2	3	1	3	3	0	2	3	0	0
CO2	2	0	2	0	2	3	1	3	3	0	2	3	0	0
CO3	2	0	2	0	2	3	1	3	3	0	2	3	0	0
CO4	2	0	2	0	2	3	1	3	3	0	2	3	0	0
CO5	2	0	2	0	2	3	1	3	3	0	2	3	0	0
	10	0	10	0	10	15	5	15	15	0	10	15	0	0

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

# Mapping of Subject Vs POs

	PO	PO1	PO1	PSO	PSO									
	1	2	3	4	5	6	7	8	9	0	1	2	1	2
Origina	10	0	10	0	10	15	5	15	15	0	10	15	0	0
l value														
Scaled	2	0	2	0	2	3	0	3	3	0	2	3	0	0
Value														

 $1-5 \rightarrow 1$ ,  $6-10 \rightarrow 2$ ,  $11-15 \rightarrow 3$ 

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

# Value Added Course

8thBoard of Studies for the programme B.Tech Biotechnology was conducted on 19.Aug.2021. The following new value added courses were introduced and recommended for ACM approval.

	Course Description								
S.No	Торіс	Hrs							
11.	R and Rstudio Installation and Operation	3							
12.	Variables and Data Types	3							
13.	Data Frames	3							
14.	Recasting and Joining of Data Frames	3							
15.	Arithmetic, Logical and Matrix Operation in R and Rstudio	3							
16.	R Functions	6							
17.	Control Structures	3							
18.	Basic Data Visualization	3							
19.	Introduction to apply on Biotechnology Domain	3							
20.	Report Submission	-							
	TOTAL	30							

# 1. R Program and R Studio for Biotechnologist

# **References:**

R.Ragunathan and N. Shankar, "Data Science for Engineers" NPTEL, CSE, IIT Madras.

### 2. Python for Biotechnologist

	Course Description				
S.No	Торіс	Hrs			
12.	Python Installation and Operation	3			
13.	Fundamentals of the Program – An Introduction	3			
14.	Variables and Expressions	3			
15.	Math Module	3			
16.	Statements and Type	3			
17.	Functions	3			
18.	Code organizations	3			
19.	Conditionals and Exercise	3			
20.	Introduction to Biopython	3			
21.	Installation of Biopython and Guide to do program in Online	3			
22.	Report Submission	-			
	TOTAL	30			

# **References:**

https://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1004867 http://biopython.org/DIST/docs/tutorial/Tutorial.html

3. Training on Hospital's Clinical Research Lab

	Course Description					
S.No	Торіс	Days				
1.	Clinical Data Management	3				
2.	Clinical Research	3				
3.	Pharmacovigilance	3				
4.	Anatomy and Physiology	3				
5.	Infectious Diseases	3				
6.	Bacterial Infection Treatment	3				
7.	Viral Infection Treatment	3				
8.	Fungai Infection Treatment	3				
9.	Basic Training on Hospital Equipments for Diagnosis	3				
	Combine with Deepam Hospitals – Tambaram (West)					
	Chennai					
	TOTAL	27				

# **References:**

Materials Provides by Trainers

# 4. Downstream Manufacturing (Microbial)

	Course Description						
S.No	Торіс	Hrs					
1.	Basic Requirements	3					
2.	Initiating	3					
3.	Microbial Medium preparations	3					
4.	Conditions Maintenance	3					
5.	Loading and Operating	3					
6.	Trouble Shooting	3					
7.	Product Yielding	3					
8.	Purification	3					
9.	Quality and Quantity Analysis	3					
10.	Operating Test and Report Writing	3					
	Exclusive training on Labscale fermenter Imported from						
	Boengineering Swizerland						
	TOTAL	30					

# **References:**

Bioengineering Fermenter Manual Book.

# **Biotechnology specialization course curriculum and syllabus**

**B.Tech (Hons) Biotechnology** (Specialization in Computer Science and Biology)

### **Curriculum and Syllabus**

Computer Science and Biology is the combined application of the Maths, Statistics and computer programming to solve Biology based problems and applications. All the below computer programming will be thought and trained in appropriate Biological applications emerging in current requirements in Bio-Industries.

S.No	Course	Semester	Councer		Crea	lits					
<b>3.1NU</b>	Code		Courses	L	Т	P	С	L	Т	Р	Total
1.	XBTHC1	III	C and Java	1	0	2	3	3	0	2	5
2.	XBTHC2	IV	Python	1	0	2	3	3	0	2	5
3.	XBTHC3	IV	Biostatistics	2	1	0	3	3	2	0	5
4.	XBTHC4	V	R program and R studio	1	0	2	3	3	0	2	5
5	XBTHC5	VI	MAT Lab	1	0	2	3	3	0	2	5
6	XBTHC6	VII	Mini Project	0	0	5	5	0	0	10	10
			Total	6	1	13	20	15	2	18	35

**Total Credit = 20** 

### **Semester III**

XBTC01			`L	Т	Р	С
C P		C and JAVA	1	0	2	3
3 0			L	Т	Р	Η
3 0			2	0	3	5
		COURSE CONTENT				Hours
UNIT I	Introduction Comp					3
		Computing environments, Computer	r languag	ges, Crea	ting and	1
UNIT II	Introduction to the	, Program Development. C Language				10
		rams, Identifiers, Types Variables, Con	nstants, I	nput/ Out	put Ope	rators –
	<u> </u>	al, Logical, Bitwise, etc. Statements		*	• •	
		Strings, Structures, Apply for simple				
	programme.					
UNIT III	Introduction to JAV					8
		Java Installation, Java program stru	icture and	d Java d	ata type	es, Java
	variables.					12
UNIT IV	Operators in JAVA					
		- Decision Making and Loop Stater				1
		nd array list, Apply for simple biologica	al applica	tion using	Java.	
UNIT V	Introduction to Rea					12
	· · · ·	eact components and JSX, props, state.	[			
		al Hours				45
	<b>DKS/REFERENCE</b>					
		Murugesan, Anuradha Publications.				
	ning in C, Ajay Mitta					
	Beginner's Guide, H			1.0	. J	
4. Learning Chinnatha		n Guide – to building web applications	using Rea	act and Re	edux, Ki	rupa
Chinnatha	01.					

Semester IV

C     P     A       Python     1	2							
		3						
3 0 0 L T	Р	H						
	3	5						
COURSE CONTENT		Hours						
UNIT I Introduction to Python Language		3						
History of Python, Basic installation, Sources of downloads.								
UNIT II Operation of Python		12						
Language Syntax, Keywords Identifiers, Python Comments, Python Da	ta Type	×S,						
Python Operators.	•••							
UNIT III Python Control Flow Decision Making		15						
Looping, Branching, Numbers, Strings, Lists, Tuples, Sets, Arrays, File Hand	ling							
UNIT IV Applications		15						
Apply on various applications – Mathematical equations – Data Science – I	Biologic	al						
systems.								
Total Hours		45						
TEXT BOOKS/REFERENCE BOOKS								
1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edit								
2. Allen B. Downey, "Think Python: How to Think like a Computer Scientist O'Reilly Publishers,	, 2nd	2016.						
3. Karl Beecher, "Computational Thinking: A Beginner & 39;s Guide to P	roblem							
and programming", 1st Edition, BCS Learning & amp; Development Limited, 2017.	looicin	Solving						
4. G Venkatesh and MadhavanMukund, "Computational Thinking: A Primer for Progra	mmers	and Data						
Scientists", 1st Edition, Notion Press, 2021.								
5. John V Guttag, " Introduction to Computation and Programming	Using	Python:						
With Applications to Computational Modeling and Understanding Data", Third Edi								
2021 GE3151 Notes PROBLEM SOLVING AND PYTHON PROGRAMMING								
6. Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to	o Progra	mming",						
Starch Press 2nd Edition,								
7.https://www.python.org/								
8. Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.								

Semester IV				
	L	Τ	P	C
1	2	1	0	3
BIOSTATISTICS			1	
A	L	Т	P	Η
0	2	1	0	3
Course content			Hours	
JCTION TO STATISTIC		~ .	10	
n, graphical representation of data. Measures of central tendency, d biological problems, experimental studies; randomized contro studies, factorial design, cluster design,; completely randomized b on.	lled st	udies,	histori	cally
TIVE STATISTICS AND OBSERVATIONAL STUDY DESIGN	N		12	
ariables, measure of spread, logarithmic transformations, multivari		a. Basi		studv
ort studies, case control studies, outcomes, odd ratio and relative risl Parameter estimation, hypothesis testing. Variables; categorical da ribution	ks. Prin	ciples c	of statis	stical
ISON OF MEANS			12	
ics; t-test, F distribution, independent and dependent sample comp	parison.	Wilco		gned
regression model fit, Multiple linear regression and linear mode ession model, ANOVA table for multiple linear regression mo ls and interactions. Oneway and Two-way ANOVA tables, F-tests. AND ANALYSIS OF EXPERIMENTS				
	ndom	offooto		nion
lock design, multiple sources of variation, correlated data and rang. Completely randomized design, stratified design. Biological stuvith case studies.				
			Tot	al:45
S:				
statistics Alvin E. Lewis McGraw-Hill Professional Publishing 2013				
istics and Numerical Methods in BASIC for Biologists J.D. Lee and hold Company 1982	1 T.D. 1	Lee Va	n Nost	r and
istical Analysis of Gene Expression Microarray Data T.P. Chapman				
Essentials: Mastering SAS for Data Analytics Alan C. Elliott, Wey & Sons 2nd Edition, 2015				
nerical Methods of Statistics (Cambridge Series in Statistical and P n F. Monahan Cambridge University Press 2011	robabil	istic M	athema	atics)
perical Methods for Engineers and Scientists Ice D. Hoffman CRC F				
	1	nd Uan	th) W	arren
nerical Me				thods for Engineers and Scientists Joe D. Hoffman CRC Press 2ndEdition, 200 thods in Bioinformatics: An Introduction (Statistics for Biology and Health) W

#### **Semester V**

Δ	BTC	03		`L	Т	Р	С
C	Р	Α	<b>R</b> Programme and <b>R</b> Studio	1	0	2	3
			K i logi anni e and K Studio				
3	0	0		L	Τ	Р	Η
				2	0	3	5
			COURSE CONTENT				Hours
UN	IT I	Т	ntroduction				5
011			ntroduction to R Program and R Studio, Difference betwee	en R Prog	ram and F	8 Studio	•
			ownloads sources, Installation and updating.				-,
UN	IT II		Language				9
			verview, Data types, Operators, decision making.				
UN	IT II	ΙΟ	peration				9
		L	oop Control, Array, String, Function, Vector, Lists, Matr	ices.			
UN	T IV	/ <b>D</b>	ata Operation				10
		F	actors, Data Frames, Data and File Management, Charts a	and Graphs	8.		
UN	T V	A	pplications				12
		R	unning R studio – Biological applications on R Program	and R Stuc	lio		
			Total Hours				45
TEX	KT B	001	XS/REFERENCE BOOKS				
		·	ckham, R for Data Science, 1st edition, O'Reilly,2017				
2. T	ʻilmaı	n M.	Davies, The Book of R, 1st edition, 2016.				

Data Science for Engineers, RagunathanRengasamy, Shankar Narasimhan, IIT Madras, NPTEL.
 François Chollet with J. J. Allaire, Deep Learning with R, Second Edition, 2018.

### Semester VI

X	BTC	04		`L	Т	Р	С			
С	Р	Α	MATLAB	1	0	2	3			
			WIATLAD							
3	0	0		L	Т	Р	Η			
				2	0	3	5			
			COURSE CONTENT				Hours			
UN	ITI		ntroduction				5			
		Iı	nstallation, Overview on Mathworks, Online operation sour	rce, Tools	8.					
UN	IT II	R	Running Files				9			
			ariables, Data Types, Script Files, Function files			I				
UN	IT II	I C	Deration				9			
			fatrix, ODE, Integration, Input and Output Statements	s, Condit	ional Sta	tements	8,			
TINT			oops, Arrays, Array Function.				10			
UN.	11 11		<b>Data Operation</b> Cactors, Data Frames, Data and File Management, Charts ar	d Croph			10			
		Г	actors, Data Frames, Data and File Management, Charts an	lu Graphs						
UN	IT V	A	pplications				12			
011			Iumerical methods, Image processing, Simulink, AI, Data S	Science -	Introduct	ion				
			Total Hours				45			
TE	XT B	00	KS/REFERENCE BOOKS							
	1. C	ettin	g Started with MATLAB 7: A Quick Introduction for Scie	ntists and	Engineer	s, by				
	RudraPratap,OUP USA,2005.									
	2. Programming and Engineering Computing with MATLAB 2018 by Huei-Huang Lee, SDC									
			cations, 2018	-	Ũ					
	<b>3.</b> Н	lolly	Moore, "MATLAB for Engineers" Third Edition - Pearson	on Publica	ations.					
	<b>4</b> . S	teph	en J. Chapman, "MATLAB Programming for Engineers" F	Fourth Ed	ition – Th	omson	earning			