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 2023-24

DEPARTMENT OF MATHEMATICS

S. No.	Programme Code	Programme name	Year of Introduction	Year of revision	Percentage of Syllabus content added or replaced
1.	164	B.Sc. Mathematics (Full Time)	2017-18	2023-24	28.55%
2.	359	M.Sc.–Mathematics (Full Time)	2014-15	2023-24	44.43 %

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 added into syllabus after revision

1. Minutes of the Board of Studies for B.SC and M.SC- Mathematics held on 05.06.2023

Department of Mathematics

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PERIYAR MANIAMMAI

BOARD OF STUDIES MEETING

For B.Sc. and M.Sc Mathematics Programmes

Minutes of Meeting

Date: 05.06.2023 Time: 10.30 AM Venue: Department of Mathematics

The Board of Studies meeting was held on 05.06.2023 for revision of Curriculum and Syllabi of B.Sc Mathematics and M.Sc Mathematics programmes of Regulation 2023.

Members present:

Members of the BoS

Sl.No.	Name	Designation	Representing	Signature
1.	Dr.S. Buvaneswari	Associate Professor & Head Department of Mathematics Periyar Maniammai Institute of Science and Technology	Chair person	
2.	Dr.A.Tamilselvan	Prof. & Head Department of Mathematics Bharathidasan University Tiruchirappalli 620 024	Member (Academic Expert)	05/06/23
3.	Dr. S. Mohanraj	Managing Director AlgaeR NutraPharma Pvt. Ltd 259/1Q1,1Q2,1R1,1R2, Palayapatti-North, Chithampurampatti, Sengipatti-via, Manayerapatti post Budalur taluk, Thanjavur - 613402	Member (Industry Expert)	
4.	Dr.A.George	Dean Academic Professor, Department of Mathematics, Periyar Maniammai Institute of Science and Technology	Member	

5	Dr P Vijayalakshmi	Dean (Acs) PMIST Asso. Professor Department of Mathematics Periyar Maniammai Institute of Science and Technology	Member	P.Vijay
6	Dr C Vimala	Asso. Professor Department of Mathematics Periyar Maniammai Institute of Science and Technology	Member	C [illegible] 5/6/13
7	Dr P N Sudha	Associate Professor Department of Mathematics, Periyar Maniammai Institute of Science and Technology	Member	[illegible] 5/6/13
8	Dr R Balakumar	Assistant Professor Department of Mathematics Periyar Maniammai Institute of Science and Technology	Member	[illegible]

Department of Mathematics

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PERIYAR MANIAMMAI

BOARD OF STUDIES MEETING

For B.Sc. and M.Sc Mathematics Programmes

Minutes of Meeting

Date: 05.06.2023 **Time: 10.30 AM** **Venue: Department of Mathematics**

The Board of Studies meeting was held on 05.06.2023 for revision of Curriculum and Syllabi of B.Sc Mathematics and M.Sc Mathematics programmes of Regulation 2023.

Members present:

Members of the BoS

Sl.No.	Name	Designation	Representing	Signature
1.	Dr S. Buvaneswari	Associate Professor & Head Department of Mathematics Periyar Maniammai Institute of Science and Technology	Chairperson	
2.	Dr A.Tamilselvan	Prof & Head Department of Mathematics Bharathidasan University Tiruchirappalli 620 024	Member (Academic Expert)	05/06/23
3.	Dr. S. Mohanraj	Managing Director AlgaliR NumaPharms Pvt. Ltd 259/1Q1,1Q2,1R1,1R2, Palayapatti North, Chithampalapatti, Sengipatti via, Manaiyeripatti post Budalur taluk, Thanjavur – 613402	Member (Industry Expert)	
4.	Dr A.George	Dean Academic Professor, Department of Mathematics, Periyar Maniammai Institute of Science and Technology	Member	

5.	Dr.P.Vijayalakshmi	Dean(i/c) FHSM Asso. Professor Department of Mathematics Periyar Maniammai Institute of Science and Technology.	Member	
6.	Dr.C.Vimala	Asso. Professor Department of Mathematics Periyar Maniammai Institute of Science and Technology.	Member	
7.	Dr.P.N.Sudha	Assistant Professor Department of Mathematics. Periyar Maniammai Institute of Science and Technology.	Member	
8.	Dr.R.Balakumar	Assistant Professor Department of Mathematics Periyar Maniammai Institute of Science and Technology.	Member	

- **A. FEEDBACK ON CURRICULAR ASPECTS**

The feedback was collected and analyzed during 2021-2022 and 2022-2023 from the following stake holders

- Teachers
- Employers
- Alumni students
- Students

In addition, the feedback from Academic Expert, Teachers, Alumni and Students who participated in Department Advisory Committee (**DAC**) Meeting were presented. The action taken for the feedbacks are given as "Remarks" in Table I.

- **B. CURRICULUM INTERVENTION BASED ON CO ATTAINMENT**

The CO attainment and PO attainment for the courses were presented to the members and were discussed.

- **C. PRESENTATION OF CURRICULUM AND SYLLABUS**

All the courses which are framed by the Department of Mathematics are presented individually. The deletion, addition and introduction of new courses related details are tabulated for all courses in the following table.

Table I: Discussions on courses with actions as remarks B. Sc. Mathematics

No	Sem	Course type	Course Name (Proposed)	Course content Deletion/ Addition/New	Percentage of change	Remarks
1.	I	CC	Algebra &Trigonometry	No Change	0%	-
2.	I	CC	Differential Calculus	No Change	0%	-
3.	II	CC	Analytical Geometry 3-D and Integral Calculus	Change	20 %	Feedback received from stake holders
4.	II	CC	Sequence and Series	No Change	0%	-
5.	III	CC	Differential Equations and Applications	Change	40%	Feedback received from stake holders
6.	III	CC	Vector Calculus and Applications	Change	60%	Feedback received from stake holders
7.	IV	CC	Object Oriented Programming with C++	New Course	100%	Feedback received from BOS Expert

						members
8.	IV	CC	Fourier Series and Transforms	Change	40 %	Feedback received from stake holders
9.	V	CC	Abstract Algebra	Change	40%	Feedback received from stake holders
10.	V	CC	Real Analysis	Change	40%	Feedback received from stake holders
11.	V	CC	Number Theory	Change	60%	Feedback received from stake holders
12.	V	DSE	Graph Theory	Change	50%	Feedback received from stake holders
13.	V	DSE	Mathematical Modeling	No Change	0%	-
14.	V	DSE	Numerical Methods with MATLAB	New Course	100%	Feedback received from BOS Expert members
15.	V	DSE	Discrete Mathematics	Change	50%	Feedback received from stake holders
16.	VI	CC	Complex Analysis	Change	40%	Feedback received from stake holders
17.	VI	CC	Mechanics	Change	40%	Feedback received from stake holders
18.	III	DSC	Statistics for Data Science - I	New Course	100%	Feedback received from BOS Expert members
19.	III	DSC	Statistics for Data Science - I - Lab using R-Programming	New Course	100%	Feedback received from BOS Expert members
20.	IV	DSC	Statistics for Data Science - II	New Course	100%	Feedback received from BOS Expert members
21.	IV	DSC	Statistics for Data Science – II Lab using R-Programming	New Course	100%	Feedback received from BOS Expert members
22.	VI	DSE	Optimization Techniques	No Change	0%	-

23.	VI	DSE	Industrial Mathematics 4.0	No Change	0%	-
24.	VI	DSE	Introduction to Machine Learning	New Course	100%	Feedback received from BOS Expert members
25.	VI	DSE	Astronomy	No Change	0%	-
26.	VI	DSE	Stochastic Processes	No Change	0%	-
27.	II	SEC	Quantitative Aptitude - I	No Change	0%	-
28.	III	SEC	Quantitative Aptitude - II	No Change	0%	-
29.	IV	SEC	Vedic Mathematics – I	New Course	100%	Feedback received from BOS Expert members
30.	V	SEC	Vedic Mathematics - II	New Course	100%	Feedback received from BOS Expert members
31.	I	Bridge Course	Foundation Course	New Course	100%	Feedback received from BOS Expert members
32.	V	NME	Mathematics for Finance	New Course	100%	Feedback received from BOS Expert members

- **LIST OF NEW COURSES**

ble II: NEWLY INTRODUCED COURSES IN REGULATION 2023 B.Sc. Mathematics 34.4%

S. No	Name of the course	Remarks
1.	Vedic Mathematics – I	Introduced as per recommendations of BOS
2.	Vedic Mathematics - II	Introduced as per recommendations of BOS
3.	Introduction to Machine Learning	Introduced as per feedback received from students and industrialist
4.	Numerical Methods with MATLAB	Introduced as per feedback received from students
5.	Statistics for Data Science –I Lab using R-Programming	Introduced as per recommendations of BOS
6.	Statistics for Data Science - I	Introduced as per recommendations of BOS
7.	Statistics for Data Science - II	Introduced as per recommendations of BOS
8.	Statistics for Data Science – II Lab using R-Programming	Introduced as per recommendations of BOS
9.	Object Oriented Programming with C++	Introduced as per feedback received from students
10.	Foundation Course	Introduced as per TANSCHE
11.	Mathematics for Finance	Introduced as per TANSCHE

- **A. FEEDBACK ON CURRICULAR ASPECTS**

The feedback was collected and analyzed during 2021-2022 and 2022-2023 from the following stake holders

- Teachers
- Employers
- Industrialist
- Alumni students
- Students

In addition, the feedback from Academic Expert, Teachers, Alumni and Students who participated in Department Advisory Committee **(DAC)** Meeting were presented. The action taken for the feedbacks are given as "Remarks" in Table I.

- **B. CURRICULUM INTERVENTION BASED ON CO ATTAINMENT**

The CO attainment and PO attainment for the courses were presented to the members and were discussed.

- **C. PRESENTATION OF CURRICULUM AND SYLLABUS**

All the courses which are framed by the Department of Mathematics are presented individually. The deletion, addition and introduction of new courses related details are tabulated for all courses in the following table.

M.Sc. Mathematics

Table I: Discussions on courses with actions as remarks

S.No	Sem	Course Name	Course content Deletion/Addition/New	Percentage of Change	Remarks
1	I	Linear Algebra	New Course	100%	Feedback given by BoS Subject experts
2	I	Real Analysis	-	20%	Feedback received from stake holders
3	I	Ordinary Differential Equations	-	80%	Feedback received from stake holders
4	I	Graph Theory	No Change	0%	-
5	I	Mathematical Statistics	-	40%	Feedback received from stake holders
		Fuzzy sets and their applications	-	40%	Feedback given by BoS Subject experts

		AI and Machine Learning	New Course	100%	Feedback given by BoS Subject experts
6	I	Computer Programming (C++ Theory and Lab)	No Change	0%	-
		Number Theory and Cryptography	-	60%	Feedback received from stake holders
		Formal Languages and Automata Theory	-	60%	Feedback received from stake holders
7	II	Advanced Algebra	New Course	100%	Feedback given by BoS Subject experts
8	II	Complex Analysis	-	40%	Feedback received from stake holders
9	II	Partial Differential Equations	-	40%	Feedback given by DAC members and BoS Subject experts
10	II	Advanced Numerical Methods	-	60%	Feedback received from stake holders
11	II	Resource Management Techniques	-	60%	Feedback received from stake holders
		Data Science using R programming	New Course	100%	Feedback given by DAC members and BoS Subject experts
		Python for Mathematics	New Course	100%	Feedback given by BoS Subject experts
12	II	Data Analysis using SPSS	No Change	0%	-
		Numerical Methods Practical using MATLAB	New Course	100%	Feedback given by BoS Subject experts
		Data Analytics Practical with Python	New Course	100%	Feedback given by BoS Subject experts

13	II	Research Methodology	New Course	100%	Feedback given by BoS Subject experts
14	III	Topology	No Change	0%	-
15	III	Measure theory and Integration	New Course	100%	Feedback given by BoS Subject experts
16	III	Functional Analysis	-	40%	Feedback given by BoS Subject experts
17	III	Differential Geometry	-	60%	Feedback given by BoS Subject experts
18	III	Core Industry Module: Mathematics of Finance and Insurance	New Course	100%	Feedback given by BoS Subject experts
19	III	Fluid Dynamics	-	80%	Feedback given by BoS Subject experts
		Probability Theory	New Course	100%	Feedback given by BoS Subject experts
		Design and Analysis of Algorithms	New Course	100%	Feedback given by BoS Subject experts
20	IV	Project	No Change	0%	Only change in credit

1. **LIST OF NEWLY INTRODUCED COURSES IN REGULATION 2023 (38.7%)**

Table II Newly courses introduced 4

S.NO.	**Course Name**
1.	Linear Algebra
2.	Machine Learning and AI
3.	Advanced Algebra
4.	Data Science using R programming
5.	Python for Mathematics
6.	Numerical Methods Practical using MATLAB
7.	Data Analytics Practical with Python
8.	Research Methodology
9.	Measure theory and Integration
10.	Core Industry Module: Mathematics of Finance and Insurance
11.	Probability Theory
12.	Design and Analysis of Algorithms

2. Extracts of Minutes of the Academic Council Meeting-B.Sc Maths conducted on 08.07.2023

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PERIYAR MANIAMMAI
INSTITUTE OF SCIENCE & TECHNOLOGY

MINUTES OF FORTY SECOND MEETING OF THE ACADEMIC COUNCIL

Date : 08.07.2023 **Venue: Richard Dawkins Hall**

Time : 10.30 A.M **Place : PMIST, Vallam – Thanjavur**

The Forty Second Meeting of the Academic Council of the Periyar Maniammai Institute of Science & Technology (PMIST), Vallam, Thanjavur held on 08.07.2023 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.A.P.Aruna	Member
5.	Dr.P.Aruna	Member
6.	Dr.S.Asokan	Member
7.	Dr.P.Balakumar	Member
8.	Dr.S.Buvaneswari	Member
9.	Dr.P.Guru	Member
10.	Dr.K.Geetha	Member
11.	Dr.A.George	Member
12.	Dr.A.Manohar (Represented for Dr.S.Gomathi)	Member
13.	Dr.V.Hamsadhwani	Member
14.	Dr.R.Jayanthi	Member
15.	Dr.N.Jayanthi	Member
16.	Dr.J.Jeyachidra	Member
17.	Dr.D.Jeyasimman	Member
18.	Mr.I.Karthic Subramaniayan	Member
19.	Dr.R.Kathiravan	Member

51.	Dr.D.Umamaheswari	Member
52.	Dr.P.Vijayalakshmi	Member

ADDRESS BY THE VICE-CHANCELLOR

Hon'ble Chair Person welcomed all the Internal & External Members of the Academic Council. He presented all the academic activities held in the campus after the previous meeting.

1. BUSINESS BROUGHT FORWARD BY THE VICE-CHANCELLOR

VC 42.1.1 **TO CONSIDER AND APPROVE** the confirmation of the minutes of the 41st Academic Council Meeting held on 10.12.2022.

Notes:

The Minutes of the 41st Academic Council Meeting held on 10.12.2022 were communicated to all members. The same was placed before the Board of Management Meeting held on 27.12.2022 and got approved; no dissent / corrections have been received from the members.

The matter is placed before the Academic Council for approval.

Resolution

RESOLVED TO APPROVE the confirmation of the minutes of the 41st Academic Council Meeting held on 10.12.2022.

VC 42.1.2 **TO CONSIDER AND RATIFY** the course works offered for the Research scholars registered in the academic year 2022-23 under Regulations 2022.

Notes:

The respective Doctoral Committees of the following departments have discussed and finalized the course work syllabi for the Research Scholars registered in the academic year 2022-23. The list is given below:

FHSM B.Sc.-Maths 42.5.4	**TO CONSIDER AND APPROVE** the Curriculum and Syllabi for I to VI Semester for B.Sc.-Mathematics programme under Regulation 2023 and Proposed Value-Added Courses.

Notes:

The Board of Studies of Department of Mathematics recommended the Curriculum and Syllabi for I to VI Semester for B.Sc.-Mathematics programme under full time (Regulation 2023) for the candidates admitted from 2023 –24 onwards.

Curriculum and Syllabus is with 35% revision from previous syllabus. The syllabus revision included feedback on curricular aspects from students, teachers, Industrialist, employers and alumni. The syllabus has courses having focus on employability/entrepreneurship / skill development.

The new courses offered by the department are

S.No	Name of the course
1.	Vedic Mathematics – I
2.	Vedic Mathematics – II
3.	Introduction to Machine Learning
4.	Numerical Methods with MATLAB
5.	Statistics for Data Science - I
6.	Statistics for Data Science –I Lab using R-Programming
7.	Statistics for Data Science - II
8.	Statistics for Data Science – II Lab using R-Programming
9.	Object Oriented Programming with C++
10.	Foundation Course
11.	Mathematics for Finance

Extracts of the Minutes of the 42nd Academic Council Meeting dated 08.07.2023

DEPARTMENT OF MATHEMATICS

FHSM M.Sc.-Maths 42.5.3

TO CONSIDER AND APPROVE the Curriculum and Syllabi for I to IV Semester for M.Sc.-Mathematics programme under Regulation 2023 and Proposed Value-Added Courses.

Notes:

The Board of Studies of Department of Mathematics recommended the Curriculum and Syllabi for I to IV Semester for M.Sc.-Mathematics programme under full time (Regulation 2023) for the candidates admitted from 2023–24 onwards. Curriculum and Syllabus is with 39% revision from previous syllabus. The syllabus revision included feedback on curricular aspects from students, teachers, Industrialist, employers and alumni. The syllabus has courses having focus on employability / entrepreneurship / skill development.

The new courses offered by the department are

Sl.No.	Course Name
1	Linear Algebra
2	Machine Learning and AI
3	Advanced Algebra
4	Data Science using R programming
5	Python for Mathematics
6	Numerical Methods Practical usingMAT LAB
7	Data Analytics Practical with Python
8	Research Methodology
9	Measure theory and Integration
10	Core Industry Module: Mathematics of Finance and Insurance
11	Probability Theory
12	Design and Analysis of Algorithms

3.a. Curriculum and Syllabus of B.Sc Maths – Before Revision

B.Sc. (Mathematics)
REGULATION – 2022
SEMESTER – I

Category	Code	Course Name	L	T	P	SS	H	C
Part – I	XGT101/XFT101	Tamil – I/ Foundational Tamil- I	3	0	0	0	3	3
Part – II	XGE102	English – I	3	0	0	0	3	3
Core -1	XMT103	Differential Calculus and Trigonometry	4	1	0	0	5	4
Core -2	XMT104	Analytical geometry 3-D and Integral Calculus	4	1	0	0	5	4
Allied -1	XPG105	Physics – I	3	1	0	0	4	4
	XPG106	Physics Practical - I	0	0	4	0	4	2
UMAN - 1	XUM001	Human Ethics,Values, Rights and Gender Equality	1	0	0	1	2	1
		Mentoring	0	0	0	0	1	0
		Library/E-Library	0	0	0	0	1	0
		Extension Activities (NSS, NCC, NSO,RRC and YRC)	0	0	0	0	2	0
		Total	**16**	**3**	**4**	**1**	**30**	**21**

SEMESTER II								
Category	**Code**	**Course Name**	**L**	**T**	**P**	**SS**	**H**	**C**
Part – I	XGT201/ XFT201	Tamil – II/ Foundational Tamil – II	3	0	0	0	3	3
Part – II	XGE202	English – II	3	0	0	0	3	3
Core-3	XMT203	Classical Algebra	3	1	0	0	4	4
Core-4	XMT204	Sequence and Series	3	1	0	0	4	4
Allied -2	XPG205	Physics – II	3	1	0	0	4	4
	XPG206	Physics Practical - II	0	0	4	0	4	2
SEC -1	XMT207	Skill Based Elective Course - 1	2	0	0	0	2	2
UMAN - 2	XUM002	Environmental Studies	1	0	0	1	2	1
		Field Visit/Industrial Visit	0	0	0	0	0	2
		Mentoring	0	0	0	0	1	0
		Library/E-Library	0	0	0	0	1	0
		Extension Activities (NSS, NCC, NSO, RRC and YRC)	0	0	0	0	2	0
		Total	**18**	**3**	**4**	**1**	**30**	**25**

SEMESTER III								
Category	**Code**	**Course Name**	**L**	**T**	**P**	**SS**	**H**	**C**
Core -5	XMT301	Differential Equations and Laplace Transforms	3	1	0	0	5	4
Core -6	XMT302	Vector Calculus, Fourier Series and Fourier Transforms	3	1	0	0	5	4
Allied -3	XMT303	Mathematical Statistics - 1	3	1	0	0	5	4
	XMT304	Mathematical Statistics Practical –1	0	0	4	0	4	2
GE - 1		Open Elective- I	3	0	0	0	3	3
SEC - 2	XMT305	Skill Based Elective Course –2- Quantitative Aptitude - II	2	0	0	0	2	2
UMAN -3	XUM003	Disaster Management	1	0	0	1	2	1
		Mentoring	0	0	0	0	1	0
		Library/E-Library	0	0	0	0	1	0
		Extension Activities (NSS, NCC, NSO,RRC and YRC)	0	0	0	0	2	0
		Total	**15**	**3**	**4**	**1**	**30**	**20**

SEMESTER IV								
Category	**Code**	**Course Name**	**L**	**T**	**P**	**SS**	**H**	**C**
Core –7	XMT401	Abstract Algebra	3	1	0	0	5	4
Core -8	XMT402	Mechanics	3	1	0	0	5	4
Allied - 4	XMT403	Mathematical Statistics – 2	3	1	0	0	5	4
	XMT404	Mathematical Statistics Practical – 2	0	0	4	0	4	2
GE- 2		Open Elective- 2	3	0	0	0	3	3
SEC – 3	XMT405	Skill Based Elective Course –3- Quantitative Aptitude - III	2	0	0	0	2	2
UMAN - 4	XUM004	Introduction to Entrepreneurship Development	1	0	0	1	2	1
		Mentoring	0	0	0	0	1	0
		Library/E-Library	0	0	0	0	1	0
		Extension Activities (NSS, NCC, NSO,RRC and YRC)	0	0	0	0	2	0
		Total	**15**	**3**	**4**	**1**	**30**	**20**

SEMESTER V								
Category	**Code**	**Course Name**	**L**	**T**	**P**	**SS**	**H**	**C**
Core -9	XMT501	Real Analysis	3	1	0	0	5	4
Core-10	XMT502	Discrete Mathematics	3	1	0	0	4	4
DSE – 1	XMT503	Discipline Specific Course - 1	4	1	0	0	5	5
DSE–2	XMT504	Discipline Specific Course - 2	4	1	0	0	5	5

GE -3		Open Elective- 3	3	0	0	0	3	3
NME	XMT505	Fundamentals of Data Science & R Programming	1	1	0	0	2	2
SEC–4	XMT506	Skill Based Elective Course –4- Quantitative Aptitude -IV	2	0	0	0	2	2
IPT	XMT507	IPT	0	0	0	0	0	4
		Mentoring	0	0	0	0	1	0
		Library/E-Library	0	0	0	0	1	0
		Extension Activities (NSS, NCC, NSO,RRC and YRC)	0	0	0	0	2	0
		Total	**20**	**5**	**0**	**0**	**30**	**29**

SEMESTER VI								
Category	**Code**	**Course Name**	**L**	**T**	**P**	**SS**	**H**	**C**
Core -11	XMT601	Complex Analysis	3	1	0	0	5	4
Core -12	XMT602	Operations Research	3	1	0	0	4	4
DSE - 3	XMT603	Discipline Specific Course - 3	4	1	0	0	5	5
DSE - 4	XMT604	Discipline Specific Course - 4	4	1	0	0	5	5
Project	XMT605	Project	1	4	0	0	5	6
UMAN - 5	XUM005	Cyber Security	1	0	0	1	2	1
		Mentoring	0	0	0	0	1	0
		Library/E-Library	0	0	0	0	1	0
		Extension Activities (NSS, NCC, NSO,RRC and YRC)	0	0	0	0	2	2
		Total	**16**	**8**	**0**	**1**	**30**	**27**

Note:

L – Lecture **T – Tutorial** **P – Practical**
SS – Self Study **H – Hours** **C – Credits**

LIST OF SKILL BASED ELECTIVE COURSES

Category	Semester	Code	Course Name	L	T	P	H	C
SEC -1	II	XMT207	Quantitative Aptitude – I	2	0	0	0	2
SEC -2	III	XMT305	Quantitative Aptitude - II	2	0	0	0	2
SEC -3	IV	XMT405	Quantitative Aptitude - III	2	0	0	0	2
SEC -4	V	XMT506	Quantitative Aptitude – IV	2	0	0	0	2

LIST OF DISCIPLINE SPECIFIC ELECTIVE COURSES

Semester – V
DSE – 1 (Any one of the following)

Category	Code	Course Name	L	T	P	H	C
DSE1A	XMT503A	Numerical Methods	4	1	0	5	5
DSE1B	XMT503B	Number Theory	4	1	0	5	5

DSE – 2 (Any one of the following)

Category	Code	Course Name	L	T	P	H	C
DSE2A	XMT504A	Graph Theory	4	1	0	5	5
DSE2B	XMT504B	Mathematical Modeling	4	1	0	5	5

Semester – VI
DSE – 3 (Any one of the following)

Category	Code	Course Name	L	T	P	H	C
DSE3A	XMT603A	Fuzzy sets and its applications	4	1	0	5	5
DSE3B	XMT603B	**Introduction to Industry 4.0**	4	1	0	5	5

DSE – 4 (Any one of the following)

Category	Code	Course Name	L	T	P	H	C
DSE4A	XMT604A	Astronomy	4	1	0	5	5
DSE4B	XMT604B	Stochastic Processes	4	1	0	5	5

COURSE CODE	XGE102	L	T	P	SS	H	C
COURSE NAME	English - I	3	0	0	0	3	3
C:P: A - 3:0:0							

COURSE OUTCOMES:		Domain	Level
CO1	***Recall*** the basic grammar and using it in proper context	Cognitive	Rememberin g
CO2	***Explain*** the process of listening and speaking	Cognitive	Understandin g
CO3	***Adapt*** important methods of reading	Cognitive	Creating
CO4	***Demonstrate*** the basic writing skills	Cognitive	Understandin g

SYLLABUS		HOURS
UNIT I	**Grammar**	
i. Major basic grammatical categories ii. Notion of correctness and attitude to error correction		9
UNIT II	**Listening and speaking**	
iii. Importance of listening skills iv. Problems of listening to unfamiliar dialects v. Aspects of pronunciation and fluency in speaking vi. Intelligibility in speaking		9
UNIT III	**Basics of Reading**	
vii. Introduction to reading skills viii. Introducing different types of texts – narrative, descriptive, extrapolative		9
UNIT IV	**Basics of Writing**	
ix. Introduction to writing skills x. Aspects of cohesion and coherence xi. Expanding a given sentence without affecting the structure xii. Reorganizing jumbled sentences into a coherent paragraph xiii. Drafting different types of letters (personal notes, notices, complaints, appreciation, conveying sympathies etc.)		9
	Total Hours	**36**

Text books

1. Acevedo and Gower M (1999) Reading and Writing Skills. London, Longman
2. Deuter, M et.al. (2015). Oxford Advanced Learner's Dictionary of English (Ninth Edition). New Delhi, OUP
3. Eastwood, John (2008). Oxford Practice Grammar. Oxford, OUP
4. Hadefield, Chris and J Hadefield (2008). Reading Games. London, Longman
5. Hedge, T (2005). Writing. Oxford, OUP
6. Jolly, David (1984). Writing Tasks: Stuidents' Book. Cambridge, CUP
7. Klippel and Swan (1984). Keep Talking. Oxford, OUP
8. Saraswati, V (2005). Organized Writing 1. Hyderabad, Orient Blackswan
9. Swan, Michael. (1980). Practical English Usage. Oxford, OUP
10. Walter and Swan (1997). How English Works. Oxford, OUP

Course Code		L	T	P	C
Course Name	**தமிழ் - I**	3	0	0	3
Prerequisite		L	T	P	H
C:P:A	3:0:0	3	0	0	3

	COURSE OUTCOMES	DOMAIN	LEVEL
	After the completion of the course, students will be able to		
CO1	*Recognize* (அடையாளம் காணுதல்) பல்வேறு அறிஞர் பெருமக்களின் தொண்டுகளைத் தமிழ்மொழி மூலம் அறிந்து கொள்ளல்.	Cognitive	Remember
CO2	*Choose* (தெரிவு செய்தல்) பன்முகப் பரிமாணங்களின் கவிதைகளை இலக்கியங்கள் மூலம் அறிந்து கொள்ளல்.	Cognitive	Remember
CO3	*Describe* (விளக்குதல்) தமிழ் மகளிரின் உரையாடல் சிறப்புச் செய்திகளை உணர்தல்.	Cognitive	Understand
CO4	*Apply* (விளக்குதல்) பல்வேறு கலைத்துறைச் சார்ந்த பிரிவுகள், மண்ணின் பாடல்கள் குறித்துத் தெளிவு பெறல்.	Cognitive	Apply
CO5	*Analyze* (பகுத்தல்) சிறுகதைகளின் தோற்றம் மற்றும் வளர்ச்சி நிலை நாடகங்கள் - கவிதை குறித்துத் தெளிவு பெறுதல்.	Cognitive	Analyze

அலகு-1	**தமிழ் அறிஞர்களும் தமிழ்த்தொண்டும்**	9
பாரதியார், பாரதிதாசன், நாமக்கல் கவிஞர், சி.இலக்குவனார், உ.வே.சாமிநாத அய்யர், தெ.பொ.மீனாட்சி சுந்தரம், கவிமணி தேசியவிநாயகம் பிள்ளை தொடர்பான செய்திகள், சிறந்த தொடர்கள், சிறப்புப் பெயர்கள்.		
அலகு-2	**கவிதைகள் (மரபுக்கவிதை, புதுக்கவிதை)**	9
மரபுக்கவிதை : முடியரசன், வாணிதாசன், சுரதா, கண்ணதாசன், உடுமலை நாராயண கவி, பட்டுக்கோட்டை கல்யாண சுந்தரம், மருதகாசி தொடர்பான செய்திகள். புதுக்கவிதை : ந.பிச்சமூர்த்தி, சி.சு.செல்லப்பா, மு.மேத்தா, ஈரோடு தமிழன்பன், அப்துல் ரகுமான், ஞானக்கூத்தன், ஆலந்தூர் மோகனரங்கன் தொடர்பான செய்திகள்.		
அலகு-3	**உரையாடல்கள், தமிழ் மகளிரின் சிறப்பு**	9
ஜி.யு.போப் மற்றும் வீரமாமுனிவரின் தமிழ்ப்பணி, பெரியார், அண்ணா, முத்துராமலிங்கத்தேவர், அம்பேத்கர், காமராசர், மா.பொ.சிவஞானம், காயிதே மில்லத் சமுதாயத் தொண்டு. அன்னி பெசண்ட் அம்மையார், மூவாலூர் ராமாமிர்தம்மாள், டாக்டர் முத்துலட்சுமி ரெட்டி, வேலுநாச்சியார், வள்ளியம்மை, ராணி மங்கம்மாள் சிறப்பு.		
அலகு-4	**நாட்டுப்புறப்பாடல்**	9
தாலாட்டுப்பாடல், தொழில் பாடல், ஒப்பாரிப் பாடல்.		
அலகு-5	**இலக்கிய வரலாறு**	9
உரைநடை, சிறுகதை, நாடகம், கவிதைகள்.		

LECTURE	TUTORIAL	PRACTICAL	TOTAL
45	---	---	45

பாட நூல்கள்:

1. முனைவர் கா.செல்வகுமார் (தொ.ஆ.), பொதுத்தமிழ், மார்ச் - 2022, துரைகோ பதிப்பகம், அரும்பாக்கம், சென்னை – 106. 9884159972.
2. முனைவர் மு.அருணாசலம் (ப.ஆ.) – தமிழ் இலக்கிய வரலாறு – 2012, அருண் பதிப்பகம், தரைத்தளம், பாலாஜி நகர், ஞுடிஜ காலனி, கண்டோன்மெண்ட், திருச்சி - 1. 9894440530
3. சு.சக்திவேல் - நாட்டுப்புற இயல் ஆய்வு, மணிவாசகர் பதிப்பகம் - 12, மேலசன்னதி வீதி, சிதம்பரம் - 1.
4. முனைவர் கோ.பெரியண்ணன் - அடிப்படை எளிய தமிழ் இலக்கணம் - 2003 –வனிதா பதிப்பகம், 11- நானா தெரு, பாண்டி பஜார், தி.நகர், சென்னை - 17.

பார்வை நூல்கள்:

1. முனைவர் ந.லெனின், தாலாட்டுப் பாடல், பிப்ரவரி - 2015, பிருந்தா பதிப்பகம், தஞ்சாவூர் - 5.
2. கோ. வெங்கடாசலம் (தொ.ஆ.) - 2005, தமிழ் இலக்கிய கைவிளக்கு, அன்னை சரஸ்வதி பதிப்பகம், குடியாத்தம்.
3. முனைவர் இராஜா வரதராஜா - பயன்முறைத் தமிழ் - ஜுன் 2015, சிவகுரு பதிப்பகம், 7.'.40, கிழக்குச் செட்டித்தெரு, பரங்கிமலை, சென்னை – 16.

Table 1: Assessment Template

S.No.	Task	Marks
1	CA 1 (Descriptive + MCQ)	15
2	CA 2 (Class Test- Descriptive + MCQ)	15
3	CA3 (Rubrics prepared by the Course Teacher)	20
4	CA 4- End Semester Pattern (MCQ – 20% + Descriptive 80%)	50
	Total	**100**

Course Name			Differential Calculus and Trigonometry	L	T	P	C
Course Code			XMT103	3	1	0	4
C	P	A		L	T	SS	H
4	0	0		3	2	0	5

Prerequisite	**Higher Secondary level Mathematics**

On successful completion of this course, the students will be able to:

Course Outcomes		Domain	Level
CO 1	**Apply** Leibnitz rule to solve problems related to nth order derivatives	Cognitive	Applying
CO 2	**Identify** maxima and minima of multivariable functions	Cognitive	Applying
CO 3	**Apply** the concept and principles of differential calculus to find the curvature, radius of curvature, envelopes, evolute and involute of different curves	Cognitive	Applying
CO 4	**Demonstrate** the expansions of trigonometric functions in terms of θ	Cognitive	Understanding
CO 5	**Demonstrate** the relations between hyperbolic functions and circular functions	Cognitive	Understanding

UNIT 1	**Successive Differentiation**	**12**
Successive Differentiation – The n^{th} derivative – Standard results – Trigonometrical transformation – Formation of equations involving derivatives – Leibnitz formula for the n^{th} derivative of a product – Proof		
UNIT 2	**Partial Differentiation, Maxima and minima of functions of two variables**	**12**
Successive partial derivatives – Function of function rule – Total differential coefficient – Implicit functions – Homogeneous functions – Partial derivatives of a function of two functions – Taylor's expansion of $f(x,y)$ - Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.		
UNIT 3	**Envelopes, Curvature of Plane curve**	**12**
Envelopes – Method of finding envelope – Curvature – Cartesian formula for radius of curvature – The coordinates of centre of curvature – Evolute and involute – Radius of curvature when the curve is given in polar co-ordinates – p-r equation; pedal equation of a curve – Chord of curvature.		
UNIT 4	**Expansions**	**12**
Expansions of cos $n\theta$ and sin $n\theta$ - Expansion of tan $n\theta$ in powers of tan θ - Expansion of tan $A+B+C+\cdots$ - Examples on formation of equations – Expansions of $\cos^n\theta$ and $\sin^n\theta$ in terms of functions of multiples of θ - Expansion of cos θ and sin θ in a series of ascending powers of θ.		
UNIT 5	**Hyperbolic Functions and Logarithms of Complex quantities**	**12**
Hyperbolic functions – Relations between hyperbolic functions – Relations between hyperbolic functions and circular functions – Inverse hyperbolic functions – Separation into real and imaginary parts – Logarithms of complex quantities – logarithm of $x+iy$ - General value of logarithm of $x+iy$.		

Lecture	45	Tutorial	15	Practical	0	Total	60

Text Books

1. Calculus Volume I, S. Narayanan and T.K. ManicavachagomPillay, S. Viswanathanpvt. Ltd., 2014.
   Unit I : Chapter III (All sections)
   Unit II : Chapter VIII (Sections 1, 3, 4 & 5)
   Unit III: Chapter X (All sections)
2. Trigonometry, Narayanan and T.K. ManicavachagomPillay, S. Viswanathanpvt. Ltd., 2014.
   Unit IV: Chapter III
   Unit V: Chapter IV (All sections) & Chapter V (Section 5)

E-References

1. https://math.Korea. Edu/math_en/calculus/syllabus. Do [Korea University]
2. https://explore course. Stanford. edu/search?q=MATH21 [Stanford University]

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	3	3	2	3	1	1	1	1
CO 2	3	3	3	2	3	1	1	1	1
CO 3	3	3	3	2	3	1	1	1	1
CO 4	3	3	2	1	3	1	0	1	1
CO 5	3	3	2	1	3	1	0	1	1
TOTAL	**15**	**15**	**13**	**8**	**15**	**5**	**3**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**1**

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

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

Course Name			Analytical Geometry 3-D and Integral Calculus	L	T	P	C
Course Code			**XMT104**	**3**	**1**	**0**	**4**
C	**P**	**A**		**L**	**T**	**SS**	**H**
4	**0**	**0**		**3**	**2**	**0**	**5**
Prerequisite			**Higher Secondary level Mathematics**				

On successful completion of this course, the students will be able to:

Course Outcomes		Domain	Level
CO 1	**Identify** the given lines are coplanar lines and shortest distance between the skew lines	Cognitive	Applying
CO 2	**Identify** the equation of the tangent plane to a given sphere	Cognitive	Applying
CO 3	**Apply** reduction formulae to Integrate functions of a higher degree.	Cognitive	Applying
CO 4	**Apply** the concepts of Beta and Gamma functions and their properties to evaluate definite integral.	Cognitive	Applying
CO 5	**Apply** the concepts of multiple integral for finding the area and volume of the region bounded by curves	Cognitive	Applying

UNIT 1 **12**

Analytical Geometry 3-D – The plane – The straight line – Coplanar lines - skew lines S.D.

UNIT 2 **12**

Sphere- Tangent plane- intersection of two spheres – Equation of tangent plane to a sphere.

UNIT 3 **12**

Properties of definite integrals - Reduction formulae of the types:

$\int x^n e^{ax} dx, \int x^n \cos ax\ dx, \int \sin^n x\ dx, \int \cos^n x\ dx, \int \sin^m x \cos^n x\ dx, \int \tan^n x\ dx$

UNIT 4 **12**

Beta and Gamma Functions: Definitions – Convergence of $\Gamma(n)$ – Recurrence formula of gamma function – Properties of beta function – relation between beta and gamma functions.

UNIT 5 **12**

Multiple integral: Double integral – Evaluation of double integral - change of order of integration – Polar coordinates - Triple integrals - Application of multiple integrals.

Lecture	45	Tutorial	15	Practical	0	Total	60

Text Books

1. Analytical geometry: T.K. M. Pillai, 2015 (for Unit I & II)

2. Calculus Vol II : T.K. M. Pillai, 2015 (for Unit III, IV & V)

Unit I	:	Chapter 2 (Sec: 1 – 7), Chapter 3 (Sec: 1 - 8)
Unit II	:	Chapter 4 (Sec: 1 – 8)
Unit III	:	Chapter 1 (Sec: 11, 13.1 – 13.6)
Unit IV	:	Chapter 7 (Sec: 2 – 5)
Unit V	:	Chapter 5 (Sec: 2 – 5.4)

References

1. Solid Geometry- M.L. Khanna (Jainath& Co Publishers, Meerut)
2. Mathematics for BSc – Vol I and. II - P. Kandasamy. Thilagarathy (S. Chand and Co- 2004)

E-References

1. https://sites.math.washington.edu/~m125/ [Washington University]
2. https://courses.maths.ox.ac.uk/node/28 [Oxford University]

COs vs POs

	PO 1	PO2	PO 3	PO 4	PO5	PO 6	PO7	PO 8	PO9
CO 1	3	3	3	2	3	1	1	1	1
CO 2	3	3	3	2	3	1	1	1	1
CO 3	3	3	2	1	3	1	0	1	1
CO 4	3	3	2	1	3	1	0	1	1
CO 5	3	3	3	2	3	1	1	1	1
TOTAL	**15**	**15**	**13**	**8**	**15**	**5**	**3**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**1**

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

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

Course Name			Physics –I	L	T	P	C
Course Code			XPG105	3	1	0	4
C	P	A		L	T	SS	H
4	0	0		3	1	0	4
Prerequisite			Basic knowledge of physics concepts.				

On successful completion of this course, the students will be able to:

	Course Outcomes	Domain	Level
CO 1	**Identify** the principles of elasticity, **derive** expression for twisting couple and **determine** rigidity modulus of a wire	Cognitive	Remember, Understand and Apply
CO 2	**Describe** sound, propagation, perception **analysis** of acoustical wave and effect echoes in building.	Cognitive	Understand and apply
CO 3	**Recall** basic concepts of specific heat capacity **List** the laws of thermodynamics.	Cognitive	Remember and understand
CO 4	**Understand** Interference, diffraction and **identify** their applications.	Cognitive	Understand and Analyze
CO 5	**Recall** the general properties of atoms and nucleus, **Discuss** the various models and **Analyze** various applications of X–ray.	Cognitive	Remember Understand, analyze

UNIT	Title	Hours
UNIT 1	**Elasticity**	**12**
Stress – Strain –Hooke' law-Different moduli of elasticity - Twisting couple on a cylinder – Determination of Rigidity modulus by Static Torsion method –Bending of beams–Experimental methods for the determination of Young's modulus by non-uniform bending.		
UNIT 2	**Sound**	**12**
Introduction – characteristic of musical sound - Loudness – unit of loudness – Noise - Acoustics of buildings – Reverberation – Reverberation time- requirements for good acoustics of buildings - Echo and Echelon effect.		
UNIT 3	**Thermal Physics**	**12**
Specific Heat – Specific Heat of a Liquid by Joule's Electrical Method – Newton's law of cooling –verification - specific heat capacity of a liquid by cooling– Conduction: Coefficient of thermal conductivity – Lee's disc method for bad conductors – Black body radiation- Stefan's law.		
UNIT 4	**Optics**	**12**
Interference – determination of thickness of a thin wire by air wedge method – Diffraction – Fresnel's and Fraunhofer diffraction – Diffraction grating–Dispersion- Optical instrument: Spectrometer - Determination of refractive index and dispersive power of a prism.		

UNIT 5	Atomic and Nuclear physics	12
Atom Physics – Electron - spin quantum numbers – Pauli's exclusion principle – Excitation and ionization potentials – Photoelectric effect –X – rays: continuous and characteristic–applications. Nuclear Physics: Nuclear size –mass – charge – Mass defect – Binding energy – packing fraction –binding energy – nuclear fission – nuclear fusion– chain reaction –nuclear reactor.		

Lecture	45	Tutorial	15	Practical	0	Total	60

Text Books

1. A Text book of sound - N. Subrahmanyam and BirjLal. Publisher, Vikas Publishing House, 1985
2. Allied physics – A. Sundaravelusamy, Priya Publications, Karur-2.
3. Properties of matter – R. Murugesan. S Chand & Co. Pvt. Ltd., New Delhi. 2

References

1. Concepts of Modern Physics, *Arthur Beiser*, 6^{th} Ed, McGraw Hill (India) Pvt. Ltd., 2009
2. .Senthil Kumar G., "Engineering Physics", 2nd Enlarged Revised Edition, VRB Publishers, Chennai, 2011.

E-References[MOOC, SWAYAM, NPTEL, Websites etc.]

1. Biswanath Banerjee and Amit Shaw, Department of Civil Engineering IIT Kharagpur, " THEORY OF ELASTICITY", National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/courses/105/105/105105177/
2. NPTEL , Engineering Physics, Prof. M. K. Srivastava, Department of Physics, IIT, Roorkee.

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	3	3	2	3	1	1	1	1
CO 2	3	3	3	2	3	1	1	1	1
CO 3	3	3	2	1	3	1	0	1	1
CO 4	3	3	3	3	3	1	2	1	1
CO 5	3	3	3	3	3	1	2	1	1
TOTAL	15	15	14	11	15	5	6	1	1
SCALED VALUE	3	3	3	3	3	1	2	1	1

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

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

Course Name			Physics Practical - I	L	T	P	C
Course Code			**XPG106**	**0**	**0**	**4**	**2**
C	**P**	**A**		**L**	**T**	**P**	**H**
0.5	**1**	**0.5**		**0**	**0**	**4**	**4**
Prerequisite			Basic knowledge of physics concepts.				

On successful completion of this course, the students will be able to:

	Course Outcomes	Domain	Level
CO 1	**Describe** sound, propagation, perception **analysis** of acoustical wave.	Cognitive Psychomotor	Knowledge
CO 2	**Identify** the principles of elasticity, **derive** expression for twisting couple and **determine** rigidity modulus of a wire.	Psychomotor: Affective:	Analyze, Mechanism Respond
CO 3	**Define** heat capacity, **recall** the concepts of temperature and **explain** the specific heat capacity.	Cognitive Psychomotor	Evaluate
CO 4	**Explain** interference & diffraction and **analysis** various application of diffraction and interference.	Psychomotor:	Knowledge, Mechanism
CO 5	**Know** the determination of wavelength and size of the micro particle.	Cognitive Psychomotor	Comprehension, Evaluate

Ex. No	Experiments (Any Eight Experiments)	
1.	Torsional pendulum – Determination of the rigidity modulus of thin wire.	CO2
2.	Young's modulus – Non uniform bending –Pin and microscope.	CO2
3.	Lee's disc –Specific heat capacity of the bad conductor.	CO3
4.	Specific heat capacity of liquid – Newton's law of cooling	CO3
5.	Spectrometer – Refractive index of a prism	CO4
6.	Spectrometer grating – a wavelength of various spectral line by normal incidence	CO4
7.	Air wedge – Thickness of wire	CO4
8.	Sonometer – verification of laws	CO1
9.	Determination specific heat capacity using Spherical Calorimeter	CO3
10.	Laser grating – Determination of wave length and To find the size of the micro particle.	CO5

Lecture	0	Tutorial	0	Practical	30	Total	30

Text Books

Course Name	Classical Algebra	L	T	P	C

1. C. L. Arora,"B.Sc. Practical Physics",S. Chand & Company Ltd. Ram Nagar, New Delhi, 2007.
2. R. K. Shukla &Anchal Srivastava. "Practical Physics," New Age International (P) Ltd, Publishers, New Delhi, 2006.

References

1. Indu Prakash and Ramakrishna, "A Text Book of Practical Physics," 11th Edition, KitabMahal, New Delhi, 2011.
2. C. Ouseph,K. Rangarajan, "A Text Book of Practical Physics", Volume I & II, S.Viswanathan Publishers,1997.

E-References

1. Amal Kumar Das, Department of Physics, IIT Kharagpur ,"Experimental Physics – II", National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/courses/115/105/115105120/
2. S. Srinivasan, Department of Electrical Engineering, IIT Madras, " Digital Circuits and Systems", National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/courses/117/106/117106086/

COs vs POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	3	3	3	3	1	2	1	1
CO 2	3	3	3	3	3	1	2	1	1
CO 3	3	3	3	3	3	1	3	1	1
CO 4	3	3	3	3	3	1	2	1	1
CO 5	3	3	3	3	3	1	3	1	1
TOTAL	**15**	**15**	**15**	**15**	**15**	**5**	**12**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**3**	**3**	**1**	**3**	**1**	**1**

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

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

Course Code			XMT203	3	1	0	4
C	P	A		L	T	SS	H
4	0	0		3	1	0	4
Prerequisite			Basic knowledge of Polynomials, logarithmic functions.				

On successful completion of this course, the students will be able to:			
Course Outcomes		**Domain**	**Level**
CO 1	**Utilize**Cayley Hamilton Theorem to find inverse and power of a given matrix	Cognitive	Applying
CO 2	**Utilize** Newton’s method to find the sum of the roots of a given polynomial equation	Cognitive	Applying
CO 3	**Apply** Descartes' rule of signs technique to find the maximum number of positive real zeros of a polynomial function	Cognitive	Applying
CO 4	**Utilize** the binomial theorem to expand polynomials and to identify terms for a given polynomial	Cognitive	Applying
CO 5	**Utilize** logarithmic functions to solve equations involving exponential functions	Cognitive	Applying
UNIT 1	**MATRICES**		**12**
Characteristic roots and characteristic vectors - Linear transformation – the characteristic equation of transformation – Cayley-Hamilton theorem – Diagonalisation of a matrix – orthogonal matrices.			
UNIT 2	**THEORY OF EQUATIONS**		**12**
Relation between roots and coefficients- symmetric functions of the roots in terms of the coefficients- imaginary roots and irrational roots- sum of the powers of the roots of an equation.			
UNIT 3	**TRANSFORMATION OF EQUATIONS**		**12**
Transformation of equations – Reciprocal equations- standard forms to increase and decrease the roots of a given equation by a given quantity- Removal of terms- Descartes’ rule of sign.			
UNIT 4	**BINOMIAL THEOREM**		**12**
Binomial theorem – positive integral index – the greatest coefficient in the expansion of $(1 + x)^n$ – Binomial theorem for a rational index – particular cases of the Binomial expansions – Numerically greatest terms – summation of a series			
UNIT 5	**EXPONENTIAL AND LOGARITHMIC SERIES**		**12**
Exponential limit – the exponential theorem – summation – Logarithmic series - modification of the logarithmic series – summation			

Lecture	**45**	**Tutorial**	**15**	**Practical**	**0**	**Total**	**60**
Text Books							

1. Engineering Mathematics, Vol.I. P.Kandasamy, K.Thilagavathi, K.Gunavathi, S.Chand& sons, second edition,1996 Unit – I: Matrices: Chapter 5 2. Algebra Volume I, T.K.M. Pillay, T. Natarajan and K.S.Ganapathy, S. Viswanathan (Printers & Publishers) Pvt. Ltd., 2015. Unit II : Chapter 6 (Sections 1 - 13) Unit III : Chapter 6 (Sections 15 – 19, 24) Unit IV : Chapter 3 (Sections 1, 5, 6, 8, 10) Unit V : Chapter 4 (Sections 1, 2, 3, 5, 6, 9)
References
1. S. Arumugam and A. ThangapandiIssac,Theory of equations and Trigonometry, New Gamma Publishing House, Palayamkottai, 2011. 2. A. Singaravelu, Engineering Maths Volume I, Meenakshi Agency 2019 Edition
E-References
1. https://explore course. Stanford. edu/search?q=MATH51[Stanford University] 2. https://courses.maths.ox.ac.uk/node/37616[Oxford University]

COs vs POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	3	3	2	3	1	1	1	1
CO 2	3	3	3	2	3	1	1	1	1
CO 3	3	3	3	2	3	1	1	1	1
CO 4	3	3	3	2	3	1	1	1	1
CO 5	3	3	3	2	3	1	1	1	1
TOTAL	**15**	**15**	**15**	**10**	**15**	**5**	**5**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**1**

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

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

<table>
<tr><td>Course Name</td><td colspan="3">Sequence and Series</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>Course Code</td><td colspan="3">XMT204</td><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td>C</td><td>P</td><td>A</td><td></td><td>L</td><td>T</td><td>SS</td><td>H</td></tr>
<tr><td>4</td><td>0</td><td>0</td><td></td><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td>Prerequisite</td><td colspan="7">Basic knowledge of numbers</td></tr>
<tr><td colspan="8">On successful completion of this course, the students will be able to:</td></tr>
<tr><td colspan="4">Course Outcomes</td><td colspan="2">Domain</td><td colspan="2">Level</td></tr>
<tr><td>CO 1</td><td colspan="3">Determine if an infinite sequence is bounded, monotonic or oscillating</td><td colspan="2">Cognitive</td><td colspan="2">Evaluating</td></tr>
<tr><td>CO 2</td><td colspan="3">Determine the series whether it is convergent or divergent by using the appropriate tests.</td><td colspan="2">Cognitive</td><td colspan="2">Understanding</td></tr>
<tr><td>CO 3</td><td colspan="3">Determine the series whether it is convergent or divergent by using the appropriate tests.</td><td colspan="2">Cognitive</td><td colspan="2">Evaluating</td></tr>
<tr><td>CO 4</td><td colspan="3">Identify the sequence of partial sum for a given infinite series</td><td colspan="2">Cognitive</td><td colspan="2">Applying</td></tr>
<tr><td>CO 5</td><td colspan="3">Demonstrate the concepts about the Weirstrass inequalities and Cauchy's inequality</td><td colspan="2">Cognitive</td><td colspan="2">Understanding</td></tr>
<tr><td>UNIT 1</td><td colspan="5"></td><td colspan="2">12</td></tr>
<tr><td colspan="8">Sets, Sequences – Aggregate: Upper and lower bounds – Bounded sequences - monotonic sequence always tends to a limit, finite or infinite.</td></tr>
<tr><td>UNIT 2</td><td colspan="5"></td><td colspan="2">12</td></tr>
<tr><td colspan="8">Some general theorems concerning infinite series – series of positive terms – comparison tests – Cauchy's condensation test – D-Alembert's ratio test - Definition of convergence, Divergence and Oscillation- Necessary condition for convergence- convergence of $\sum \frac{1}{n^p}$ and Geometric series.</td></tr>
<tr><td>UNIT 3</td><td colspan="5"></td><td colspan="2">12</td></tr>
<tr><td colspan="8">Cauchy's root test and their simple problems - Raabe's test – Absolutely convergent series - Alternative series with simple problems.</td></tr>
<tr><td>UNIT 4</td><td colspan="5"></td><td colspan="2">12</td></tr>
<tr><td colspan="8">Summation of series – Summation by different series – recurring series.</td></tr>
<tr><td>UNIT 5</td><td colspan="5"></td><td colspan="2">12</td></tr>
<tr><td colspan="8">Inequalities- Geometric and Arithmetic means- Weirstrass inequalities- Cauchy's inequality.</td></tr>
<tr><td>Lecture</td><td>45</td><td>Tutorial</td><td>15</td><td>Practical</td><td>0</td><td>Total</td><td>60</td></tr>
<tr><td colspan="8">Text Books</td></tr>
<tr><td colspan="8">1. Algebra Volume I, T.K.M. Pillay, T. Natarajan and K.S.Ganapathy, S. Viswanathan</td></tr>
</table>

(Printers & Publishers) Pvt. Ltd., 2015.

Unit I :Chapter 2 (Sec: 4 – 7), Pages: 20 - 40

Unit II :Chapter 2 (Sec: 8 – 16), Pages: 41 - 68

Unit III:Chapter 2 (Sec: 17 – 19, 21 – 24), Pages: 68 - 88

Unit IV:Chapter 5 (Sec: 1 – 7), Pages: 246 – 281

2. Algebra Volume II, T.K.M. Pillay, T. Natarajan and K.S.Ganapathy, S. Viswanathan (Printers & Publishers) Pvt. Ltd., 2015.

Unit V :Chapter 4 (Sec: 1 – 12), Pages: 179 - 212

Reference

1. Sequence and series: S. Arumugam and Isaac, New Gamma Publishing House – 2002 Edition

E-References

1. https://courses.maths.ox.ac.uk/node/43846[Oxford University]
2. https://explore course. Stanford. edu/search?q=MATH21[Stanford University]

COs vs POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	3	3	3	3	1	2	1	1
CO 2	3	3	2	1	3	1	0	1	1
CO 3	3	3	3	3	3	1	2	1	1
CO 4	3	3	3	2	3	1	1	1	1
CO 5	3	3	2	1	3	1	0	1	1
TOTAL	15	15	13	11	15	5	5	5	5
SCALED VALUE	3	3	3	3	3	1	1	1	1

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

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

Course Name			**Physics –II**	**L**	**T**	**P**	**C**
Course Code			**XPG205**	**3**	**1**	**0**	**4**
C	**P**	**A**		**L**	**T**	**SS**	**H**
2.8	**0.8**	**0.4**		**3**	**1**	**0**	**4**
Prerequisite			**Basic knowledge of Physics.**				

On successful completion of this course, the students will be able to:

Course Outcomes		**Domain**	**Level**
CO 1	**Recall** Ohms law, **learn** about resistors and capacitors and**apply** knowledge to calibrate low voltmeter using potentiometer.	Cognitive	Understand
CO 2	**Recall** Biot–Savart's law, **explain** current passing through straight conductor, coil and **distinguish** various properties of magnetic materials.	Cognitive	Remember, understand, analyze
CO 3	**Recall** basic of semiconductor **distinguish** different types of diodes and their applications.	Cognitive	Understand apply
CO 4	**Examine** the structure of number systems, **perform** the conversion among different number systems and **discuss** operation of all the gates.	Cognitive	Understand Apply
CO 5	**Illustrate** reduction of logical expressions **using** Boolean algebra and k-map.	Cognitive	Understand Apply

UNIT I	**ELECTRICITY**	**9+3**
Ohms law – Law of resistance in series in parallel – Specific resistance – Capacitors: capacitors in series and parallel – Kirchhoff's laws – Wheatstone's Bridge – Carey Foster's bridge – measurement of specific resistance - Potentiometer – Principle – Calibration of voltmeter. Electromagnetic induction: Laws of electromagnetic induction – self-induction - Mutual induction of coil.		
UNIT II	**MAGNETISM**	**9+3**
Biot–Savart's law – Ampere's circuital law – Magnetic properties of materials: magnetic intensity, magnetic induction, permeability, magnetic susceptibility – brief introduction of dia, para and ferro magnetic materials. – Magnetic field due to current carrying conductor – field along the axis of a coil.		
UNIT III	**SEMICONDUCTOR**	**9+3**
Properties of semiconductors – Types of semiconductors– PN junction diode –V I Characteristics– full wave and Bridge rectifiers – Zener diode– characteristics of Zener diode – Zener diode as voltage regulator– Photo Diode and Uses.		
UNIT IV	**NUMBER SYSTEM AND LOGIC GATES**	**9+3**

Number System: Decimal – Binary – Octal – Hexadecimal Number Systems – Binary Arithmetic Operations – Addition – Subtraction – Multiplication – Division – 1's Complement – 2's Complement Binary Operation.
Logic Gates: Basic Logic Gates AND, OR, NOT, NAND, NOR, XOR, X – NOR – Universal Building Blocks.

UNIT V	**BOOLEAN ALGEBRA AND KARNAUGH MAPS**	**9+3**

Basic law of Boolean algebra – Demorgan's theorems – Duality Theorem – Reducing Boolean expressions Using Boolean laws – Minterms – Maxterms – Sum of Products – Products of Sums. 3 Variable K – Map – 4 - Variable K – Map sum of product only –Simplification of K-Maps.

Lecture	**45**	**Tutorial**	**15**	**Practical**	**0**	**Total**	**60**

Text Books

1. R Murugeshan, "Modern Physics", 3rd Edition, S. Chand Publishing, New Delhi, 2004.
2. Electricity and Magnetism , R. Murugesan, Revised Edition , S. Chand & Co., New Delhi, Reprint (2014)
3. M. Morris Mano and Michael D. Ciletti, ―Digital Design‖, 5th Edition, Pearson, 2014.
4. Albert Paul Malvino; Donald P Leach; GoutamSaha, "Digital principles and applications", 8th Edition, McGraw Hill Education, New Delhi, 2015.

References

1. Thomas L. Floyd, ―Digital Fundamentals‖, 10th Edition, Pearson Education Inc, 2011.
2. Jacob Millman, Christos Halkias, "Analog and Digital Circuit and Systems", 2nd Edition, Tata McGraw–Hill Education, 2017.

E-References

1. Biswanath Banerjee and Amit Shaw, Department of Civil Engineering IIT Kharagpur, "THEORY OF ELASTICITY", National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/courses/105/105/105105177/
2. Prof. GoutamSaha, Department of Electronics & Communication Engineering IIT Kharagpur, "DIGITAL ELECTRONIC CIRCUITS", National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/courses/108/101/108101091/
3. Prof. S. Srinivasan Department of Electrical Engineering, IIT Madras, "Digital Circuits and Systems", National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/courses/117/106/117106086/

COs vs POs

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO 1	3	3	2	1	3	1	0	1	1
CO 2	3	3	3	3	3	1	2	1	1
CO 3	3	3	3	2	3	1	1	1	1
CO 4	3	3	3	2	3	1	1	1	1
CO 5	3	3	3	2	3	1	1	1	1
TOTAL	**15**	**15**	**14**	**10**	**15**	**5**	**5**	**5**	**5**

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

Course Name			**Physics Practical - II**	**L**	**T**	**P**	**C**
Course Code			**XPG206**	**0**	**0**	**4**	**2**
C	**P**	**A**		**L**	**T**	**P**	**H**
0.5	**1**	**0.5**		**0**	**0**	**4**	**4**
Prerequisite			**Basic knowledge of Physics.**				

On successful completion of this course, the students will be able to:

	Course Outcomes	**Domain**	**Level**
CO1	**Explain** specific resistance and **demonstrate** calibration of voltmeter using a potentiometer.	Psychomotor Affective	Analyze, Mechanism Respond
CO2	**Measure** different physical parameters with maximum accuracy.	Cognitive Psychomotor	Evaluate
CO3	**Recall** Magnetic laws, **explain** current passing through coil, solenoid	Psychomotor Affective	Analyze, Mechanism
CO4	**Construct** simple circuits using logic gates.	Cognitive Psychomotor	Synthesis
CO5	**Know** the conceptual difference between analog and digital circuits.	Cognitive Psychomotor	Comprehension

Ex. No	**Experiments (Any Eight Experiments)**	
1.	Potentiometer – low range voltmeter	CO1
2.	Carey Foster’s Bridge – Specific Resistance Determination	CO1
3.	Deflection Magnetometer – Tan A.	CO3
4.	Field along the axis of the coil	CO3
5.	P.O Box – Specific Resistance	CO1
6.	Logic gates (AND, OR, NOT) – using discrete components	CO5
7.	NAND & NOR as Universal Logic gates.	CO5
8.	Basic Logic gates IC’s verification.	CO2
9.	Verification of De Morgan’s theorem.	CO4
10.	Half adder & Half subtractor using basic gate.	CO4

Lecture	**0**	**Tutorial**	**0**	**Practical**	**30**	**Total**	**30**

Text Books
1. C. L. Arora,“B.Sc. Practical Physics”,S. Chand & Company Ltd. Ram Nagar, New Delhi, 2007. 2. R. K. Shukla &Anchal Srivastava. “Practical Physics,” New Age International (P) Ltd, Publishers, New Delhi, 2006.
References
1. Indu Prakash and Ramakrishna, “A Text Book of Practical Physics,” 11th Edition, KitabMahal, New Delhi, 2011. 2. C. Ouseph,K. Rangarajan, “A Text Book of Practical Physics”, Volume I & II, S.Viswanathan Publishers,1997.
E – References
1. Amal Kumar Das, Department of Physics, IIT Kharagpur ,“Experimental Physics – II”, National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/courses/115/105/115105120/ 2. S. Srinivasan, Department of Electrical Engineering, IIT Madras, “ Digital Circuits and Systems”, National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/courses/117/106/117106086/

COs vs POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	3	3	3	3	1	2	1	1
CO 2	3	3	3	3	3	1	3	1	1
CO 3	3	3	3	3	3	1	2	1	1
CO 4	3	3	3	3	3	1	3	1	1
CO 5	3	3	3	3	3	1	3	1	1
TOTAL	15	15	15	15	15	5	13	5	5
SCALED VALUE	3	3	3	3	3	1	3	1	1

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

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

Course Name	Quantitative Aptitude I	L	T	P	C
Course Code	**XMT207**	**2**	**0**	**0**	**2**

C	P	A		L	T	P	H
2	0	0		2	0	0	2

Prerequisite	Basic mathematical knowledge.

On successful completion of this course, the students will be able to:

Course Outcomes		Domain	Level
CO1	**Explain** the basic concepts of Numbers, H.C.F. &L.C.M of Numbers and to solve the problems	Cognitive	Understanding
CO2	**Explain** the basic concepts of Decimal Fractions, Simplification and to solve the problems	Cognitive	Understanding
CO3	**Explain** the basic concepts of Square Roots & Cube Roots, Average and to solve the problems	Cognitive	Understanding
CO4	**Explain** the basic concepts of Problems on Numbers, Problems on Ages and to solvethe problems	Cognitive	Understanding
CO5	**Explain** the basic concepts of Surds & Indices, Percentage and to solvethe Problems	Cognitive	Understanding

UNIT 1 — **6**

Numbers, H.C.F. &L.C.M of Numbers.

UNIT 2 — **6**

Decimal Fractions, Simplification

UNIT 3 — **6**

Square Roots & Cube Roots, Average.

UNIT 4 — **6**

Problems on Numbers, Problems on Ages.

UNIT 5 — **6**

Surds & Indices, Percentage.

Lecture	30	Tutorial	0	Practical	0	Total	30

Text Book

1. R.S. Aggarwal, Quantitative Aptitude for Competitive Examinations, S Chand; 20th edition (2013)

References

1. Banking awareness by SangramKeshari Rout and SoumyaRanjanBehera, B.K. Publications Pvt. Ltd.; Second edition (2014).

2. UGC-CSIR NET/SET by Dr. Pawan Sharma and Anshuman, Arihant Publication.

3. Fast Track Objective Arithmetic by Rajesh Verma, ArihantPublication, Edition 2012.
E-References
1. www.careerbless.com 2. www.jagranjosh.com 3. www.bestguru.com

COs vs POs

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO 1	3	3	2	1	3	1	0	1	1
CO 2	3	3	2	1	3	1	0	1	1
CO 3	3	3	2	1	3	1	0	1	1
CO 4	3	3	2	1	3	1	0	1	1
CO 5	3	3	2	1	3	1	0	1	1
TOTAL	**15**	**15**	**10**	**5**	**15**	**1**	**0**	**5**	**5**
SCALED VALUE	**3**	**3**	**2**	**1**	**3**	**1**	**0**	**1**	**1**

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

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

SEMESTER III

Course Name			Differential Equations and Laplace Transforms	L	T	P	C
Course Code			XMT301	3	1	0	4
C	P	A		L	T	P	H
4	0	0		3	2	0	5
Prerequisite			Knowledge of Ordinary and Partial Derivatives				

On successful completion of this course, the students will be able to:			
Course Outcomes		Domain	Level
CO1	**Identify** the solution of a given partial differential equation which is in the form of Clairaut's.	Cognitive	Applying
CO2	**Demonstrate** the methods for finding particular integral of the partial differential equation	Cognitive	Understanding
CO3	**Utilize** the concepts of variation of parameters for solving a given partial differential equations	Cognitive	Applying
CO4	**Solve** a given partial differential equation using Lagrange's Method	Cognitive	Applying
CO5	**Solve** second order differential equations using Laplace Transforms	Cognitive	Applying

UNIT 1	9+3
Formation of differential equation – equation of the first order and the first degree - exact differential equation – rules for finding integrating factors – Equation of first order, but of higher degree - Clairaut's form.	
UNIT 2	**9+3**
Linear differential equations with constant coefficients: Particular Integral – methods for finding P.I. - linear equations with variable coefficients.	
UNIT 3	**9+3**
Variation of parameters- Total differential equation Pdx+Qdy+Rdz=0– rules for integrating Pdx + Qdy + Rdz = 0	
UNIT 4	**9+3**
Partial Differential Equation- Four standard types- Lagrange's method for solving Pq + Qq = R	
UNIT 5	**9+3**
Laplace transform – Laplace transform of periodic functions – Some general theorems - Inverse transforms	

- Solving second order differential equations using Laplace transform - problems

Lecture	45	Tutorial	15	Practical	0	Total	60

Text Book

1.Calculus, volume III,S. Narayanan, T.K.M. Pillai, S. Viswanathan Pvt. Ltd., 2014.

Unit I : Chapter 1 (sec: 1 – 6), Pages: 1 – 38

Unit II : Chapter 2 (sec: 1 – 4, 8), Pages: 49 – 75, 81–89

Unit III: Chapter 2 (sec: 10), Chapter3(sec:7), Pages:91-95,108-114

Unit IV: Chapter 4 (sec: 1 – 6), Pages: 115 – 145

Unit V : Chapter 5 (sec: 1 – 8), Pages: 154 – 189

References

1. Engineering Mathematics- A. Singaravelu, Meenakshi Agency, 2022.
2. Ordinary and Partial Differential Equations- M.D. Raisinghania and R.S. Aggarwal. S.Chand& Company Ltd, New Delhi, 2022.

COs vs POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	3	3	2	3	1	1	1	1
CO 2	3	3	2	1	3	1	0	1	1
CO 3	3	3	3	2	3	1	1	1	1
CO 4	3	3	3	2	3	1	1	1	1
CO 5	3	3	3	2	3	1	1	1	1
TOTAL	15	15	14	9	15	5	4	5	5
SCALED VALUE	3	3	3	2	3	1	1	1	1

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

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

Course Name			Vector Calculus, Fourier Series and Fourier Transforms	L	T	P	C
Course Code			**XMT302**	**3**	**1**	**0**	**4**
C	**P**	**A**		**L**	**T**	**P**	**H**
4	**0**	**0**		**3**	**2**	**0**	**5**
Prerequisite			Knowledge In Differentiation, Integration				

On successful completion of this course, the students will be able to:			
Course Outcomes		**Domain**	**Level**
CO1	**Identify**	Cognitive	Applying
CO2	**Identify**	Cognitive	Applying
CO3	**Identify**	Cognitive	Applying
CO4	**Identity**	Cognitive	Applying
CO5	**Identify**	Cognitive	Applying
UNIT 1	**VECTOR DIFFERENTIATION**		**9+3**
Differentiation of vectors – Gradient, Divergence and Curl.			
UNIT 2	**VECTOR INTEGRATION**		**9+3**
Integration as inverse of differentiation – The line integral – Surface integral – Gauss's Divergence theorem, Green's theorem, Stoke's theorem (Without Proof).			
UNIT 3	**FOURIER SERIES**		**9+3**
Periodic functions – Fourier series – Dirichlet's Conditions – Even and odd functions- Half range sine series – Half range cosine series.			
UNIT 4	**FOURIER SERIES**		**9+3**
Change of interval – Parseval's Theorem, Harmonic Analysis.			
UNIT 5	**FOURIER TRANSFORMS**		**9+3**
Definition – Integral Transforms – Properties of Fourier Transforms – Parseval's identity – Infinite Fourier cosine and sine transform.			

Lecture	45	Tutorial	15	Practical	0	Total	60
Text Book							
1. P. Kandasamyand K. Thilagavathy, Mathematics Volume IV: Vector Calculus, Fourier series and Fourier							

Transforms,S. Chand&CompanyLtd,New Delhi, 2004.

Unit I : Vector Calculus: Pages 1 – 23.
Unit II : Vector Calculus: Pages 24 - 50
Unit III: Fourier series: Pages 93 - 144
Unit IV: Fourier series: Pages 145 – 174, 176 – 182
Unit V : Fourier Transforms: Pages 196 - 226

References

1. Vector Algebra and Analysis- T.K.M. Pillai, Anand Book Depot. 2009.
2. Calculus Volume III- T.K.M. Pillai, Anand Book Depot, 1991.
3.Engineering Mathematics- A. Singaravelu, Meenakshi Agency,2022.

E-References

1. https://courses.maths.ox.ac.uk/node/43944[Oxford University]
2. https://courses.maths.ox.ac.uk/node/43955 [Oxford University]
3. https://www.maths.cam.ac.uk/undergrad/files/coursesIA.pdf [Cambridge]

COs vs POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	3	3	2	3	1	1	1	1
CO 2	3	3	3	2	3	1	1	1	1
CO 3	3	3	3	2	3	1	1	1	1
CO 4	3	3	3	2	3	1	1	1	1
CO 5	3	3	3	2	3	1	1	1	1
TOTAL	15	15	15	10	15	5	5	5	5
SCALED VALUE	3	3	3	2	3	1	1	1	1

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

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

Course Name			Mathematical Statistics- I	L	T	P	C
Course Code			XMT303	3	1	0	4
C	P	A		L	T	P	H
4	0	0		3	2	0	5
Prerequisite			Basic knowledge of statistics.				

On successful completion of this course, the students will be able to:

	Course Outcomes	Domain	Level
CO1	**Explain** the concepts of discrete and continuous random variable	Cognitive	Understanding
CO2	**Explain** the concepts of two-dimensional random variable	Cognitive	Understanding
CO3	**Utilize** moment generating function for finding expectation and variance of a given random variable	Cognitive	Applying
CO4	**Explain** the concepts of Normal distributions, Gamma distribution and Exponential distribution	Cognitive	Understanding
CO5	**Identify** correlation coefficient of the given random variables by way of regression analysis	Cognitive	Applying

UNIT 1 **9+3**

Random variables- distribution function- discrete random variable – probability mass function - discrete distribution function - continuous random variable- probability density function – continuous distribution function.

UNIT 2 **9+3**

Two-dimensional random variable: joint probability mass function – continuous probability function - Marginal Distribution Function – Stochastic independence -Mathematical Expectations - Properties of expectation – Properties of variance – simple problems only.

UNIT 3 **9+3**

M.G.F – Cumulants - Characteristic Functions - Binomial, Poisson distributions – Moments, mode and MGF only.

UNIT 4 **9+3**

Normaldistribution- Gammadistribution- Beta distribution (without problems) - Exponential distribution.

UNIT 5 **9+3**

Correlation: Karl Pearson coefficient of correlation–Rank correlation – Regression: Linear regression – Regression coefficient – properties of regression coefficients – related problems.

Lecture	45	Tutorial	15	Practical	0	Total	60

Text Book

1. “Fundamentals of Mathematical Statistics”, S.C. Gupta, V.K. Kapoor, Sultan Chand & Sons, 2014 (11th revised edition)

Unit I : Chapter 5 (Sec. 5.1 - 5.4)
Unit II : Chapter 5 (Sec. 5.5- 5.5.6)
Chapter 6 (Sec. 6.1 - 6.5)
Unit III: Chapter 7 (Sec.7.1-7.3.1)
Chapter8(Sec.8.4, 8.4.1, 8.4.2, 8.4.5, 8.4.6, 8.5, 8.5.2 - 8.5.5)
Unit IV: Chapter 9 (Sec.9.2, 9.2.1-9.2.3, 9.2.5, 9.2.11, 9.3, 9.5, 9.8)
Unit V : Chapter 10 (Sec.10.2-10.4& 10.7)
Chapter 11 (Sec.11.1-11.2.2)

Reference

1. Dr. P.R. Vittal “Mathematical Statistics” Margham Publications Chennai, 2009.

E-References

1. https://science.korea.edu/science_en/undergraduate/under_math3.do
   [Korea University college of science]
2. http://www.bath.ac.uk/catalogues/2019-2020/ma/MA10211.html
   [University of Bath, United Kingdom

COs vs POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	3	2	1	3	1	0	1	1
CO 2	3	3	2	1	3	1	0	1	1
CO 3	3	3	3	2	3	1	1	1	1
CO 4	3	3	2	1	3	1	0	1	1
CO 5	3	3	3	2	3	1	1	1	1
TOTAL	**15**	**15**	**12**	**7**	**15**	**5**	**2**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**1**

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

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

Course Name			Mathematical Statistics Practical - I	L	T	P	C
Course Code			XMT304	0	0	4	2
C	P	A		L	T	P	H
2	0	0		0	0	4	2
Prerequisite							

On successful completion of this course, the students will be able to:

	Course Outcomes	Domain	Level
CO1	**Apply** the concept of discrete and continuous random variables to solve the problems	Cognitive	Applying
CO2	**Utilizing** the concepts of two-dimensional random variables to find the marginal and conditional distribution of both discrete and continuous random variables	Cognitive	Applying
CO3	**Find** the mean, variance and mgf of binomial and Poisson distribution	Cognitive	Understanding
CO4	**Apply** the concept of given distribution to find the area of the given problems	Cognitive	Applying
CO5	**Apply** the concept of correlation and regression to solve the given problem	Cognitive	Applying

UNIT 1 **6**

Random variables- Discrete distribution function - continuous random variable- Probability density function – Continuous distribution function.

UNIT 2 **6**

Two-dimensional random variable: joint probability mass function – continuous probability function - Marginal Distribution Function -Mathematical Expectations - Properties of expectation – Properties of variance – simple problems only

UNIT 3 **6**

M.G.F – Cumulants - Characteristic Functions - Binomial, Poisson distributions – Moments, mode and MGF only

UNIT 4 **6**

Normaldistribution- Gammadistribution- Beta distribution - Exponential distribution

UNIT 5 **6**

Correlation: Karl Pearson coefficient of correlation–Rank correlation – Regression: Linear regression – Regression coefficient.

Lecture	0	Tutorial	0	Practical	30	Total	30

Text Book
1. S.C. Gupta, V.K. Kapoor, Elements of Mathematical Statistics, Sultan Chand & Sons, Educational Publishers, New Delhi, 3rd Edition, Reprint 2008.
Reference
1. Dr. P.R. Vittal "Mathematical Statistics" Margham Publications Chennai, 2009.
E-References
1. https://science.korea.edu/science_en/undergraduate/under_math3.do[Korea University college of science] **2.** http://www.bath.ac.uk/catalogues/2019-2020/ma/MA10211.html[University of Bath, United Kingdom

COs vs POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	3	3	2	3	1	1	1	1
CO 2	3	3	3	2	3	1	1	1	1
CO 3	3	3	2	1	3	1	0	1	1
CO 4	3	3	3	2	3	1	1	1	1
CO 5	3	3	3	2	3	1	1	1	1
TOTAL	**15**	**15**	**11**	**9**	**15**	**5**	**4**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**1**

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

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

Course Name			**Quantitative Aptitude - II**	**L**	**T**	**P**	**C**
Course Code			**XMT305**	**2**	**0**	**0**	**2**
C	**P**	**A**		**L**	**T**	**P**	**H**
2	**0**	**0**		**2**	**0**	**0**	**2**
Prerequisite			Basic higher secondary level mathematical knowledge.				

On successful completion of this course, the students will be able to:			
	Course Outcomes	**Domain**	**Level**
CO1	**Apply**the basic concepts of profit and loss, ratio &proportionto solve the problems	Cognitive	Applying
CO2	**Apply** the basic concepts of partnership, chain rule to solve the problems	Cognitive	Applying
CO3	**Explain** the basic concepts of time & work, pipes &cisternsto solve the problems	Cognitive	Applying
CO4	**Explain** the basic concepts of time & distance and problems on trains to solve the problems	Cognitive	Applying
CO5	**Explain** the basic concepts of boats and streams and allegation or mixture to solve the problems	Cognitive	Applying
UNIT 1			**6**
Profit & Loss, Ratio & Proportion.			
UNIT 2			**6**
Partnership, Chain Rule.			
UNIT 3			**6**
Time & work, Pipes& Cisterns			
UNIT 4			**6**
Times & Distance, Problems on Trains.			
UNIT 5			**6**
Boats & Streams, Alligation or Mixture.			

Lecture	**30**	**Tutorial**	**0**	**Practical**	**0**	**Total**	**30**

Text Book

1. R.S. Aggarwal, Quantitative Aptitude for Competitive Examinations, S Chand; 20th edition (2013)

References

1. Banking awareness by Sangram Keshari Rout and Soumya Ranjan Behera, B.K. Publications Pvt. Ltd.; Second edition (2014).
2. UGC-CSIR NET/SET by Dr. Pawan Sharma and Anshuman, Arihant Publication.
3. Fast Track Objective Arithmetic by Rajesh Verma, Arihant Publication, Edition 2012.

E-References

1. www.careerbless.com
2. www.jagranjosh.com
3. www.bestguru.com

COs vs POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	3	3	2	3	1	1	1	1
CO 2	3	3	3	2	3	1	1	1	1
CO 3	3	3	3	2	3	1	1	1	1
CO 4	3	3	3	2	3	1	1	1	1
CO 5	3	3	3	2	3	1	1	1	1
TOTAL	**15**	**15**	**15**	**10**	**15**	**5**	**5**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**1**

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

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

Course Name			DISASTERMANAGEMENT	L	T	P	C
Course Code			**XUM003**	**1**	**0**	**0**	**1**
C	**P**	**A**		**L**	**T**	**SS**	**H**
1	**0**	**0**		**1**	**0**	**1**	**2**
Prerequisite			Basic knowledge about environment.				

On successful completion of this course, the students will be able to:

	Course Outcomes	Domain	Level
CO1	**Understandin**gtheconceptsofapplicationoftypes Ofdisasterpreparedness	Cognitive	Apply
CO2	**Infer**theendconditions&**Discuss**thefailuresduetodisaster.	Cognitive	Analyze
CO3	**Understanding**of importance of seismic waves occurring globally	Cognitive	Analyze
CO4	**Estimate**Disasterandmitigationproblems.	Cognitive	Apply
CO5	Keen**knowledge**onessentialsofriskreduction	Cognitive	Apply

UNIT 1	**INTRODUCTION**	**3**
Introduction–Disasterpreparedness–GoalsandobjectivesofISDRProgramme-Risk identification – Risk sharing – Disaster and development: Development plans and disastermanagement–Alternative to dominant approach – disaster – development linkages – Principleofrisk partnership.		
UNIT 2	**APPLICATIONOFTECHNOLOGY INDISASTERRISK REDUCTION**	**3**
Applicationofvarioustechnologies:Databases–RDBMS–ManagementInformationSystems-Decision support system and other systems – Geographic information systems – Intranets andextranets–videoteleconferencing.Triggermechanism–Remotesensing-aninsight–contributionof remotesensing and GIS-Casestudy.		
UNIT 3	**AWARENESSOF RISKREDUCTION**	**3**
Triggermechanism–constitutionoftriggermechanism–riskreductionbyeducation–disaster Informationnetwork–risk reduction bypublicawareness.		
UNIT 4	**DEVELOPMENTPLANNING ONDISASTER**	**3**
Implicationofdevelopmentplanning–Financialarrangements–Areasofimprovement–DisasterPreparedness-Communitybased disastermanagement–Emergencyresponse.		
UNIT 5	**SEISMICITY**	**3**
Seismicwaves–Earthquakesandfaults– measuresofanearthquake,magnitudeandintensity–grounddamage– Tsunamisand earthquakes.		

Lecture	15	Tutorial	-	Practical	-	Total	15

Text Book

1. SiddharthaGautamandKLeelakrishaRao,"DisasterManagementProgrammesand Policies",VistaInternationalPubHouse,2012
2. ArunKumar,"GlobalDisasterManagement",SBSPublishers,2008

References

1. " EncyclopaediaOfDisaster Management",NehaPublishers&Distributors, 2008
2. PardeepSahni,Madhavimalalgodaandariyabandu,"DisasterriskreductioninSouthAsia",PHI,2002
3. Amitasinvhal,"Understandingearthquakedisasters"TMH,2010.
4. PardeepSahni,AlkaDhamejaandUmamedury,"Disastermitigation:Experiencesandreflections",PHI, 2000

E-References

http://icom.museum/disaster_preparedness_book/copyright.pdf
http://www.international.icomos.org/centre_documentation/bib/riskpreparedness.pdf

COs vs POs

	PO 1	PO 2	PO3	PO4	PO 5	PO6	PO7	PO8	PO9
CO 1	3	3	3	2	3	1	1	1	1
CO 2	3	3	3	3	3	1	2	1	1
CO 3	3	3	3	3	3	1	2	1	1
CO 4	3	3	3	2	3	1	1	1	1
CO 5	3	3	3	2	3	1	1	1	1
TOTAL	**15**	**15**	**15**	**12**	**15**	**5**	**7**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**3**	**3**	**1**	**2**	**1**	**1**

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

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

SEMESTER IV

Course Name			Abstract Algebra	L	T	P	C
Course Code			XMT401	3	1	0	4
C	P	A		L	T	P	H
4	0	0		3	2	0	5
Prerequisite			Higher Secondary level Mathematics				
On successful completion of this course, the students will be able to:							

	Course Outcomes	Domain	Level
CO1	**Construct** Cayley table for the given permutation groups	Cognitive	Applying
CO2	**Identify** the left and right coset of the given symmetric group	Cognitive	Applying
CO3	**Explain** normal subgroups and quotient groups	Cognitive	Understanding
CO4	**Explain** the concepts of ring and its properties	Cognitive	Understanding
CO5	**Explain** Integral domain and Euclidean domain	Cognitive	Understanding

UNIT 1		**9+3**
Groups: Definition and Examples – Elementary Properties of a Group – Equivalent definitions of a Group – Permutation Groups.		
UNIT 2		**9+3**
Subgroups – Cyclic Groups – Order of an Element – Cosets and Lagrange’s Theorem.		
UNIT 3		**9+3**
Normal Subgroups and Quotient Groups – Isomorphism – Homomorphism.		
UNIT 4		**9+3**
Rings: Definitions and Examples – Elementary properties of rings – Isomorphism – Types of rings – Characteristic of a ring – Subrings – Ideals – Quotient rings.		
UNIT 5		**9+3**
Maximal and Prime Ideals – Homomorphism of rings – Field of quotients of an Integral domain – Unique factorization domain – Euclidean domain.		

Lecture	45	Tutorial	15	Practical	0	Total	60
Text Book							
1. S. Arumugam and A. ThangapandiIssac, Modern Algebra, SciTech Publications Pvt. Ltd., Chennai, 2003.							

Unit I -Chapter 3 - Sections 3.1 to 3.4 Unit II -Chapter 3 - Sections 3.5 to 3.8 Unit III-Chapter 3 - Sections 3.9 to 3.11 Unit IV -Chapter 4-Sections 4.1 to 4.8 Unit V -Chapter 4 - Sections 4.9 to 4.11, 4.13 & 4.14
References
1. N. Herstein, Topics in Algebra, John Wiley & Sons, Student 2nd edition, 1975. 2. Vijay, K. Khanna and S.K. Bhambri, A course in Abstract Algebra, Vikas Publishing House Pvt. Ltd, 2017. 3. Dr. R. Balakrishnan and N. Ramabadran, A text book of Modern Algebra, Vikas Publishing House Pvt. Ltd, New Delhi, 1994.
E-References
1. https://courses.maths.ox.ac.uk/node/43944[Oxford University] 2. https://courses.maths.ox.ac.uk/node/43955 [Oxford University]

COs vs POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	3	3	2	3	1	1	1	1
CO 2	3	3	3	2	3	1	1	1	1
CO 3	3	3	2	1	3	1	0	1	1
CO 4	3	3	2	1	3	1	0	1	1
CO 5	3	3	2	1	3	1	0	1	1
TOTAL	15	15	12	7	15	5	2	5	5
SCALED VALUE	3	3	3	2	3	1	1	1	1

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

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

Course Name			Mechanics	L	T	P	C
Course Code			XMT402	3	1	0	4
C	P	A		L	T	P	H
4	0	0		3	2	0	5
Prerequisite			Basic Physics knowledge				

On successful completion of this course, the students will be able to:

	Course Outcomes	Domain	Level
CO1	**Explain** about forces, velocity, acceleration, moments, couples, friction etc., in trigonometrically and geometrically	Cognitive	Understanding
CO2	**Explain** Newton's laws of motion and equilibrium of forces acting on a rigid body	Cognitive	Understanding
CO3	**Apply** geometrical concepts in parallel forces, moments, and couples in physics problems	Cognitive	Applying
CO4	**Analyze** for Newton's laws of motion and projectiles	Cognitive	Analyzing
CO5	**Analyze** the equation of central orbits	Cognitive	Analyzing

UNIT 1 **12**

Basic concepts and principles –Forces acting at a point-Lami's theorem and applications-Parallel forces –Like and unlike parallel forces-Moment ofaforce– Couples– Related problems.

UNIT 2 **12**

Equilibrium of three forces acting on a rigid body-Friction- Laws of friction-Angle of friction-Cone of friction- Properties and related problems.

UNIT 3 **12**

Motion in a straight line under uniform acceleration - Newton's laws of motion. Projectiles: Definition-Path of projectile-Range on an inclined plane- Properties and problems.

UNIT 4 **12**

Impulse and Impact: Collision of elastic Bodies–Direct and oblique impact–Loss of Kinetic Energy–Related Properties and Simple Problems.

UNIT 5 **12**

Central Orbits: Motion under the action of central Forces - Properties and related Problems – Differential equation of central orbit- Pedal equation of central orbit-Velocities in a central orbit-Law of forces- Properties and related Problems

Lecture	45	Tutorial	15	Practical	0	Total	60

Text Books

1. M.K.Venkataraman,"Statics",AgasthiarPublications,Trichy,2004.
   Unit1: Chapters2,3,4
   Unit2:Chapters 5,7
2. M.K.Venkataraman,"Dynamics",AgasthiarPublications,Trichy,2004.

Unit3:Chapters3: section3.22,Chapter4:Section4.3,Chapter6
Unit4:Chapter 8
Unit5:Chapter11

References

1. T.K.ManickavasagamPillai,“Statics”,S.Viswanathan&Co.,Chennai,1980.
2. S.Narayanan,“Dynamics”,S.Chand&Co.,NewDelhi,1980.

E-References

http://nptel.ac.in

COs vs POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	3	2	1	3	1	0	1	1
CO 2	3	3	2	1	3	1	0	1	1
CO 3	3	3	3	2	3	1	1	1	1
CO 4	3	3	3	3	3	1	2	1	1
CO 5	3	3	3	3	3	1	2	1	1
TOTAL	**15**	**15**	**13**	**10**	**15**	**5**	**5**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**1**

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

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

Course Name			Mathematical Statistics - II	L	T	P	C
Course Code			XMT403	3	1	0	4
C	P	A		L	T	P	H
4	0	0		3	2	0	5
Prerequisite			Basic knowledge of random variables and distributions.				

On successful completion of this course, the students will be able to:

Course Outcomes		Domain	Level
CO1	**Explain** the test of significance for large sampling	Cognitive	Understandin g
CO2	**Explain** the chi square distribution	Cognitive	Understandin g
CO3	**Explain** the Student's t-distribution	Cognitive	Understandin g
CO4	**Explain** the F distribution	Cognitive	Understandin g
CO5	**Classify** the various types of analysis of variance	Cognitive	Understandin g

UNIT 1	**Large sampling theory**	**12**
Types of sampling- test of significance- null hypothesis- error in sampling- critical regions and level of significance- test of significance for large- samples- sampling of attributes.		
UNIT 2	χ^2 **Distribution**	**12**
χ^2 - variates- derivation of the χ^2 distribution (Method of M.G.F only)- M.G.F, C.G.F- mode and skewness - additive property - χ^2 probability curve - Theorems on χ^2 distribution - Application of χ^2 - distribution: Inference about a population variance – goodness of fit test.		
UNIT 3	**Student's t-distribution**	**12**
Derivation of t-distribution - constants of t-distribution- limiting of t-distribution- application of t-distribution - test of single mean, difference of mean.		
UNIT 4	**F- distribution**	**12**
Derivation of F-distribution- constant of F-distribution- mode of F-distribution- application of F-distribution - test for equality of two population variance (only simple problems of F-distribution). – Relation between t and F and relation between F and χ^2 tests.		
UNIT 5	**Analysis of Variance**	**12**
Introduction - one-way, two-way classifications – Experimental designs: Randomized block		

design - Latin squares.

Lecture	45	Tutorial	15	Practical	0	Total	60

Text Books

1. Fundamentals of mathematical statistics, S.C Gupta, V. K. Kapoor (11^{th} edition) - Sultan Chand & Sons 2002.
   Unit I : Chapter: 14 (Sec. 14.1 – 14.7.2)
   Unit II : Chapter: 15 (Sec. 15.1- 15.4, 15.6(15.6.1-15.6.2))
   Unit III :Chapter: 16 (16.2, 16.3(16.3.1, 16.3.2))
   Unit IV :Chapter: 16(16.5- 16.8)
2. 'Statistical Methods' Vol. II, Dr. S.P. Gupta, Sultan Chand & Sons 2008.
   Unit V:Chapter: 5, 6

Reference

1. Dr. P.R. Vittal "Mathematical Statistics" Margham Publications Chennai,2009.

E-References

1.https://acadinfo.wustl.edu/CourseListings/CourseInfo.aspx?sem=FL2020&sch=L&dept=L24&crs=494[Washington University]
2.https://www.maths.cam.ac.uk/undergrad/files/coursesIB.pdf [Cambridge]

COs vs POs

	PO 1	PO 2	PO3	PO4	PO 5	PO6	PO7	PO8	PO9
CO 1	3	3	2	1	3	1	0	1	1
CO 2	3	3	2	1	3	1	0	1	1
CO 3	3	3	2	1	3	1	0	1	1
CO 4	3	3	2	1	3	1	0	1	1
CO 5	3	3	2	1	3	1	0	1	1
TOTAL	**15**	**15**	**10**	**5**	**15**	**5**	**0**	**5**	**5**
SCALED VALUE	**3**	**3**	**2**	**1**	**3**	**1**	**0**	**1**	**1**

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

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

Course Name			Mathematical Statistics Practical - II	L	T	P	C
Course Code			XMT404	0	0	4	2
C	P	A		L	T	P	H
2	0	0		0	0	4	2
Prerequisite			Basic knowledge of random variables and distributions.				

On successful completion of this course, the students will be able to:

	Course Outcomes	Domain	Level
CO1	**Explain** the concept of large samples and solve the related problems	Cognitive	Applying
CO2	**Solve** the problems by using χ^2 Distribution	Cognitive	Applying
CO3	**Solve** the problems by usingt- test of single mean, difference of mean.	Cognitive	Applying
CO4	**Apply** the concept of F-distribution to solve simple problems	Cognitive	Applying
CO5	**Explain** the concept ofanalysis of variance to solve the problems by using methods such as one-way, two-way classifications, randomized block design and Latin squares	Cognitive	Applying

UNIT 1	**Large sampling theory**	**6**
Types of sampling- test of significance- null hypothesis- error in sampling- Critical regions and level of significance- test of significance for large sample.		
UNIT 2	**χ^2 Distribution**	**6**
χ^2 Distribution- Theorems on χ^2 distribution - Application of χ^2 - distribution: Inference about a population variance – goodness of fit test.		
UNIT 3	**Student's t-distribution**	**6**
Definition of t-distribution- application of t-distribution - test of single mean, difference of mean.		
UNIT 4	**F-distribution**	**6**
Definition of F-distribution- application of F-distribution - test for equality of two population variance (only simple problems of F- distribution).		
UNIT 5	**Analysis of variance**	**6**
Introduction - one-way, two-way classifications – Experimental designs: Randomized block design - Latin squares.		

Lecture	0	Tutorial	0	Practical	30	Total	30
Text Books							

1. Fundamentals of mathematical statistics, S.C Gupta, V. K. Kapoor (11th edition) - Sultan Chand & Sons2002.
   Unit I:Chapter: 14 (Sec. 14.1 – 14.7.2)
   Unit II:Chapter: 15 (Sec. 15.1- 15.4, 15.6(15.6.1-15.6.2))
   Unit III:Chapter: 16 (16.2, 16.3(16.3.1, 16.3.2))
   Unit IV:Chapter: 16(16.5- 16.8)
2. ‘Statistical Methods’ Vol. II, Dr. S.P. Gupta, Sultan Chand & Sons 2008.
   Unit V: Chapter: 5, 6

Reference

1. Dr. P.R. Vittal “Mathematical Statistics” Margham Publications Chennai, 2009.

E-References

1. https://acadinfo.wustl.edu/CourseListings/CourseInfo.aspx?sem=FL2020&sch=L&dept=L24&crs=494[Washington University]
2. https://www.maths.cam.ac.uk/undergrad/files/coursesIB.pdf [Cambridge]

COs vs POs

	PO 1	PO 2	PO3	PO4	PO 5	PO6	PO7	PO8	PO9
CO 1	3	3	3	2	3	1	1	1	1
CO 2	3	3	3	2	3	1	1	1	1
CO 3	3	3	3	2	3	1	1	1	1
CO 4	3	3	3	2	3	1	1	1	1
CO 5	3	3	3	2	3	1	1	1	1
TOTAL	**15**	**15**	**15**	**10**	**15**	**5**	**5**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**1**

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

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

Course Name			Quantitative Aptitude - III	L	T	P	C
COURSE CODE			XMT405	2	0	0	2
C	P	A		L	T	P	H
2	0	0		2	0	0	2
Prerequisite			Basic mathematical knowledge.				

On successful completion of this course, the students will be able to:

	Course Outcomes	Domain	Level
CO1	**Find** simple interest and compound interest of the given problems	Cognitive	Remembering
CO2	**Find** the area of the bounded region	Cognitive	Remembering
CO3	**Find**the volume and surface area of the given region	Cognitive	Remembering
CO4	**Find**the angle between the hour hand and minute hand of the clock	Cognitive	Remembering
CO5	**Find**the permutations and combinations of the given problems	Cognitive	Remembering

UNIT 1		**6**

Simple Interest, Compound Interest.

UNIT 2		**6**

Logarithms, Area.

UNIT 3		**6**

Volume & Surface Areas, Races & Games of Skill.

UNIT 4		**6**

Calendar, Clocks.

UNIT 5		**6**

Stocks & Shares, Permutations & Combinations.

Lecture	30	Tutorial	15	Practical	0	Total	30

Text Book

1. R.S. Aggarwal, Quantitative Aptitude for Competitive Examinations, S Chand; 20th edition (2013)

References

1. Banking awareness by Sangram Keshari Rout and Soumya Ranjan Behera, B.K. Publications Pvt. Ltd.; Second edition (2014).
2. UGC-CSIR NET/SET by Dr. Pawan Sharma and Anshuman, Arihant Publication.
3. Fast Track Objective Arithmetic by Rajesh Verma, Arihant Publication, Edition 2012.

E-References

1. www.careerbless.com
2. www.jagranjosh.com
3. www.bestguru.com

COs vs POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	2	1	0	3	1	0	1	1
CO 2	3	2	1	0	3	1	0	1	1
CO 3	3	2	1	0	3	1	0	1	1
CO 4	3	2	1	0	3	1	0	1	1
CO 5	3	2	1	0	3	1	0	1	1
TOTAL	**15**	**10**	**5**	**0**	**15**	**5**	**0**	**5**	**5**
SCALED VALUE	**3**	**2**	**1**	**0**	**3**	**1**	**0**	**1**	**1**

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

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

Course Name		**Entrepreneurship Development**	**L**	**T**	**P**	**C**
Course Code		**XUM004**	**1**	**0**	**0**	**1**
C	**P**	**A**	**L**	**T**	**SS**	**H**
2	**0**	**0**	**1**	**0**	**1**	**2**

Prerequisite	Basic skills like critical thinking, creativity, risk-taking, problem-solving, networking, leadership.

On successful completion of this course, the students will be able to:

	Course Outcomes	**Domain**	**Level**
CO1	**Understand** the concept of Entrepreneurship	Cognitive	Understanding
CO2	**Understand** about an Entrepreneur	Cognitive	Understanding
CO3	**Understand** the characteristics of Entrepreneur	Cognitive	Understanding
CO4	**Understand** the ways to acquire skills of Entrepreneur	Cognitive	Understanding
CO5	**Understand**the concept of Intrepreneurship	Cognitive	Understanding

UNIT 1	**INTRODUCTION TO ENTREPRENEURSHIP**	**3 + 3**

Meaning and Concept of Entrepreneurship, History of Entrepreneurship Development, Role of Entrepreneurship in Economic Development, Myths about Entrepreneurs, Agencies in Entrepreneurship Management and Future of Entrepreneurship.

UNIT 2	**THE ENTREPRENEUR**	**3 + 3**

Gender Discrimination in society and in family, Gender equity, equality, and empowerment. Social and Economic Status of Women in India in Education, Health, Employment, Definition of HDI, GDI and GEM. Contributions of Dr.B.R. Ambethkar, ThanthaiPeriyar and Phule to Women Empowerment.

UNIT 3	**CHARACTERISTICS OF AN ENTREPRENEUR**	**3 + 3**

Introduction - Characteristic Features of Successful Indian Entrepreneurs - Differences between an Entrepreneur and a Manager - Difference between an Entrepreneur and an Intrapreneur - Relationship between the terms Entrepreneur, Entrepreneurial and Entrepreneurship - Difference between a Scientist, Inventor and Entrepreneur - Relationship between Entrepreneur and Enterprise - Difference between Entrepreneur and Enterprise - Difference between a Self-employed person and Entrepreneur - Common Myths on Entrepreneur.

UNIT 4	**SKILLS FOR AN ENTREPRENEUR**	**3 + 3**

Business Management Skills - Communication and active listening skills - Risk-taking skills – Networking Skills – Critical Thinking Skills – Problem Solving Skills – Creative Thinking Skills – Customer Service Skills – Financial Skills – Leadership Skills – Time Management and Organizational Skills – Technical Skills.					
UNIT 5	**INTRAPRENEURSHIP**				**3 + 3**
What is Intrapreneurship? – Understanding Intrapreneurship – Types of Intrapreneurs – Characteristics of Intrapreneurs – Examples of Intrapreneurship.					
Lecture	**15**	**Self - Study**	**15**	**Total**	**30**
Text Book					
1. Jayashree Suresh, Entrepreneurial Development, Margham Publications.					
References					
1.Essentials of Entrepreneurship and Small Business Management (6th Edition) by Norman M. Scarborough (Paperback - Jan 13, 2010) 2. Entrepreneurship and Small Business Management, Student Edition by Glencoe McGraw-Hill (Hardcover - Feb 24, 2005) 3. Vasant Desai, Dynamics of Entrepreneurship Development, Star Publication, New Delhi.					
E-References					
1. https://in.indeed.com/career-advice/career-development/entrepreneur-skills 2. https://www.investopedia.com/terms/i/intrapreneurship.asp					

COs vs POs

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO 1	3	3	2	1	3	1	0	1	1
CO 2	3	3	2	1	3	1	0	1	1
CO 3	3	3	2	1	3	1	0	1	1
CO 4	3	3	2	1	3	1	0	1	1
CO 5	3	3	2	1	3	1	0	1	1
TOTAL	**15**	**15**	**10**	**5**	**15**	**5**	**0**	**5**	**5**
SCALED VALUE	**3**	**3**	**2**	**1**	**3**	**1**	**0**	**1**	**1**

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

SEMESTER V

Course Name			**Real Analysis**	**L**	**T**	**P**	**C**
Course Code			**XMT501**	**3**	**1**	**0**	**4**
C	**P**	**A**		**L**	**T**	**P**	**H**
4	**0**	**0**		**3**	**2**	**0**	**5**
PREREQUISITE			Knowledge in the basic properties of real numbers				

On successful completion of this course, the students will be able to:			
Course Outcomes		**Domain**	**Level**
CO1	**Explain** the basics of real numbers.	Cognitive	Understanding
CO2	**Explain** the neighborhoods and limit points.	Cognitive	Understanding
CO3	**Demonstrate**about continuity and discontinuity of various functions in different contexts.	Cognitive	Understanding
CO4	**Demonstrate** about derivatives and continuity	Cognitive	Understanding
CO5	**Explain** the Riemann integration and mean value theorems.	Cognitive	Understanding
UNIT 1	**Real numbers**		**9 + 3**
The field axioms- Field Properties-Order in R- Absolute value- Completeness – Representation of Real numbers on a straight line – Intervals – Countable and Uncountable sets.			
UNIT 2	**Neighborhoods and limit points**		**9 + 3**
Open sets – Closed sets –Limit points of a set – Closure of a set.			
UNIT 3	**Limits and Continuity**		**9 + 3**
Limits – Continuous functions – Types of discontinuities- Algebra of Continuous functions – Boundedness of continuous functions.			
UNIT 4	**Derivatives**		**9 + 3**
Introduction – Derivability and continuity- Algebra of derivatives – Inverse function theorem for derivatives – Darboux's theorem.			
UNIT 5			**9 + 3**

Riemann Integration- Definition – Daurboux's theorem – conditions for integrability – properties of integrable functions – continuity and derivability of integral functions – Mean value theorems – the fundamental theorem of Calculus and the first mean value theorem.							
Lecture	**45**	**Tutorial**	**15**	**Practical**	**0**	**Total**	**60**

Text Books

1.M.K. Singhal and Asha Rani Singhal, "A first course in Real Analysis"., R. Chand & Co., June,1997 (Units I to IV).
2. Shanthi Narayan, "A Course of Mathematical Analysis", S. Chand& Co. 1995 (Unit-V).

Unit-I Chapter 1, Sec. 1.1 – 1.10
Unit-II Chapter 2 Sec 2.1 – 2.6
Unit-III Chapter 5 Sec 5.1 – 5.5
Unit – IV Chapter 6 Sec 6.1 – 6.5
Unit – V Chapter 6 Sec 6.2, 6.3 & 6.5 6.7 6.8, 6.9 of [2]

Reference

1. Arumugam. S. and Thangapandi Issac, "Sequences and Series", New Gamma, Publishing House, Palayamkottai - 627 002, 1997.
2. Goldberg. R. "Methods of Real Analysis", Oxford and IBH Publishing Co., New Delhi (2000).
3. Arumugam and Issac,"Modern Analysis", New Publishing House, 2017.
4. Malik S.C and Savitha Arora,"Mathematical Analysis", 1991, Wiley Eastern Limited New Delhi.

E-References

1. https://nptel.ac.in

COs vs POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	3	2	1	3	1	0	1	1
CO 2	3	3	2	1	3	1	0	1	1
CO 3	3	3	2	1	3	1	0	1	1
CO 4	3	3	2	1	3	1	0	1	1
CO 5	3	3	2	1	3	1	0	1	1
TOTAL	**15**	**10**	**10**	**5**	**15**	**5**	**0**	**5**	**5**
SCALED VALUE	**3**	**2**	**2**	**1**	**3**	**1**	**0**	**1**	**1**

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

1-5 → 1, 6-10 → 2, 11-15 → 3

Course Name			Discrete Mathematics	L	T	P	C
Course Code			XMT502	3	1	0	4
C	P	A		L	T	P	H
4	0	0		3	1	0	4
Prerequisite			Higher Secondary level Mathematics				

On successful completion of this course, the students will be able to:

Course Outcomes		Domain	Level
CO1	**Solve** second order recurrence relations by finding the corresponding generating functions	Cognitive	Applying
CO2	**Utilize** truth tables and the properties of logic to simplify given logic statements	Cognitive	Applying
CO3	**Determine** if the given statements are logically equivalent or not using logical operators	Cognitive	Evaluating
CO4	**Analyze** the basic structures of lattice and Boolean algebra	Cognitive	Analyzing
CO5	**Identify** different formal language classes and their relationships	Cognitive	Applying

UNIT 1		**9 + 3**

Recurrence relations and generating function: Recurrence-an introduction-polynomials and their evaluations- Recurrence relations- solution of finite order Homogeneous (linear) Relations- Solution of Non-Homogeneous relations.

UNIT 2		**9 + 3**

Logic: TF- statements – connectives- atomic and compound statements-well formed (statements) Formulae – parsing trees.

UNIT 3		**9 + 3**

Logic: Truth table of a formula – Tautology- Tautological Implications and Equivalence of Formulae -Replacement process- Functionally Complete sets of connectives and Duality law.

UNIT 4		**9 + 3**

Lattices and Boolean Algebras: Lattices- some properties of lattices- New lattices- Modular and distributive lattices.

UNIT 5		**9 + 3**

Automata and Languages: Finite Automata – definition of finite automation – Representation of finite automation Acceptability of a string by a finite automation - Languages accepted by a finite automation - Non-deterministic finite automata.

Lecture	**45**	**Tutorial**	**15**	**Practical**	**0**	**Total**	**60**

Text Book
1. "Discrete Mathematics" by Dr. M.K. Venkatraman, Dr.N. Sridharan, N. Chandrasekeran, the National Publishing Company, 2003. Unit I :Chapter: 5 Sec 1-5 (Pages: 5.01- 5.19) Unit II : Chapter: 9 Sec 1- 5 (Pages: 9.1- 9.20) Unit III : Chapter: 9 Sec 6- 10 (Pages: 9.21- 9.42) Unit IV : Chapter: 10 Sec 1- 4 (Pages: 10.1- 10.32) Unit V : Chapter: 12 Sec 1 –7 (Pages: 12.1- 12.16)
Reference
1. Koleman and Bushy- Discrete Mathematical Structures, Prentice Hall of India, New Delhi- 2002.
E-References
1. https://www.cst.cam.ac.uk/teaching/2021/DiscMath[University of Cambridge] **2.** https://explorecourses.stanford.edu/search?q=CS157[Stanford]

COs vs POs

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO 1	3	3	3	2	3	1	1	1	1
CO 2	3	3	3	2	3	1	1	1	1
CO 3	3	3	3	3	3	1	3	1	1
CO 4	3	3	3	3	3	1	2	1	1
CO 5	3	3	3	2	3	1	1	1	1
TOTAL	**15**	**15**	**15**	**12**	**15**	**5**	**8**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**3**	**3**	**1**	**2**	**1**	**1**

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

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

Course Name	**Numerical methods**	**L**	**T**	**P**	**C**

Course Code			XMT503	4	1	0	5
C	**P**	**A**		**L**	**T**	**P**	**H**
5	**0**	**0**		**4**	**1**	**0**	**5**
Prerequisite			Knowledge In Higher Secondary Level Mathematics				

On successful completion of this course, the students will be able to:

	Course Outcomes	Domain	Level
CO1	**Identify** the solution of numerical algebraic and transcendental equations using appropriate methods	Cognitive	Applying
CO2	**Identify** the solution of simultaneous linear algebraic equation using Gauss elimination and Gauss Jordan method	Cognitive	Applying
CO3	**Construct** a function which closely fits given n- points in the plane by using interpolation method	Cognitive	Applying
CO4	**Identify** the solution of an equation using the concepts of the Numerical Differentiation and integration	Cognitive	Applying
CO5	**Analyze**the solution of anordinary Differential Equations using Euler method, modified Euler method and Runge - Kutta method	Cognitive	Analyzing

UNIT 1 **12 + 3**

The solution of numerical algebraic and Transcendental Equations: The Bisection Method- iteration method- Order of convergence- Regula False method- Newton Raphson Method- order of convergence**.**

UNIT 2 **12 + 3**

Solution of simultaneous linear algebraic equation: Gauss elimination method- Gauss Jordan method- inversion of a matrix using Gauss elimination method- Gauss Jacobi method- Gauss-Seidel method.

UNIT 3 **12 + 3**

Interpolation - Gregory Newton forward interpolation formula - Backward interpolation formula- Gauss forward interpolation formula - Backward interpolation formula – Lagrange’s interpolation formula – different forms of Lagrange’s interpolation formula.

UNIT 4 **12 + 3**

Numerical Differentiation and integration- Newton’s forward and backward difference method to compute derivatives- the trapezoidal- Romberg’s method- Simpson’s one third rule- Simpson’s 3/8 rule- Weddle’s rule.

UNIT 5 **12 + 3**

Numerical Solution of ordinary Differential Equations-Power series approximation- solution by Taylor’s series- Picard’s method of successive approximations- Euler method- modified Euler method- Runge- Kutta method- orders 2 and 4.

Lecture	60	Tutorial	15	Practical	0	Total	75

Text Book

1. "Numerical Methods" (2001), P. Kandasamy, K. Thilagavathy, K. Gunavathy, S. Chand& Company Ltd., New Delhi.
   Unit I : Chapter: 3 (3.1.1 to 3.4.3), Pages: 69 - 96
   Unit II : Chapter: 4 (4.1- 4.3 and 4.7 - 4.9), Pages: 112-126, 145-158
   Unit III: Chapter: 6 (6.1-6.6), Pages: 209 – 225,
   Chapter: 7 (7.1-7.4), Pages: 231 – 240,
   Chapter: 8 (8.7 only), Pages: 271 - 276.
   Unit IV:Chapter: 9 (9.1- 9.3, 9.6- 9.15), Pages: 281 - 317
   Unit V :Chapter: 11 (11.1- 11.15), Pages: 348 - 393

References

1. S. Sastri, Introduction methods of Numerical Analysis, Fifth Edition, PHI Learning Pvt. Ltd, 2012.
2. M.K. Venkataraman, Numerical methods in science and Engineering- Fifth Edition (Revised& Enlarged), The National Publishing Co., Chennai, 2004.
3. A. Singaravelu, Numerical methods Meenakshi Agency, 2019.

E-References

1. https://explorecourses.stanford.edu/search?q=CME206 [Stanford University]
2. https://courses.maths.ox.ac.uk/node/44065 [Oxford]

COs vs POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	3	3	2	3	1	1	1	1
CO 2	3	3	3	2	3	1	1	1	1
CO 3	3	3	3	2	3	1	1	1	1
CO 4	3	3	3	2	3	1	1	1	1
CO 5	3	3	3	3	3	1	2	1	1
TOTAL	**15**	**15**	**15**	**11**	**15**	**5**	**6**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**3**	**3**	**1**	**2**	**1**	**1**

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

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

Course Name	Number Theory	L	T	P	C
Course Code	**XMT503**	**4**	**1**	**0**	**5**

C	P	A		L	T	P	H
5	0	0		4	1	0	5

Prerequisite	Knowledge in Algebra

On successful completion of this course, the students will be able to:

	Course Outcomes	Domain	Level
CO1	**Apply** the Euclidean algorithm to compute the gcd of two integers.	Cognitive	Applying
CO2	**Apply** the Dirichlet product to Mobious functions.	Cognitive	Applying
CO3	**Apply** the Dirichlet multiplication to Mangold functions.	Cognitive	Applying
CO4	**Solve** the number theoretic problems on averages arithmetic functions	Cognitive	Applying
CO5	**Solve** the linear congruences using the concepts of congruence relations	Cognitive	Applying

UNIT 1 **12 + 3**

The Fundamental Theorem of Arithmetic: Introduction- Divisibility - Greatest Common divisor - Prime numbers - The fundamental theorem of arithmetic - The series of reciprocals of the primes - The Euclidean algorithm - The greatest Common divisor of more than two numbers.

UNIT 2 **12 + 3**

Arithmetical Functions and Dirichlet multiplication: The mobius function (n) - The Euler totient function- A relation connecting and - A product formula for (n) - the Dirichlet product of arithmetical functions - Dirichlet inverses and the Mobius inversion formula.

UNIT 3 **12 + 3**

The Mangoldt function (n) - multiplicative functions- Multiplicative function and Dirichlet multiplication - The inverse of a completely multiplicative function - Liouville's function A (n) - the divisor functions $\sigma_\alpha(n)$ - Generalized convolutions - formal power series.

UNIT 4 **12 + 3**

Averages of Arithmetical Functions: The big oh notation Asymptotic equality of functions – Euler’s summation formula - some elementary asymptotic formulas - the average order of d (n).

UNIT 5 **12 + 3**

Congruences: Definition and basic properties of congruence’s - Residue classes complete residue systems - Linear congruence’s – solved problems and examples.

Lecture	60	Tutorial	15	Practical	0	Total	75

Text Book

1. Analytic Number Theory by Tom.M.Apostal, Springer Science &Buisness Media, 2013.
   Unit I Chapter 1 (1.1 - 1.8)

Unit II	Chapter 2 (2.1 - 2.7)
Unit III	Chapter 3 (2.8 – 2.15)
Unit IV	Chapter 5 (3.1- 3.5)
Unit V	Chapter 9 (5.1- 5.3)

References

1. Number Theory, GeorgeE. Andrews, Courier Corporation, 1994.
2. Introduction to theory of Number, G.H. Hardy and E.M. Wright, Oxford University Press, 6th edition (2008)..
3. Basic Number Theory, S.B. Malilk, Vikas Publishing, 2018.

E-References

http://nptel.ac.in

COs vs POs

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO 1	3	3	3	2	3	1	1	1	1
CO 2	3	3	3	2	3	1	1	1	1
CO 3	3	3	3	2	3	1	1	1	1
CO 4	3	3	3	2	3	1	1	1	1
CO 5	3	3	3	2	3	1	1	1	1
TOTAL	**15**	**15**	**15**	**10**	**15**	**5**	**5**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**1**

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

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

Course Name			Graph Theory	L	T	P	C
Course Code			XMT504	4	1	0	5
C	P	A		L	T	P	H
5	0	0		4	1	0	5
Prerequisite			Knowledge In Basic Mathematics				

On successful completion of this course, the students will be able to:

Course Outcomes		Domain	Level
CO1	**Explain** the basic concepts graphs and operation on graph	Cognitive	Understanding
CO2	**Demonstrate** the concepts of walks, trials, paths, connectedness and components	Cognitive	Understanding
CO3	**Infer** the characterization of trees and centre of a tree	Cognitive	Understanding
CO4	**Outline** the basics of matchings and planarity	Cognitive	Understanding
CO5	**Relate** the four colour theorem and five colour theorem	Cognitive	Understanding

UNIT 1	**Graphs and Subgraphs**	**12 + 3**
Introduction, definition – Degrees, subgraphs, Isomorphism, Ramsey numbers – Independent sets and coverings – Intersection graphs and line graphs – matrices and operations on graphs		
UNIT 2	**Degree sequences and connectedness**	**12 + 3**
Degree sequences and graphic sequences – Walks, trials and paths – connectedness and components – Blocks and connectivity		
UNIT 3	**Eulerian and Hamiltonian Graphs, Trees**	**12 + 3**
Eulerian and Hamiltonian Graphs – Trees – characterization of trees – centre of a tree		
UNIT 4	**Matchings and Planarity**	**12 + 3**
Matchings - Matchings in Bipartite graphs – Planarity – Definition – characterization of planar graphs – Thickness, crossing and outer planarity		
UNIT 5	**Colourability**	**12 + 3**
Chromatic number- Chromatic index – Five colour theorem – Four colour problem - Chromatic Polynomials		

Lecture	60	Tutorial	15	Practical	0	Total	75
Text Book							

1. An invitation to Graph theory - Dr. S. Arumugam& S. Ramachandran,SCITEC publications (India) P. Pvt.Ltd., Chennai, 2006.

Unit I	:	Chapter 2
Unit II	:	Chapter 3 and 4
Unit III	:	Chapter 5 and 6
Unit IV	:	Chapter7 and 8
Unit V	:	Chapter 9

References

1. Graphs Theory with Applications to Engineering and computer science – NarsinghDeo, Printice- Hall of India Private Ltd, 2014.
2. Graph Theory- F. Harary, Narosa Publishing House, edition 2013.
3. S.A. Choudham, A First Course in Graph Theory, Macmillan India Ltd,1987.

E-References

http://nptel.ac.in

COs vs POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	3	2	1	3	1	0	1	1
CO 2	3	3	2	1	3	1	0	1	1
CO 3	3	3	2	1	3	1	0	1	1
CO 4	3	3	2	1	3	1	0	1	1
CO 5	3	3	2	1	3	1	0	1	1
TOTAL	**15**	**15**	**10**	**5**	**15**	**5**	**0**	**5**	**5**
SCALED VALUE	**3**	**3**	**2**	**1**	**3**	**1**	**0**	**1**	**1**

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

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

<table>
<tr><td colspan="3">Course Name</td><td colspan="3">Mathematical Modeling</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td colspan="3">Course Code</td><td colspan="3">XMT504</td><td>4</td><td>1</td><td>0</td><td>5</td></tr>
<tr><td>C</td><td>P</td><td>A</td><td colspan="3"></td><td>L</td><td>T</td><td>P</td><td>H</td></tr>
<tr><td>5</td><td>0</td><td>0</td><td colspan="3"></td><td>4</td><td>1</td><td>0</td><td>5</td></tr>
<tr><td colspan="3">Prerequisite</td><td colspan="7">Basic knowledge of algebra,differentiation concepts.</td></tr>
<tr><td colspan="10">On successful completion of this course, the students will be able to:</td></tr>
<tr><td colspan="5">Course Outcomes</td><td colspan="2">Domain</td><td colspan="3">Level</td></tr>
<tr><td colspan="2">CO1</td><td colspan="3">Explain the classification of mathematical models and limitations of mathematical modelling</td><td colspan="2">Cognitive</td><td colspan="3">Understanding</td></tr>
<tr><td colspan="2">CO2</td><td colspan="3">Apply the concepts offirstorderordinary differential equations to form mathematical modeling for Dynamic and Geometrical problems</td><td colspan="2">Cognitive</td><td colspan="3">Applying</td></tr>
<tr><td colspan="2">CO3</td><td colspan="3">Analyze the mathematical models involved in economics through first order ordinary differential equations</td><td colspan="2">Cognitive</td><td colspan="3">Analyzing</td></tr>
<tr><td colspan="2">CO4</td><td colspan="3">Analyze the mathematical models in Medicine, Arms Race, Battles and International Trade in terms of systems of ordinary differential equations</td><td colspan="2">Cognitive</td><td colspan="3">Analyzing</td></tr>
<tr><td colspan="2">CO5</td><td colspan="3">Analyze the models in Planetary motions, Circular motion and motion of Satellites</td><td colspan="2">Cognitive</td><td colspan="3">Analyzing</td></tr>
<tr><td colspan="2">UNIT 1</td><td colspan="5"></td><td colspan="3">12 + 3</td></tr>
<tr><td colspan="10">Simple situation requiring Mathematical modeling and technique-Classification of mathematical models-some characteristics of mathematical models-Modeling through Geometry-Modeling through Algebra-Modeling through Trigonometry-Modeling through Calculus-Limitations of Mathematical modeling.</td></tr>
<tr><td colspan="2">UNIT 2</td><td colspan="5"></td><td colspan="3">12 + 3</td></tr>
<tr><td colspan="10">Mathematical Modeling through differential Equations-Linear Growth and Decay Models-Non-Linear Growth and Decay Models-Compartment Models-Modeling in Dynamics through Ordinary differential equations of first order- Mathematical modeling of Geometrical problems through ordinary differential equations of first order.</td></tr>
<tr><td colspan="2">UNIT 3</td><td colspan="5"></td><td colspan="3">12 + 3</td></tr>
<tr><td colspan="10">Mathematical Modeling in Population Dynamics-Modeling of Epidemics through systems of Ordinary differential equations of first order-Compartment models through systems of ordinary differential equations-Modeling in Economics through systems of ordinary differential equations of first order.</td></tr>
<tr><td colspan="2">UNIT 4</td><td colspan="5"></td><td colspan="3">12 + 3</td></tr>
</table>

Mathematical models in Medicine, Arms Race, Battles and International Trade in terms of systems of ordinary differential equations-Modeling in Dynamics through systems of Ordinary Differential equations of first order.		
UNIT 5		**12 + 3**
Mathematical modeling of Planetary motions – Modeling of Circular motion and motion of Satellites.		

Lecture	60	Tutorial	15	Practical	0	Total	75

Text book

1. **“**Mathematical Modeling’ by J.N. Kapur, New Age International Private Limited, Second edition, 2021.

   Unit I : Chapter 1.1-1.9
   Unit II : Chapter 2.1-2.6
   Unit III : Chapter 3.1-3.4
   Unit IV : Chapter 3.5-3.6
   Unit V : Chapter 4.1-4.2

References

1.” An Introduction to Mathematical Modeling “byEdward A. Bender, Dover publications (2003)

E-References

http://nptel.ac.in

COs vs POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	3	2	1	3	1	0	1	1
CO 2	3	3	3	2	3	1	1	1	1
CO 3	3	3	2	1	3	1	0	1	1
CO 4	3	3	3	3	3	1	2	1	1
CO 5	3	3	3	3	3	1	2	1	1
TOTAL	**15**	**15**	**14**	**12**	**15**	**5**	**7**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**3**	**3**	**1**	**2**	**1**	**1**

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

1-5 → 1, 6-10 → 2, 11-15 → 3

Course Name			**Fundamentals of Data Science & R Programming**	**L**	**T**	**P**	**C**
Course Code			**XMT505**	**1**	**1**	**0**	**1**
C	**P**	**A**		**L**	**T**	**P**	**H**
1	**0**	**0**		**1**	**1**	**0**	**2**
Prerequisite			Basic computer knowledge				
On successful completion of this course, the students will be able to:							

	Course Outcomes	**Domain**	**Level**
CO1	**Describe** the significance of data science and understand the Data Science process	Cognitive	Understanding
CO2	**Build, and prepare** data for use with a variety of statistical methods and models	Cognitive	Applying
CO3	**Analyze** Data using various Visualization techniques.	Cognitive	Analyzing
CO4	**Analyze** the variables, scalars, vectors in R programming.	Cognitive	Analyzing
CO5	**Apply** the various charts and plots.	Cognitive	Applying
UNIT 1			**12 + 3**
	Introduction To Data Science: Definition, Big Data and Data Science Hype, Datafication, Data Science Profile, Meta-Definition, Data Scientist, Statistical Inference, Populations and Samples, Populations and Samples of Big Data, Big Data Can Mean Big Assumptions, Modeling, Philosophy of Exploratory Data Analysis, The Data Science Process, A Data Scientist's Role in this Process		
UNIT 2			**12 + 3**
	Data Munging: Properties of Data, Languages for Data Science, Collecting Data, Cleaning Data, Crowdsourcing. Scores and Rankings: Developing Scoring Systems, Z-scores and Normalization, Advanced Ranking Techniques Statistical Analysis: Sampling from Distributions, Statistical Distributions, Statistical Significance, Permutation Tests and P-values		

UNIT 3		**12 + 3**
	Introduction to R Understanding R data structure, Variables in R, Scalars, Vectors. Matrices, List, Data frames, Using c, Cbind, Rbind, attach and detach functions in R , Factors	
UNIT 4		**12 + 3**
	Importing data Importing data from excel, importing data from SAS, accessing database, Saving in R data, Loading R data objects, writing to files Manipulating Data, selecting rows/observations, selecting columns/fields, merging data, Relabeling the column names	
UNIT 5		**12 + 3**
	R Programming, While loop, If loop, For loop, Arithmetic operations Charts and Plots, Box plot, Histogram, Pareto charts, Pie graph, Line chart, Scatterplot	

Lecture	**60**	**Tutorial**	**15**	**Practical**	**0**	**Total**	**75**

Text Book

1. Steven S. Skiena, “The Data Science Design Manual”, Springer 2017.
2. Rachel Schutt &O’neil, “Doing Data Science”, Straight Talk from The Frontline O’REILLY, ISBN:978-1-449-35865-5, 1st edition, October 2013.
3. Cotton, R., Learning R: a step-by-step function guide to data analysis. 1st edition. O’reilly Media Inc.

References

1. Joel Grus,” Data Science from Scratch” First Edition, April 2015 2. Gareth James, Daniela Witten, Trevor Hatie, RoberstTibhirani, “An Introduction to Statistical Learning- with Applications in R “, 2013
2. R Programming for Data Science, Roger D. Peng, LeanPub, 2015.

E-References

1.“Data science for engineers” https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs28/
2.https://jrnold.github.io/r4ds-exercise-solutions/index.html
3. https://www.r-project.org/
4. https://cran.r-project.org/

COs vs POs

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO 1	3	3	2	1	3	1	0	1	1
CO 2	3	3	3	2	3	1	1	1	1

CO 3	3	3	2	1	3	1	0	1	1
CO 4	3	3	2	1	3	1	0	1	1
CO 5	3	3	3	2	3	1	1	1	1
TOTAL	**15**	**15**	**12**	**7**	**15**	**5**	**2**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**1**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation									
1-5 $\rightarrow$ 1, 6-10 $\rightarrow$ 2, 11-15 $\rightarrow$ 3									

Course Name			**Quantitative Aptitude -IV**	**L**	**T**	**P**	**C**
Course Code			**XMT506**	**2**	**0**	**0**	**2**
C	**P**	**A**		**L**	**T**	**P**	**H**
2	**0**	**0**		**2**	**0**	**0**	**2**
Prerequisite			Basic mathematical knowledge				
On successful completion of this course, the students will be able to:							

Course Outcomes		**Domain**	**Level**
CO1	**Explain** the basic concepts of Probability and True Discountand to solve problems	Cognitive	Applying
CO2	**Explain** the basic concepts of Banker's Discount, Heights & Distances and solve problems	Cognitive	Applying
CO3	**Explain** the basic concepts of odd man Out, Series and Patterns, Tabulation and to solve the problems	Cognitive	Applying
CO4	**Explain** the basic concepts of Bar Graphs Pie Charts and to solve the problems	Cognitive	Applying
CO5	**Explain** the basic concepts of Line Graphs and to solve the Problems	Cognitive	Applying
UNIT 1			**6**
Probability, True Discount.			
UNIT 2			**6**

Banker’s Discount, Heights & Distances.

UNIT 3		**6**

Odd man Out, Series and Patterns, Tabulation.

UNIT 4		**6**

Bar Graphs Pie Charts

UNIT 5		**15**

Line Graphs.

Lecture	**30**	**Tutorial**	**0**	**Practical**	**0**	**Total**	**30**

Text Book

1. R.S. Aggarwal, Quantitative Aptitude for Competitive Examinations, S Chand; 20th edition (2013)

References

1. Banking awareness by Sangram Keshari Rout and Soumya Ranjan Behera, B.K. Publications Pvt. Ltd.; Second edition (2014).
2. UGC-CSIR NET/SET by Dr. Pawan Sharma and Anshuman, Arihant Publication.
3. Fast Track Objective Arithmetic by Rajesh Verma, Arihant Publication, Edition 2012.

E-References

1. www.careerbless.com
2. www.jagranjosh.com
3. www.bestguru.com

COs vs POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	3	3	2	3	1	1	1	1
CO 2	3	3	3	2	3	1	1	1	1
CO 3	3	3	3	2	3	1	1	1	1
CO 4	3	3	3	2	3	1	1	1	1
CO 5	3	3	3	2	3	1	1	1	1
TOTAL	**15**	**15**	**15**	**10**	**15**	**5**	**5**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**1**

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

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

SEMESTER VI

Course Name			Complex Analysis	L	T	P	C
Course Code			XMT601	3	1	0	4
C	P	A		L	T	P	H
4	0	0		3	2	0	5
Prerequisite			Knowledge in Calculus				

On successful completion of this course, the students will be able to:			
Course Outcomes		**Domain**	**Level**
CO1	**Determine** whether the given function is Continuous / differentiable / analytic.	Cognitive	Evaluating
CO2	**Determine** the image of given region under the given bilinear transformation	Cognitive	Evaluating
CO3	**Explain** Cauchy's theorem and Cauchy Integral formula	Cognitive	Understanding
CO4	**Determine** the annulus of convergence of a given function using the concepts of series expansion	Cognitive	Evaluating
CO5	**Evaluate** complex contour integrals using the Cauchy Residue theorem	Cognitive	Evaluating

UNIT 1	**Complex numbers**	**9 + 3**
Complex numbers – Functions of a complex variable – Limits – Theorems on limit – Continuous functions – Differentiability - The Cauchy Riemann equations – Analytic functions – Harmonic functions (Except Milne-Thompson method).		
UNIT 2	**Bilinear Transformation**	**9 + 3**
Introduction – Elementary transformations – Bilinear transformation – cross ratio – fixed points of bilinear transformation – some special bilinear transformations		
UNIT 3	**Complex Integration**	**9 + 3**
Introduction – definite integral – Cauchy's Theorem – Cauchy's integral formula – Maximum modulus theorem – Higher derivatives – Cauchy's inequality – Liouville's theorem – Fundamental theorem of algebra – Morera's theorem.		
UNIT 4	**Series Expansions**	**9 + 3**
Introduction – Taylor's series – Laurent's series – Zeros of an analytic function – singularities and poles – Riemann's theorem - meromorphic function.		
UNIT 5	**Calculus of residues**	**9 + 3**
Residues – Cauchy's Residue theorem – Argument theorem – Rouche's theorem - Evaluation of definite integral –Contour integration types.		

Lecture	**45**	**Tutorial**	**15**	**Practical**	**0**	**Total**	**60**
Text Book							

1. “Complex Analysis” by S. Arumugam, A. Thangapandi Isaac, A. Somasundaram, Scitech Publications, 2014.

Unit I	:	Chapter 1 (Sec: 1.1), Pages: 1 – 2 Chapter 2 (Sec: 2.1 – 2.8), Pages: 24 – 52
Unit II	:	Chapter 3 (Sec: 3.1 – 3.5), Pages: 74 – 100
Unit III	:	Chapter 6(Sec: 6.1 – 6.4), Pages: 132 – 170
Unit IV	:	Chapter 7(Sec: 7.1 – 7.4), Pages: 173 – 207
Unit V	:	Chapter 8(Sec: 8.1 – 8.3), Pages: 209 – 254

References

1. “Foundations of complex Analysis” by S. Ponnusamy- Narosa Publishing House- New Delhi Chennai.
2. “Functions of a complex variables with applications” by E.G. Phillis (1968)- Oliver & Boy D, Edinburg

E-References

http//nptel.ac.in

COs vs POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	3	3	3	3	1	3	1	1
CO 2	3	3	3	3	3	1	3	1	1
CO 3	3	3	2	1	3	1	0	1	1
CO 4	3	3	3	3	3	1	3	1	1
CO 5	3	3	3	3	3	1	3	1	1
TOTAL	**15**	**15**	**14**	**13**	**15**	**5**	**12**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**3**	**3**	**1**	**3**	**1**	**1**

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

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

Course Name			Operations Research	L	T	P	C
Course Code			XMT602	3	1	0	4
C	P	A		L	T	P	H
4	0	0		3	1	0	4
Prerequisite			Knowledge In Basic Mathematical Concepts				

On successful completion of this course, the students will be able to:

Course Outcomes		Domain	Level
CO1	**Apply** graphical method to solve a given linear programming problem	Cognitive	Applying
CO2	**Solve** thelinear programming problem using simplex method and big M method	Cognitive	Applying
CO3	**Identify** the timeline of a given project using PERT	Cognitive	Applying
CO4	**Determine** the optimal solution for Transportation problems and Assignment Problems	Cognitive	Applying
CO5	**Utilize** dominance property for finding saddle point of the zero-sum game with mixed strategies	Cognitive	Applying

UNIT 1 — **9 + 3**

Operations Research- An overview: Nature and characteristic Features of OR- Models in OR- OR and Decision Making- Applications and Limitations of OR- Linear Programming Problem: Formulation and Graphical methods.

UNIT 2 — **9 + 3**

Simplex Method – Big M method - Two phase- Simplex Method-Duality in Linear Programming: Formulation of Primal Dual Pairs – Mathematical formulation of duality - problems.

UNIT 3 — **9 + 3**

Dual Simplex Method - Network Scheduling by PERT/ CPM: Critical path Method and PERT calculations.

UNIT 4 — **9 + 3**

Transportation Problem and Assignment Problem.

UNIT 5 — **9 + 3**

Game Theory: Optimal solution of two person zero- sum games- games with mixed strategies - The graphical method- Dominance property- general solution of (m x n) rectangular games (LPP only)

Lecture	45	Tutorial	15	Practical	0	Total	60

Text Book									
1. Problems in operations Research, P.K Gupta & Man Mohan, Sultan Chand & Sons. Unit I : Chapters 0 to 3 Unit II : Chapters 4, 5,6,8,9 Unit III : Chapters 9 and 27 Unit IV : Chapters 15 and 16 Unit V : Chapters 20									
Reference									
1.” Operations Research” Kanti Swarup, PK. Gupta and Man Mohan, Sultan Chand and Sons, edition 2020.									
E-References									
http//nptel.ac.in									
COs vs POs									
	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO 1	3	3	3	2	3	1	1	1	1
CO 2	3	3	3	2	3	1	1	1	1
CO 3	3	3	3	2	3	1	1	1	1
CO 4	3	3	3	2	3	1	1	1	1
CO 5	3	3	3	2	3	1	1	1	1
TOTAL	**15**	**15**	**15**	**10**	**15**	**5**	**5**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**1**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation									
1-5 $\rightarrow$ 1, 6-10 $\rightarrow$ 2, 11-15 $\rightarrow$ 3									

Course Name			Fuzzy Sets and its Applications	L	T	P	C
Course Code			XMT603	4	1	0	5
C	P	A		L	T	P	H
5	0	0		4	1	0	5
Prerequisite							

On successful completion of this course, the students will be able to:

Course Outcomes		Domain	Level
CO1	**Define** the Fuzzy sets, Fuzzy graphs and their principles.	Cognitive	Understanding
CO2	**Understand**Fuzzy relations and Fuzzy graphs.	Cognitive	Analyzing
CO3	**Analyze**Fuzzy quantifiers and Multi conditional approximate reasoning	Cognitive	Analyzing
CO4	**Explain** the Fuzzification. Defuzzification and the various Defuzzification methods	Cognitive	Understanding
CO5	**Apply** the Fuzzy ranking methods in Civil Engineering, Mechanical Engineering, Industrial Engineering and Medicine	Cognitive	Applying

UNIT 1	Fuzzy sets	12+ 3

Basic Definitions – Basic set theoretic operations for Fuzzy sets – Extensions: Types of Fuzzy sets – algebraic operations - Extension Principle: operation for type 2 fuzzy sets – algebraic operations with fuzzy numbers – special extended operations – Extended operations for LR-representation of fuzzy sets.

UNIT 2	Fuzzy relations and Fuzzy Graphs	12+ 3

Fuzzy relations and fuzzy sets – Composition of Fuzzy relations – Min-max composition and its properties – Fuzzy graphs – Special fuzzy relation - Possibility Theory – Possibility of fuzzy events – Possibility Vs Probability.

UNIT 3	Fuzzy Logic	12+ 3

Classical logic: An overview – Multi valued logic – Fuzzy propositions – Fuzzy quantifiers – Linguistic hedges – Inference from conditional fuzzy propositions–**Approximate reasoning**: An overview of fuzzy expert system – Fuzzy implications and their selection – Multi conditional approximate reasoning – The role of fuzzy relation equation.

UNIT 4	Fuzzy Systems	12+ 3

Fuzzy controllers: An overview – Fuzzy rule base. Fuzzy inference engine. Fuzzification. Defuzzification and the various Defuzzification methods (the centre of area, the centre of maxima and the mean of maxima methods)

Fuzzy controllers: An example – Fuzzy systems and Neural Networks – Automata – Dynamical Systems.							
UNIT 5	**Decision making in Fuzzy Environment**						**12+ 3**
Individual decision making – Multiperson decision making – Multicriteria decision making – Multi stage decision making – Fuzzy ranking methods – Fuzzy linear programming – Applications in Civil Engineering, Mechanical Engineering, Industrial Engineering and Medicine.							
LECTURE	**60**	**TUTORIAL**	**15**	**PRACTICAL**	**0**	**TOTAL**	**75**

Text Books

1. Fuzzy set theory and its applications Fourth edition, H. J. Zimmermann. Springer, 2015.
   Unit – I: Chapters. 2, 3(Sec. 3.1 – 3.2.1), 5
   Unit – II: Chapters. 6, 8(Sec. 8.2 – 8.4)
2. Fuzzy sets and Fuzzy Logic, Theory and Applications, George J. Klir and Bo Yuan, PHI, 2013.
   Unit – III: Chapters. 8(Sec. 8.1 – 8.6), 11(Sec. 11.1 – 11.5)
   Unit – IV: Chapters. 12
   Unit – IV: Chapters. 15, 16(Sec. 16.2, 16.3), 17(Sec. 17.2)

References

, Bhargava A.K.. Publisher, S. Chand Publishing, 2013

E-References

1.http://www.tezu.ernet.in/dmaths/programme/PhD-MathSc-syllabus_2013.pdf[Cambridge *University]*
2. http://www.imperial.ac.uk/civil-engineering/prospective-students/postgraduate-taught-admissions/environmental-engineering-cluster/syllabus/cive97035/[Imperial College London]

COs vs POs

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO 1	3	3	2	1	3	1	0	1	1
CO 2	3	3	3	3	3	1	2	1	1
CO 3	3	3	3	3	3	1	2	1	1
CO 4	3	3	2	1	3	1	0	1	1
CO 5	3	3	3	2	3	1	1	1	1
TOTAL	**15**	**15**	**13**	**10**	**15**	**5**	**5**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**1**

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

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

Course Name			Introduction to Industry 4.0	L	T	P	C
Course Code			XMT603	4	1	0	5
C	P	A		L	T	P	H
5	0	0		4	1	0	5
Prerequisite							

On successful completion of this course, the students will be able to:

	Course Outcomes	Domain	Level
CO1	**Know** the reason for adopting Industry 4.0 and Artificial Intelligence.	Cognitive	Remembering
CO2	**Understand** the need for digital transformation.	Cognitive	Understanding
CO3	**Apply** the industry 4.0 tools.	Cognitive	Applying
CO4	**Analyze** the applications of Big Data.	Cognitive	Analyzing
CO5	**Examine** the applications and security of IoT Applications	Cognitive	Analyzing

UNIT 1	**Industry 4.0**	**12+ 3**
Need – Reason for Adopting Industry 4.0 - Definition – Goals and Design Principles - Technologies of Industry 4.0 – Big Data – Artificial Intelligence (AI) – Industrial Internet of Things - Cyber Security – Cloud – Augmented Reality.		
UNIT 2	**Artificial Intelligence**	**12+ 3**
Artificial Intelligence: Artificial Intelligence (AI) – What & Why? - History of AI - Foundations of AI -The AI -environment - Societal Influences of AI - Application Domains and Tools - Associated Technologies of AI - Future Prospects of AI - Challenges of AI .		
UNIT 3	**Big Data and IoT**	**12+ 3**
Big Data : Evolution - Data Evolution - Data : Terminologies - Big Data Definitions - Essential of Big Data in Industry 4.0 - Big Data Merits and Advantages - Big Data Components : Big Data Characteristics - Big Data Processing Frameworks - Big Data Applications - Big Data Tools - Big Data Domain Stack : Big Data in Data Science - Big Data in IoT - Big Data in Machine Learning - Big Data in Databases - Big Data Use cases Big Data in Social Causes - Big Data for Industry - Big Data Roles and Skills -Big Data Roles - Learning Platforms; Internet of Things (IoT) : Introduction to IoT - Architecture of IoT - Technologies for IoT - Developing IoT Applications - Applications of IoT - Security in IoT .		
UNIT 4	**Applications And Tools Of Industry 4.0**	**12+ 3**

Applications of IoT – Manufacturing – Healthcare – Education – Aerospace and Defense – Agriculture – Transportation and Logistics – Impact of Industry 4.0 on Society: Impact on Business, Government, People. Tools for Artificial Intelligence, Big Data and Data Analytics, Virtual Reality, Augmented Reality, IoT, Robotics.							
UNIT 5	**Jobs 2030**						**12+ 3**
Industry 4.0 – Education 4.0 – Curriculum 4.0 – Faculty 4.0 – Skills required for Future - Tools for Education – Artificial Intelligence Jobs in 2030 – Jobs 2030 - Framework for aligning Education with Industry 4.0 .							
Lecture	**60**	**Tutorial**	**15**	**Practical**	**0**	**Total**	**75**
Text Book							
1. Higher Education for Industry 4.0 and Transformation to Education 5.0(2020)- P. Kaliraj& T. Devi							
References							
1.” Industry 4.0”, by Jean-Claude André, Publisher: Wiley-ISTE (2019)							
E-References							
https://nptel.ac.in/courses/106/105/106105195/							

COs vs POs

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO 1	3	2	1	0	3	1	0	1	1
CO 2	3	3	2	1	3	1	0	1	1
CO 3	3	3	3	2	3	1	1	1	1
CO 4	3	3	3	3	3	1	2	1	1
CO 5	3	3	3	3	3	1	2	1	1
TOTAL	**15**	**15**	**12**	**9**	**15**	**5**	**5**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**1**

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

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

Course Name			Astronomy	L	T	P	C
Course Code			XMT604	4	1	0	5
C	P	A		L	T	P	H
5	0	0		4	1	0	5
Prerequisite			Knowledge In Physics and Mathematics				

On successful completion of this course, the students will be able to:

Course Outcomes		Domain	Level
CO1	**Explain** the celestial sphere and its movement.	Cognitive	Understanding
CO2	**Demonstrate** the radius of earth and rotation of earth	Cognitive	Understanding
CO3	**Infer**the phenomenon of twilight and refraction.	Cognitive	Understanding
CO4	**Apply** Kepler's third law to construct explanations about planetary systems	Cognitive	Applying
CO5	**Interpret the e**quation of time, seasons and calendar	Cognitive	Understanding

UNIT 1 **12+ 3**

Celestial sphere – Diurnal motion

UNIT 2 **12+ 3**

The Earth: Zones of Earth – Terrestrial latitudes and longitudes – Radius of earth – Rotation of earth – Dip of horizon

UNIT 3 **12+ 3**

Twilight – Refraction

UNIT 4 **12+ 3**

Kepler's Laws

UNIT 5 **12+ 3**

Time: Equation of time – seasons – calendar

Lecture	60	Tutorial	15	Practical	0	Total	75

Text Book

1. "Astronomy" by S. Kumaravelu and SusheelaKumaravelu, Agasthiyar Publication, 2013.
   Unit : Chapter II, Article 39 – 79
   Unit II : Chapter III (Sec: 3.1 – 3.5), Article 87 – 110
   Unit III : Chapter III (sec: 3.6), Chapter IV, Article 111 – 134
   Unit IV : Chapter VI, Article 146 – 165
   Unit V : Chapter VII, Article 166 – 179

References

1 “Astronomy” by G.V. Ramachandran. Mission Press, Palayamkottai, 1965
2. Textbook on Astronomy H. SubramaniAiyar, Publisher : National Book Trust (1970)

E-References

- http://bulletin.columbia.edu/columbia-college/departments-instruction/astronomy/#coursestext [Columbia University]
- Https://Www.Physics.Utoronto.Ca/~Jharlow/Teaching/Astron03/Fullnotes/ [University Of Toronto]

COs vs POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	3	2	1	3	1	0	1	1
CO 2	3	3	2	1	3	1	0	1	1
CO 3	3	3	2	1	3	1	0	1	1
CO 4	3	3	3	2	3	1	1	1	1
CO 5	3	3	2	1	3	1	0	1	1
TOTAL	**15**	**15**	**11**	**7**	**15**	**5**	**1**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**1**

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

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

Course Name			Stochastic Processes	L	T	P	C
Course Code			XMT604	4	1	0	5
C	P	A		L	T	P	H
5	0	0		4	1	0	5
Prerequisite			Basic knowledge in probability theory and linear algebra including conditional expectation				

On successful completion of this course, the students will be able to:

	Course Outcomes	Domain	Level
CO1	**Explain** the classification of stochastic process and Markov chain	Cognitive	Understanding
CO2	**Identity** absorption probabilities and expected absorption time for Markov chains using the principle of conditioning with respect to the first jump	Cognitive	Applying
CO3	**Demonstrate** the concepts of birth and death processes	Cognitive	Understanding
CO4	**Summarize** the concepts of renewal process	Cognitive	Understanding
CO5	**Infer** the concepts of super martingales and sub martingales	Cognitive	Understanding

UNIT 1 **12+ 3**

Elements of Stochastic Processes-Two simple examples of Stochastic processes-Classification of general Stochastic processes – Markov Chains- Definitions – Examples of Markov Chain-Transition probability matrices of a Markov chain - classification of states of a Markov chain-Recurrence

UNIT 2 **12+ 3**

The basic limit theorem of Markov chains and applications-Discrete renewal equation-proof of theorem-Absorption probabilities - criteria for recurrence- A queuing Example.

UNIT 3 **12+ 3**

Classical Examples of continuous time Markov chains-General pure birth processes and Poisson processes-more about Poisson processes- A counter model-birth and death processes-Differential equations of birth and death processes-Examples of birth and death processes.

UNIT 4 **12+ 3**

Renewal processes- Definition of Renewal process and related concepts – Some examples of Renewal Processes – More on some special Renewal processes – Renewal equations and elementary Renewal theorem - The Renewal Theorem – Applications of Renewal theorem

UNIT 5 **12+ 3**

Martingales - Preliminary definitions and examples – Super martingales and Sub martingales-The optional sampling theorem.

Lecture	60	Tutorial	15	Practical	0	Total	75

Text Book
1. A First course in Stochastic Processes - Second Edition by Samuel karlin and M.Taylor, Academic Press New York. Unit I : Chapter (1.2 to 1.3) Unit II : Chapter (2.1 to 2.5) Unit III : Chapter (3.1 to 3.5) Unit IV : Chapter (4.1 to 4.6) Unit V : Chapter (6.1 to 6.3)
References
1. "Stochastic Processes" S.K. Srinivasan and K.M. Mehata, TataMcGraw - Hill Publishing Company Ltd., New Delhi. 2. "Stochastic Processes" Mehdi, Second Edition Wiley Eastern Ltd., New Delhi.
E-References
http//nptel.co.in

COs vs POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	3	2	1	3	1	0	1	1
CO 2	3	3	3	2	3	1	1	1	1
CO 3	3	3	2	1	3	1	0	1	1
CO 4	3	3	2	1	3	1	0	1	1
CO 5	3	3	2	1	3	1	0	1	1
TOTAL	**15**	**15**	**11**	**6**	**15**	**5**	**1**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**1**

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

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

Course Name			Cyber Security	L	T	P	C
Course Code			XUM005	1	0	0	1
C	P	A		L	T	SS	H
1	0	0		1	0	1	2
Prerequisite			Basic Programming knowledge and technical skills.				

On successful completion of this course, the students will be able to:			
Course Outcomes		**Domain**	**Level**
CO 1	**Understand** the fundamentals of Cyber Security and the technologies.	Cognitive	Understanding
CO 2	**Understand** the organizational structure of Cyber security	Cognitive	Understanding
CO 3	**Understand** the Cyber Security policy development	Cognitive	Understanding
CO 4	**Understand** the Indian IT act and the initiatives	Cognitive	Understanding
CO 5	**Understand** and **Apply** the Cyber security practices	Cognitive	Applying

UNIT 1	**INTRODUCTION**	**3**
Cyber Security – Cyber Security policy – Domain of Cyber Security Policy – Laws and Regulations – Enterprise Policy – Technology Operations – Technology Configuration – Strategy Versus Policy – Cyber Security Evolution – Productivity – Internet – E commerce – Counter Measures – Challenges		
UNIT 2	**CYBER SECURITY OBJECTIVES AND GUIDANCE**	**3**
Cyber Security Metrics – Security Management Goals – Counting Vulnerabilities – Security Frameworks – E Commerce Systems – Industrial Control Systems – Personal Mobile Devices – Security Policy Objectives – Guidance for Decision Makers – Tone at the Top – Policy as a Project– Cyber Security Management – Arriving at Goals – Cyber Security Documentation – The Catalog Approach – Catalog Format – Cyber Security Policy Taxonomy.		
UNIT 3	**CYBER SECURITY POLICY CATALOG**	**3**
Cyber Governance Issues – Net Neutrality – Internet Names and Numbers – Copyright and Trademarks – Email and Messaging – Cyber User Issues – Malvertising – Impersonation – Appropriate Use – Cyber Crime – Geo location – Privacy – Cyber Conflict Issues – Intellectual property Theft – Cyber Espionage – Cyber Sabotage – Cyber Welfare– Computer Forensics – Steganography		
UNIT 4	**CYBER SECURITY INITIATIVES AND IT ACT**	**3**
Counter Cyber Security Initiatives in India, Cyber Security Exercise, 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 5	**SECURITY PRACTICES**	**3**

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 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, AndroidSecurity, 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)

Lecture	**15**	**Tutorial**	**0**	**Practical**	**0**	**Total**	**15**

Text Books

1. Jennifer L. Bayuk, J. Healey, P. Rohmeyer, Marcus Sachs , Jeffrey Schmidt, Joseph Weiss "Cyber Security Policy Guidebook" John Wiley & Sons 2012.
2. Rick Howard "Cyber Security Essentials" Auerbach Publications 2011.
3. Cyber Laws & Information Technology, Jothi Rathan, VijayRathan, Bhrath Pubishers,7th Edition January 2019.

References

1. Modern Cyber security Practices by Pascal Ackerman, BPB Publications,2020
2. Dan Shoemaker Cyber security The Essential Body Of Knowledge, 1st ed. Cengage Learning 2011
3. Rhodes–Ousley, Mark, "Information Security: The Complete Reference", Second Edition, McGraw–Hill, 2013.

E–References

1. https://www.coursera.org/specializations/cyber–security
2. www. nptel.ac.in
3. http://professional.mit.edu/programs/short–programs/applied–cybersecurityhttps://us.norton.com/internetsecurity–how–to–cyber–security–best–practices–for–employees. html
4. https://www.meity.gov.in/content/cyber–laws

COs vs POs

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO 1	0	0	0	0	0	2	0	3	0
CO 2	0	0	0	0	0	0	2	0	0
CO 3	3	0	0	0	0	2	3	0	3
CO 4	0	0	0	0	0	0	0	0	0
CO 5	3	0	0	0	0	0	0	0	3
TOTAL	**6**	**0**	**0**	**0**	**0**	**4**	**5**	**3**	**6**

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

3.b. Curriculum and Syllabus of M.Sc Mathematics - Before Revision

MASTER OF SCIENCE
(TWO YEAR - FULL TIME) REGULATION - 2022
(Applicable to the students admitted from the academic year 2022-2023 onwards)

Semester	Course Code	Course Name	L	T	P	H	C
I	YMA101	Algebra - I	4	1	0	5	5
	YMA102	RealAnalysis - I	4	1	0	5	5
	YMA103	Graph Theory	4	1	0	5	5
	YMA104	Ordinary Differential Equations	4	1	0	5	5
	YMA105	Optimization Techniques	4	1	0	5	5
	YMA1E*	One among the list of electives (1E)	3	0	0	3	3
		Mentoring	0	0	0	1	0
		Library/ E- Library	0	0	0	1	0
		Total	**23**	**5**	**0**	**30**	**28**

***Listof Electives (1E)**

Elective Code	Course Name	L	T	P	C
1	Fuzzy sets and Fuzzy logic	3	0	0	3
2	Coding Theory	3	0	0	3
3	Neural Networks	3	0	0	3

Semester	Course Code	Course Name	L	T	P	H	C
II	YMA201	Algebra -II	4	1	0	5	5
	YMA202	Real Analysis -II	4	1	0	5	5
	YMA203	Partial Differential Equations	4	1	0	5	5
	YMA204	Classical Dynamics	4	1	0	5	5
	YMA2E*	One among the list of electives (2E)	3	0	0	3	3
NME	YMA205	Computer Programming (c++ Theory and Lab)	3	0	2	5	5
		Mentoring	0	0	0	1	0
		Library/ E- Library	0	0	0	1	0

	Total	22	4	2	30	28

***List of Electives (2E)**

Elective Code	Course Name	L	T	P	C
1	Fluid Dynamics	3	0	0	3
2	Combinatorics	3	0	0	3
3	Cryptography	3	0	0	3

Semester	Course Code	Course Name	L	T	P	H	C
III	YMA301	Topology	4	1	0	5	5
	YMA302	Integral Equations, Calculus of Variations and Transforms	4	1	0	5	5
	YMA303	Functional Analysis	4	1	0	5	5
	YMA304	Differential Geometry	4	1	0	5	5
	YMA305	Complex Analysis	4	1	0	5	5
	YMA3E*	One among the list of Electives (3E)	3	0	0	3	3
		Mentoring	0	0	0	1	0
		Library/ E- Library	0	0	0	1	0
		Total	**23**	**5**	**0**	**30**	**28**

***List of Electives (3E)**

Elective code	Course Name	L	T	P	C
1	Elements of Stochastic Processes	3	0	0	3
2	Mathematical Modeling	3	0	0	3
3	Data Analysis using SPSS	3	0	0	3

Semester	Course Code	Course Name	L	T	P	H	C
IV	YMA401	Project	0	0	0	30	8
		Total				**30**	**8**

Mandatory: Value Added courseandSelf LearningCourse – (NPTEL) will be offered during theprogramme

Total Number of Credits: 92

Total Number of Hours :120

COURSE NAME			**ALGEBRA - I**	**L**	**T**	**P**	**C**
COURSE CODE			**YMA101**	**4**	**1**	**0**	**5**
C	**P**	**A**		**L**	**T**	**P**	**H**
5	**0**	**0**		**4**	**1**	**0**	**5**
PREREQUISITE			Basics of sets, relations and functions				

On successful completion of this course, the students will be able to:

	COURSE OUTCOMES	DOMAIN	LEVEL
CO 1	**Construct**Cayley table for the given symmetric group of degree 2 and 3	Cognitive	Applying
CO 2	**Extend** group structure to finite permutation groups	Cognitive	Understanding
CO 3	**Classify** groups of finite order upto 120 using Sylow's theorems	Cognitive	Analyzing
CO 4	**Identify** the quotient field of the given integral domain	Cognitive	Applying
CO 5	**Categorize** the factorization of polynomials over a field	Cognitive	Analyzing

UNIT 1 — **15 hours**

Binary Operations – Groups - Subgroups – Permutations I – Permutations II – Cyclic Groups

UNIT 2 — **15 hours**

Isomorphisms – Direct Products – Finitely Generated Abelian groups - Groups of Cosets - Normal subgroups and factor groups- Homomorphisms

UNIT 3 — **15 hours**

Series of Groups – Isomorphism theorems- Proof of the Jordan Holder theorem—Group action on a set- Applications of G-sets to counting - Sylow's theorems –ApplicationsofSylow theorems

UNIT 4 — **15 hours**

Rings – Integral Domains - Some non-commutative examples –The Field of quotients – Quotient rings and Ideal.

UNIT 5 — **15 hours**

Homomorphism of Rings – Rings of polynomials – Factorization of Polynomialsoverafield – Euclideandomains-Gaussian integers and norms

LECTURE	**60**	**TUTORIAL**	**15**	**PRACTICAL**	**0**	**TOTAL**	**75**

TEXT BOOK
1.John B. Fraleigh, A First Course in Abstract Algebra, Narosa Publishing House, Third edition, 1992. UNIT – I Chapter 1, 2, 3,4,5,6 UNIT – II Chapter 7,8,9,11,12,13 UNIT – III Chapter 14,15,16,17,18,19 UNIT – IV Chapter 23,24,25,26,27,28 UNIT – V Chapter 29,30,31,33,34
REFERENCES
1.P.B. Bhattacharya et al., Basic Abstract Algebra, 2nd edition, Cambridge University Press, 1995 2.I.N.Herstein, Topics in Algebra, John Wiley, 2nd Edition, 1975. 3.R. Solomon, Abstract Algebra, AMS Indian edition, 2010.

CO Vs PO

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO 1	3	3	3	2	3	1	1	1	1
CO 2	3	3	2	1	3	1	0	1	1
CO 3	3	3	3	1	3	1	1	1	1
CO 4	3	3	3	1	3	1	1	1	1
CO 5	3	3	3	1	3	1	1	1	1
TOTAL	**15**	**15**	**14**	**6**	**15**	**5**	**4**	1	**5**
SCALED VALUE	**3**	**3**	**3**	**2**	**3**	1	**1**	1	**1**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation									
1-5→1, 6-10→2, 11-15→3									

COURSE NAME			REAL ANALYSIS - I	L	T	P	C
COURSE CODE			YMA102	4	1	0	5
C	P	A		L	T	P	H
5	0	0		4	1	0	5
PREREQUISITE			Basic concepts of real numbers				

On successful completion of this course, the students will be able to:

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Explain** the concepts of real number system and its algebraic properties	Cognitive	Understanding
CO 2	**Explain** the concepts of metric space and its properties	Cognitive	Understanding
CO 3	**Apply** convergence sequence in metric space	Cognitive	Applying
CO 4	**Classify** the characterization of compact metric space geometrically	Cognitive	Analyzing
CO 5	**Utilize** the Banach contraction principle in formulating and solving given problems	Cognitive	Applying

UNIT 1		**15 hours**
Sets and Functions, Mathematical Induction, Finite and Infinite sets. Real Number system: Algebraic and Order properties: Infimum, Supremum, LUB Axiom. Countable and uncountable sets.		
UNIT 2		**15 hours**
Metric spaces – Definition and examples - open balls and open sets		
UNIT 3		**15 hours**
Sequences and Series of real numbers – limit theorems – monotone sequences – Cauchy criterion – limsup, liminf - Convergent sequences in metric spaces – limit and cluster points – Cauchy sequences – Bounded sets – Dense sets.		
UNIT 4		**15 hours**
Continuous functions – Equivalent Definitions of Continuity – Uniform Continuity - Limit of a function – Discontinuities of a Real Valued function - Compact spaces and their properties – Continuous functions on Compact spaces- Characterization of Compact Metric spaces.		
UNIT 5		**15 hours**
Connectedness: Connected spaces – Complete metric spaces – Examples- BaireCategory Theorem –		

Banach Contraction Principle.							
LECTURE	**60**	**TUTORIAL**	**15**	**PRACTICAL**	**0**	**TOTAL**	**75**

TEXT BOOKS

1. R.G. Bartle and D.R. Sherbert,Introduction to Real Analysis 3rdEdn,John Wiley &Sons, 2000.
2. S.Kumaresan,TopologyofMetricSpaces,NarosaPublishingHouse,New Delhi,2005.

UNIT–I- Chapters 1 and 2from [1]
UNIT–II -Chapter1from [2]
UNIT–III-Chapter3from [1]andChapter2sections 2.1to2.5 from[2]
UNIT–IV-Chapter3, Chapter4from[2](sections3.3and 3.6omitted)and Chapter5 from [1]
UNITV-Chapter 5section5.1andChapter 6sections 6.1,6.3and6.4(section6.2,6.3.16 and6.3.17 omitted)from [2]

REFERENCES

1. EdwardD.Gaughan,IntroductiontoAnalysis,AMS,Indianedition,2010.
2. KennethA. Ross,ElementaryAnalysis:TheTheoryofCalculus,Springer Verlag,2004.
3. WalterRudin,PrinciplesofMathematicalAnalysis,ThirdEdition,McGrawHill,1976.

COs VS POs

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO 1	3	3	2	1	3	1	0	1	1
CO 2	3	3	2	1	3	1	0	1	1
CO 3	3	3	3	2	3	1	1	1	1
CO 4	3	3	3	3	3	1	2	1	1
CO 5	3	3	3	2	3	1	1	1	1
TOTAL	**15**	**15**	**13**	**9**	**15**	**5**	**4**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**1**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation									
1-5→1, 6-10→2, 11-15→3									

COURSE NAME			GRAPH THEORY	L	T	P	C
COURSE CODE			YMA103	4	1	0	5
C	P	A		L	T	P	H
5	0	0		4	1	0	5
PREREQUISITE			Basic concepts of Graphs				

On successful completion of this course, the students will be able to:

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Explain**basic concepts of **graphs**	Cognitive	Understanding
CO 2	**Explain** vertex connectivity and edge connectivity in graphs	Cognitive	Understanding
CO 3	**Explain**Eulerian Graphs and Hamiltonian Graphs	Cognitive	Understanding
CO 4	**Apply**coloring principle for solving problems in Vertex colorings and Edge coloring	Cognitive	Applying
CO 5	**Demonstrate** planar graphs	Cognitive	Understanding

UNIT 1	Basic Results	15 hours
Basic Concepts - Subgraphs - Degrees of Vertices - Paths and ConnectednessOperations on Graphs - Directed Graphs: Basic Concepts - Tournaments.		
UNIT 2	Connectivity	15 hours
Vertex Cuts and Edge Cuts - Connectivity and Edge - Connectivity, Trees:Definitions, Characterization and Simple Properties - Counting the Number of Spanning Trees - Cayley's Formula.		
UNIT 3	Independent Sets and Matchings	15 hours
Vertex Independent Sets and Vertex Coverings - Edge Independent Sets -Matchings and Factors - Eulerian Graphs - Hamiltonian Graphs.		
UNIT 4	Graph Colourings	15 hours
Vertex Colouring - Critical Graphs - Triangle - Free Graphs - Edge Colourings of Graphs - Chromatic Polynomials.		
UNIT 5	Planarity	15 hours
Planar and Nonplanar Graphs - Euler Formula and its Consequences - K5 and K3,3 are Nonplanar Graphs - Dual of a Plane Graph - The Four-Colour Theorem and the Heawood Five-Colour Theorem-Kuratowski's Theorem.		

LECTURE	60	TUTORIAL	15	PRACTICAL	0	TOTAL	75

TEXT BOOK
1.Douglas B. West, "Introduction to Graph Theory", Prentice Hall of India, Second Edition, 2002.
REFERENCES
1. Bondy J. A, and Murty U. S. R., "Graph Theory", Springer, 2008. 2. Balakrishnan R. and Ranganathan K., "A textbook of Graph Theory", Springer, 2012. 3. Graham R.L., Rothschild B.L and Spencer J.H., "Ramsey Theory", Wiley Publishers, Second Edition, 1990. 4. Biggs N., "Algebraic Graph Theory", Cambridge Tracts in Mathematics 67, Cambridge University Press, 1994. MX8003 Algebraic Theory of Semigroups.

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	3	2	1	3	1	0	1	1
CO 2	3	3	3	2	3	1	1	1	1
CO 3	3	3	2	1	3	1	0	1	1
CO 4	3	3	3	2	3	1	1	1	1
CO 5	3	3	2	1	3	1	0	1	1
TOTAL	**15**	**15**	**12**	**7**	**15**	**5**	**2**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**1**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation									
1-5→1, 6-10→2, 11-15→3									

COURSE NAME			ORDINARY DIFFERENTIAL EQUATIONS	L	T	P	C
COURSE CODE			YMA104	**4**	**1**	**0**	**5**
C	P	A		L	T	P	H
5	**0**	**0**		**4**	**1**	**0**	**5**
PREREQUISITE			Knowledge in differentiation				

On successful completion of this course, the students will be able to:

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Utilize** the theory of power series when solving second order differential equations	Cognitive	Applying
CO 2	**Solve** the problems arises in mathematical physics using properties of Bessel functions	Cognitive	Applying
CO 3	**Apply** Picard's theorem for calculating exact solution for a given initial value problem	Cognitive	Applying
CO 4	**Examine** the classical vibrating string problem through eigenvalues and eigenfunctions with given boundary conditions	Cognitive	Analyzing
CO 5	**Identify** critical points and phase portrait of nonlinear equations	Cognitive	Applying

UNIT 1		**15 hours**
The general solution of the homogeneous equation – The use of one known solution to find another – The method of variation of parameters – Power Series solutions. A review of power series – Series solutions of first order equations – Second order linear equations; Ordinary points.		
UNIT 2		**15 hours**
Regular Singular Points – Gauss's hypergeometric equation – The Point at infinity - Legendre Polynomials – Bessel functions – Properties of Legendre Polynomials and Bessel functions.		
UNIT 3		**15 hours**
Linear Systems of First Order Equations – Homogeneous Equations with Constant Coefficients – The Existence and Uniqueness of Solutions of Initial Value Problem for First Order Ordinary Differential Equations – The Method of Solutions of Successive Approximations and Picard's Theorem.		
UNIT 4		**15 hours**

Oscillation Theory and Boundary value problems – Qualitative Properties of Solutions– Sturm Comparison Theorems – Eigenvalues, Eigenfunctions and the Vibrating String.

UNIT 5		**15 hours**
Nonlinearequations:AutonomousSystems;thephaseplaneanditsphenomena–Types of criticalpoints;Stability – critical points and stability for linear systems – StabilitybyLiapunov's direct method – Simple critical pointsof nonlinear systems.		

LECTURE	**60**	**TUTORIAL**	**15**	**PRACTICAL**	**0**	**TOTAL**	**75**

TEXT BOOK

1.G.F. Simmons, Differential Equations with Applications and Historical Notes, TMH, New Delhi, 1974.

UNIT – I -Chapter 3: Sections 15, 16, 19 and Chapter 5: Sections 25 to 27

UNIT – II -Chapter 5 : Sections 28 to 31 and Chapter 6: Sections 32 to 35

UNIT – III -Chapter 7: Sections 37, 38 and Chapter 11: Sections 55, 56

UNIT – IV -Chapter 4: Sections 22 to 24

UNIT – V -Chapter 8: Sections 40 to 44

REFERENCES

1. M.E. Taylor, Introduction to Differential Equations, AMS Indian Edition, 2011.
2. M. Braun, Differential Equations and Their Applications, Springer, 1992.
3. E.A. Coddington and N. Levinson, Theory of Ordinary Differential Equations, McGraw Hill, 1955.

COs VS POs

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO 1	3	3	3	2	3	1	1	1	1
CO 2	3	3	3	2	3	1	1	1	1
CO 3	3	3	3	2	3	1	1	1	1
CO 4	3	3	3	3	3	1	2	1	1
CO 5	3	3	3	2	3	1	1	1	1
TOTAL	15	15	15	11	15	5	6	5	5
SCALED VALUE	3	3	3	3	3	1	2	1	1
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation									
1-5→1, 6-10→2, 11-15→3									

COURSE NAME			OPTIMIZATION TECHNIQUES	L	T	P	C
COURSE CODE			YMA105	4	1	0	5
C	P	A		L	T	P	H
5	0	0		4	1	0	5
PREREQUISITE			Probability and random process				

On successful completion of this course, the students will be able to:

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Explain** the systematic way of approaching a decision theory to get desired outcome of where the possibility of occurrence of different outcomes are evaluated in advance.	Cognitive	Understanding
CO 2	**Solve** the abilities in project evaluation techniques using PERT, CPM	Cognitive	Applying
CO 3	**Explain** the dynamics of inventory management's principles, concepts, and techniques	Cognitive	Understanding
CO 4	**Solve** fourth order polynomial function using Newton Raphson Method	Cognitive	Applying
CO 5	**Apply**the direct search method and gradient method for obtaining optimal solutions for the given function	Cognitive	Applying

UNIT 1	DECISION THEORY	15 hours
Steps in Decision theory Approach - Types of Decision-Making Environments - Decision Making Under Uncertainty - Decision Making under Risk - Posterior Probabilities and Bayesian Analysis - Decision Tree Analysis - Decision Making with Utilities		
UNIT 2	**PROJECT MANAGEMENT: PERT AND CPM**	**15 hours**
Basic Differences between PERT and CPM - Steps in PERT/CPM Techniques - PERT/CPM Network Components and Precedence Relationships - Critical Path Analysis - Probability in PERT Analysis - Project time-cost Trade Off - Updating the Project - Resource Allocation		
UNIT 3	**DETERMINISTIC INVENTORY CONTROLMODELS**	**15 hours**
Meaning of Inventory Control - Functional Classification - Advantage of Carrying Inventory - Features of Inventory System - Inventory Model building - Deterministic Inventory Models with no shortage - Deterministic Inventory with ShortagesProbabilistic Inventory Control Models:Single Period Probabilistic Models without Setup cost - Single Period Probabilities Model with Setup cost.		
UNIT 4	**Classical Optimization Theory**	**15 hours**
Unconstrained Problems-Necessary and Sufficient Conditions- The Newton-Raphson Method- Constrained Problems- Equality Constraints- Inequality Constraints.		
UNIT 5	**Nonlinear Programming Algorithms**	**15 hours**
Unconstrained Algorithms- Direct Search Method- Gradient Method- Constrained Algorithms- Quadratic Programming- Chance-Constrained Programming		

LECTURE	60	TUTORIAL	15	PRACTICAL	0	TOTAL	75

TEXT BOOK

1.J.K.Sharma, "Operations Research Theory and Applications", Third Edition, Macmillan India Ltd.,

2007 Unit I - Chapter-11 (Section 11.1 - 11.8) Unit II - Chapter-13 (Section 13.1 - 13.9) Unit III - Chapter-14 (Section 14.1 - 14.8); Chapter-15 : (Section15.1 - 15.4) 2.Hamdy A Taha, Operations Research: An Introduction, Eighth Edition,. University of Arkansas, Fayetteville, PEARSON Prentice Hall. © 2007 by Pearson Education, Inc. Unit IV-Chapter 18 – Section 18.1.1, 18.1.2, 18.2.1, 18.2.2 Unit V-Chapter 19 – Section 19.1.1, 19.1.2, 19.2.2 and 19.2.3
REFERENCES
1. HillierF.S. andJ.Lieberman, “Introduction to Operations Research” (8th Edition), Tata McGraw Hill Publishing Company, New Delhi, 2006. 2. Beightler. C, D.Phillips, B. Wilde, “Foundations of Optimization” (2nd Edition) Prentice Hall Pvt Ltd., New York,1979 3. Bazaraa, M.S; J.J.Jarvis, H.D.Sharall, “Linear Programming and Network flow”, John Wiley and sons, New York,1990. 4. Gross, D and C.M.Harris, “Fundamentals of Queueing Theory”, (3rd Edition), Wiley andSons, New York, 1998. 5. Hamdy A. Taha , “Operations Research” (sixth edition), Prentice - Hall of India PrivateLimited, New Delhi.2007

COs VS POs

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO 1	3	3	2	1	3	1	0	1	1
CO 2	3	3	3	2	3	1	1	1	1
CO 3	3	3	2	1	3	1	0	1	1
CO 4	3	3	2	1	3	1	0	1	1
CO 5	3	3	2	1	3	1	0	1	1
TOTAL	**15**	**15**	**11**	**6**	**15**	**5**	**1**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**1**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation									
1-5→1, 6-10→2, 11-15→3									

COURSE NAME			FUZZY SETS AND FUZZY LOGIC	L	T	P	C
COURSE CODE			YMA1E1	3	0	0	3
C	P	A		L	T	P	H
3	0	0		3	0	0	3
PREREQUISITE			Basic concepts of sets				

On successful completion of this course, the students will be able to:

	COURSE OUTCOMES	DOMAIN	LEVEL
CO 1	**Compare** the relationship between Crisp sets and Fuzzy sets	Cognitive	Applying
CO 2	**Explain** operation on Fuzzy Sets	Cognitive	Understanding
CO 3	**Compare** Fuzzy Relations and crisp relations	Cognitive	Applying
CO 4	**Demonstrate** the propositional calculus	Cognitive	Understanding
CO 5	**Explain** the concepts of fuzzy logic	Cognitive	Understanding

UNIT 1	**Crisp Sets and Fuzzy Sets**	**9 hours**
Crisp sets basic definitions - the notion of fuzzy sets - basic concepts of fuzzy sets		
UNIT 2	**Operation on FuzzySets**	**9 hours**
Fuzzy complement - fuzzy union - fuzzy intersection - combination and general aggregation operations		
UNIT 3	**Fuzzy Relations**	**9 hours**
Crisp and fuzzy relations - binary relation - equivalence and similarity relations - tolerance relations-orderings		
UNIT 4	**Classical Logic**	**9 hours**
Tautologies - contradictions - equivalence - exclusive OR and exclusive NOR - logical proofs		
UNIT 5	**Fuzzy Logic**	**9hours**
Fuzzy logic - approximate reasoning - fuzzy tautologies - contradictions - equivalence and logical proofs		

LECTURE	**45**	**TUTORIAL**	**0**	**PRACTICAL**	**0**	**TOTAL**	**45**

TEXT BOOKS

1. George J. Klir& Tina A. Folger, “Fuzzy Sets, Uncertainty, and Information”, Prentice Hall of India Pvt. Ltd., New Delhi, 1988
2. Timothy J. Ross, “Fuzzy Logic with Engineering Applications”, 3rd edition, McGraw-Hill. Inc, 2010.

REFERENCES
1. Zimmermann. H.J, “Fuzzy Set Theory and Its Applications”, 4th edition, Springer, Netherlands,2015. 2. Bart Kosko, “Neural Networks and Fuzzy Systems”, Prentice-Hall International,1992.

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	3	3	2	3	1	1	1	1
CO 2	3	3	2	1	3	1	0	1	1
CO 3	3	3	3	2	3	1	1	1	1
CO 4	3	3	2	1	3	1	0	1	1
CO 5	3	3	2	1	3	1	0	1	1
TOTAL	**15**	**15**	**12**	**7**	**15**	**5**	**2**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**1**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation									
1-5→1, 6-10→2, 11-15→3									

COURSE NAME			CODING THEORY	L	T	P	C
COURSE CODE			YMA1E2	3	0	0	3
C	P	A		L	T	P	H
3	0	0		3	0	0	3
PREREQUISITE			Linear algebra				

On successful completion of this course, the students will be able to:

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Utilize** the maximum likelihood decoding rule to decode the received words	Cognitive	Applying
CO 2	**Identify** a generator matrix and parity check matrix for the given binary linear code	Cognitive	Applying
CO 3	**Explain** various bounds involved in coding theory	Cognitive	Understanding
CO 4	**Construct** the generator polynomial for all binary cyclic codes of given length	Cognitive	Applying
CO 5	**Examine** the decoding of narrow-sense binary BCH codes	Cognitive	Analyzing

UNIT 1 **9hours**

Error detection, Correction and decoding: Communication channels – Maximum likelihood decoding – Hamming distance – Nearest neighborhood minimum distancedecoding – Distance of a code

UNIT 2 **9hours**

Linear codes: Linear codes – Self orthogonal codes – Self dual codes – Bases forlinear codes – Generator matrix and parity check matrix – Encoding with a linear code – Decoding of linear codes – Syndrome decoding.

UNIT 3 **9 hours**

Bounds in coding theory: The main coding theory problem – lower bounds -Sphere covering bound – Gilbert Varshamov bound – Binary Hamming codes – q-ary Hamming codes – Golay codes – Singleton bound and MDS codes – Plotkin bound

UNIT 4 **9 hours**

Cyclic codes: Definitions – Generator polynomials – Generator matrix and parity check matrix – Decoding of Cyclic codes.

UNIT 5							**9 hours**
Special cyclic codes: BCH codes – Parameters of BCH codes – Decoding of BCHcodes – Reed Solomon codes.							
LECTURE	**45**	**TUTORIAL**	**0**	**PRACTICAL**	**0**	**TOTAL**	**45**
TEXT BOOK							
1.San Ling and Chaoping Xing , Coding Theory: A First Course, Cambridge University Press, 2004. Unit 1 : Sections 2.1, 2.2, 2.3, 2.4, 2.5 Unit 2 : Sections 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8 Unit 3 : Sections 5.1, 5.2, 5.3, 5.4, 5.5, Unit 4 : Sections 7.1, 7.2, 7.3, 7. Unit 5 : Sections 8.1, 8.2							
REFERENCES							
1. S. Lin &D. J. Costello, Jr., Error Control Coding: Fundamentals andApplications, Prentice-Hall, Inc., New Jersey,1983. 2. Vera Pless, Introduction to the Theory of Error Correcting Codes, Wiley, NewYork, 1982. 3. E. R Berlekamp, Algebraic Coding Theory, Mc Graw-Hill,1968. 4. H. Hill, A First Course in Coding Theory, OUP,1986							

COs VS POs

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO 1	3	3	3	2	3	1	1	1	1
CO 2	3	3	3	2	3	1	1	1	1
CO 3	3	3	2	1	3	1	0	1	1
CO 4	3	3	3	2	3	1	1	1	1
CO 5	3	3	3	3	3	1	2	1	1
TOTAL	15	15	14	10	15	5	6	5	5
SCALED VALUE	3	3	3	2	3	1	2	1	1
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation									
1-5→1, 6-10→2, 11-15→3									

COURSE NAME			NEURAL NETWORKS	L	T	P	C
COURSE CODE			YMA1E3	3	0	0	3
C	P	A		L	T	P	H
3	0	0		3	0	0	3
PREREQUISITE			Linear algebra				

On successful completion of this course, the students will be able to:

	COURSE OUTCOMES	DOMAIN	LEVEL
CO 1	**Summarize** different neuron network models	Cognitive	Understanding
CO 2	**Explain** Perceptron Architectures and Learning Rules	Cognitive	Understanding
CO 3	**Apply**Hebb rule for finding the appropriate weight matrix for the given linear associator	Cognitive	Applying
CO 4	**Construct** back propagation algorithm for the given network	Cognitive	Applying
CO 5	**Identify** the second order Taylor series expansions for the given function about the two minima	Cognitive	Applying

UNIT 1	Neuron Model and Network Architectures	9 hours
Mathematical Neuron Model- Network Architectures- Perceptron-Hamming Network- Hopfield Network-Learning Rules.		
UNIT 2	**Perceptron Architectures**	**9 hours**
Perceptron Architectures and Learning Rule with Proof of Convergence. Supervised Hebbian Learning - Linear Associator.		
UNIT 3	**Supervised Hebbian Learning**	**9 hours**
The Hebb Rule-Pseudo inverse Rule-Variations of Hebbian Learning-Back Propagation - Multilayer Perceptron		
UNIT 4	**Back Propagation**	**9 hours**
Back propagation Algorithm-Convergence and Generalization - Performances Surfaces and Optimum Points-Taylor series.		
UNIT 5	**Performance Surfaces and Performance Optimizations**	**9 hours**
Directional Derivatives - Minima-Necessary Conditions for Optimality-Quadratic Functions-Performance Optimizations-Steepest Descent-Newton’s Method-Conjugate Gradient.		

LECTURE	45	TUTORIAL	0	PRACTICAL	0	TOTAL	45

TEXT BOOK

1.Martin T. Hagan, Howard B. Demuth and Mark Beale, Neural Network Design, Vikas Publishing House, New Delhi,2002.

REFERENCES

1. James A. Freeman, David M. Skapura, Neural Networks Algorithms, Applications and Programming Techniques, Pearson Education, 2003.
2. Robert J. Schalkoff, Artificial Neural Network, McGraw-Hill International Edition, 1997.

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	3	2	1	3	1	0	1	1
CO 2	3	3	2	1	3	1	0	1	1
CO 3	3	3	3	2	3	1	1	1	1
CO 4	3	3	3	2	3	1	1	1	1
CO 5	3	3	3	2	3	1	1	1	1
TOTAL	**15**	**15**	**13**	**8**	**15**	**5**	**3**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**1**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation									
1-5→1, 6-10→2, 11-15→3									

COURSE NAME			ALGEBRA - II	L	T	P	C
COURSE CODE			YMA201	4	1	0	5
C	P	A		L	T	P	H
5	0	0		4	1	0	5
PREREQUISITE			YMA101				

On successful completion of this course, the students will be able to:

	COURSE OUTCOMES	DOMAIN	LEVEL
CO 1	**Explain** the concepts of prime ideal and Maximal ideal	Cognitive	Understanding
CO 2	**Explain** the concepts of splitting fields	Cognitive	Understanding
CO 3	**Explain** the proof solvability by radicals	Cognitive	Understanding
CO 4	**Explain** the concepts of Galois's Extensions	Cognitive	Understanding
CO 5	**Explain** the proof of fundamental theorem of Galois's Theory	Cognitive	Understanding

UNIT 1		**15 hours**
Prime ideals and Maximal Ideals, Irreducible polynomials.		
UNIT 2		**15 hours**
Classical Formulas, Splitting Fields		
UNIT 3		**15 hours**
The Galois Group, Roots of Unity, Solvability by Radicals.		
UNIT 4		**15 hours**
Independence of Characters, Galois Extensions		
UNIT 5		**15hours**
The Fundamental theorem of Galois theory, Applications, Galois Great Theorem.		

LECTURE	60	TUTORIAL	15	PRACTICAL	0	TOTAL	75

TEXT BOOK

1.Joseph Rotman, Galois Theory, 2nd edition, Springer Verlag, 1990.

UNIT – I Pages 31 - 43

UNIT – II Pages 44 -58

UNIT – III Pages 59 - 75

UNIT – IV Pages 76-82

UNIT – V Pages 83-95
REFERENCES
1. DavidS. DummitandRichardM.Foote,AbstractAlgebra,2nd Edition,Wiley StudentEdition, 2008. 2. SergeLang. Algebra-Revisedthird edition-Springer–Verlag-2002. 3. IanStewart,GaloisTheory,ChapmanandHall,1973

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	3	2	1	3	1	0	1	1
CO 2	3	3	2	1	3	1	0	1	1
CO 3	3	3	2	1	3	1	0	1	1
CO 4	3	3	2	1	3	1	0	1	1
CO 5	3	3	2	1	3	1	0	1	1
TOTAL	**15**	**15**	**15**	**5**	**15**	**5**	**0**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**1**	**3**	**1**	**0**	**1**	**1**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation									
1-5→1, 6-10→2, 11-15→3									

COURSE NAME			REAL ANALYSIS - II	L	T	P	C
COURSE CODE			YMA202	4	1	0	5
C	P	A		L	T	P	H
5	0	0		4	1	0	5
PREREQUISITE			Basic concepts of convergence and uniform convergence				

On successful completion of this course, the students will be able to:			
COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Explain** mean value theorem and functions of bounded variations	Cognitive	Understanding
CO 2	**Compare** mean value theorems for Riemann Stieltjes Integrals	Cognitive	Applying
CO 3	**Explain** uniform convergence and integration and differentiation	Cognitive	Understanding
CO 4	**Explain** directional derivatives and total derivative	Cognitive	Understanding
CO 5	**Explain** Inverse function theorem and Implicit function theorem	Cognitive	Understanding

UNIT 1		15 hours
Differentiation of single variable: Derivatives – The chain rule – local extrema – Rolle's theorem – Mean Value Theorem – Taylor's formula – Derivatives of vector – valued functions – Functions of Bounded variation and rectifiable curves – Total variation – Functions of bounded variation – Equivalence of paths – Change of parameter.		
UNIT 2		15 hours
Riemann – Stieltjesintegral:Definition –linearpropertiesoftheintegral– Necessary conditions for the existence -First fundamental theorem of Integral calculus -Mean Value Theorem for integrals – Second fundamental theorem of Integral calculus-Change of variable in a Riemann integral – Second Mean value Theorem for Riemannintegrals.		
UNIT 3		15 hours
Sequenceandseriesoffunctions–Pointwiseconvergence–Uniformconvergence– Uniformconvergenceandintegration–UniformconvergenceandDifferentiation– Sufficientconditionsforuniformconvergenceofaseries.		

UNIT 4		15 hours
Functions of Several variables – Directional derivative –Total derivative – Jacobian – Chain rule –Mean Value Theorem – Taylor's formula.		
UNIT 5		15hours
Inverse function theorem – Implicit function theorem – Extremum problems with side conditions.		

LECTURE	60	TUTORIAL	15	PRACTICAL	0	TOTAL	75

TEXT BOOK

1. TomM.Apostol, MathematicalAnalysisSecondEdition,Narosa Publishing House, NewDelhi,1985.

UNIT–I-Chapter5 and 6
UNIT–II-Chapter7Section 7.1-7.22
UNIT–III- Chapter 9Section 9.1 - 9.11 and 9.14 -9.18
UNIT–IV-Chapter12
UNIT–V-Chapter13

REFERENCES

1. WalterRudin, Principles of Mathematical Analysis,Third Edition,Mc GrawHill,1976.
2. TomApostol,Calculus II,Mc GrawHill,1983.

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	3	2	1	3	1	0	1	1
CO 2	3	3	3	2	3	1	1	1	1
CO 3	3	3	2	1	3	1	0	1	1
CO 4	3	3	2	1	3	1	0	1	1
CO 5	3	3	2	1	3	1	0	1	1
TOTAL	15	15	11	6	15	5	1	5	5
SCALED VALUE	3	3	2	2	3	1	1	1	1
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation									
1-5→1, 6-10→2, 11-15→3									

COURSE NAME			PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	C
COURSE CODE			YMA203	4	1	0	5
C	P	A		L	T	P	H
5	0	0		4	1	0	5
PREREQUISITE			Knowledge in Undergraduate differential equations				

On successful completion of this course, the students will be able to:

	COURSE OUTCOMES	DOMAIN	LEVEL
CO 1	**Summarize** the first order partial differential equations	Cognitive	Understanding
CO 2	**Analyze**the different methods of Partial Differential Equations of the Second Order	Cognitive	Analyzing
CO 3	**Apply**the method of variable separable for solving Laplace Equation	Cognitive	Applying
CO 4	**Apply**the partial differential equations for obtaining general solutions of wave equation	Cognitive	Applying
CO 5	**Utilize** Green's Function for finding solutions of diffusion equation	Cognitive	Applying

UNIT 1	Partial Differential Equations of the First Order	15 hours

PartialDifferentialEquations–OriginsofFirstOrderDifferentialEquations–Cauchy'sProblem for first order equations– Linear Equations of the first order– Nonlinear partial differential equations of the first order – Cauchy's method of characteristics – Compatible system of First order Equations–Solutions satisfying given Condition- Jacobi's method.

UNIT 2	Partial Differential Equations of the Second Order	15 hours

The Origin of Second Order Equations – Linear partial Differential Equations with constant coefficients – Equations with variable coefficients – Separation of variables – The method of Integral Transforms– Non – linear equations of the second order.

UNIT 3	Laplace's Equation	15 hours

Elementary solutions of Laplace equation – Families of Equipotential Surfaces – Boundary value problems – Separation of variables – Surface Boundary Value Problems – Separation of Variables – Problems with Axial Symmetry – The Theory of Green's Function for Laplace Equation.

UNIT 4	The Wave Equation	15 hours

The Occurrence of the wave equation in Physics–Elementary Solutions of the One–dimensional Wave equations – Vibrating membrane, Application of the calculus of variations –Three dimensional problem–General solutions of the Wave equation		
UNIT 5	**The Diffusion Equation**	**15hours**
Elementary Solutions of the Diffusion Equation – Separation of variables – The use of Integral Transforms – The use of Green's functions		

LECTURE	60	TUTORIAL	15	PRACTICAL	0	TOTAL	75

TEXT BOOK

1.Ian Sneddon, Elements of Partial Differential Equations, McGraw Hill International Book Company, New Delhi, 1983

REFERENCES

1. M. D. Raisinghania, Advanced Differential Equations, S. Chand and Company Ltd., New Delhi, 2001.
2. K. Sankara Rao, Introduction to Partial Differential Equations, Second edition, Prentice-Hall of India, New Delhi, 2006.
3. J. N. Sharma and K. Singh, Partial Differential Equations for Engineers and Scientists, Narosa Publishing House, 2001.

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	3	2	1	3	1	0	1	1
CO 2	3	3	3	3	3	1	2	1	1
CO 3	3	3	3	2	3	1	1	1	1
CO 4	3	3	3	2	3	1	1	1	1
CO 5	3	3	3	2	3	1	1	1	1
TOTAL	15	15	14	10	15	5	5	5	5
SCALED VALUE	3	3	3	2	3	1	1	1	1
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation									
1-5→1, 6-10→2, 11-15→3									

COURSE NAME			**CLASSICAL DYNAMICS**	**L**	**T**	**P**	**C**
COURSE CODE			**YMA204**	**4**	**1**	**0**	**5**
C	**P**	**A**		**L**	**T**	**P**	**H**
5	**0**	**0**		**4**	**1**	**0**	**5**
PREREQUISITE			Trigonometry and Statics				

On successful completion of this course, the students will be able to:

	COURSE OUTCOMES	DOMAIN	LEVEL
CO 1	**Explain** the mechanical system, energy and momentum.	Cognitive	Understanding
CO 2	**Explain** Lagrange's equation and integrals of motion.	Cognitive	Understanding
CO 3	**Explain**Rayleigh's dissipation function and impulsive motion	Cognitive	Understanding
CO 4	**Explain**Hamilton's principle andHamilton's equations	Cognitive	Understanding
CO 5	**Explain**Hamilton's Principal Function, The Hamiltonand Jacobi's equation	Cognitive	Understanding

UNIT 1	**15 hours**

Introductory concepts: The mechanical system - Generalized Coordinates - constraints - virtual work - Energy and momentum.

UNIT 2	**15 hours**

Lagrange's equation: Derivation and examples - Integrals of the Motion - Small oscillations.

UNIT 3	**15 hours**

Special Applications of Lagrange's Equations: Rayleigh's dissipation function - impulsive motion - Gyroscopic systems - velocity dependent potentials.

UNIT 4	**15 hours**

Hamilton's equations: Hamilton's principle - Hamilton's equations - Other variational principles - phase space.

UNIT 5	**15hours**

Hamilton - Jacobi Theory: Hamilton's Principal Function – The Hamilton – Jacobi's equation - Separability.

LECTURE	**60**	**TUTORIAL**	**15**	**PRACTICAL**	**0**	**TOTAL**	**75**

TEXT BOOK

1.Donald T. Greenwood,Classical Dynamics, PHI Pvt. Ltd., New Delhi-1985. UNIT – I Chapter 1: Sections 1.1 to 1.5 UNIT – II Chapter 2: Sections 2.1 to 2.4 UNIT – III Chapter 3 : Sections 3.1 to 3.4 UNIT – IV Chapter 4: Sections 4.1 to 4.4 UNIT – V Chapter 5: Sections 5.1 to 5.3
REFERENCES
1.H. Goldstein, Classical Mechanics, (2nd Edition), Narosa Publishing House, New Delhi. 2. Narayan Chandra Rana&PromodSharad Chandra Joag, Classical Mechanics, Tata McGrawHill, 1991.

COs VS POs

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO 1	3	3	2	1	3	1	0	1	1
CO 2	3	3	2	1	3	1	0	1	1
CO 3	3	3	2	1	3	1	0	1	1
CO 4	3	3	2	1	3	1	0	1	1
CO 5	3	3	2	1	3	1	0	1	1
TOTAL	**15**	**15**	**10**	**5**	**15**	**5**	**0**	**5**	**5**
SCALED VALUE	**3**	**3**	**2**	**1**	**3**	**1**	**0**	**1**	**1**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation									
1-5→1, 6-10→2, 11-15→3									

<table>
<tr><td colspan="3">COURSE NAME</td><td>COMPUTER PROGRAMMING (C++ Theory and Lab)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td colspan="3">COURSE CODE</td><td>YMA205</td><td>3</td><td>0</td><td>2</td><td>5</td></tr>
<tr><td>C</td><td>P</td><td>A</td><td></td><td>L</td><td>T</td><td>P</td><td>H</td></tr>
<tr><td>5</td><td>0</td><td>0</td><td></td><td>3</td><td>0</td><td>2</td><td>5</td></tr>
<tr><td colspan="3">PREREQUISITE</td><td colspan="5"></td></tr>
<tr><td colspan="8">On successful completion of this course, the students will be able to:</td></tr>
<tr><td colspan="5">COURSE OUTCOMES</td><td>DOMAIN</td><td colspan="2">LEVEL</td></tr>
<tr><td>CO 1</td><td colspan="4">Explain C programming fundamentals</td><td>Cognitive</td><td colspan="2">Understanding</td></tr>
<tr><td>CO 2</td><td colspan="4">Apply structure and union for various functions</td><td>Cognitive</td><td colspan="2">Applying</td></tr>
<tr><td>CO 3</td><td colspan="4">Explain advanced concept of pointers and files</td><td>Cognitive</td><td colspan="2">Understanding</td></tr>
<tr><td>CO 4</td><td colspan="4">Explainobject oriented technologies</td><td>Cognitive</td><td colspan="2">Understanding</td></tr>
<tr><td>CO 5</td><td colspan="4">Explain Algorithms Using Functions and Objects</td><td>Cognitive</td><td colspan="2">Understanding</td></tr>
<tr><td>UNIT 1</td><td colspan="6">INTRODUCTION TO C LANGUAGE</td><td>15 hours</td></tr>
<tr><td colspan="8">Overview of C – Constants, Variables and Data Types – Operators and Expressions – Managing Input/Output Operations – Formatted I/O – Decision Making - Branching –- if, nested if , switch, goto and Looping- while, do, for statements.
Lab:
1.Program to implement formatted I/O operations
2. Program to implement formatted I/O operations
3.Program to implement control structures</td></tr>
<tr><td>UNIT 2</td><td colspan="6">ARRAYS, FUNCTIONS, STRUCTURES AND UNIONS</td><td>15 hours</td></tr>
<tr><td colspan="8">Arrays – dynamic and multi-dimensional arrays - Character arrays and Strings – String handling Functions - User defined Functions – Categories of Functions – Recursion - Structures and Unions – Array of Structures – Structures and Functions
Lab:
4. Program using 2D arrays
5.Program to implement calling the function through call by value method&call by reference
6.Program to implement Structures</td></tr>
<tr><td>UNIT 3</td><td colspan="6">POINTERS AND FILE MANAGEMENT</td><td>15 hours</td></tr>
<tr><td colspan="8">Pointers – Declaration, Accessing a variable, character strings, pointers to functions and structures - File Management in C – Dynamic Memory allocation – Linked Lists – Preprocessors.
Lab:
7.Program to implement dynamic memory allocation
8.Program to implement pointer to function
9.Program to implement an array of pointers</td></tr>
</table>

UNIT 4	INTRODUCTION TO C++	15 hours

Overview of C++-Classes and Objects-Friend Functions-Friend Classes-Inline Function-Static Members-Arrays-Pointers-References-Dynamic Allocation- Function Overloading-Overloading Constructor Functions-Copy Constructors-Default Argument-Operator Overloading-Member Operator Overloading

Lab:

10. Demonstrate Inline Functions
11.Implement Class and Subclass
12. Demonstrate Constructors & Destructors.

UNIT 5	ADDITIONAL FEATURES	15 hours

Inheritance-Base Class-Access Control-Virtual Functions-Pure Virtual Functions-Templates-Generic Functions-Applying Generic Functions-Generic Classes-Exception Handling-C++ I/O Streams-File I/O-STL-Overview-Container Classes-Lists-Maps-Algorithms Using Functions and Objects-String Class

Lab:

13. Implement Virtual Function
14.Programs to implement the concept of exception handling
15. Program to implement file operations.

LECTURE	60	TUTORIAL	15	PRACTICAL	0	TOTAL	75

TEXT BOOKS

1. E.Balagurusamy, Programming in ANSI C , Tata McGraw Hill, 2008
2. Herbert Schildt, C++ The Complete Reference, Tata McGrawHill Edition, 2014

REFERENCES

1. Deitel and Deitel, C How to Program, Addison Wesley , 2011
2. K. N. King,C Programming: A Modern Approach, 2nd Edition**,** W. W. Norton & Company; 2 edition,2008
3. Robert Lafore, OOP in Turbo C++,Galgotia Publications, 2001

COs VS POs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	3	2	1	3	1	0	1	1
CO 2	3	3	3	2	3	1	1	1	1
CO 3	3	3	2	1	3	1	0	1	1
CO 4	3	3	2	1	3	1	0	1	1
CO 5	3	3	2	1	3	1	0	1	1
TOTAL	**15**	**15**	**11**	**6**	**15**	**5**	**1**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**1**

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

1-5→1, 6-10→2, 11-15→3

COURSE NAME			FLUID DYNAMICS	L	T	P	C
COURSE CODE			YMA2E1	3	0	0	3
C	P	A		L	T	P	H
3	0	0		3	0	0	3
PREREQUISITE			Trigonometry				

On successful completion of this course, the students will be able to:			
COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	Recall the basic concepts of velocity, density and curvilinear co-ordinates.	Cognitive	Remembering
CO 2	Understand the concepts and equations of fluid dynamics	Cognitive	Understanding
CO 3	Analyze and understand the concepts of the force experienced by a twodimensional fixed body in a steady irrotational flow	Cognitive	Understanding Analyze
CO 4	Analyze the approximate solutions of the Navier – Stokes equation.	Cognitive	Applying
CO 5	Apply the appropriate method to solve integral equation of boundary layer, Blasius equation and its series solution	Cognitive	Applying

UNIT 1	Bernoulli's Equation and Equations of Motion	9 hours
Introductory Notions – Velocity – Stream Lines and Path Lines – Stream Tubes and Filaments – Fluid Body – Density – Pressure. Differentiation with respect to the time – Equation of continuity – Boundary conditions – Kinematical and physical – Rate of change of linear momentum – Equation of motion of an inviscid fluid.		
UNIT 2	Equations of Motion (Contd)	9 hours
Euler's momentum Theorem – Conservative forces – Bernoulli's theorem in steady motion – energy equation for inviscid fluid – circulation – Kelvin's theorem – vortex motion – Helmholtz equation.		
UNIT 3	Two-Dimensional Motion	9 hours
Two Dimensional Motion – Two Dimensional Functions – Complex Potential – basic singularities – source – sink – Vortex – doublet – Circle theorem. Flow past a circular cylinder with circulation – Blasius Theorem – Lift force. (Magnus effect)		
UNIT 4	Dynamics of Real Fluids	9 hours
Viscous flows – Navier-Stokes equations – Vorticity and circulation in a viscous fluid – Steady flow		

through an arbitrary cylinder under pressure – Steady Couette flow between cylinders in relative motion – Steady flow between parallel planes.		
UNIT 5	**The Laminar Boundary Layer in Incompressible Flow**	**9hours**
Boundary Layer concept – Boundary Layer equations – Displacement thickness, Momentum thickness – Kinetic energy thickness – integral equation of boundary layer – flow parallel to semi infinite flat plate – Blasius equation and its solution in series.		

LECTURE	**45**	**TUTORIAL**	**0**	**PRACTICAL**	**0**	**TOTAL**	**45**

TEXT BOOKS

1. Units I and II: L. M. Milne Thomson, Theoretical Hydro Dynamics, Macmillan Company, 5th Edition (1968). Chapter I : Sections 1.0 – 1.3., 3.10-3.41 (omit 3.32) Chapter III : Sections 3.42 – 3.53 (omit 3.44)
2. Units III, IV and V: Modern Fluid Dynamics Volume I, N. Curle and H. J. Davies, D. Van Nostrand Company Limited, London, 1968. Chapter III : Sections 3.1 – 3.7.5 (omit 3.3.4, 3.4, 3.5.2,3.6) Chapter V : Sections 5.2.1– 5.3.3 Chapter VI : Sections 6.1 – 6.3.1 (omit 6.2.2., 6.2.5)

REFERENCES

1. F. Chorlton, Textbook of Fluid Dynamics, CBS Publishers, New Delhi, 2004.
2. A. J. Chorin and A. Marsden, A Mathematical Introduction to Fluid Dynamics, SpringerVerlag, New York, 1993.

E – Resources (MOOC, SWAYAM, NPTEL, Websites etc)

1 https://nptel.ac.in/courses/112/106/112106200/

COs VS POs

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO 1	3	3	2	1	3	1	0	1	1
CO 2	3	3	2	1	3	1	0	1	1
CO 3	3	3	2	1	3	1	0	1	1
CO 4	3	3	2	1	3	1	0	1	1
CO 5	3	3	2	1	3	1	0	1	1
TOTAL	**15**	**15**	**10**	**5**	**15**	**5**	**0**	**5**	**5**
SCALED VALUE	**3**	**3**	**2**	**1**	**3**	**1**	**0**	**1**	**1**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation									
1-5→1, 6-10→2, 11-15→3									

COURSE NAME			**COMBINATORICS**	**L**	**T**	**P**	**C**
COURSE CODE			**YMA2E2**	**3**	**0**	**0**	**3**
C	**P**	**A**		**L**	**T**	**P**	**H**
3	**0**	**0**		**3**	**0**	**0**	**3**
PREREQUISITE			Basics of sets				

On successful completion of this course, the students will be able to:

	COURSE OUTCOMES	**DOMAIN**	**LEVEL**
CO 1	**Explain** the distributions of distinct objects and non-distinct objects	Cognitive	Understanding
CO 2	**Apply** diverse counting strategies to solve varied problems involving strings, combinations, distributions, and partitions	Cognitive	Applying
CO 3	**Solve** linear recurrence relations by recognizing homogeneity, linearity, constant coefficients, degree, and characteristic equation	Cognitive	Applying
CO 4	**Identify** the number of permutations with forbidden positions using rook polynomials	Cognitive	Applying
CO 5	**Apply**Polya's theorem for finding number of permutations of given objects	Cognitive	Applying

UNIT 1	**Permutations and combinations**	**9 hours**
Distributions of distinct objects – Distributions of non-distinct objects – Stirling's formula.		
UNIT 2	**Generating functions**	**9 hours**
Generating function for combinations – Enumerators for permutations distributions of distinct objects into non distinct cells – partitions of integers – Ferrers graphs – Elementary relations.		
UNIT 3	**Recurrence relation**	**9hours**
Linear recurrence relations with constant coefficients- solutions by the technique of generating functions – A special class of nonlinear difference equations – Recurrence relations with two indices.		
UNIT 4	**The principle of inclusion and exclusion**	**9 hours**
General formula – Permutations with restriction on relative positions – Derangements – Rook polynomials – permutations with forbidden positions.		
UNIT 5	**Polya's theory of counting**	**9 hours**

Equivalence classes under a permutation group – Burnside theorem – Equivalence classes of functions – Weights and inventories of functions – Polya's fundamental theorem – Generalization of Polya's theorem

LECTURE	**45**	**TUTORIAL**	**0**	**PRACTICAL**	**0**	**TOTAL**	**45**

TEXT BOOKS

1. Cameron, P.J. (1998) Combinatorics: Topics, Techniques, Algorithms. Cambridge: Cambridge University Press.
2. Liu, C.L., Eddberg, M. (1968).Solutions to problems in Introduction to Combinatorial Mathematics. New York: McGraw-Hill Book & Co.

REFERENCES

1. Liu, C.L. (1968). Introduction of Combinatorial Mathematics. New York: McGraw Hill Book Co.
2. Stanley, R.P.(1997). Enumerative Combinatorics, Volume I, Cambridge Studies in Advanced Mathematics, Volume 49. Cambridge University Press.

COs VS POs

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO 1	3	3	2	1	3	1	0	1	1
CO 2	3	3	3	2	3	1	1	1	1
CO 3	3	3	3	2	3	1	1	1	1
CO 4	3	3	3	2	3	1	1	1	1
CO 5	3	3	3	2	3	1	1	1	1
TOTAL	15	15	14	9	15	5	4	5	5
SCALED VALUE	3	3	3	2	3	1	1	1	1
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation									
1-5→1, 6-10→2, 11-15→3									

COURSE NAME			CRYPTOGRAPHY	L	T	P	C
COURSE CODE			YMA2E3	3	0	0	3
C	P	A		L	T	P	H
3	0	0		3	0	0	3
PREREQUISITE			Basic concepts of number theory				

On successful completion of this course, the students will be able to:

	COURSE OUTCOMES	DOMAIN	LEVEL
CO 1	**Apply** the concept and properties of modular arithmetic in various algorithms to find the solution	Cognitive	Applying
CO 2	**Utilize** Pollard's rho method for solving the elliptic curve discrete logarithm problem	Cognitive	Applying
CO 3	**Utilize** basic properties of finite fields for factoring polynomials over finite fields	Cognitive	Applying
CO 4	**Demonstrate** the concepts of stream ciphers and block ciphers	Cognitive	Understanding
CO 5	**Analyze** the concepts of public key cryptography, RSA and Elliptic curve cryptography	Cognitive	Applying

UNIT 1		**9 hours**
Introduction – Encryption and Secrecy – The objective of Cryptography - Number Theory – Introduction – Modular Arithmetic.		
UNIT 2		**9 hours**
Integer factorization problem – Pollard's rho factoring – Elliptic curve factoring – Discrete logarithm problem.		
UNIT 3		**9 hours**
Finite fields – Basic properties – Arithmetic of polynomials –Factoring polynomials over finite fields – Square free factorization.		
UNIT 4		**9 hours**
Symmetric key encryption – Stream ciphers – Block Ciphers – DES.		
UNIT 5		**9 hours**
Public key cryptography – Concepts of public key cryptography – Modular arithmetic – RSA – Discrete		

logarithm – Elliptic curve cryptography.							
LECTURE	**45**	**TUTORIAL**	**0**	**PRACTICAL**	**0**	**TOTAL**	**45**

TEXT BOOKS

1. Hans Delfs, Helmut Knebl, Introduction to Cryptography, Springer Verlag, 2002.
2. Alfred J. Menezes, Paul C. Van Oorschot, Scott A. Vanstone, Handbook of Applied Cryptography, CRC Press, 2000.
3. William Stallings, Cryptography and Network Security, Prentice Hall of India, 2000.

REFERENCES

1. Pachghare V.K., Cryptography and Information Security, PHI Learning Pvt. Ltd., New Delhi, 2009
2. Behrouz A. Forouzan and DebdeepMukhopathyey, Cryptography and Network Security, 2013, second edition, McGraw Hill Education Pvt. Ltd., New Delhi.

COs VS POs

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO 1	3	3	3	2	3	1	1	1	1
CO 2	3	3	3	2	3	1	1	1	1
CO 3	3	3	3	2	3	1	1	1	1
CO 4	3	3	2	1	3	1	0	1	1
CO 5	3	3	3	2	3	1	1	1	1
TOTAL	**15**	**15**	**14**	**9**	**15**	**5**	**4**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**1**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation									
1-5→1, 6-10→2, 11-15→3									

COURSE NAME			**TOPOLOGY**	**L**	**T**	**P**	**C**
COURSE CODE			**YMA301**	**4**	**1**	**0**	**5**
C	**P**	**A**		**L**	**T**	**P**	**H**
5	**0**	**0**		**4**	**1**	**0**	**5**
PREREQUISITE			Basic concepts of sets				

On successful completion of this course, the students will be able to:

COURSE OUTCOMES		**DOMAIN**	**LEVEL**
CO 1	**Identify** whether a given family of subsets is a topology or not	Cognitive	Applying
CO 2	**Apply** the concepts of continuous function on product topology and metric topology	Cognitive	Applying
CO 3	**Explain** the concepts of local connectedness and path connectedness	Cognitive	Understanding
CO 4	**Explain** the concepts of limit point compactness and local compactness	Cognitive	Understanding
CO 5	**Apply** the concept of separation axiom and normal spaces to prove the Urysohnmetrizationtheoremand the Tietz extension theorem	Cognitive	Applying

UNIT 1	**Topological Spaces**	**15 hours**
Topological spaces - Basis for a topology - The order topology - The product topology on X x Y - The subspace topology.		
UNIT 2	**Continuous Functions**	**15 hours**
Closed sets and limit points-Continuous functions - the product topology - The metric topology - The metric topology (continued) - Uniform limit theorem.		
UNIT 3	**Connectedness**	**15 hours**
Connected spaces - connected subspaces of the Real line - Components and local connectedness.		
UNIT 4	**Compactness**	**15 hours**
Compact spaces - compact subspaces of the Real line - Limit Point Compactness – Local Compactness.		
UNIT 5	**Countability and Separation Axiom**	**15hours**
The Countability Axioms - The separation Axioms - Normal spaces - The Urysohn Lemma - The		

Urysohnmetrization Theorem - The Tietz extension theorem							
LECTURE	**60**	**TUTORIAL**	**15**	**PRACTICAL**	**0**	**TOTAL**	**75**
TEXT BOOK							
1.James R. Munkres, "Topology", (2nd Edition) PHI Learning Pvt. Ltd., (Third Indian Reprint) NewDelhi,2014 Unit I - Chapter 2: Sections 12 to 17 Unit II - Chapter 2: Sections 18 to 21 (Omit Section 22) Unit III - Chapter 3: Sections 23 to25 Unit IV - Chapter 3: Sections 26 to29 Unit V - Chapter 4: Sections 30 to 35							
REFERENCES							
1. J. Dugundji, "Topology", Prentice Hall of India, New Delhi,1975. 2. George F. Simmons, "Introduction to Topology and Modern Analysis", McGraw Hill Book Co., 1963. 3. J.L. Kelly, "General Topology", Van Nostrand, Reinhold Co., NewYork.1995 4. L.Steen and J.Subhash, "Counter Examples in Topology", Holt, Rinehart and Winston, New York,1970. 5. S.Willard, "General Topology", Addison - Wesley,Mas.1970.							

COs VS POs

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO 1	3	3	3	2	3	1	1	1	1
CO 2	3	3	3	2	3	1	1	1	1
CO 3	3	3	3	2	3	1	1	1	1
CO 4	3	3	2	1	3	1	0	1	1
CO 5	3	3	3	2	3	1	1	1	1
TOTAL	**15**	**15**	**14**	**9**	**15**	**5**	**4**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**1**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation									
1-5→1, 6-10→2, 11-15→3									

COURSE NAME			INTEGRAL EQUATIONS, CALCULUS OF VARIATIONS AND TRANSFORMS	L	T	P	C
COURSE CODE			YMA302	4	1	0	5
C	P	A		L	T	P	H
5	0	0		4	1	0	5
PREREQUISITE			Multivariable calculus and vector calculus				

On successful completion of this course, the students will be able to:			
COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Identify** maxima and minima of functionals	Cognitive	Applying
CO 2	**Utilize** Fourier transform for solving boundary value problems	Cognitive	Applying
CO 3	**Solve** Bessel function integrals over a finite interval	Cognitive	Applying
CO 4	**Identify** eigenvalues and eigenfunction of the homogeneous integral equations with degenerate kernels	Cognitive	Applying
CO 5	**Solve**Volterra integral equation and Fredholm integral equations by using method of successive approximations	Cognitive	Applying

UNIT 1		15 hours
Calculus of variations – Maxima and Minima – the simplest case – Natural boundary and transition conditions - variational notation – more general case – constraints and Lagrange's multipliers – variable end points – Sturm-Liouville problems		
UNIT 2		**15hours**
Fourier transform - Fourier sine and cosine transforms - Properties Convolution -Solving integral equations - Finite Fourier transform - Finite Fourier sine and cosine transforms - Fourier integral theorem - Parseval's identity		
UNIT 3		**15 hours**
Hankel Transform : Definition – Inverse formula – Some important results for Bessel function – Linearity property – Hankel Transform of the derivatives of the function –Hankel Transform of differential operators – Parseval's Theorem		
UNIT 4		**15hours**
Linear Integral Equations - Definition, Regularity conditions – special kind of kernels –eigen values and		

eigen functions – convolution Integral – the inner and scalar product of two functions – Notation – reduction to a system of Algebraic equations – examples– Fredholm alternative - examples – an approximate method.

UNIT 5		**15hours**
Method of successive approximations: Iterative scheme – examples – Volterra Integral equation – examples – some results about the resolvent kernel. Classical Fredholm Theory: the method of solution of Fredholm – Fredholm's first theorem – second theorem – third theorem		

LECTURE	**60**	**TUTORIAL**	**15**	**PRACTICAL**	**0**	**TOTAL**	**75**

TEXT BOOKS

1. Ram.P.Kanwal – Linear Integral Equations Theory and Practice, Academic Press 1971.
2. F.B. Hildebrand, Methods of Applied Mathematics II ed. PHI, ND 1972.
3. A.R. Vasishtha, R.K. Gupta, Integral Transforms, Krishna Prakashan Media Pvt Ltd, India, 2002.

UNIT – I Chapter 2: Sections 2.1 to 2.9 of [2]
UNIT – II Chapter 7 of [3]
UNIT – III Chapter 9 of [3];
UNIT – IV -Chapters 1 and 2 of [1]
UNIT – V Chapters 3 and 4 of [1]

REFERENCES

1. S.J. Mikhlin, Linear Integral Equations (translated from Russian), Hindustan Book Agency, 1960.
2. I.N. Snedden, Mixed Boundary Value Problems in Potential Theory, North Holland,1966.

COs VS POs

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO 1	3	3	3	2	3	1	1	1	1
CO 2	3	3	3	2	3	1	1	1	1
CO 3	3	3	3	2	3	1	1	1	1
CO 4	3	3	3	2	3	1	1	1	1
CO 5	3	3	3	2	3	1	1	1	1
TOTAL	**15**	**15**	**15**	**10**	**15**	**5**	**5**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**1**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation									
1-5→1, 6-10→2, 11-15→3									

COURSE NAME			FUNCTIONAL ANALYSIS	L	T	P	C
COURSE CODE			YMA303	4	1	0	5
C	P	A		L	T	P	H
5	0	0		4	1	0	5
PREREQUISITE			Basic concepts of algebra				

On successful completion of this course, the students will be able to:

	COURSE OUTCOMES	DOMAIN	LEVEL
CO 1	**Explain** Normed Spaces and Hahn – Banach Theorems	Cognitive	Understanding
CO 2	**Explain** Closed Graph and Open Mapping Theorems	Cognitive	Understanding
CO 3	**Explain** Bounded Inverse Theorem – Spectrum of a Bounded Operator	Cognitive	Understanding
CO 4	**Explain** Inner Product Spaces and Riesz Representation Theorems	Cognitive	Understanding
CO 5	**Explain** Bounded Operators and Self-adjoint Operators	Cognitive	Understanding

UNIT 1		**15 hours**
Normed Spaces – Continued of Linear Maps – Hahn – Banach Theorems		
UNIT 2		**15 hours**
Banach Spaces – Uniform Boundedness Principle – Closed Graph and Open Mapping Theorems		
UNIT 3		**15 hours**
Bounded Inverse Theorem – Spectrum of a Bounded Operator		
UNIT 4		**15 hours**
Inner Product Spaces – Orthonormal Sets – Projection and Riesz Representation Theorems		
UNIT 5		**15hours**
Bounded Operators and adjoint, Normal , Unitary and Self-adjoint Operators		

LECTURE	60	TUTORIAL	15	PRACTICAL	0	TOTAL	75

TEXT BOOK

1.Balmohan V Limaye, “Functional Analysis”, 3rd Edition, New Age International (P) Limited Publishers, New Delhi, 2017

REFERENCES

1. G.F.Simmons,“Introduction to Topology and Modern Analysis”,McGraw Hill International Book

Company, New York, 1963.
2. W. Rudin, “Functional Analysis”, Tata McGraw-Hill Publishing Company, New Delhi, 1973.
3. E. Kreyszig, “Introductory Functional Analysis with Applications”, John Wiley & Sons, New York, 1978.
4. H. C. Goffman and G.Fedrick, “First Course in Functional Analysis”, Prentice Hall of India, New Delhi, 1987

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	3	2	1	3	1	0	1	1
CO 2	3	3	2	1	3	1	0	1	1
CO 3	3	3	2	1	3	1	0	1	1
CO 4	3	3	2	1	3	1	0	1	1
CO 5	3	3	2	1	3	1	0	1	1
TOTAL	**15**	**15**	**10**	**5**	**15**	**5**	**0**	**5**	**5**
SCALED VALUE	**3**	**3**	**2**	**1**	**3**	**1**	**0**	**1**	**1**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation									
1-5→1, 6-10→2, 11-15→3									

COURSE NAME			**DIFFERENTIAL GEOMETRY**	**L**	**T**	**P**	**C**
COURSE CODE			**YMA304**	**4**	**1**	**0**	**5**
C	**P**	**A**		**L**	**T**	**P**	**H**
5	**0**	**0**		**4**	**1**	**0**	**5**
PREREQUISITE			Multivariable Calculus and Vector Calculus				

On successful completion of this course, the students will be able to:

	COURSE OUTCOMES	**DOMAIN**	**LEVEL**
CO 1	**Identify** involutes and evolutes of a given curve	Cognitive	Applying
CO 2	**Explain** the concept of Helicoids and Families of curves	Cognitive	Understanding
CO 3	**Identify**Geodesic curvature, Gaussian curvature and Surfaces of constant curvature of a given curve	Cognitive	Applying
CO 4	**Explain** non intrinsic properties of a surface	Cognitive	Understanding
CO 5	**Explain** compact surface and complete surface	Cognitive	Understanding

UNIT 1	**SPACE CURVES**	**15 hours**

Definition of Space curves – Arc length – tangent – normal and binormal – curvature and torsion – contact between curves and surfaces – tangent surface – involutes and evolutes – intrinsic equations – Fundamental Existence Theorem for space curves – Helics.

UNIT 2	**INTRINSIC PROPERTIES OF A SURFACE**	**15 hours**

Definition of surface - Curves on a surface - Surfaces of revolution – Helicoids – Metric - Direction coefficients - Families of curves - Isometric correspondence - Intrinsic properties – Geodesics - Canonical geodesic equations.

UNIT 3	**GEODESICS**	**15 hours**

Normal property of geodesic - Existence theorems - Geodesic parallels - Geodesic curvature - Gauss Bonnet theorem - Gaussian curvature - Surfaces of constant curvature - Conformal mapping - Geodesic mapping.

UNIT 4	**NON INTRINSIC PROPERTIES OF A SURFACE**	**15hours**

Second fundamental form - Principal curvatures- Lines of curvature – Developables - Developables associated with space curves - Developables associated with curves on surfaces- Minimal surfaces and ruled surfaces - Fundamental equations of Surface theory - Parallel surfaces.

UNIT 5	**DIFFERENTIAL GEOMETRY OF SURFACES**	**15 hours**

Compact surfaces whose points are umbilics- Hilbert's lemma- Compact surfaces of constant Gaussian

or mean curvature- Complete surfaces- Characterization of complete surfaces- Hilbert's theorem- Conjugate points on geodesics.							
LECTURE	**60**	**TUTORIAL**	**15**	**PRACTICAL**	**0**	**TOTAL**	**75**
TEXT BOOK							
1.T. J. Wilmore, "An introduction to Differential Geometry", Oxford University Press, 1997.							
REFERENCES							
1. Do Carmo,"Geometry of curves and surfaces", Academic Press, 2017. 2. D.Somasundaram, "Differential Geometry", Narosa Publ. House, Chennai, 2005. **3.** J.A.Thorpe, "Elementary Topics in Differential Geometry", Springer - Verlag, New York, 1979.							

COs VS POs

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO 1	3	3	3	2	3	1	1	1	1
CO 2	3	3	2	1	3	1	0	1	1
CO 3	3	3	3	2	3	1	1	1	1
CO 4	3	3	2	1	3	1	0	1	1
CO 5	3	3	2	1	3	1	0	1	1
TOTAL	**15**	**15**	**12**	**7**	**15**	**5**	**2**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**1**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation									
1-5→1, 6-10→2, 11-15→3									

COURSE NAME			COMPLEX ANALYSIS	L	T	P	C
COURSE CODE			YMA305	4	1	0	5
C	P	A		L	T	P	H
5	0	0		4	1	0	5
PREREQUISITE			Basic concepts of real numbers				

On successful completion of this course, the students will be able to:

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Explain** Cauchy's Theorem for rectangle and disc	Cognitive	Understanding
CO 2	**Apply** Cauchy's integral formula and Taylor's theorem for finding the higher order derivatives	Cognitive	Applying
CO 3	**Explain** Locally Exact Differentials – Multiply Connected regions	Cognitive	Applying
CO 4	**Evaluate** the given definite integrals using Cauchy' theorem	Cognitive	Analyzing
CO 5	**Utilize** the Taylor Series and the Laurent Series for finding zeros and poles for the given problem	Cognitive	Applying

UNIT 1		**15 hours**
Line Integrals- Rectifiable arc – Line integrals as functions of arc- Cauchy's Theorem for rectangle-Cauchy's Theorem for disc		
UNIT 2		**15 hours**
The Index of a point - Integral Formula – Higher derivatives – Removable singularities – Taylor's theorem – Zeros and Poles – The Local Mapping – The Maximum Principle		
UNIT 3		**15 hours**
Chains and Cycles – Simple Connectivity – Homology – The General Statement of Cauchy's Theorem – Proof of Cauchy's Theorem – Locally Exact Differentials – Multiply Connected Regions		
UNIT 4		**15 hours**
The Residue Theorem – The Argument Principle – Evaluation of Definite Integrals – The Mean – value property – Poisson's formula- Schwarz's Theorem – The Reflection Principle		
UNIT 5		**15hours**
Weierstrass's Theorem – The Taylor Series – The Laurent Series – Partial Fractions- Jensen's Formula – Hadamard's Theorem		

LECTURE	60	TUTORIAL	15	PRACTICAL	0	TOTAL	75

TEXT BOOK
1.LarsV.Ahlfors, “Complex Analysis”, 3rd Edition McGraw Hill Education (India) Private Ltd.2013. Chapter 4 - Section 1.1 to 1.5, Section 2.1 to 2.3, Section 3.1 to 3.4, Section 4.1 to 4.7, Section 5.1 to 5.3 , Section 6.1 to 6.5. Chapter 5 - Section 1.1 to 1.3, Section 2.1, Section 3.1 & 3.2.
REFERENCE
1.S. Ponnusamy, “Complex Analysis”, Alpha Science International Ltd; 2nd Revised edition, 2005

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	3	2	1	3	1	0	1	1
CO 2	3	3	3	2	3	1	1	1	1
CO 3	3	3	3	2	3	1	1	1	1
CO 4	3	3	3	3	3	1	2	1	1
CO 5	3	3	3	2	3	1	1	1	1
TOTAL	**15**	**15**	**14**	**10**	**15**	**5**	**5**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**1**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation									
1-5→1, 6-10→2, 11-15→3									

COURSE NAME			**ELEMENTS OF STOCHASTIC PROCESS**	**L**	**T**	**P**	**C**
COURSE CODE			**YMA3E1**	**3**	**0**	**0**	**3**
C	**P**	**A**		**L**	**T**	**P**	**H**
3	**0**	**0**		**3**	**0**	**0**	**3**
PREREQUISITE			Probability and Statistics				

On successful completion of this course, the students will be able to:

	COURSE OUTCOMES	DOMAIN	LEVEL
CO 1	**Utilize** continuous time Markov model for constructing TPM.	Cognitive	Applying
CO 2	**Explain** renewal process and long term analysis with examples	Cognitive	Understanding
CO 3	**Apply** different methods and solve Birth and Death queues	Cognitive	Applying
CO 4	**Examine** the computations of M/G/1 and G/M/1 Queues and Network of Queues	Cognitive	Analyzing
CO 5	**Conclude** the idea of Brownian Motion and First Passage Times	Cognitive	Evaluating

UNIT 1	**Continuous-Time Markov Models**	**9hours**
Continuous Time Markov Chain, Examples, Transient Analysis, Occupancy Times, Limiting Behavior		
UNIT 2	**Generalized Markov Models**	**9 hours**
Renewal Process, Cumulative Process, Semi-Markov Process, Examples and Long-term Analysis.		
UNIT 3	**Queueing Models**	**9 hours**
Queueing Systems, Single-Station Queues, Birth and Death queues with Finite and Infinite Capacity.		
UNIT 4	**Queueing Models (Contd)**	**9 hours**
M/G/1 and G/M/1 Queues and Network of Queues.		
UNIT 5	**Brownian Motion**	**9 hours**
Standard Brownian Motion, Brownian Motion and First Passage Times.		

LECTURE	**45**	**TUTORIAL**	**0**	**PRACTICAL**	**0**	**TOTAL**	**45**

TEXT BOOK

1.V. G. Kulkarni, Introduction to Modeling and Analysis of Stochastic Systems, Second Edition, Springer, 2011

REFERENCES
1. J. Medhi, Stochastic Processes, New Age, 2009. 2. S. M. Ross, Stochastic Processes, Wiley Series in Probability and Statistics, 1996

COs VS POs

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO 1	3	3	3	2	3	1	1	1	1
CO 2	3	3	2	1	3	1	0	1	1
CO 3	3	3	3	2	3	1	1	1	1
CO 4	3	3	3	3	3	1	2	1	1
CO 5	3	3	3	3	3	1	3	1	1
TOTAL	**15**	**15**	**14**	**11**	**15**	**5**	**7**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**3**	**3**	**1**	**2**	**1**	**1**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation									
1-5→1, 6-10→2, 11-15→3									

COURSE NAME			MATHEMATICAL MODELING	L	T	P	C
COURSE CODE			YMA3E2	3	0	0	3
C	P	A		L	T	P	H
3	0	0		3	0	0	3
PREREQUISITE			YMA103				
On successful completion of this course, the students will be able to:							

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Compare** models that can be constructed by ordinary differential equations of first order under study	Cognitive	Applying
CO 2	**Utilize** compartment models to solve the problems involved in economics and medicine	Cognitive	Applying
CO 3	**Analyze** mathematical models that can be developed by second order linear differential equations	Cognitive	Analyzing
CO 4	**Apply** linear difference equation to solve problems in finance and economics	Cognitive	Applying
CO 5	**Identify** the solutions of the given problems that can be modeled through graphs	Cognitive	Applying

UNIT 1	Mathematical Modeling through Ordinary Differential Equations of First order	9 hours
Linear Growth and Decay Models – Non-Linear Growth and Decay Models –Compartment Models – Dynamics problems – Geometrical problems		
UNIT 2	**Mathematical Modeling through Systems of OrdinaryDifferential Equations of First Order**	**9hours**
Population Dynamics – Epidemics – Compartment Models – Economics –Medicine, Arms Race, Battles and International Trade – Dynamics		
UNIT 3	**Mathematical Modeling through Ordinary Differential Equationsof Second Order**	**9 hours**
Planetary Motions – Circular Motion and Motion of Satellites – Mathematical Modeling through Linear Differential Equations of Second Order –Miscellaneous Mathematical Models		
UNIT 4	**Mathematical Modeling through Difference Equations**	**9 hours**

Simple Models – Basic Theory of Linear Difference Equations with ConstantCoefficients – Economics and Finance – Population Dynamics and Genetics –Probability Theory							
UNIT 5	**Mathematical Modeling through Graphs**						**9 hours**
Solutions that can be Modeled through Graphs – Mathematical ModelinginTerms of Directed Graphs, Signed Graphs, Weighted Digraphs and UnorientedGraphs							
LECTURE	**45**	**TUTORIAL**	**0**	**PRACTICAL**	**0**	**TOTAL**	**45**
TEXT BOOK							
1.J.N. Kapur, Mathematical Modeling, Wiley Eastern Limited, New Delhi, 1988							
REFERENCE							
1.J. N. Kapur, Mathematical Models in Biology and Medicine, Affiliated East –West Press Pvt Limited, New Delhi, 19							

COs VS POs

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO 1	3	3	3	2	3	1	1	1	1
CO 2	3	3	3	2	3	1	1	1	1
CO 3	3	3	3	3	3	1	2	1	1
CO 4	3	3	3	2	3	1	1	1	1
CO 5	3	3	3	2	3	1	1	1	1
TOTAL	**15**	**15**	**15**	**11**	**15**	**5**	**6**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**3**	**3**	**1**	**2**	**1**	**1**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation									
1-5→1, 6-10→2, 11-15→3									

COURSE NAME			DATA ANALYSIS USING SPSS	L	T	P	C
COURSE CODE			**YMA3E3**	**3**	**0**	**0**	**3**
C	**P**	**A**		**L**	**T**	**P**	**H**
3	**0**	**0**		**3**	**0**	**0**	**3**
PREREQUISITE			Probability and Statistics				

On successful completion of this course, the students will be able to:

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Explain** basic concepts of SPSS, working with the Data Editor and Plotting of Charts using Bar and Pie diagram	Cognitive	Understanding
CO 2	**Explain** measures of central tendencies and measures of dispersion using SPSS	Understanding	Understanding
CO 3	**Utilize** concept of testing hypothesis for finding significance level for the given data using one sample t-test, independent sample t-test and paired t-test in SPSS	Cognitive	Applying
CO 4	**Apply** One-way ANOVA, two-way ANOVA and Chi-square test for the given data in SPSS	Cognitive	Applying
CO 5	**Compare** the relationship for the datausing methods of correlation and regression in SPSS	Cognitive	Applying

UNIT 1		9 hours

Introduction to SPSS – Starting SPSS – SPSS Main Menus – Working with the Data Editor – SPSS Viewer – Importing and Exporting data. Plotting of Charts: Simple Bar diagram, Multiple Bar Diagram and Pie Diagram.

UNIT 2		9 hours

Descriptive Statistics and Frequencies using SPSS. Measures of central tendencies: Arithmetic mean, Median, Mode, Geometric mean and Harmonic Mean. Measures of Dispersion: Range, inter quartile range, Mean Deviation and Standard deviation. Measures of Skewness and Kurtosis.

UNIT 3		9 hours

Testing of Hypothesis: Type I error and Type II Errors – Concept of p values – Basic Concepts of One Sample t-test, Independent Samples t-test, Paired samples t-test using SPSS with interpretation.

UNIT 4		9 hours

Analysis of Variance: Basic concepts of ANOVA – One Way and Two-Way ANOVA using SPSS with interpretation. Chi-square Test for Independence of attributes using SPSS.							
UNIT 5							**9 hours**
Correlation: Karl Pearson's coefficient of Correlation – Spearman's Rank correlation – Simple linear Regression using SPSS with interpretation.							
LECTURE	**45**	**TUTORIAL**	**0**	**PRACTICAL**	**0**	**TOTAL**	**45**
TEXT BOOK							
1.Ajai J Gaur and Sanjay S. Gaur (2008): Statistical Methods for Practice and Research:A guide to data analysis using SPSS, First Edition, Sage Publications							
REFERENCES							
1. Andy Field.(2011); Discovering Statistics Using SPSS, Sage Publications. 2. Hinton P R, Brownlow C, McMurray,I. and Cozens, B. (2004) SPSS Explained, Routledge							

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	3	2	1	3	1	0	1	1
CO 2	3	3	2	1	3	1	0	1	1
CO 3	3	3	3	2	3	1	1	1	1
CO 4	3	3	3	2	3	1	1	1	1
CO 5	3	3	3	2	3	1	1	1	1
TOTAL	**15**	**15**	**13**	**8**	**15**	**5**	**3**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**1**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation									
1-5→1, 6-10→2, 11-15→3									

4.a. Curriculum and Syllabus of B.Sc Mathematics - After Revision

BACHELOR OFSCIENCE (THREE YEAR - FULL TIME)

REGULATION - 2023

SEMESTER - I

Part	Category	Course Code	Course Name	L	T	P	SS	H	C
I	Language	XGT101	Tamil – I	3	0	0	0	3	3
II	Language	XGE102	English – I	3	0	0	0	3	3
III	Core – 1	XMT103	Algebra &Trigonometry	3	1	0	0	4	4
	Core – 2	XMT104	Differential Calculus	3	1	0	0	4	4
	Allied–1 (GE)	XPG105	Allied Physics - I	2	1	0	0	4	3
	Allied–1 (GE)	XPG106	Allied Physics Practical - I	0	0	2	0	2	1
IV	FC	XMT107	Foundation Course-Bridge Course	1	1	0	0	2	2
	UMAN - 1	XUM001	Human Ethics, Values, Rights and Gender Equality	1	0	0	1	1	1
			Total	**16**	**4**	**2**	**1**	**23**	**21**

SEMESTER - II

I	Language	XGT201	Tamil – II	3	0	0	0	3	3
II	Language	XGE202	English – II	3	0	0	0	3	3
III	Core – 3	XMT203	Analytical Geometry 3-D and Integral Calculus	3	1	0	0	4	4
	Core – 4	XMT204	Sequence and Series	3	1	0	0	4	4
	Allied- 2 GE)	XPG205	Allied Physics - II	2	1	0	0	3	3
	Allied- 2 GE)	XPG206	Allied Physics Practical - II	0	0	2	0	2	1
	SEC – 1	XMT207	Quantitative Aptitude – I	1	1	0	0	2	2
IV	UMAN - 2	XUM002	Environmental Studies	1	0	0	1	1	1
			Field Visit	0	0	0	0	0	2
			Total	**16**	**4**	**2**	**1**	**22**	**23**

SEMESTER - III

I	Language	XGT301	Tamil – III	3	0	0	0	3	3
II	Language	XGE302	English – III	3	0	0	0	3	3
III	Core – 5	XMT303	Differential Equations and Applications	3	1	0	0	4	4
	Core – 6	XMT304	Vector Calculus and Applications	3	1	0	0	4	4
	Allied – 3 (DSC)	XMT305	Statistics for Data Science - I	2	1	0	0	3	3
	Allied – 3 (DSC)	XMT306	Statistics for Data Science - I - Lab using R-Programming	0	0	2	0	2	1
	SEC – 2	XMT307	Quantitative Aptitude - II	1	1	0	0	2	2
IV	GE: Open Elective		Open Elective- I	3	0	0	0	3	3
	UMAN -3	XUM003	Disaster Management	1	0	0	1	1	1
			Total	**19**	**4**	**2**	**1**	**25**	**24**

SEMESTER - IV

I	Language	XGT401	Tamil – IV	3	0	0	0	3	3
II	Language	XGE402	English – IV	3	0	0	0	3	3
III	Core – 7	XMT403	Object Oriented Programming with C++	3	1	0	0	4	4
	Core - 8	XMT404	Fourier Series and Transforms	3	1	0	0	4	4
	Allied – 4 (DSC)	XMT405	Statistics for Data Science - II	2	1	0	0	3	3
	Allied – 4 (DSC)	XMT406	Statistics for Data Science –II - Lab using R-Programming	0	0	2	0	2	1
	SEC – 3	XMT407	Vedic Mathematics - I	1	1	0	0	2	2
IV	GE: Open Elective		Open Elective- 2	3	0	0	0	3	3
	UMAN - 4	XUM004	Introduction to Entrepreneurship Development	1	0	0	1	**1**	1
			Total	**19**	**4**	**2**	**1**	**25**	**24**

SEMESTER -V

III	Core - 9	XMT501	Abstract Algebra	3	1	0	0	4	4
	Core - 10	XMT502	Real Analysis	3	1	0	0	4	4
	Core - 11	XMT503	Number Theory	3	1	0	0	4	4
	DSE – 1	XMT504A	Graph Theory	3	1	0	0	4	4
		XMT504B	Mathematical Modeling						
		XMT504C	Numerical Methods with MATLAB						
		XMT504D	Discrete Mathematics						
	SEC - 4	XMT505	Vedic Mathematics - II	1	1	0	0	2	2
	NME	XMT506	Python Programming / Mathematics for Finance	2	1	0	0	3	3
	GE: Open Elective		Open Elective- 3	3	0	0	0	3	3
IV	IPT		IPT/Internship	0	0	0	0	0	2
	Core		Project Phase - I	0	0	3	0	3	1
			Total	**18**	**6**	**3**	**0**	**27**	**27**

SEMESTER - VI

III	Core -12	XMT601	Complex Analysis	3	1	0	0	4	4
	Core -13	XMT602	Mechanics	3	1	0	0	4	4
	Core – 14	XMT603	Optimization Techniques	3	1	0	0	4	4
	DSE – 2	XMT604A	Industrial Mathematics 4.0	3	1	0	0	4	4
		XMT604B	Introduction to Machine Learning						
		XMT604C	Astronomy						
		XMT604D	Stochastic Processes						
	Core-15	XMT605	Project Phase - II	1	0	4	0	5	3
IV	UMAN - 5	XUM005	Cyber Security	1	0	0	1	1	1
			Total	**14**	**4**	**4**	**1**	**22**	**20**
			Total Credit						**139**

SEMESTER I

பொதுத்தமிழ் - 1

பாடக்குறியீடு/ Course Code	பாடப்பெயர்/ Course Name	**Category**	**L**	**T**	**P**	**SS**	**H**	**C**
XGT101	**பொதுத்தமிழ் - 1**	Supportive	**3**	**0**	**0**	**0**	**3**	**3**
Pre-requisite	பன்னிரெண்டாம்வகுப்பில்தமிழைஒருபாடமாகப்பயின்றிருக்கவேண்டும்.							
பாடப்பயன்கள் / Course outcomes	இப்பாடத்தைக்கற்பதால்பின்வரும்பயன்களைமாணவர்கள்அடைவர்.							
CO1	கவிதைஇலக்கியம்அறிமுகப்படுத்தப்படுவதால்படைப்பாற்றல்திறன்பெறுதல்.	புரிந்துகொள்ளல் (Understand)						
CO2	புதுக்கவிதைவரலாற்றினைஅறிந்துகொள்வர்.	புரிந்துகொள்ளல் (Understand)						
CO3	இக்காலஇலக்கியவகையினைக்கற்பதன்மூலம்படைப்பாக்கத்திறனைப்பெறுவர்.	பகுப்பாய்வுசெய்தல் Analyze						
CO4	மொழிஅறிவோடுசிந்தனைத்திறன்அதிகரித்தல்.	தெரிந்துகொள்ளல் (Apply)						
CO5	தமிழ்மொழியைப்பிழையின்றிஎழுதவும், புதியகலைச்சொற்களைஉருவாக்கவும்அறிந்துகொள்ளுதல்.	புரிந்துகொள்ளல் (Understand)						
	K1- Remember; K2 – Understand; K3 –Apply; K4 Analyze; K5 Evaluate; K6 – Create.							

அலகு - I	**மரபுக்கவிதை**	**9 மணிகள்**
	1. பெ. சுந்தரனார்- தமிழ்த்தெய்வவணக்கம். 2. பாரதிதாசன் – சிறுத்தையைவெளியேவா. 3. கவிமணி - புத்தரும்சிறுவனும் 4. முடியரசன் – மொழிஉணர்ச்சி	

	5. கண்ணதாசன் – ஆட்டனத்திஆதிமந்தி – ஆதிமந்திபுலம்பல். 6. சுரதாதுறைமுகம்தொகுப்பிலிருந்துஏதேனும்ஒருகவிதை 7. தமிழ்ஒளி - கடல்	
அலகு - II	**புதுக்கவிதை**	**9 மணிகள்**
	1. அப்துல்ரகுமான் – வீட்டுக்குஒருமரம்வளர்ப்போம். 2. ஈரோடுதமிழன்பன் - வணக்கம்வள்ளுவ. 3. வைரமுத்து – பிற்சேர்க்கை 4. மு.மேத்தா – வாழைமரம். 5. அறிவுமதி – வள்ளுவன்பத்து. 6. நா.முத்துக்குமார் – ஆனந்தயாழைமீட்டுகிறாய். 7. சுகிர்தாராணி – சபிக்கப்பட்டமுத்தம். 8. இளம்பிறை – நீஎழுதமறுக்கும்எனதுஅழகு.	
அலகு - III	**சிறுகதைகள்**	**9 மணிகள்**
	1. வாய்ச்சொற்கள் – ஜெயகாந்தன் (மாலைமயக்கம்தொகுப்பு) 2. கடிதம் - புதுப்பித்தன். 3. கரு - உமாமகேஸ்வரி. 4. முள்முடி - திஜானகிராமன். 5. சிதறல்கள் - விழி.பா.இதயவேந்தன். 6. காகிதஉறவு - சு.சமுத்திரம். 7. வீட்டின்மூலையில்சமையலறை - அம்பை. (மொழிபெயர்ப்புக்கதை) ஆண்டன்செக்காவ் – நாய்க்காரச்சீமாட்டி.	
அலகு - IV	**இலக்கியவரலாறு**	**9 மணிகள்**
	பாடம்தழுவியஇலக்கியவரலாறு	
அலகு - V	**மொழித்திறன்/ போட்டித்தேர்வு**	**9 மணிகள்**

	1. பொருள்பொதிந்தசொற்றொடர்அமைத்தல் 2. ஓர்எழுத்துஒருமொழி 3. வேற்றுமைஉருபுகள் 4. திணை, பால், எண், இடம் 5. கலைச்சொல்லாக்கம், மொழிபெயர்ப்பு (குறிப்பு : அலகு 4, 5 ஆகியபகுதிகள்போட்டித்தேர்வுநோக்கில்நடத்தப்படவேண்டும்)	
பாடநூல்கள்		
1.	மேலேசுட்டப்பட்டுள்ளகவிதைகள், பாடம்தொடர்புடையநூல்கள்	
பார்வைநூல்கள்		
1.	தமிழ்இலக்கியவரலாறு – சிற்பிபாலசுப்பிரமணியன்.	
2.	புதியநோக்கில்தமிழ்இலக்கியவரலாறு - தமிழண்ணல்	
3.	வகைமைநோக்கில்தமிழ்இலக்கியவரலாறு – எ.ஃப்.பாக்கியமேரி.	

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
Web Sources
• **Tamil Heritage Foundation - www.tamilheritage.org<http://www.tamilheritage.org>** • **Tamil virtual University Library - www.tamilvu.org/library http://www.virtualvu.org/library** • **Project Madurai - www.projectmadurai.org.** • **Chennai Library - www.chennailibrary.com<http://www.chennailibrary.com>.** • **Tamil Universal Digital Library-www.ulib.prg<http://www.ulib.prg>.** • **Tamil E-Books Downloads – tamilebooksdownloads.blogspot.com** • **Tamil Books online - books.tamilcube.com** • **Catalogue of the Tamil books in the Library of British Congress archive.org** • **Tamil novels online - books.tamilcube.com**
Strong-3, Medium-2, Low-1

COURSE CODE	**XGE102**		**L**	**T**	**P**	**SS**	**H**	**C**
COURSENAME	**ENGLISH I**		**3**	**0**	**0**	**0**	**3**	**3**
C:P:A- 3:0:0								
COURSE OUTCOMES: After the completion of course, the learners will be able to get comprehensive skills like:			**Domain**			**Level**		
CO1	***Develop*** and integrate the use of the four language skills i.e. Reading, Listening, Speaking and Writing		Cognitive			Understand		
CO2	***Understand*** the total content and underlying meaning in the context.		Cognitive			Apply		
CO3	***Form*** the habit of reading for pleasure and for information		Cognitive			Understand		
CO4	***Comprehend*** material other than the prescribed text		Cognitive			Understand		
CO5	***Develop*** the linguistic competence that enables them, in the future, to present the culture and civilization of their nation.		Cognitive			Understand		

SYLLABUS		**HOURS**
UNIT-I	**POETRY**	**6+3+0=9**
1.1 A Patch of Land - Subramania Bharati 1.2 The Sparrow - Paul Laurence Dunbar 1.3 A Nation's Strength – Ralph Waldo Emerson 1.4 Love Cycle - Chinua Achebe		
UNIT-II	**PROSE**	**6+3+0=9**
2.1 JRD - Harish Bhat 2.2 Us and Them - David Sedaris From Dress Your Family in Corduroy and Denim 2.3 Uncle Podger Hangs a Picture - Jerome K Jerome		
UNIT-III	**SHORT STORIES**	**6+3+0=9**
3.1 The Faltering Pendulum- Bhabani Bhattacharya 3.2 How I Taught my Grandmother to Read - Sudha Murthy 3.3 The Gold Frame- R.K. Laxman		
UNIT-IV	**LANGUAGE COMPETENCY**	**6+3+0=9**
4.1 Vocabulary : Synonyms, Antonyms, Word Formation 4.2 Appropriate use of Articles and Parts of Speech 4.3 Error correction		
UNIT - V	**ENGLISH FOR WORKPLACE**	**6+3+0=9**
5.1 Self - introduction, Greetings 5.2 Introducing others 5.3 Listening for General and Specific Information		

5.4 Listening to and Giving Instructions / Directions	
L=30 / T=15 **Total Hours**	**45**
Tutorial Activities 1) Reading and understanding incomplete texts 2) Summarize a piece of prose or poetry 3) Communication Practice 4) Role play	
Text books • **Hogan, Sharon. The Art of Civilized Conversation: A Guide to Expressing Yourself withStyle and Grace -Margaret Shepherd,Penny Carter, (Illustrator), 2015.** • Kumar, Vijay T. English in Use - *A Textbook For College Students* (English Paper back, - K Durga Bhavani, YL Srinivas,2015 • Murthy, Sudha. *How I taught my Grandmother to Read and other Stories*. Penguin Books, India, 2014 • Swan, Michael. *Practical English Usage* - 4th Edition By, 2018	

<table>
<tr><td colspan="3">COURSE NAME</td><td colspan="2">Algebra & Trigonometry</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td colspan="3">COURSE CODE</td><td colspan="2">XMT103</td><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td>C</td><td>P</td><td>A</td><td colspan="2"></td><td>L</td><td>T</td><td>P</td><td>H</td></tr>
<tr><td>4</td><td>0</td><td>0</td><td colspan="2"></td><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td colspan="3">PREREQUISITE</td><td colspan="6">Number systems</td></tr>
<tr><td colspan="9">On successful completion of this course, the students will be able to:</td></tr>
<tr><td colspan="4">COURSE OUTCOMES</td><td colspan="2">DOMAIN</td><td colspan="3">LEVEL</td></tr>
<tr><td>CO 1</td><td colspan="3">Utilize Horner’s Method to obtain the roots of polynomials</td><td colspan="2">Cognitive</td><td colspan="3">Applying</td></tr>
<tr><td>CO 2</td><td colspan="3">Find the summation of the given series such as binomial, exponential and logarithmic series</td><td colspan="2">Cognitive</td><td colspan="3">Remembering</td></tr>
<tr><td>CO 3</td><td colspan="3">Utilize Cayley-Hamilton theorem to find powers of a given square matrix and inverse of a given matrix</td><td colspan="2">Cognitive</td><td colspan="3">Applying</td></tr>
<tr><td>CO 4</td><td colspan="3">Find the expansion of trigonometric ratios in terms of θ</td><td colspan="2">Cognitive</td><td colspan="3">Remembering</td></tr>
<tr><td>CO 5</td><td colspan="3">Explain the relation between circular and hyperbolic functions</td><td colspan="2">Cognitive</td><td colspan="3">Understanding</td></tr>
<tr><td>UNIT 1</td><td colspan="7"></td><td>9 + 3</td></tr>
<tr><td colspan="9">Reciprocal Equations - Standard form – Increasing or decreasing the roots ofa given equation – Removal of terms, Approximate solutions of roots ofpolynomialsbyHorner’smethod–relatedproblems.</td></tr>
<tr><td>UNIT 2</td><td colspan="7"></td><td>9 + 3</td></tr>
<tr><td colspan="9">Summation of Series: Binomial– Exponential –Logarithmic series(Theoremswithout proof)–Approximations–relatedproblems.</td></tr>
<tr><td>UNIT 3</td><td colspan="7"></td><td>9 + 3</td></tr>
<tr><td colspan="9">Characteristicequation–Eigen valuesandEigen Vectors - Similar matrices - Cayley–HamiltonTheorem(Statementonly)-Findingpowersofsquare matrix, Inverse of a square matrix up to order 3, Diagonalization ofsquare matrices-related problems.</td></tr>
<tr><td>UNIT 4</td><td colspan="7"></td><td>9 + 3</td></tr>
<tr><td colspan="9">Expansions of $\sin n\theta$, $\cos n\theta$ in powers of $\sin\theta$, $\cos\theta$ - Expansion of $\tan n\theta$ interms of $\tan\theta$, Expansions of $\cos^n\theta$, $\sin^n\theta$, $\cos^m\theta\sin^n\theta$ –Expansions of $\tan(\theta_1+\theta_2+,\ldots,+\theta_n)$-Expansionsof $\sin\theta$, $\cos\theta$ and $\tan\theta$ intermsof θ-relatedproblems.</td></tr>
<tr><td>UNIT 5</td><td colspan="7"></td><td>9 + 3</td></tr>
<tr><td colspan="9">Hyperbolic functions – Relation between circular and hyperbolic functions-Inverse hyperbolic functions, Logarithm of complex quantities, - relatedproblems.</td></tr>
<tr><td>LECTURE</td><td>45</td><td>TUTORIAL</td><td>15</td><td>PRACTICAL</td><td>0</td><td>TOTAL</td><td colspan="2">60</td></tr>
<tr><td colspan="9">Text Book</td></tr>
<tr><td colspan="9">1. Mathematics,Volume-IandII,P. Kandasamy,K. Thilagavathy,S.ChandPublication, 1st Edition, 2004.
Unit I - 1[Vol-I], 21-23,36-43,65-70
Unit II - 2,3,4[Vol-I], 71-100
Unit III - 4[Vol-II], 59-96
Unit IV - 6[Vol-I], 122-141
Unit V -7[Vol-I], 143-155, 1[Vol-II], 242-247.</td></tr>
</table>

References
1. AlgebraandTrigonometry,J.Stewart,L.Redlin,andS.Watson,CengageLearning,2012. 2. CalculusandAnalyticalGeometry,G.B.ThomasandR.L.Finny,PearsonPublication,9th Edition, 2010.
E-References
https://nptel.ac.in

COs VS POs											
	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**
CO 1	3	3	2	0	1	3	3	3	3	3	0
CO 2	2	1	0	0	0	1	1	1	2	1	0
CO 3	3	3	2	0	1	3	3	3	3	3	0
CO 4	2	1	0	0	0	1	1	1	2	1	0
CO 5	3	2	1	0	0	2	2	2	3	2	0
TOTAL	13	10	5	0	2	10	10	10	13	10	0
SCALED VALUE	**3**	**3**	**1**	**0**	**1**	**2**	**2**	**2**	**3**	**2**	**0**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											
1-5→1, 6-10→2, 11-15→3											

COURSE NAME			Differential Calculus	L	T	P	C
COURSE CODE			XMT104	3	1	0	4
C	P	A		L	T	P	H
4	0	0		3	1	0	4
PREREQUISITE			Basic differentiation formula				

On successful completion of this course, the students will be able to:

	COURSE OUTCOMES	DOMAIN	LEVEL
CO 1	**Utilize**Leibnitz formula to find n^{th} derivative of a given function.	Cognitive	Applying
CO 2	**Identify**thepartialderivatives of the given functions.	Cognitive	Applying
CO 3	**Utilize** Lagrange's method to findthemaximaand minima of a functionoftwo variables.	Cognitive	Applying
CO 4	**Identify** the envelope of various family of curves.	Cognitive	Applying
CO 5	**Identify** evolute of a given family of curves.	Cognitive	Applying

UNIT 1 **9 + 3**

Introduction (Review of basic concepts)–The n^{th}derivative–Standardresults–Fractionalexpressions–Trigonometricaltransformation–Formationofequationsinvolvingderivatives–Leibnitzformula forthe n^{th}derivativeofaproduct.

UNIT 2 **9 + 3**

Partial derivatives - Successive partial derivatives – Function of function rule – Total differential coefficient – Implicit functions

UNIT 3 **9 + 3**

Homogeneousfunctions–Partialderivatives of a function of two functions –Maxima and minima offunctionsoftwovariables–Lagrange'smethodofundeterminedmultipliers.

UNIT 4 **9 + 3**

Method of finding envelope – Another definition of envelope- Envelope of family of curves which are quadratic in the parameter.

UNIT 5 **9 + 3**

Definition of Curvature – Circle, Radius and Centre of Curvature – Evolutes and Involutes – Radius of curvature in polar co- ordinates.

LECTURE	45	TUTORIAL	15	PRACTICAL	0	TOTAL	60

Text Book

1. Calculus Volume I, S. Narayanan and T.K. Manicavachagom Pillay, S. Viswanathan Pvt. Ltd., 2014.

Unit I - Chapter III All sections (Pages 69 to 87)
Unit II - Chapter VIII Sections: 1.1 to 1.5 (Pages 178 to 191)
Unit III - Chapter VIII Sections: 1.6 to 1.7,4 & 5 (Pages 191 to 204,222 to 2347)
Unit IV- Chapter IV Sections: 1.1 to 1.4, (Pages 281 to 291)
Unit V- Chapter V Sections :2.1 to 2.3& 2.5 (Pages 291 to 301,309 to 312)

References

1. Calculus, H. Anton, I. Birens and S. Davis, John Wiley and Sons, Inc., 2002.
2. Calculus, G.B. Thomas and R.L. Finney, Pearson Education, 2010.
3. Calculus, M.J. Strauss, G.L. Bradley and K. J. Smith, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi, 2007.
4. Introduction to Calculus and Analysis (Volumes I & II), R. Courant and F. John, Springer- Verlag, New York, Inc., 1989.
5. Calculus, Volumes I and II, T. Apostol.
6. Calculus and mathematical analysis, S. Goldberg,

E-References

1. https://nptel.ac.in
2. https://www.math.columbia.edu/programs-math/undergraduate-program/ [Columbia University]
3. https://www.math.harvard.edu/undergraduate/?courseid=63/(Hardvard University)

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2
CO 1	3	3	2	0	1	3	3	3	3	3	0
CO 2	3	3	2	0	1	3	3	3	3	3	0
CO 3	3	3	2	0	1	3	3	3	3	3	0
CO 4	3	3	2	0	1	3	3	3	3	3	0
CO 5	3	3	2	0	1	3	3	3	3	3	0
TOTAL	15	15	10	0	5	15	15	15	15	15	0
SCALED VALUE	**3**	**3**	**2**	**0**	**1**	**3**	**3**	**3**	**3**	**3**	**0**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											
1-5→1, 6-10→2, 11-15→3											

<table>
<tr><td colspan="3">COURSE CODE</td><td>COURSE NAME</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td colspan="3">XPG105</td><td rowspan="3">ALLIED PHYSICS – I</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>C</td><td>P</td><td>A</td><td>L</td><td>T</td><td>P</td><td>H</td></tr>
<tr><td>2.7</td><td>0</td><td>0.3</td><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td colspan="8">COURSE OUTCOMES: At the end of the course, the student will be able to</td></tr>
</table>

OBJECTIVES: To impart basic principles of Physics that which would be helpful for students who have taken programmes other than Physics.		**DOMAIN**	**LEVEL**
CO1	***Explain*** types of motion and extend their knowledge in the study of various dynamic motions analyze and demonstrate mathematically. ***Relate*** theory with practical applications in medical field.	Cognitive	Remember, Understand Apply
CO2	***Explain*** their knowledge of understanding about materials and ***apply*** it to various situations in laboratory and real life.	Cognitive	Understand apply
CO3	***Comprehend*** basic concept of thermodynamics concept of entropy and ***interpret*** the process of flow temperature.	Cognitive	Remember understand
CO4	***Articulate*** the knowledge about electric current resistance, capacitance in terms of potential electric field and ***analyze*** them mathematically verify circuits.	Cognitive	Understand Analyze
CO5	***Interpret*** the real life solutions using AND, OR, NOT basic logic gates and ***Infer*** operations using Boolean algebra and acquire elementary ideas of IC circuits.	Cognitive	Remember analyze

UNIT – I	**WAVES, OSCILLATIONS AND ULTRASONICS**	**9 + 3**
Simple harmonic motion (SHM) – composition of two SHMs at right angles (periods in the ratio 1:1) – Lissajous figures – uses – laws of transverse vibrations of strings – determination of AC frequency using sonometer (steel and brass wires) – ultrasound – production – piezoelectric method – application of ultrasonics: medical field – lithotripsy, ultrasonography – ultrasonic imaging- ultrasonics in dentistry – physiotheraphy, opthalmology – advantages of noninvasive surgery – ultrasonics in green chemistry		
UNIT – II	**PROPERTIES OF MATTER**	**9 + 3**
Elasticity: elastic constants – bending of beam – theory of non- uniform bending – determination of Young’s modulus by non-uniform bending – energy stored in a stretched		

wire – torsion of a wire – determination of rigidity modulus by torsional pendulum

Viscosity: streamline and turbulent motion – critical velocity – coefficient of viscosity – Poiseuille's formula – comparison of viscosities – burette method,

Surface tension: definition – molecular theory – droplets formation–shape, size and lifetime – COVID transmission through droplets, saliva – drop weight method – interfacial surface tension.

UNIT – III	**HEAT AND THERMODYNAMICS**	**9 + 3**

: Joule-Kelvin effect – Joule-Thomson porous plug experiment – theory – temperature of inversion – liquefaction of Oxygen– Linde's process of liquefaction of air– liquid Oxygen for medical purpose– importance of cryocoolers – thermodynamic system – thermodynamic equilibrium – laws of thermodynamics – heat engine – Carnot's cycle – efficiency – entropy – change of entropy in reversible and irreversible process.

UNIT – IV	**ELECTRICITY AND MAGNETISM**	**9 + 3**

Potentiometer – principle – measurement of thermo emf using potentiometer –magnetic field due to a current carrying conductor – Biot-Savart's law – field along the axis of the coil carrying current – peak, average and RMS values of ac current and voltage – power factor and current values in an AC circuit – types of switches in household and factories– Smart wifi switches- fuses and circuit breakers in houses.

UNIT – V	**DIGITAL ELECTRONICS AND DIGITAL INDIA**	**9 + 3**

Logic gates, OR, AND, NOT, NAND, NOR , EXOR logic gates – universal building blocks – Boolean algebra – De Morgan's theorem – verification – overview of Government initiatives: software technological parks under MeitY, NIELIT- semiconductor laboratories under Dept. of Space – an introduction to Digital India.

HOURS	**LECTURE**	**TUTORIAL**	**TOTAL**
	45	**15**	**60**

TEXT BOOKS

1. Murugeshan R , "Properties of Matter For B. Sc. Students", S Chand & Company Limited, Mohan Co-Operative Industrial Estate, New Delhi - 110 044, First edition 1994, Reprint 2022.
2. R. Murugeshan, Er. Kiruthiga Siva Prasath, "Properties of Matter and Acoustics", S.Chand& Company Ltd, Ram Nagar, New Delhi - 110 055, First edition 2005, Second Edition 2012.
3. Brijlal and N.Subramanyam (1994), Waves and Oscillations, Vikas Publishing House, New Delhi
4. V.K.Metha(2004). Principles of electronics 6thEdn. S. Chand and company.

5. J.B.Rajam and C.L.Arora (1976). Heat and Thermodynamics (8^{th} edition), S.Chand&Co.,New Delhi.

REFERENCE BOOKS

1. DS Mathur, "Elements of Properties of Matter", S. Chand Limited, S. Chand & Company Pvt. Ltd., Ram Nagar, New Delhi - 110 055, First edition 1949, Reprint 2016.
2. Brij Lal, N Subrahmanyam, "*A Textbook of Sound* " 2^{nd} Edition, Vikas Publishing House Pvt.Ltd.A–27, 2nd Floor, Mohan Co–operative Industrial Estate, New Delhi–110044, 2018.
3. ResnickHallidayandWalker(2018).FundamentalsofPhysics(11^{th}edition),JohnWilleyand Sons, Asia Pvt.Ltd., Singapore.
4. R. Murugesan (2001), Allied Physics, S. Chand & Co, New Delhi
5. V.R. Khannaand R.S. Bedi (1998), Text book of Sound 1^{st}Edn. Kedharnaath Publish &Co, Meerut.
6. N.S. Khare and S.S.Srivastava (1983), Electricity and Magnetism10^{th}Edn., Atma Ram &Sons, New Delhi

E REFERENCES

1. https://youtu.be/M_5KYncYNyc
2. https://youtu.be/ljJLJgIvaHY
3. https://youtu.be/7mGqd9HQ_AU
4. https://youtu.be/h5jOAw57OXM
5. https://learningtechnologyofficial.com/category/fluid-mechanics-lab/
6. http://hyperphysics.phy-astr.gsu.edu/hbase/permot2.html
7. https://www.youtube.com/watch?v=gT8Nth9NWPM
8. https://www.youtube.com/watch?v=9mXOMzUruMQ&t=1s
9. https://www.youtube.com/watch?v=m4u-SuaSu1s&t=3s
10. https://www.biolinscientific.com/blog/what-are-surfactants-and-how-do-they-work

Mapping with Programme Outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO9	PO10	PSO1	PSO2
CO_1	3	0	1	0	1	3	1	2	1	2	2	1
CO_2	2	0	1	2	1	3	1	1	1	2	2	1
CO_3	2	1	3	3	1	3	2	1	0	2	1	1
CO_4	1	1	2	3	2	3	1	2	0	2	2	2
CO_5	2	1	1	3	1	3	1	2	1	2	1	1
Total	10	3	8	11	6	15	6	8	3	10	8	6
Scaled to 1, 2, 3	**2**	**1**	**2**	**3**	**2**	**3**	**3**	**2**	**1**	**2**	**2**	**2**

0 – No relation 1 – Low relation 2 – Medium relation 3 – High relation

COURSE CODE			COURSE NAME	L	T	P	C
XPG106			**ALLIED PHYSICS PRACTICAL – I**	**0**	**0**	**1**	**1**
C	**P**	**A**		**L**	**T**	**P**	**H**
0	**0.75**	**0.25**		**0**	**0**	**2**	**2**

COURSE OUTCOMES On the successful completion of this course students would able to		**Domain**	**Level**
CO1	***Develop*** *Knowledge* on bending of beams, its properties and *application*	Psychomotor	Mechanism
CO2	***Identify*** the principles of elasticity, ***derive*** expression for twisting couple and ***determine*** rigidity modulus of a wire.	Psychomotor: Affective:	Analyze, Mechanism Respond
CO3	. ***Understand*** *flow* of liquid, viscosity and *identify* its *applications and* ***Define*** surface tension	Psychomotor: Affective:	Apply Mechanism Receive
CO4	***recall*** the concepts of electric and magnetic field and ***explain*** the calibration of the equipments.	Psychomotor: Affective:	Analyze Mechanism Receive
CO5	. ***Understand*** basic concepts of gates and ***identify*** its ***applications***	Psychomotor: Affective:	Analyze Mechanism Receive

Ex. No	Experiments (Any eight experiments)	Cos
1.	Young's modulus by non-uniform bending using pin and microscope	CO2
2.	Young's modulus by non-uniform bending using optic lever,scale and telescope	CO2
3.	Rigidity modulus by static torsion method.	CO1

4.	Rigidity modulus by torsional oscillations without mass	CO1
5.	Surface tension and interfacial Surface tension – drop weight method	CO3
6.	Comparison of viscosities of two liquids – burette method	CO3
7.	Specific heat capacity of a liquid – half time correction	CO3
8.	Verification of laws of transverse vibrations using sonometer	CO4
9.	Calibration of low range voltmeter using potentiometer	CO4
10.	Determination of thermo emf using potentiometer	CO4
11	Verification of De Morgan's theorems using logic gate ICs.	CO5
12	Use of NAND as universal building block.	CO5

	LECTURE	**PRACTICAL**	**TOTAL**
HOURS	**0**	**30**	**30**

TEXT BOOKS

1. C. L. Arora,"B.Sc .Practical Physics", S. Chand & Company Ltd. Ram Nagar, New Delhi–110055. 2007.

2. R. K. Shukla & Anchal Srivastava. "Practical Physics," New Age International (P) Ltd, Publishers, (Formerly Wiley Eastern Limited), 4835/24, Ansari Raod, Daryagani, New Delhi–11002. 2006.

REFERENCE BOOKS

1. Geeta Sanon, "B. Sc., Practical Physics", 1st Edition, S. Chand and Company, 2007.

2. Chattopadhyay, D., Rakshit, P. C. and Saha, B., "An Advanced Course in Practical Physics," 8th Edition, Books & Allied Ltd., Calcutta, 2007.

3. G. L. Squires, "Practical Physics", Fourth edition, Cambridge University Press, 2001.

4. Indu Prakash and Ramakrishna, "A Text Book of Practical Physics," 11th Edition, Kitab Mahal, New Delhi, 2011.

5. C. Ouseph,K. Rangarajan, "A Text Book of Practical Physics", Volume I,II, S.Viswanathan Publishers,1997.

E–Resources:

1. Amal Kumar Das , Department of Physics, IIT Kanpur, “Introduction to Electromagnetic Theory”, National Programme on Technology Enhanced Learning (NPTEL), https://onlinecourses.nptel.ac.in/noc20_ph16/preview

Mapping of COs with POs

Course Outcomes	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**	**PO9**	**PO10**	**PSO1**	**PSO2**
CO_1	1	1	3	3	2	3	1	3	0	1	2	1
CO_2	1	1	3	2	1	3	1	3	1	1	2	1
CO_3	1	1	3	3	1	3	2	3	1	2	2	1
CO_4	1	1	2	2	2	3	1	3	1	2	2	1
CO_5	1	1	3	3	2	3	1	3	1	2	2	1
Total	5	5	14	13	8	15	6	15	4	8	10	5
Scaled to 1, 2, 3	**1**	**1**	**3**	**3**	**2**	**3**	**2**	**3**	**1**	**2**	**2**	**1**

0 – No relation 1 – Low relation 2 – Medium relation 3 – High relation

COURSE NAME			Foundation Course	L	T	P	C
COURSE CODE			XMT107	1	1	0	2
C	P	A		L	T	P	H
2	0	0		1	1	0	2
PREREQUISITE			Number systems & Algebra				

On successful completion of this course, the students will be able to:

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Find** a general term and middle tern in a binomial expansion using binomial theorem.	Cognitive	Remembering
CO 2	**Find**the number of possible combinations for a given situation using the fundamental counting principle.	Cognitive	Remembering
CO 3	**Find** the combinations of objects with repetitions.	Cognitive	Remembering
CO 4	**Find** the 6 trigonometric functions using a calculator, as well as determining exact values for some special angles without a calculator.	Cognitive	Remembering
CO 5	**Find** derivatives of the given composite functions.	Cognitive	Remembering

UNIT 1 **3+3**

Binomial theorem, General term, middle term, problems based on these concepts.

UNIT 2 **3+3**

Fundamental principle of counting. Factorial n.

UNIT 3 **3+3**

Derivation of formulae and their connections, simple applications, combinations with repetitions, arrangements within groups, formation of groups.

UNIT 4 **3+3**

Introduction to trigonometric ratios, proof of sin(A+B), cos(A+B), tan(A+B) formulae, multiple and sub multiple angles, sin(2A), cos(2A), tan(2A) etc., transformations sum into product and product into sum formulae, inverse trigonometric functions, sine rule and cosine rule.

UNIT 5 **3+3**

Limits, standard formulae and problems, differentiation, first principle, uv rule, u/v rule, methods of differentiation, application of derivatives, integration - product rule and substitution method.

LECTURE	15	TUTORIAL	15	PRACTICAL	0	TOTAL	30

Text Book

1. NCERT class XI and XII text books
2. Any State Board Mathematics text books of class XI and XII current Edition

References

Any State Board Mathematics text books of class XI and XII, Old Edition.

E-References

https://nptel.ac.in

COs Vs POs											
	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**
CO 1	2	1	0	0	0	1	1	1	2	1	0
CO 2	2	1	0	0	0	1	1	1	2	1	0
CO 3	2	1	0	0	0	1	1	1	2	1	0
CO 4	2	1	0	0	0	1	1	1	2	1	0
CO 5	2	1	0	0	0	1	1	1	2	1	0
TOTAL	10	5	0	0	0	5	5	5	10	5	0
SCALED VALUE	**2**	**1**	**0**	**0**	**0**	**1**	**1**	**1**	**2**	**1**	**0**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											
1-5→1, 6-10→2, 11-15→3											

COURSE CODE	XUM001	L	T	P	SS	C
COURSE NAME	HUMAN ETHICS, VALUES, RIGHTS AND GENDER EQUALITY	1	0	0	1	1
PREREQUISITES	Not Required	L	T	P	SS	H
C:P:A	0.8:0.1:0.1	1	0	0	1	2

COURSE OUTCOMES		Domain	Level
CO1	***Relate*** and ***Interpret*** the human ethics and human relationships	Cognitive	Remember, Understand
CO2	***Explain*** and ***Apply*** gender issues, equality and violence against women	Cognitive	Understand, Apply
CO3	***Classify*** and ***Develop*** the identify of women issues and challenges	Cognitive & Affective	Analyze Receive
CO4	***Classify***and***Dissect*** human rights and report on violations.	Cognitive	Understand, Analyze
CO5	***List*** and **respond** to family values, universal brotherhood, fight against corruption by common man and good governance.	Cognitive & Affective	Remember, Respond

UNIT I HUMAN ETHICS AND VALUES	**3+3**
HUMAN ETHICS AND VALUES Human Ethics and values - Family and Society, Social service, Social Justice, Integrity, Caring and Sharing, Honesty and Courage, Time Management, Co-operation, Commitment, Sympathy and Empathy, Self respect, Self-Confidence, Personality Development	
UNIT IIGENDER EQUALITY	**3+3**
Gender Discrimination in society and in family, Gender equity, equality, and empowerment. Social and Economic Status of Women in India in Education, Health, Employment, Definition of HDI, GDI and GEM. Contributions of Dr.B.R. Ambethkar, ThanthaiPeriyar and Phule to Women Empowerment.	
UNIT IIIWOMEN ISSUES AND CHALLENGES	**3+3**
Women Issues and Challenges- Female Infanticide and Feticide, Violence against women, Domestic violence, Sexual Harassment, Trafficking, Remedial Measures – Acts related to women: Political Right, Property Rights, and Rights to Education, Dowry Prohibition Act.	
UNIT IV HUMAN RIGHTS	**3+3**
Human Rights and Duties, Universal Declaration of Human Rights (UDHR), Civil, Political, Economical, Social and Cultural Rights, Rights against torture, Forced Labour, Child helpline-Intellectual Property Rights (IPR) and its types. National Policy on occupational safety and health.	
UNIT V GOOD GOVERNANCE	**3+3**
Good Governance - Democracy, People's Participation, Transparency in governance and audit, Corruption, Impact of corruption on society and Remedial measures, Government system of Redressal. Creation of People friendly environment and universal brotherhood.	

	LECTURE	SELF STUDY	TOTAL

	15	**15**	**30**

REFERENCES

1. Aftab A, (Ed.), Human Rights in India: Issues and Challenges, (New Delhi: Raj Publications, 2012).
2. Bajwa, G.S. and Bajwa, D.K. Human Rights in India: Implementation and Violations (New Delhi: D.K. Publications, 1996).
3. Chatrath, K. J. S., (ed.), Education for Human Rights and Democracy (Shimala: Indian Institute of Advanced Studies, 1998).
4. Jagadeesan. P. Marriage and Social legislations in Tamil Nadu, Chennai: Elachiapen Publications, 1990).
5. Kaushal, Rachna, Women and Human Rights in India (New Delhi: Kaveri Books, 2000)
6. Mani. V. S., Human Rights in India: An Overview (New Delhi: Institute for the World Congress on Human Rights, 1998).
7. Singh, B. P. Sehgal, (ed) Human Rights in India: Problems and Perspectives (New Delhi: Deep and Deep, 1999).
8. Veeramani, K. (ed) Periyar on Women Right, (Chennai: Emerald Publishers, 1996)
9. Veeramani, K. (ed) Periyar Feminism, (Periyar Maniammai University, Vallam, Thanjavur: 2010).
10. Planning Commission report on Occupational Health and Safety http://planningcommission.nic.in/aboutus/committee/wrkgrp12/wg_occup_safety.p
11. Central Vigilance Commission (Gov. of India) website: http://cvc.nic.in/welcome.html.
12. Weblink of Transparency International: https://www.transparency.org/
13. Weblink Status report: https://www.hrw.org/world-report/2015/country-chapters/india

Table 1 : Mapping of COs with Pos

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1								2						
CO2								3	1					
CO3								2						
CO4								3		2				
CO5								3	2	2		2		
Total		2						13	3	4		2		
Scaled Value		1						3	1	1		1		

SEMESTER II

பொதுத்தமிழ் - 2

பாடக்குறியீடு/ Course Code	பாடப்பெயர்/ Course Name	**Category**	**L**	**T**	**P**	**SS**	**H**	**C**
XGT201	**பொதுத் தமிழ் - 2**	Supportive	**3**	**0**	**0**	**0**	**3**	**3**
Pre-requisite	பன்னிரெண்டாம்வகுப்பில்தமிழைஒருபாடமாகப்பயின்றிருக்கவேண்டும்.							
பாடப்பயன்கள் / Course outcomes	இப்பாடத்தைக்கற்பதால்பின்வரும்பயன்களைமாணவர்கள் அடைவர்.							
CO1	நீதிஇலக்கியங்களைக்கற்பதன்மூலம்நீதிநெறியினையும்வாழ்வியல்மற்றும்மேலாண்மைச் சிந்தனைகளையும்தெரிந்துபின்பற்றுவர்	புரிந்துகொள்ளல் (Understand)						
CO2	சிற்றிலக்கியங்களின்வழிஇலக்கியச்சுவையினையும்பண்பாட்டுஅறிவினையும்பெறுவர்	புரிந்துகொள்ளல் (Understand)						
CO3	பட்டப்படிப்பினைப்படிக்கும்போதேபெரும்பான்மையானதமிழ்இலக்கியங்கள்குறித்தஅறிவினைப்பெறுவர்	பகுப்பாய்வு செய்தல் Analyze						
CO4	தமிழ்ச்சமூகப்பண்பாட்டுவரலாற்றினைஇலக்கியங்கள்வாயிலாகஅறிவர்	தெரிந்து கொள்ளல் (Apply)						
CO5	போட்டித்தேர்வுகளில்வெற்றிபெறுவதற்குத்தமிழ்ப்பாடத்தினைப்பயன்கொள்ளும்வகையில் ஏற்றபயிற்சிபெறுவர்	புரிந்துகொள்ளல் (Understand)						
	K1- Remember; K2 – Understand; K3 –Apply; K4 Analyze; K5 Evaluate; K6 – Create.							

அல	**நீதிஇலக்கியம்**	**9மணிக**

கு - I		**ள்**
	திருக்குறளில்வாழ்வியல் – திருக்குறளில்மேலாண்மைச்சிந்தனைகள்	
அல கு - II	**பிறஇலக்கியங்கள்**	**9மணிக ள்**
	வள்ளலார் – அருள்விளக்கமாலை (முதல் 10 பாடல்கள்) – எச்.ஏ.கிருட்டிணப்பிள்ளை – இரட்சணியமனோகரம் – பால்யபிரார்த்தனை – குணங்குடிமஸ்தான்சாகிபு – பராபரக்கண்ணி (முதல் 10 கண்ணி)	
அல கு - III	**சிற்றிலக்கியங்கள்**	**9மணிக ள்**
	தமிழ்விடுதூது (முதல் 20 கண்ணி) – திருக்குற்றாலக்குறவஞ்சி – குறத்திமலைவளம்கூறல் – முக்கூடல்பள்ளு – நாட்டுவளம்	
அல கு -IV	**இலக்கியவரலாறு**	**9மணிக ள்**
	பாடம்தழுவியஇலக்கியவரலாறு (பல்லவர்காலம், நாயக்கர்காலம்)	
அல கு - V	**மொழித்திறன்/ போட்டித்தேர்வுத்திறன்**	**9மணிக ள்**
	1. தொடர்வகைகள் 2. மரபுத்தொடர், பழமொழிகள் 3. பிறமொழிச்சொற்களைக்களைதல் 4. வழுச்சொற்கள்நீக்குதல் 5. இலக்கணக்குறிப்புஅறிதல்	
	(குறிப்பு : அலகு 4, 5	**45**

	ஆகியபகுதிகள்போட்டித்தேர்வுநோக்கில்நடத்தப்படவேண்டும்)	**மணிகள்**
பாடநூல்கள்		
1.	திருக்குறள், மணிவாசகர்பதிப்பகம், சென்னை	
2.	இலக்கியத்தல்மனிதவளமேம்பாடு, சி. சரவணஜோதி, பாவைபப்ளிகேசன்ஸ்,	
3.	தமிழ்விடுதூது	
4.	திருக்குற்றாலக்குறவஞ்சி	
5.	எச்.ஏ.கிருட்டிணப்பிள்ளை – இரட்சணியமனோகரம்	
பார்வைநூல்கள்		
1.	தமிழ்இலக்கியவரலாறு – சிற்பிபாலசுப்பிரமணியன்.	
2.	புதியநோக்கில்தமிழ்இலக்கியவரலாறு - தமிழண்ணல்	
3.	வகைமைநோக்கில்தமிழ்இலக்கியவரலாறு – எ.ஃப்.பாக்கியமேரி.	

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
Web Sources
• **Tamil Heritage Foundation - www.tamilheritage.org<http://www.tamilheritage.org>** • **Tamil virtual University Library - www.tamilvu.org/library http://www.virtualvu.org/library** • **Project Madurai - www.projectmadurai.org.** • **Chennai Library - www.chennailibrary.com<http://www.chennailibrary.com>.** • **Tamil Universal Digital Library-www.ulib.prg<http://www.ulib.prg>.** • **Tamil E-Books Downloads – tamilebooksdownloads.blogspot.com** • **Tamil Books online - books.tamilcube.com** • **Catalogue of the Tamil books in the Library of British Congress archive.org** • **Tamil novels online - books.tamilcube.com**
Strong-3, Medium-2, Low-1

COURSE CODE	XGE202	L	T	P	SS	H	C
COURSENAME	ENGLISH II	2	1	0	0	3	3
C:P:A- 3:0:0							

COURSE OUTCOMES: **After the completion of course, the learners will be able to get comprehensive skills like:**		**Domain**	**Level**
CO1	***Learn*** to introduce themselves and talk about everyday activities confidently	Cognitive	Understand
CO2	A***ble*** to write short paragraphs on people, places and events	Cognitive	Apply
CO3	***Identify*** the purpose of using various tenses and effectively employ them in speaking and writing	Cognitive	Understand
CO4	***Gain*** knowledge to write subjective and objective descriptions	Cognitive	Understand
CO5	***Identify*** and use their skills effectively in formal contexts.	Cognitive	Understand

SYLLABUS		**HOURS**
UNIT-I	**POETRY**	**6+3+0=9**
1.1Very Indian Poem in Indian English - Nissim Ezekiel 1.2 Still I Rise - Maya Angelou 1.3 The Flower -Tennyson 1.4 On Killing a Tree - Gieve Patel		
UNIT-II	**PROSE**	**6+3+0=9**
2.1 If You Are Wrong Admit it- Dale Carnegie 2.2 Kindly Adjust Please - Shashi Tharoor 2.3 The Spoon-fed Age- W.R. Inge		
UNIT-III	**FICTION**	**6+3+0=9**
Alchemist - Paulo Coelho		
UNIT-IV	**LANGUAGE COMPETENCY**	**6+3+0=9**
4.1 Homonyms, Homophones, Homographs Portmanteau words 4.2 Verbs and Tenses, Subject Verb Agreement 4.3 Error correction		
UNIT - V	**ENGLISH FOR WORKPLACE**	**6+3+0=9**
5.1 Reading for General and Specific Information [charts, tables, schedules, graphs etc] 5.2 Reading news and weather reports 5.3 Writing paragraphs 5.4 Taking and making notes		
L=30 / T=15	**Total Hours**	**45**
Tutorial Activities 5) Reading and understanding incomplete texts 6) Summarize a piece of prose or poetry 7) Communication Practice 8) Role play		

Textbooks • Coelho, Paulo.*The Alchemist.* Harper ,2016 • Chambers, Pearson.*Brilliant Speed Reading: Whatever you need to read, however* ...Phil, 2013 • Hewings, Martin.*Advanced English Grammar.* Cambridge University Press, 2000 • Sharma, Richa *Descriptive English*. Arihant Publications (India) Ltd, 2019 **E- Resources:** • Very Indian poem by Nissim Ezekiel • http://econtent.in/pacc.in/admin/contents/40_%20_2020103001102714.pdf • Still I Rise by Maya Angelou https://www.poetryfoundation.org/poems/46446/still-i-rise • Kindly Adjust please - Shashi Tharoor • https://www.theweek.in/columns/shashi-tharoor/2018/05/25/kindly-adjust-to-our-english.html?fbclid=IwAR3IhtdXqvuV4ySECn9S7SA6HmCEYISyd1QHd3BlwKgiNKKwdkeSg3qWp-U/ • The Alchemist: https://www.youtube.com/watch?v=lxBYpmxjeDU	

COURSE NAME			Analytical Geometry 3-D and Integral Calculus	L	T	P	C
COURSE CODE			XMT203	3	1	0	4
C	P	A		L	T	P	H
4	0	0		3	1	0	4
PREREQUISITE			2D and 3D Shapes & Basic Integration Formulae				

On successful completion of this course, the students will be able to:

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Find** the equation tangent plane to a given sphere.	Cognitive	Remembering
CO 2	**Find** the equation tangent plane to a given cone and cylinder.	Cognitive	Remembering
CO 3	**Apply** the properties of definite integral to find reduction formulae for a given integral.	Cognitive	Applying
CO 4	**Examine** the relation between beta and gamma function and also find recurrence for gamma function.	Cognitive	Analyzing
CO 5	**Utilize** the change of order of integration to obtain area the given bounded region.	Cognitive	Applying

UNIT 1 — **9 + 3**

Sphere- Tangent plane- intersection of two spheres – Equation of tangentplanetoasphere.

UNIT 2 — **9 + 3**

The equation of surface – cone- Right Circular Cone- Tangent plane and normal –Cylinder- Enveloping Cylinder.

UNIT 3 — **9 + 3**

Propertiesofdefiniteintegrals-Reductionformulaeofthetypes:

$\int x^n e^{ax} dx$, $\int x^n e^{ax} cosaxdx$, $\int sin^n xdx$, $\int cos^n xdx$, $\int sin^m xcos^n x\, dx$, $\int tan^n xdx$.

UNIT 4 — **9 + 3**

Beta and Gamma Functions: Definitions – Convergence of Γ(n) – Recurrence formula of gamma function – Properties of beta function – relation between beta and gamma functions.

UNIT 5 — **9 + 3**

Multiple integral: Double integral – Evaluation of double integral - change of order of integration – Polar coordinates - Triple integrals - Application of multiple integrals.

LECTURE	45	TUTORIAL	15	PRACTICAL	0	TOTAL	60

Text Book

1. Analytical Geometry Part II – Three Dimensions: T.K. M. Pillai, 2015 (for Unit I, II)

Unit I - Chapter 4 Sec: 1 – 8 (pages:92 -111)

Unit II - Chapter 5 Sec: 1 – 8 (pages :115-139)

2. Calculus Vol II: T.K. M. Pillai, 2015 (for Unit III, IV & V)

Unit III - Chapter 1 Sec: 11, 13.1 – 13.6 (pages: 66-72,79-88)

Unit IV- Chapter 7 Sec: 2 – 5 (pages 278-290)

Unit V- Chapter 5 Sec: 2 – 5.4(pages 203-231)

References

1. AnalyticalGeometryandVectorCalculus,S.ArumugamandIssac, New Gamma, 2008.
2. EngineeringMathematics,Dr.M.K.Venkatraman, National Publishing Company.
3. AncillaryMathematics,T.K.M.Pillai,P.Natarajan, S. Viswanathan (Printers & Publishers) Pvt Ltd. 1992.

E-References

1. https://sites.math.washington.edu/~m125/[WashingtonUniversity]
2. https://courses.maths.ox.ac.uk/node/28[OxfordUniversity]

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2
CO 1	2	1	0	0	0	1	1	1	2	1	0
CO 2	2	1	0	0	0	1	1	1	2	1	0
CO 3	3	3	2	0	1	3	3	3	3	3	0
CO 4	3	3	3	1	2	3	3	3	3	3	1
CO 5	3	3	2	0	1	3	3	3	3	3	0
TOTAL	13	11	7	1	4	11	11	11	13	11	1
SCALED VALUE	**3**	**3**	**2**	**1**	**1**	**3**	**3**	**3**	**3**	**3**	**1**

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

1-5→1, 6-10→2, 11-15→3

COURSE NAME			Sequence and Series	L	T	P	C
COURSE CODE			XMT204	3	1	0	4
C	P	A		L	T	P	H
4	0	0		3	1	0	4
PREREQUISITE			Algebra and Number Systems				

On successful completion of this course, the students will be able to:

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Demonstrate** if an infinite sequence is bounded, monotonic or oscillating.	Cognitive	Understanding
CO 2	**Demonstrate** the given series whether it is convergent or divergent by using the appropriate tests.	Cognitive	Understanding
CO 3	**Demonstrate** the series whether it is convergent or divergent by using the appropriate tests such as Raabe's test and Cauchy's root test.	Cognitive	Understanding
CO 4	**Identify** the sequence of partial sum for a given infinite series.	Cognitive	Applying
CO 5	**Demonstrate** the concepts about the Weirstrass inequalities and Cauchy's inequality.	Cognitive	Understanding

UNIT 1		9 + 3
Sets, Sequences – Aggregate: Upper and lower bounds – Bounded sequences - monotonic sequence always tends to a limit, finite or infinite.		
UNIT 2		**9 + 3**
Some general theorems concerning infinite series – series of positive terms – comparison tests – Cauchy's condensation test – D-Alembert's ratio test - Definition of convergence, Divergence and Oscillation- Necessary condition for convergence- convergence of $\sum \frac{1}{n^p}$ and Geometric series.		
UNIT 3		**9 + 3**
Cauchy's root test and their simple problems - Raabe's test – Absolutely convergent series - Alternative series with simple problems.		
UNIT 4		**9 + 3**
Summation of series – Summation by different series – recurring series.		
UNIT 5		**9 + 3**
Inequalities- Geometric and Arithmetic means- Weirstrass inequalities- Cauchy's inequality.		

LECTURE	45	TUTORIAL	15	PRACTICAL	0	TOTAL	60

Text Books

3. Algebra, Volume I, T.K.M. Pillay, T. Natarajan and K.S.Ganapathy, S. Viswanathan (Printers & Publishers) Pvt. Ltd., 2015.

Unit I : Chapter 2 (Sec: 4 – 7), Pages: 20 - 40
Unit II : Chapter 2 (Sec: 8 – 16), Pages: 41 - 68
Unit III: Chapter 2 (Sec: 17 – 19, 21 – 24), Pages: 68 - 88
Unit IV: Chapter 5 (Sec: 1 – 7), Pages: 246 – 281.

4. Algebra Volume II, T.K.M. Pillay, T. Natarajan and K.S.Ganapathy, S. Viswanathan (Printers &Publishers) Pvt. Ltd., 2015. Unit V : Chapter 4 (Sec: 1 – 12), Pages: 179 – 212.
Reference
1. Sequence and Series: S. Arumugam and Isaac, New Gamma Publishing House – 2002 Edition
E-References
1. https://courses.maths.ox.ac.uk/node/43846[Oxford University] 2. https://explore course. Stanford. edu/search?q=MATH21[Stanford University]

COs VS POs											
	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**
CO 1	3	2	1	0	0	2	2	2	3	2	0
CO 2	3	2	1	0	0	2	2	2	3	2	0
CO 3	3	2	1	0	0	2	2	2	3	2	0
CO 4	3	3	2	0	1	3	3	3	3	3	0
CO 5	3	2	1	0	0	2	2	2	3	2	0
TOTAL	15	11	6	0	1	11	11	11	15	11	0
SCALED VALUE	**3**	**3**	**2**	**0**	**1**	**3**	**3**	**3**	**3**	**3**	**0**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											
1-5→1, 6-10→2, 11-15→3											

COURSE CODE			COURSE NAME	L	T	P	C
XPG205			ALLIED PHYSICS –II	3	0	0	3
C	P	A		L	T	P	H
2.7	0	0.3		3	1	0	4

COURSE OUTCOMES

On the successful completion of this course students would able to

OBJECTIVES : To understand the basic concepts of optics, modern Physics, concepts of relativity and quantum physics, semiconductor physics, and electronics.		DOMAIN	LEVEL
CO1	***Explain*** the concepts of interference diffraction and ***rephrase*** the concept of polarization based on wave patterns	Cognitive	Understanding analyze
CO2	***Outline*** the basic foundation of different atom models and ***Relate*** the importance of interpreting improving theoretical models based on observation.	Cognitive	Remembering understanding
CO3	***Summarize*** the properties of nuclei, nuclear forces structure of atomic nucleus and nuclear models. ***Interpret*** nuclear processes like fission and fusion. ***Understand*** the importance of nuclear energy, safety measures.	Cognitive	Remembering, understanding apply
CO4	***Describe*** the basic concepts of relativity like equivalence principle, inertial frames and Lorentz transformation.	Cognitive	Remembering, understanding apply
CO5	***Summarize*** the working of semiconductor devices, Zener diode, transistors and practical devices.	Cognitive	Remembering understanding

UNIT – I	OPTICS	9 + 3

Interference – interference in thin films –colors of thin films – air wedge – determination of diameter of a thin wire by air wedge – diffraction – diffraction of light vs sound – normal incidence – experimental determination of wavelength using diffraction grating (no theory) – polarization – polarization by double reflection – Brewster's law – optical activity – application in sugar industries.

UNIT – II	ATOMIC PHYSICS	9 + 3

Atom models – Bohr atom model – mass number – atomic number – nucleons – vector atom model – various quantum numbers – Pauli's exclusion principle – electronic configuration –

periodic classification of elements – Bohr magneton – Stark effect –Zeeman effect (elementary ideas only) – photo electric effect – Einstein's photoelectric equation – applications of photoelectric effect: solar cells, solar panels, optoelectric devices		
UNIT – III	**NUCLEAR PHYSICS**	**9 + 3**
Nuclear models – liquid drop model – magic numbers – shell model – nuclear energy – mass defect – binding energy – radioactivity – uses – half life – mean life - radio isotopes and uses – controlled and uncontrolled chain reaction – nuclear fission – energy released in fission – chain reaction – critical reaction – critical size- atom bomb – nuclear reactor – breeder reactor – importance of commissioning PFBR in our country – heavy water disposal, safety of reactors: seismic and floods –introduction to DAE, IAEA – nuclear fusion – thermonuclear reactions – differences between fission and fusion.		
UNIT – IV	**INTRODUCTION TO RELATIVITY AND GRAVITATIONAL WAVES**	**9 + 3**
Frame of reference – postulates of special theory of relativity – Galilean transformation equations – Lorentz transformation equations – derivation – length contraction – time dilation – twin paradox – mass-energy equivalence –introduction on gravitational waves, LIGO, ICTS opportunities at International Centre for Theoretical Sciences.		
UNIT – V	**SEMICONDUCTOR PHYSICS**	**9 + 3**
p-n junction diode – forward and reverse biasing – characteristic of diode – zener diode – characteristic of zener diode – voltage regulator – full wave bridge rectifier – construction and working – advantages (no mathematical treatment) – USB cell phone charger –introduction to e-vehicles and EV charging stations		

	LECTURE	TUTORIAL	TOTAL
HOURS	**45**	**15**	**60**

TEXT BOOKS

1. R. Murugesan (2005), Allied Physics, S. Chand & Co, New Delhi.
2. K. Thangaraj and D. Jayaraman (2004), Allied Physics, Popular Book Depot, Chennai.
3. Brijlal and N. Subramanyam(2002), Text book of Optics, S. Chand & Co, New Delhi.
4. R.Murugesan (2005), Modern Physics, S. Chand & Co, New Delhi.
5. A. Subramaniyam Applied Electronics, 2nd Edn., National Publishing Co., Chennai..

REFERENCE BOOKS

1. Resnick Halliday and Walker (2018), Fundamentals of Physics, 11th Edn., John Willey and Sons, Asia Pvt. Ltd., Singapore.
2. D.R. Khannaand H.R. Gulati (1979).Optics, S.Chand& Co. Ltd., New Delhi.
3. A. Beiser (1997), Concepts of Modern Physics, Tata Mc Graw Hill Publication, New Delhi.
4. Thomas L. Floyd (2017), Digital Fundamentals, 11th Edn., Universal Book Stall, New Delhi.
5. V.K.Metha (2004), Principles of electronics, 6th Edn. ,S. Chand and Company, New Delhi.

E REFERENCES

1. https://www.berkshire.com/learning-center/delta-p-facemask/
2. https://www.youtube.com/watch?v=QrhxU47gtj4
3. https://www.youtube.com/watch?time_continue=318&v=D38BjgUdL5U&feature=emb_logo
4. https://www.youtube.com/watch?v=JrRrp5F-Qu4
5. https://www.validyne.com/blog/leak-test-using-pressure-transducers/
6. https://www.atoptics.co.uk/atoptics/blsky.htm -
7. https://www.metoffice.gov.uk/weather/learn-about/weather/optical-effects

Mapping with Programme Outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO9	PO10	PSO1	PSO2
CO_1	3	0	1	0	1	3	1	2	1	2	2	1
CO_2	2	0	1	2	1	3	1	1	1	2	2	1
CO_3	2	1	3	3	1	3	2	1	0	2	1	1
CO_4	1	1	2	3	2	3	1	2	0	2	2	2
CO_5	2	1	1	3	1	3	1	2	1	2	1	1
Total	10	3	8	11	6	15	6	8	3	10	8	6
Scaled to 1, 2, 3	**2**	**1**	**2**	**3**	**2**	**3**	**3**	**2**	**1**	**2**	**2**	**2**

0 – No relation 1 – Low relation 2 – Medium relation 3 – High relation

<table>
<tr><td colspan="3">COURSE CODE</td><td>COURSE NAME</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td colspan="3">XPG206</td><td rowspan="3">ALLIED PHYSICS PRACTICAL – II</td><td>0</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>C</td><td>P</td><td>A</td><td>L</td><td>T</td><td>P</td><td>H</td></tr>
<tr><td>0</td><td>0.75</td><td>0.25</td><td>0</td><td>0</td><td>2</td><td>2</td></tr>
<tr><td colspan="5">COURSE OUTCOMES
On the successful completion of this course students would able to</td><td colspan="2"></td><td></td></tr>
<tr><td colspan="5">OBJECTIVES : Apply various Physics concepts to understand concepts of Light, electricity and magnetism and waves, set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results</td><td colspan="2">Domain</td><td>Level</td></tr>
<tr><td>CO1</td><td colspan="4">Understand basic concepts of physics and identify its applications</td><td colspan="2">Psychomoto r</td><td>Mechanism</td></tr>
<tr><td>CO2</td><td colspan="4">Identify the principles of optics, and determine refractive index.</td><td colspan="2">Psychomoto r: Affective:</td><td>Analyze,
Respond</td></tr>
<tr><td>CO3</td><td colspan="4">Develop Knowledge to differentiate resistance of material affected by temperature.</td><td colspan="2">Psychomoto r:
Affective:</td><td>Mechanism
Receive</td></tr>
<tr><td>CO4</td><td colspan="4">Recall the concepts of laws and explain the methods of magnetic field.</td><td colspan="2">Psychomoto r: Affective:</td><td>Mechanism
Receive</td></tr>
<tr><td>CO5</td><td colspan="4">Understand function of semiconductor and zener diode and how it is working regulator.</td><td colspan="2">Psychomoto r: Affective:</td><td>Analyze
Receive</td></tr>
</table>

Any Eight of the experiments

Ex. No	Experiments (Any eight experiments)	Cos
1.	Radius of curvature of lens by forming Newton’s rings	CO1
2.	Thickness of a wire using air wedge	CO1
3.	Wavelength of mercury lines using spectrometer and grating	CO1
4.	Refractive index of material of the lens by minimum deviation	CO2
5.	Refractive index of liquid using liquid prism	CO2
6.	Specific resistance of a wire using PO box	CO3
7.	Thermal conductivity of poor conductor using Lee’s disc	CO3
8.	Determination of Earth’s magnetic field using field along the axis of a	CO4

	coil	
9.	Characterisation of Zener diode	CO5
10.	Construction of Zerner/IC regulated power supply	CO5
11.	Construction of AND, OR, NOT gates using diodes and transistor	CO5
12.	NOR gate as a universal building block	CO5

	LECTURE	PRACTICAL	TOTAL
HOURS	**0**	**30**	**30**

TEXT BOOKS

1. C. L. Arora,"B.Sc .Practical Physics", S. Chand & Company Ltd. Ram Nagar, New Delhi–110055. 2007.
2. R. K. Shukla & Anchal Srivastava. "Practical Physics," New Age International (P) Ltd, Publishers, (Formerly Wiley Eastern Limited), 4835/24, Ansari Raod, Daryagani, New Delhi–11002. 2006.

REFERENCE BOOKS

1. Geeta Sanon, "B. Sc., Practical Physics", 1st Edition, S. Chand and Company, 2007.
2. Chattopadhyay, D., Rakshit, P. C. and Saha, B., "An Advanced Course in Practical Physics," 8th Edition, Books & Allied Ltd., Calcutta, 2007.
3. G. L. Squires, "Practical Physics", Fourth edition, Cambridge University Press, 2001.
4. Indu Prakash and Ramakrishna, "A Text Book of Practical Physics," 11th Edition, Kitab Mahal, New Delhi, 2011.
5. C. Ouseph,K. Rangarajan, "A Text Book of Practical Physics", Volume I,II, S.Viswanathan Publishers,1997.

E–Resources:

1. Amal Kumar Das , Department of Physics, IIT Kanpur, "Introduction to Electromagnetic Theory", National Programme on Technology Enhanced Learning (NPTEL), https://onlinecourses.nptel.ac.in/noc20_ph16/preview

Mapping of COs with POs

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO9	PO10	PSO1	PSO2
CO_1	1	1	3	3	2	3	1	3	0	1	2	1
CO_2	1	1	3	2	1	3	1	3	1	1	2	1
CO_3	1	1	3	3	1	3	2	3	1	2	2	1
CO_4	1	1	2	2	2	3	1	3	1	2	2	1

CO_5	1	1	3	3	2	3	1	3	1	2	2	1
Total	5	5	14	13	8	15	6	15	4	8	10	5
Scaled to 1, 2, 3	**1**	**1**	**3**	**3**	**2**	**3**	**2**	**3**	**1**	**2**	**2**	**1**

0 – No relation   1 – Low relation   2 – Medium relation   3 – High relation

COURSE NAME			**Quantitative Aptitude – I**	**L**	**T**	**P**	**C**
COURSE CODE			**XMT207**	**1**	**1**	**0**	**2**
C	**P**	**A**		**L**	**T**	**P**	**H**
2	**0**	**0**		**1**	**1**	**0**	**2**
PREREQUISITE			Number Systems				

On successful completion of this course, the students will be able to:

	COURSE OUTCOMES	**DOMAIN**	**LEVEL**
CO 1	**Explain** the basic concepts of Numbers, H.C.F. & L.C.M of Numbers and to solve the problems.	Cognitive	Understanding
CO 2	**Explain** the basic concepts of Decimal Fractions, Simplification and to solve the problems.	Cognitive	Understanding
CO 3	**Explain** the basic concepts of Square Roots & Cube Roots, Average and to solve the problems.	Cognitive	Understanding
CO 4	**Explain** the basic concepts of Problems on Numbers, Problems on Ages and to solve the problems.	Cognitive	Understanding
CO 5	**Explain** the basic concepts of Surds & Indices, Percentage and to solve the Problems.	Cognitive	Understanding

UNIT 1		**3+3**
Numbers, H.C.F. &L.C.M of Numbers.		
UNIT 2		**3+3**
Decimal Fractions, Simplification.		
UNIT 3		**3+3**
Square Roots & Cube Roots, Average.		
UNIT 4		**3+3**
Problems on Numbers, Problems on Ages.		
UNIT 5		**3+3**
Surds & Indices, Percentage.		

LECTURE	**15**	**TUTORIAL**	**15**	**PRACTICAL**	**0**	**TOTAL**	**30**

Text Book
1. R.S. Aggarwal, Quantitative Aptitude for Competitive Examinations, S Chand; 20th edition (2013).
References
4. Banking awareness by SangramKeshari Rout and SoumyaRanjanBehera, B.K. Publications Pvt. Ltd.; Second edition (2014). 5. UGC-CSIR NET/SET by Dr. Pawan Sharma and Anshuman, Arihant Publication. 6. Fast Track Objective Arithmetic by Rajesh Verma, Arihant Publication, Edition 2012.
E-References
1. www.careerbless.com 2. www.jagranjosh.com 3. www.bestguru.com

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2
CO 1	3	2	1	0	0	2	2	2	3	2	0
CO 2	3	2	1	0	0	2	2	2	3	2	0
CO 3	3	2	1	0	0	2	2	2	3	2	0
CO 4	3	2	1	0	0	2	2	2	3	2	0
CO 5	3	2	1	0	0	2	2	2	3	2	0
TOTAL	15	10	5	0	0	10	10	10	15	10	0
SCALED VALUE	**3**	**2**	**1**	**0**	**0**	**2**	**2**	**2**	**3**	**2**	**0**

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

1-5→1, 6-10→2, 11-15→3

	SEMESTER II	L	T	P	SS	C
COURSE CODE	**XUM002**	**1**	**0**	**0**	**1**	**1**
COURSE NAME	**ENVIRONMENTAL STUDIES**	**L**	**T**	**P**	**SS**	**H**
C: P: A	**0.8:0.1:0.1**	**1**	**0**	**0**	**1**	**2**

COURSE OUTCOMES:		**Domain**		**Level**
CO1	***Describe*** the significance of natural resources and ***explain*** anthropogenic impacts.	Cognitive		Remember Understand
CO2	***Illustrate*** the significance of ecosystem, biodiversity and natural geo bio chemical cycles for maintaining ecological balance.	Cognitive		Understand
CO3	***Identify*** the facts, consequences, preventive measures of major pollutions and ***recognize*** the disaster phenomenon.	Cognitive Affective		Remember Receiving
CO4	***Explain*** the socio-economic, policy dynamics and***practice*** the control measures of global issues for sustainable development.	Cognitive		Understand Analyse
CO5	***Recognize*** the impact of population and the concept of various welfare programs, and ***apply*** themodern technology towards environmental protection.	Cognitive Psychomotor		Understand Apply

UNIT - I NATURAL RESOURCES AND ENERGY	**3+3**
World Environment Day and its need- Forest resources: Use, Deforestation– Water resources: over-utilization of surface and ground water- Mineral resources: Environmental effects of mining– Food resources: Modern agriculture, Fertilizer-Pesticide problems, Water logging, Salinity-Energy resources: Renewable and Non-renewable energy sources; Alternate energy resources-Role Of individual in Conservation of Resources.	
UNIT - IIECOSYSTEMS AND BIODIVERSITY	**3+3**
Structure and function of an ecosystem – Producers, consumers and decomposers –Biogeochemical cycles- Food chains, Food webs, Structure and Function of the Forest ecosystem and Aquatic ecosystem– Introduction to Biodiversity- Endemic, Extinct and Endangered species- Conservation of Biodiversity: In-situ and Ex-situ conservation.	
UNIT – IIIENVIRONMENTAL POLLUTION	**3+3**
Definition – Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution and Nuclear hazards – Solid waste management: Causes, effects and control measures of industrial wastes – Role of an individual in prevention of pollution – Pollution case studies	
UNIT –IVSOCIAL ISSUES AND THE ENVIRONMENT	**3+3**
Rain water harvesting– Resettlement and Rehabilitation of people, Climate change, Global warming, Acid rain, Ozone layer depletion, Nuclear accidents and Holocaust – Environment Protection Act – Water Act – Wildlife Protection Act – Forest Conservation Act.	
UNIT –VHUMAN POPULATION AND THE ENVIRONMENT	**3+3**
Population growth, Variation among nations - Population explosion - Environment and Human health- HIV / AIDS – Role of Information Technology in Environment and human health – Case studies.	

LECTURE	TUTORIALS	PRACTICALS		TOTAL
30	**0**	**-------**		**30**

TEXT BOOKS

1. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co, USA, (2000).
2. Townsend C., Harper J and Michael Begon, Essentials of Ecology, Blackwell Science, UK, (2003).
3. Trivedi R.K and P.K.Goel, Introduction to Air pollution, Techno Science Publications, India, (2003).
4. Disaster mitigation, Preparedness, Recovery and Response, SBS Publishers & Distributors Pvt. Ltd, New Delhi, (2006).
5. Introduction to International disaster management, Butterworth Heinemann, (2006).
6. Gilbert M.Masters, Introduction to Environmental Engineering and Science, Pearson Education Pvt., Ltd., Second Edition, New Delhi, (2004).

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1. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media, India, (2009).
2. Cunningham, W.P.Cooper, T.H.Gorhani, Environmental Encyclopedia, Jaico Publ., House, Mumbai, (2001).
3. S.K.Dhameja, Environmental Engineering and Management, S.K.Kataria and Sons, New Delhi, (2012).
4. Sahni, Disaster Risk Reduction in South Asia, PHI Learning, New Delhi, (2003).
5. Sundar, Disaster Management, Sarup & Sons, New Delhi, (2007).
6. G.K.Ghosh, Disaster Management, A.P.H.Publishers, New Delhi, (2006).

E RESOURCES

1. http://www.e-booksdirectory.com/details.php?ebook=10526
2. https://www.free-ebooks.net/ebook/Introduction-to-Environmental-Science
3. https://www.free-ebooks.net/ebook/What-is-Biodiversity
4. https://www.learner.org/courses/envsci/unit/unit_vis.php?unit=4
5. http://bookboon.com/en/pollution-prevention-and-control-ebook
6. http://www.e-booksdirectory.com/details.php?ebook=8557
7. http://www.e-booksdirectory.com/details.php?ebook=6804
8. http://bookboon.com/en/atmospheric-pollution-ebook
9. http://www.e-booksdirectory.com/details.php?ebook=3749
10. http://www.e-booksdirectory.com/details.php?ebook=2604
11. http://www.e-booksdirectory.com/details.php?ebook=2116
12. http://www.e-booksdirectory.com/details.php?ebook=1026
13. http://www.faadooengineers.com/threads/7894-Environmental-Science

SEMESTER III

பொதுத்தமிழ் - 3

பாடக்குறியீடு/ Course Code	பாடப்பெயர்/ Course Name	**Category**	**L**	**T**	**P**	**SS**	**H**	**C**
XGT301	**பொதுத்தமிழ் - 3**	Supportive	**3**	**0**	**0**	**0**	**3**	**3**
Pre-requisite	பன்னிரெண்டாம்வகுப்பில்தமிழைஒருபாடமாகப்பயின்றிருக்க வேண்டும்.							
பாடப்பயன்கள் Course outcomes	இப்பாடத்தைக்கற்பதால்பின்வரும்பயன்களைமாணவர்கள்அடைவர்.							
CO1	தமிழ்க்காப்பியங்களின்வழிவாழ்வியல்சிந்தனையைப்பெறுவர்.						புரிந்துகொள்ளல் (Understand)	
CO2	காப்பியங்கள்அறிமுகப்படுத்தப்படுவதால்தமிழ்மொழியின்உயர்வையும்சிறப்பையும்உணர்தல்						புரிந்துகொள்ளல் (Understand)	
CO3	தமிழ்ப்புதினங்களின்வழிச்சமகாலப்படைப்புகளின் வாழ்வியல்சிந்தனைகளைஅறிந்துகொள்வர்.						பகுப்பாய்வுசெய்தல் Analyze	
CO4	நாவல்இலக்கியம்அறிமுகப்படுத்தப்படுவதால்சிந்தனைஆற்றல், படைப்பாற்றல், கற்பனைத்திறன்வளர்தல்						தெரிந்துகொள்ளல் (Apply)	
CO5	யாப்பு, அணிஇலக்கணங்கள், மொழிபெயர்ப்புத்திறன்ஆகியவற்றைக்கற்பதன்மூலம்போட்டித்தேர்வுகளைஎதிர்கொள்ளுதல்						புரிந்துகொள்ளல் (Understand)	
	K1- Remember; K2 – Understand; K3 –Apply; K4 Analyze; K5							

	Evaluate; K6 – Create.	
அலகு - I	**பெருங்காப்பியங்கள்**	**9மணிகள்**
	சிலப்பதிகாரம் - வழக்குரைகாதை – இளங்கோவடிகள்மணிமேகலை - ஆதிரைபிச்சையிட்டகாதை – சீத்தலைச்சாத்தனார்சீவகசிந்தாமணி - பூமகள்இலம்பகம் – திருத்தக்கதேவர்வளையாபதி - நாதகுத்தனார்	
அலகு - II	**சித்தர்பாடல்கள்**	**9 மணிகள்**
	திருமூலர்பாடல்கள் (10 பாடல்கள்) கரூர்சித்தர்பாடல்கள் (10 பாடல்கள்) – பாம்பாட்டிச்சித்தர்கள் - (10 பாடல்கள்) குதம்பைச்சித்தர்கள் - (10 பாடல்கள்)	
அலகு - III	**புதினம்**	**9மணிகள்**
	வஞ்சிமாநகரம் (வரலாற்றுப்புதினம்) - நா.பார்த்தசாரதி	
அலகு - IV	**பாடம்தழுவியஇலக்கியவரலாறு**	**9மணிகள்**
அலகு - V	**மொழித்திறன்**	**9மணிகள்**
	1. நூல்மதிப்புரை 2. திறனாய்வுசெய்தல்	

	3. கடிதம்வரைதல் 4. விண்ணப்பம்எழுதுதல்	
	Total Lecture Hours	**45மணிகள்**
பாடநூல்கள்		
1.	சிலப்பதிகாரம், கழகவெளியீடு, சென்னை	
2.	மணிமேகலை, கழகவெளியீடு, சென்னை	
3.	சீவகசிந்தாமணி, கழகவெளியீடு, சென்னை	
4.	சித்தர்பாடல்கள், பாரிநிலையம், சென்னை	
பார்வைநூல்கள்		
1.	தமிழ்இலக்கியவரலாறு – சிற்பிபாலசுப்பிரமணியன்.	
2.	புதியநோக்கில்தமிழ்இலக்கியவரலாறு - தமிழண்ணல்	
3.	வகைமைநோக்கில்தமிழ்இலக்கியவரலாறு – எ.ஃப்.பாக்கியமேரி.	

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
Web Sources
• **Tamil Heritage Foundation - www.tamilheritage.org<http://www.tamilheritage.org>** • **Tamil virtual University Library - www.tamilvu.org/library http://www.virtualvu.org/library** • **Project Madurai - www.projectmadurai.org.** • **Chennai Library - www.chennailibrary.com<http://www.chennailibrary.com>.** • **Tamil Universal Digital Library-www.ulib.prg<http://www.ulib.prg>.** • **Tamil E-Books Downloads – tamilebooksdownloads.blogspot.com** • **Tamil Books online - books.tamilcube.com** • **Catalogue of the Tamil books in the Library of British Congress archive.org** • **Tamil novels online - books.tamilcube.com**
Strong-3, Medium-2, Low-1

COURSE CODE	XGE302	L	T	P	SS	H	C
COURSE NAME	ENGLISH III	3	0	0	0	3	3
C:P:A- 3:0:0							

COURSE OUTCOMES: After the completion of course, the learners will be able to get comprehensive skills like:		Domain	Level
CO1	***Broaden*** their outlook and sensibility and be acquainted with cultural diversity and divergence in perspectives.	Cognitive	Understand
CO2	Be ***updated*** with basic informatics skills and attitudes relevant to the emerging knowledge society	Cognitive	Apply
CO3	***Produce*** grammatically and idiomatically correct language.	Cognitive	Understand
CO4	***Gain*** knowledge in writing techniques to meet academic and professional needs.	Cognitive	Understand
CO5	Be ***equipped*** with sufficient practice in Vocabulary, Grammar, Comprehension and Remedial English from the perspective of career oriented tests.	Cognitive	Understand

SYLLABUS		HOURS
UNIT-I	**POETRY**	**6+3+0=9**
1.1 The Voice of the Mountains - Mamang Dai 1.2 Sita - Toru Dutt 1.3 A Song of Hope - Oodgeroo Noonuccal 1.4 In an Artist’s Studio - Christina Rossetti		
UNIT-II	**SCENES FROM SHAKESPEARE**	**6+3+0=9**
2.1 Romeo & Juliet -The Balcony Scene 2.2 Macbeth-Banquet Scene 2.3 Julius Caesar - Murder Scene		
UNIT-III	**SPEECHES OF FAMOUS PERSONALITIES**	**6+3+0=9**
3.1 Tryst with Destiny- Jawaharlal Nehru 3.2 Yes, We Can-Barack Obama 3.3 You’ve Got to Find What You Love-Steve Jobs		
UNIT-IV	**LANGUAGE COMPETENCY**	**6+3+0=9**
4.1 Writing letters and emails 4.2 Writing and messaging in social media platforms [blogs, twitter, instagram. facebook] 4.3 Learning netiquette, email etiquette		
UNIT - V	**ENGLISH FOR WORKPLACE**	**6+3+0=9**
5.1 Data Interpretation and Reporting 5.2 Data Presentation and analysis 5.3 Meeting Etiquettes - language, dress code, voice modulation. Online Meetings - Terms and expressions used 5.4 Conducting and participating in a meeting		
L=30 / T=15	**Total Hours**	**45**

COURSE NAME			Differential Equations and Applications	L	T	P	C
COURSE CODE			XMT303	3	1	0	4
C	P	A		L	T	P	H
4	0	0		3	1	0	4
PREREQUISITE			Differential Calculus				

On successful completion of this course, the students will be able to:

	COURSE OUTCOMES	DOMAIN	LEVEL
CO 1	**Demonstrate** the solutionsof homogeneous sequations,non-homogeneous equationsofdegreeoneintwovariables.	Cognitive	Understanding
CO 2	**Find** the solutions of equations of first order but not of higher degree andtodetermine particularintegralsofalgebraic,exponential, trigonometricfunctionsandtheirproducts	Cognitive	Remembering
CO 3	**Find** solutions of simultaneous linear differential equations, linearequationsof second order andtofindsolutionsusingthemethodof variationsofparameters	Cognitive	Remembering
CO 4	**Build**aPDEbyeliminatingarbitraryconstantsandarbitraryfunction and to obtain thecomplete,singularandgeneralintegrals.	Cognitive	Applying
CO 5	**Solve** Differential equations using Charpit's method	Cognitive	Applying

UNIT 1	**Ordinary Differential Equations**	**9 + 3**
Variable separable-HomogeneousEquation - Non-Homogeneous Equations of first degree in two variables - LinearEquation–Bernoulli'sEquation - Exactdifferentialequations.		
UNIT 2	**Equation of first order but not of higher degree**	**9 + 3**
Equation solvable for dy/dx- Equation solvable for y-Equation solvable for x- Clairaut's form - Linear Equations with constant coefficients-Particular integrals of algebraic, exponential, trigonometric functions and their products.		
UNIT 3	**Simultaneous linear differential equations**	**9 + 3**
Linear Equations of theSecond Order - Complete solution in terms of a known integrals - ReductiontotheNormalform - ChangeoftheIndependentVariable - MethodofVariationof Parameters.		
UNIT 4	**Partial differential equation**	**9 + 3**
Formation of PDE by Eliminating arbitraryconstants and arbitrary functions – complete integral – singular integral-Generalintegral -Lagrange'sLinearEquations– SimpleApplications.		
UNIT 5	**Partial differential equation**	**9 + 3**
Specialmethods–Standardforms–Charpit'sMethods–SimpleApplications.		

LECTURE	45	TUTORIAL	15	PRACTICAL	0	TOTAL	60

Text Book

1. Differential Equations and its applications, S. Narayanan, T. K. Manickavachagam Pillay, S. Viswanathan Printers – Chennai, .2009.

Unit I : Chapter 2 Sections 1- 6
Unit II : Chapter 4, 5 Sections 1 – 3, 1 – 4
Unit III: Chapter 2 Sections 1 – 4
Unit IV: Chapter 12 Sections 1 – 4

Unit V: Chapter 12 Sections 5 – 6
References

1. DifferentialEquations,ShepleyL.Ross,3rdEd.,JohnWileyandSons,1984.
2. Elements of Partial Differential Equations, I. Sneddon, McGraw-Hill, InternationalEdition, 2013.
3. G.F. Simmons, Differential equations with applications and historical notes, 2nd Ed,Tata McGrawHill Publications, 2017.

E-References

1. http://science.korea.edu/science_en/undergraduate/under_math3.do
2. http://scinece.utm.my/ug/course_list_old/sscm1703/
3. http://nptel.ac.in

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2
CO 1	3	2	1	0	0	2	2	2	3	2	0
CO 2	2	1	0	0	0	1	1	1	2	1	0
CO 3	2	1	0	0	0	1	1	1	2	1	0
CO 4	3	2	1	0	0	2	2	2	3	2	0
CO 5	3	2	1	0	0	2	2	2	3	2	0
TOTAL	13	8	3	0	0	8	8	8	13	8	0
SCALED VALUE	**3**	**2**	**1**	**0**	**0**	**2**	**2**	**2**	**3**	**2**	**0**

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

1-5→1, 6-10→2, 11-15→3

COURSE NAME			Vector Calculus and Applications	L	T	P	C
COURSE CODE			XMT304	3	1	0	4
C	P	A		L	T	P	H
4	0	0		3	1	0	4
PREREQUISITE			Differential and integral calculus				

On successful completion of this course, the students will be able to:

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Find**thederivative of a vector, derivative of a scalar and derivative of a scalar product and vector product.	Cognitive	Remembering
CO 2	**Find** gradient of a scalar, Divergence and Curl of a vector.	Cognitive	Applying
CO 3	**Solve**simplelineintegrals.	Cognitive	Applying
CO 4	**Solve**surfaceintegralsandvolumeintegrals.	Cognitive	Applying
CO 5	**Analyze**thetheoremsofGauss,Stoke'sandGreen's (TwoDimension).	Cognitive	Applying

UNIT 1		9 + 3
Vector point function - Scalar point function - Derivative of a vector andderivative of a sum of vectors - Derivative of a product of a scalar and avectorpointfunction-Derivative ofascalarproductandvectorproduct.		
UNIT 2		**9 + 3**
The vector operator "del", The gradient of a scalar point function - Divergence of a vector - Curl of a vector - solenoidal and irrotational vectors – simple applications.		
UNIT 3		**9 + 3**
Laplacianoperator,Vectoridentities-Lineintegral-simpleproblems.		
UNIT 4		**9 + 3**
Surface integral - Volume integral – Applications.		
UNIT 5		**9 + 3**
GaussdivergenceTheorem,Stoke'sTheorem,Green'sTheoremintwo dimensions– Applicationstoreallifesituations.		

LECTURE	45	TUTORIAL	15	PRACTICAL	0	TOTAL	60

Text Book

1. VectorAnalysis,P.DuraiPandian,LaxmiDuraiPandian,EmeraldPublishers2017.

Unit I : Chapter 2 Sections2.1, 2.2., 2.3
Unit II : Chapter 2 Sections2.4, 2.5, 2.6, 2.7
Unit III: Chapter 2, 3 Sections2.8, 3.1, 3.2, 3.3., 3.4
Unit IV: Chapter 3 Sections3.5, 3.6
Unit V: Chapter 4 Sections4.2, 4.3, 4.4, 4.5

References

1. VectorCalculus,J.C.Susan,(4thEdn.)PearsonEducation,Boston,2012.

2. VectorCalculusforCollegeStudents,A. Gorguis,XilbiusCorporation,2014.
3. Vector Calculus, J.E. Marsden and A. Tromba (5th edn.) W.H. Freeman, NewYork,1988.

E-References

http://mathforum.org,

http://www.opensource.org

http://nptel.ac.in

COs VS POs											
	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**
CO 1	2	1	0	0	0	1	1	1	2	1	0
CO 2	3	3	2	0	1	3	3	3	3	3	0
CO 3	3	3	2	0	1	3	3	3	3	3	0
CO 4	3	3	2	0	1	3	3	3	3	3	0
CO 5	3	3	2	0	1	3	3	3	3	3	0
TOTAL	14	13	8	0	4	13	13	13	14	13	0
SCALED VALUE	**3**	**3**	**2**	**0**	**1**	**3**	**3**	**3**	**3**	**3**	**0**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											
1-5→1, 6-10→2, 11-15→3											

COURSE NAME			Statistics for Data Science I	L	T	P	C
COURSE CODE			XMT305	2	1	0	3
C	P	A		L	T	P	H
4	0	0		2	1	0	3
PREREQUISITE			Basic Statistics				

On successful completion of this course, the students will be able to:

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Demonstrate** to understand basics of Data Science.	Cognitive	Understanding
CO 2	**Classify** the various types of data collection and pre-processing.	Cognitive	Understanding
CO 3	**Identify** measures of central tendency and dispersion for the given data set.	Cognitive	Applying
CO 4	**Construct** the model development of simple and multiple regression using visualization.	Cognitive	Applying
CO 5	**Analyze**the model selection and the prediction by using regression.	Cognitive	Analyzing

UNIT 1	**Introduction**	**6 + 3**
Introduction to Data Science – Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields – Data Security Issues.		
UNIT 2	**Data Collection and Data Pre-Processing**	**6 + 3**
Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization.		
UNIT 3	**Exploratory Data Analytics**	**6 + 3**
Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis–Correlation Statistics – ANOVA.		
UNIT 4	**Model Development**	**6 + 3**
Simple and Multiple Regression – Model Evaluation using Visualization – Residual Plot – Distribution Plot – Polynomial Regression and Pipelines.		
UNIT 5	**Model Evaluation**	**6 + 3**
Generalization Error – Out-of-Sample Evaluation Metrics – Cross Validation – Overfitting – Under Fitting andModel Selection – Prediction by using Ridge Regression.		

LECTURE	30	TUTORIAL	15	PRACTICAL	0	TOTAL	45

Text Book

1. Jojo Moolayil, "Smarter Decisions: The Intersection of IoT and Data Science", PACKT, 2016.

References

1.Cathy O'Neil and Rachel Schutt, "Doing Data Science", O'Reilly, 2015.

1. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", EMC 2013
2. Raj, Pethuru, "Handbook of Research on Cloud Infrastructures for Big Data Analytics", IGI Global.
3. Gupta, S.C. and Kapoor, V.K.: "Fundamentals of Mathematical Statistics", Sultan & Chand & Sons, New

Delhi, 11th Ed, 2002. 4. Hastie, Trevor, et al. “The elements of Statistical Learning”, Springer, 2009. 5. Peter Bruce, Andrew Bruce and Peter Gedeck,“Practical Statistics for Data Scientists”, 2nd Edition, May 2020. 6. Pratap Dangeti, “Statistics for Machine Learning “, July 2017.
E-References
https://nptel.ac.in

COs VS POs											
	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**
CO 1	3	2	1	0	0	2	2	2	3	2	0
CO 2	3	2	1	0	0	2	2	2	3	2	0
CO 3	3	3	2	0	1	3	3	3	3	3	0
CO 4	3	3	2	0	1	3	3	3	3	3	0
CO 5	3	3	3	1	2	3	3	3	3	3	1
TOTAL	15	13	9	1	4	13	13	13	15	13	1
SCALED VALUE	**3**	**3**	**2**	**1**	**1**	**3**	**3**	**3**	**3**	**3**	**1**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											
1-5→1, 6-10→2, 11-15→3											

COURSE NAME			Statistics for Data Science Lab I using R Programming	L	T	P	C
COURSE CODE			XMT306	0	0	2	1
C	P	A		L	T	P	H
1	0	0		0	0	2	1
PREREQUISITE			Basic Statistics				

On successful completion of this course, the students will be able to:

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Construct** the frequency distributions for the given data sets.	Cognitive	Applying
CO 2	**Interpret** and draw pie, bar, line, histogram and scatter diagrams for the given data sets.	Cognitive	Evaluating
CO 3	**Identify** the coefficient of correlation using Karl Pearson's Method and Spearman's Method.	Cognitive	Applying
CO 4	**Examine** the existence of a relationship between two or more variables using linear regression.	Cognitive	Analyzing
CO 5	**Estimate**the inter-relation between two or more phenomena with the help of curve fitting.	Cognitive	Evaluating

List of Experiments

1. Formation of discrete and continuous frequency distributions-descriptive statistics.
2. Diagrams: Pie, bar, line and scatter diagrams, Graphs: Histogram and normal probability plot.
3. Correlation coefficient, rank correlation, partial and multiple correlations.
4. Regression: Simple and multiple linear regression.
5. Curve estimation.

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2
CO 1	3	3	2	0	1	3	3	3	3	3	0
CO 2	3	3	3	2	3	3	3	3	3	3	2
CO 3	3	3	2	0	1	3	3	3	3	3	0
CO 4	3	3	3	1	2	3	3	3	3	3	1
CO 5	3	3	3	2	3	3	3	3	3	3	2
TOTAL	15	15	13	5	9	15	15	15	15	15	5
SCALED VALUE	**3**	**3**	**3**	**1**	**2**	**3**	**3**	**3**	**3**	**3**	**1**

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

1-5→1, 6-10→2, 11-15→3

COURSE NAME			Quantitative Aptitude - II	L	T	P	C
COURSE CODE			XMT307	1	1	0	2
C	P	A		L	T	P	H
2	0	0		1	1	0	2
PREREQUISITE			Number systems and algebra				

On successful completion of this course, the students will be able to:

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Apply** the basic concepts of profit and loss, ratio & proportion to solve the problems.	Cognitive	Applying
CO 2	**Apply** the basic concepts of partnership, chain rule to solve the problems	Cognitive	Applying
CO 3	**Apply** the basic concepts of time & work, pipes &cisterns to solve the problems.	Cognitive	Applying
CO 4	**Apply** the basic concepts of time & distance and problems on trains to solve the problems.	Cognitive	Applying
CO 5	**Apply** the basic concepts of boats and streams and allegation or mixture to solve the problems.	Cognitive	Applying

UNIT 1		**3+3**
Profit and Loss, Ratio and Proportion.		
UNIT 2		**3+3**
Partnership, Chain Rule.		
UNIT 3		**3+3**
Time and work, Pipes and Cisterns.		
UNIT 4		**3+3**
Times and Distance, Problems on Trains.		
UNIT 5		**3+3**
Boats and Streams and allegation or mixture.		

LECTURE	15	TUTORIAL	15	PRACTICAL	0	TOTAL	30

Text Book

3. R.S. Aggarwal, Quantitative Aptitude for Competitive Examinations, S Chand; 20th edition (2013).

References

4. Banking awareness by Sangram Keshari Rout and Soumya Ranjan Behera, B.K. Publications Pvt. Ltd.; Second edition (2014).
5. UGC-CSIR NET/SET by Dr. Pawan Sharma and Anshuman, Arihant Publication.
6. Fast Track Objective Arithmetic by Rajesh Verma, Arihant Publication, Edition 2012.

E-References

4. www.careerbless.com
5. www.jagranjosh.com
6. www.bestguru.com

COs VS POs											
	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**
CO 1	3	3	2	0	1	3	3	3	3	3	0
CO 2	3	3	2	0	1	3	3	3	3	3	0
CO 3	3	3	2	0	1	3	3	3	3	3	0
CO 4	3	3	2	0	1	3	3	3	3	3	0
CO 5	3	3	2	0	1	3	3	3	3	3	0
TOTAL	15	15	10	0	5	15	15	15	15	15	0
SCALED VALUE	**3**	**3**	**2**	**0**	**1**	**3**	**3**	**3**	**3**	**3**	**0**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											
1-5→1, 6-10→2, 11-15→3											

Course Name			DISASTERMANAGEMENT	L	T	P	C
Course Code			XUM003	1	0	0	1
C	P	A		L	T	SS	H
1	0	0		1	0	1	1
Prerequisite			Basic knowledge about environment.				

On successful completion of this course, the students will be able to:			
Course Outcomes		**Domain**	**Level**
CO1	**Understandin**gtheconceptsofapplicationoftypes Ofdisasterpreparedness	Cognitive	Apply
CO2	**Infer**theendconditions&**Discuss**thefailuresduetodisaster.	Cognitive	Analyze
CO3	**Understanding**of importance of seismic waves occurring globally	Cognitive	Analyze
CO4	**Estimate**Disasterandmitigationproblems.	Cognitive	Apply
CO5	Keen**knowledge**one essentials ofriskreduction	Cognitive	Apply
UNIT 1	**INTRODUCTION**		**3**
Introduction–Disasterpreparedness–GoalsandobjectivesofISDRProgramme-Risk identification – Risk sharing – Disaster and development: Development plans and disastermanagement–Alternative to dominant approach – disaster – development linkages – Principleofrisk partnership.			
UNIT 2	**APPLICATIONOFTECHNOLOGY INDISASTERRISK REDUCTION**		**3**
Applicationofvarioustechnologies:Databases–RDBMS–ManagementInformationSystems-Decision support system and other systems – Geographic information systems – Intranets andextranets–videoteleconferencing.Triggermechanism–Remotesensing-aninsight–contributionof remotesensing and GIS-Casestudy.			
UNIT 3	**AWARENESSOF RISKREDUCTION**		**3**
Triggermechanism–constitutionoftriggermechanism–riskreductionbyeducation–disaster Informationnetwork–risk reduction bypublicawareness.			
UNIT 4	**DEVELOPMENTPLANNING ONDISASTER**		**3**
Implicationofdevelopmentplanning–Financialarrangements–Areasofimprovement–DisasterPreparedness-Communitybased disastermanagement–Emergencyresponse.			
UNIT 5	**SEISMICITY**		**3**
Seismicwaves–Earthquakesandfaults– measuresofaearthquake, magnitudeandintensity–grounddamage– Tsunamis and earthquakes.			

Lecture	15	Tutorial	-	Practical	-	Total	15
Text Book							

1.SiddharthaGautamandKLeelakrishaRao,“DisasterManagementProgrammesandPolicies”, VistaInternationalPubHouse,2012 4. ArunKumar,“GlobalDisasterManagement”,SBSPublishers,2008
References
5. “ EncyclopediaOfDisaster Management”, Neha Publishers &Distributors, 2008 6. PardeepSahni, Madhavimalalgodaandariyabandu, “DisasterriskreductioninSouthAsia”,PHI,2002 7. Amitasinvhal, “Understandingearthquakedisasters”TMH,2010. 8. PardeepSahni,AlkaDhamejaandUmamedury,“Disastermitigation:Experiencesandreflections ”,PHI, 2000
E-References
http://icom.museum/disaster_preparedness_book/copyright.pdf http://www.international.icomos.org/centre_documentation/bib/riskpreparedness.pdf

COs vs POs

	PO 1	**PO 2**	**PO3**	**PO4**	**PO 5**	**PO6**	**PO7**	**PO8**	**PO9**
CO 1	3	3	3	2	3	1	1	1	1
CO 2	3	3	3	3	3	1	2	1	1
CO 3	3	3	3	3	3	1	2	1	1
CO 4	3	3	3	2	3	1	1	1	1
CO 5	3	3	3	2	3	1	1	1	1
TOTAL	**15**	**15**	**15**	**12**	**15**	**5**	**7**	**5**	**5**
SCALED VALUE	**3**	**3**	**3**	**3**	**3**	**1**	**2**	**1**	**1**

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

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

SEMESTER IV

பொதுத்தமிழ் - 4

பாடக்குறியீடு/ Course Code	பாடப்பெயர்/ Course Name	**Category**	**L**	**T**	**P**	**SS**	**H**	**C**
XGT401	**பொதுத்தமிழ் - 4**	Supportive	**3**	**0**	**0**	**0**	**3**	**3**
Pre-requisite	பன்னிரெண்டாம்வகுப்பில்தமிழைஒருபாடமாகப்பயின்றிருக்க வேண்டும்.							
பாடப்பயன்கள் / Course outcomes	இப்பாடத்தைக்கற்பதால்பின்வரும்பயன்களைமாணவர்கள்அடைவர்.							
CO1	சங்கஇலக்கியத்தில்காணப்பெறும்வாழ்வியல்சிந்தனைகளைஅறிந்துகொள்வர்.	புரிந்துகொள்ளல் (Understand)						
CO2	தமிழின்தொன்மையையும், செம்மொழித்தகுதியையும்அறிந்துகொள்ளுதல்.	புரிந்துகொள்ளல் (Understand)						
CO3	நாடகஇலக்கியம்மூலம்நடிப்பாற்றலையும், கலைத்தன்மையையும், படைப்பாற்றலையும்வளர்த்தல்.	தெரிந்து கொள்ளல் (Apply)						
CO4	தமிழிலிருந்துஅலுவலகக்கடிதங்களைமொழிபெயர்ப்பதால்ஆங்கிலஅறிவைப்பெறுதல்.	தெரிந்து கொள்ளல் (Apply)						
CO5	மொழியறிவோடுவேலைவாய்ப்பினைப்பெறுதல்.	பகுப்பாய்வு செய்தல் Analyze						
	K1- Remember; K2 – Understand; K3 –Apply; K4 Analyze; K5 Evaluate; K6 – Create.							

அலகு - I	**எட்டுத்தொகை**	**9மணிகள்**
	நற்றிணை (10,14,16) குறுந்தொகை	

	(16,17,19,20,25,29,38,440), கலித்தொகை(38,51), அகநானூறு (15,33,55), புறநானூறு (37,88,112), பரிபாடல் (55)	
அலகு - II	**பத்துப்பாட்டு**	**9மணிகள்**
	நெடுநல்வாடை – நக்கீரர்.	
அலகு - III	**நாடகம்**	**9மணிகள்**
	கலகக்காரர்தோழர்பெரியார் – மு.ராமசாமி.	
அலகு - IV	**பாடம்தழுவியஇலக்கியவரலாறு**	**9மணிகள்**
அலகு - V	**மொழித்திறன்**	**9மணிகள்**
	1. மொழிபெயர்ப்பு / கலைச்சொற்கள் 2. ஆங்கிலப்பகுதியைத்தமிழில்மொழிபெயர்த்தல். 3. அலுவலகக்கடிதம் – தமிழில்மொழிபெயர்த்தல்.	
	Total Lecture Hours	**45மணிகள்**
பாடநூல்கள்		
1.	எட்டுத்தொகை, எம்.நாராயணவேலுப்பிள்ளை, நர்மதாபதிப்பகம், சென்னை.	
2.	பத்துப்பாட்டுமூலமும்நச்சினார்க்கினியர்உரையும், டாக்டர்.உ.வே.சாமிநாதையர், டாக்டர்.உ.வே.சாமிநாதையர்நூல்நிலையம், சென்னை.	
3.	கலகக்காரர்தோழர்பெரியார் – மு.ராமசாமி (நாடகநூல்)	
பார்வைநூல்கள்		
1.	தமிழ்இலக்கியவரலாறு – சிற்பிபாலசுப்பிரமணியன்.	
2.	புதியநோக்கில்தமிழ்இலக்கியவரலாறு - தமிழண்ணல்	
3.	வகைமைநோக்கில்தமிழ்இலக்கியவரலாறு – எஃப்.பாக்கியமேரி.	

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
Web Sources
• **Tamil Heritage Foundation - www.tamilheritage.org<http://www.tamilheritage.org>** • **Tamil virtual University Library - www.tamilvu.org/library http://www.virtualvu.org/library** • **Project Madurai - www.projectmadurai.org.** • **Chennai Library - www.chennailibrary.com<http://www.chennailibrary.com>.** • **Tamil Universal Digital Library-www.ulib.prg<http://www.ulib.prg>.** • **Tamil E-Books Downloads – tamilebooksdownloads.blogspot.com** • **Tamil Books online - books.tamilcube.com** • **Catalogue of the Tamil books in the Library of British Congress archive.org** • **Tamil novels online - books.tamilcube.com**
Strong-3, Medium-2, Low-1

COURSE CODE	**XGE402**	**L**	**T**	**P**	**SS**	**H**	**C**
COURSE NAME	**ENGLISH IV**	**2**	**1**	**0**	**0**	**3**	**3**
C:P:A- 3:0:0							

COURSE OUTCOMES: **After the completion of course, the learners will be able to get comprehensive skills like:**		**Domain**	**Level**
CO1	***Learn*** to communicate effectively and appropriately in real life situation.	Cognitive	Understand
CO2	***Use*** English effectively for study purpose across the curriculum	Cognitive	Apply
CO3	***Develop*** interest in and appreciation of Literature	Cognitive	Understand
CO4	***Develop*** and integrate the use of the four language skills	Cognitive	Understand
CO5	***Enhance*** their language skills especially in the areas of grammar and pronunciation.	Cognitive	Understand

SYLLABUS		**HOURS**
UNIT-I	**LIFE WRITING**	**6+3+0=9**
1.1 I am Malala-Malala Yousafzai - Chapter 1 1.2 My Inventions - Nikola Tesla - Chapter 2		
UNIT-II	**ONE ACT PLAY**	**6+3+0=9**
2.1 The Zoo Story- Edward Albee 2.2 The Proposal- Anton Chekhov		
UNIT-III	**INTERVIEWS**	**6+3+0=9**
Interviews 3.1 Nelson Mandela’s Interview with Larry King. 3.2 Rakesh Sharma’s Interview with Indira Gandhi from Space 3.3 Lionel Messi with Sid Lowe (Print)		
UNIT-IV	**LANGUAGE COMPETENCY**	**6+3+0=9**
4.1 Refuting, Arguing & Debating 4.2 Making Suggestions & Responding to Suggestions, Asking for and Giving Advice 4.3 Interviews (face to face, telephone and video conferencing)		
UNIT - V	**ENGLISH FOR WORKPLACE**	**6+3+0=9**
5.1 Job Applications: Covering letters, CV and Resume 5.2 Creating a digital profile - LinkedIn 5.3 Filling Forms (Online & Manual): creation of account, railway reservation, ATM, Credit/debit card 5.4 Body Language -Practical Skills for Interviews.		
L=30 / T=15	**Total Hours**	**45**
Tutorial Activities 9) Reading and understanding incomplete texts 10) Summarize a piece of prose or poetry 11) Communication Practice 12) Role play		

Text books: • Borg, Taylor &Francis,*Writing Your Life: A Guide to Writing Autobiographies*,Mary 2021 • Colin Dolley , Rex Walfor. *The One-Act Play Companion: A Guide to plays, playwrights*, 2015 • Jeanne Kelly.*How to Build a Professional Digital Profile* Kindle Edition by Bernish, Bernish Communications Associates, LLC; 1st edition, 2012 • Tesla, Nikola.*My Inventions by Ingram* Short title, 2011 • Yousafzai, Malala. *I Am Malala The Girl Who Stood Up for Education and Was Shot by the Taliban,* Christina Lamb , Little Brown, 2013 **E-Resources:** • For Readers'Theatre: https://www.youtube.com/watch?v=JaLQJt8orSw&t=469s(the link to the performance; refer scripts by Aaron Sheperd) • http://BBC learn English.com • Nelson Mandela with Larry King • Interviews: http://edition.cnn.com/TRANSCRIPTS/0005/16/lkl.00.html	

COURSE NAME			Object Oriented Programming with C++	L	T	P	C
COURSE CODE			**XMT403**	**3**	**1**	**0**	**4**
C	**P**	**A**		**L**	**T**	**P**	**H**
4	**0**	**0**		**3**	**1**	**0**	**4**
PREREQUISITE			C programme				

On successful completion of this course, the students will be able to:

	COURSE OUTCOMES	DOMAIN	LEVEL
CO 1	**Define** basic concepts on object-oriented programming.	Cognitive	Understanding
CO 2	**Explain** the types of inheritances and Applying various levels of Inheritance for real time problem.	Cognitive	Understanding
CO 3	**Explain** the operator Overloading function.	Cognitive	Understanding
CO 4	**Demonstrate** the concept of Polymorphism.	Cognitive	Understanding
CO 5	**Explain**the file concept and exception handlings in C++	Cognitive	Understanding

UNIT 1	INTRODUCTION TO C++	9 + 3
Key concepts of Object-Oriented Programming – Object Oriented Languages – I/O in C++ - C++ Declarations. Control Structures: - Decision Making and Statements: If, else ,jump, goto, break, continue, Switch case statements - Loops in C++ : For, While, Do - Functions in C++ - Inline functions – Function Overloading.		
UNIT 2	**CLASSES AND OBJECTS**	**9 + 3**
Declaring Objects – Defining Member Functions – Static Member variables and functions – array of objects – friend functions – Overloading member functions – classes – Constructor and destructor with static members.		
UNIT 3	**OPERATOR OVERLOADING AND INHERITANCE**	**9 + 3**
Overloading unary, binary operators – Overloading Friend functions – type conversion – Inheritance: Types of Inheritance – Single, Multilevel, Multiple, Hierarchal, Hybrid, Multi path inheritance – Virtual base Classes – Abstract Classes.		
UNIT 4	**POINTERS AND POLYMORPHISM**	**9 + 3**
Declaration – Pointer to Class, Object – this pointer – Pointers to derived classes and Base classes – Arrays – Characteristics – array of classes – Memory models – new and delete operators – dynamic object – Binding, Polymorphism and Virtual Functions.		
UNIT 5	**FILES**	**9 + 3**
File stream classes – file modes – Sequential Read / Write operations – Binary and ASCII Files – Random Access Operation – Templates – Exception Handling - String – Declaring and Initializing string objects – String Attributes – Miscellaneous functions.		

LECTURE	45	TUTORIAL	15	PRACTICAL	0	TOTAL	60

Text Book

1. Ashok N Kamthane , “Object-Oriented Programming With ANSI and TURBO C & C++”, Pearson Education Publication. 2003.

Reference

1. E. Balagurusamy, OBJECT-ORIENTED PROGRAMMING WITH C++, Tata McGraw Hill Education

Private Limited, 2011, fifth edition.
E-References:
https://nptel.ac.in

COs VS POs											
	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**
CO 1	3	2	1	0	0	2	2	2	3	2	0
CO 2	3	2	1	0	0	2	2	2	3	2	0
CO 3	3	2	1	0	0	2	2	2	3	2	0
CO 4	3	2	1	0	0	2	2	2	3	2	0
CO 5	3	2	1	0	0	2	2	2	3	2	0
TOTAL	15	10	5	0	0	10	10	10	15	10	0
SCALED VALUE	**3**	**2**	**1**	**0**	**0**	**2**	**2**	**2**	**3**	**2**	**0**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											
1-5→1, 6-10→2, 11-15→3											

COURSE NAME			Fourier Series and Transforms	L	T	P	C
COURSE CODE			XMT404	3	1	0	4
C	P	A		L	T	P	H
4	0	0		3	1	0	4
PREREQUISITE			Algebra, Trigonometry, Differential and Integral calculus				

On successful completion of this course, the students will be able to:

	COURSE OUTCOMES	DOMAIN	LEVEL
CO 1	**Identify** odd and even functions and determine Fourier series expansion of these given functions.	Cognitive	Applying
CO 2	**Determine** Half- range Fourier sine and cosine expansions.	Cognitive	Understanding
CO 3	**Demonstrate** the properties of Fourier Transform.	Cognitive	Understanding
CO 4	**Solve** the linear differential equations using Laplace transform.	Cognitive	Applying
CO 5	**Apply** Z-transforms to solve the difference equations.	Cognitive	Applying

UNIT 1 Fourier series **9 + 3**

Fourier series- definition - Fourier Series expansion of periodic functions with Period 2 π and period 2a – Use of odd & even functions in Fourier Series.

UNIT 2 Half-range Fourier Series **9 + 3**

Half-range Fourier Series – definition- Development in Cosine series & in Sine series Change of interval - Root mean square value - Parseval's identity— Harmonic analysis.

UNIT 3 Fourier Transforms **9 + 3**

Fourier Integral Theorem (statement only), Fourier Transform of a function, Fourier Cosine & Sine Transforms. Fourier Cosine & Sine Transforms of elementary functions - Properties of Fourier Transform: Linearity, Shifting, Change of scale, Modulation. Examples Fourier Transform of Derivatives. Examples. Convolution Theorem (statement only), Inverse of Fourier Transform, Examples.

UNIT 4 Laplace Transforms **9 + 3**

Laplace transform – Transforms of Elementary functions – Properties of Laplace transform - Transform of periodic functions - Transform of Derivatives - Transform of integrals- Inverse transforms – Convolution theorem – Applications of Laplace Transforms for solving second order differential equations.

UNIT 5 Z Transforms **9 + 3**

Z-transform – Elementary properties – Inverse Z – transform – Convolution theorem – Initial and Final value theorems - Formation of difference equations – Solution of difference equations. using Z-transform.

LECTURE	45	TUTORIAL	15	PRACTICAL	0	TOTAL	60

Text Book

1. Grewal, B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, New Delhi (2017).

References

1. Veerarajan. T, "Engineering Mathematics Volume III", Second reprint, Tata McGraw Hill Education

Pvt. Ltd., New Delhi, 2012.
2. Robert T. Seeley. Fourier Series and Integrals, Dover Publications, New York, 2006.
3. Ray Hanna, J. Fourier Series, Transforms and Boundary Value Problems, Dover Publications, New York, 2008.
4. Churchill, R.V. and Brown, J.W., "Fourier Series and Boundary Value Problems", Fourth Edition, McGraw Hill Book Co., Singapore (1987).

E-References:

https://nptel.ac.in

COs VS POs											
	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**
CO 1	3	3	2	0	1	3	3	3	3	3	0
CO 2	3	2	1	0	0	2	2	2	3	2	0
CO 3	3	2	1	0	0	2	2	2	3	2	0
CO 4	3	3	2	0	1	3	3	3	3	3	0
CO 5	3	3	2	0	1	3	3	3	3	3	0
TOTAL	15	13	8	0	3	13	13	13	15	13	0
SCALED VALUE	**3**	**3**	**2**	**0**	**1**	**3**	**3**	**3**	**3**	**3**	**0**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											
1-5→1, 6-10→2, 11-15→3											

COURSE NAME	Statistics for Data Science - II	L	T	P	C
COURSE CODE	XMT405	2	1	0	3

C	P	A		L	T	P	H
2	0	0		2	1	0	3

PREREQUISITE	Basic Statistics

On successful completion of this course, the students will be able to:

	COURSE OUTCOMES	DOMAIN	LEVEL
CO 1	**Demonstrate** the basics of R.	Cognitive	Understanding
CO 2	**Explain** the basic concepts of probability.	Cognitive	Understanding
CO 3	**Illustrate** the discrete and continuous random variable.	Cognitive	Understanding
CO 4	**Demonstrate** the concepts of discrete and continuous probability distributions.	Cognitive	Understanding
CO 5	**Construct** the statistical inference of Student T test for the given data sets.	Cognitive	Applying

UNIT 1	**R**	**6+ 3**
An introduction to R - Data structures in R- Data visualization with R- Data analysis with R.		
UNIT 2	**Probability Theory**	**6 + 3**
Random Experiment – Sample Space – Events – Axiomatic Definition of Probability – Addition Theorem – Multiplication Theorem – Baye's Theorem -Applications.		
UNIT 3	**Distribution Function**	**6 + 3**
Continuous and Discrete Random Variables – Distribution Function of a Random Variable – Probability Mass Functions and Probability Density Functions – Characteristic Functions.		
UNIT 4	**Probability Distributions**	**6 + 3**
Probability Distributions – Recurrence Relationships – Moment Generating Functions – Cumulant Generating Functions – Discrete Probability Distribution – Binomial Distribution – Poisson Distribution – Continuous Probability Distributions - Normal Distribution.		
UNIT 5	**Inferential statistics**	**6 + 3**
Test hypotheses- Central limit theorem - Confidence interval- T-test- Type I and II errors- Student's T distribution.		

LECTURE	30	TUTORIAL	15	PRACTICAL	0	TOTAL	45

Text Book

1. Jared P Lander, "R for everyone: Advanced Analytics and Graphics", Addition Wesley, 2014.
2. Gupta, S.C. and Kapoor, V.K.: "Fundamentals of Mathematical Statistics", Sultan & Chand & Sons, New Delhi, 11th Ed, 2020.

References

1. Hastie, Trevor, et al. "The elements of Statistical Learning", Springer, 2009.
2. Peter Bruce, Andrew Bruce and Peter Gedeck, "Practical Statistics for Data Scientists", 2nd Edition, May 2020.

3. Pratap Dangeti, “Statistics for Machine Learning”, July 2017.
E-References
https://nptel.ac.in

COs VS POs											
	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**
CO 1	3	2	1	0	0	2	2	2	3	2	0
CO 2	3	2	1	0	0	2	2	2	3	2	0
CO 3	3	2	1	0	0	2	2	2	3	2	0
CO 4	3	2	1	0	0	2	2	2	3	2	0
CO 5	3	3	2	0	1	3	3	3	3	3	0
TOTAL	15	11	6	0	1	11	11	11	15	11	0
SCALED VALUE	**3**	**3**	**2**	**0**	**1**	**3**	**3**	**3**	**3**	**3**	**0**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											
1-5→1, 6-10→2, 11-15→3											

COURSE NAME			Statistics for Data Science Lab II using R Programming	L	T	P	C
COURSE CODE			XMT406	0	0	2	1
C	P	A		L	T	P	H
1	0	0		0	0	2	1
PREREQUISITE			Basic Statistics				

On successful completion of this course, the students will be able to:

	COURSE OUTCOMES	DOMAIN	LEVEL
CO 1	**Compare** the means using paired T test for the given data sets.	Cognitive	Applying
CO 2	**Compare** the means using unpaired T test for the given data sets.	Cognitive	Applying
CO 3	**Test** the level of significance using chi – square test.	Cognitive	Analyzing
CO 4	**Analyze** the variance for the given data sets by using One-way and two-way ANOVA.	Cognitive	Analyzing
CO 5	**Apply** binomial test, run test, and sign test for a given data set.	Cognitive	Applying

List of Experiments

1. Comparing means: Independent sample test and paired t-test.
2. Unpaired T Test.
3. Cross tabulation and Chi-square-test.
4. One-way and two-way ANOVA.
5. Binomial test, run test, and sign test.

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2
CO 1	3	2	1	0	0	2	2	2	3	2	0
CO 2	3	2	1	0	0	2	2	2	3	2	0
CO 3	3	3	3	1	2	3	3	3	3	3	1
CO 4	3	3	3	1	2	3	3	3	3	3	1
CO 5	3	2	1	0	0	2	2	2	3	2	0
TOTAL	15	12	8	2	4	12	12	12	15	12	2
SCALED VALUE	**3**	**3**	**2**	**1**	**1**	**3**	**3**	**3**	**3**	**3**	**1**

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

1-5→1, 6-10→2, 11-15→3

COURSE NAME			Vedic Mathematics I	L	T	P	C
COURSE CODE			XMT407	1	1	0	2
C	P	A		L	T	P	H
2	0	0		1	1	0	2
PREREQUISITE			Number Systems and Algebra				

On successful completion of this course, the students will be able to:

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Explain** the history of Vedic mathematics	Cognitive	Understanding
CO 2	**Explain** the concept of multiplication and division using completing the whole and from left to right.	Cognitive	Understanding
CO 3	**Explain** the between squaring numbers ending in 5 and squaring numbers near number 50 and manage to simplify algebraic squaring.	Cognitive	Understanding
CO 4	**Identify** cube and cube roots, recognize and apply division by 9 and recognize the concept of division by using straight division.	Cognitive	Applying
CO 5	**Demonstrate** simple arithmetic calculations of HCF and LCM with speed and accuracy	Cognitive	Understanding

UNIT	Title	Hours
UNIT 1	**Additions and Subtractions**	**3+3**
History of Vedic Mathematics; Various techniques to carry out basic operations covering Addition - Addition by Left to Right - Dropping tens and grouping techniques; Various techniques to carry out basic operations covering Subtraction -Starting complements from the middle of the sum - leaving complements from the middle of the sum - General case.		
UNIT 2	**Multiplication and Division**	**3+3**
Multiplication by specific numbers – Multiplication by numbers near base - Verifying answers by use of digital roots; Division (Division of Double-Digit Numbers) - Digital Roots - Divisibility tests - Division of numbers near base - Comparison of fractions.		
UNIT 3	**Square and Square Roots**	**3+3**
Introduction of squares of numbers - Difference of two Square numbers - Finding squares of numbers ending with 5 - Different methods of Squares (General method, Base method, Duplex method) - Square Roots.		
UNIT 4	**Cube and Cube Roots**	**3+3**
Cubes - Cube roots - Cube Roots of Exact Cubes - General division.		
UNIT 5	**LCM and HCF**	**3+3**
Factorisation Method of LCM and HCF - HCF and LCM of Arithmetic and Algebra.		

LECTURE	15	TUTORIAL	15	PRACTICAL	0	TOTAL	30

Text Book

1. Vedic Mathematics, Swami Bharati Krishna Trithaji, Motilal Banarsidas, New Delhi,1990.

References

1. Elements of Vedic Mathematics, Udayan S. Patankar, Sunil M. Patankar, TTU Press,2018.

2. Advanced Vedic Mathematics, Rajesh Kumar Thakur, Rupa Publications, New Delhi,2019.
E-References http://www.funwithfigures.com/ http://www.youtube.com/watch?v=b3PFjsUgULM&feature=youtu.be

COs VS POs											
	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**
CO 1	3	2	1	0	0	2	2	2	3	2	0
CO 2	3	2	1	0	0	2	2	2	3	2	0
CO 3	3	2	1	0	0	2	2	2	3	2	0
CO 4	3	3	2	0	1	3	3	3	3	3	0
CO 5	3	2	1	0	0	2	2	2	3	2	0
TOTAL	15	11	6	0	1	11	11	11	15	11	0
SCALED VALUE	**3**	**3**	**2**	**0**	**1**	**3**	**3**	**3**	**3**	**3**	**0**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											
1-5→1, 6-10→2, 11-15→3											

Course Name			Introduction to Entrepreneurship Development	L	T	P	C
Course Code			XUM004	1	0	0	1
C	P	A		L	T	SS	H
1	0	0		1	0	1	1
Prerequisite			Basic skills like critical thinking, creativity, risk-taking, problem-solving, networking, leadership.				

On successful completion of this course, the students will be able to:

	Course Outcomes	Domain	Level
CO1	**Understand** the concept of Entrepreneurship	Cognitive	Understanding
CO2	**Understand** about an Entrepreneur	Cognitive	Understanding
CO3	**Understand** the characteristics of Entrepreneur	Cognitive	Understanding
CO4	**Understand** the ways to acquire skills of Entrepreneur	Cognitive	Understanding
CO5	**Understand**the concept of Intrepreneurship	Cognitive	Understanding

UNIT 1	**INTRODUCTION TO ENTREPRENEURSHIP**	**3+3**
Meaning and Concept of Entrepreneurship, History of Entrepreneurship Development, Role of Entrepreneurship in Economic Development, Myths about Entrepreneurs, Agencies in Entrepreneurship Management and Future of Entrepreneurship		
UNIT 2	**THE ENTREPRENEUR**	**3+3**
Why to become Entrepreneur, Skills/ Traits required for being an Entrepreneur, Creative and Design Thinking, Entrepreneurial Decision Process, Skill Gap Analysis, Role Models, Mentors and Support System, Entrepreneurial Success Stories.		
UNIT 3	**CHARACTERISTICS OF AN ENTREPRENEUR**	**3 +3**
Introduction - Characteristic Features of Successful Indian Entrepreneurs - Differences between an Entrepreneur and a Manager - Difference between an Entrepreneur and an Intrapreneur - Relationship between the terms Entrepreneur, Entrepreneurial and Entrepreneurship - Difference between a Scientist, Inventor and Entrepreneur - Relationship between Entrepreneur and Enterprise - Difference between Entrepreneur and Enterprise - Difference between a Self-employed person and Entrepreneur - Common Myths on Entrepreneur		
UNIT 4	**SKILLS FOR AN ENTREPRENEUR**	**3 + 3**

Business Management Skills - Communication and active listening skills - Risk-taking skills – Networking Skills – Critical Thinking Skills – Problem Solving Skills – Creative Thinking Skills – Customer Service Skills – Financial Skills – Leadership Skills – Time Management and Organizational Skills – Technical Skills					
UNIT 5	**INTRAPRENEURSHIP**				**3 + 3**
What is Intrapreneurship – Understanding Intrapreneurship – Types of Intrapreneurs – Characteristics of Intrapreneurs – Examples of Intapreneurship					
Lecture	**15**	**Self - Study**	**15**	**Total**	**30**
Text Book					
1. Jayashree Suresh, Entrepreneurial Development, Margham Publications.					
References					
Essentials of Entrepreneurship and Small Business Management (6th Edition) by Norman M. Scarborough (Paperback - Jan 13, 2010) 2. Entrepreneurship and Small Business Management, Student Edition by Glencoe McGraw-Hill (Hardcover - Feb 24, 2005) 3. Vasant Desai, Dynamics of Entrepreneurship Development, Star Publication, New Delhi.					
E-References					
1. https://in.indeed.com/career-advice/career-development/entrepreneur-skills 2. https://www.investopedia.com/terms/i/intrapreneurship.asp					

COs vs POs

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO 1	**2**	**1**					**1**	**2**	**1**
CO 2	**2**	**1**							**1**
CO 3	**2**	**1**					**1**		**1**
CO 4	**2**	**2**							**1**
CO 5	**2**	**2**							**1**
TOTAL	**10**	**7**	**0**	**0**	**0**	**0**	**2**	**2**	**5**
SCALED VALUE	**2**	**2**	**0**	**0**	**0**	**0**	**1**	**1**	**1**

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

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

SEMESTER V

COURSE NAME			**Abstract Algebra**	**L**	**T**	**P**	**C**
COURSE CODE			**XMT501**	**3**	**1**	**0**	**4**
C	**P**	**A**		**L**	**T**	**P**	**H**
4	**0**	**0**		**3**	**1**	**0**	**4**
PREREQUISITE			Algebra				
On successful completion of this course, the students will be able to:							

	COURSE OUTCOMES	**DOMAIN**	**LEVEL**
CO 1	**Explain** the basics of subgroup and cyclic subgroups.	Cognitive	Understanding
CO 2	**Explain** the significance of the notions of quotient groups and permutation groups.	Cognitive	Understanding
CO 3	**Demonstrate** the fundamental concepts in ring theory such as of the ideals, quotient rings, integral domains, and fields.	Cognitive	Understanding
CO 4	**Demonstrate** the concepts of vector spaces, subspaces, bases, dimension and their properties with examples.	Cognitive	Understanding
CO 5	**Identify** the eigenvalues and eigenvectors of linear transformations.	Cognitive	Applying

UNIT 1		**9 + 3**
Subgroup: Necessary and sufficient condition for a subset to be a subgroup –Order of the Group – Order of an element – Centre of a group – Normalizer and Centralizer, Product of two subgroups – Order of HK – Necessary and sufficient condition for HK to be of a cyclic group a subgroup – Intersection and union of subgroups. **Cyclic subgroups:** Subgroups, generators of a cyclic group – Number of generators of a cyclic group – cosets – left cosets and right cosets – Partitioning of a group by cosets – Lagrange's theorem – Euler's theorem – Fermat's theorem.		
UNIT 2		**9 + 3**
Normal subgroups: Quotient groups – Group Homomorphism – Canonical Homomorphism – Kernel of a homomorphism – Isomorphism – Automorphism - Inner Automorphism – Cayley's Theorem – Permutation groups.		
UNIT 3		**9 + 3**
Rings: Definition and examples – Types of rings – Elementary properties of a ring – Integral Domain – Field – Sub rings – Sub fields – Ideals – Left ideal – Right ideal – Principal ideal – quotient ring – Maximal and prime Ideals – Characteristic of a ring – PID – UFD – Homomorphisms – Isomorphism – Kernel of a Homomorphism – Fundamental theorem of Homomorphism – Field of quotients of an Integral domain – Polynomial rings – Division algorithm – Polynomial rings over a UFD – Gauss lemma – Polynomials over the rational field – Eienstein's criterion.		
UNIT 4		**9 + 3**

Vector Space: Definition and Examples – Subspaces – Linear Transformation – Fundamental Theorem of Homomorphism.
Span of a Set: Linear Independence – Basis and Dimension – Rank and Nullity – Matrix and Linear transformation.

UNIT 5		9 + 3

Inner Product Space: Definition and Examples – Orthogonality – Orthogonal Complement – Gram Schmidt orthogonalization process.
Matrices: Elementary transformation – Inverse – Rank – Test for consistency – Solving Linear Equations – Cayley Hamilton theorem – Uses of Cayley Hamilton theorem – Inverse and power of a matrix, Eigenvalues and Eigenvectors.

LECTURE	45	TUTORIAL	15	PRACTICAL	0	TOTAL	60

Text Book

1. Herstein .I.N – Topics in Algebra, Vikas Publishing house Pvt. Ltd., 1975, New Delhi.

References

1. Arumugam.S and A. ThangapandiIssac – "Modern Algebra", Scitech Publications (India) Pvt.Ltd.
2. Sharma. J.N. and A.R. Vashistha – "Linear Algebra", Krishna Prakash Nandir 1981.
3. John B. Fraleigh, "A First Course in Abstract Algebra", 7th Ed., Pearson, 2002.
4. Murugan .M , "A First Course in Groups and Rings", Muthali Publishing House, Chennai, 2017.
5. Murugan. M, "A First Course in Linear Algebra and Boolean Algebra", Muthali Publishing House, Chennai, 2018.

E-References

1. https://nptel.ac.in
2. https://franciscan.smartcatalogiq.com/en/2021-2022/Undergraduate-Catalog/Courses/MTH-Mathematics-Course-Descriptions/300
3. http://catalog.yale.edu/ycps/courses/math/
4. https://www.princeton.edu/academics/area-of-study/mathematics
5. https://lsa.umich.edu/math/undergraduates/undergraduate-math-courses/500-level-math-courses.html

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO	PSO1	PSO2
CO 1	3	2	1	0	0	2	2	2	3	2	0
CO 2	3	2	1	0	0	2	2	2	3	2	0
CO 3	3	2	1	0	0	2	2	2	3	2	0
CO 4	3	2	1	0	0	2	2	2	3	2	0
CO 5	3	3	2	0	1	3	3	3	3	3	0
TOTAL	15	11	6	0	1	11	11	11	15	11	0
SCALED VALUE	**3**	**3**	**2**	**0**	**1**	**3**	**3**	**3**	**3**	**3**	**0**

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

1-5→1, 6-10→2, 11-15→3

COURSE NAME			**Real Analysis**	**L**	**T**	**P**	**C**
COURSE CODE			**XMT502**	**3**	**1**	**0**	**4**
C	**P**	**A**		**L**	**T**	**P**	**H**
4	**0**	**0**		**3**	**1**	**0**	**4**
PREREQUISITE			Number Systems				
On successful completion of this course, the students will be able to:							

COURSE OUTCOMES		**DOMAIN**	**LEVEL**
CO 1	**Summarize**the different properties of the real line R.	Cognitive	Understanding
CO 2	**Demonstrate** bounded, convergent, divergent, Cauchy, and monotonic sequences, and calculate limit superior, limit inferior of bounded sequences.	Cognitive	Understanding
CO 3	**Demonstrate** the basic definition and topology of metric spaces.	Cognitive	Understanding
CO 4	**Explain** the concepts of Connectedness, Completeness and Compactness.	Cognitive	Understanding
CO 5	**Demonstrate** the consequences of mean value theorems.	Cognitive	Understanding

UNIT 1		**9 +3**
Real Number system: The field axioms, the order axioms, the rational numbers, the irrational numbers, upper bounds, maximum element, least upper bound (supremum)- The completeness axiom- some properties of the supremum- Absolute values - The triangle inequality- the Cauchy-Schwarz's inequality. **Elements of point set Topology:** Euclidean space -Open sets and closed sets-Bolzano-Weierstrass theorem-The Cantor Intersection theorem-Coverings Lindelof covering theorem.		
UNIT 2		**9 +3**
Sequences: Bounded, Convergent, Divergent and oscillating sequences, Algebra of limits - Behaviour of Monotonic sequences. Cauchy's first limit Theorem, Cauchy's second limit Theorem, subsequences, Cauchy sequence, upper and lower limit of sequences. **Series:** Infinite series –nth term test-Comparison text- Linear Comparison test-Root test- Integral test-Alternating series.		
UNIT 3		**9 +3**
Metric Spaces: Metric Spaces - Limit in Metric Spaces- point set topology in metric spaces. **Continuous functions on metric spaces:** Functions continuous at a point on the real line - Functions continuous in a metric space - - Discontinuous function on R_1		
UNIT 4		**9 +3**
Connectedness, Completeness and Compactness: - Connectedness - Bounded sets and totally bounded sets - Complete metric spaces – Continuous functions on compact metric spaces -Continuity of the inverse function - Uniform continuity		

UNIT 5		9 +3
Riemann Integral: Existence of the Riemann integral. Derivatives-Rolle's theorem - Fundamental theorem of Calculus –Mean value theorem- Cauchy’s Mean Value theorem-Taylor's Theorem.		

LECTURE	45	TUTORIAL	15	PRACTICAL	0	TOTAL	60

Text Book

1. Tom M. Apostol - Mathematical Analysis, II Edition, Narosa Publishing House, New Delhi (Unit I), 1997.

References

5. Arumugam. S. and Thangapandi Issac, "Sequences and Series", New Gamma, Publishing House, Palayamkottai - 627 002, 1997.
6. Goldberg. R. “Methods of Real Analysis”, Oxford and IBH Publishing Co., New Delhi (2000).
7. Arumugam and Issac,“Modern Analysis”, New Publishing House, 2017.
8. Malik S.C and Savitha Arora,“Mathematical Analysis”, 1991, Wiley Eastern Limited New Delhi.
9. Viswanath Naik, K,“Real Analysis”, Emerald Publishers, Chennai.

E-References

2. https://nptel.ac.in
3. https://www.google.com/url?sa=t&source=web&rct=j&url=https://alansinyal.files.wordpress.com/2012/08/method-of-real-analysis.pdf&ved=2ahUKEwiHw4Ozusr-AhUdwjgGHQsaBSYQFnoECBsQAQ&usg=AOvVaw0V9zo2qyZvq3sS2eEWAbkY

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO	PSO1	PSO2
CO 1	3	2	1	0	0	2	2	2	3	2	0
CO 2	3	2	1	0	0	2	2	2	3	2	0
CO 3	3	2	1	0	0	2	2	2	3	2	0
CO 4	3	2	1	0	0	2	2	2	3	2	0
CO 5	3	2	1	0	0	2	2	2	3	2	0
TOTAL	15	10	5	0	0	10	10	10	15	10	0
SCALED VALUE	**3**	**2**	**1**	**0**	**0**	**2**	**2**	**2**	**3**	**2**	**0**

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

1-5→1, 6-10→2, 11-15→3

COURSE NAME	Number Theory	L	T	P	C
COURSE CODE	XMT503	3	1	0	4

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<tr><td>C</td><td>P</td><td>A</td><td colspan="4"></td><td>L</td><td>T</td><td>P</td><td>H</td></tr>
<tr><td>4</td><td>0</td><td>0</td><td colspan="4"></td><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td colspan="3">PREREQUISITE</td><td colspan="8">Number Systems</td></tr>
<tr><td colspan="11">On successful completion of this course, the students will be able to:</td></tr>
<tr><td colspan="7">COURSE OUTCOMES</td><td colspan="2">DOMAIN</td><td colspan="2">LEVEL</td></tr>
<tr><td>CO 1</td><td colspan="6">Demonstrate an understanding of the basic properties of the integers by applying principles of mathematical induction.</td><td colspan="2">Cognitive</td><td colspan="2">Understanding</td></tr>
<tr><td>CO 2</td><td colspan="6">Solve the given Diophantine Equation by using Euclidean algorithm.</td><td colspan="2">Cognitive</td><td colspan="2">Applying</td></tr>
<tr><td>CO 3</td><td colspan="6">Demonstrate the fundamental theorem of Arithmetic.</td><td colspan="2">Cognitive</td><td colspan="2">Understanding</td></tr>
<tr><td>CO 4</td><td colspan="6">Explain the basic properties of congruence.</td><td colspan="2">Cognitive</td><td colspan="2">Understanding</td></tr>
<tr><td>CO 5</td><td colspan="6">Demonstrate the results in theory of numbers including Fermat’s theorem, the Little theorem and Wilson’s theorem.</td><td colspan="2">Cognitive</td><td colspan="2">Understanding</td></tr>
<tr><td>UNIT 1</td><td colspan="8"></td><td colspan="2">9 + 3</td></tr>
<tr><td colspan="11">Peano's Axiom - Mathematical Induction - The Binomial Theorem - Early Number Theory.</td></tr>
<tr><td>UNIT 2</td><td colspan="8"></td><td colspan="2">9 + 3</td></tr>
<tr><td colspan="11">Divisibility Theory in Integers - The Division Algorithm - The g.c.d. - Euclidean Algorithm - The Diophantine Equation ax + by = c.</td></tr>
<tr><td>UNIT 3</td><td colspan="8"></td><td colspan="2">9 + 3</td></tr>
<tr><td colspan="11">Primes and their Distributions - The fundamental Theorem of Arithmetic - The sieve of Eratosthenes - The Gull Conjecture.</td></tr>
<tr><td>UNIT 4</td><td colspan="8"></td><td colspan="2">9 + 3</td></tr>
<tr><td colspan="11">The Theory of Congruence - Basic Properties of Congruence - Special Divisibility test - Linear Congruence. - Prime modulus- Power residues.</td></tr>
<tr><td>UNIT 5</td><td colspan="8"></td><td colspan="2">9 + 3</td></tr>
<tr><td colspan="11">Fermat's Theorem - Fermat's factorization method - The Little theorem - Wilson's theorem.</td></tr>
<tr><td colspan="2">LECTURE</td><td>45</td><td>TUTORIAL</td><td>15</td><td>PRACTICAL</td><td colspan="2">0</td><td colspan="2">TOTAL</td><td>60</td></tr>
<tr><td colspan="11">Text Book</td></tr>
<tr><td colspan="11">1. Elementary Number Theory, David M Burton, McGraw Hill Education, Seventhedition, 2017.</td></tr>
<tr><td colspan="11">References</td></tr>
<tr><td colspan="11">1. Tom. M. Apostol,Introduction to Analytic Number Theory, Springer, New York, 1976.
2. Ivan Nivan and H. Zuckerman - An Introduction to theory of Numbers.
3. Kumaravelu. S and Susheela Kumaravelu – Elements of Number Theory, Nagercoil, 2002.
4. Neville Robinns, Beginning Number Theory, 2nd Ed., Narosa Publishing House Pvt.Ltd.,Delhi, 2007.
5. K.C.Chowdhury,AFirstCourseInNumberTheory, AsianBooksPvt.Ltd,NewDelhi, 2007.</td></tr>
<tr><td colspan="11">E-References</td></tr>
<tr><td colspan="11">1. https://lsa.umich.edu/math/undergraduates/undergraduate-math-courses/500-level-math-</td></tr>
</table>

courses.html

2. http://collegecatalog.uchicago.edu/thecollege/mathematics/#courseinventory
3. https://www.princeton.edu/academics/area-of-study/mathematics

COs VS POs											
	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO**	**PSO1**	**PSO2**
CO 1	3	2	1	0	0	2	2	2	3	2	0
CO 2	3	3	2	0	1	3	3	3	3	3	0
CO 3	3	2	1	0	0	2	2	2	3	2	0
CO 4	3	2	1	0	0	2	2	2	3	2	0
CO 5	3	2	1	0	0	2	2	2	3	2	0
TOTAL	15	11	6	0	1	11	11	11	15	11	0
SCALED VALUE	**3**	**3**	**2**	**0**	**1**	**3**	**3**	**3**	**3**	**3**	**0**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											
1-5→1, 6-10→2, 11-15→3											

COURSE NAME			Graph Theory	L	T	P	C
COURSE CODE			XMT504A	3	1	0	4
C	P	A		L	T	P	H
4	0	0		3	1	0	4
PREREQUISITE			Algebra				

On successful completion of this course, the students will be able to:

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Explain** the fundamental concepts in graph theory.	Cognitive	Understanding
CO 2	**Compare** Eulerian and Hamiltonian graphs.	Cognitive	Understanding
CO 3	**Relate** graph with matrix.	Cognitive	Understanding
CO 4	**Utilize** Euler formula to obtain planar graphs.	Cognitive	Applying
CO 5	**Explain** an algorithm for vertex colouring.	Cognitive	Understanding

UNIT 1 — **9 +3**

Basics: Graphs – Pictorial representation – Subgroups – Isomorphism and degrees – Walks and connected graphs – Cycles in graphs – Cut-vertices and cut-edges.

UNIT 2 — **9 +3**

Eulerian and Hamiltonian Graphs: Eulerian graphs – Fleury's algorithm – Hamiltonian graphs – weighted graphs.

UNIT 3 — **9 +3**

Bipartite Graphs and Matrices: Bipartite graphs – Marriage problem – Trees – Connector problem – Matrix representations – Vector spaces associated with graphs – Cycle space – cut-set space.

UNIT 4 — **9 +3**

Planar Graphs: Planar Graphs – Euler formula – Platonic solids – Dual of a plane graph – Characterization of planar graphs.

UNIT 5 — **9 +3**

Colourings: Vertex colouring – Edge colouring – An algorithm for vertex colouring.

LECTURE	45	TUTORIAL	15	PRACTICAL	0	TOTAL	60

Text Book

1. Choudum.S.A. – A First Course in Graph Theory, Macmillan India Limited, 1987
2. **"**AninvitationtoGraphtheory**",** Dr.S.Arumugam&S.Ramachandran,**-** SCITECHpublications(India) Pvt.Ltd.,Chennai, 2006.

References

1. Graphs Theory with Applications to Engineering and Computer Science –NarsinghDeo,Prentice-Hallof India PrivateLtd, 1974.
2. Introduction to Graph Theory – Gary Chartrand and Ping Zhang, Tata McGraw-HillEdition, 2004.
3. GraphTheory-F.Harary,Addison-WesleyPublishingCompany, Inc.,1969.
4. Murugan.M – Introduction to Graph Theory, Muthali Publishing House, Chennai, 2005.

E-References
1. https://archive.nptel.ac.in/courses/111/106/111106102/ 2. https://www.youtube.com/watch?v=sWsXBY19o8I 3. https://www.youtube.com/watch?v=3VeQhNF5-rE

COs VS POs											
	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO**	**PSO1**	**PSO2**
CO 1	3	2	1	0	0	2	2	2	3	2	0
CO 2	3	2	1	0	0	2	2	2	3	2	0
CO 3	3	2	1	0	0	2	2	2	3	2	0
CO 4	3	3	2	0	1	3	3	3	3	3	0
CO 5	3	2	1	0	0	2	2	2	3	2	0
TOTAL	15	11	6	0	1	11	11	11	15	11	0
SCALED VALUE	**3**	**3**	**2**	**0**	**1**	**3**	**3**	**3**	**3**	**3**	**0**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											
1-5→1, 6-10→2, 11-15→3											

COURSE NAME			Mathematical Modeling	L	T	P	C
COURSE CODE			XMT504B	3	1	0	4
C	P	A		L	T	P	H
4	0	0		3	1	0	4
PREREQUISITE			Differential Calculus				

On successful completion of this course, the students will be able to:

	COURSE OUTCOMES	DOMAIN	LEVEL
CO 1	**Compare** models that can be constructed by ordinary differential equations of first order under study	Cognitive	Applying
CO 2	**Utilize** compartment models to solve the problems involved in economics and medicine	Cognitive	Applying
CO 3	**Analyze** mathematical models that can be developed by second order linear differential equations	Cognitive	Analyzing
CO 4	**Apply** linear difference equation to solve problems in finance and economics	Cognitive	Applying
CO 5	**Identify** the solutions of the given problems that can be modelled through graphs	Cognitive	Applying

UNIT 1	MathematicalModeling	**9 +3**

Simplesituationsrequiringmathematicalmodeling- Technique of mathematical models – Classification ofmathematical models - Characteristics of mathematical models-Mathematicalmodelingthroughalgebra.

UNIT 2	Mathematical Modeling through differential equations	**9 +3**

Linear Growthand Decay Models - Non-Linear growth and decay models - Compartmentmodels.

UNIT 3	Mathematical Modeling, through system of Ordinary differentialequationsoffirstorder	**9 +3**

Mathematicalmodelinginpopulationdynamics – Mathematical modeling of epidemics through systems of ordinary differentialequations–Mathematical modelsMedicine.

UNIT 4	Introduction to difference equations	**9 +3**

The need for mathematicalmodeling through difference equation – basic theory of linear differenceequationswithconstantcoefficients.

UNIT 5	Mathematical Modeling through difference equations	**9 +3**

Mathematical modelingthrough difference equations in economics and finance -Mathematical modeling through difference equations in populationdynamicsand genetics.

LECTURE	45	TUTORIAL	15	PRACTICAL	0	TOTAL	60

Text Book

1. “MathematicalModelling”,JNKapur,NewAgeInternationalpublishers,Reprint 2018.

Unit I Chapter: 1 Sections:1.1 – 1.6 (Pages1– 20)
Unit II Chapter: 2 & 3 Sections:2.1–2.4 (Pages30 – 42) &
Sections:3.1 – 3.2,3.5 (Pages53–62&69-72)
Unit III Chapter: 4 Sections:4.1–4.3 (Pages76 – 93)
Unit IV Chapter: 5 Sections:5.1–5.2 (Pages96 – 105)

Unit V Chapter: 5 Sections:5.3–5.5 (Pages106 – 121)
References

1. Mathematical Modeling by BimalK.Mishra and DipakK.Satpathi. AneBooksPvt.Ltd(1 January2009)
2. Mathematical Modeling Models, Analysis and Applications, by Sandip Banerjee, CRCPress,Taylor&Francisgroup, 2014
3. MathematicalModelingapplicationswithGeogebrabyJonasHall&ThomasLigefjard,John Wiley& Sons, 2017

E-References

1. https://www.digimat.in/nptel/courses/video/111107113/L19.html
2. https://www.youtube.com/watch?v=AccTsyDtV_8

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO	PSO1	PSO2
CO 1	3	3	2	0	1	3	3	3	3	3	0
CO 2	3	3	2	0	1	3	3	3	3	3	0
CO 3	3	3	3	1	2	3	3	3	3	3	1
CO 4	3	3	2	0	1	3	3	3	3	3	0
CO 5	3	3	2	0	1	3	3	3	3	3	0
TOTAL	15	15	11	1	6	15	15	15	15	15	1
SCALED VALUE	**3**	**3**	**3**	**1**	**2**	**3**	**3**	**3**	**3**	**3**	**1**

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

1-5→1, 6-10→2, 11-15→3

COURSE NAME			Numerical Methods with MATLAB	L	T	P	C
COURSE CODE			XMT504C	3	1	0	4
C	P	A		L	T	P	H
4	0	0		3	1	0	4
PREREQUISITE			Algebra and Number systems				

On successful completion of this course, the students will be able to:

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Demonstrate** to recognize and use of MATLAB.	Cognitive	Understanding
CO 2	**Apply** a top-down, modular, and systematic approach to design, write, test, and debug sequential MATLAB programs to solve numerical problems.	Cognitive	Applying
CO 3	**Apply** curve fitting and construct polynomialsfor a given set of data points or given functions using MATLAB.	Cognitive	Applying
CO 4	**Identify**numerical solutions of algebraic and transcendental equations by using bisection method and Newton's Method with MATLAB	Cognitive	Applying
CO 5	**Solve** ordinary differential equations numerically using Euler and Runge-Kutta methods with MATLAB.	Cognitive	Applying

UNIT 1 **9 + 3**

MATLAB Environment: Getting Started – Solving Problems in MATLAB – Saving your works – Predefined MATLAB Functions – Using Predefined Functions – Manipulating Matrices – Computational Limitations- Special Values and Functions.

UNIT 2 **9 + 3**

Plotting: Introduction to Two-Dimensional Plotting – Three-Dimensional Plotting – Editing Plots from the Menu Bar – Creating Plots from the Workshop Window. Programming in MATLAB: Introduction – Problems with Two Variables – Input/Functions – Statement level Control Structures.

UNIT 3 **9 + 3**

Numerical Techniques: Introduction – Curve Fitting: Linear and Polynomial Regression – Using the Interactive Fitting Tools – Numerical Integration – Numerical Differentiation.

UNIT 4 **9 + 3**

Curve Fitting – Fitting Linear and parabolic curves by the method of least squares principles- Solving algebraic and transcendental equations-Bisection method, false position method and Newton Raphson method – Solving simultaneous algebraic equations – Gauss-Seidel method – Gauss elimination method.

UNIT 5 **9 + 3**

Interpolation – Newton's forward and backward difference formulae – Lagrange's interpolation formula – Numerical integrations using Trapezoidal and Simpson's one – third rules – solution of ODE's – Euler method and Runge-Kutta fourth order method.

LECTURE	45	TUTORIAL	15	PRACTICAL	0	TOTAL	60

Text Book

1. Numerical methods in Science and Engineering, M.K. Venkatraman, National Publisher Company, Fifth Edition, 2001 (For Units IV and V). UNIT – I : Chapter 2&3 of [1] UNIT – II : Chapter 4&5 of [1] UNIT – III : Chapter 8 of [1] UNIT – IV : Chapter 1, Sections 1.7-1.8, Chapter 3, Sections 2, 4 and 5, Chapter 4, Sections 2, 6 of [2] UNIT – V : Chapter 6, Sections 3 & 4, Chapter 8 Section 4, Chapter 9 Sections 8 & 10, Chapter 11 Sections 10 & 16 of [2].
References
1. Introduction to MATLAB, Delores M. Etter, David C. Kuncicky, Holly Moore, Published by Dorling Kindersley (India) Pvt. Ltd., licenses of Pearson Education in South Asia. **2.** Let us ‘C’, Yashavant. P. Kanetkar, BPB Publications, 2002. Computer oriented numerical methods, Rajaraman, Prentice-Hall of India, 1971.
E-References
https://nptel.ac.in

COs VS POs											
	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**
CO 1	3	2	1	0	0	2	2	2	3	2	0
CO 2	3	3	2	0	1	3	3	3	3	3	0
CO 3	3	3	2	0	1	3	3	3	3	3	0
CO 4	3	3	2	0	1	3	3	3	3	3	0
CO 5	3	3	2	0	1	3	3	3	3	3	0
TOTAL	15	14	9	0	4	14	14	14	15	14	0
SCALED VALUE	**3**	**3**	**2**	**0**	**1**	**3**	**3**	**3**	**3**	**3**	**0**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											
1-5→1, 6-10→2, 11-15→3											

COURSE NAME			Discrete Mathematics	L	T	P	C
COURSE CODE			XMT504D	3	1	0	4
C	P	A		L	T	P	H
4	0	0		3	1	0	4
PREREQUISITE			Algebra and Number Systems				

On successful completion of this course, the students will be able to:

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Utilize** standard notation of mathematical logic to write English sentences for logical expressions and vice-versa.	Cognitive	Applying
CO 2	**Explain** the algebraic structure of groups.	Cognitive	Understanding
CO 3	**Simplify** and prove Boolean expressions.	Cognitive	Analyzing
CO 4	**Construct** non-deterministic finite state machine.	Cognitive	Applying
CO 5	**Demonstrate** the ability to convert numerals into various number systems.	Cognitive	Understanding

UNIT 1		9 +3
Mathematical logic: Statement and Notation - Connectives - Negation - Conjunction - Disjunctions - Statement Formula and Truth Table – Conditional and Biconditional - Well defined formulae - Tautologies - Equivalence of formulae - Duality Laws - Normal forms.		
UNIT 2		**9 +3**
Algebraic Structures: Groups and Monoids - Simple Properties - Group Codes.		
UNIT 3		**9 +3**
Lattices and Boolean Algebra: Lattices and Posets - Properties of Lattices - Special Lattices - Boolean Algebra - Gating Networks - Minimal sums of Products - Karnaugh maps.		
UNIT 4		**9 +3**
Languages: Finite State Machines Language - The Set Theory and Strings - Finite State Machine - A first encounter - Finite State machine - a Second encounter.		
UNIT 5		**9 +3**
Number system and codes: Decimal, Binary, Octal, Hexadecimal - Conversion from one to another - Binary addition, subtraction multiplication and division - BCD - Weighted excess time - Gray Code - ASCII code, Error Detecting Code.		

LECTURE	45	TUTORIAL	15	PRACTICAL	0	TOTAL	60

Text Book

1. Trembley and Manohar - Discrete Mathematical structures with application to Computer Science, (Tata McGraw Hill, New Delhi) 35th reprint 2008.

References

1. Koleman and Bushy- Discrete Mathematical Structures, Prentice Hall of India, New Delhi- 2002.
2. “Discrete Mathematics” by Dr.M.K.Venkatraman, Dr.N.Sridharan, N.Chandrasekeran, the National Publishing Company, 2003.

3. Ralph P. Grumaldi Pearson Edelen - Discrete and Combinational Mathematics - an Applied Introduction (IV Edn.). 1998.
4. Maluino A and Leech - Digital Principles and Application, Mcgraw Hill, 2011.

E-References

1. https://www.cst.cam.ac.uk/teaching/2021/DiscMath [University of Cambridge]
2. https://explorecourses.stanford.edu/search?q=CS157 [Stanford]

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO	PSO1	PSO2
CO 1	3	3	2	0	1	3	3	3	3	3	0
CO 2	3	2	1	0	0	2	2	2	3	2	0
CO 3	3	3	3	1	2	3	3	3	3	3	1
CO 4	3	3	2	0	1	3	3	3	3	3	0
CO 5	3	2	1	0	0	2	2	2	3	2	0
TOTAL	15	13	9	1	4	13	13	13	15	13	1
SCALED VALUE	**3**	**3**	**2**	**1**	**1**	**3**	**3**	**3**	**3**	**3**	**1**

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

1-5→1, 6-10→2, 11-15→3

COURSE NAME			Vedic Mathematics - II	L	T	P	C
COURSE CODE			XMT505	1	1	0	2
C	P	A		L	T	P	H
2	0	0		1	1	0	2
PREREQUISITE			Algebra and Number Systems				

On successful completion of this course, the students will be able to:

	COURSE OUTCOMES	DOMAIN	LEVEL
CO 1	**Solve** the linear equations in two variables faster and with ease.	Cognitive	Applying
CO 2	**Utilize** vertical and crosswise technique for multiplication of Polynomials.	Cognitive	Applying
CO 3	**Explain**the Introduction and history of Matrices and Determinants	Cognitive	Understanding
CO 4	**Explain** different forms of straight lines.	Cognitive	Understanding
CO 5	**Solve** system of simultaneous linear equations with matrices faster and with ease.	Cognitive	Applying

UNIT 1	**Solution of linear equations**	**3+3**
Introduction of simple equation - Solutions of simple equations - Solutions of linear equations in two variables - Practical application of linear equations in two variables.		
UNIT 2	**Factorization**	**3+3**
Factorization of Quadratics - cubic polynomials, homogeneous expressions of the second degree – Solving Quadratics by calculus and many other special techniques -Multiplication of Polynomials using vertically and crosswise technique.		
UNIT 3	**VedicMatrix Algebra**	**3+3**
Introduction and history of Matrices and Determinants - Matrices and Determinants of third order - Inverse of Matrices.		
UNIT 4	**Vedic Geometry**	**3+3**
Different forms of straight lines - The Triangle - The Cyclic Quadrilateral, Squares, and the Circle - Geometrical constructions - Transformation of simple shapes.		
UNIT 5	**Solution of linear simultaneous equations**	**3+3**
Simultaneous Equation with two Variables - Simultaneous Equation with 3 Variables by determinant method.		

LECTURE	15	TUTORIAL	15	PRACTICAL	0	TOTAL	30

Text Book

1. Vedic Mathematics, Swami Bharati Krishna Trithaji, Motilal Banarsidas, New Delhi,1990.

References

1. Elements of Vedic Mathematics, Udayan S. Patankar, Sunil M. Patankar, TTU Press,2018.
2. Advanced Vedic Mathematics, Rajesh Kumar Thakur, Rupa Publications, New Delhi,2019.

E-References

1. http://www.funwithfigures.com/
2. http://www.youtube.com/watch?v=b3PFjsUgULM&feature=youtu.be

COs VS POs											
	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO**	**PSO1**	**PSO2**
CO 1	3	3	2	0	1	3	3	3	3	3	0
CO 2	3	2	1	0	0	2	2	2	3	2	0
CO 3	3	2	1	0	0	2	2	2	3	2	0
CO 4	3	3	2	0	1	3	3	3	3	3	0
CO 5	3	3	2	0	1	3	3	3	3	3	0
TOTAL	15	13	8	0	3	13	13	13	15	13	0
SCALED VALUE	**3**	**3**	**2**	**0**	**1**	**3**	**3**	**3**	**3**	**3**	**0**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											
1-5→1, 6-10→2, 11-15→3											

COURSE NAME			Python Programming	L	T	P	C
COURSE CODE			XMT506A	2	1	0	3
C	P	A		L	T	P	H
3	0	0		2	1	0	3
PREREQUISITE			Basic programme language				

On successful completion of this course, the students will be able to:

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Demonstrate** the basics of object-oriented concepts and pythonprogramming.	Cognitive	Understanding
CO 2	**Utilize** the array,develop the programs using selection and jumpstatements.	Cognitive	Applying
CO 3	**Illustrate**thesignificanceoffunction,stringsandmodules;andImple mentinvariousapplications.	Cognitive	Understanding
CO 4	**Demonstrate** the List, Tuples and Dictionary; and write program using the list, tuples and dictionary.	Cognitive	Applying
CO 5	**Analyze** the given data by handlingthefilesinPython.	Cognitive	Analyzing

UNIT 1	BasicsofObjectOrientedandPythonProgramming	**6 +3**

BasicsofObject-OrientedProgramming: ProceduralandObject-OrientedProgramming–Classesand Objects– Encapsulation– Polymorphism– Inheritance –Abstraction.

Basicsof PythonProgramming:HistoryofPython–FeaturesofPython–Literal–Constants –Variables–Identifiers–Keywords–Built-inDataTypes–OutputStatements–InputStatements – Comments– Indentation– Operators–Expressions– Type conversions.

UNIT 2	Python ArraysandControl Statements	**6 +3**

PythonArrays:DefiningandProcessingArrays –Array methods.
ControlStatements:Selection/ConditionalBranchingstatements–if,if-else,nestedifandif-elif-else statements. Iterative Statements: While loop, for loop, else suite in loop and nestedloops.JumpStatements: break,continue and pass statements.

UNIT 3	Functions,StringsandModules	**6 +3**

Functions: Function Definition – Function Call – Variable Scope and its Lifetime – ReturnStatement–Recursion.PythonStrings:Stringoperations–ImmutableStrings–Built-inStringMethodsandFunctions–StringComparison.Modules:Importstatement–ThePythonmodule –dir() function –Modules and Namespace –Defining ourown modules.

UNIT 4	Lists,TuplesandDictionaries	**6 +3**

Lists: Creating a list – Access values in List – Updating values in Lists – Nested lists – Basiclist operations – List Methods. Tuples: Creating, Accessing, Updating and Deleting Elementsin a tuple – Nested tuples – Difference between lists and tuples. Dictionaries : Creating,Accessing,UpdatingandDeletingElementsinaDictionary–DictionaryFunctionsandMethods – DifferencebetweenListsandDictionaries.

UNIT 5	FileHandlingandDataAnalysis	**6 +3**

File Handling: Types of files in Python – Opening and Closing files – Reading and Writingfiles–

Splittingwords–Filemethods–FilePositionsRenaminganddeletingfiles.DataAnalysisusingPython:LoaddataintoaDataFrame–FundamentalsofDataManipulationwith Python.

LECTURE	30	TUTORIAL	15	PRACTICAL	0	TOTAL	45

Text Book

1. ReemaThareja,"PythonProgrammingusingproblemsolvingapproach",2nd Edition,2023,OxfordUniversityPress.
2. Dr.R.NageswaraRao, "CorePythonProgramming",3rd Edition,2021,DreamtechPublishers.

References

1. VamsiKurama,"PythonProgramming:AModernApproach", PearsonEducation.
2. MarkLutz,"LearningPython",Orielly.
3. AdamStewarts,"PythonProgramming",Online.
4. FabioNelli,"PythonDataAnalytics:WithPandas,NumPy,andMatplotlib",APress.
5. KennethA.Lambert,"FundamentalsofPython–FirstPrograms",2nd Edition,CengagePublication.

E-References

1. NPTEL Course in Python for Data Science by Prof. Ragunathan Rengasamy, IIT Madras, https://onlinecourses.nptel.ac.in/noc22_cs32/preview
2. Python for Beginners, https://alison.com/course/python-for-beginners
3. Python for Fundamentals for Beginners, https://www.mygreatlearning.com/academy/learn-for-free/courses/python-fundamentals-for-beginners
4. Python Certificate Course, https://data-flair.training/courses/python-course/
5. Crash Course on Python, https://www.coursera.org/learn/python-crash-course

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO	PSO1	PSO2
CO 1	3	2	1	0	0	2	2	2	3	2	0
CO 2	3	3	2	0	1	3	3	3	3	3	0
CO 3	3	2	1	0	0	2	2	2	3	2	0
CO 4	3	3	2	0	1	3	3	3	3	3	0
CO 5	3	3	3	1	2	3	3	3	3	3	1
TOTAL	15	13	9	1	4	13	13	13	15	13	1
SCALED VALUE	**3**	**3**	**2**	**1**	**1**	**3**	**3**	**3**	**3**	**3**	**1**

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

1-5→1, 6-10→2, 11-15→3

COURSE NAME			Mathematics for Finance	L	T	P	C
COURSE CODE			XMT506B	2	1	0	3
C	P	A		L	T	P	H
3	0	0		2	1	0	3
PREREQUISITE			Basic Economics				

On successful completion of this course, the students will be able to:

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Estimate** Time value of money and compound interest functions.	Cognitive	Evaluating
CO 2	**Measure** breakeven point and make use of breakeven point in managerial decision making	Cognitive	Evaluating
CO 3	**Estimate** Annuities and Equation of Value Discounting	Cognitive	Evaluating
CO 4	**Estimate** internal rate of return with reference to IRR method and valuing a loan with allowance for capital gains.	Cognitive	Evaluating
CO 5	**Estimate** stock and bond price.	Cognitive	Evaluating

UNIT 1	Introduction	**6 +3**
Simple and compound interest. Kinds of interest rates: Effective rate, nominal rate and force of interest rates - Calculation of accumulated value using different kinds of interest rates - the time value of money - Present value calculation and discount rate - Nominal rate of discount and its relationship with effective rate of discount		
UNIT 2	Break even Analysis and leverage	**6 +3**
Break-even point – Chart – Decision making – leverage – operating – financial – combined leverage.		
UNIT 3	Annuities and Equation of Value Discounting and Accumulation	**6 +3**
Discrete and continuous cash flows; level annuities, deferred and increasing/decreasing annuities, equation of value and yield on transaction, probability of cash flows, higher discount, loan schedules; consumer credit: flat rate and APRs..		
UNIT 4	Capital Budgeting Techniques	**6 +3**
Introduction to financial statement, assessing financial performance, net present value, internal rate of return, payback period; projects with different live.		
UNIT 5	Risk and insurance	**6 +3**
Long-term and short-term insurance, Life Insurance, Endowment, and annuities, Insurance policies, automobile insurance, property insurance, indemnity principle, coinsurance principle, valuation of stock and bonds.		

LECTURE	30	TUTORIAL	15	PRACTICAL	0	TOTAL	45

Text Books

1. Arlie O Petters, Xiaoying Dong (2016) An Introduction to Mathematical finance with applications: Understanding and Building Financial Intuition (Springer Undergraduate texts in Mathematics and Technology).
2. Ross, S.M., (1999): An Introduction to Mathematical Finance, Cambridge University Press, Norton, London.
3. Martin, P.G. and Michael B., (1991): Applied Financial Mathematics, Prentice Hall.

References
1. Baxter, M. and A. L. Rennie, (1996): Financial Calculus, Cambridge University Press. 2. Karatzas, L. and Shreve S.E., (1998): Methods of Mathematical Finance, Springer. 3. Watsham,T.J .and Perramore. K., (1997): Quantitative Methods in Finance, International Thomson Business Press.
E-References
https://nptel.ac.in

COs VS POs											
	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**
CO 1	3	3	3	2	3	3	3	3	3	3	2
CO 2	3	3	3	2	3	3	3	3	3	3	2
CO 3	3	3	3	2	3	3	3	3	3	3	2
CO 4	3	3	3	2	3	3	3	3	3	3	2
CO 5	3	3	3	2	3	3	3	3	3	3	2
TOTAL	15	15	15	10	15	15	15	15	15	15	10
SCALED VALUE	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**2**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											
1-5→1, 6-10→2, 11-15→3											

SEMESTER VI

COURSE NAME			Complex Analysis	L	T	P	C
COURSE CODE			XMT601	3	1	0	4
C	P	A		L	T	P	H
4	0	0		3	1	0	4
PREREQUISITE			Real Analysis				

On successful completion of this course, the students will be able to:

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Determine** whether the given function is Continuous / differentiable / analytic.	Cognitive	Evaluating
CO 2	**Determine** the image of given region under the given bilinear transformation	Cognitive	Evaluating
CO 3	**Explain** Cauchy's theorem and Cauchy Integral formula	Cognitive	Understanding
CO 4	**Determine** the annulus of convergence of a given function using the concepts of series expansion	Cognitive	Evaluating
CO 5	**Evaluate** complex contour integrals using the Cauchy Residue theorem	Cognitive	Evaluating

UNIT 1	**Complex numbers**	**9 + 3**
Complex numbers – Functions of a complex variable – Limits – Theorems on limit – Continuous functions – Differentiability - The Cauchy Riemann equations – Analytic functions – Harmonic functions.		
UNIT 2	**Bilinear Transformation**	**9 + 3**
Introduction – Elementary transformations – Bilinear transformation – cross ratio – fixed points of bilinear transformation – some special bilinear transformations.		
UNIT 3	**Complex Integration**	**9 + 3**
Introduction – definite integral – Cauchy's Theorem – Cauchy's integral formula – Maximum modulus theorem – Higher derivatives – Cauchy's inequality – Liouville's theorem – Fundamental theorem of algebra – Morera's theorem.		
UNIT 4	**Series Expansions**	**9 + 3**
Introduction – Taylor's series – Laurent's series – Zeros of an analytic function – singularities and poles – Riemann's theorem - meromorphic function.		
UNIT 5	**Calculus of Residues**	**9 + 3**
Residues – Cauchy's Residue theorem – Argument theorem – Rouche's theorem - Evaluation of definite integral –Contour integration types.		

LECTURE	45	TUTORIAL	15	PRACTICAL	0	TOTAL	60

Text Book

2. "Complex Analysis" by S.Arumugam, A. Thangapandi Isaac, A. Somasundaram, Scitech Publications, 2014.

Unit I	:	Chapter 1 (Sec: 1.1), Pages: 1 – 2
		Chapter 2 (Sec: 2.1 – 2.8), Pages: 24 – 52
Unit II	:	Chapter 3 (Sec: 3.1 – 3.5), Pages: 74 – 100

Unit III	:	Chapter 6(Sec: 6.1 – 6.4), Pages: 132 – 170
Unit IV	:	Chapter 7(Sec: 7.1 – 7.4), Pages: 173 – 207
Unit V	:	Chapter 8(Sec: 8.1 – 8.3), Pages: 209 – 254

References

3. “Foundations of complex Analysis” by S.Ponnusamy- Narosa Publishing House- New Delhi Chennai.
4. “Functions of a complex variables with applications” by E.G. Phillis (1968)- Oliver & Boy D, Edinburg
5. Churchill.R.V.and J.W. Brown - "Complex variables and Applications" - Fourth Edition - McGraw Hill International Editions.
6. Duraipandian. P. and Lakshmi Duraipandian - "Complex Analysis" - Emerald Publications, Chennai (2001).
7. Roopkumar R. Complex Analysis, Pearson Education India, 2014.

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1. https://courses.maths.ox.ac.uk/node/9[Oxford]
2. https://services.math.duke.edu/~ng/math633s14/syllabus.pdf[Duke]
3. https://nptel.ac.in

COs VS Pos

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO	PSO1	PSO2
CO 1	3	3	3	2	3	3	3	3	3	3	2
CO 2	3	3	3	2	3	3	3	3	3	3	2
CO 3	3	2	1	0	0	2	2	2	3	2	0
CO 4	3	3	3	2	3	3	3	3	3	3	2
CO 5	3	3	3	2	3	3	3	3	3	3	2
TOTAL	15	14	13	8	12	14	14	14	15	14	8
SCALED VALUE	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**2**

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

1-5→1, 6-10→2, 11-15→3

COURSE NAME			Mechanics	L	T	P	C
COURSE CODE			XMT602	3	1	0	4
C	P	A		L	T	P	H
4	0	0		3	1	0	4
PREREQUISITE			Algebra & Trigonometry				

On successful completion of this course, the students will be able to:

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Demonstrate** necessary conditions for the equilibrium of particles acted upon by various forces	Cognitive	Understanding
CO 2	**Analyze** various systems of forces	Cognitive	Analyzing
CO 3	**Explain** the relation between work and power	Cognitive	Understanding
CO 4	**Illustrate** the effects of a projectile acted upon various forces	Cognitive	Understanding
CO 5	**Apply** the theory of central orbit to study planetary motions.	Cognitive	Applying

UNIT 1	**Force:**	9 + 3
Newton'slawsofmotion–Resultantoftwoforcesonaparticle- EquilibriumofaParticle:Equilibriumofaparticle–Limitingequilibriumofaparticleon an inclinedplane.		
UNIT 2	**Forces on a Rigid Body:**	9 + 3
Moment of a Force – General motion of a body –Equivalentsystemsofforces-ParallelForces–ForcesactingalongaTriangle - A specific reduction of Forces: Reduction of coplanar forces intoaforceand couple.		
UNIT 3	**Work, Energy and Power**:	9 + 3
Work–Conservativefield of force–Power-RectilinearMotionunderVaryingForce:SimpleHarmonicMotion–along a horizontal line–alongaverticalline.		
UNIT 4	**Projectiles:**	9 + 3
Forcesonaprojectile–Projectileprojectedonaninclined plane		
UNIT 5	**CentralOrbits:**	9 + 3
Generalorbits–Centralorbit –Conicasacenteredorbit		

LECTURE	45	TUTORIAL	15	PRACTICAL	0	TOTAL	60

Text Book

1. Mechanics, P.Duraipandian,LaxmiDuraipandian,MuthamizhJayapragasam,S.Chand&CompanyLtd.,Fourth Edition, Sixth Revised Edition 2005.

References

1. IntroductiontoStaticsandDynamics,A.RuinaandR,Pratap,OxfordUniversityPress,2014.
2. TheElementsofStaticsandDynamics,S.L.Loney,CambridgeUniversityPress,1904.
3. Engineering Mechanics: Statics, J.L.Meriam and L.G.Kraige, SeventhEdition,WileyandSonsPvt ltd., NewYork, 2012.

4. EngineeringMechanics:Dynamics, J.L.Meriam,L.G.Kraige,andJ.N.Bolton,8th edn,Wileyand sonsPvtltd., NewYork, 2015. 5. EngineeringMechanics(StaticsandDynamics), K.Dhiman,P.DhinamandD.Kulshreshtha,Mc Graw HillEducation(India)PrivateLimited,NewDelhi,2015.
E-References
1. https://nptel.ac.in 2. https://archive.nptel.ac.in/courses/115/104/115104094/ 3. https://www.youtube.com/watch?v=FD4BQjMuhYY 4. https://www.youtube.com/watch?v=olTD-mpsU4E 5. https://www.digimat.in/nptel/courses/video/122104015/L27.html

COs VS Pos

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO	PSO1	PSO2
CO 1	3	2	1	0	0	2	2	2	3	2	0
CO 2	3	3	3	1	2	3	3	3	3	3	1
CO 3	3	2	1	0	0	2	2	2	3	2	0
CO 4	3	2	1	0	0	2	2	2	3	2	0
CO 5	3	3	2	0	1	3	3	3	3	3	0
TOTAL	15	12	7	1	3	12	12	12	15	12	1
SCALED VALUE	**3**	**3**	**2**	**1**	**1**	**3**	**3**	**3**	**3**	**3**	**1**

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

1-5→1, 6-10→2, 11-15→3

COURSE NAME			Optimization Techniques	L	T	P	C
COURSE CODE			XMT603	3	1	0	4
C	P	A		L	T	P	H
4	0	0		3	1	0	4
PREREQUISITE			Algebra				

On successful completion of this course, the students will be able to:

	COURSE OUTCOMES	DOMAIN	LEVEL
CO 1	**Solve** linear programming problem using Simplex Method	Cognitive	Applying
CO 2	**Utilize** MODI method to obtain optimum solution of Transportation problem	Cognitive	Applying
CO 3	**Apply** dominance property to obtain saddle points for the given two-person zero sum games	Cognitive	Applying
CO 4	**Determine** the minimum time to complete a project using PERT & CPM	Cognitive	Evaluating
CO 5	**Classify** the dynamics of inventory management's principles, concepts, and techniques as they relate to the entire supply chain (customer demand, distribution,and product transformation processes),	Cognitive	Analyzing

UNIT 1 **9 + 3**

Linear Programming Problem: Mathematical formulation of LPP - Simplex Method - Artificial variable technique - Concept of Duality - Primal and Dual Problems - Duality - Dual Simplex Method.

UNIT 2 **9 + 3**

Transportation Problem: North-West Corner Rule - Matrix Minima method - Vogel's Approximation Method - MODI Method - Degeneracy and Unbalanced Transportation Problem.
Assignment Problem: Hungarian Method - Unbalance Assignment Problem - Travelling Salesman Problem.

UNIT 3 **9 + 3**

Games and Strategies: Two Person Zero sum Games - The Maximin - Minimax Principle - Games without Saddle Points - Mixed Strategies - Graphical Solution of 2 x n and m x 2 games - Dominance Property.

UNIT 4 **9 + 3**

Network scheduling by PERT / CPM: Network and basic components - Rules of Network Construction - Time Calculation in network - Critical Path Method - PERT Calculation.

UNIT 5 **9 + 3**

Inventory Control: Introductions - Types of Inventories - Inventory decisions - Deterministic inventory Problems - EOQ Problems with no shortages - Production Problems with no shortages - EOQ problems with shortages - Production Problems with shortages. EOQ Problems with One and More Price breaks

LECTURE	45	TUTORIAL	15	PRACTICAL	0	TOTAL	60

Text Book

1. KantiSwarup, P.K. Gupta and Manmohan - Operations Research - Sultan Chand & Sons – 2006, 12th edition.

References

1. Gupta.P.K.and D.S. Hira – Operations Research - S.Chand and Company.
2. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, Linear Programming and NetworkFlows, 2nd Ed., John Wiley and Sons, India, 2004.
3. Hillier, F.S. and G.J. Lieberman, Introduction to Operations Research, 9th Ed., Tata McGrawHill, Singapore, 2009.
4. Hamdy A. Taha, Operations Research, An Introduction, 8th Ed., Prentice Hall India, 2006.
5. Hadley,G. Linear Programming, Narosa Publishing House, New Delhi, 2002.

E-References

https://web.stanford.edu/group/sis1/k12/optimization/#!index.md[StandardUniversity]

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO	PSO1	PSO2
CO 1	3	3	2	0	1	3	3	3	3	3	0
CO 2	3	3	2	0	1	3	3	3	3	3	0
CO 3	3	3	2	0	1	3	3	3	3	3	0
CO 4	3	3	3	2	3	3	3	3	3	3	2
CO 5	3	3	3	1	2	3	3	3	3	3	1
TOTAL	15	15	12	3	8	15	15	15	15	15	3
SCALED VALUE	**3**	**3**	**3**	**1**	**2**	**3**	**3**	**3**	**3**	**3**	**1**

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

1-5→1, 6-10→2, 11-15→3

COURSE NAME			Industrial Mathematics 4.0	L	T	P	C
COURSE CODE			XMT604A	3	1	0	4
C	P	A		L	T	P	H
4	0	0		3	1	0	4
PREREQUISITE			Statistics				

On successful completion of this course, the students will be able to:

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Infer** the reason for adopting Industry 4.0 and Artificial Intelligence.	Cognitive	Understanding
CO 2	**Demonstrate** the need for digital transformation.	Cognitive	Understanding
CO 3	**Apply** the industry 4.0 tools.	Cognitive	Applying
CO 4	**Analyze** the applications of Big Data.	Cognitive	Analyzing
CO 5	**Examine** the applications and security of IoT Applications	Cognitive	Analyzing

UNIT 1	**Industry 4.0**	**9+3**
Need – Reason for Adopting Industry 4.0 - Definition – Goals and Design Principles - Technologies of Industry 4.0 – Big Data – Artificial Intelligence (AI) – Industrial Internet of Things - Cyber Security – Cloud – Augmented Reality.		
UNIT 2	**Artificial Intelligence**	**9+3**
Artificial Intelligence: Artificial Intelligence (AI) – What & Why? - History of AI - Foundations of AI -The AI -environment - Societal Influences of AI - Application Domains and Tools - Associated Technologies of AI - Future Prospects of AI - Challenges of AI .		
UNIT 3	**Big Data And IoT**	**9+3**
Big Data : Evolution - Data Evolution - Data : Terminologies - Big Data Definitions - Essential of Big Data in Industry 4.0 - Big Data Merits and Advantages - Big Data Components : Big Data Characteristics - Big Data Processing Frameworks - Big Data Applications - Big Data Tools - Big Data Domain Stack : Big Data in Data Science - Big Data in IoT - Big Data in Machine Learning - Big Data in Databases - Big Data Use cases Big Data in Social Causes - Big Data for Industry - Big Data Roles and Skills -Big Data Roles - Learning Platforms; Internet of Things (IoT) : Introduction to IoT - Architecture of IoT - Technologies for IoT - Developing IoT Applications - Applications of IoT - Security in IoT .		
UNIT 4	**Applications And Tools Of Industry 4.0**	**9+3**
Applications of IoT – Manufacturing – Healthcare – Education – Aerospace and Defense – Agriculture – Transportation and Logistics – Impact of Industry 4.0 on Society: Impact on Business, Government, People. Tools for Artificial Intelligence, Big Data and Data Analytics, Virtual Reality, Augmented Reality, IoT, Robotics.		
UNIT 5	**Jobs 2030**	**9+3**
Industry 4.0 – Education 4.0 – Curriculum 4.0 – Faculty 4.0 – Skills required for Future - Tools for Education – Artificial Intelligence Jobs in 2030 – Jobs 2030 - Framework for aligning Education with Industry 4.0 .		

LECTURE	45	TUTORIAL	15	PRACTICAL	0	TOTAL	60

Text Book
1. Higher Education for Industry 4.0 and Transformation to Education 5.0(2020)- P.Kaliraj& T. Devi
Reference
1. Advances in Mathematics for Industry 4.0 1st Edition, Kindle Edition, 2020.
E-References
1. htttps://doi.org/10.1016/j.matpr.2020.06.331 2. https://nptel.ac.in

COs VS POs

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO**	**PSO1**	**PSO2**
CO 1	3	2	1	0	0	2	2	2	3	2	0
CO 2	3	2	1	0	0	2	2	2	3	2	0
CO 3	3	3	2	0	1	3	3	3	3	3	0
CO 4	3	3	3	1	2	3	3	3	3	3	1
CO 5	3	3	3	1	2	3	3	3	3	3	1
TOTAL	15	13	10	2	5	10	13	13	15	13	2
SCALED VALUE	**3**	**3**	**2**	**1**	**1**	**2**	**3**	**3**	**3**	**3**	**1**

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

1-5→1, 6-10→2, 11-15→3

COURSE NAME			**Introduction to Machine Learning**	**L**	**T**	**P**	**C**
COURSE CODE			**XMT604B**	**3**	**1**	**0**	**4**
C	**P**	**A**		**L**	**T**	**P**	**H**
4	**0**	**0**		**3**	**1**	**0**	**4**
PREREQUISITE			Algebra, Trigonometry, Probability and Statistics				

On successful completion of this course, the students will be able to:

	COURSE OUTCOMES	DOMAIN	LEVEL
CO 1	**Demonstrate** the basics of Artificial Intelligence, Machine Learning, and Predictive Models.	Cognitive	Understanding
CO 2	**Interpret** the significance of Probabilistic and Stochastic Models used in machine learning algorithms.	Cognitive	Understanding
CO 3	**Apply** the basic supervised learning algorithms and Classify the simple datasets.	Cognitive	Applying
CO 4	**Analyze** the similarities and Grouping the undefined data sets by the use of unsupervised learning algorithms.	Cognitive	Analyzing
CO 5	**Evaluate** the learning models by using basic performance measures.	Cognitive	Evaluating

UNIT 1	Basics Concepts of Machine Learning	**9+ 3**

Introduction–ArtificialIntelligence–DifferencebetweenAIandMachineLearning–Prediction and Classification – A simple predicting machine – Training a simple classifier –Types of machine learning – Applications of Machine Learning – Perspectives and issues in machine learning.

UNIT 2	Probabilistic and Stochastic Models	**9 + 3**

Introduction – Bayesian Learning – Bayes theorem, Concept learning, Maximum likelihood, Bayes optimal classifier, Gibbs algorithm, Naive Bayes classifier, Expectation maximization and Gaussian Mixture Models, Hidden Markov models.

UNIT 3	Supervised Learning	**9 + 3**

Introduction–Regression, Linear regression, Classification: Decision trees, k-Nearest Neighbors, Support Vector Machine, Logistic regression, Random Forest. Artificial Neural Network: Introduction, Perceptions, multi-layer networks and back propagation.

UNIT 4	Unsupervised Learning	**9 + 3**

Introduction–Supervised *vs* Unsupervised Cluster Analysis, K means clustering, Hierarchical clustering. Dimension reduction: Principal Component Analysis, Linear Discriminant Analysis.

UNIT 5	Modelling and Evaluation	**9 + 3**

Introduction – Building the model, training a model, Evaluating a model, Improving a model. Performance Metrics – Accuracy, Precision, Recall, Sensitivity, Specificity, AUC, RoC, Bias Variance decomposition.

LECTURE	**45**	**TUTORIAL**	**15**	**PRACTICAL**	**0**	**TOTAL**	**60**

Text Books

1. Subramanian Chandramouli, Saikat Dutt, Amit Kumar Das, “Machine Learning”, 2nd Edition, 2018, Pearson Education, India.
2. Ethem Alpaydin, “Introduction to Machine Learning”, 4th Edition, 2020, MIT Press.

3. Tariq Rashid, “Make Your Own Neural Network”,2016, Create Space Independent Publishing Platform

References

1. ShaiShalev- Shwartz,Shai Ben David, “Understanding Machine Learning: From Theory to Algorithms”, Cambridge University Press.
2. T.Hastie,R. Tibshirani and J.Friedman, “Elements of Statistical Learning”, Springer.
3. Charu C.Aggarwal, “DATA CLUSTERING Algorithms and Applications”,2014,CRC Press.
4. C.Bishop, “Pattern Recognition and Machine Learning”, Springer.
5. Sebastian Raschka and Vahid Mirjalili,“PythonMachineLearning”, 3rd edition,2019,Packet Publishing.

E-References

1. NPTEL Course in *Introduction to Machine Learning* by Dr. Balaraman Ravindran, IIT Madras,https://nptel.ac.in/courses/106106139
2. NPTELCourse in *Introduction to Machine Learning (Tamil)*by Prof.Arun Rajkumar, IITMadras,https://nptel.ac.in/courses/106106236
3. *Machine Learning for Absolute Beginners,*https://alison.com/topic/learn/132506/introduction-to-ai-and-ml-learning-outcomes
4. *Supervised Machine Learning :Regression and Classification,* https://www.coursera.org/learn/machine-learning
5. *Unsupervised Learning, Recommenders ,Reinforcement Learning,*https://www.coursera.org/learn/unsupervised-learning-recommenders-reinforcement-learning

COs VS POs											
	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**
CO 1	3	2	1	0	0	2	2	2	3	2	0
CO 2	3	2	1	0	0	2	2	2	3	2	0
CO 3	3	3	2	0	1	3	3	3	3	3	0
CO 4	3	3	3	1	2	3	3	3	3	3	1
CO 5	3	3	3	2	3	3	3	3	3	3	2
TOTAL	15	13	10	3	6	13	13	13	15	13	3
SCALED VALUE	**3**	**3**	**2**	**1**	**2**	**3**	**3**	**3**	**3**	**3**	**1**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											
1-5→1, 6-10→2, 11-15→3											

COURSE NAME			Astronomy	L	T	P	C
COURSE CODE			XMT604C	3	1	0	4
C	P	A		L	T	P	H
4	0	0		3	1	0	4
PREREQUISITE			Algebra and Trigonometry				

On successful completion of this course, the students will be able to:

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Apply** the concept of spherical trigonometry to explain celestial sphere and diurnal motion.	Cognitive	Applying
CO 2	**Explain** the effects of various types of parallax.	Cognitive	Understanding
CO 3	**Apply** Kepler's law of harmonies to make calculations regarding the radius and period of orbits of planets.	Cognitive	Applying
CO 4	**Explain**the formation of moon and its surface features.	Cognitive	Understanding
CO 5	**Explain** a brief history of Astronomy.	Cognitive	Understanding

UNIT 1 **9 + 3**

Spherical Trigonometry - Spherical Triangle - The fundamental formulae of Spherical Trigonometry, the sine, cosine, four parts and Napier formulae (without proof).
The Celestial Sphere: Celestial coordinators - Diurnal motion - Rising and setting of a star - Sidereal time - Circumpolar star - Morning and Evening stars - Twilight - Earth - Length of the day.

UNIT 2 **9 + 3**

Refraction - Tangent Formula – Cassini's formula - Effects of Refraction - Geocentric Parallax - Effects of Geocentric Parallax - Heliocentric Parallax - Effects of Heliocentric Parallax - Aberration - Its Effects.

UNIT 3 **9 + 3**

Kepler's Laws - Verification of Kepler's Laws - True anomaly, Mean Anomaly - Eccentric Anomaly, Relation between them - Time - Equation of Time - Seasons - Conversion of Time.

UNIT 4 **9 + 3**

Moon - Sidereal Month, Lunation and Relation between them - Phases of the Moon - Lunar Libration - Surface of the Moon - Metonic Cycle - Tides - Eclipses - Shadow Cone - Minimum and Maximum number of Eclipses.

UNIT 5 **9 + 3**

Planetary Phenomena - Bodes law - Elongation - Sidereal Period, Synodic period and the relation between them - Phase - Stationary Points - Solar System - Stellar Universe - A brief history of Astronomy - Astronomical Instruments.

LECTURE	45	TUTORIAL	15	PRACTICAL	0	TOTAL	60

Text Book

1. Kumaravelu. Sand Susheela Kumaravelu – Astronomy for degree classes, Rainbow printers, Nagarcoil (2005).

References

1. A Text-Book of Astronomy, **By:** Ramachandran, G. V**,** Tiruchirappalli Rukmani Ramachandran 1970.

2. George.O.Abell - Exploration of the Universe Holt,Rinehart& Winston of Canada Ltd; 2nd Revised edition (1 June 1969).
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1. http://bulletin.columbia.edu/columbia-college/departments-instruction/astronomy/#coursestext[ColumbiaUniversity] 2. Https://Www.Physics.Utoronto.Ca/~Jharlow/Teaching/Astron03/Fullnotes/ [UniversityOf Toronto]

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2
CO 1	3	3	2	0	1	3	3	3	3	3	0
CO 2	3	2	1	0	0	2	2	2	3	2	0
CO 3	3	3	2	0	1	3	3	3	3	3	0
CO 4	3	2	1	0	0	2	2	2	3	2	0
CO 5	3	2	1	0	0	2	2	2	3	2	0
TOTAL	15	12	7	0	2	12	12	12	15	12	0
SCALED VALUE	**3**	**3**	**2**	**0**	**1**	**3**	**3**	**3**	**3**	**3**	**0**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											
1-5→1, 6-10→2, 11-15→3											

COURSE NAME			Stochastic Processes	L	T	P	C
COURSE CODE			XMT604D	3	1	0	4
C	P	A		L	T	P	H
4	0	0		3	1	0	4
PREREQUISITE			Probability and Statistics				

On successful completion of this course, the students will be able to:

	COURSE OUTCOMES	DOMAIN	LEVEL
CO 1	**Classify** a stochastic process according to whether it operates in continuous or discrete time and whether it has a continuous or a discrete state space, and give examples of each type process	Cognitive	Understanding
CO 2	**Demonstrate** limit probabilities in Markov chains after an infinitely long period	Cognitive	Understanding
CO 3	**Explain** the concepts of birth and death process with examples	Cognitive	Understanding
CO 4	**Demonstrate** to recognize the concepts of renewal process	Cognitive	Understanding
CO 5	**Explain** in detail the utility of martingales	Cognitive	Understanding

UNIT 1 — **9 + 3**

ElementsofStochasticProcesses-TwosimpleexamplesofStochasticProcesses-Classification of general Stochastic processes – Markov Chains-Definitions – Examples of Markov Chain-Transition probability matricesofaMarkovchain-classification of statesofaMarkovchain-Recurrence.

UNIT 2 — **9 + 3**

ThebasiclimittheoremofMarkovchainsandapplications-Discreterenewal equation-proof of theorem-Absorption probabilities - criteria forrecurrence-AqueuingExample.

UNIT 3 — **9 + 3**

Classical Examples of continuous time Markov chains-General pure birthprocesses and Poisson processes-more about Poisson processes- A counter model birth and death processes-Differential equations of birth and deathprocesses-Examplesofbirthand death processes.

UNIT 4 — **9 + 3**

Renewal processes - Definition of Renewal process and related concepts –Some examples of Renewal Processes – More on some special Renewalprocesses– RenewalequationsandelementaryRenewal theorem.

UNIT 5 — **9 + 3**

Martingales-Preliminarydefinitionsandexamples–SupermartingalesandSub martingales-Theoptionalsamplingtheorem.

LECTURE	45	TUTORIAL	15	PRACTICAL	0	TOTAL	60

Text Book

1. AFirstcourseinStochasticProcesses-SecondEditionby SamuelKarlinandM.Taylor,AcademicPressNewYork.2003.

References

1. “Stochastic Processes” S.K.Srinivasan and K.M.Mehata, Tata Mcgraw – Hill

PublishingCompanyLtd.,NewDelhi.1978. 2. "Stochastic Processes", 2e, Medhi,John Wiley & Sons (Asia) Pte Ltd ,2000.
E-References
http://nptel.ac.in/courses/111/102/111102014/# http://nptel.ac.in/courses/111/102/111102014/#http://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=2145&context=graduatereports.

COs VS POs											
	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**
CO 1	3	2	1	0	0	2	2	2	3	2	0
CO 2	3	2	1	0	0	2	2	2	3	2	0
CO 3	3	2	1	0	0	2	2	2	3	2	0
CO 4	3	2	1	0	0	2	2	2	3	2	0
CO 5	3	2	1	0	0	2	2	2	3	2	0
TOTAL	15	10	5	0	0	10	10	10	15	10	0
SCALED VALUE	**3**	**2**	**1**	**0**	**0**	**2**	**2**	**2**	**3**	**2**	**0**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											
1-5→1, 6-10→2, 11-15→3											

Course Name			Cyber Security	L	T	P	C
Course Code			XUM005	1	0	0	1
C	P	A		L	T	SS	H
1	0	0		1	0	1	1
Prerequisite			Basic Programming knowledge and technical skills.				

On successful completion of this course, the students will be able to:

Course Outcomes		Domain	Level
CO 1	**Understand** the fundamentals of Cyber Security and the technologies.	Cognitive	Understanding
CO 2	**Understand** the organizational structure of Cyber security	Cognitive	Understanding
CO 3	**Understand** the Cyber Security policy development	Cognitive	Understanding
CO 4	**Understand** the Indian IT act and the initiatives	Cognitive	Understanding
CO 5	**Understand** and **Apply** the Cyber security practices	Cognitive	Applying

UNIT 1	**INTRODUCTION**	**3+3**
Cyber Security – Cyber Security policy – Domain of Cyber Security Policy – Laws and Regulations – Enterprise Policy – Technology Operations – Technology Configuration – Strategy Versus Policy – Cyber Security Evolution – Productivity – Internet – E commerce – Counter Measures – Challenges		
UNIT 2	**CYBER SECURITY OBJECTIVES AND GUIDANCE**	**3+3**
Cyber Security Metrics – Security Management Goals – Counting Vulnerabilities – Security Frameworks – E Commerce Systems – Industrial Control Systems – Personal Mobile Devices – Security Policy Objectives – Guidance for Decision Makers – Tone at the Top – Policy as a Project– Cyber Security Management – Arriving at Goals – Cyber Security Documentation – The Catalog Approach – Catalog Format – Cyber Security Policy Taxonomy.		
UNIT 3	**CYBER SECURITY POLICY CATALOG**	**3+3**
Cyber Governance Issues – Net Neutrality – Internet Names and Numbers – Copyright and Trademarks – Email and Messaging – Cyber User Issues – Malvertising – Impersonation – Appropriate Use – Cyber Crime – Geo location – Privacy – Cyber Conflict Issues – Intellectual property Theft – Cyber Espionage – Cyber Sabotage – Cyber Welfare– Computer Forensics – Steganography		
UNIT 4	**CYBER SECURITY INITIATIVES AND IT ACT**	**3+3**
Counter Cyber Security Initiatives in India, Cyber Security Exercise, 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 5	SECURITY PRACTICES	3+3

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 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, AndroidSecurity, 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)

Lecture	15	Tutorial	0	SS	15	Total	30

Text Books

1. Jennifer L. Bayuk, J. Healey, P. Rohmeyer, Marcus Sachs , Jeffrey Schmidt, Joseph Weiss "Cyber Security Policy Guidebook" John Wiley & Sons 2012.
2. Rick Howard "Cyber Security Essentials" Auerbach Publications 2011.
3. Cyber Laws & Information Technology, Jothi Rathan, VijayRathan, Bhrath Pubishers,7th Edition January 2019.

References

1.Modern Cyber security Practices by Pascal Ackerman, BPB Publications,2020
2. Dan Shoemaker Cyber security The Essential Body Of Knowledge, 1st ed. Cengage Learning 2011
3. Rhodes–Ousley, Mark, "Information Security: The Complete Reference", Second Edition, McGraw–Hill, 2013.

E–References

5. https://www.coursera.org/specializations/cyber–security
6. www. nptel.ac.in
7. http://professional.mit.edu/programs/short–programs/applied–cybersecurityhttps://us.norton.com/internetsecurity–how–to–cyber–security–best–practices–for–employees. html
8. https://www.meity.gov.in/content/cyber–laws

COs vs POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	0	0	0	0	0	2	0	3	0
CO 2	0	0	0	0	0	0	2	0	0
CO 3	3	0	0	0	0	2	3	0	3
CO 4	0	0	0	0	0	0	0	0	0
CO 5	3	0	0	0	0	0	0	0	3
TOTAL	**6**	**0**	**0**	**0**	**0**	**4**	**5**	**3**	**6**
SCALED VALUE	**2**	**0**	**0**	**0**	**0**	**1**	**1**	**1**	**2**

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

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

4.b. Curriculum and Syllabus of M.Sc Mathematics -After Revision

MASTER OF SCIENCE
(TWO YEAR - FULL TIME) REGULATION - 2023
(Applicable to the students admitted from the academic year 2023-2024 onwards)

Semester	Category	CourseCode	TitleoftheCourse	L	T	P	H	C
I	Core	YMA101	LinearAlgebra	4	1	0	5	5
	Core	YMA102	RealAnalysis	4	1	0	5	5
	Core	YMA103	OrdinaryDifferentialEquations	4	1	0	5	5
	Core	YMA104	Graph Theory	4	1	0	5	5
	Elective	YMA1E1	MathematicalStatistics /Fuzzy Sets and their Applications/ AI and Machine Learning	3	1	0	4	4
	Elective	YMA1E2	Computer Programming (C++ Theory and Lab)/Number Theory and Cryptography/Formal Languages and Automata Theory	2/4	0	2/0	4	4
	Total			**21**	**5**	**2**	**28**	**28**
II	Core	YMA201	AdvancedAlgebra	4	1	0	5	5
	Core	YMA202	Complex Analysis	4	1	0	5	5
	Core	YMA203	Partial Differential Equations	4	1	0	5	5
	Core	YMA204	AdvancedNumericalMethods	4	1	0	5	5
	Elective	YMA2E1	Resource Management Techniques /Data Science using R programming/ Python for Mathematics	3	1	0	4	4
	Elective	YMA2E2	Data Analysis using SPSS/ NumericalMethodsPracticalusingMAT Lab/Data Analytics Practical with Python	3/2	1	0/2	4	4
	SEC	YRM001	Research Methodology	2	0	0	2	2
	Total			**23**	**5**	**2**	**30**	**30**
III	Core	YMA301	Topology	4	1	0	5	5
	Core	YMA302	Measure theory and Integration	4	1	0	5	5
	Core	YMA303	Functional Analysis	4	1	0	5	5
	Core	YMA304	Differential Geometry	4	1	0	5	5

				L	T	P	H	C
	NME	YMA305	Core Industry Module: Mathematics for Finance and Insurance	3	1	0	4	4
	Elective	YMA3E1	Fluid Dynamics / Probability Theory / Design and Analysis of Algorithms	3	1	0	4	4
	Total			**22**	**6**	**0**	**28**	**28**
IV		YMA401	Project	0	0	0	30	6
	Total			**0**	**0**	**0**	**30**	**6**

Total Number of Credits: 92

COURSE NAME			**LINEAR ALGEBRA**	**L**	**T**	**P**	**C**
COURSE CODE			**YMA101**	**4**	**1**	**0**	**5**
C	**P**	**A**		**L**	**T**	**P**	**H**
5	**0**	**0**		**4**	**1**	**0**	**5**
PREREQUISITE			Algebraic Structures				

Objective:

The objective of this course is to develop a strong foundation in linear algebra that provide a basic for advanced studies not only in mathematics but also in other branches like engineering, physics and computers, etc. Particular attention is given to canonical forms of linear transformations, diagonalizations of linear transformations, matrices and determinants.

COURSE OUTCOMES		**DOMAIN**	**LEVEL**
CO 1	**Utilize** properties of linear transformations to solve problems.	Cognitive	Applying
CO 2	**Demonstrate** the concept of prime factorization of a given polynomial.	Cognitive	Understanding
CO 3	**Utilize** the concept of determinant find the adjoint, inverse, and characteristic values.	Cognitive	Applying
CO 4	**Compare**Simultaneous triangulations, diagonalization and decomposition.	Cognitive	Understanding
CO 5	**Demonstrate** the Rational and Jordan forms.	Cognitive	Understanding

UNIT 1	**Linear transformations**	**12 + 3**
Linear transformations – The Algebra of Linear Transformation - Isomorphism of vector spaces – Representations of linear transformations by matrices – Linear functional.		
UNIT 2	**Algebra of polynomials**	**12 + 3**
Algebras - The algebra of polynomials –Polynomial ideals - The prime factorization of a polynomial – Commutative Rings - Determinant functions.		
UNIT 3	**Determinants**	**12 + 3**

Permutations and the Uniqueness of Determinants – Classical adjoint of A (square) matrix – Inverse of an invertible matrix using determinants – Characteristic values – Annihilating polynomials.		
UNIT 4	**Diagonalization**	**12 + 3**
Invariant subspaces – Simultaneous triangulations – Simultaneous diagonalization – Direct-sum decompositions – Invariant direct sums – Primary decomposition theorem.		
UNIT 5	**The Rational and Jordan forms**	**12 + 3**
Cyclic subspaces – Cyclic decompositions theorem (Statement only) – Generalized Cayley – Hamilton theorem - Rational forms – Jordan forms.		

LECTURE	**60**	**TUTORIAL**	**15**	**PRACTICAL**	**0**	**TOTAL**	**75**

Text Book:

1. Kenneth M Hoffman and Ray Kunze, Linear Algebra, 2nd Edition, Prentice-Hall of India Pvt. Ltd, New Delhi, 2013.

Unit	Chapter(s)	Sections
I	3	3.1 – 3.5
II	4 & 5	4.1, 4.2, 4.4, 4.5 and 5.1, 5.2
III	5 & 6	5.3, 5.4 and 6.1-6.3
IV	6	6.4 – 6.8
V	7	7.1 - 7.3

References:

1.M.Artin,“Algebra”,PrenticeHallofIndiaPvt.Ltd.,2005.
2.S.H.Friedberg,A.J.InselandL.ESpence,“LinearAlgebra”,4th Edition, Pritice-HallofIndiaPvt.Ltd.,2009.
3.I.N. Herstein, “Topics in Algebra”, 2nd Edition, Wiley Eastern Ltd,NewDelhi,2013.
4.J.J. Rotman, “Advanced Modern Algebra”, 2nd Edition, Graduate Studies in Mathematics, Vol. 114, AMS, Providence, Rhode Island,2010.
5.G.Strang,“IntroductiontoLinearAlgebra”, 2nd Edition, PrenticeHallof IndiaPvt.Ltd,2013.

E-References

1. http://asian-university.org/wp-content/uploads/2018/02/Linear-Algebra_Fall18.pdf [Asian women university]
2. http://people.math.harvard.edu/~knill/teaching/math21b2010/21b_text.pdf [Harvard University]

COs VS Pos

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**
CO 1	3	3	2	0	1	3	3	3	3	3	0

CO 2	3	2	1	0	0	2	2	2	3	2	0
CO 3	3	3	2	0	1	3	3	3	3	3	0
CO 4	3	2	1	0	0	2	2	2	3	2	0
CO 5	3	2	1	0	0	2	2	2	3	2	0
TOTAL	15	12	7	0	2	12	12	12	15	12	0
SCALED VALUE	**3**	**3**	**2**	**0**	**1**	**3**	**3**	**3**	**3**	**3**	**0**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											
1-5→1, 6-10→2, 11-15→3											

<table>
<tr><td colspan="3">Course Name</td><td>REALANALYSIS</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td colspan="3">Course Code</td><td>YMA102</td><td>4</td><td>1</td><td>0</td><td>5</td></tr>
<tr><td>C</td><td>P</td><td>A</td><td></td><td>L</td><td>T</td><td>P</td><td>H</td></tr>
<tr><td>5</td><td>0</td><td>0</td><td></td><td>4</td><td>1</td><td>0</td><td>5</td></tr>
<tr><td colspan="3">PREREQUISITE</td><td colspan="5">Algebraic Structures</td></tr>
<tr><td colspan="8">Objective:
Aim of this course is to work comfortably with functions of bounded variation, Riemann-Stieltjes Integration, convergence of infinite series, infinite product and uniform convergence and its interplay between various limiting operations.</td></tr>
<tr><td colspan="8">On successful completion of this course, the students will be able to:</td></tr>
</table>

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Explain** and evaluate functions of bounded variation and Rectifiable Curves.	Cognitive	Understanding
CO 2	**Demonstrate** the concept of Riemann-Stieltjes integral and its properties.	Cognitive	Understanding
CO 3	**Demonstrate** the concept of step function, upper function, Lebesgue function and their integrals.	Cognitive	Understanding
CO 4	**Construct** various mathematical proofs using the properties of Lebesgue integrals and establish the Levi monotone convergence theorem.	Cognitive	Applying
CO 5	**Demonstrate** the concept and properties of inner products, norms and measurable functions.	Cognitive	Understanding

<table>
<tr><td>UNIT I</td><td>Functionsofboundedvariation</td><td>12 + 3</td></tr>
<tr><td colspan="3">Introduction - Properties of monotonic functions - Functions of bounded variation - Total variation - Additive property of total variation - Total variation on [a, x] as a function of x - Functions of bounded variation expressed as the difference of two increasing functions - Continuous functions of bounded variation.
Infinite Series: Absolute and conditional convergence - Dirichlet's test and Abel's test - Rearrangement of series - Riemann's theorem on conditionally convergent series.</td></tr>
<tr><td>UNIT 2</td><td>The Riemann - Stieltjes Integral</td><td>12 + 3</td></tr>
<tr><td colspan="3">Introduction-Notation-ThedefinitionoftheRiemann-Stieltjesintegral-LinearProperties-Integration by parts-Change of variable in a Riemann - Stieltjes integral -ReductiontoaRiemannIntegral–Euler’ssummationformula-Monotonicallyincreasingintegrators,Upperandlowerintegrals-Additiveandlinearitypropertiesofupper,lowerintegrals-Riemann's condition -Comparisontheorems.</td></tr>
<tr><td>UNIT 3</td><td>The Riemann - Stieltjes Integral</td><td>12 + 3</td></tr>
<tr><td colspan="3">Integrators of bounded variation-Sufficient conditions for the existence of Riemann-Stieltjes integrals-Necessary conditions for the existence of RS integrals- Mean value theorems - integrals as a function of the interval – Second fundamental theorem of integral calculus-Change of variable -Second Mean Value Theorem for Riemann integral- Riemann-Stieltjes integrals depending on a parameter-Differentiationunderintegralsign-Lebesguecriterionforexistenceof Riemannintegrals.</td></tr>
<tr><td>UNIT 4</td><td>InfiniteSeriesandinfiniteProducts</td><td>12 + 3</td></tr>
</table>

Double sequences - Double series - Rearrangement theorem for double series - A sufficient condition for equality of iterated series - Multiplication of series – Cesaro summability - Infinite products. **Power series** - Multiplication of power series - The Taylor's series generated by a function - Bernstein's theorem - Abel's limit theorem - Tauber's theorem.		
UNIT 5	**Sequences of Functions**	**12 + 3**
Pointwise convergence of sequences of functions - Examples of sequences of real - valued functions - Uniform convergence and continuity - Cauchy condition for uniform convergence - Uniform convergence of infinite series of functions - Riemann - Stieltjes integration – Non-uniform Convergence and Term-by-term Integration - Uniform convergence and differentiation - Sufficient condition for uniform convergence of a series - Mean convergence.		

LECTURE	60	TUTORIAL	15	PRACTICAL	0	TOTAL	75

Text Book:

TomM.Apostol:*MathematicalAnalysis*,2nd Edition,Addison-WesleyPublishingCompanyInc. NewYork, 1974.

Unit	Chapter	Sections
I	6 8	Sections6.1 to 6.8 Sections8.8, 8.15, 8.17, 8.18
II	7	Sections7.1 to 7.14
III	7	Sections7.15 to 7.26
IV	8 9	Sections8.20, 8.21 to 8.26 Sections9.149.15, 9.19, 9.20
V	9	Sections9.1to 9.6,9.8,9.9,9.10,9.11,9.13

References:

1.Walter Rudin, Principles of Mathematical Analysis, Tata McGraw Hill, New York, 1988.
2. G. de Barra, Measure Theory and Integration, Wiley Eastern Ltd., New Delhi 1981.
3. Tom M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi, 1997.
4. H. L. Royden, Real Analysis, Third Edition, Macmillan Publishing Company, New Delhi, 1988.
5. Inder K. Rana, An Introduction to Measure and Integration, 2nd Edition, Narosa Publishing House, 2015.
6. Gelbaum, B. R. and J. Olmsted, Counter Examples in Analysis, Holden day, San Francisco, 1964.
7. Burkill. J. C, The Lebesgue Integral, Cambridge University Press, 1951.
8. Munroe. M. E, Measure and Integration, Addison- Wesley, Mass, 1971.

Website and e-Learning Source

1. http://mathforum.org,
2. http://ocw.mit.edu/ocwweb/Mathematics,
3. http://www.opensource.org,
4. www.mathpages.com

COs VS POs											
	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**
CO 1	3	2	1	0	0	2	2	2	3	2	0
CO 2	3	2	1	0	0	2	2	2	3	2	0
CO 3	3	2	1	0	0	2	2	2	3	2	0
CO 4	3	3	2	0	1	3	3	3	3	3	0
CO 5	3	2	1	0	0	2	2	2	3	2	0
TOTAL	15	10	6	0	1	11	11	11	15	11	0
SCALED VALUE	**3**	**2**	**2**	**0**	**1**	**3**	**3**	**3**	**3**	**3**	**0**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											

Course Name			ORDINARY DIFFERENTIAL EQUATIONS	L	T	P	C
Course Code			**YMA103**	**4**	**1**	**0**	**5**
C	**P**	**A**		**L**	**T**	**P**	**H**
5	**0**	**0**		**4**	**1**	**0**	**5**
PREREQUISITE			UG level Calculus and Differential Equations				

Objective:

To develop a strong background on finding solutions to linear differential equations with constant and variable coefficients and also with regular singular points.

.

On successful completion of this course, the students will be able to:

	COURSE OUTCOMES	DOMAIN	LEVEL
CO 1	**Explain** the qualitative behavior of solutions of systems of differential Equations.	Cognitive	Understanding
CO 2	**Recall** the physical phenomena modeled by differential equations and dynamical systems.	Cognitive	Remembering
CO 3	**Analyze** the solutions of linear equations with variable coefficients.	Cognitive	Analyzing
CO 4	**Formulate** Green's function for boundary value problems.	Cognitive	Creating
CO 5	**Solve** the First order linear equations by using method of successive approximations.	Cognitive	Applying

UNIT I	**Linear equations with constant coefficients**	**12 + 3**
Second order homogeneous equations-Initial value problems-Linear dependence and independence-Wronskian and a formula for Wronskian- Non-homogeneous equation of order two.		
UNIT 2	**Linear equations with constant coefficients**	**12 + 3**
Homogeneous and non-homogeneous equation of order n –Initial value problems- Annihilator method to solve non-homogeneous equation- Algebra of constant coefficient operators.		
UNIT 3	**Linearequationwithvariablecoefficients**	**12 + 3**
Initial value problems -Existence and uniqueness theorems – Solutions to solve a non-homogeneous equation – Wronskian and linear dependence – Reduction of the order of a homogeneous equation – Homogeneous equation with analytic coefficients-The Legendre equation.		
UNIT 4	**Linear equation with regular singular points**	**12 + 3**
Euler equation – Second order equations with regular singular points –Exceptional cases – Bessel Function.		
UNIT 5	**Existence and uniqueness of solutions to first order equations**	**12 + 3**

Equationwithvariableseparated–Exactequation–Methodofsuccessiveapproximations–theLipschitzcondition– ConvergenceoftheSuccessiveapproximationsand theexistence theorem.							
LECTURE	**60**	**TUTORIAL**	**15**	**PRACTICAL**	**0**	**TOTAL**	**75**

Text Book:

1. E.A. Coddington, *An introduction to ordinary differential equations* (3^{rd} Printing) Prentice-Hall of India Ltd., New Delhi, 1987.

Unit	Chapter	Sections
I	2	Sections 1 to 6
II	2	Sections 7 to 12.
III	3	Sections 1 to 8
IV	4	Sections 1 to 4 and 6 to 8
V	5	Sections 1 to 6

References:

1. WilliamsE.BoyceandRichardC.DIPrima,*Elementarydifferentialequationsandbounda ry valueproblems*, JohnWileyandsons,NewYork, 1967.
2. GeorgeFSimmons,*Differentialequationswithapplicationsandhistoricalnotes,* TataMcGrawHill,NewDelhi,1974.
3. N.N.Lebedev,*Specialfunctionsandtheirapplications*,PrenticeHallofIndia,NewDelhi, 1965.
4. W.T.Reid.*OrdinaryDifferentialEquations*,JohnWileyandSons,NewYork,1971
5. M.D. Raisinghania,*AdvancedDifferentialEquations*,S. Chand&CompanyLtd.NewDelhi 2001
6. B. Rai,D. P. ChoudaryandH.I.Freedman,*ACourseinOrdinaryDifferentialEquations*,Narosa PublishingHouse, NewDelhi, 2002.

Website and e-Learning Source

1. http://mathforum.org,
2. http://ocw.mit.edu/ocwweb/Mathematics,
3. http://www.opensource.org,
4. www.mathpages.com

COs VS POs

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**
CO 1	3	2	1	0	0	2	2	2	3	2	0
CO 2	2	1	0	0	0	1	1	1	2	1	0
CO 3	3	3	3	1	2	3	3	3	3	3	1

CO 4	3	3	3	3	3	3	3	3	3	3	3
CO 5	3	3	2	0	1	3	3	3	3	3	0
TOTAL	14	12	9	4	6	12	12	12	14	12	4
SCALED VALUE	**3**	**3**	**2**	**1**	**2**	**3**	**3**	**3**	**3**	**3**	**1**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											

Course Name			**GRAPH THEORY**	**L**	**T**	**P**	**C**
Course Code			**YMA104**	**4**	**1**	**0**	**5**
C	**P**	**A**		**L**	**T**	**P**	**H**
5	**0**	**0**		**4**	**1**	**0**	**5**
PREREQUISITE			Concept of relation, mapping, Discrete Structures				

Objective:
To develop a strong background on finding solutions to linear differential equations with constant and variable coefficients and also with regular singular points.
.

On successful completion of this course, the students will be able to:

	COURSE OUTCOMES	**DOMAIN**	**LEVEL**
CO 1	**Demonstrate** to state that basic definitions and relevant theorems.	Cognitive	Understanding
CO 2	**Construct** graph theoretic models for real life problems.	Cognitive	Applying
CO 3	**Analyze** graphs satisfying certain properties.	Cognitive	Analyzing
CO 4	**Apply** core theoretical knowledge of graph theory to solve problems.	Cognitive	Applying
CO 5	**Demonstrate** the significance of planar graphs.	Cognitive	Understanding

UNIT I	**Graphs, sub graphs and Trees**	**12 + 3**
Graphsandsimplegraphs–Graphisomorphism–Theincidenceandadjacencymatrices–Subgraphs–Vertex Degrees – Paths and Connection – Cycles – Trees – Cut edges andBonds– Cutvertices – Cayley'sFormula.		
UNIT 2	**Connectivity,EulerToursandHamiltonCycles**	**12 + 3**

Connectivity–Edge Connectivity - Blocks – Whitney's Theorem – Euler Tours –Hamilton Cycles – Dirac's Theorem – Closure of a graph –Chvatal'sTheorem.		
UNIT 3	**Matchings,EdgeColourings**	**12 + 3**
Matchings–Berge'sTheorem–Matchings and Coverings in Bipartite Graphs – Hall's Theorem - PerfectMatchings – Tutte's Theorem – Peterson's Theorem - Edge ChromaticNumber– Vizing'sTheorem.		
UNIT 4	**Independent Sets and Cliques, Vertex Colouring**	**12 + 3**
Independent Sets –Gallai'sTheorem-Ramsey'sTheorem–Ramsey'sgraph–Erdos'sTheorem -Chromatic Number – Critical Graph - Brook's Theorem –Hajos'Conjecture.		
UNIT 5	**PlanarGraphs**	**12 + 3**
PlaneandPlanarGraphs–PlanarEmbeddingofagraph –StereographicProjection-DualGraphs–Isomorphicplanegraphswith non-isomorphicduals–Euler'sFormula–Bridges–Thetransferofabridge - Kuratowski'sTheorem. Thefive-colortheoremandthefour-colorconjecture		

LECTURE	**60**	**TUTORIAL**	**15**	**PRACTICAL**	**0**	**TOTAL**	**75**

Text Book:

1. Graph Theory with Applications, J. A. Bondy and U. S. R. Murty, Macmillan, London,1976.

Unit	Chapter	Sections
1	1 2	Sec: 1.1 - 1.7 Sec: 2.1 - 2.4
2	3 4	Sec: 3.1 - 3.2 Sec: 4.1 - 4.2
3	5 6	Sec: 5.1 - 5.3 Sec: 6.1 - 6.2
4	7 8	Sec: 7.1 - 7.2 Sec: 8.1 - 8.3
5	9	Sec: 9.1 - 9.5

References:

1. Balakrishnan R. and Ranganathan K., "A textbook of Graph Theory", Springer, 2012.
2. D.B. West, Introduction to Graph Theory, II Ed., PHI, New Delhi, 2007.
3. J. Clark and D.A. Holton, A First look at Graph Theory, Allied Publishers, New Delhi, 1995.
4. F. Harary, Graph Theory, Addison –Wesley, Reading Mass, 1969.
5. Graham R.L., Rothschild B.L and Spencer J.H., "Ramsey Theory", Wiley Publishers, Second Edition, 1990.
6. Biggs N., "Algebraic Graph Theory", Cambridge Tracts in Mathematics 67, Cambridge University Press, 1994. MX8003 Algebraic Theory of Semigroups.

Website and e-Learning Source

1. **https://www.zib.de/groetschel/teaching/WS1314/BondyMurtyGTWA.pdf**
2. **https://en.wikipedia.org/wiki/Graph_theory**
3. http://tezu.ernet.in/dmaths/programme/m.sc.syllabus-2019.pdf[OxfordUniversity]

4. https://www-wp.maths.cam.ac.uk/documents/schedules.pdf/[CambridgeUniversity

5. GraphTheoryANPTELCoursebyS.A.Choudum,DepartmentofMathematicsIITMadras Chennai,Indiahttps://nptel.ac.in/courses/111/106/111106050/

COs VS POs											
	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**
CO 1	3	2	1	0	0	2	2	2	3	2	0
CO 2	3	3	2	0	1	3	3	3	3	3	0
CO 3	3	3	3	1	2	3	3	3	3	3	1
CO 4	3	3	2	0	1	3	3	3	3	3	0
CO 5	3	2	1	0	0	2	2	2	3	2	0
TOTAL	15	13	9	1	4	13	13	13	15	13	1
SCALED VALUE	**3**	**3**	**2**	**1**	**1**	**3**	**3**	**3**	**3**	**3**	**1**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											
1-5→1, 6-10→2, 11-15→3											

Course Name			MATHEMATICAL STATISTICS	L	T	P	C
Course Code			YMA1E1A	3	1	0	4
C	P	A		L	T	P	H
4	0	0		3	1	0	4
PREREQUISITE							

Objective:

On successful completion of this course, the students will be able to:

	COURSE OUTCOMES	DOMAIN	LEVEL
CO 1	**Demonstrate**theknowledgeofprobabilityandstatistical Distributions.	Cognitive	Understanding
CO 2	**Solve**the probabilitydistributionsoftransformedvariablesand variousparametersusingspecialdistributions.	Cognitive	Applying
CO 3	**Examine**transformationsofvariables using special distributions.	Cognitive	Analyzing
CO 4	**Elaborate**theconceptsofprobabilityinmultivariable distribution.	Cognitive	Creating
CO 5	**Estimate**probabilityvalueusingcentrallimittheorem.	Cognitive	Evaluating

UNIT I	**Probability and Distributions**	**9 + 3**
The probability set function – Randomvariables–Distributionfunction–Mathematicalexpectation–Special mathematicalexpectations–Specialmathematicalexpectations–Chebyshev'sinequality.		
UNIT 2	**MultivariateDistributions**	**9 + 3**
DistributionsoftwoRandomvariables–Conditionaldistributionsandexpectations–IndependentRandomvariables–SomespecialDistributions:TheBinomialandrelateddistributions– ThePoisson distribution.		
UNIT 3	**Some Special Distributions**	**9 + 3**
The Gamma and Chi-Square distributions –TheNormaldistributions–TheBivariatenormaldistribution–DistributionsofFunctionsofRandomVariables:Samplingtheory–Transformations of variables of the discrete Type– Transformation ofvariablesofthecontinuoustype.		
UNIT 4	**DistributionsofFunctionsofRandomVariables**	**9 + 3**
The Beta, t and F distributions, - Distributions of order statistics – The moment generating function technique – the distributions of x and $n S^2$ - Expectations of functions of Random variables.		

UNIT 5	Limiting Distributions	9 + 3

Convergence in distribution– Convergence inProbability – Limiting moment generation functions – The central limittheorem– sometheoremonlimitingdistributions.

LECTURE	45	TUTORIAL	15	PRACTICAL	0	TOTAL	60

Text Book:

1. Introduction to Mathematical Statistics (Fifth Edition) by Robert V. Hogg, Allen T. Craig.,

Unit	Chapter(s)	Section(s)	Page (s)
1	1	1.3, 1.5, 1.7, 1.8, 1.9, 1.10	12-17, 28-35, 44-50, 52-56, 57-64, 68-70
2	2 3	2.1, 2.2, 3.1, 3.2	74-81, 82-90, 116-124, 126-129
3	3 4	3.3, 3.4, 4.1, 4.2, 4.3	131-136, 138-144, 146-150, 155-178
4	4	4.4, 4.7, 4.8, 4.9	179-184, 193-200, 203-220.
5	5	5.1, 5.3, 5.4, 5.5	233-255.

References:

1. M. Fisz, Probability theory and Mathematical Statistics, John Wiley & Sons, New York, 1963.
2. E.J. Dudewiczn and S.N. Mishra, Modern Mathematical Statistics, John Wiley & Sons, New York, 1988.
3. V.N. Rohatgi, An introduction to Probability theory and Mathematical Statistics, Wiley Eastern Limited, New Delhi, 1988.

Website and e-Learning Source

1.https://nptel.ac.in/courses/111/105/111105124/
2.https://nptel.ac.in/courses/111/102/111102134

COs VS Pos

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2
CO 1	3	2	1	0	0	2	2	2	3	2	0
CO 2	3	3	2	0	1	3	3	3	3	3	0
CO 3	3	3	3	1	2	3	3	3	3	3	1
CO 4	3	3	3	3	3	3	3	3	3	3	3
CO 5	3	3	3	2	3	3	3	3	3	3	2
TOTAL	15	14	12	6	9	14	14	14	15	14	6

SCALED VALUE	3	3	3	2	2	3	3	3	3	3	2
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											

1-5→1, 6-10→2, 11-15→3

Course Name			FUZZY SETS AND THEIR APPLICATIONS	L	T	P	C
Course Code			**YMA1E1B**	**3**	**1**	**0**	**4**
C	**P**	**A**		**L**	**T**	**P**	**H**
4	**0**	**0**		**3**	**1**	**0**	**4**
PREREQUISITE			**Basicknowledgeinsettheory&Analysis**				

Objective:

Themainobjectivesofthiscourseareto:

1. Tounderstandthebasicknowledgeoffuzzysettheory.
2. Togainknowledgeinfuzzyrelationsandfuzzymeasures.
3. Tolearnthebasicsofpatternrecognitionanddecisionmaking.
4. Tolearnaboutrelationsbetweencrispandfuzzyinapplications.

On successful completion of this course, the students will be able to:

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Demonstrate** the basic ideas of fuzzy sets, operations and properties of fuzzy sets and also about fuzzy relations.	Cognitive	Understanding
CO 2	**Demonstrate** Standard fuzzy operations.	Cognitive	Understanding
CO 3	**Compare** Crisp and fuzzy relations.	Cognitive	Understanding
CO 4	**Compare** random and non-random uncertainty, and the decision-making processes in Fuzzy environment.	Cognitive	Understanding
CO 5	**Demonstrate** the applications of Fuzzy in different fields.	Cognitive	Understanding

UNIT I	**Crispsetsandfuzzysets**	**9 + 3**
Overview of Classical Sets, Membership Function, Height of a fuzzy set – Normal and sub normal fuzzy sets – Support – Level sets, fuzzy points, α–cuts – Decomposition Theorems, Extension Principle.		
UNIT 2	**Operation on fuzzy sets**	**9 + 3**
Standard fuzzy operations – Union, intersection and complement – properties of De Morgan's laws - α–Cuts		

of fuzzy operations.		
UNIT 3	**Fuzzyrelations**	**9 + 3**
Cartesian Product, Crisp relations – Cardinality – operations and properties of Crisp and Fuzzy relations. Image and inverse image of fuzzy sets - Various definitions of fuzzy operations – Generalizations – Non interacting fuzzy sets, Tolerance and equivalence relations.		
UNIT 4	**DecisionmakinginFuzzyEnvironments**	**9 + 3**
General Discussion – Individual Decision making – Multi person decision making – Multi criteria decision making – Multi stage decision making – Fuzzy ranking methods – Fuzzy linear programming.		
UNIT 5	**Applications**	**9 + 3**
Medicine – Economics – Fuzzy Systems and Genetic Algorithms – Fuzzy Regression – Interpersonal Communication – Other Applications.		

LECTURE	**45**	**TUTORIAL**	**15**	**PRACTICAL**	**0**	**TOTAL**	**60**

Text Book:

1. George J. Klir and Bo Yuan, Fuzzy sets and Fuzzy Logic Theory and Applications, PHI Leaning Private Limited, New Delhi (2009).

References:

1. A. K. Bhargava; Fuzzy Set Theory, Fuzzy Logic and their Applications, published by S. Chand Pvt. Limited (2013).
2. K. Pundir and R. Pundir, Fuzzy sets and their application, Published by A Pragati edition (2012)
3. H. J. Zimmermann, Fuzzy set theory and its applications, Springer (2012).

Website and e-Learning Source: NPTEL

COs VS POs

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**
CO 1	3	2	1	0	0	2	2	2	3	2	0
CO 2	3	2	1	0	0	2	2	2	3	2	0
CO 3	3	2	1	0	0	2	2	2	3	2	0
CO 4	3	2	1	0	0	2	2	2	3	2	0
CO 5	3	2	1	0	0	2	2	2	3	2	0
TOTAL	15	10	5	0	0	10	10	10	15	10	0

SCALED VALUE	3	2	1	0	0	2	2	2	3	2	0
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											
1-5→1, 6-10→2, 11-15→3											

Course Name			AI AND MACHINE LEARNING	L	T	P	C
Course Code			YMA1E1C	3	1	0	4
C	P	A		L	T	P	H
4	0	0		3	1	0	4
PREREQUISITE							
Objective: .							
On successful completion of this course, the students will be able to:							

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	Overview of AI.	Cognitive	Understanding
CO 2	Categorize knowledge using propositional calculus and predicate calculus.	Cognitive	Analyzing
CO 3	Explain the foundations of Learning models.	Cognitive	Understanding
CO 4	Construct Linear Regression Models and Probabilistic discriminative model.	Cognitive	Applying
CO 5	Determine ensemble Learning and unsupervised learning.	Cognitive	Evaluating

UNIT I	INTRODUCTION	9 + 3
General Issues and overview of AI The AI problems: what is an AI technique; Characteristics of AI applications Problem Solving, Search and Control Strategies General Problem solving; Production systems; Control strategies; forward and backward chaining Exhaustive searches: Depth first Breadth first search.		
UNIT 2	**LOGIC IN AI**	**9 + 3**
Syntax and Semantics: Knowledge Representation – Predicate Calculus; Reasoning in Predicate Logic: Modus Ponens-Inference Rules; Applying Resolution: Normal Form Conversion-Reasoning through Refutation		
UNIT 3	**FOUNDATIONS OF LEARNING**	**9 + 3**
Components of learning – Learning models – Geometric models – Pprobabilistic models – Logical models – Grouping and grading – Learning versus design – Types of learning – Ssupervised – Unsupervised – reinforcement – Theory of learning – Feasibility of learning – error and noise – Training versus testing – Ttheory of generalization – generalization bound – Approximation generalization trade off – bias and variance – Learning curve.		
UNIT 4	**SUPERVISED LEARNING**	**9 + 3**

Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, Gradient descent, Linear Classification Models: Discriminant function – Perceptron algorithm, Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random Forests							
UNIT 5	**ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING**						**9 + 3**
Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking; Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization.							
LECTURE	**45**	**TUTORIAL**	**15**	**PRACTICAL**	**0**	**TOTAL**	**60**

Text Book:

1. Stephen Marsland, ―Machine Learning – An Algorithmic Perspective‖, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.

References:

1. Stuart Russell & Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice-Hall, Third Edition (2009)
2. Aurélien Géron - Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition. September 2019, Reilly Media, Inc., ISBN: 9781492032649.
3. Shai Shalev-Shwartz and Shai Ben-David," Understanding Machine Learning: From Theory to Algorithms", Cambridge University Press 2014.

Website and e-Learning Source; https://nptel.ac.in

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2
CO 1	3	2	1	0	0	2	2	2	3	2	0
CO 2	3	3	3	1	2	3	3	3	3	3	1
CO 3	3	2	1	0	0	2	2	2	3	2	0
CO 4	3	3	2	0	1	3	3	3	3	3	0
CO 5	3	3	3	2	3	3	3	3	3	3	2
TOTAL	15	13	10	3	6	13	13	13	15	13	3
SCALED VALUE	3	3	2	1	2	3	3	3	3	3	1

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

1-5→1, 6-10→2, 11-15→3

<table>
<tr><td colspan="3">Course Name</td><td colspan="2">COMPUTER PROGRAMMING
(C++ Theory and Lab)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td colspan="3">Course Code</td><td colspan="2">YMA1E2A</td><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td>C</td><td>P</td><td>A</td><td colspan="2"></td><td>L</td><td>T</td><td>P</td><td>H</td></tr>
<tr><td>4</td><td>0</td><td>0</td><td colspan="2"></td><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td colspan="3">PREREQUISITE</td><td colspan="6">BasicknowledgefromCLanguage</td></tr>
<tr><td colspan="9">Objective:
TodevelopprogrammingskillsinC++anditsobject-orientedconcepts.</td></tr>
<tr><td colspan="4">COURSE OUTCOMES</td><td colspan="2">DOMAIN</td><td colspan="3">LEVEL</td></tr>
<tr><td>CO 1</td><td colspan="3">Explain C++ programming fundamentals.</td><td colspan="2">Cognitive</td><td colspan="3">Understanding</td></tr>
<tr><td>CO 2</td><td colspan="3">Apply structure and union for various functions.</td><td colspan="2">Cognitive</td><td colspan="3">Applying</td></tr>
<tr><td>CO 3</td><td colspan="3">Explain the concept of objects and constructors.</td><td colspan="2">Cognitive</td><td colspan="3">Understanding</td></tr>
<tr><td>CO 4</td><td colspan="3">Explain Destructors&OperatorOverloadingandTypesConversions.</td><td colspan="2">Cognitive</td><td colspan="3">Understanding</td></tr>
<tr><td>CO 5</td><td colspan="3">ExplainExtending Classes and Pointers, Virtual Functions and Polymorphism.</td><td colspan="2">Cognitive</td><td colspan="3">Understanding</td></tr>
<tr><td>UNIT I</td><td colspan="7">Beginning with C++ & Tokens, Expressions and Control Structures</td><td>9 + 3</td></tr>
<tr><td colspan="9">Applications of C++– A simple C++ Program–– An Example with Class– Structure of C++ Program– Creating the Source File– Compiling and Linking–Introduction– Token and Keyword.</td></tr>
<tr><td>UNIT 2</td><td colspan="7">FunctionsinC++andclasses</td><td>9 + 3</td></tr>
<tr><td colspan="9">Introduction– the Main Function– Function Prototyping– Call by Reference–Return by Reference– Inline Function– Defaults Arguments– const Arguments– Function Overloading– Friend and Virtual Functions– C Structures Revisited– Specifying a Class– Defining Membership Functions– A C++ Program with Class– Making an Outside Function Inline– Nesting of Member Functions– Private Member Functions– Arrays with an Class.</td></tr>
<tr><td>UNIT 3</td><td colspan="7">Objects, Constructors</td><td>9 + 3</td></tr>
<tr><td colspan="9">Introduction– – Memory Allocation for Objects– Static Data Member– Static Member Functions–Arrays of Objects– Objects as Function Arguments– Friendly Functions– Returning Objects– const. Member Functions– Pointers of Members– Local Classes– Constructors– Parameterized Constructors– Multiple constructors in a class– Constructors with Default Arguments.</td></tr>
<tr><td>UNIT 4</td><td colspan="7">Destructors&OperatorOverloadingandTypesConversions</td><td>9 + 3</td></tr>
<tr><td colspan="9">Introduction –– Dynamic Initialization of Objects– Copy Constructor– Dynamic Constructors–Constructing</td></tr>
</table>

Two – Dimensional Arrays – constant Objects– Destructors – Introduction – Defining Operator Overloading – Overloading Unary Operators – Overloading Binary Operators – Overloading Binary Operators Using Friends– Manipulation of Strings Using Operators– Rules for Overloading Operators– Type Conversions.							
UNIT 5	**Inheritance: Extending Classes and Pointers, Virtual Functions and Polymorphism**						**9 + 3**
Introduction–Defining Derived Classes– Single Inheritance–Making a Private Member Inheritance–Making a Private Member Inheritable– Multilevel Inheritance–Multiple Inheritance–Hierarchical Inheritance–Hybrid Inheritance–Virtual Base Classes–Abstract Classes– Constructors in Derived Classes– Member Classes: Nesting of Classes–Introduction– Pointers to Objects–this Pointer–Pointers to Derived Classes–Virtual Functions– Pure Virtual Functions.							
LECTURE	**45**	**TUTORIAL**	**15**	**PRACTICAL**	**0**	**TOTAL**	**60**

Text Book:

1. E.Balagurusamy, Object Oriented Programming with C++, 4th Edition, The McGraw–Hill Company Ltd, New Delhi, 2008.

References:

1. V. Ravichandran, Programming with C++, Second Edition Tata McGraw – Hill, New Delhi, 2006.
2. H. Schildt, The complete Reference of C++, Tata–McGraw–Hill publishing Company Ltd. New Delhi, 2003.
3. S.B. Lipman and J.Lafer, C++ Primer, Addition Wesley, Mass., 1998.
4. Ashok N.Kamthane, Object Oriented Programming with ANSI and TURBO C++, Pearson Education(P) Ltd, 2003.
5. BjarmeStroustrup, The C++ Programming Language, AT & T Labs, Murray Hills, NewJersey, 1998.

Website and e-Learning Source: https://nptel.ac.in

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2
CO 1	3	2	1	0	0	2	2	2	3	2	0
CO 2	3	3	2	0	1	3	3	3	3	3	0
CO 3	3	2	1	0	0	2	2	2	3	2	0
CO 4	3	2	1	0	0	2	2	2	3	2	0
CO 5	3	2	1	0	0	2	2	2	3	2	0
TOTAL	15	11	6	0	1	11	11	11	15	11	0
SCALED VALUE	3	3	2	0	1	3	3	3	3	3	0

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

1-5→1, 6-10→2, 11-15→3

Course Name			**NUMBER THEORY AND CRYPTOGRAPHY**	**L**	**T**	**P**	**C**
Course Code			**YMA1E2B**	**3**	**1**	**0**	**4**
C	**P**	**A**		**L**	**T**	**P**	**H**
4	**0**	**0**		**3**	**1**	**0**	**4**
PREREQUISITE			BasicknowledgefromCLanguage				

Objective:

1. To provide techniques for keeping information secret.
2. To impart some techniques for determining the information has not been tampered with.
3. To explain fundamentals of cryptography and its application to network security.

	COURSE OUTCOMES	DOMAIN	LEVEL
CO 1	**Apply** the concept and properties of modular arithmetic in various algorithms to find the solution.	Cognitive	Applying
CO 2	**Analyze** the concepts of public key cryptography, RSA and Elliptic curve cryptography.	Cognitive	Analyzing
CO 3	**Demonstrate** the concepts of Pseudo primes.	Cognitive	Understanding
CO 4	**Utilize** basic properties of finite fields for factoring polynomials over finite fields.	Cognitive	Applying
CO 5	**Utilize** Pollard's rho method for solving the elliptic curve discrete logarithm problem.	Cognitive	Applying

UNIT I	**Cryptography**	**9 + 3**
Some simple Cryptosystems: Basic notions – Digraph transformation – Enciphering Matrices – Linear algebra modulo.		
UNIT 2	**Public Key**	**9 + 3**
Idea of Public Key Cryptography: Classical versus public key – Authentication – Hash function – Key exchange – Probabilistic encryption – RSA – Discrete Log: Diffle-Hellman key exchange system – Massey-Omura cryptosystem – ELGamel cryptosystem – Digital signature standard		
UNIT 3	**Primality**	**9 + 3**
Pseudo primes: Definitions and Propositions – The rho method.		
UNIT 4	**Factoring**	**9 + 3**
Fermat factorization and factor bases – Factor base algorithm – Heuristic time estimate – Continued Fraction Method – Continued fraction factoring algorithm.		
UNIT 5	**Elliptic Curves**	**9 + 3**

Basic Facts - Elliptic curve Cryptosystems: Discrete Log on E – Analog of Diffle-Hellman key exchange – Analog of Massey- Omura – Analog of EL Gamel cryptosystems - Elliptic curve factorization: Pollard's p-1 method.

LECTURE	45	TUTORIAL	15	PRACTICAL	0	TOTAL	60

Text Book:

1. N. Koblitz, "A Course in Number Theory and Cryptography", Second edition, Springer- Verlag, New York, 2014.

Unit	Chapter	Sections
I	III	Sec 1-2 (Pages 54-74)
II	IV	Sec 1-3 (Pages 83-103)
III	V	Sec 1-2 (Pages 126-134, 138-142)
IV	V	Sec 3-4 (Pages 143-159)
V	VI	Sec 1-3 (Pages 166-182, 191-192)

References:

1. D.R.Stinson, "**Cryptography**", CRC Press, New York, 1995.
2. A. J Meneze, P.R.Oorche and S.A Vans ton " **Hand book of applied Cryptography**", Crc Press New York, 1995.
3. William Stallings, "**Cryptograpy and Network Security Principles and Practice**" Prentice Hall, Fifth Edition, New Delhi, 2011.

Website and e-Learning Source

1. http://abel.harvard.edu/quals/index.html[HavardUniversity]
2. https://www-wp.maths.cam.ac.uk/documents/schedules.pdf/[CambridgeUniversity]

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2
CO 1	3	3	2	0	1	3	3	3	3	3	0
CO 2	3	3	3	1	2	3	3	3	3	3	1
CO 3	3	2	1	0	0	2	2	2	3	2	0
CO 4	3	3	2	0	1	3	3	3	3	3	0
CO 5	3	3	2	0	1	3	3	3	3	3	0
TOTAL	15	14	10	1	5	14	14	14	15	14	1
SCALED VALUE	3	**3**	**2**	1	1	3	3	3	3	3	1

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

1-5→1, 6-10→2, 11-15→3

Course Name			FORMAL LANGUAGES AND AUTOMATA THEORY	L	T	P	C
Course Code			YMA1E2C	3	1	0	4
C	P	A		L	T	P	H
4	0	0		3	1	0	4
PREREQUISITE			Knowledge about Set theory, Relations, functions and basic concepts of Grammars.				

Objective:

Thepurposeofthiscourseistoacquaintthestudentwithanoverviewofthetheoretical foundations of computer science from the perspectiveofformallanguages.

- Classify machines by theirpower to recognize languages.
- Employfinitestatemachinestosolveproblemsin computing.
- Explaindeterministicandnon-deterministic machines.

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	Explain finite automata and regular expressions	Cognitive	Understanding
CO 2	Construct NFA to DFA and minimization DFA	Cognitive	Applying
CO 3	Determine Parse Trees and normal forms of Context Free Grammars	Cognitive	Evaluating
CO 4	Analyze the Equivalence of PDA's and CFG's	Cognitive	Analyzing
CO 5	Determine the Pumping Lemma for Context-free Languages	Cognitive	Evaluating

UNIT I	**Finite Automata and Regular Expressions**	**9 + 3**
Finite state systems- Deterministic Finite state Automata- Non deterministic Finite Automata- Finite Automata with Epsilon-Transitions – Regular Expressions- Finite Automata and Regular Expressions.		
UNIT 2	**Properties of Regular Languages**	**9 + 3**
The Pumping Lemma for Regular Languages – Application of the Pumping Lemma – Closure Properties of Regular Languages – Reversal – Homomorphism – Decision properties of Regular Languages – Converting NFA's to DFA'S – Minimization of DFA's.		
UNIT 3	**Context Free Grammars and Languages**	**9 + 3**
Context Free Grammars – Parse Trees – Normal forms for Context Free Grammars – Chomsky Normal Form – Greibach Normal Form.		
UNIT 4	**Pushdown Automata**	**9 + 3**
Definition – The languages of a PDA – Equivalence of PDA's and CFG's – Deterministic Pushdown		

Automata.		
UNIT 5	**Properties of Context-Free Languages**	**9 + 3**
The Pumping Lemma for Context-free Languages – Closure Properties of Context- Free Languages – Decision properties of CFL's.		

LECTURE	**45**	**TUTORIAL**	**15**	**PRACTICAL**	**0**	**TOTAL**	**60**

Text Book:

1. John. E. Hopcraft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to Automata Theory, Languages and Computation, Pearson Education, 2013.

References:

1. A Salomaa, Formal Languages, Academic press, New York, 1973
2. John C. Martin, Introduction to Languages and theory of Computations (2ndEdn), Tata – McGraw Hill company Ltd., New Delhi, 1997.

Website and e-Learning Source: NPTEL Courses and MOOC Courses.

COs VS POs

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**
CO 1	3	2	1	0	0	2	2	2	3	2	0
CO 2	3	3	2	0	1	3	3	3	3	3	0
CO 3	3	3	3	2	3	3	3	3	3	3	2
CO 4	3	3	3	1	2	3	3	3	3	3	1
CO 5	3	3	3	2	3	3	3	3	3	3	2
TOTAL	15	14	12	5	9	14	14	14	15	14	5
SCALED VALUE	3	3	3	1	2	3	3	3	3	3	1

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

1-5→1, 6-10→2, 11-15→3

SEMESTER II

Course Name			ADVANCED ALGEBRA	L	T	P	C
Course Code			YMA201	4	1	0	5
C	**P**	**A**		**L**	**T**	**P**	**H**
5	**0**	**0**		**4**	**1**	**0**	**5**
PREREQUISITE			BasicknowledgefromCLanguage				

Objective:
The main objectives of this course are: To study field extension, roots of polynomials, Galois Theory, finite fields, division rings, solvability by radicals and to develop computational skill in abstract algebra.

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Explain** basic properties of Extension Fields and Transcendence.	Cognitive	Understanding
CO 2	**Solve** polynomial equations by radicals along with the understanding of ruler and compass constructions.	Cognitive	Applying
CO 3	**Explain** the basic aspects of elements of Galois theory.	Cognitive	Understanding
CO 4	**Summarize** Wedderburn's theorem on finite division rings.	Cognitive	Understanding
CO 5	**Demonstrate** the basic mathematical ideas for theorem of Frobenius and square theorem.	Cognitive	Understanding

UNIT I		**12 + 3**
Extension fields – Transcendence of e.		
UNIT 2		**12 + 3**
Roots or Polynomials. - More about roots.		
UNIT 3		**12 + 3**
Elements of Galois theory.		
UNIT 4		**12 + 3**
Finite fields - Wedderburn's theorem on finite division rings.		
UNIT 5		**12 + 3**
Solvability by radicals - A theorem of Frobenius - Integral Quaternions andtheFour- Squaretheorem. Galiosgroupsovertheradicals.		

LECTURE	60	TUTORIAL	15	PRACTICAL	0	TOTAL	60

Text Book:

1. I.N. Herstein.TopicsinAlgebra (IIEdition)WileyEastern Limited,NewDelhi,1975.

Unit	Chapter	Sections
I	5	Section 5.1 and 5.2
II	5	Sections5.3 and 5.5
III	5	Section5.6
IV	7	Sections7.1and7.2(Theorem7.2.1only)
V	5 7	Section5.7(omitLemma5.7.1, Lemma5.7.2andTheorem5.7.1) Sections7.3 and7.4

References:

1. M.Artin,Algebra,PrenticeHallofIndia,1991.
2. P.B.Bhattacharya,S.K.Jain,andS.R.Nagpaul,BasicAbstractAlgebra(II Edition)Cambridge UniversityPress, 1997. (Indian Edition)
3. I.S.LutherandI.B.S.Passi,Algebra,Vol.I–Groups(1996);Vol.IIRings,NarosaPublishingHouse, NewDelhi, 1999
4. D.S.Malik,J.N.MordesonandM.K.Sen,FundamentalofAbstractAlgebra,McGrawHill(International Edition), NewYork. 1997.
5. N.Jacobson, BasicAlgebra,Vol. I&II HindustanPublishingCompany,NewDelhi.

Website and e-Learning Source

1. http://mathforum.org,
2. http://ocw.mit.edu/ocwweb/Mathematics
3. http://www.opensource.org,
4. www.algebra.com

COs VS POs											
	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**
CO 1	3	2	1	0	0	2	2	2	3	2	0
CO 2	3	3	2	0	1	3	3	3	3	3	0
CO 3	3	2	1	0	0	2	2	2	3	2	0
CO 4	3	2	1	0	0	2	2	2	3	2	0
CO 5	3	2	1	0	0	2	2	2	3	2	0
TOTAL	15	11	6	0	1	11	11	11	15	11	0
SCALED VALUE	**3**	**3**	**2**	**0**	**1**	**3**	**3**	**3**	**3**	**3**	**0**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											
1-5→1, 6-10→2, 11-15→3											

Course Name			COMPLEX ANALYSIS	L	T	P	C
Course Code			YMA202	4	1	0	5
C	P	A		L	T	P	H
5	0	0		4	1	0	5

PREREQUISITE	Basics laws of arithmetic - Geometric representation of complex numbers - Differentiation and Integration – A mixture of geometric feeling and computational skill.

Objective:

Making students to know

*Complex analysis, in particular the theory of conformal mappings, has many physical applications and is also used throughout analytic numbertheory.

*In modern times, it has become very popular through a new boost from complex dynamics and the pictures of fractals produced by iterating holomorphic functions.

*Another important application of complex analysis is in stringtheory which studies conformal invariants in quantum field theory.

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Demonstrate** the basic concept of line integrals, rectifiable arcs with examples and prove Cauchy's theorems.	Cognitive	Understanding
CO 2	**Demonstrate** the homology in complex plain and prove residue theorem.	Cognitive	Understanding
CO 3	**Explain** the canonical products and gamma functions with examples.	Cognitive	Understanding
CO 4	**Illustrate** the use of the reflection principle and prove Riemann mapping theorem.	Cognitive	Understanding
CO 5	**Explain** the general properties of elliptic functions.	Cognitive	Understanding

UNIT I	**Complex Integration**	**12 + 3**

Fundamental Theorems: Cauchy's Theorem for a Rectangle- Cauchy's Theorem in a Disk. Cauchy's Integral Formula: The Index of a point with respect to a closed curve – The Integral formula – Higher derivatives. Local Properties of analytical Functions:Removable Singularities- Taylors's Theorem – Zeros and poles – The local Mapping – The Maximum Principle.

UNIT 2	**Complex Integration**	**12 + 3**

The General form of Cauchy's Theorem: Chains and cycles- Simple Continuity - Homology - The General statement of Cauchy's Theorem - Proof of Cauchy's theorem - Locally exact differentials- Multilply connected regions - Residue theorem - The argument principle.

Evaluation of Definite Integrals and Harmonic Functions: Evaluation of definite integrals - Definition of Harmonic function and basic properties - Mean value property - Poisson formula.

UNIT 3	**Series and Product Developments**	**12 + 3**

Partial Fractions and Entire Functions: Partial fractions - Infinite products – Canonical products – Gamma Function- Jensen's formula – Hadamard's Theorem.Riemann Theta Function and Normal Families: Product development – Extension of ζ (s) to the whole plane – The zeros of zeta function – Equicontinuity – Normality and compactness – Arzela's theorem – Families of analytic functions – The Classical Definition.

UNIT 4	Conformal mappings	12 + 3

Riemann mapping Theorem: Statement and Proof – Boundary Behaviour – Use of the Reflection Principle. Conformal mappings of polygons: Behaviour at an angle – Schwarz- Christoffel formula – Mapping on a rectangle. Harmonic Functions: Functions with mean value property – Harnack's principle.

UNIT 5	Elliptic functions	12 + 3

Simply Periodic Functions : Representation by Exponentials-The Fourier Development - Functions of Finite Order.Doubly Periodic Functions:The Period Module-Unimodular Transformations - The Canonical Basis-General Properties of Elliptic Functions.WeierstrassTheory:TheWeierstrass $\wp$-function–Thefunctions ζ (s)and σ (s)–Thedifferentialequation – The modular equation $\lambda(\tau)$ – TheConformalmappingby $\lambda(\tau)$.

LECTURE	60	TUTORIAL	15	PRACTICAL	0	TOTAL	60

Text Book:

1. Lars F. Ahlfors, Complex Analysis, (3rd Edition) McGraw Hill Book Company, New York, 1979

References:

1. H.A. Presfly, Introduction to complex Analysis, Clarendon Press, ford, 1990.
2. J.B. Corway, Functions of one complex variables, Springer - Verlag, International student Edition, Narosa Publishing Co.
3. E. Hille, Analytic function Theory (2 vols.), Gonm& Co, 1959.
4. M.Heins, Complex function Theory, Academic Press, New York, 1968.

Website and e-Learning Source

https://nptel.ac.in

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2
CO 1	3	2	1	0	0	2	2	2	3	2	0
CO 2	3	2	1	0	0	2	2	2	3	2	0
CO 3	3	2	1	0	0	2	2	2	3	2	0
CO 4	3	2	1	0	0	2	2	2	3	2	0
CO 5	3	2	1	0	0	2	2	2	3	2	0
TOTAL	15	10	5	0	0	10	10	10	15	10	0
SCALED VALUE	**3**	**2**	**1**	**0**	**0**	**2**	**2**	**2**	**3**	**2**	**0**

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

1-5→1, 6-10→2, 11-15→3

Course Name			PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	C
Course Code			**YMA203**	**4**	**1**	**0**	**5**
C	**P**	**A**		**L**	**T**	**P**	**H**
5	**0**	**0**		**4**	**1**	**0**	**5**
PREREQUISITE			The only prerequisite is a good course in Calculus.				

Objective:

The students can be able to

1. Describe real world system using Partial Differential Equations.
2. Identify, analyse, and subsequently solve physical situations whose behavior can be described by Partial Differential Equations.

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Recall** the basic concept of first order P.D.E and classification of integrals with examples.	Cognitive	Remembering
CO 2	**Explain** the origin of second order P.D.E with examples.	Cognitive	Understanding
CO 3	**Apply** the concept of Laplace equation to solve boundary value problems.	Cognitive	Applying
CO 4	**Classify** wave equation with examples.	Cognitive	Analyzing
CO 5	**Appraise** the elementary solution of diffusion equation.	Cognitive	Evaluating

UNIT I	**PARTIAL DIFFERENTIAL EQUATIONS OF THE FIRST ORDER**	**12 + 3**

Partial Differential Equations – Origins of First Order Differential Equations – Cauchy's Problem for first order equations – Linear Equations of the first order – Nonlinear partial differential equations of the first order – Cauchy's method ofcharacteristics – Compatible system of First order Equations – Solutions satisfying Given Condition, Jacobi's method.

UNIT 2	**PARTIALDIFFERENTIALEQUATIONSOFTHE2ndORDER**	**12 + 3**

The Origin of Second Order Equations – Linear partial Differential Equations with constant coefficients – Equations with variable coefficients – Separation of variables – The method of Integral Transforms – Non – linear equations of the second order.

UNIT 3	**LAPLACE'S EQUATION**	**12 + 3**

Elementary solutions of Laplace equation – Families of Equipotential Surfaces – Boundary value problems – Separation of variables – Surface Boundary Value Problems – Separation of Variables – Problems With Axial Symmetry – The Theory of Green's Function for Laplace Equation.

UNIT 4	**THE WAVE EQUATION**	**12 + 3**

The Occurrence of the wave equation in Physics – Elementary solutions of the one – dimensional wave equations – Vibrating membrane, Application of the calculus of variations – Three-dimensional problem – General solutions of the wave equation.

UNIT 5	**THE DIFFUSION EQUATION**	**12 + 3**

ElementarySolutionsoftheDiffusionEquation–Separationofvariables – TheuseofIntegralTransforms–The useofGreen'sfunctions.

LECTURE	60	TUTORIAL	15	PRACTICAL	0	TOTAL	75

Text Book:
1. K. Sankara Rao, Introduction to Partial Differential Equations, Second edition – Prentice – Hall of India, New Delhi 2006
References: 1. Ian Sneddon – Elements of Partial Differential Equations – McGraw Hill International Book Company, New Delhi, 1983 2. M.D. Raisinghania Advanced Differential Equations S. Chand and Company Ltd., New Delhi, 2001 3. J.N. Sharma & K. Singh Partial Differential Equations for Engineers & Scientists, Narosa Publishing House, 2001 4. R. Dennemeyer, Introduction to Partial Differential Equations and Boundary value Problems, McGraw Hill Book Company, New York, 1968.
Website and e-Learning Source: ; https://nptel.ac.in

COs VS POs											
	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**
CO 1	2	1	0	0	0	1	1	1	2	1	0
CO 2	3	2	1	0	0	2	2	2	3	2	0
CO 3	3	3	2	0	1	3	3	3	3	3	0
CO 4	3	3	3	1	2	3	3	3	3	3	1
CO 5	3	3	3	2	3	3	3	3	3	3	2
TOTAL	14	12	9	3	6	12	12	12	14	12	3
SCALED VALUE	**3**	**3**	**2**	**1**	**2**	**3**	**3**	**3**	**3**	**3**	**1**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											
1-5→1, 6-10→2, 11-15→3											

Course Name			**ADVANCED NUMERICAL METHODS**	**L**	**T**	**P**	**C**
Course Code			**YMA204**	**4**	**1**	**0**	**5**
C	**P**	**A**		**L**	**T**	**P**	**H**
5	**0**	**0**		**4**	**1**	**0**	**5**
PREREQUISITE			Knowledge about Number system, polynomials and matrices.				

Objective:
The objective of this course is to develop Numerical computational skills and to study their applications. This course focuses on the topics Interpolation by polynomials, the solution of nonlinear equations, Numerical differentiation and Numerical Integration.

COURSE OUTCOMES		**DOMAIN**	**LEVEL**
CO 1	**Apply** the mean value theorem for derivatives and integrals to find specified point and verify this point lies inside the given integral.	Cognitive	Applying
CO 2	**Evaluate** up to cubic polynomials using appropriate methods.	Cognitive	Evaluating

CO 3	**Analyze** the solution of nonlinear equations by the appropriate methods.	Cognitive	Analyzing
CO 4	**Examine** the triangular factorization is unique.	Cognitive	Analyzing
CO 5	**Estimate** the value of the given integrals using appropriate methods.	Cognitive	Evaluating

UNIT I	**Number Systems and Errors**	**12 + 3**
The Representation of Integers -The Representation of Fractions - Floating point arithmetic- Loss of Significance and Error Propagation – Computational Methods for error estimation-Some comments on convergence of sequences-Some mathematical preliminaries.		
UNIT 2	**Interpolation by polynomials**	**12 + 3**
Polynomial forms- Existence and Uniqueness of the Interpolating polynomial-The divided difference table-The error of the interpolating polynomial-Interpolation in a function table based on equally spaced points.		
UNIT 3	**The solution of nonlinear equations**	**12 + 3**
A survey of iterative methods-Fixed point iteration-Polynomial Equations: Real Roots-Complex roots and Muller's Method.		
UNIT 4	**Matrices and Systems of Linear equations**	**12 + 3**
The solution of linear systems by elimination-The pivoting strategy - The triangular factorization.		
UNIT 5	**Differentiation and Integration**	**12 + 3**
Numerical differentiation- Numerical Integration: Some basic rules-Composite rules.		

LECTURE	**60**	**TUTORIAL**	**15**	**PRACTICAL**	**0**	**TOTAL**	**75**

Text Book:

1. Elementary Numerical Analysis-An algorithmic approach by Samuel D. Conte and Carlde Boor, Sections 1.1 to 1.7, 2.1 to 2.3, 2.5, 2.6, 3.1, 3.3, 3.6, 3.7, 4.2 to 4.4, 7.1, 7.2 and 7.4. March 2018.

Reference:

1. Azmysackleh et al, Classical and modern Numerical Analysis, CRC Press,Copyright 2009.

Website and e-Learning Source; https://nptel.ac.in

COs VS POs											
	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**
CO 1	3	3	2	0	1	3	3	3	3	3	0
CO 2	3	3	3	2	3	3	3	3	3	3	2
CO 3	3	3	3	1	2	3	3	3	3	3	1
CO 4	3	3	3	1	2	3	3	3	3	3	1

CO 5	3	3	3	2	3	3	3	3	3	3	2
TOTAL	15	15	14	6	11	15	15	15	15	15	6
SCALED VALUE	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**2**
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											
1-5→1, 6-10→2, 11-15→3											

Course Name			**RESOURCE MANAGEMENT TECHNIQUES**	**L**	**T**	**P**	**C**
Course Code			**YMA2E1A**	**3**	**1**	**0**	**4**
C	**P**	**A**		**L**	**T**	**P**	**H**
4	**0**	**0**		**3**	**1**	**0**	**4**
PREREQUISITE			Basic knowledge about linear programming problems.				

Objective:

1. To introduce basic optimization techniques in order to get best results from a set of several possible solutions of different problems like unconstrained and constrained problems etc.
2. To teach the formulation of real-world phenomena from its physical considerations and implementation of optimization algorithms for solving these problems.
3. To equip the knowledge of various types of queuing problem

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Identify** the optimal allocation using sequencing problems.	Cognitive	Applying
CO 2	**Apply** Dynamic programme to find the solution of L.P.P. by programming.	Cognitive	Applying
CO 3	**Apply** Replacement policy to find the solutions.	Cognitive	Applying
CO 4	**Analyze** various types of queuing problems with suitable simple problems.	Cognitive	Analyzing
CO 5	**Compare** the solutions of problems on deterministicmodels and probabilistic models in inventory theory.	Cognitive	Applying

UNIT I	**Sequencing Problems**	**9 + 3**
Optimal sequence algorithm – njobs and two machines – n jobs and m machines – solved problems – twojoband m machines.		
UNIT 2	**Dynamic Programming**	**9 + 3**
Introduction - Recursive relationship – Dynamic programming algorithms – solved problems – Solution of L.P.P. by Dynamic programming.		
UNIT 3	**Replacement Theory**	**9 + 3**
Introduction – Replacement policy for equipment which deteriorates gradually – Replacement of items that fail suddenly – Problems in mortality and staffing – Solved problems.		
UNIT 4	**Queuing Theory**	**9 + 3**
Introduction – Classification of Queues – Queuing Problems -(M/M/1): (∞/FCFS) – (M/M/1): (N/FCFS) – (M/M/C): (∞/FCFS) – (M/M/C): (N/FCFS) – solved problems of the above types.		
UNIT 5	**Inventory Control**	**9 + 3**
Introduction–Deterministicmodels–Purchasingproblem with no shortages – Production problems with no shortages -Purchasingproblemwithshortages–Productionproblemswithshortages –EOQsystemofordering–Purchaseproblemwithpricebreaks–Probabilisticmodels – solvedproblems.		

LECTURE	45	TUTORIAL	15	PRACTICAL	0	TOTAL	60

Text Book:

1. Problem in operations Research, PK Gupta & Man Mohan, Fourteenth Edition,SultanChand&Sons, New Delhi, 2014.

Unit	Chapter	Pages
I	Chapter 17	383 – 399
II	Chapter18	409 – 428
III	Chapter24	619 – 630
IV	Chapter22	535 – 556
V	Chapter23	571 – 600

References:

1. OperationsResearch–AnIntroduction–H.A.Taha–PrenticeHallPublication.
2. OperationsResearch–S.D.Sharma–KedarnathRamnath&Co.,
3. OperationsResearch –PK.GuptaandD.S.Hira –SultanChand&Sons.
4. OperationsResearch–PathakH.K,PradeepKJoshiandSharma.C,ShreeShikshaSahityaPrakashan, Meerut, Second edition,2022.

Website and e-Learning Source

1. http://www.drps.ed.ac.uk/18-19/dpt/cxmath11194.htm[TheUniversityofEdinburgh]
2. maths.cam.ac.uk/undergrad/files/schedules.pdf[UniversityofCambridge]

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2
CO 1	3	3	2	0	1	3	3	3	3	3	0
CO 2	3	3	2	0	1	3	3	3	3	3	0
CO 3	3	3	2	0	1	3	3	3	3	3	0
CO 4	3	3	3	1	2	3	3	3	3	3	1
CO 5	3	3	2	0	1	3	3	3	3	3	0
TOTAL	**15**	**15**	**11**	**1**	**6**	**15**	**15**	**15**	**15**	**15**	**1**
SCALED VALUE	**3**	**3**	**3**	**1**	**2**	**3**	**3**	**3**	**3**	**3**	**1**

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

1-5→1, 6-10→2, 11-15→3

Course Name			**DATA SCIENCE USING R PROGRAMMING**	**L**	**T**	**P**	**C**
Course Code			**YMA2E1B**	**3**	**1**	**0**	**4**
C	**P**	**A**		**L**	**T**	**P**	**H**
4	**0**	**0**		**3**	**1**	**0**	**4**
PREREQUISITE			Knowledge about basic computer programming commands and operators.				

Objective:

1. Learn Fundamentals of R.
2. Covers how to use different functions in R, how to read data into R, accessing R packages, writing R functions, debugging, and organizing data using R functions.
3. Cover the basics of statistical data analysis with examples.
4. The whole syllabus will give an idea to collect, compile and visualize data using statistical functions.

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Explain** the basics of R.	Cognitive	Understanding
CO 2	**Apply** the R Data Types Vectors, Lists, Matrices, Arrays, Factors, Data Frame.	Cognitive	Applying
CO 3	**Make use** of R-Function, R Strings R Matrices, and R Arrays.	Cognitive	Applying
CO 4	**Make use** of CSV File and Excel Loading and handling Data inR.	Cognitive	Applying
CO 5	**Determine** measures of central tendency and dispersion.	Cognitive	Evaluating

UNIT I		**9 + 3**
Introduction to R What is R? – Why R? – Advantages of R over Other Programming Languages - R Studio: R command Prompt, R script file, comments – Handling Packages in R: Installing a R Package, Few commands to get started: installed.packages(), packageDescription(), help(), find.package(), library() - Input and Output – Entering Data from keyboard – Printing fewer digits or more digits – Special Values functions : NA, Inf and –inf.		
UNIT 2		**9 + 3**
R Data Types Vectors, Lists, Matrices, Arrays, Factors, Data Frame – R - Variables: Variable assignment, Data types of Variable, Finding Variable ls(), Deleting Variables - R Operators: Arithmetic Operators, Relational Operators, Logical Operator, Assignment Operators, Miscellaneous Operators - R Decision Making: if statement, if – else statement, if – else if statement, switch statement – R Loops: repeat loop, while loop, for loop - Loop control statement: break statement, next statement.		
UNIT 3		**9 + 3**
R-Function : function definition, Built in functions: mean(), paste(), sum(), min(), max(), seq(), user-defined function, calling a function, calling a function without an argument, calling a function with argument values - R-Strings – Manipulating Text in Data: substr(), strsplit(), paste(), grep(), toupper(), tolower() - R Vectors – Sequence vector, rep function, vector access, vector names, vector math, vector recycling, vector element sorting - R List - Creating a List, List Tags and Values, Add/Delete Element to or from a List, Size of List, Merging Lists, Converting List to Vector - R Matrices – Accessing Elements of a Matrix, Matrix Computations: Addition, Subtraction, Multiplication and Division- R Arrays: Naming Columns and Rows, Accessing Array Elements, Manipulating Array Elements, Calculation Across Array Elements - R Factors.		
UNIT 4		**9 + 3**
Data Frames –Create Data Frame, Data Frame Access, Understanding Data in Data Frames: dim (), nrow(), ncol(), str(), Summary(), names(), head(), tail(), edit() functions - Extract Data from Data Frame, Expand Data Frame: Add Column, Add Row - Joining columns and rows in a Data frame rbind() and cbind() – Merging Data frames merge() – Melting and Casting data melt(), cast().Loading and handling Data in R: Getting and Setting the Working Directory – getwd(), setwd(), dir() - R-CSV Files - Input as a CSV file, Reading a CSV File, Analyzing the CSV File: summary(), min(), max(), range(), mean(), median(), apply() -		

Writing into a CSV File – R -Excel File – Reading the Excel file.							
UNIT 5							**9 + 3**
Descriptive Statistics: Data Range, Frequencies, Mode, Mean and Median: Mean Applying Trim Option, Applying NA Option, Median - Mode - Standard Deviation – Correlation - Spotting Problems in Data with Visualization: visually Checking Distributions for a single Variable - R –Pie Charts: Pie Chart title and Colors – Slice Percentages and Chart Legend, 3D Pie Chart – R Histograms – Density Plot - R – Bar Charts: Bar Chart Labels, Title and Colors.							
LECTURE	**45**	**TUTORIAL**	**15**	**PRACTICAL**	**0**	**TOTAL**	**60**

Text Book:

1. Sandip Rakshit, R Programming for Beginners, McGraw Hill Education (India), 2017, ISBN: 978-93-5260-455-5.

References:

1. Seema Acharya, Data Analytics using R, McGrawHill Education (India), 2018, ISBN: 978-93-5260-524-8.

Website and e-Learning Source

1. https://www.tutorialspoint.com/r/r_tutorial.pdf

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2
CO 1	3	2	1	0	0	2	2	2	3	2	0
CO 2	3	3	2	0	1	3	3	3	3	3	0
CO 3	3	3	2	0	1	3	3	3	3	3	0
CO 4	3	3	2	0	1	3	3	3	3	3	0
CO 5	3	3	3	2	3	3	3	3	3	3	2
TOTAL	15	14	10	2	6	14	14	15	15	14	2
SCALED VALUE	3	3	2	1	2	3	3	3	3	3	1

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

1 – 5→1, 6 – 10→2, 11 – 15→3

Course Name	**PYTHON FOR MATHEMATICS**	**L**	**T**	**P**	**C**

Course Code			YMA2E1C	3	1	0	4
C	P	A		L	T	P	H
4	0	0		3	1	0	4
PREREQUISITE			**Basic Computer Knowledge**				

Objective:

1. introduce a useful scripting language
2. learn how to work with various data formats within Python
3. teach how to use lists, tuples and dictionaries in Python programs

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	Explain the overview of python.	Cognitive	Understanding
CO 2	Make use of Control Statements & Functions.	Cognitive	Applying
CO 3	Explain Strings and Lists.	Cognitive	Understanding
CO 4	Create Graphs with Matplotlib – Plotting with Formulas.	Cognitive	Creating
CO 5	Describe Data with Statistics and Algebra and Symbolic Math with SymPy.	Cognitive	Understanding

UNIT I	**Introduction to Python**	**9 + 3**
Introduction – Python Overview – Getting Started with Python –Comments – Python Identifiers – Reserved Keywords – Variables – Standard Data Types-Operators: Types of Operators - Statement and Expressions – String Operations.		
UNIT 2	**Control Statements & Functions**	**9 + 3**
Iteration While Statement – Input from Keyboard. Function's introduction – Built-in Functions – Composition of Functions – User defined Functions - Parameters and Arguments –Function Calls- The return statement – Python Recursive Functions.		
UNIT 3	**Strings and Lists**	**9 + 3**
Introduction about Strings and Lists- Strings - Lists. Tuples and Dictionaries: Tuples – Dictionaries.		
UNIT 4	**Visualizing Data with Graphs**	**9 + 3**
Understanding the Cartesian Coordinate Plane – Working with List and Tuples – Creating Graphs with Matplotlib – Plotting with Formulas.		
UNIT 5	**Describing Data with Statistics and Algebra and Symbolic Math with SymPy**	**9 + 3**
Finding the Mean – Finding the Median – Finding the Mode and Creating a Frequency Table. Defining Symbols and Symbolic.		

LECTURE	45	TUTORIAL	15	PRACTICAL	0	TOTAL	60

Text Book:

1. E.Balagurusamy,“IntroductiontoComputingandProblem-SolvingUsing Python”, McGraw-Hill Education (India) Private Limited, 1st edition(2017).

2. AmitSaha,“DoingMathwithPython”,1stedition,nostarchpress.

Unit	Text Book	Chapter	Sections
I	1	3	3.1-3.11Pg.no.(36-64)
II	1	3 4	3.13-3.15Pg.no.(65-74) 4.1-4.8Pg.no.(82-98)
III	1	5 6	5.1-5.2Pg.no.(112-132) 6.1-6.2Pg.no.(148-166)
IV	2	2	Pg.no.(43-73)
V	2	3 4	Pg.no.(82-93) Pg.no.(117-139)

References:

1. FabioNelli,” PythonDataAnalytics”,Apress,SecondEdition. (2018)
2. H.P.Langtangen,“APrimeronScientificProgrammingwithPython”,Secondedition,Springer, 2016.
3. Ashok Namdev Kamthane, Amit Ashok Kamthane, “Programming and ProblemSolvingwithPython”,McGraw-HillEducation(India)PrivateLimited,Seconedition(2017).
4. ThomasNield,“Essential MathforData Science”, O’ReillyMedia (2022).

Website and e-Learning Source

1. https://fangohr.github.io/python/book/Introduction-to-Python-for-Computational-Science-and-Engineering.pdf
2. https://sites.google.com/a/aicte-india.org/swayamrepo/big-data-analytics-for-smart-grid
3. https://youtu.be/sbGO9l83Ewg
4. https://wesmckinney.com/book/plotting-and-visualization.html

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2
CO 1	3	2	1	0	0	2	2	2	3	2	0
CO 2	3	3	2	0	1	3	3	3	3	3	0
CO 3	3	2	1	0	0	2	2	2	3	2	0
CO 4	3	3	3	3	3	3	3	3	3	3	3

CO 5	3	2	1	0	0	2	2	2	3	2	0
TOTAL	15	12	8	3	4	12	12	12	15	12	3
SCALED VALUE	3	3	2	1	1	3	3	3	3	3	1
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											
1-5→1, 6-10→2, 11-15→3											

Course Name			**DATA ANALYSIS USING SPSS**	**L**	**T**	**P**	**C**
Course Code			**YMA2E2A**	**3**	**1**	**0**	**4**
C	**P**	**A**		**L**	**T**	**P**	**H**
4	**0**	**0**		**3**	**1**	**0**	**4**
PREREQUISITE			Probability and Statistics				

Objective:

The objective of this course is to teach how to explore, analyze, and understand data and how the software SPSS (Statistical Package for the Social Sciences) is used.

COURSE OUTCOMES	**DOMAIN**	**LEVEL**

CO 1	**Explain** basic concepts of SPSS, working with the Data Editor and Plotting of Charts using Bar and Pie diagram.	Cognitive	Understanding
CO 2	**Explain** measures of central tendencies and measures of dispersion using SPSS.	Understanding	Understanding
CO 3	**Utilize** concept of testing hypothesis for finding significance level for the given data using one sample t-test, independent sample t-test and paired t-test in SPSS.	Cognitive	Applying
CO 4	**Apply** One-way ANOVA, two-way ANOVA and Chi-square test for the given data in SPSS.	Cognitive	Applying
CO 5	**Compare** the relationship for the data using methods of correlation and regression in SPSS.	Cognitive	Applying

UNIT I **9 + 3**

Introduction to SPSS – Starting SPSS – SPSS Main Menus – Working with the Data Editor – SPSS Viewer – Importing and Exporting data. Plotting of Charts: Simple Bar diagram, Multiple Bar Diagram and Pie Diagram.

UNIT 2 **9 + 3**

Descriptive Statistics and Frequencies using SPSS. Measures of central tendencies: Arithmetic mean, Median, Mode, Geometric mean and Harmonic Mean. Measures of Dispersion: Range, inter quartile range, Mean Deviation and Standard deviation. Measures of Skewness and Kurtosis.

UNIT 3 **9 + 3**

Testing of Hypothesis: Type I error and Type II Errors – Concept of p values – Basic Concepts of One Sample t-test, Independent Samples t-test, Paired samples t-test using SPSS with interpretation.

UNIT 4 **9 + 3**

Analysis of Variance: Basic concepts of ANOVA – One Way and Two-Way ANOVA using SPSS with interpretation. Chi-square Test for Independence of attributes using SPSS.

UNIT 5 **9 + 3**

Correlation: Karl Pearson's coefficient of Correlation – Spearman's Rank correlation – Simple linear Regression using SPSS with interpretation.

LECTURE	45	TUTORIAL	15	PRACTICAL	0	TOTAL	60

Text Book:

1. Ajai J Gaur and Sanjay S. Gaur (2008): Statistical Methods for Practice and Research: A guide to data analysis using SPSS, First Edition, Sage Publications.

References:

3. Andy Field. (2011); Discovering Statistics Using SPSS, Sage Publications.

4. Hinton P R, Brownlow C, McMurray,I. and Cozens, B. (2004) SPSS Explained, Routledge

Website and e-Learning Source : ; https://nptel.ac.in

COs VS POs										
	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**
CO 1	3	2	1	0	0	2	2	2	3	2	0
CO 2	3	2	1	0	0	2	2	2	3	2	0
CO 3	3	3	2	0	1	3	3	3	3	3	0
CO 4	3	3	2	0	1	3	3	3	3	3	0
CO 5	3	3	2	0	1	3	3	3	3	3	0
TOTAL	15	13	8	0	3	13	13	13	15	13	0
SCALED VALUE	3	**3**	**2**	0	1	3	3	3	3	3	0
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											
1-5→1, 6-10→2, 11-15→3											

Course Name			**NUMERICAL METHODS PRACTICAL USING MAT LAB**	**L**	**T**	**P**	**C**
Course Code			**YMA2E2B**	**2**	**0**	**2**	**4**
C	**P**	**A**		**L**	**T**	**P**	**H**
4	**0**	**0**		**3**	**1**	**0**	**4**

PREREQUISITE	Working knowledge of some basic application software (Excel). Basic knowledge of computer programming and an understanding of matrix and linear algebra are highly beneficial.

Objective:

1. Understanding the MATLAB environment
2. Being able to do simple calculations using MATLAB

3. Being able to carry out simple numerical computations and analyses using MATLAB

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	Understand the main features of the MATLAB development environment.	Cognitive, Psychomotor Affective	Understanding Guided Response Responding
CO 2	Use the MATLAB GUI effectively.	Cognitive Psychomotor	Understanding Guided Response Responding
CO 3	Design simple algorithms to solve problems.	Cognitive Psychomotor Affective	Applying Guided Response Responding
CO 4	Write simple programs in MATLAB to solve scientific and mathematical problems.	Cognitive Psychomotor Affective	Applying Guided Response Responding
CO 5	Graphical representations and tips for designing and implementing MATLAB code.	Cognitive Psychomotor Affective	Applying Guided Response Responding

THEORY	**30**
MATLAB basics, The MATLAB environment, Basic computer programming Variables and constants, operators and simple calculations, Formulas and functions, MATLAB toolboxes, Matrix and linear algebra review, Vectors and matrices in MATLAB, Matrix operations and functions in MATLAB Reading and writing data, file handling, Personalized functions, Toolbox structure, MATLAB graphic functions.	

EXPERIMENTS	**30**
1. Study of Introduction to MATLAB 2. Study of basic matrix operations 3. To solve linear equation 4. Solution of Linear equations for Underdetermined and over determined cases. 5. Determination of Eigen values and Eigen vectors of a square matrix. 6. Solution of Difference Equations. 7. Solution of Difference Equations using Euler Method. 8. Solution of differential equation using 4th order Runge- Kutta method. 9. Determination of roots of a polynomial. 10. Determination of polynomial using method of Least Square Curve Fitting. 11. Determination of polynomial fit, analyzing residuals, exponential fit and error bounds from the given data.	

LECTURE	**30**	**TUTORIAL**	**0**	**PRACTICAL**	**30**	**TOTAL**	**60**

Text Book:
1. Amos Gilat 'MATLAB, An Introduction with Applications',3rd edition, Wiely publishers,2008 2.Stephen J. Chapman' MATLAB Programming for Engineers' 5th edition, Cengauge learninb,2016 3.Holly Moore 'MATLAB for Engineers', 5th edition, Pearson, 2012
References: 1. "IntroductionToMatlabforEngineeringStudents",DavidHoucqueNorthwestern University,(version 1.2, August 2005) 2. "GettingStartedwithMATLAB–AQuickIntroductionforScientistsandEngineers"by R.Pratap,OxfordUniversityPress,NewDelhi,2010. **3.** "Introduction toMATLAB®forEngineers",WilliamJ.PalmIII,UniversityofRhodeIsland,McGraw Hill, ThirdEdition, 2011.
Website and e-Learning Source 1. https://nptel.ac.in/courses/122106033 2. https://www.youtube.com/watch?v=83S48Fs9WhY 3. https://archive.nptel.ac.in/courses/103/106/103106118/ 4. https://www.youtube.com/watch?v=qpZUQTjFk6Q

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO 1	PSO2
CO 1	3	2	1	0	0	2	2	2	3	2	0
CO 2	3	2	1	0	0	2	2	2	3	2	0
CO 3	3	3	2	0	1	3	3	3	3	3	0
CO 4	3	3	2	0	1	3	3	3	3	3	0
CO 5	3	3	2	0	1	3	3	3	3	3	0
TOTAL	15	14	8	0	3	14	14	14	15	14	0
SCALED VALUE	3	3	2	0	1	3	3	3	3	3	0

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

1-5→1, 6-10→2, 11-15→3

Course Name			**DATA ANALYTICS PRACTICAL WITH PYTHON**	**L**	**T**	**P**	**C**
Course Code			**YMA2E2C**	**2**	**0**	**2**	**4**
C	**P**	**A**		**L**	**T**	**P**	**H**
4	**0**	**0**		**2**	**0**	**2**	**4**
PREREQUISITE			**Basic knowledge of programming, statistics & mathematics**				
Objective:							

Learning Objectives

- Learn the implementation of basics of Python and text pre-processing
- Learn the implementation of classification and clustering algorithms
- Learn the implementation of visualization

	COURSE OUTCOMES	DOMAIN	LEVEL
CO 1	**Demonstrate** the basics of python for performing data analysis.	Cognitive	Apply
CO 2	**Demonstrate** the use of text preprocessing, regression.	Cognitive	Apply
CO 3	**Demonstrate** the use of classification algorithms.	Cognitive	Apply

UNIT I		**9**

Introduction to Data Understanding and Preprocessing Knowledge domains of Data Analysis, understanding structured and unstructured data, Data Analysis process, Dataset generation, Importing Dataset: Importing and Exporting Data, Basic Insights from Datasets, Cleaning and Preparing the Data: Identify and Handle Missing Values.

UNIT 2		**12**

Introduction to machine learning- Supervised and Unsupervised Learning, Model development using Linear Regression, Model Visualization, Prediction and Decision Making, Model Evaluation: Over-fitting, Under-fitting and Model Selection.

UNIT 3		**9**

Data Processing and Visualization Data Formatting, Exploratory Data Analysis, Filtering and hierarchical indexing using Pandas. Data Visualization: Basic Visualization Tools, Specialized Visualization Tools, Seaborn Creating and Plotting Maps.

S. No.	**List of Experiments**	**Course Outcome**	**30**
1.	Write a program to Implement Text Pre-processing with TF-IDF	CO1	
2.	Write a program to Implement Linear and Logistics regression	CO1	
3.	Write a program to Implement Decision Tree Classification	CO2	
4.	Write a program to Implement Naïve Bayes Classification	CO2	
5.	Write a program to Implement Principal Component Analysis	CO2	
6.	Write a program to Implement K-Means Clustering	CO2	
7.	Introduction to Matplotlib, Seaborn Packages in Python	CO3	

LECTURE	**30**	**TUTORIAL**	**0**	**PRACTICAL**	**30**	**TOTAL**	**60**

Text Books: 1. E. Balagurusamy, "Introduction to Computing and Problem-Solving using Python ", McGraw-Hill Education (India) Private Limited, 1st edition (2017). **2.** Thomas Nield, "Essential Math for Data Science", O'Reilly Media (2022).
References: **1.** Fabio Nelli," Python Data Analytics", A press, Second Edition. **2.** H. P. Langtangen, "A Primer on Scientific Programming with Python", Second edition, Springer, 2016. **3.** Ashok Namdev Kamthane, , Amit Ashok Kamthane, "Programming and Problem Solving with Python", McGraw-Hill Education (India) Private Limited, Second edition (2017).
Website and e-Learning Source **1. https://www.packtpub.com/product/python-data-analytics-and-visualization/9781788290098** **2. https://youtu.be/oCoQm7Ro_ME** **3. https://in.docs.wps.com/module/common/loadPlatform/?sid=sIFmo8KshhLiAoAY**

COs VS POs

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**
CO 1	3	3	2	0	1	3	3	3	3	3	0
CO 1	3	3	2	0	1	3	3	3	3	3	0
CO 2	3	3	2	0	1	3	3	3	3	3	0
CO 2	3	3	2	0	1	3	3	3	3	3	0
CO 3	3	3	2	0	1	3	3	3	3	3	0
TOTAL	15	15	10	0	5	15	15	15	15	15	0
SCALED VALUE	3	3	**2**	0	1	3	3	3	3	3	0

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

1-5→1, 6-10→2, 11-15→3

Course Name			**TOPOLOGY**	**L**	**T**	**P**	**C**
Course Code			**YMA301**	**4**	**1**	**0**	**5**
C	**P**	**A**		**L**	**T**	**P**	**H**
5	**0**	**0**		**4**	**1**	**0**	**5**
PREREQUISITE			**Basic knowledge of set theory, and its operations**				
Objective:							

To studytopologicalspaces,continuousfunctions,connectedness,compactness,countabilityandseparationaxioms.

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Define** the concept of topological spaces and the basicdefinitionsofopensets,neighborhood,interior,exterior,closureand theiraxiomsfordefiningtopologicalspace with example.	Cognitive	Remembering
CO 2	**Demonstrate** the concepts ofcontinuity,compactness,connectedness,homeomorphismandtopologicalproperties.	Cognitive	Understanding
CO 3	**Demonstrate** the concept of connectedness and components.	Cognitive	Understanding
CO 4	**Explain**thatagivenpointinatopologicalspaceiseitheralimitpointor notforagivensubsetofatopologicalspace.	Cognitive	Understanding
CO 5	**Illustrate** the concepts of separation axioms and its theorems.	Cognitive	Understanding

UNIT I	**Topological spaces**	**12 + 3**
Topological spaces – Basis for a topology – The order topology – The product topology on X x Y – The subspace topology – Closed sets and limit points.		
UNIT 2	**Continuous functions**	**12 + 3**
Continuous functions – The product topology – The metric topology - The Quotient topology.		
UNIT 3	**Connectedness**	**12 + 3**
Connected spaces- Connected subspaces of the Real line – Components and local connectedness.		
UNIT 4	**Compactness**	**12 + 3**
Compact spaces – Compact subspaces of the Real line – Limit Point Compactness – Local Compactness.		
UNIT 5	**Countability and Separation Axiom**	**12 + 3**
The Countability Axioms – The separation Axioms – Normal spaces – The Urysohn's Lemma – The Urysohn'smetrization Theorem – The Tietz extension theorem.		

LECTURE	**60**	**TUTORIAL**	**15**	**PRACTICAL**	**0**	**TOTAL**	**75**

Text Book:
James R. Munkres, Topology (2nd Edition) Pearson Education Pve. Ltd., Delhi-2002(Third Indian Reprint)

Unit	Chapter	Sections
I	2	Sections2.1 – 2.6
II	2	Sections2.7– 2.9
III	3	Sections3.1– 3.4
IV	3	Sections3.5– 3.8
V	4	Sections4.1– 4.4

References:

1. J.Dugundji,Topology,Prentice HallofIndia,NewDelhi,1975.
2. George F.Sinmons, Introduction to Topology and Modern Analysis, McGrawHillBook Co., 1963
3. J.L. Kelly,GeneralTopology,VanNostrand,ReinholdCo.,NewYork (2018)
4. L.Steen and J.Subhash, Counter Examples in Topology, Holt, Rinehart andWinston,NewYork, 1970.
5. S.Willard,GeneralTopology,Addison-Wesley,Mass.,1970

Website and e-Learning Source

1. http://mathforum.org,
2. http://ocw.mit.edu/ocwweb/Mathematics,
3. http://www.opensource.org,
4. http://en.wikipedia.org

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2
CO 1	2	**1**	**0**	0	0	1	1	1	2	1	0
CO 2	3	**2**	**1**	0	0	2	2	2	3	2	0
CO 3	3	**2**	**1**	0	0	2	2	2	3	2	0
CO 4	3	**2**	**1**	0	0	2	2	2	3	2	0
CO 5	3	**2**	**1**	0	0	2	2	2	3	2	0
TOTAL	14	**9**	**4**	0	0	9	9	9	13	9	0
SCALED VALUE	3	**2**	**1**	0	0	2	2	2	3	2	0

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

1-5→1, 6-10→2, 11-15→3

Course Name			**MEASURE THEORY AND INTEGRATION**	**L**	**T**	**P**	**C**
Course Code			**YMA302**	**4**	**1**	**0**	**5**
C	**P**	**A**		**L**	**T**	**P**	**H**
5	**0**	**0**		**4**	**1**	**0**	**5**
PREREQUISITE			**KnowledgeinAnalysis**				
Objective:							

1.To generalize the concept of integration using measures.
2. To develop the concept o f analysis in abstract situations.

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Define** the concept of Lebesgue measure, Measurable functions.	Cognitive	Remembering
CO 2	**Demonstrate**the concept of series of integration, Riemann and Lebesgue integration.	Cognitive	Understanding
CO 3	**Summarize** the measures and integration of measures.	Cognitive	Understanding
CO 4	**Explain** the concept of convergence and product measure.	Cognitive	Understanding
CO 5	**Illustrate** the concepts of completeness and approximation in LP spaces.	Cognitive	Understanding

UNIT I	**Measure on Real line**	**12 + 3**
Lebesgue outer measure - Measurable sets - Regularity - Measurable function - Borel and Lebesgue measurability.		
UNIT 2	**Integration of non-negative functions**	**12 + 3**
The General integral - Integration of series - Riemann and Lebesgue integrals.		
UNIT 3	**Abstract Measure spaces**	**12 + 3**
Measures and outer measures - Completion of measures - Measure spaces - Integration with respect to a measure.		
UNIT 4	**Convergence in Measure**	**12 + 3**
Almost uniform convergence- Signed Measures and Halin Decomposition –The Jordan Decomposition – Measurability in a Product space – The product Measure and Fubini's Theorem.		
UNIT 5	**The Classical Banach spaces**	**12 + 3**
LP spaces – Minkowski and Holder’s inequality – Completeness – Approximation in LP spaces.		

LECTURE	**60**	**TUTORIAL**	**15**	**PRACTICAL**	**0**	**TOTAL**	**75**

Text Book:

H. L. Royden, Real Analysis, 3rd Edition, PHI Ltd. (1988).

UNIT – I Chapter II: Sec 2.1 to 2.5 of (1)

UNIT – II Chapter III: Sec 3.1 to 3.4 of (1)

UNIT – III Chapter V: Sec 5.1 to 5.6 of (1)

UNIT – IV Chapter VII: Sec 7.1, 7.2 Chapter VIII: Sec 8.1, 8.2 Chapter X: Sec 10.1,10.2 of (1)

UNIT – V Chapter VI: Sec 6.1 to 6.4 of (2)

References:

1.G. De Barra, Measure Theory and Integration, New age international (p) Limited.
2.M.E. Munroe, Measure and Integration, by Addison - Wesley Publishing Company, Second Edition, 1971.
3. P.K. Jain, V.P. Gupta, Lebesgue Measure and Integration, New Age International Pvt Limited Publishers, New Delhi, 1986, Reprint 2000.
4. Richard L. Wheeden and Antoni Zygmund, Measure and Integral: An Introduction to Real Analysis, Marcel Dekker Inc. 1977
5. Inder, K. Rana, An Introduction to Measure and Integration, Narosa Publishing House, New Delhi, 1997.

Website and e-Learning Source

1. https://www.youtube.com/watch?v=83S48Fs9WhY
2. https://archive.nptel.ac.in/courses/103/106/103106118/

COs VS Pos

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2
CO 1	2	**1**	**0**	0	0	**1**	**1**	**1**	2	**1**	0
CO 2	3	**2**	**1**	0	0	**2**	**2**	**2**	3	**2**	0
CO 3	3	**2**	**1**	0	0	**2**	**2**	**2**	3	**2**	0
CO 4	3	**2**	**1**	0	0	**2**	**2**	**2**	3	**2**	0
CO 5	3	**2**	**1**	0	0	**2**	**2**	**2**	3	**2**	0
TOTAL	14	**9**	**4**	0	0	**9**	**9**	**9**	14	**9**	0
SCALED VALUE	3	**2**	**1**	0	0	2	2	2	3	2	0

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

1-5→1, 6-10→2, 11-15→3

Course Name			FUNCTIONAL ANALYSIS	L	T	P	C
Course Code			YMA303	4	1	0	5
C	P	A		L	T	P	H
5	0	0		4	1	0	5
PREREQUISITE			Linearspaces–Bases–Lineartransformations and Metricspaces–Completeness–Compactness–Continuousfunctions.				

Objective:

1. To introduce Banach spaces and Hilbert spaces– To study fundamental theorems of functional analysis that includes Hahn Banach theorem, Open mapping theorem and Uniform boundedness principle.
2. To introduce operator theory and Banach algebras leading to the spectral theory of operators.

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Define** the concept of Normal spaces, properties and theorems.	Cognitive	Remembering
CO 2	**Demonstrate** the concept of convergence, uniform boundedness and theorems.	Cognitive	Understanding
CO 3	**Explain** the concepts of Hilbert space and its properties	Cognitive	Understanding
CO 4	**Summarize** the concept of Normal and Unitary operators and the difference between operators.	Cognitive	Understanding
CO 5	**Illustrate** the concept of Banach Algebras.	Cognitive	Understanding

UNIT I	**NORMED SPACES**	**12 + 3**
Normed spaces - Banach spaces and further properties - Heine-Borel theorem - Riesz lemma – Continuous linear transformation – Hahn Banach theorem and its consequences.		
UNIT 2	**FUNDAMENTAL THEOREMS**	**12 + 3**
Dual spaces - Dual of some well known spaces – Strong and weak convergence - The natural embedding of N in N** - Uniform boundedness principle – Open mapping theorem – Closed graph theorem – The conjugate of an operator.		
UNIT 3	**HILBERT SPACES**	**12 + 3**
Hilbert space: Definition and properties – Orthogonal complements and direct sums – Orthonormal sets and sequences – Series related to orthonormal sets and sequences – Maximal orthonormal sets and sequences – Projection theorem – Representation of functionals on Hilbert spaces.		
UNIT 4	**OPERATORS ON HILBERT SPACES**	**12 + 3**
The adjoint of an operator – Self adjoint operator - Normal and Unitary operators – Projections - The spectrum of bounded operator - Spectral theorem for normal and self-adjoint operator.		
UNIT 5	**BANACH ALGEBRAS**	**12 + 3**
Introduction to Banach Algebras: Definition, Examples and some related basic results – Regular and singular		

elements – The spectrum – The formula for the spectral radius.							
LECTURE	**60**	**TUTORIAL**	**15**	**PRACTICAL**	**0**	**TOTAL**	**75**

Text Book:

1. G. F. Simmons, Introduction to Topology and Modern Analysis, Tata McGraw-Hill, 1963.

References:

1. E.Kreyszig,IntroductoryFunctionalAnalysiswithApplications,JohnWiley&sons,1978.
2. G.BachmanandLawrenceNarici,FunctionalAnalysis,DoverPublications,2000.
3. H.C.GoffmanandG.Fedrick,FirstcourseinFunctionalAnalysis,PrenticeHallofIndia,NewDelhi,1987.
4. A.E.TaylorandD.C.Lay,IntroductiontoFunctionalAnalysis,secondedition, JohnWiley&Sons,1980.
5. B.Bollabas,LinearAnalysis-Anintroductorycourse,CambridgeUniversityPress(Indianedition),1999.
6. B.V.Limaye,FunctionalAnalysis,RevisedThirdEdition,NewAgeInternational, 2017.
7. M.ThambanNair,FunctionalAnalysis-AFirstCourse,PrenticeHallofIndia,2010.
8. S. Ponnusamy, Foundations of Functional Analysis, NarosaPublishingHouse,2002.
9. S.Kesavan,FunctionalAnalysis,TRIMseries,HindustanBookAgency,NewDelhi,2009.
10. RajendraBhatia,LecturesonFunctionalAnalysis,TRIMseries,HindustanBook Agency,NewDelhi,2009.

Website and e-Learning Source:

1. http://mathforum.org,
2. http://ocw.mit.edu/ocwweb/Mathematics,
3. http://www.opensource.org,
4. http://en.wikiepedia.org

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2
CO 1	2	**1**	**0**	0	0	**1**	**1**	**1**	2	**1**	0
CO 2	3	**2**	**1**	0	0	**2**	**2**	**2**	3	**2**	0
CO 3	3	**2**	**1**	0	0	**2**	**2**	**2**	3	**2**	0
CO 4	3	**2**	**1**	0	0	**2**	**2**	**2**	3	**2**	0

CO 5	3	**2**	**1**	0	0	**2**	**2**	**2**	3	**2**	0
TOTAL	14	**9**	**4**	0	0	**9**	**9**	**9**	14	**9**	0
SCALED VALUE	3	**2**	**1**	0	0	2	2	2	3	2	0
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											
1-5→1, 6-10→2, 11-15→3											

Course Name			**DIFFERENTIAL GEOMETRY**	**L**	**T**	**P**	**C**
Course Code			**YMA304**	**4**	**1**	**0**	**5**
C	**P**	**A**		**L**	**T**	**P**	**H**
5	**0**	**0**		**4**	**1**	**0**	**5**
PREREQUISITE			Basic knowledge about Multivariable Calculus and Linear Algebra.				

Objective:
This course gives students basic knowledge of classical differential geometry of curves and surfaces such as the catenary, the tractrix, the cycloid and the surfaces of constant Gaussian curvature and minimal surfaces.

COURSE OUTCOMES		**DOMAIN**	**LEVEL**
CO 1	**Define** the concept of curvature, torsion and involute.	Cognitive	Remembering
CO 2	**Explain**the concept of helicoids and isometric correspondence.	Cognitive	Understanding
CO 3	**Explain** the Normal property of geodesics, Gaussian curvature.	Cognitive	Understanding
CO 4	**Summarize** the concept of lines of curvature and space curves.	Cognitive	Understanding
CO 5	**Illustrate** the concept of Compact surfaces and their characterization.	Cognitive	Understanding

UNIT I	**Space curves**	**12 + 3**
Definition of a space curve – Arc length – Tangent – Normal and binormal – Curvature and torsion – Contact between curves and surfaces – Tangent surface – Involutes and evolutes – Intrinsic equations – Fundamental existence theorem for space curves – Helics.		
UNIT 2	**Intrinsic properties of a surface**	**12 + 3**
Definition of a surface – Curves on a surface – Surface of revolution – Helicoids – Metric – Direction coefficients – Families of curves – Isometric correspondence – Intrinsic properties.		
UNIT 3	**GEODESICS**	**12 + 3**
Geodesics – Canonical geodesic equations – Normal property of geodesics-Existence theorems – Geodesic parallels – Geodesics curvature- Gauss- Bonnet Theorem – Gaussian curvature – Surface of constant curvature.		

UNIT 4	Non-intrinsic properties of a surface	12 + 3

The second fundamental form – Principal curvature – Lines of curvature -Developable - Developable associated with space curves and with curves on surface – Minimal surfaces – Ruled surfaces.

UNIT 5	Differential geometry of surfaces	12 + 3

Compact surfaces whose points are umblics – Hilbert's lemma – Compact surface of constant curvature – Complete surface and their characterization – Hilbert's Theorem – Conjugate points on geodesics.

LECTURE	60	TUTORIAL	15	PRACTICAL	0	TOTAL	75

Text Book:

T.J. Willmore, An Introduction to Differential Geometry, Oxford UniversityPress, (17^{th}Impression) NewDelhi 2002.(Indian Print)

Unit	Chapter	Sections
I	I	Sections1 to 9.
II	II	Sections1 to 9.
III	II	Sections10 to 17.
IV	III	Sections1 to 8.
V	IV	Sections1 to 8.

References:

1. Struik, D.T.Lectures on Classical Differential Geometry, Addison–Wesley,Mass.1950.
2. Kobayashi.S.andNomizu.K.FoundationsofDifferentialGeometry,IntersciencePublishers,1963.
3. Wilhelm Klingenberg: A course in Differential Geometry, Graduate Texts inMathematics,Springer-Verlag1978.
4. J.A. Thorpe Elementary topics in Differential Geometry, Under- graduate Texts inMathematics,Springer-Verlag1979.

Website and e-Learning Source

http://mathforum.org,http://ocw.mit.edu/ocwweb/Mathematics, http://www.opensource.org,www.physicsforum.com

COs VS POs											
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2

CO 1	2	**1**	**0**	0	0	**1**	**1**	**1**	2	**1**	0
CO 2	3	**2**	**1**	0	0	**2**	**2**	**2**	3	**2**	0
CO 3	3	**2**	**1**	0	0	**2**	**2**	**2**	3	**2**	0
CO 4	3	**2**	**1**	0	0	**2**	**2**	**2**	3	**2**	0
CO 5	3	**2**	**1**	0	0	**2**	**2**	**2**	3	**2**	0
TOTAL	14	**9**	**4**	0	0	**9**	**9**	**9**	14	**9**	0
SCALED VALUE	3	**2**	**1**	0	0	2	2	2	3	2	0
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											
1-5→1, 6-10→2, 11-15→3											

Course Name			MATHEMATICS OF FINANCE AND INSURANCE	L	T	P	C
Course Code			YMA305	3	1	0	4
C	P	A		L	T	P	H
4	0	0		3	1	0	4
PREREQUISITE			The objective of the course is to educate the basic skills and knowledge about insurance and banking.				

Objective:
The focus is on mathematical theory and modelling, drawing from the disciplines of Geometric Brownian Motion as a Limit of Simpler Models, Relations between Interest Rates and Present Value Analysis, Value at Risk and Conditional Value at Risk and to develop models for Stochastic Order Relations and Pricing Approximations via Multiperiod Binomial Models.

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Define** Brownian Motion and Geometric Brownian Motion and Interest Rates - Present value analysis.	Cognitive	Remembering
CO 2	**Explain**the concept of the arbitrage theorem and the black–scholes formula.	Cognitive	Applying
CO 3	**Analyze** the value at risk and conditional value at risk	Cognitive	Analyzing
CO 4	**Explain the** stochastic order relations.	Cognitive	Understanding
CO 5	**Compare** the concept of monte carlo simulation and multiperiod binomial models.	Cognitive	Applying

UNIT I		9 + 3
Brownian Motion and Geometric Brownian Motion: Brownian Motion - Brownian Motion as a Limit of Simpler Models - Geometric Brownian Motion - Geometric Brownian Motion as a Limit of Simpler Models - The Maximum Variable - The Cameron-Martin Theorem. **Interest Rates and Present Value Analysis:** Interest Rates - Present Value Analysis - Rate of Return - Continuously Varying Interest Rates.		
UNIT 2		9 + 3
The Arbitrage Theorem: The Arbitrage Theorem - The Multiperiod Binomial Model - Proof of the Arbitrage Theorem. **The Black–Scholes Formula**: Introduction - The Black–Scholes Formula - Properties of the Black–Scholes Option Cost - The Delta Hedging Arbitrage Strategy - Some Derivations - The Black–Scholes Formula - The Partial Derivatives.		
UNIT 3		9 + 3
Valuing by Expected Utility: Limitations of Arbitrage Pricing - Valuing Investments by Expected Utility - The Portfolio Selection Problem - Estimating Covariances - Value at Risk and Conditional Value at Risk - The Capital Assets Pricing Model - Rates of Return: Single-Period and Geometric Brownian Motion.		
UNIT 4		9 + 3
Stochastic Order Relations: First-Order Stochastic Dominance - Using Coupling to Show Stochastic Dominance - Likelihood Ratio Ordering - A Single Period Investment Problem – Second Order Dominance - Normal Random Variables - More on Second Order Dominance.		
UNIT 5		9 + 3

Exotic Options: Introduction - Barrier Options - Asian and Lookback Options - Monte Carlo Simulation - Pricing Exotic Options by Simulation - More Efficient Simulation Estimators - Options with Nonlinear Payoffs - Pricing Approximations via Multiperiod Binomial Models - Continuous Time Approximations of Barrier and Lookback Options.

LECTURE	45	TUTORIAL	15	PRACTICAL	0	TOTAL	60

Text Book:

1.SheldonM.Ross,"AnElementaryIntroductiontoMathematicalFinance",ThirdEdition ,Universityof Southern California,CambridgeUniversityPress, 2011.

Unit	Chapter	Sections
I	3 & 4	Sections3.1 – 3.5(Pages34–46) & Sections4.1–4.4(Pages48-67)
II	6 & 7	Sections6.1 –6.3(Pages92 -101)& Sections7.1 -7.6(Pages106 –127)
III	9	Sections9.1 – 9.6(Pages165–189)
IV	10	Sections10.1–10.5(Pages193 -210)
V	13	Sections13.1 – 13.9(Pages247–262)

References:

1. SalihN.Nettci,AnintroductiontotheMathematicsofFinancialDerivatives,Academic Press, Inc.(1996)
2. Robert J.Ellicott and P.Ekkehardkopp, Mathematics of Financial Markets, Springer-Verlag,NewYork
3. JohnC.Hull,Options, FuturesandOtherDerivatives,PrenticeHallofIndiaPrivateLimited

Website and e-Learning Source

1. https://archive.nptel.ac.in/courses/111/103/111103126/
2. https://www.youtube.com/watch?v=CffjpwKc_X4
3. https://www.youtube.com/watch?v=lzMQ3hZqtp0

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2
CO 1	2	**1**	**0**	0	0	1	1	1	2	1	0
CO 2	3	**3**	**2**	0	1	3	3	3	3	3	0
CO 3	3	**3**	**3**	1	2	3	3	3	3	3	1
CO 4	3	**2**	**1**	0	0	2	2	2	3	2	0
CO 5	3	**3**	**2**	0	1	3	3	3	3	3	0
TOTAL	14	**12**	**8**	1	4	12	12	12	14	12	1

SCALED VALUE	3	**3**	**2**	1	1	3	3	3	3	3	1
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											
1-5→1, 6-10→2, 11-15→3											

Course Name			**FLUID DYNAMICS**	**L**	**T**	**P**	**C**
Course Code			**YMA3E1A**	**3**	**1**	**0**	**4**
C	**P**	**A**		**L**	**T**	**P**	**H**
4	**0**	**0**		**3**	**1**	**0**	**4**
PREREQUISITE			Basic knowledge of to know calculus up to partial differential equations and vector calculus				

Objective:

- To establish an understanding of the fundamental concepts of fluid dynamics
- To make students understand the importance of fluid dynamics in diverse real-life applications
- To build the necessary theoretical background for solving a variety of problems

COURSE OUTCOMES		**DOMAIN**	**LEVEL**
CO 1	**Explain** Bernoulli's theorem , equation of continuity.	Cognitive	Remembering
CO 2	**Explain** the concept of Euler's equation , Kelvin's theorem.	Cognitive	Applying
CO 3	**Explain** the circle theorem, Blasius's theorem-lift force.	Cognitive	Analyzing
CO 4	**Explain** theLaplace equation and demonstrate pressure distribution.	Cognitive	Understanding
CO 5	**Explain** the concept Navier-Stokes equations and Couette and plane Poiseuille flow.	Cognitive	Applying

UNIT I	**Introductory ideas**	**9 + 3**
Quantities like velocity, density, pressure, etc.streamlines and pathlines - stream tubes and filaments – fluid body - Bernoulli's theorem - differentiation w.r.to time - equation of continuity – transport theorem - boundary conditions - rate of change of linear momentum.		
UNIT 2	**Inviscid theory**	**9 + 3**
Euler's equation - conservative forces - Lagrangian form of the equation of motion - steady motion - energy equation - rate of change of circulation – Kelvin's theorem - vortex motion and its permanence.		
UNIT 3	**Two-dimensional motion**	**9 + 3**
Examples – stream function and velocity potential - complex potentials and flows – the singularities source, doublet and vortex - mixed flow - method of images - circle theorem - flow past a circular cylinder with circulation – Blasius's theorem-lift force.		
UNIT 4	**Irrotational motion in three dimensions**	**9 + 3**

Laplace equation – spherical harmonics – axially symmetric field – Stoke's stream function – motion of a sphere – pressure distribution – drag force – axial distributions of sources and doublets – continuous distributions – flow near axis due to sources and doublets.		
UNIT 5	**Viscous theory**	**9+ 3**
The Navier-Stokes equations - vorticity and circulation in a viscous fluid – some exact solutions – steady flow through an arbitrary cylinder with pressure – steady Couette flow between cylinders in relative motion – steady flow between parallel planes - Couette and plane Poiseuille flow.		

LECTURE	**45**	**TUTORIAL**	**15**	**PRACTICAL**	**0**	**TOTAL**	**60**

Text Book:

1. F. Chorlton, Textbook of Fluid Dynamics, CBS Publishers, New Delhi, 2004

References:

1. L.M. Milne Thomson, Theoretical Hydrodynamics, Dover, 1996.
2. N. Curle and H.J. Davies, Modern Fluid Dynamics, D Van Nostrand Company Ltd., London, 1968.
3. S.W. Yuan, Foundations of Fluid Mechanics, Prentice- Hall of India, New Delhi, 1988.
4. .A.J. Chorin and A. Marsden, A Mathematical Introduction to Fluid Dynamics, Springer-Verlag, New York, 1993.

Website and e-Learning Source - http//nptel.ac.in

COs VS POs

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**
CO 1	2	**1**	**0**	0	0	1	1	1	2	1	0
CO 2	3	**3**	**2**	0	1	3	3	3	3	3	0
CO 3	3	**3**	**3**	1	2	3	3	3	3	3	1
CO 4	3	**2**	**1**	0	0	2	2	2	3	2	0
CO 5	3	**3**	**2**	0	1	3	3	3	3	3	0
TOTAL	14	**12**	**8**	1	4	12	12	12	14	12	1
SCALED VALUE	3	**3**	**2**	1	1	3	3	3	3	3	1

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

1-5→1, 6-10→2, 11-15→3

Course Name			PROBABILITY THEORY	L	T	P	C
Course Code			YMA3E1B	3	1	0	4
C	P	A		L	T	P	H
4	0	0		3	1	0	4
PREREQUISITE			Basic concept of Algebra and Calculus				

Objective:
To introduce axiomatic approach to probability theory, to study some statistical characteristics, discrete and continuous distribution functions and their properties, characteristic function and basic limit theorems of probability.

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Define** distribution Function, joint distribution function, Conditional Distribution function to solve functions on random variables.	Cognitive	Remembering
CO 2	**Explain** Expectation, Moments and Chebyshev Inequality, to solve Regression of the first and second types.	Cognitive	Applying
CO 3	**Explain** Characteristic functions, to define distribution function, to find probability generating functions.	Cognitive	Analyzing
CO 4	**Define** one point, two-point, Binomial distributions, to solve problems of hypergeometric and Poisson distributions, to define Uniform, normal, gamma, Beta distributions, to solve problems on Cauchy and Laplace distributions.	Cognitive	Understanding
CO 5	**Discuss** Stochastic convergence, Bernoulli law of large numbers, to elaborate convergence of sequence of distribution functions.	Cognitive	Applying

UNIT I	**Random Events and Random Variables**	**9 + 3**
Random events – Probability axioms – Combinatorial formulae – Conditional probability – Bayes Theorem – Independent events – Random Variables – Distribution Function – Joint Distribution – Marginal Distribution – Conditional Distribution – Independent random variables – Functions of random variables.		
UNIT 2	**Parameters of the Distribution**	**9 + 3**
Expectation- Moments – The Chebyshev Inequality – Absolute moments – Order parameters – Moments of random vectors – Regression of the first and second types.		
UNIT 3	**Characteristic functions**	**9 + 3**
Properties of characteristic functions – Characteristic functions and moments – semi0invariants – characteristic function of the sum of the independent random variables – Determination of distribution function by the Characteristic function – Characteristic function of multidimensional random vectors – Probability generating functions.		
UNIT 4	**Some Probability distributions**	**9 + 3**

One point, two-point, Binomial – Polya – Hypergeometric – Poisson (discrete) distributions – Uniform – normal gamma – Beta – Cauchy and Laplace (continuous) distributions.		
UNIT 5	**Limit Theorems**	**9 + 3**
Stochastic convergence – Bernaulli law of large numbers – Convergence of sequence of distribution functions – Levy-Cramer Theorems – De Moivre-Laplace Theorem – Poisson, Chebyshev, Khintchine Weak law of large numbers – Lindberg Theorem – Lapunov Theroem – Borel-Cantelli Lemma - Kolmogorov Inequality and Kolmogorov Strong Law of large numbers.		

LECTURE	**45**	**TUTORIAL**	**15**	**PRACTICAL**	**0**	**TOTAL**	**60**

Text Book:

M. Fisz, *Probability Theory and Mathematical Statistics*, John Wiley and Sons, New York, 1963.

UNIT-I- Chapter 1: Sections 1.1 to 1.7 and Chapter 2 : Sections 2.1 to 2.9

UNIT-II - Chapter 3 : Sections 3.1 to 3.8

UNIT-III - Chapter 4 : Sections 4.1 to 4.7

UNIT-IV - Chapter 5 : Section 5.1 to 5.10 (Omit Section 5.11)

UNIT-V - Chapter 6 : Sections 6.1 to 6.4, 6.6 to 6.9 , 6.11 and 6.12. (Omit Sections 6.5, 6.10,6.13 to 6.15)

References:

1. R.B. Ash, *Real Analysis and Probability*, Academic Press, New York, 1972

2. K.L.Chung, *A course in Probability*, Academic Press, New York, 1974.

4. R.Durrett, *Probability : Theory and Examples*, (2nd Edition) Duxbury Press, New York, 1996.

5. V.K.Rohatgi*An Introduction to Probability Theory and Mathematical Statistics*, Wiley Eastern Ltd., New Delhi, 1988(3rd Print).

6. S.I.Resnick, *A Probability Path*, Birhauser, Berlin,1999.

7. B.R.Bhat , *Modern Probability Theory* (3rd Edition), New Age International (P)Ltd, New Delhi, 1999

Website and e-Learning Source

http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,

http://www.opensource.org, http://www.probability.net

COs VS POs											
	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO**	**PSO1**	**PSO2**
CO 1	2	**1**	**0**	0	0	1	1	1	2	1	0
CO 2	3	**3**	**2**	0	1	3	3	3	3	3	0
CO 3	3	**3**	**3**	1	2	3	3	3	3	3	1
CO 4	3	**2**	**1**	0	0	2	2	2	3	2	0
CO 5	3	**3**	**2**	0	1	3	3	3	3	3	0
TOTAL	14	**12**	**8**	1	4	12	12	12	14	12	1
SCALED VALUE	3	**3**	**2**	1	1	3	3	3	3	3	1
0 - No Relation, 1 – Low Relation, 2- Medium Relation, 3- High Relation											
1-5→1, 6-10→2, 11-15→3											

Course Name			DESIGN AND ANALYSIS OF ALGORITHMS	L	T	P	C
Course Code			YMA3E1C	3	1	0	4
C	P	A		L	T	P	H
4	0	0		3	1	0	4
PREREQUISITE			Basic knowledge about basic knowledge of programming and mathematics				

Objective:

The main objectives of this course are to:

- Impart the knowledge of design analysis of algorithms which is the core of computerscience.
- Teach the asymptotic performance of algorithms.
- Demonstrate a familiarity with major algorithms and data structures.

Teach important algorithmic design paradigms and methods of analysis.

COURSE OUTCOMES		DOMAIN	LEVEL
CO 1	**Define**Algorithm. Randomized algorithms.	Cognitive	Remembering
CO 2	**Explain**Stacks and Queues.	Cognitive	Understanding
CO 3	**Demonstrate** the Merge sort, Quick sort.	Cognitive	Analyzing
CO 4	**Apply** tree traversal and search techniques and ttechniques for Binary trees.	Cognitive	Applying
CO 5	**Interpret** the evaluation and interpolation and Modular arithmetic.	Cognitive	Applying

UNIT I	Introduction	9 + 3
What is an algorithm?- Algorithm specification- Performance analysis- Randomized algorithms.		
UNIT 2	**Elementary data structures**	**9 + 3**
Stacks and Queues- Trees- Dictionaries- Priority Queues- Graph representations.		
UNIT 3	**Design of algorithm methods**	**9 + 3**
Divided- And- Conquer- General method- Binary search- finding the maximum and minimum in a set of items- Merge sort- Quick sort.		
UNIT 4	**Design of algorithm methods continuation**	**9 + 3**
The Greedy method- The general method- Tree vertex Splitting Problem- Tree traversal and search techniques- Techniques for Binary trees- Techniques for Graphs- Breadth first search and depth first search traversal- Connected components and spanning trees- Backtracking- General method- the 8- Queens Problem.		
UNIT 5	**Algebraic problems**	**9 + 3**
Algebraic problems- The general method- Evaluation and Interpolation- The Fast Fourier transform- Modular arithmetic- Even faster evaluation and interpolation.		

LECTURE	45	TUTORIAL	15	PRACTICAL	0	TOTAL	60

Text Book:

1.Fundamentals of Computer Algorithm, Eills Horowitz, SartajShani andSanguthevarRajasekaran,Galgotia PublicationsPvtLtd,2000.

Unit	Chapter	Sections
I	1	sections;1.1,1.2, 1.3.1to 1.3.4,1.4.1to1.4.3
II	2	section:2.1to 2.4, 2.6
III	3	sections3.1 to 3.5
IV	4 6 7 8	sections4.1, 4.3 sections6.1 to 6.3 sections7.1, 7.2 sections8.1, 8.3
V	9	sections9.1 to 9.5

References:

1. AhoA.V.,Hopcroft,J.E.andUllman,J.D.:TheDesignandAnalysisofComputerAlgorithms.AdditorWesleyReading Mass(1974)
2. Goodman,S.EandHedetniemi,S.T.:Introductiontothedesignandanalysisofalgorithms(McGrawHillinternational Edition1987).

Website and e-Learning Source

1. http://mathforum.org,
2. http://ocw.mit.edu/ocwweb/Mathematics,
3. http://www.opensource.org,
4. www.physicsforum.com

COs VS POs

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2
CO 1	2	**1**	**0**	0	0	**1**	**1**	**1**	2	**1**	0
CO 2	3	**2**	**1**	0	0	**2**	**2**	**2**	3	**2**	0
CO 3	3	**3**	**3**	1	2	**3**	**3**	**3**	3	**3**	1
CO 4	3	**3**	**2**	0	1	**3**	**3**	**3**	3	**3**	0
CO 5	3	**3**	**2**	0	1	**3**	**3**	**3**	3	**3**	0
TOTAL	14	**12**	**8**	1	4	**12**	**12**	**12**	14	**12**	1
SCALED VALUE	3	**3**	**2**	1	1	3	3	3	3	3	1

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

1-5→1, 6-10→2, 11-15→3

SEMESTER	COURSE CODE	COURSE NAME	L	T	P	H	C
IV	YMA401	PROJECT WORK	0	0	0	30	6
		TOTAL				**30**	**6**