Periyar Nagar, Vallam, Thanjavur - 613 403, Tamil Nad
Phone: +91 - 4362 – 264600 Fax: +91- 4362 - 264660
Email: headmca@pmu.edu Web: www. pmu.edu

PERIYAR MANIAMMAI INSTITUTE OF SCIENCE & TECHNOLOGY
(Deemed to be University)
Established Under Sec. 3 of UGC Act, 1956 - NAAC Accredited
think • innovate • transform

FACULTY OF COMPUTING SCIENCES AND ENGINEERING

B.Sc. DATA SCIENCE

CURRICULUM AND SYLLABUS
(SEMESTER: I, II, III, IV, V and VI)

REGULATION 2022 REVISION 1

(Applicable to the students Admitted from the Academic Year 2023-2024 onwards)

TABLE OF CONTENTS

S.No	Contents
1.	Institute Vision and Mission
2.	Department Vision and Mission
3.	Members of Board of studies
4.	Department Vision and Mission Definition Process
5.	Programme Educational Objectives (PEO)
6.	PEO Process Establishment
7.	Mapping of Institute Mission to PEO
8.	Mapping of Department Mission to PEO
9.	Programme Outcome (PO)
10.	PO Process Establishment
11	Correlation between the POs and the PEOs
12	Curriculum development process
13.	Faculty allotted for course development
14	Pre-requisite Course Chart
15	B.Sc. Data Science – Curriculum
16	B.Sc. Data Science– Syllabus
17	Overall course mapping with POS
18.	Annexure – I PART – I Tamil Syllabus PART – II English Syllabus

University Vision and Mission

Vision

To be a university of global dynamism with excellence in knowledge and innovation ensuring social responsibility for creating an egalitarian society.

Mission

UM1: Offering well balanced programmes with scholarly faculty and state-of-art facilities to impart high level of knowledge.

UM2: Providing student - centered education and foster their growth in critical thinking, creativity, entrepreneurship, problem solving and collaborative work.

UM3: Involving progressive and meaningful research with concern for sustainable development.

UM4: Enabling the students to acquire the skills for global competencies.

UM5: Inculcating Universal values, Self-respect, Gender equality, Dignity and Ethics.

Vision and Mission

Vision

To be a leading, contemporary, innovative Computer Science and Applications department in inculcating professional competencies in the field of Computing and related interdisciplinary technologies to achieve academic excellence and to facilitate research activities as a timely response to dynamic needs and challenges of industry and society.

Mission

DM1: Imparting quality education in the field of Computing Sciences and Applications and generate successful computing professional

DM2: Encouraging students to collaborate with industry environment and analyze the real-world problems culminating in efficient solutions.

DM3: Transforming students into computing professionals and entrepreneurs by imparting quality training and hands on experience with latest tools and technologies.

DM4: Promoting activities in creating applications in emerging areas of computing technologies and applications in order to serve the needs of research, industry, society and scientific community.

DM5: Inculcating value based and ethical commitment for bringing out successful professionals.

MEMBERS OF THE BOARD OF STUDIES

S.No	Name of the Member	Designation and Address
1.	Dr.J.Jeyachidra	Professor and Dean FCSE, Faculty of Computing Sciences and Engineering, Periyar Maniammai Institute of Science & Technology, Vallam.
2.	Dr.D.Ruby BoS Chairman	Associate Professor and Head, Department of Computer Science and Applications, Periyar Maniammai Institute of Science & Technology, Vallam.
3.	Dr.S.Nickolas **(Academic Expert)**	Professor, Department of Computer Applications, NIT, Tiruchirappalli. nickolas@nitt.edu, nickolasnitt@gmail.com, 94435 61989,94860 01131
4.	Dr.V.Adithya Pothan Raj **(Industry Expert)**	Associate Operations Manager ,CTS, Chennai.apr1991@rediffmail.com 9444408814
5.	Dr.A.Muthamizh Selvan BoS Member Internal	Asso.Prof./CSA Periyar Maniammai Institute of Science & Technology, Vallam.
6.	Dr.S.Arumugam BoS Member Internal	Asso.Prof./CSA Periyar Maniammai Institute of Science & Technology, Vallam.
7.	Dr.V.Srithar BoS Member Internal	Asst.Prof./CSA Periyar Maniammai Institute of Science & Technology, Vallam.
8.	Dr.S.Bhuvaneswari BoS Member Internal	Asso.Prof./Mathematics Periyar Maniammai Institute of Science & Technology, Vallam.

The current B.Sc Data Science Curriculum is undergone in **Department Advisory Committee Meeting on 25.05.2023 and Board of studies Meeting on 15.06.2023** to tune the syllabus towards Outcome based Education and meet the UGC requirements and in turn the suggestions provided will be implemented in Regulations 2022 Revision 1.

It is thoroughly felt there is a need to change the present curriculum in order to graduate the students who possess skills that are employable. Hence, appropriate modification in the existing curriculum will augment the manpower and skill requirement of our country. The quality of an educational system can be judged from at least three perspectives: the inputs to the system, what happens within the system and the outputs from the system. In order to refine the input to the

system, BoS members redefined the curriculum with the focus towards outcome-based education.

In this connection, it is felt to frame the department vision and attain the vision through a well-structured mission framed in consultation with the faculty members and other administrators of Periyar Maniammai Institute of Science and Technology.

Department Vision and Mission Definition Process

The development of vision and mission of the department is carried out as per the following steps.

Step: I Brainstorming/Feedback carried out at different levels

First level - Department faculty by the HOD

Second level – Current students by the faculty

Third level - Employers, alumni and academia and industry experts

Step: II Benchmarking with other Universities: Understanding the Vision and Mission

Step: III Validation by the Board of studies and then Academic Council

Step: IV Wide publicity in the department and institution

The University Vision is split up into small elements and verifies its compliance with Department Vision

To be a university of global dynamism with excellence in knowledge and innovation ensuring social responsibility for creating an egalitarian society

To be a leading, contemporary, innovative Computer Science and Applications department in inculcating professional competencies in the field of Computing and related interdisciplinary technologies to achieve academic excellence and to facilitate research activities as a timely response to dynamic needs and challenges of industry and society.

UNIVERSITY VISION	DEPARTMENT VISION
To be a university of global dynamism with excellence in knowledge and innovation ensuring social responsibility for creating an egalitarian society	To be a leading, contemporary, innovative Computer Science and Applications department in inculcating professional competencies in the field of Computing and related interdisciplinary technologies to achieve academic excellence and to facilitate research activities as a timely response to dynamic needs and challenges of industry and society.
Global Dynamism **Excellence in Knowledge** **Social Responsibility**	Placement (Global Level) Teaching Learning (New Technologies) Contribution (Needs and challenges of Industry and Society)

To accomplish the vision stated, well-structured mission is established with consultation with administrators, faculty members and other officials.

UNIVERSITY MISSION	DEPARTEMNT MISSION
Offering well balanced programmes with scholarly faculty and state-of-art facilities to impart high level of knowledge.	Imparting quality education in the field of Computing Sciences and Applications and generate successful computing professional
Providing student - centered education and foster their growth in critical thinking, creativity, entrepreneurship, problem solving and collaborative work.	Encouraging students to collaborate with industry environment and analyze the real-world problems culminating in efficient solutions.
Involving progressive and meaningful research with concern for sustainable development.	Transforming students into computing professionals and entrepreneurs by imparting quality training and hands on experience with latest tools and technologies.
Enabling the students to acquire the skills for global competencies.	Promoting activities in creating applications in emerging areas of computing technologies and applications in order to serve the needs of research, industry, society and scientific community.
Inculcating Universal values, Self-respect, Gender equality, Dignity and Ethics.	Inculcating value based and ethical commitment for bringing out successful professionals.

Mapping of University Vision and Department Mission

	DM1	DM2	DM3	DM4	DM5	**Total**
UM1	3	1	1	1	1	**7**
UM2	1	2	3	2	0	**8**
UM3	0	1	2	3	2	**8**
UM4	1	1	3	3	0	**8**
UM5	1	1	0	1	3	**6**

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

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

Based on the mission of the department, the programme educational objectives are formulated as

PEO1	The graduates will be able to work as a data scientist along with various domain experts.
PEO2	The graduate will be able to undertake higher education in the field of data science or other field where data science will be an allied programme.
PEO3	The graduate will be able to work as an individual or team in fields where big data is involved.

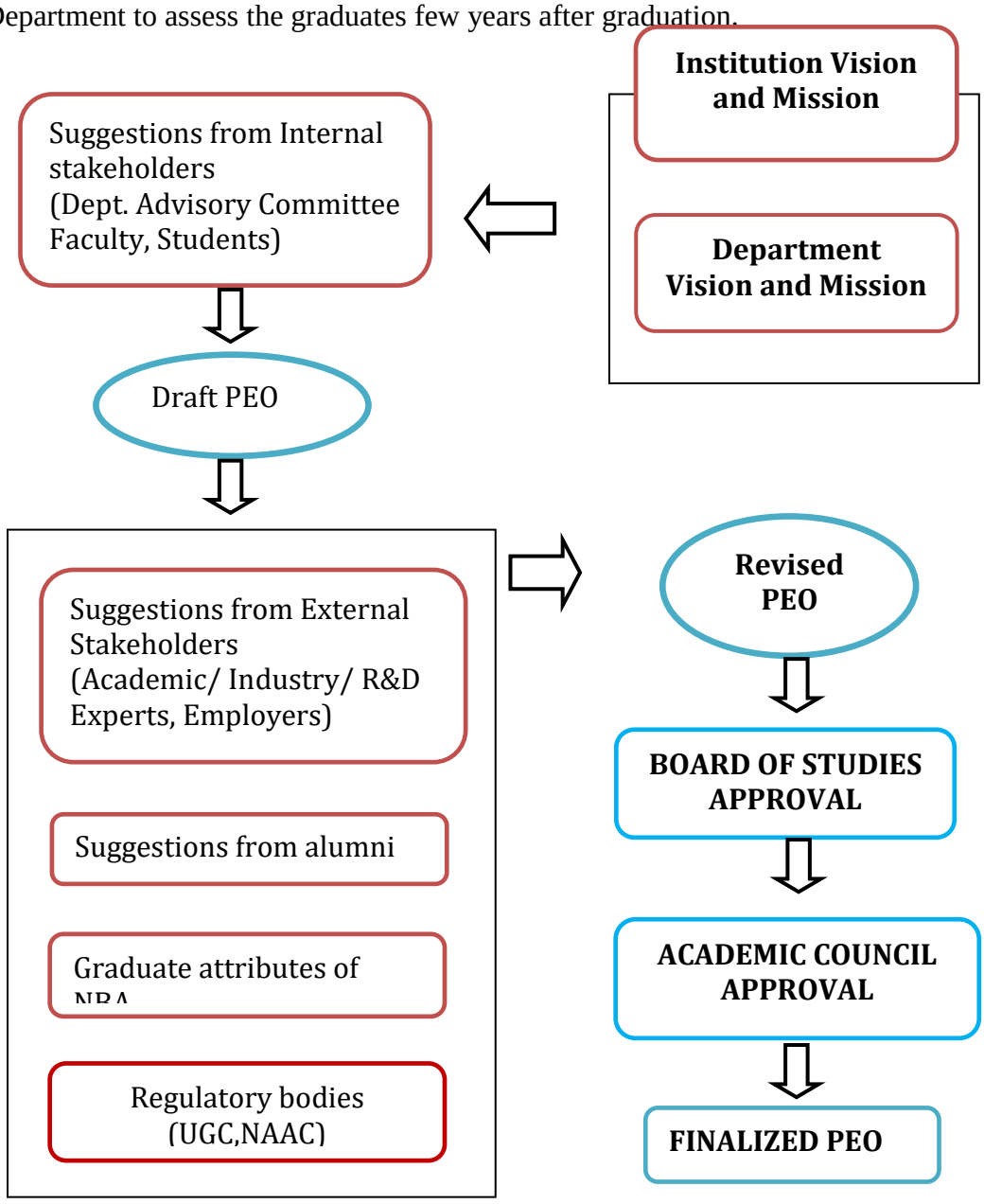
PEO4	The graduates will be lifelong learner and apply ethics in the field of data science

REFERENCES

1. University Grants Commission, "Learning Outcomes-Based Curriculum Framework for Undergraduate Education", January, 2020
2. All India Council for Technical Education, “Examination Reform Policy”, November 2018
3. ACM Data Science Task Force, "Computing Competencies for Undergraduate Data Science Curricula", January 2021
4. IBM Analytics, "The Data Science Skills Competency Model A blueprint for the growing data scientist profession " © Copyright IBM Corporation 2020.

PEO PROCESS ESTABLISHMENT

The faculty of the CSA department at our institution met on different occasions for discussion and a final work session to complete the steps of the process in order to draft the set of PEOs for CSA Department to assess the graduates few years after graduation.



The framework for the review and revision of the PEOs at the departmental level involving all the faculty members comprised the following broad stages.

1. Using the key words and phrases extracted from the Mission Statement of the institution and department to identify attributes to gauge graduates.
2. Capturing the distinction between the educational objective and the student outcomes.
3. Formulating each objective to be measurable.

The program educational objectives for the B.Sc. Data Science program describe accomplishments that graduates are expected to attain within three years after graduation. Graduates will have applied their expertise to contemporary problem solving, be engaged professionally, and have continued to learn and adapt, and have contributed to their organizations through leadership and teamwork.

Mapping of Program Educational Objectives (PEOs) with Department Mission (DM)

	DM1	**DM2**	**DM3**	**DM4**	**DM5**
PEO1	3	2	2	1	0
PEO2	2	3	2	2	1
PEO3	2	2	3	1	3
PEO4	2	1	3	2	1
Total	**9**	**8**	**10**	**6**	**5**

1- Low 2 – Medium 3-High

The development of vision, mission and programme educational objectives is tuned in line with the global and national standards and it is assured that the department vision and mission will facilitate in meeting the vision and mission of the University.

The Program Educational Objectives shall cover both technical and professional aspects of the expected achieve-Achievement in terms of technical skills required in the profession for which the program prepares students

- Achievements in terms of professional, ethical, and Communicational aspects required by the profession for which the program prepares students (team work, ethical behavior, effective communication, etc.)
- Achievements in terms of management and leadership skills (project managers, directors, CTOs, CEOs, etc.)
- Achievements in terms of life-long learning and continuous education (certifications, conferences and workshops attendance, etc.)
- Achievements in terms of advanced and graduate studies pursuing (graduate studies, research careers, etc.)
- Other aspects could be considered when defining educational objectives such as the ability to engage in entrepreneurship activities.

SUMMARY OF THE FEED BACK OBTAINED

Total number of feedbacks collected: 19

In that the following important observations were made,

1. XDS501-Artificial Intelligence - Implemented in V Semester
2. XDS601 – Introduction to IoT - Implemented in VI Semester
3. XDS602C-Machine Learning- Implemented in VI Semester
4. VA-XDS-01- Image processing- Implemented as Value Added Course
5. VA-XDS-02- MATLAB- Implemented as Value Added Course
6. VA-XDS-03- Strike and DIP - Implemented as Value Added Course

Based on the stakeholders‟ input and the attainment results from stakeholder survey, PEO statements and targets were revised.

PROGRAMME OUTCOME (PO)

At the time of graduation, competency of the student is measured through the attainment of programme outcomes. The quantification of programme outcomes attainment is measured through the assessment of established course outcomes for each course.

PROGRAM OUTCOMES	
PO 1	Demonstrate comprehensive knowledge and understanding of computing fundamentals, statistics and mathematics for solutions in data science.

PO 2	Define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions
PO 3	Select and apply appropriate computer, mathematical and ICT tools for solving complex problems
PO 4	Express thoughts, ideas, results, inference effectively in the contest of traditional and digital forms of communication
PO 5	Work effectively and respectfully with diverse (Multicultural, global) as an individual or in teams in diverse domains with leadership qualities when required
PO 6	Able to embrace moral/ethical values, appreciate legal, safety, cultural, environmental and sustainability issues.
PO 7	Able to self-learn in the ever-changing aspects of data science and computer skills and adept to new challenges in the fields of study.
PROGRAM SPECIFIC OUTCOME	
PSO1	Develop programming abilities to build and assess data-based models
PSO2	Demonstrate proficiency in data management and statistical analysis of data with appropriate software.

GRADUATE ATTRIBUTES

Graduates Attributes (GAs) form a set of individually assessable outcomes that are the components indicative of the graduate's potential to acquire competence to practice at the appropriate level. The GAs are examples of the attributes expected of a graduate from an accredited programme. The computing professional Graduate Attributes are derived from NBA and National Institutes.

1. **Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate programme of study.
2. **Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one‟s views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.
3. **Critical thinking:** Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically

evaluate practices, policies and theories by following scientific approach to knowledge development.

4. **Problem solving:** Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.
5. **Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesise data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.
6. **Research-related skills:** A sense of inquiry and capability for asking relevant/appropriate questions, problematising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyze, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation.
7. **Cooperation/Team work**: Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team.
8. **Scientific reasoning:** Ability to analyze, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.
9. **Reflective thinking:** Critical sensibility to lived experiences, with self-awareness and reflexivity of both self and society.
10. **Information/digital literacy:** Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.
11. **Self-directed learning:** Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.
12. **Multicultural competence:** Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.

13. **Moral and ethical awareness/reasoning:** Ability to embrace moral/ethical values in conducting one‟s life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one's work, avoid unethical behavior such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.
14. **Leadership readiness/qualities:** Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way.
15. **Lifelong learning:** Ability to acquire knowledge and skills, including „learning how to learn‟, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.

Table: 3 Mapping of Program Educational Objectives (PEOs) with Program Outcomes (POs)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	Total
PEO 1	3	2	1	1	0	0	1	2	2	12
PEO 2	1	2	1	1	0	0	1	2	2	10
PEO 3	0	0	0	0	1	3	1	1	2	08
PEO 4	0	0	1	1	2	0	2	2	2	10
Total	4	4	3	3	3	3	5	7	8	

1 - Low 2 – Medium 3 - High

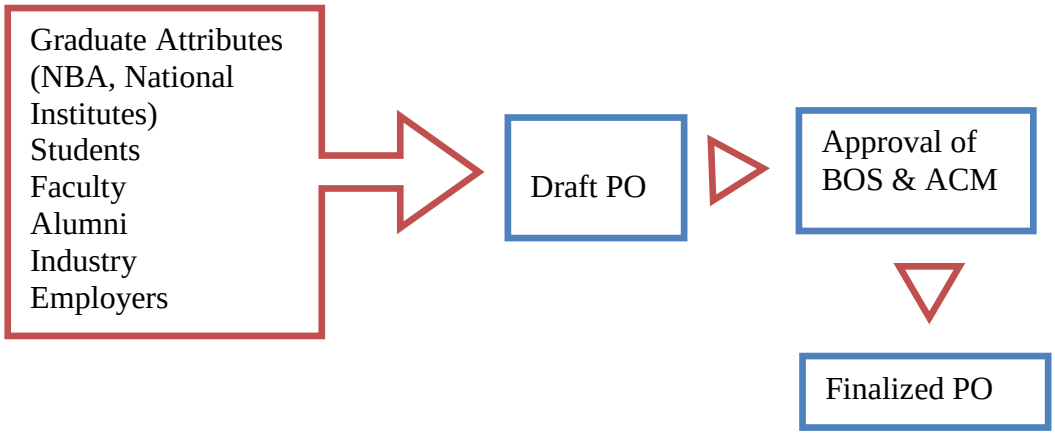
Table :4 Mapping of Program Outcomes (POs) with Graduate Attributes (GAs)

GA	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**TOTAL**
1. *Disciplinary knowledge:* PO 1 PSO2	3									3
2. *Communication Skills:*PO4.				3						3

3. *Critical thinking:*PO2 PO3.		3	1							4
4. *Problem solving:*PO2 PO3 PO4 PSO 1 PSO2 PSO3.	3	2	1	1	1					11
5. *Analytical reasoning:* PO2 PO3 PO4.		2	3	1						6
6. *Research-related skills:* PO2 PO3 PO4PSO1 PSO 3		3	1	1				1	2	11
7. *Cooperation/Team work:* PO5.					3					3
8. *Scientific reasoning:* PO2 PO3 PO4.		2	1	1						4
9. *Reflective thinking:* PO6.						3				3
10. *Information/digital literacy:*PO 3, PSO 1.			1					1		2
11. *Self-directed learning:*PO5 PO7.					1		3			4
12. *Multicultural competence:*PO5.					3					3
13. *Moral and ethical awareness/reasoning:* PO6.						3				3
14. *Leadership readiness/qualities:* PO5.					3					3
15. *Lifelong learning:*PO7.							3			3

1- Slightly **2 – Supportive** **3 - Highly related**

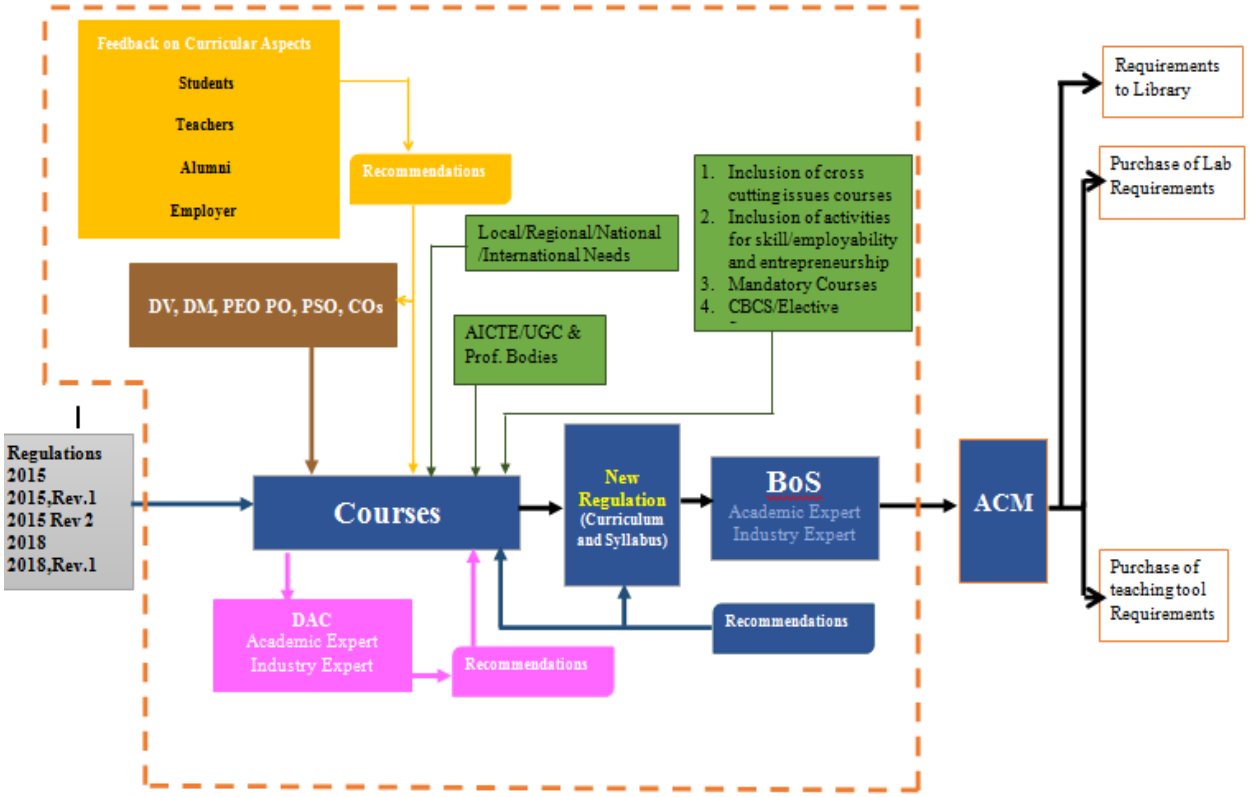
PO PROCESS ESTABILSHMENT



Curriculum Development Steps

1. (Start Here for new progrmme or when DV/DM/PEO expires) Develop PEO of the programme. Ensure its relation with Department Mission
2. Check for statutory body GAs. Derive POs, PSO with GAs and PEO into consideration.
3. Gather core courses and elective courses from statutory bodies) model syllabus /Profession bodies (Programme Specific Criteria and develop COs to fulfil the POs and PSOs. Note: Do the step with top 10 programmes from NIRF or QS ranking if there is no statutory bodies syllabus is not available.
4. Compare with existing (if there is) courses and update.
5. Develop course syllabus for each course selected in step 2 and 3 by specialist (Faculty Competency Matrix) in that area..
6. For revision of existing syllabus, Incorporate the actions taken in terms of curriculum intervention based on CO attainment, feedback from student, teacher, alumni and employer. Incorporate the suggestions given by academic and industrial expert during DAC and
7. Gather mandatory courses given by statutory bodies
8. Design (or fit given) additional courses which reflect University Vision and Mission.
9. Ensure presence of employability/entrepreneurship and skill development component in courses.
10. Ensure cross cutting courses available.
11. Compare the credit distribution with statutory bodies guidelines
12. Draw Course Articulation Matrix. If POs are not uniformly covered, go to step 3 and repeat.
13. Check for C P A distribution. If not as planned go to step 3 and repeat.
14. Present the curriculum and syllabus to Department Advisory Committee, Get the feedbacks and incorporate.
15. Present the curriculum and syllabus to BoS Get the feedbacks and incorporate
16. Present the curriculum and syllabus to ACM Get the feedbacks and incorporate
    a. Initiate augmentation of teaching learning tools and other infrastructure which are not present in the department/institute for new additions in this regulation

Curriculum Design and Development Process - Revision



Faculty Members Assigned for Course Development

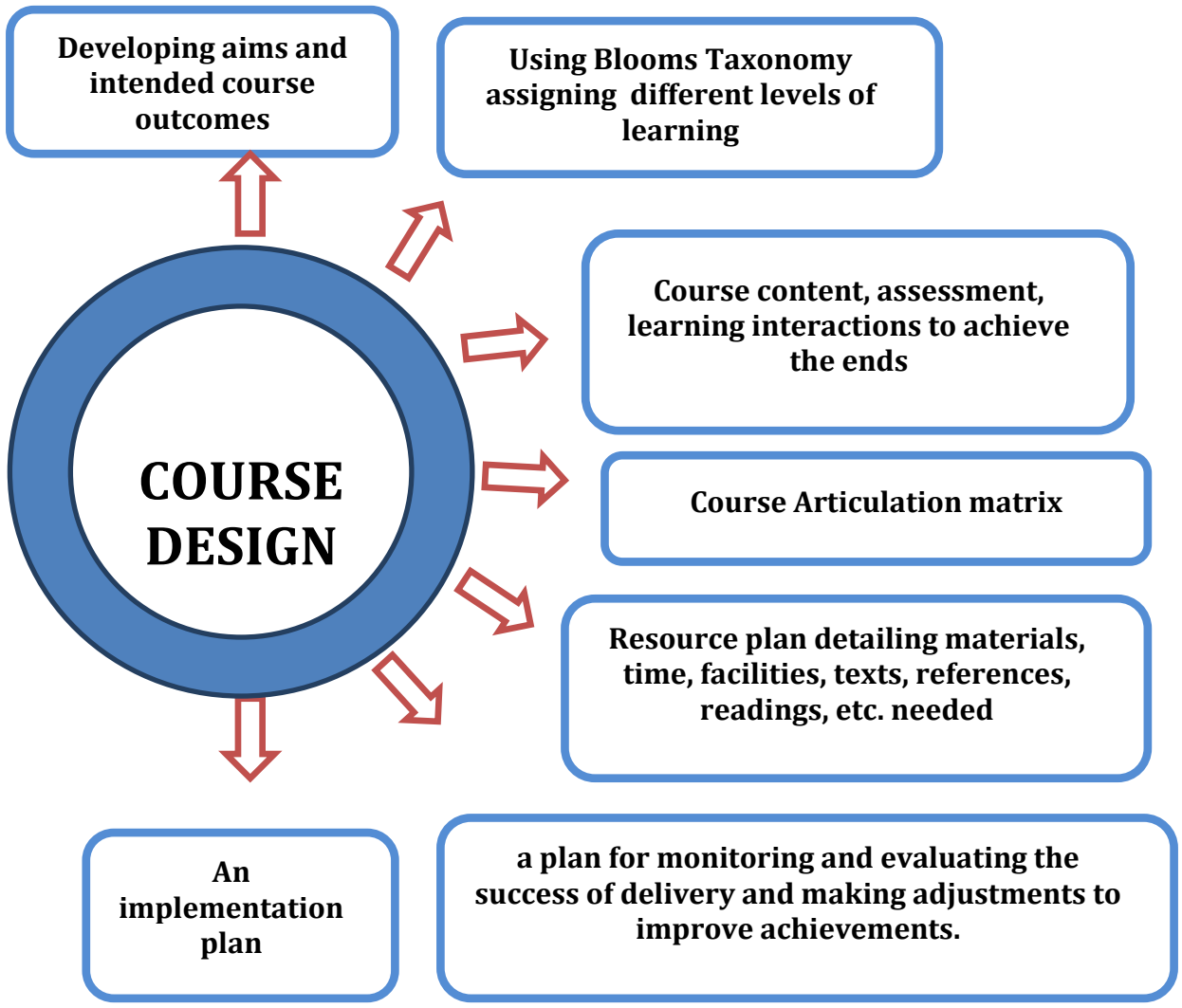
S.No	Semester	Category	Code	Subject Name	Faculty Members
1.	I	CC- 1	XDS103	C Programming	Ms.P.Ranjani
2.	I	CC- 2	XDS105	Computer Organization and Architecture	Dr.S.Arumugam
3.	I	CC-3	XDS106	C Programming Laboratory	Ms.P.Ranjani
4.	II	CC- 4	XDS203	Object Oriented Programming with C++	Ms.R.Ragini
5.	II	CC- 5	XDS205	Fundamentals of Data Science	Dr.D.Ruby

6.	II	CC- 6	XDS206	Data Structures and Algorithms	Ms.S.Manimozhi
7.	II	CC-7	XDS207	Object Oriented Programming with C++ Laboratory	Ms.R.Ragini
8.	II	CC-8	XDS208	Data Structures and Algorithms Laboratory	Ms.S.Manimozhi
9.	III	SEC 1	XDS303	Introduction to Python	Ms.T.Logesh
10.	III	CC- 9	XDS305	Database Management Systems	Ms.K.Geetha
11.	III	CC- 10	XDS306	Operating Systems	Dr.D.Ruby
12.	III	SEC 1-Lab	XDS308	Introduction to Python Laboratory	Ms.T.Logesh
13.	III	CC-11	XDS309	Database Management Systems Laboratory	Ms.K.Geetha
14.	III	CC-12	XDS310	Operating Systems Laboratory	Dr.D.Ruby
15.	IV	SEC 2	XDS403	Data Analytics	Ms.K.Nandhini
16.	IV	CC-13	XDS405	R programming	Ms. R. Manisha
17.	IV	CC-14	XDS406	DataMining and Data Warehousing	MS.R.Sivaranajni
18.	IV	SEC 2-Lab	XDS408	Data Analytics Laboratory	Ms.K.Nandhini
19.	IV	CC-15	XDS409	R programming Laboratory	Ms. R. Manisha
20.	IV	CC-16	XDS410	DataMining and Data Warehousing Laboratory	MS.R.Sivaranajni
21.	V	SEC-3	XDS501	Artificial Intelligence	Dr.S.Arumugam
22.	V	DSE- 1	XDS502A	Java programming	Dr.D.Ruby
23.			XDS502B	RDBMS and SQL	Ms.G.Umamaheswari
			XDS502C	Data Science using Python	Ms. R. Kowsalya
24.	V	DSE-2	XDS503A	Computer Networks	Ms. G.Praveena
25.			XDS503B	Cloud Computing	Ms. M. Umamaheswari
			XDS503C	Exploratory Data Analysis	Ms.I. Epistle
26.	V	SEC-3-Lab	XDS505	Artificial Intelligence Laboratory	Ms.S.Krishnaveni
27.	V	DSE-2-Lab	XDS506A	Java programming Laboratory	Dr.D.Ruby
28.			XDS506B	RDBMS and SQL Laboratory	Ms.G.Umamaheswari
			XDS506C	Data Science using Python Laboratory	Ms. R. Kowsalya
29.	VI	SEC-4	XDS601	Introduction to IoT	Ms.M.Lavanya
30.		DSE-3	XDS602A	Big data Analytics	Ms.S.Krishnaveni
			XDS602B	Business Intelligence	Dr.J.Jeyachidra

			XDS602C	Machine learning	Dr.V.Sridhar
31.	VI	DSE-4	XDS603A	Data Visualization	Ms.I.Epistle
			XDS603B	Data wrangling with DBMS	Dr.A.Muthamizh Selvan
			XDS603C	Data Integrity	Dr.A.Muthamizh Selvan
32.	VI	SEC-4 - Lab	XDS604	Introduction to IoT Laboratory	Ms.M.Lavanya
33.	VI	DSE -4 Lab	XDS605 A	Big data Analytics Laboratory	Ms.S.Krishnaveni
			XDS605 B	Business Intelligence Laboratory	Dr.J.Jeyachidra
			XDS605 C	Machine learning Laboratory	Dr.V.Sridhar

COURSE DEVELOPMENT

The following elements were developed by the faculty involved after interaction and discussions.

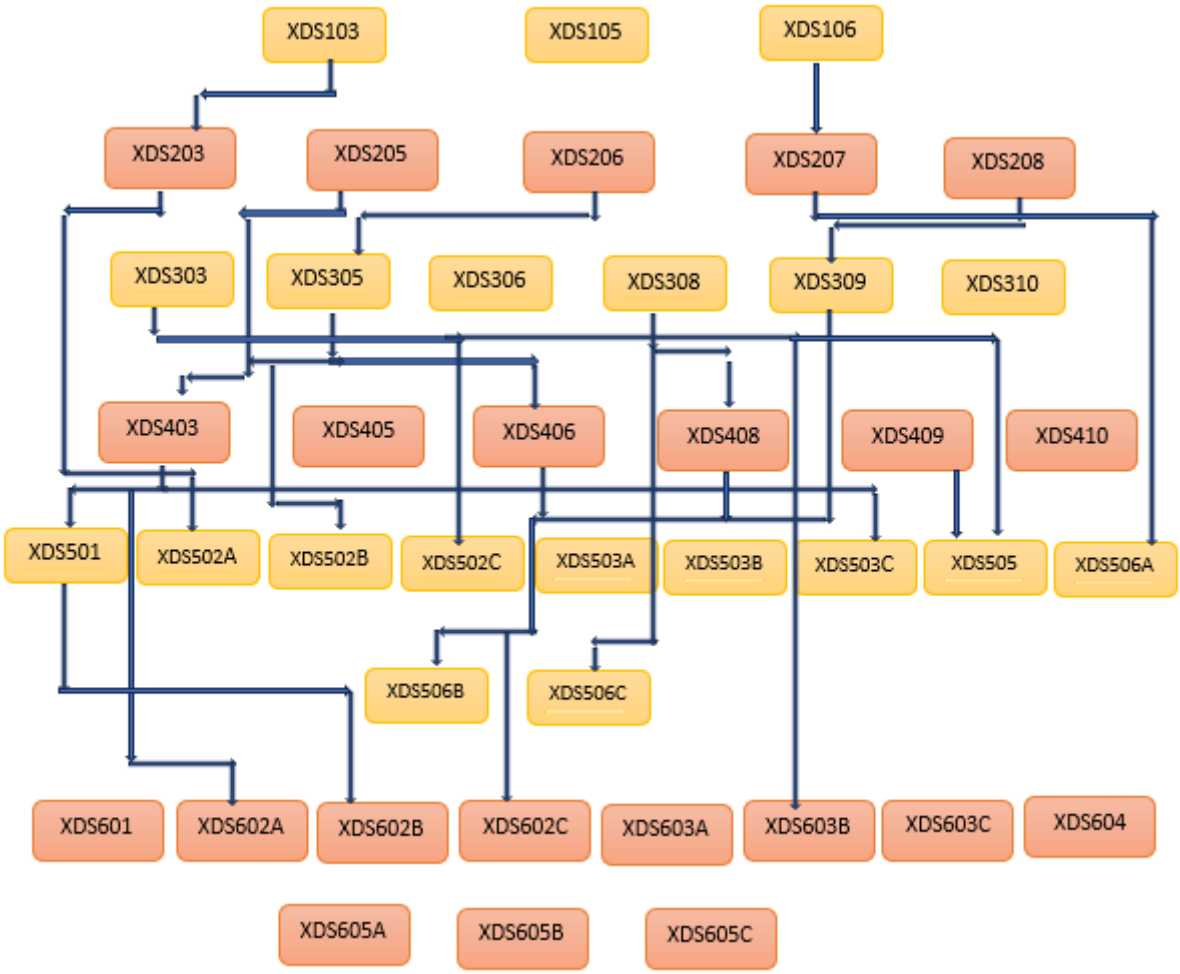


In aligning programme outcome and graduate attributes, course offered to the degree programme are finalized based on the standard template finalized by the university.

Distribution of Courses to be included as per UGC and NAAC

S.No	Category	Symbol
1.	**Part I/Part II**	Languages
2.	**D**epartment **S**pecific Course (Core Course) (Theory & Laboratory)	DSC(CC)
3.	**D**iscipline **S**pecific **E**lective	DSE
4.	**S**kill **E**nhancement **C**ourse	SEC
5.	**G**eneric **E**lective	GE
6.	**U**niversity **MAN**datory	UMAN
7.	In-Plant Training	IPT
8.	NCC/NSS/YRC/RRC/Sports	
9.	Field Visit	FV

REQUISITE MAPPING



B.Sc. DATA SCIENCE

REGULATION 2022

CURRICULUM

SEMESTER – I

Category	Course Code	Course Title	Credits				Hours				
			L	T	P	Total	L	T	P	SS	Total
PART1	XGT101/ XFT101	Tamil I/Foundational Tamil I	3	0	0	3	3	0	0	0	3
PART2	XGE102	English I	3	0	0	3	3	0	0	0	3
CC- 1	XDS103	C Programming	4	0	0	4	4	0	0	0	4
DSC – 1	XDS104	**Mathematics for Data Science -I**	4	1	0	5	4	1	0	0	5
CC- 2	XDS105	Computer Organization and Architecture	4	0	0	4	4	0	0	0	4
CC-3	XDS106	C Programming Laboratory	0	0	1	1	0	0	2	0	2
UMAN 1	XUM001	Human Ethics, Values, Rights and Gender Equality	1	0	0	1	1	0	0	1	2
EA		Extension Activites (NSS, NCC, NSO, RRC and Swachh Bharat)				-					2
		Mentor, Library									2
	XDS107	Field Visit				2					2
		Placement Activity									1
		Total	**19**	**1**	**1**	**23**	**19**	**1**	**2**	**1**	**30**

SEMESTER – II

Category	Course Code	Course Title	Credits				Hours				
			L	T	P	Total	L	T	P	SS	Total
PART1	XGT201/ XFT201	Tamil II/Foundational Tamil II	3	0	0	3	3	0	0	0	3
PART2	XGE202	English II	3	0	0	3	3	0	0	0	3
CC- 4	XDS203	Object Oriented Programming with C++	4	0	0	4	4	0	0	0	4
DSC – 2	XDS204	**Mathematics for Data Science - II**	4	1	0	5	4	1	0	0	5
CC- 5	XDS205	Fundamentals of Data Science	4	0	0	4	4	0	0	0	4
CC- 6	XDS206	Data Structures and Algorithms	4	0	0	4	4	0	0	0	4
CC-7	XDS207	Object Oriented Programming with C++ Laboratory	0	0	1	1	0	0	2	0	2
CC-8	XDS208	Data Structures and Algorithms Laboratory	0	0	1	1	0	0	2	0	2
UMAN2	XUM002	Environmental Studies	1	0	0	1	1	0	0	1	2
EA		Extension Activities (NSS, NCC, NSO, RRC and Swachh Bharat)				-					1
		Mentor, library									
		Total	**23**	**01**	**02**	**26**	**23**	**01**	**04**	**1**	**30**

SEMESTER – III

Category	Course Code	Course Title	Credits				Hours				
			L	T	P	Total	L	T	P	SS	Total
PART1	XGT301/ XFT301	Tamil III/Foundational Tamil III	3	0	0	3	3	0	0	0	3
PART2	XGE302	English III	3	0	0	3	3	0	0	0	3
SEC 1	XDS303	**Introduction to Python**	2	0	0	2	2	0	0	0	2
DSC – 3	XDS304	**Mathematics for Data Science – III**	3	1	0	4	3	1	0	0	4
CC- 9	XDS305	Database Management Systems	3	0	0	3	3	0	0	0	3
CC- 10	XDS306	Operating Systems	3	0	0	3	3	0	0	0	3
GE1		Generic Elective – 1	3	0	0	3	3	0	0	0	3
SEC 1-Lab	XDS308	Introduction to Python Laboratory	0	0	1	1	0	0	2	0	2
CC-11	XDS309	Database Management Systems Laboratory	0	0	1	1	0	0	2	0	2
CC-12	XDS310	Operating Systems Laboratory	0	0	1	1	0	0	2	0	2
UMAN 3	XUM003	Disaster Management	1	0	0	1	1	0	0	1	2
Extra Credit Course		(MOOC) Massive Open Online Course	-	-	-	-	-	-	-	-	--
EA		Extension Activities (NSS, NCC, NSO, RRC and Swachh Bharat)	-	-	-	-	-	-	-	-	--
		Mentor, library									1
		Total	**21**	**1**	**3**	**25**	**22**	**1**	**6**	**1**	**30**

SEMESTER – IV

Category	Course Code	Course Title	Credits				Hours				
			L	T	P	Total	L	T	P	SS	Total
PART1	XGT401/XFT401	Tamil IV/Foundational Tamil IV	3	0	0	3	3	0	0	0	3
PART2	XGE402	English IV	3	0	0	3	3	0	0	0	3
SEC 2	XDS403	Data Analytics	2	0	0	2	2	0	0	0	2
DSC – 4	XDS404	**Mathematics for Data Science -IV**	3	1	0	4	3	1	0	0	4
CC-13	XDS405	R programming	3	0	0	3	3	0	0	0	3
CC-14	XDS406	DataMining and Data Warehousing	3	0	0	3	3	0	0	0	3
GE2		Generic Elective – 2	3	0	0	3	3	0	0	0	3
SEC 2-Lab	XDS408	Data Analytics Laboratory	0	0	1	1	0	0	2	0	2
CC-15	XDS409	R programming Laboratory	0	0	1	1	0	0	2	0	2
CC-16	XDS410	Data Mining and Data Warehousing Laboratory	0	0	1	1	0	0	2	0	2
UMAN4	XUM004	Introduction to Entrepreneurship Development	1	0	0	1	1	0	0	1	2
Extra Credit Course		(MOOC) Massive Open Online Course	-	-	-	-	-	-	-	-	--
EA		Extension Activities (NSS, NCC, NSO, RRC and Swachh Bharat)	-	-	-	-	-	-	-	-	--
		Mentor, library	-	-	-	-	-	-	-	-	1
		Total	**21**	**1**	**03**	**25**	**21**	**1**	**6**	**1**	**30**

SEMESTER – V

Category	Course Code	Course Title	Credits				Hours				
			L	T	P	Total	L	T	P	SS	Total
SEC-3	XDS501	Artificial Intelligence	2	0	0	2	2	0	0	0	2
DSE- 1	XDS502A	Java programming	4	0	0	4	4	0	0	0	4
	XDS502B	RDBMS and SQL	4	0	0	4	4	0	0	0	4
	XDS502C	Data Science using Python	4	0	0	4	4	0	0	0	4
DSE-2	XDS503A	Computer Networks	4	0	0	4	4	0	0	0	4
	XDS503B	Cloud Computing	4	0	0	4	4	0	0	0	4
	XDS503C	Exploratory Data Analysis	4	0	0	4	4	0	0	0	4
GE 3		Generic Elective – 3	3	0	0	3	3	0	0	0	3
SEC-3-Lab	XDS505	Artificial Intelligence Laboratory	0	0	1	1	0	0	2	0	2
DSE- 1 Lab	XDS506A	Java programming Laboratory	0	0	1	1	0	0	2	0	2
	XDS506B	RDBMS and SQL Laboratory	0	0	1	1	0	0	2	0	2
	XDS506C	Data Science using Python Laboratory	0	0	1	1	0	0	2	0	2
	XDS507	In Plant Training (45 days)	0	0	4	4	-	4	-	-	4
UMAN5	XUM005	Cyber Security	1	0	0	1	1	0	0	1	2
		Extension Activities (NSS, NCC, NSO, RRC and Swachh Bharat)									2
		Mentor, Library									2
		Placement Activity,									3
		Total	**14**	**0**	**06**	**20**	**14**	**4**	**04**	**01**	**30**

SEMESTER – VI

Category	Course Code	Course Title	Credits				Hours				
			L	T	P	Total	L	T	P	SS	Total
SEC-4	XDS601	Introduction to IoT	2	0	0	2	2	0	0	0	2
DSE-3	XDS602A	Big data Analytics	4	0	0	4	4	0	0	0	4
	XDS602B	Business Intelligence	4	0	0	4	4	0	0	0	4
	XDS602C	Machine learning	4	0	0	4	4	0	0	0	4
DSE-4	XDS603A	Data Visualization	4	0	0	4	4	0	0	0	4
	XDS603B	Data wrangling with DBMS	4	0	0	4	4	0	0	0	4
	XDS603C	Data Integrity	4	0	0	4	4	0	0	0	4
SEC-4 Lab	XDS604	Introduction to IoT Laboratory	0	0	1	1	0	0	2	0	2
DSE-LAB-2	XDS605 A	Big data Analytics Laboratory	0	0	1	1	0	0	2	0	2
	XDS605 B	Business Intelligence Laboratory	0	0	1	1	0	0	2	0	2
	XDS605 C	Machine learning Laboratory	0	0	1	1	0	0	2	0	2
DSE-5	XDS606	Project Work	0	0	6	6	0	0	**10**	**0**	**10**
EA		Extension Activities (NSS, NCC, NSO, RRC and Swachh Bharat)				2					2
		Mentor, library									2
		Placement Activity									2
		Total	**10**	**0**	**8**	**20**	**10**	**0**	**14**	**0**	**30**

Total Credits: 139

NOTE :

DSC – Department **S**pecific **C**ourse

DSE – Discipline **S**pecific **E**lective

SEC – Skill **E**nhancement **C**ourse

CC – **C**ore **C**ourse

FV – **F**ield **V**isit

GE – Generic **E**lective

UMAN – University **MAN**datory

EA – Extra- Curricular **A**ctivity

PART 1 /PART 2 – Language

Summary

Total Number of courses proposed with the credits is given below:

S. No.	Type of Courses	Numbers	Total Credit
1	PART 1	4	12
2	PART 2	4	12
3	CC	9	32
4	CC – LAB	**7**	**7**
5	DSC	4	18
6	SEC	4	8
7	SEC – LAB	4	4
8	DSE	5	22
9	DSE-LAB	2	2
10	GE	3	9
11	UMAN- VOCATIONAL (1)	5	5
12	IPT	1	4
13	Extra-Curricular		2
14	Field Visit		2
15	Project	1	6
	TOTAL	**52**	**139**

Total Credits = 139

Total Credit	PART 1 **(%)**	PART 2 **(%)**	CC **(%)**	CC – LAB **(%)**	DSC **(%)**	SEC **(%)**	SEC – LAB **(%)**	DSE **(%)**	DSE-LAB **(%)**	GE **(%)**	UMAN-VOC (1) (%)	IPT (%d)	EA	FV	Project
139	12 8.6	12 8.6	36 23	7 5.3	18 12.9	8 5.7	4 3	22 15.8	2 1.4	9 6.47	5 3.6	4 3	2 1.4	2 1.4	6 4.3

XDS103 C PROGRAMMING

Course Outcomes:

CO1	C	Remember	**Defines** the concept of C programming and its fundamental
CO2	C	Understand	**illustrate** various control statements and arrays
CO3	C	Understand	**Differentiate** structures and unions
CO4	C	Understand	**Explain** the pointer concepts
CO5	C	Understand	**Develop** a program to create and process a file for different applications

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS103	**C PROGRAMMING**	4	0	0	4
C:P:A = 4:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	Nil	**4**	**0**	**0**	**4**

UNIT- I : INTRODUCTION TO C LANGUAGE	**12**
C Language - History of C - Features of C - Structure of a C Program –Pre-processors-# define- # include-Writing a C Program - Compiling and Linking a C Program - C compiler - syntax and semantic errors - link and run the C program - linker errors - logical and runtime errors - Constants, Variables and Data Types – storage – qualifiers - Operators and Expressions – Input/Output Operations – Unformatted I/O – Formatted I/O.	

UNIT- II : CONTROL STATEMENTS AND ARRAYS	**12**
Control Statements - if statement - switch statement - Loop Control Statements - while loop - do-while statement - for loop – Un-conditional Controls - goto statement - break statement - continue Statement - Arrays – multi-dimensional arrays - Character arrays and Strings – dynamic arrays	

UNIT- III: FUNCTIONS, STRUCTURE AND UNIONS	**12**
Functions - User defined Functions – Call by value, Call by reference Categories of Functions – Recursion. Structures – declaration, definition- accessing the members of a structure - initializing structures - structures as function arguments - structures and arrays – Unions – dynamic memory allocation – malloc(), calloc(), realloc(), free()	

UNIT- IV: POINTERS	**12**
Pointers: Introduction-Understanding pointers-Accessing the address of a variable-Declaration and Initialization of pointer Variable – Accessing a variable through its pointer-Pointer Expressions – Pointers and Arrays- Pointers and Strings – Array of pointers – Pointers as Function Arguments- Functions returning pointers – Pointers to Functions – Pointers and Structures.	

UNIT- V: FILE PROCESSING	**12**
File Management in C – Definition of Files- Opening modes of files- Standard function:	

fopen(), fclose(), feof(), fseek(),fewind()-fgetc(), fputc(), fscanf()-program using files				
	LECTURE	**TUTORIAL**	**PRACTICAL**	**TOTAL**
	60	**0**		**60**

TEXT

1. Programming in ANSI 8th Edition,935316513X · 9789353165130 By E Balagurusamy © 2019 | Published: March 15, 2019

REFERENCES

1. YashwantKanetker, Let us C, BPB Publications.
2. R. B. Patel, Fundamental of Computers and Programming in C, Khanna Book Publishing Company PVT. LTD. Delhi, India, 1st edition, 2008, ISBN: 13: 978-81-906988-7-0.
3. Gottfried, Programming with C, Tata McGraw Hill.
4. Brian W. Kernighan, Dennis M. Ritchie, The C Programming Language, 2nd Ed., PHI.

E REFERENCES

1. NPTEL, Introduction to C Programming, Prof.SatyadevNandakumar ,IIT, Computer Science and Engineering Kanpur.
2. NPTEL, Introduction to Problem Solving & Programming, by Prof. Deepak Gupta Department of Computer Science and Engineering IIT Kanpur.

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PSO 1**	**PSO 2**
CO 1	3	2	2	1	1	1	1	2	1
CO 2	3	2	2	1	1	1	1	2	1
CO 3	3	2	2	1	1	1	1	1	1
CO 4	3	2	2	1	1	1	1	1	1
CO 5	2	2	2	1	1	1	1	1	1
Total	14	10	10	5	5	5	5	7	5
Course	3	2	2	1	1	1	1	2	1

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

COURSE NAME			MATHEMATICS FOR DATA SCIENCE -I	L	T	P	C
COURSE CODE			XDS104	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	Utilize the concepts of elimination method to solve system of linear equations	Cognitive	Applying
CO 2	Apply Gram Schmidt orthonormalization process to construct an orthonormal set of vectors from the given linearly independent set of vectors	Cognitive	Applying
CO 3	Utilize the concepts of orthogonal transformation to diagonalize a given matrix	Cognitive	Applying
CO 4	Construct SV decomposition for a given set of vectors	Cognitive	Applying
CO 5	Utilize the concepts of iterative methods for solving linear systems	Cognitive	Applying

UNIT 1	**Introduction to Vectors and Solving Linear Equations**	**15 hours**

Introduction to Vectors and Matrices: Length and Dot Products.
Solving Linear Equations: Linear Equations – The Idea of Elimination – Elimination Using Matrices – Rules for Matrix Operations – Inverse Matrices – Elimination = Factorization: A = LU – Transposes and Permutations

UNIT 2	**Vector Spaces and Orthogonality**	**15 hours**

Vector Spaces and Subspaces: Spaces of Vectors – The Null space of A: Solving Ax = 0 – The Rank and the Row Reduced Form – The complete solution to Ax=b – Independence, Basis, and Dimensions – Dimensions of the four Subspaces.
Orthogonality: Orthogonality of the Four Subspaces – Projections – Least Squares Approximations – Orthogonal Bases and Gram – Schmidt.

UNIT 3	**Determinants and Eigen values and Eigen vectors**	**15 hours**

Determinants: The Properties of Determinants – Permutations and Cofactors – Cramer‟s Rule, Inverse, and Volumes.

Eigen values and Eigenvectors: Introduction to Eigen values – Diagonalizing Matrix – System of Differential Equations – Symmetric Matrices – Positive Definite Matrices.

UNIT 4	**The Singular Value Decomposition (SVD) and Linear Transformations**	**15 hours**

Singular value Decomposition: Bases and Matrices in the SVD - Principal Component Analysis - The Geometry of the SVD.
Linear Transformations: The Idea of a Linear Transformation – The Matrix of a Linear Transformation – The Search for a Good Basis

UNIT 5	**Complex Vectors, Complex Matrices and Numerical Linear Algebra**	**15 hours**

Complex Vectors and Complex Matrices: Complex Numbers – Hermitian and Unitary Matrices –The

Fast Fourier Transform – Applications.

Numerical Linear Algebra: Gaussian Elimination in Practice -Norms and Condition Numbers - Iterative Methods and Preconditioners.

LECTURE	60	TUTORIAL	15	PRACTICAL	0	TOTAL	75

TEXT BOOK

1. Gilbert Strang (2016). Introduction to Linear Algebra, 5th Edition. Wellesley – Cambridge Press

UNIT – I Chapter 1& 2
UNIT – II Chapter 3 & 4
UNIT – III Chapter 5 & 6
UNIT – IV Chapter 7 & 8
UNIT – V Chapter 9 & 11

REFERENCES

1. S.Lang (1997). Introduction to Linear Algebra. Second Edition. Springer.
2. Gilbert Strang (2006). Linear Algebra and Its Applications. Fourth Edition. Cengage Learning.
3. David C. Lay, Steven R. Lay, and Judi J. McDonald (2014). Linear Algebra and Its Applications. 5th Edition. Pearson.

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	2	3	1	1	1	0	1	2	3
CO 2	2	3	1	1	1	0	1	2	3
CO 3	1	3	1	1	1	0	1	2	3
CO 4	1	3	1	1	1	0	1	2	3
CO 5	2	3	1	1	1	0	1	2	3
TOTAL	**8**	**15**	**5**	**5**	**5**	**0**	**5**	**10**	**15**
SCALED VALUE	2	3	1	1	1	0	1	2	**3**

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS105 COMPUTER ORGANIZATION AND ARCHITECTURE

Course Outcomes:

CO1	C	Remember	**Defines** basic number systems, Boolean expression simplification and logic gates manipulation
CO2	C	Understand	**Explain** the functions of various components in digital system
CO3	C	Understand	**Describe** general Instruction types, formats, addressing modes and organization
CO4	C	Understand	**Summarize** various modes of Data transfer and interface
CO5	C	Understand	**Summarizes** memory organization and management

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS105	**COMPUTER ORGANIZATION AND ARCHITECTURE**	**4**	**0**	**0**	**4**
C:P:A = 4:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	Number system	**4**	**0**	**0**	**4**

UNIT –I: NUMBER SYSTEM AND BOOLEAN LOGIC	**12**
Introduction: Simple Computer Organization - Number System – Data Representation – Complements – Subtraction of unsigned numbers- Arithmetic Addition and Subtraction Boolean Algebra – Truth Tables -Logic Gates - Map Simplification- Other Binary codes- Error detection codes	
UNIT- II: COMBINATIONAL AND SEQUENTIAL CIRCUIT	**12**
Combinational Circuit - Half adder, Full Adder - Decoders – Multiplexer – Sequential circuit - Flip Flops: RS, JK, D, T Flip Flops – Excitation Table – Master / Slave Flip Flop- Registers – Counters.	
UNIT- III: INSTRUCTION FORMATS AND TYPES	**12**
Instruction codes –-Components of CPU- General Register Organization – Instruction Format -Addressing Modes – Memory Reference Instructions – Data Transfer and Manipulation Instruction – Shift Instruction.	
UNIT –IV: INPUT OUTPUT ORGANIZATION	**12**
Peripheral Devices – Input Interface – I/O Bus and Interface modules- Asynchronous Data Transfer – Modes of Transfer – Direct Memory Access.	
UNIT- V: MEMORY ORGANIZATION	**12**
Memory Hierarchy – Main Memory - Auxiliary Memory – Associative Memory- Cache – Virtual Memory.	

	LECTURE	**TUTORIAL**	**TOTAL**
	60	**0**	**60**

TEXT

1. M.Morris Mano "Computer System Architecture", Pearson Education, Third

Edition,2014.
2. M.Morris Mano "Digital Logic and Computer Design", Pearson Education, 2010.
3. William Stallings, "Computer Organization and Architecture", Tenth Edition, Pearson Education, 2015.

REFERENCES

1. Stallings, William. Computer organization and architecture : designing for performance / William Stallings. — Tenth edition. pages cm Includes bibliographical references and index. ISBN 978-0-13-410161-3 — ISBN 0-13-410161-8
2. David A. Patterson, John L.Hennessy, "Computer Organization and Design", Fourth Edition, Morgan Kauffmann Publishers, 2011.

E REFERENCES

1. NPTEL, Computer Architecture, Prof. Anshul Kumar, Department of Computer Science & Engineering, IIT Delhi.
2. NPTEL, Digital Computer Organization by Prof.P.K. Biswas, Department of Electronics and Electrical Communication Engineering, IIT Kharagpur.

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
CO 1	3	3	2	2	2	1	1	2	2
CO 2	3	3	2	2	2	1	1	2	2
CO 3	3	3	2	2	2	1	1	2	2
CO 4	3	2	2	2	2	1	1	2	2
CO 5	2	2	2	2	2	1	1	2	2
Total	14	13	10	10	10	5	5	10	10
Course	3	3	2	2	2	1	1	2	2

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS106 C PROGRAMMING LABORATORY

Course Outcomes:

CO1	C	Apply	**Computes** various control statements and arrays
CO2	C	Apply	**Solve** an application program using various controls statements and arrays
CO3	C	Apply	**Implement** structures and unions **Develop** an application program using structures and unions
CO4	C	Apply	**Implement** the pointer concepts **Develop** an application program using structures and unions
CO5	C	Apply	**Develop** a program to create and process a file for different applications

COURSE CODE		**COURSE NAME**	**L**	**T**	**P**	**C**
XDS106		**C PROGRAMMING – LAB**	0	0	1	1
C:P:A = 2:0:0						
			L	**T**	**P**	**H**
PREREQUISITE		Nil	**0**	**0**	**2**	**2**

1.Program to implement formatted I/O operations
2.Program to implement unformatted I/O operations
3.Program to implement control structures
4.Program to implement one dimensional and two-dimensional arrays
5.Program to implement calling the function through call by value method & call by reference
6.Program to implement Structures
7.Program to implement dynamic memory allocation
8.Program to implement pointer to function
9.Program to implement an array of pointers
10.Program to implement various file operations in a standard file
11. Program to implement various file operations in text file

PRACTICAL	**TOTAL**
30	**30**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO 1**	**PSO 2**
CO 1	3	2	2	1	1	1	1	2	1
CO 2	3	2	2	1	1	1	1	2	1
CO 3	3	2	2	1	1	1	1	1	1
CO 4	3	2	2	1	1	1	1	1	1
CO 5	2	2	2	1	1	1	1	1	1
Total	14	10	10	5	5	5	5	7	5
Course	3	2	2	1	1	1	1	2	1

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XUM001 HUMAN ETHICS, VALUES, RIGHTS AND GENDER EQUALITY

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 II GENDER 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, Thanthai Periyar and Phule to Women Empowerment.

UNIT III WOMEN 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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	**0**	0	0	0	0	3	1	0	0
CO2	**0**	0	0	0	0	3	1	0	0
CO3	**0**	0	0	0	0	3	1	0	0
CO4	**0**	0	0	0	0	3	1	0	0
CO5	**0**	0	0	0	0	3	1	0	0
Total	0	0	0	0	0	3	1	0	0
Scaled Value	0	0	0	0	0	3	1	0	0

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

XDS203 OBJECT ORIENTED PROGRAMMING WITH C++

Course Outcomes:

CO1	C	Remember	**Recall** the basic concepts on object-oriented programming
CO2	C	Understand	**Defends** the classes and objects with array and functions.
CO3	C	Understand	**Explain** the types of inheritances and operator Overloading functions
CO4	C	Apply	**Apply** the concepts of Polymorphism
CO5	C	Understand	**Define and explain** file concept and exception handlings in C++

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS203	**OBJECT ORIENTED PROGRAMMING WITH C++**	**4**	**0**	**0**	**4**
C:P: A =4:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	C Programming	**4**	**0**	**0**	**4**

UNIT- I : INTRODUCTION TO C++	**12**
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.	
UNIT- II: CLASSES AND OBJECTS	**12**
Declaring Objects- Classes – Static Member variables. Arrays – Characteristics – array of classes - array of objects. Functions in C++ - Defining Member Functions -Inline functions – Function Overloading- Constructor and destructor-friend functions.	
UNIT- III: OPERATOR OVERLOADING AND INHERITANCE	**12**
Overloading unary, binary operators– type conversion – Inheritance: Types of Inheritance – Single, Multilevel, Multiple, Hierarchal, Hybrid, Multi path inheritance – Virtual base Classes – Abstract Classes.	
UNIT-IV: POINTERS AND POLYMORPHISM	**12**
Declaration – Pointer to Class , Object – this pointer – Pointers to derived classes and Base classes – Memory models – new and delete operators – dynamic object – Binding , Polymorphism-Compile time polymorphism-run time polymorphism.	
UNIT- V: EXCEPTION HANDLING AND FILES	**12**
Exception Handling -File stream classes – file modes – Sequential Read / Write operations – Binary and ASCII Files – Random Access File Operation.	

	LECTURE	**PRACTICAL**	**TUTORIAL**	**TOTAL**

	60	**0**	**0**	**60**

TEXT

1. Bjarne Stroustrup, "The C++ Programming Language", Pearson Education, 2014.
2. Stanley B. Lippman, JoseeLajoie andBarbara E. Moo, "The C++ Primer", Addison Wesley, 2013, Fifth Edition.

REFERENCES

1. E. Balagurusamy, OBJECT-ORIENTED PROGRAMMING WITH C++, Tata McGraw Hill Education Private Limited ,2011,fifthth edition

Table 1: COs vs POs Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**
CO 1	3	3	2	2	2	1	2	3	3
CO 2	3	3	2	2	2	1	2	3	3
CO 3	3	2	2	2	2	1	2	3	3
CO 4	2	3	2	2	2	1	2	2	2
CO 5	3	2	2	2	2	1	2	2	2
Total	14	13	10	10	10	5	10	13	13
Course	3	3	2	2	2	1	1	3	3

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

COURSE CODE			COURSE NAME	L	T	P	C
XDS204			MATHEMATICS FOR DATA SCIENCE -II	4	1	0	5
C	P	A					
5	0	0		L	T	P	H
				4	1	0	5

PREREQUISITE: Algebra

COURSE OUTCOMES:

Course outcomes:	Domain	Level
CO1:Explainthediscrete, continuousrandom *variable, moments,*expectation, moment*generating function and characteristic function with simple problems.*	Cognitive	Understanding
CO2: Define the probability mass function and probability density of discrete and continuous distributions and to find the mean and variance of them.	Cognitive	Understanding
CO3: Find thecentral tendency and to **identify** correlation coefficient and regression analysis for a given data.	Cognitive	Applying
CO4: Apply procedure for a population mean when the sample size is large to test the single and difference of proportions, means and standard deviation.	Cognitive	Applying
CO5:Utilize t test to find significance of the means, F test to find significance of variance and Chi square test to test the goodness of fit and independent attributes.	Cognitive	Applying

UNIT I BASIC PROBABILITY	**15**
Sample space, probability axioms, real random variables (discrete and continuous), cumulative distribution function, and probability mass/density functions. Mathematical expectation, moments, moment generating function, characteristic function.	
UNIT IIPROBABILITYDISTRIBUTIONS	**15**
Discrete Distributions: Binomial, Poisson, - ContinuousDistributions: Uniform, Normal, and Exponential.	
UNIT III BASIC STATISTICS	**15**
Measures of Central tendency-Correlation and Regression – Rank correlation.	
UNIT IV APPLIED STATISTICS-LARGE SAMPLES	**15**
Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.	
UNIT V APPLIED STATISTICS - SMALL SAMPLES	**15**
Test for single mean, difference of means and test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.	

LECTURE	TUTORIAL	TOTAL
60	15	75

TEXTBOOK

1. S.C.Gupta and Kapoor, “Fundamentals of Mathematical Statistics”, tenth revised edition Sultan Chand and Sons, New Delhi, 2002.

REFERENCES

1. Irwin Miller and Marylees Miller, John E. Freund, “Mathematical Statistics with Application”, 7th Ed., Pearson Education, Asia, 2006.
2. Sheldon Ross, “Introduction to Probability Model”, 9th Ed., Academic Press, Indian Reprint, 2007.

Table 1 : Mapping of COs with Pos

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	1	1	1	0	0	0	0	3
CO 2	3	1	1	1	0	0	0	0	3
CO 3	3	1	1	1	0	0	0	0	3
CO 4	3	1	1	1	0	0	0	0	3
CO 5	3	3	1	1	0	0	0	0	3
TOTAL	15	7	5	5	0	0	0	0	15
SCALED VALUE	3	1	1	1	0	0	0	0	3

XDS205 FUNDAMENTALS OF DATA SCIENCE

Course Outcomes:

CO1	C	Understand	**Infers** the basic concepts of data science
CO2	C	Understand	**Defines** some techniques of data science
CO3	C	Analyze	**Comparative** studies about algorithm
CO4	C	Analyze	**Analyze** study about data science
CO5	C	Understand	**Distinguishes** about tools of Visualization

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS205	**FUNDAMENTALS OF DATA SCIENCE**	**4**	**0**	**0**	**4**
C:P: A = 4:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	Nil	**4**	**0**	**0**	**4**

UNIT-I : INTRODUCTION	**12**
Introduction – What is Data Science? -Big Data and Data Science Hype- Datafication- Role of Data Scientist- Current landscape of perspectives, Statistical Inference - Populations and Samples, Statistical modeling, Probability distributions, Modeling - Exploratory Data Analysis – Philosophy Data Science Process - Case Study: RealDirect.	**12**
UNIT-II : Algorithms: Linear Regression, k-NN, k-means, Spam Filters, Naive Bayes, Wrangling - Logistic Regression: Classifiers, Case Study: M6D Logistic Regression.	
UNIT-III: EXPLORATORY DATA ANALYTICS	**12**
Feature Generation Brainstorming, Role of domain expertise, and Place for imagination – Feature Selection: Filters, Wrappers, Decision Trees, Random Forests.	
UNIT- IV: MODEL DEVELOPMENT	**12**
Recommendation Engines: Nearest Neighbors - Dimensionality Problem-Singular Value Decomposition, Principal Component Analysis - Social Network Analysis.	
UNIT- V: VISUALIZATION	**12**
Data Visualization: Basic principles, ideas and tools for data visualization, Sample projects – Data Engineering algorithms - Data Scientists and Ethics.	

	LECTURE	**TUTORIAL**	**PRACTICALS**	**TOTAL**
	60	**0**	**0**	**60**

TEXT

1. Rachel Schutt and Cathy O'Neil , “Doing Data Science, Straight Talk From The Frontline”, O’Reilly
2. Jure Leskovek, Anand Rajaraman and Jerey D. Ullman, “Mining of Massive Datasets”, 2nd Edition,
3. Cambridge University Press. 2014.
4. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective, MIT Press, Cambridge,2013.

5. Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about
6. Data Mining and Data-analytic Thinking, O'Reilly Media, 2013..

REFERENCES

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.

Table 1 : Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	3	2	2	2	1	1	3	2
CO 2	3	3	2	2	2	1	1	3	2
CO 3	3	3	2	2	2	1	1	3	2
CO 4	3	2	2	2	2	1	1	3	2
CO 5	2	2	2	2	2	1	1	3	2
Total	14	13	10	10	10	5	5	15	10
Course	3	3	2	2	2	1	1	3	2

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

XDS206 DATA STRUCTURES AND ALGORITHMS

Course Outcomes:

CO1	C	Understand	**Understand** the classification of data types and operations of stack.
CO2	C	Understand	**Understand** the functions of queue and its types
CO3	C	Understand	**Describe** the operations of linked list and its advantages
CO4	C	Understand	**Recall** the recursion function in various problems
CO5	C	Understand	**Apply** the concepts of tree and sorting

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS206	**DATA STRUCTURES AND ALGORITHMS**	**4**	**0**	**0**	**4**
C:P:A = 4:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	Nil	**4**	**0**	**0**	**4**

UNIT- I: INTRODUCTION TO DATA STRUCTURES AND STACK	**12**
Definition, Classification of data structures: primitives and non primitive, Operations on data structures – Definition, Array & Linked list representation of stack, Operations on stack, Applications of stacks, Infix, Prefix and Postfix notations – Conversion of an arithmetic expression from infix to postfix.	
UNIT –II: QUEUE	**12**
Definition, Array & Linked list representation of queue – Types of Queues: Simple queue, Circular queue, Double ended queue, Priority queue, Operations on all types of queues.	
UNIT- III: LINKED LIST	**12**
Definition, Components of linked list, Representation of linked list, Advantages and Disadvantages of linked list. Types of linked list: Singly linked list, doubly linked list, Circular linked list and circularly doubly linked list. Operations on singly linked list: creation, insertion, deletion, search and display.	
UNIT- IV: RECURSION	**12**
Definition, Recursion in C, writing recursive programs – Binomial coefficient, Fibonacci, GCD, Factorial etc.	
UNIT- V: TREE AND SORTING TECHNIQUES	**12**
Tree, Binary Tree, Complete Binary Tree, Binary Search Tree, Heap Tree Terminology: Root, Node, Degree of a Node And Tree, Terminal Nodes, Non-Terminal Nodes, Siblings, Level, Edge, Path, Depth, Parent Node, Ancestors of a Node. Different Types of Searching Techniques: Bubble Sort, Selection Sort, Merge Sort, Insertion – Quick Sort.	

	LECTURE	**TUTORIAL**	**PRACTICAL**	**TOTAL**
	60	**0**	**0**	**60**

TEXT

1. A.K. Sharma, "Data Structures using C", Pearson Education, 2013
2. Robert L. Kruse"Data Structures and Program Design in C, Pearson Education, 2013

REFERENCES

1. Kamthane: Introduction to Data Structures in C, Pearson Education, 2005
2. Aaron M. Tanenbaum, Moshe J. Augenstein and YedidyahLangsam, "Data structures using C and C++", Prentice Hall, 2012.
3. Michael T. Goodrich, Roberto Tamassia and David Mount, " Data Structures and Algorithms in C++", John Wiley, 2011.

E REFERENCES

1. NPTEL, Data structures and algorithm ,Prof. Hema A Murthy,IITMadras,Prof. Shankar Balachandran,IITMadras,Dr. N S. Narayanaswamy,IIT Madras
2. NPTEL, Data structures and algorithm ,Prof. Naveen Garg,IIT Delhi

Table 1: Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	3	2	2	2	1	2	3	3
CO 2	3	3	2	2	2	1	2	3	3
CO 3	3	2	2	2	2	1	2	3	3
CO 4	3	3	2	2	2	1	2	3	2
CO 5	3	2	2	2	2	1	2	3	2
Total	15	13	10	10	10	5	10	15	13
Course	3	3	2	2	2	1	1	3	3

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

XDS207 OBJECT ORIENTED PROGRAMMING WITH C++- LABORATORY

Course Outcomes:

CO1	C	Apply	**Apply** structure and inline functions
CO2	C	Apply	**Applying** various levels of Inheritance for real time problems **Apply** the OOPs concepts class and object
CO3	C	Apply	**Apply** various overloading methods for different applications
CO4	C	Apply	**Apply and implement** operator overloading functions
CO5	C	Apply	**Apply and implement** file operations

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS207	**OBJECT ORIENTED PROGRAMMING WITH C++ LABORATORY**	**0**	**0**	**1**	**1**
C:P:A =1:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	C Programming Laboratory	**0**	**0**	**2**	**2**
				30	

1. Implement Various Control Structures.
2. Demonstrate Inline Functions
3. Implement Structure & Unions
4. Implement Class and Subclass
5. Demonstrate Constructors & Destructors.
6. Programs to Implement Friend Function
7. Implement Multilevel Inheritance
8. Implement Multiple Inheritance with Access Specifiers
9. Implement Hierarchical inheritance
10. Programs to Overload Unary & Binary Operators
11. Program to implement file operations

	LECTURE	**PRACTICAL**	**TUTORIAL**	**TOTAL**
	0	**30**	**0**	**30**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	3	2	2	2	1	2	3	3
CO 2	3	3	2	2	2	1	2	3	3
CO 3	3	2	2	2	2	1	2	3	3
CO 4	2	3	2	2	2	1	2	2	2
CO 5	3	2	2	2	2	1	2	2	2
Total	14	13	10	10	10	5	10	13	13
Course	3	3	2	2	2	1	1	3	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS208 DATA STRUCTURES AND ALGORITHMS -LABORATORY

Course Outcomes:

CO1	C	Apply	**Computes** a program to implement the operations of stack.
CO2	C	Apply	**Computes** a program to implement the operations of queue.
CO3	C	Apply	**Computes** an application to demonstrate the functions of linked list
CO4	C	Apply	**Computes** an application in C for traversing a tree and sorting concept.
CO5	C	Apply	**Solve** the problem with different searching algorithms.

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS208	**DATA STRUCTURES ANDALGORITHMS – LABORATORY**	**0**	**0**	**1**	**1**
C:P:A = 1:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	Nil	**0**	**0**	**2**	**2**

Lab:

1. Create a Stack and do the following operations using array
2. (i)Push (ii) Pop (iii) Peep
3. Create a Queue and do the following operations using array(i)Add (ii) Remove
4. Implement the operations on singly linked list.
5. Implement the following operations on a binary search tree.
    a. (i) Insert a node (ii) Delete a node
6. Create a binary search tree and do the following traversals
    a. (i)In-order (ii) Pre order (iii) Post order
7. Sort the given list of numbers using insertion sort
8. Sort the given list of numbers using quick sort.
9. Perform the following operations in a given graph
    (i) Depth first search (ii) Breadth first search

Note: Ex.no 9 has given by industrial expert – Dr.V.Adithya Pothan Raj

LECTURE	**PRACTICAL**	**TUTORIAL**	**TOTAL**
0	**15**	**0**	**15**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	3	2	2	2	1	2	3	3
CO 2	3	3	2	2	2	1	2	3	3
CO 3	3	2	2	2	2	1	2	3	3
CO 4	3	3	2	2	2	1	2	3	2
CO 5	3	2	2	2	2	1	2	3	2
Total	15	13	10	10	10	5	10	15	13
Course	3	3	2	2	2	1	1	3	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

COURSE CODE	COURSE NAME	L	T	P	SS	C	H
XUM002	ENVIRONMENTAL STUDIES	1	0	0	1	1	2
C:P:A = 0.7: 0 : 0.3							

COURSE OUTCOMES- On the successful completion of the course, students will be able to		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 geobio chemical cycles for maintaining ecological balance.	Cognitive	Understand
CO3	***Identify*** the facts, consequences and apply the preventive measures of major pollutions and ***recognize*** and the disaster phenomenon.	Cognitive Affective	Apply 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 explain themodern technology towards environmental protection.	Cognitive	Understand

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 – II ECOSYSTEMS 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 – III ENVIRONMENTAL 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 –IV SOCIAL 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	TUTORIAL	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).

REFERENCE BOOKS

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

Table:1 Mapping of CO's with POs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	3	0	0	0	0	0	0	0
CO2	2	0	0	0	0	2	1	0
CO3	2	1	3	0	0	3	1	0
CO4	1	1	2	0	0	3	2	3
CO5	2	1	1	0	0	3	0	0
	10	**3**	**6**	**0**	**0**	**11**	**4**	**3**
Scaled to 0,1,2,3 scale	**2**	**1**	**2**	**0**	**0**	**3**	**1**	**1**

1 - Low, 2 – Medium, 3 – High

XDS303 INTRODUCTION TO PYTHON

Course Outcomes:

CO1	C	Remember	**Recall** the basics of python programming.
CO2	C	Apply	**Apply** various data structures to effectively manage various type of data
CO3	C	Understand	**Illustrate** various steps of data science pipeline with role of python
CO4	C	Create	**Develop** applications applying various operations for data cleaning and transformation
CO5	C	Analyze	**Analyze** data with pandas

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS 303	**INTRODUCTION TO PYTHON**	**2**	**0**	**0**	**2**
C:P:A = 2:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	Basic Concepts of Programming, Design	**2**	**0**	**0**	**2**

UNIT- I: DATA STRUCTURES AND OOP — **10**

Introduction to python – Numeric Data Types – Sequences – Strings – Tuples – Lists – Dictionaries. Create Python Program and Execution Procedure –Control structures- logical operations– Functions – Object Creation – Inheritance – Class – Constructors - Overloading. Text Files and Binary Files – Reading and Writing.

UNIT- II: DATA ANALYSIS AND LIBRARIES — **10**

Introduction to Data Analysis and Python libraries - NumPy Arrays and Vectorized Computation: Numpy Arrays- Array functions - Data processing using Arrays
Data Analysis with Pandas: An overview of the pandas package- The Pandas data structure- The essential basic functionality- Indexing and Selecting data- Working with missing data.

UNIT- III: DATA WRANGLING AND DATA AGGREGATION, GROUP OPERATIONS & VISUALIZATION — **10**

Combining and Merging Data Sets – Reshaping and Pivoting – Data Transformation – String manipulations – Regular Expressions- GroupBy Mechanics – Data Aggregation - Matplotlib and Seaborn Packages – Plotting Graph - Controlling Graphs – Adding Text – More Graph Types – Getting and Setting Values – Patches.

	LECTURE	**PRACTICAL**	**TUTORIAL**	**TOTAL**
	30	**0**	**0**	**30**

TEXT

1.Gowrishanker and Veena, “Introduction to Python Programming”, CRC Press, 2019.
2. Python Crash Course, 2nd Edition, By Eric Matthes, May 2019
3. NumPy Essentials, By Leo Chin and Tanmay Dutta, April 2016 4. Joel Grus, “Data Science from scratch”, O'Reilly, 2015.
4. Python cook book, Brain Jones David Beazley, 3rd Edition, 2019.

REFERENCES

1. Wes Mc Kinney, “Python for Data Analysis”, O'Reilly Media, 2012.

2. Kenneth A. Lambert, (2011), "The Fundamentals of Python: First Programs", Cengage Learning
3. Jake Vanderplas. Python Data Science Handbook: Essential Tools for Working with Data 1st Edition.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	3	2	2	2	1	2	3	3
CO 2	3	3	2	2	2	1	2	3	3
CO 3	3	2	2	2	2	1	2	3	3
CO 4	3	3	2	2	2	1	2	3	3
CO 5	3	2	2	2	2	1	2	3	3
Total	15	13	10	10	10	5	10	15	15
Course	3	3	2	2	2	1	1	3	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

COURSE CODE			COURSE NAME	L	T	P	C
XDS304			MATHEMATICS FOR DATA SCIENCE – III	3	1	0	4
C	P	A					
4	0	0		L	T	P	H
				3	1	0	4

PREREQUISITE:

COURSE OUTCOMES:

Course outcomes:	Domain	Level
CO1: Recall the methods and functionality of correlations	Cognitive	Remembering
CO2: Apply the concept of regression	Cognitive	Applying
CO3: Apply curve fitting on real time problems	Cognitive	Applying
CO4: Understand different types of attributes and its usage	Cognitive	Understanding
CO5: Apply different types of tests on real time problems	Cognitive	Applying

UNIT I	Correlation	12

Definition of correlation – scatter Diagram its coefficient and its properties, scatter digram, computation of correlation coefficient for ungrouped data. Spearman's rank correlation coefficient, properties of spearman's correlation coefficients and problems.

UNIT II	Regression	12

Simple linear Regression, properties of regression coefficients. Regression lines. Concepts of correlation ratio, partial and multiple correlation coefficients, correlation verses regression and their problems.

UNIT III	Curve fitting	12

Method of least square – fitting of linear, quadratic, Exponential and power curves and their problems.

UNIT IV	Attributes	12

Introduction, Nature and consistency and mention it's conditions. Independence and association of attributes, coefficient of association, coefficients of contingency and their problems.

UNIT V	Sampling Distributions	12

Concepts of population, parameter, random sample, statistic, sampling distribution, standard error. Statement and properties of chi-square-test, t-test, F-test distribution and their inter relationships.

LECTURE	TUTORIAL	TOTAL
45	15	60

TEXTBOOK

1. V.K.Kapoor and S.C.Gupta, "Fundamentals of Mathematical Statistics, sultan chand & Sons, New Delhi.

REFERENCE

1. Goon A.M., Gupta M.K., Das Gupta B., Outlines of Statistics, vol-II, the world press pvt.Ltd. Kolakota.
2.Hoel P.G., Introduction to matechemical statistics, Asia Publishing House.
3. Sanjay Arora and Bansi Lai., New Mathematical Statistics, Satya Prakashan, New Delhi

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	3	2	1	0	0	0	0	2
CO 2	3	3	2	1	0	0	0	0	2
CO 3	3	2	2	1	0	0	0	0	2
CO 4	3	3	2	1	0	0	0	0	2
CO 5	3	2	2	1	0	0	0	0	2
Total	15	13	10	5	0	0	0	0	2
Course	3	3	2	1	0	0	0	0	2

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS305 DATABASE MANAGEMENT SYSTEMS

Course Outcomes:

CO1	C	Remember	***Describe*** the database architecture and its applications
CO2	C	Remember	***Discuss*** about the relational algebra and calculus
CO3	C	Remember	***Describe*** the various normalization forms
CO4	C	Remember	***Describe*** the storage and accessing of data.
CO5	C	Remember	***Define*** the query processing in database management.

COURSE CODE	COURSE NAME	L	T	P	C
XDS305	**DATABASE MANAGEMENT SYSTEMS**	**3**	**0**	**0**	**3**
C:P:A = 3: 0: 0					
		L	**T**	**P**	**H**
PREREQUISITE	Data structures and aalgorithms	**3**	**0**	**0**	**3**

UNIT- I : DATABASE ARCHITECTURE AND ER DIAGRAM **9**

Introduction, History, purpose and applications of Database - View of data- Database languages - Database architecture - Database users and administrators - History of database systems-Entity relationship modeling**: e**ntity types, entity set, attribute and key, relationships, relation types, roles and structural constraints, weak entities, sub classes; super classes, inheritance, specialization and generalization

UNIT- II: RELATIONAL DATA MODEL **9**

Relational model concepts, Relational constraints, Relational Languages : Relational Algebra, The Tuple Relational Calculus - The Domain Relational Calculus - SQL: Basic Structure-Set Operations- Aggregate Functions-Nested Sub Queries-Views -Modification Of Database-Joined Relations.

UNIT – III: DATA NORMALIZATION **9**

Pitfalls in relational database design – Decomposition – Functional dependencies – Normalization – First normal form – Second normal form – Third normal form – Boyce-code normal form – Fourth normal form – Fifth normal form

UNIT- IV: STORAGE AND FILE ORGANIZATION **9**

Disks - RAID -Tertiary storage - Storage Access -File Organization – organization of files - Data Dictionary storage

UNIT- V: QUERY PROCESSING AND TRANSACTION MANAGEMENT **9**

Query Processing - Transaction Concept - Concurrency Control –Locks based protocol-Deadlock Handling -Recovery Systems

	LECTURE	TUTORIAL	PRACTICALS	TOTAL
	45	**0**	**0**	**45**

TEXT

1 Silberschatz A., Korth H. and Sudarshan S., “Database System Concepts”, McGraw Hill, 2011.

2. Elmasri R. and Navathe S.B., “Fundamentals of Database Systems”, Pearson Education, 2011.

3. Raghu Ramakrishnan and Johannes Gehrke, “Database Management System”, McGraw Hill, 2010.

4. Bipin C.Desai, “An Introduction to Database System „“, Galgotia Publishers, 2012.

5. Sivaranjani S (BE author) SIA(Author) Publisher & Distributers Pvt Ltd, 2020.

REFERENCES

1. Bipin Desai, An Introduction to database systems, Galgotia Publications, 2010.
2. RamezElamassri, Shankant B-Navathe, Fundamentals of Database Systems, Pearson, 7th Edition, 2015

E REFERENCES

1. NPTEL, Introduction to database desigh, Dr P Sreenivasa Kumar Professor CS&E, Department, IIT, Madras
2. NPTEL, Indexing and Searching TechniquesinDatabasesDr. Arnab Bhattacharya,IIT Kanpur
3. Database management system R13(Autonomous) – E book.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	3	2	2	2	1	2	3	3
CO 2	3	3	2	2	2	1	2	3	3
CO 3	3	2	2	2	2	1	2	3	3
CO 4	3	3	2	2	2	1	2	3	3
CO 5	3	2	2	2	2	1	2	3	3
Total	15	13	10	10	10	5	10	15	15
Course	3	3	2	2	2	1	1	3	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS306 OPERATING SYSTEMS

Course Outcomes:

CO1	C	Understanding	**Relate** the operating system functions
CO2	C	Understanding	**Interpret** the process and various process scheduling algorithms
CO3	C	Remembering	**Relate** process cooperation and inter process communication
CO4	C	Understanding	**Explain** various memory management concepts
CO5	C	Understanding	**Relate** the file organization

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XCA306	**OPERATING SYSTEMS**	**3**	**0**	**0**	**3**
C:P: A = 3:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	Nil	**3**	**0**	**0**	**3**

UNIT I : OVERVIEW OF OPERATING SYSTEMS	**9**
Introduction to Operating System - Functionalities and objectives of operating Systems- processor register- instruction execution- interrupts- types of interrupts.	
UNIT II: PROCESS MANAGEMENT	**9**
Introduction to Process concepts: process states- process control block- process and threads- processor scheduling- scheduling algorithms.	
UNIT III: PROCESS SYNCHRONIZATION AND CONCURRENCY	**9**
Process Synchronization Critical Sections – Race condition- Process Cooperation- Inter Process Communication- Deadlock- Detection- Deadlock Prevention- Avoidance- Semaphores- Monitors-Message Passing – Concurrency.	
UNIT IV: INTRODUCTION TO MEMORY MANAGEMENT	**9**
Virtual Memory Concepts- Paging and Segmentation- Address Mapping- Virtual Storage Management- Page Replacement Strategies.	
UNIT V: INTROCTION TO FILE MANAGEMENT	**9**
File organization, Blocking and buffering, file descriptor- file and directory structures- I/O devices- disk scheduling.	

	LECTURE	**TUTORIAL**	**PRACTICALS**	**TOTAL**
	45	**-**	**0**	**45**

TEXT

1. William Stallings, Operating Systems , Prentice Hall of India (P) Ltd, 7th edition-2012.
2. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Operating System Concepts, 9th edition.

REFERENCES

1. Andrew Tanenbaum, “Modern Operating Systems”, Pearson, 2008.
2. Silberschatz and P. B. Galvin, “Operating System Concepts”, 7th Edition, Addison Wesley Publication.

E REFERENCES

1. http://www.nptel.ac.in/courses/106108101/
2. http://nptel.ac.in/courses/Webcourse-contents/IISc-BANG/Operating%20Systems/New_index1.html
3. http://www.nptel.ac.in/downloads/106108101/

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	3	2	2	2	1	2	3	3
CO 2	3	3	2	2	2	1	2	3	3
CO 3	3	2	2	2	2	1	2	3	3
CO 4	2	3	2	2	2	1	2	2	2
CO 5	3	2	2	2	2	1	2	2	2
Total	14	13	10	10	10	5	10	13	13
Course	3	3	2	2	2	1	1	3	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS308 INTRODUCTION TO PYTHON LABORATORY

Course Outcomes:

CO1	C	Apply	**Starts** to work with Python concepts
CO2	C	Apply	**Builds** the basic programs a log with trim method
CO3	C	Apply	**Build** program with function
CO4	C	Apply	**Apply** program with string concept
CO5	C	Apply	**Organizes** the function with parameter passing

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS308	**INTRODUCTION TO PYTHON LABORATORY**	**0**	**0**	**1**	**1**
C:P:A = 1:0:0					
		L	**T**	**P**	**H**
PREREQUISITE		**0**	**0**	**2**	**2**
				15	

1. Creating and manipulating a List
2. Creating and manipulating a Tuple
3. Creating and manipulating a Dictionary
4. Program in String Manipulations
5 Editing and executing Programs involving Flow Controls.
6. Editing and executing Programs involving Functions.
7. Class Object creating and usage.
8. Program involving Inheritance
9. Program involving Overloading
10. Reading and Writing with Text Files and Binary Files
11. Combining and Merging Data Sets
12. Program involving Regular Expressions
13. Data Aggregation and GroupWise Operations

LECTURE	**PRACTICAL**	**TOTAL**
0	**15**	**15**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	3	2	2	2	1	2	3	3
CO 2	3	3	2	2	2	1	2	3	3
CO 3	3	2	2	2	2	1	2	3	3
CO 4	3	3	2	2	2	1	2	2	3
CO 5	3	2	2	2	2	1	2	2	3
Total	15	13	10	10	10	5	10	13	15
Course	3	2	2	2	2	1	1	3	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS309 DATABASE MANAGEMENT SYSTEMS -LABORATORY

Course Outcomes:

CO1	C	Understanding	**Explain** ER diagram with basic functions
CO2	C	Apply	**Apply** DDL and DCL commands
CO3	C	Apply	**Construc**ts data base using Join and View operations.
CO4	C	Apply	**Apply** the normalization concepts for a table of data
CO5	C	Apply	**Construct** various queries in SQL and PL/SQL

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS309	**DATABASE MANAGEMENT SYSTEMS**	**0**	**0**	**1**	**1**
C:P:A = 1:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	Data Structures and algorithms laboratory	**0**	**0**	**2**	**2**
					15

1. Execute a single line query and group functions.
2. Execute DDL Commands.
3. Execute DML Commands
4. Execute DCL and TCL Commands.
5. Implement the Nested Queries.
6. Implement Join operations in SQL.
7. Create views for a particular table
8. Implement Locks for a particular table.
9. Write PL/SQL procedure for an application using exception handling.
10. Write PL/SQL procedure for an application using cursors.
11. Write a PL/SQL procedure for an application using functions
12. Write a PL/SQL procedure for an application using package.

Note: Ex. No: 11, 12 (As per Industry expert Recommendation)

	LECTURE	**TUTORIAL**	**PRACTICALS**	**TOTAL**
	0	**0**	**15**	**15**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	3	2	2	2	1	2	3	3
CO 2	3	3	2	2	2	1	2	3	3
CO 3	3	2	2	2	2	1	2	3	3
CO 4	3	3	2	2	2	1	2	3	3
CO 5	3	2	2	2	2	1	2	3	3
Total	15	13	10	10	10	5	10	15	15
Course	3	3	2	2	2	1	1	3	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS310 OPERATING SYSTEMS LABORATORY

Course Outcomes:

CO1	C	Apply	**Implement** the process and various process scheduling algorithms
CO2	C	Apply	**Implement** the process and various process scheduling algorithms
CO3	C	Apply	**Computes** principles of concurrency
CO4	C	Apply	**Integrates** different memory management techniques **Apply** the fixed size and variable size page replacement algorithm
CO5	C	Apply	**Implement** and **understand** the file organization

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS310	**OPERATING SYSTEMS LABORATORY**	**0**	**0**	**1**	**1**
C:P:A = 1:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	Nil	**0**	**0**	**2**	**2**
					15

1. Write a program for FCFS - CPU Scheduling Algorithms.
2. Write a program for the SJF - CPU Scheduling Algorithms.
3. Write a program for the Priority - CPU Scheduling Algorithms.
4. Write a program for the Round Robin - CPU Scheduling Algorithms
5. Write a program for MVT and MFT
6. Write a program for Banker's algorithm for Deadlock Avoidance (As per the Industry Expert Recommendation)
7. Write a program for Bankers Algorithm for deadlock Prevention
8. Write a program for FIFO Page Replacement Algorithms
9. Write a program for LRU Page Replacement Algorithms
10. Write a program for Optimal Page Replacement Algorithms
11. Write a program for Paging Technique of Memory Management

Note: Use Unix or Ubuntu or open source.

	LECTURE	**TUTORIAL**	**PRACTICALS**	**TOTAL**
	0	**-**	**15**	**15**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO 2
CO 1	3	3	2	2	2	1	2	3	3
CO 2	3	3	2	2	2	1	2	3	3
CO 3	3	2	2	2	2	1	2	3	3
CO 4	2	3	2	2	2	1	2	2	2
CO 5	3	2	2	2	2	1	2	2	2
Total	14	13	10	10	10	5	10	13	13
Course	3	3	2	2	2	1	1	3	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS403 DATA ANALYTICS

Course Outcomes:

CO1	C	Understanding	**Demonstrate** Data Management in Worksheet
CO2	C	Understanding	**Interpret** Formulas in an Excel Spread sheet
CO3	C	Apply	**Apply** Statistical and Mathematical functions for given
CO4	C	Apply	**Apply** the type of charts to analyses the data
CO5	C	Understanding	**Explain** Analysis Tool Pak for statistical concepts

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS403	**DATA ANALYTICS**	**2**	**0**	**0**	**2**
C:P:A = 2:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	Fundamentals of Data Science	**2**	**0**	**0**	**2**

UNIT -I : INTRODUCTION TO WORKSHEET **10**

Getting Started with Excel: Excel and Spread Sheets – Excel Workbooks and Worksheets – Worksheet Cells - Excel Add-Ins – Working with Data: Data Entry – Formulas and Functions – Querying Data – Importing Data from Databases.

UNIT- II: DATA ANALYSIS IN CHARTS **10**

Working with Charts: Excel Charts – Scatter Plots – Editing a chart – Identifying Data Points: Creating Bubble Plots – Breaking a scatter plot into categories – Plotting Several Variable.

UNIT- III: STATISTICAL ANALYSIS **10**

Describe Data: Variables and Descriptive Statistics - Frequency Tables: Creating a Frequency Table – Using Bins in a Frequency Table – Working with Histograms – Distribution Statistics – Percentiles and Quartiles – Measures of the Center: Means, Medians and the Mode – Measures of Variability – Working with Boxplots.

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

TEXT

1. Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017.

REFERENCES

1. David Spiegel halter, “The Art of Statistics: Learning from Data”, Pelican Books, 2020.
2. Peter Bruce, Andrew Bruce, and Peter Gedek, “Practical Statistics for Data Scientists”, Second Edition, O’Reilly Publishers, 2020.
3. Charles R. Severance, “Python for Everybody: Exploring Data in Python 3”, Shroff Publishers, 2017.
4. Bradley Efron and Trevor Hastie, “Computer Age Statistical Inference”, Cambridge University Press, 2016.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2
CO 1	3	3	2	2	2	1	2	3	3
CO 2	3	3	2	2	2	1	2	3	3
CO 3	3	2	2	2	2	1	2	3	3
CO 4	3	3	2	2	2	1	2	2	2
CO 5	3	2	2	2	2	1	2	2	2
Total	15	13	10	10	10	5	10	13	13
Course	3	3	2	2	2	1	1	3	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

COURSE CODE			COURSE NAME	L	T	P	C
XDS404			MATHEMATICS FOR DATA SCIENCE -IV	3	1	0	4
C	P	A					
4	0	0		L	T	P	H
				3	1	0	4

PREREQUISITE: Higher Secondary level Mathematics

COURSE OUTCOMES:

Course outcomes:	Domain	Level
CO1: Assimilate various graph theoretic concepts and familiarize with their applications.	Cognitive	Remembering
CO2: Know and understand about partially ordered sets, Boolean algebra, lattices and their types.	Cognitive	Understanding
CO3: Apply Karnaugh map for simplifying the Boolean expression.	Cognitive	Applying
CO4: Explain Basic theorems on Boolean Algebra, Duality principal Boolean. functions.	Cognitive	Understanding
CO5: Demonstrate knowledge of basic concepts in graph theory**.**	Cognitive	Understanding

UNIT I	**Mathematical logic**	**12**
Connectives ,well formed formulas, Tautology, Equivalence of formulas, Tautological implications, Duality law, Normal forms, Predicates, Variables, Quantifiers, Free and bound Variables. Theory of inference for predicate calculus.		
UNIT II	**Relations And Functions**	**12**
Composition of relations, Composition of functions, Inverse functions, one-to- one, onto, one-to one & onto functions, Hashing functions, Permutation function, Growth of functions. Algebra structures: Semi groups, Free semi groups, Monoids.		
UNIT III	**Formal Languages And Automata**	**12**
Regular expressions, Types of grammar, Regular grammar and finite state automata, Context free and sensitive grammars.		
UNIT IV	**Lattices And Boolean Algebra**	**12**
Partial ordering, Poset, Lattices, Boolean algebra, Boolean functions, Theorems, Minimization of Boolean functions (Karnaugh Method only).		
UNIT V	**Graph Theory**	**12**
Directed and undirected graphs, Paths, Reachability, Connectedness, Matrix representation, Euler paths, Hamiltonian paths, Trees, Binary trees - theorems, and applications.		

LECTURE	TUTORIAL	TOTAL
45	15	60

TEXTBOOK

1.J.B. Tremblay, R. Manohar, "Discrete Mathematical structures with applications to Computer Science", Tata McGraw Hill, International edition New Delhi, 1997, Reprint 2007.

1. Discrete Mathematical Structures with applications to computer science-J.P Tremblay and R.P Manohar (McGraw Hill, 1975.)
   Unit 1: Chapter 1. Sections - 1-2, 1-2.7. 1-2.9, 1-2.10, 1-2.11, 1-3, 1-5.1, 1-5.2, 1-5.4, 1-6.4

Unit 2: Chapter 2- Sections - 2-3.5, 2-3.7, 2-4.2, 2-4.3, 2-4.6, Chapter 3- Sections-3-2, 3-5, 3-5.3, Unit 3: Chapter 3- Sections 3-3.1, 3-3.2 Chapter 4- Section 4-6.2 Unit4: Chapter 4- Section 4-1.1, 4-2, 4-3, 4-4.2 Unit 5: Chapter 5- Section 5-1.1, 5-1.2, 5-1.3, 5-1.4
REFERENCE
1. M.K. Venkatraman, Sridharan Chandrasekaran, "Discrete Mathematics", The National Publishing company India, 2000. 2. Discrete Mathematics-Oscar Levin(3rd Edition,2016)
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1 https://nptel.ac.in/courses/106/106/106106094/ 2 https://nptel.ac.in/courses/111/107/111107058/

XDS405 R PROGRAMMING

Course Outcomes:

CO1	C	Understand	**Understand** Fundamentals of R.
CO2	C	Understand	**Characterize** 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.
CO3	C	Remember	**Describe** the Basics of statistical data analysis with examples
CO4	C	Understand	**Understand** data frames
CO5	C	Understand	**Infers** to compile and visualize data using statistical functions.

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS405	**R PROGRAMMING**	**3**	**0**	**0**	**3**
C:P: A = 3:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	Basic Concepts of Programming, Design	**3**	**0**	**0**	**3**

UNIT-I : INTRODUCTION	**9**
History of R- 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- II: DATA TYPES AND OPERATORS	**9**
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- III: R FUNCTION	**9**
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 –creating factors, generating factor levels gl()	
UNIT- IV: DATA FRAMES	**9**
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- V: DESCRIPTIVE STATISTICS | **9**

Descriptive Statistics: Data Range, Frequencies, Mode, Mean and Median: Mean Applying Trim Option, Applying NA Option, Median - Mode - Standard Deviation – Correlation - 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	TUTORIAL	TOTAL
45	0	45

TEXT

1.Sandip Rakshit, R Programming for Beginners, McGraw Hill Education (India), 2017, ISBN : 978-93-5260-455-5.
2. Seema Acharya, Data Analytics using R, McGrawHill Education (India), 2018, ISBN: 978-93-5260-524-8.
3. Tutorials Point (I) simply easy learning, Online Tutorial Library (2018), R Programming, Retrieved from https://www.tutorialspoint.com/r/r_tutorial.pdf. 4. Andrie de Vries, Joris Meys, R for Dummies A Wiley Brand, 2nd Edition, John Wiley and Sons, Inc, 2015, ISBN: 978-1-119-05580-8
4. Mark Gardener, Beginning R: The Statistical Programming Language (2013).
5. Roger Peng R Programming for Data Science (2016)

REFERENCES

1. Grolemund, Garrett, Hands-On Programming with R (2014) 4. Garrett Wickham, Garrett Grolemund, R for Data Science (2017)

E REFERENCES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	2	2	2	1	1	2	2	3
CO 2	3	2	2	2	1	1	2	2	3
CO 3	3	2	2	2	1	1	2	2	3
CO 4	2	2	2	2	1	1	2	2	3
CO 5	2	2	2	2	1	1	2	2	2
Total	13	10	10	10	5	5	10	10	14
Course	3	2	2	2	1	1	2	2	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS406 DATA MINING AND DATA WARE HOUSING

Course Outcomes:

CO1	C	Understand	**Summarize** the need for Data Mining.
CO2	C	Understand	**Acquire** knowledge on Data Preprocessing and Classification techniques.
CO3	C	Remember	**Infer** the concept of Clustering
CO4	C	Understand	**Explore** the concepts of Association Mining.
CO5	C	Understand	**Understand** the need for Data Warehousing

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS405	**DATA MINING AND DATA WARE HOUSING**	**3**	**0**	**0**	**3**
C:P:A = 3:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	Fundamentals of Data Science	**3**	**0**	**0**	**3**

UNIT-I : INTRODUCTION TO DATA MINING **9**

Introduction to Data Mining – Data Mining Tasks – Components of Data Mining Algorithms – Data Mining supporting Techniques — Measurement and Data – Data Preprocessing – Data sets

UNIT- II: DATA PREPROCESSING & CLASSIFICATION **9**

Need for Data Preprocessing - Data Preprocessing Methods: Data cleaning - Data integration - Data transformation - Data reduction – Classification: Introduction to Classification - Types of Classification - Input and Output Attributes - Working of Classification - Guidelines for Size and Quality of the Training Dataset - Introduction to the Decision Tree Classifier - Naive Bayes Method - Understanding Metrics to Assess the Quality of Classifiers

UNIT- III: CLUSTER ANALYSIS **9**

Introduction to Cluster Analysis - Applications of Cluster Analysis - Desired Features of Clustering - Distance Metrics -- Partitioning Clustering - Hierarchical Clustering Algorithms (HCA)

UNIT- IV: ASSOCIATION MINING **9**

Introduction to Association Rule Mining - Defining Association Rule Mining - The Metrics to Evaluate the Strength of Association Rules - The Naive Algorithm for Finding Association Rules - Approaches for Transaction Database Storage - The Apriori Algorithm - Closed and Maximal Itemsets - Direct Hashing and Pruning (DHP) - Dynamic Itemset Counting (DIC) - Mining Frequent Patterns without Candidate Generation (FP Growth)

UNIT- V: DATA WAREHOUSE AND DATA WAREHOUSE SCHEMA **9**

The Need for an Operational Data Store (ODS) - Operational Data Store - Data Warehouse - Data Marts - Data Warehouse Schema: Introduction to Data Warehouse Schema - Star Schema - Snowflake Schema - Fact Constellation Schema (Galaxy Schema) .

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

TEXT

1 Parteek Bhatia, “Data Mining and Data Warehousing - Principles and Practical Techniques”, Cambridge University Press, 2019, ISBN: 9781108727747.

REFERENCES

1.Jiawei Han, Micheline Kamber, Jian Pei, “Data Mining - Concepts and Techniques”, 3rd Edition, Morgan Kaufmann, 2012, ISBN: 9780123814791 DIGITAL SCIENCES (2020)
2. Jared Dean, “Big Data, Data Mining, and Machine Learning”, Wiley, 2014, ISBN: 978-118-61804- 2
3. Alejandro Vaisman, Esteban Zimanyi, “Data Warehouse Systems: Design and Implementation”, Springer, 2014, ISBN: 978-3-642-54654-9
4. Christopher Adamson, “Mastering Data Warehouse Aggregates: Solutions for Star Schema Performance”, Wiley Publishing Inc, 2006, ISBN: 978-0471777090
5. Galit Shmueli, Peter C. Bruce, Mia l. Stepiiens, Nitin R. Patel, “DATA MINING FOR BUSINESS ANALYTICS: Concepts, Techniques, and Applications”, John Wiley & Sons, 2017, ISBN: 9781118729274
6. Salvador García, Julián Luengo, Francisco Herrera, “Data Preprocessing in Data Mining”, Springer International, 2015, ISBN: 978-3-319-10246-7

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	2	2	2	1	1	2	2	3
CO 2	3	2	2	2	1	1	2	2	3
CO 3	3	2	2	2	1	1	2	2	3
CO 4	2	2	2	2	1	1	2	2	3
CO 5	2	2	2	2	1	1	2	2	2
Total	13	10	10	10	5	5	10	10	14
Course	3	2	2	2	1	1	2	2	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS408 DATA ANALYTICS-LABORATORY

Course Outcomes:

CO1	C	Apply	**Computes basic concepts** in worksheet
CO2	C	Apply	**Interpret** Formulas in an Excel Spread sheet
CO3	C	Apply	**Manipulate the** data with statistical and Mathematical functions
CO4	C	Apply	**Displays** the chart for any real time data
CO5	C	Apply	**Starts** to work with Analysis Tool Pak **Practices** Analysis Tool Pak with different samples

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS408	**DATA ANALYTICS LABORATORY**	**0**	**0**	**1**	**1**
C:P:A = 1:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	Introduction to Python Laboratory	**0**	**0**	**2**	**2**
					15

1. Create a table to perform statistical and mathematical functions.
2. Create a spreadsheet to sort data and print portions of a worksheet.
3. Import and export the data from the database and files.
4. Create a spreadsheet to perform “What if?” calculations.
5. Demonstrates the ease of creating charts.
6. Draw a Histogram Diagram in MS-Excel using student data set.
7. Perform Regression analysis with given dataset.
8. Perform correlation analysis with given data.
9. Create pivot table and carry out the analysis with charts.

LECTURE	**PRACTICAL**	**TOTAL**
0	**15**	**15**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 8	PSO 9
CO 1	3	3	2	2	2	1	2	3	3
CO 2	3	3	2	2	2	1	2	3	3
CO 3	3	2	2	2	2	1	2	3	3
CO 4	3	3	2	2	2	1	2	2	2
CO 5	3	2	2	2	2	1	2	2	2
Total	15	13	10	10	10	5	10	13	13
Course	3	3	2	2	2	1	1	3	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS409 R PROGRAMMING LABORATORY

Course Outcomes:

CO1	C	Apply	Setup R Programming Environment.
CO2	C	Apply	Understand and use R – Data types.
CO3	C	Apply	Understand and use R – Data Structures
CO4	C	Apply	Develop programming logic using R – Packages.
CO5	C	Apply	Analyze data sets using R – programming capabilities

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS408	**R PROGRAMMING LABORATORY**	**0**	**0**	**1**	**1**
C:P:A = 1:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	Nil	**0**	**0**	**2**	**2**
				15	

1. Download and install R-Programming environment and install basic packages using install. Packages() command in R.
2. Learn all the basics of R-Programming (Data types, Variables, Operators etc,.)
3. Write a program to find list of even numbers from 1 to n using R-Loops.
4. Create a function to print squares of numbers in sequence.
5. Write a program to join columns and rows in a data frame using cbind() and rbind() in R.
6. Implement different String Manipulation functions in R.
7. Implement different data structures in R (Vectors, Lists, Data Frames)
8. Write a program to read a csv file and analyze the data in the file in R
9. Create pie chart and bar chart using R.
10. Create a data set and do statistical analysis on the data using R.

	LECTURE	**PRACTICAL**	**TOTAL**
	0	**15**	**15**

TEXT BOOK: Norman Matloff, The Art of R Programming, UC Davis 2009.

WEB REFERENCE: https://www.r-project.org/

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	3	2	2	2	1	2	3	3
CO 2	3	3	2	2	2	1	2	3	3
CO 3	3	2	2	2	2	1	2	3	3
CO 4	3	3	2	2	2	1	2	2	3
CO 5	3	2	2	2	2	1	2	2	3
Total	15	13	10	10	10	5	10	13	15
Course	3	2	2	2	2	1	1	3	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS410 DATA MINING AND WAREHOUSING LABORATORY

Course Outcomes:

CO1	C	Applying	**Starts** to work with Python concepts
CO2	C	Applying	**Builds** the basic programs alog with trim method
CO3	C	Applying	**Build** program with function
CO4	C	Applying	**Organizes** the function with parameter passing
CO5	C	Applying	**Demonstrate** mining concepts

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS410	**DATA MINING AND WAREHOUSING LABORATORY**	**0**	**0**	**1**	**1**
C:P:A =1:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	Nil	**0**	**0**	**2**	**2**
				15	

Lab:

1. Listing applications for mining
2. File format for data mining
3. conversion of various data files
4. Training the given dataset for an application
5. Testing the given dataset for an application
6. Generating accurate models
7. Data pre-processing – data filters
8. Feature selection
9. Web mining
10. Text mining
11. Design of fact & dimension tables
12. Generating graphs for star schema.

	LECTURE	**PRACTICAL**	**TOTAL**
	0	**15**	**15**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	3	2	2	2	1	2	3	3
CO 2	3	3	2	2	2	1	2	3	3
CO 3	3	2	2	2	2	1	2	3	3
CO 4	3	3	2	2	2	1	2	2	3
CO 5	3	2	2	2	2	1	2	2	3
Total	15	13	10	10	10	5	10	13	15
Course	3	2	2	2	2	1	1	3	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS501 ARTIFICIAL INTELLIGENCE

Course Outcomes:

CO1	C	Understand	**Comprehend** different types of problem-solving agents and its applications.
CO2	C	Understand	**Explains** the problems using informed and uninformed search strategies.
CO3	C	Remember	**Recalls** the Representation Logic using scripts and frames.
CO4	C	Understand	**Comprehend and analyze** the different types of learning.
CO5	C	Understand	**Extend** to Identify the need of Production system and Planning states. Use expert system tools to realize the concepts and components of expert system

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS501	**ARTIFICIAL INTELLIGENCE**	**2**	**0**	**0**	**2**
C:P:A = 2:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	Data Analytics	**2**	**0**	**0**	**2**

UNIT-I : INTRODUCTION & PROBLEM SOLVING **10**

Introduction to Artificial Intelligence, Background and Applications, Turing Test and Rational Agent approaches to AI, Introduction to Intelligent Agents, their structure, behavior and environment. Problem Characteristics, Production Systems, Control Strategies, Breadth First Search, Depth First Search, Hill climbing and its Variations, Heuristics

UNIT- II: SEARCHING TECHNIQUES & KNOWLEDGE REPRESENTATION **10**

Search Techniques: Best First Search, A* algorithm, Constraint Satisfaction Problem, Means-End Analysis, Introduction to Game Playing, Min-Max and Alpha-Beta pruning algorithms. Introduction to First Order Predicate Logic, Resolution Principle, Unification, Semantic Nets, Conceptual Dependencies, Frames, and Scripts, Production Rules, Conceptual Graphs..

UNIT- III: DEALING WITH UNCERTAINTY & UNDERSTANDING NATURAL LANGUAGES **10**

Truth Maintenance System, Default Reasoning, Probabilistic Reasoning, Bayesian Probabilistic Inference, Possible World Representations. Parsing Techniques, Context-Free and Transformational Grammars, Recursive and Augmented Transition Nets.

	LECTURE	**TUTORIAL**	**TOTAL**
	30	**0**	**30**

TEXT BOOKS:

1. DAN.W. Patterson, Introduction to A.I and Expert Systems – PHI, 2007.
2.Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", 3rd Edition, Pearson Education / Prentice Hall of India, 2010.
3.Prateek Joshi, "Artificial Intelligence with Python", Packt Publishing, 2017

REFERENCES

Joseph C. Giarratano , Gary D. Riley ,"Expert Systems : Principles and Programming",4th Edition, 2015.

E REFERENCES

1.https://www.pdfdrive.net/artificial-intelligence-a-modern-approach-3rd-editione32618455.html

MOOC

1. https://www.coursera.org/learn/introduction-to-ai

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	2	2	2	1	1	2	2	3
CO 2	3	2	2	2	1	1	2	2	3
CO 3	3	2	2	2	1	1	2	2	3
CO 4	2	2	2	2	1	1	2	2	3
CO 5	2	2	2	2	1	1	2	2	2
Total	13	10	10	10	5	5	10	10	14
Course	3	2	2	2	1	1	2	2	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS502A JAVA PROGRAMMING

Course Outcomes:

CO1	C	Remember	**Knows** the history and features of java
CO2	C	Understand	**Describe** and **implement** the class, packages and interfaces
CO3	C	Understand	**Describe** and **implement** the inheritance concepts
CO4	C	Understand	**Describe** and **implement** various types of exception and its handling methods
CO5	C	Remember	**Outlines** of the Applets methods in Graphics, AWT controls and event handling

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS502A	**JAVA PROGRAMMING**	**4**	**0**	**0**	**4**
C:P:A = 4:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	C++ Programming	**4**	**0**	**0**	**4**

UNIT- I: INTRODUCTION	**12**
Introduction to Java-Java and Internet-Byte codes-Features of Java-Java Development Environment- Java History -Java Development Kit (JDK)-Java Tokens-Java Character set-data types-operators-expressions-Java Statements-control statements-Simple programs- Array and Vectors-Strings and String Buffers.	
UNIT- II: CLASSES, INTERFACES AND PACKAGES	**12**
Classes-Objects-Wrapper Classes-Packages and Interfaces-extending interfaces-implementing interfaces-abstract methods.	
UNIT- III: INHERITANCE	**12**
Inheritance Extending classes-overriding methods-finalize methods-Abstract and Final classes-Interfaces and Inheritance.	
UNIT- IV: EXCEPTION HANDLING	**12**
Error Handling and Exception Handling-Exception Types and Hierarchy-Try Catch blocks-Use of Throw, Throws and Finally- Programmer Defined Exceptions.	
UNIT- V: APPLETS, GRAPHICS AND FILES	**12**
Fundamentals of Applets-Graphics. AWT and Event Handling: AWT components and Event Handlers-AWT Controls and Event Handling Types and Examples-Swing- Introduction. Input and Output: Files – Streams. Multithreading.	

LECTURE	**TUTORIAL**	**PRACTICAL**	**TOTAL**
60		**0**	**60**

TEXT

1.Amritendu De, “Spring 4 and Hibernate 4: Agile Java Design and Development”, McGraw-Hill Education, 2015

2. Herbert Schildt, The Complete Reference – Java 2, Ninth Edition, Tata McGraw Hill, 2014 3. Joyce Farrell, “Java Programming”, Cengage Learning, Seventh Edition, 201473 35

4. John Dean, Raymond Dean, “Introduction to Programming with JAVA – A Problem Solving Approach”, Tata Mc Graw Hill, 2014.

REFERENCES

1. Mahesh P. Matha, “Core Java A Comprehensive Study”, Prentice Hall of India, 2011
2.R. Nageswara Rao,“Core Java: An Integrated Approach”, DreamTech Press, 2016

E REFERENCES

1. http://www.nptelvideos.com/java/java_video_lectures_tutorials.php
2. http://www.nptelvideos.com/java/java_video_lectures_tutorials.php
3. http://freevideolectures.com/Course/2513/Java-Programming.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	3	3	3	3	1	2	3	3
CO 2	3	3	2	2	2	1	2	3	3
CO 3	3	3	2	2	2	1	2	3	3
CO 4	3	3	2	2	2	1	2	2	3
CO 5	3	3	2	2	2	1	2	2	3
Total	15	15	11	11	11	5	10	13	15
Course	3	3	2	2	2	1	1	3	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS502B RDBMS and SQL

Course Outcomes:

CO1	C	Understand	**Describes** the basics of DBMS.
CO2	C	Understand	**Discuss** the ER model and its features
CO3	C	Remember	**Describe** the relational model and views
CO4	C	Understand	**Demonstrate** SQL queries with triggers
CO5	C	Understand	**Summarize** queries with PL/SQL procedures

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS502B	**RDBMS and SQL**	**4**	**0**	**0**	**4**
C:P:A = 4:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	DBMS	**4**	**0**	**0**	**4**

UNIT-I : OVERVIEW	**12**
Overview of database systems: Managing Data - A Historical Perspective - File System versus DBMS Advantages of a DBMS - Describing and Storing data in a DBMS - Queries in a DBMS - Transaction Management - Structure of a DBMS.	
UNIT- II: ER MODEL.	**12**
Database Design & ER diagrams - Entities, Attributes and Entity Sets - Relationships and Relationship Set - Additional features of the ER model - Conceptual Database design with ER Model.	
UNIT- III: RELATIONAL MODEL	**12**
Relational Model: Introduction - Integrity Constraints Over Relations - Enforcing Integrity Constraints on Relational Data - Logical Database Design: ER to Relational - Introduction to Views - Destroying / Altering Tables and Views - Relational Algebra and Calculus.	
UNIT- IV: SQL QUERIES	**12**
SQL Queries, Constraints, Triggers: The form of a Basic SQL Query - UNION, INTERSECT and EXCEPT - Nested Queries - Aggregate Operators - Null Values - Complex integrity constraints in SQL - Triggers and Active Data bases – Query Evaluation.	
UNIT- V: PL/SQL PROGRAMMING	**12**
PL/SQL Programming: Functions and Procedures, Triggers, Queries, Forms, Reports, Cursors, Exceptions. Introduction to NoSQL – Types.	

LECTURE	**TUTORIAL**	**TOTAL**
60	**0**	**60**

TEXT

1. Raghu Ramakrishnan and Johannes Gehrke (2003). Database Management System, Third edition, McGraw-Hill.

REFERENCES

1. Abraham Silberschatz, Henry F. Korth and Sudarshan S (2005). Database System Concepts, 5/e, McGraw- Hill.
2. Date CJ (2003). An Introduction to Database Systems, 8/e, Pearson Education.
3. Michael Mclaughlin, (2010). Oracle Database 11g PL/SQL Programming, McGraw Hill.
4. Shashank Tiwari (2011). Professional NoSQL, John Wiley & Sons

E REFERENCES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	2	2	2	1	1	2	2	3
CO 2	3	2	2	2	1	1	2	2	3
CO 3	3	2	2	2	1	1	2	2	3
CO 4	2	2	2	2	1	1	2	2	3
CO 5	2	2	2	2	1	1	2	2	2
Total	13	10	10	10	5	5	10	10	14
Course	3	2	2	2	1	1	2	2	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS502C DATA SCIENCE USING PYTHON

Course Outcomes:

CO1	C	Understand	**Demonstrate** the use of built-in objects of Python
CO2	C	Understand	**Demonstrate** significant experience with python program development
CO3	C	Apply	**Implement** numerical programming, data handling through NumPy Modules.
CO4	C	Understand	**Visualize** through MatplotLib modules.
CO5	C	Understand	**Summarize** the Data

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS502C	**DATA SCIENCE USING PYTHON**	**4**	**0**	**0**	**4**
C:P:A = 4:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	Introduction to Python	**4**	**0**	**0**	**4**

UNIT-I : BASICS	**12**
Structure of Python Program-Underlying mechanism of Module Execution-Branching and Looping Problem Solving Using Branches and Loops-Functions - Lists and Mutability-Problem Solving Using Lists and Functions.	
UNIT- II: SEQUENCE DATATYPES AND OBJECT-ORIENTED PROGRAMMING	**12**
Sequences, Mapping and Sets- Dictionaries- -Classes: Classes and Instances-Inheritance-Exceptional Handling-Introduction to Regular Expressions using "re" module.	
UNIT- III: USING NUMPY	**12**
Basics of NumPy-Computation on NumPy-Aggregations-Computation on Arrays-Comparisons, Masks and Boolean Arrays-Fancy Indexing-Sorting Arrays-Structured Data:NumPy's Structured Array.	
UNIT- IV: DATA MANIPULATION WITH PANDAS – I	**12**
Introduction to Pandas Objects-Data indexing and Selection-Operating on Data in Pandas-Handling Missing Data-Hierarchical Indexing - Combining Data Sets.	
UNIT- V: DATA MANIPULATION WITH PANDAS –II AND CASE STUDY	**12**
Aggregation and Grouping-Pivot Tables-Vectorized String Operations -Working with TimeSeriesHigh Performance Pandas-eval() and query()- VISUALIZATION AND MATPLOTLIB:Basic functions of matplotlib-Simple Line Plot, Scatter Plot-Density and Contour Plots-Histograms, Binnings and Density-Customizing Plot Legends, Colour Bars-Three-Dimensional Plotting in Matplotlib. Case Study : Data Science in Pharmaceutical Industries, Bio Tech, and Education.	

	LECTURE	**TUTORIAL**	**TOTAL**
	60	**0**	**60**

TEXT

1. Jake VanderPlas ,Python Data Science Handbook - Essential Tools for Working with Data, O'ReilyMedia,Inc, 2016.
2. Zhang.Y ,An Introduction to Python and Computer Programming, Springer Publications,2016.

REFERENCES

1. Joel Grus ,Data Science from Scratch First Principles with Python, O'Reilly Media,2016
2 T.R.Padmanabhan, Programming with Python,Springer Publications,2016.

E REFERENCES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	2	2	2	1	1	2	2	3
CO 2	3	2	2	2	1	1	2	2	3
CO 3	3	2	2	2	1	1	2	2	3
CO 4	2	2	2	2	1	1	2	2	3
CO 5	2	2	2	2	1	1	2	2	2
Total	13	10	10	10	5	5	10	10	14
Course	3	2	2	2	1	1	2	2	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS503A COMPUTER NETWORKS

Course Outcomes:

CO1	C	Understand	**Explain** the OSI reference model used in the network analyze the requirement of the physical layer.
CO2	C	Understand	**Describe** the DLL services and different protocols. **Summarize** the essentials of the data link layer.
CO3	C	Understand	**Defends** the issues in the network layer
CO4	C	Understand	**Explains** the need for the transport layer.
CO5	C	Understand	**Illustrate** the importance of the application layer

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS503A	**COMPUTER NETWORKS**	**4**	**0**	**0**	**4**
C:P:A = 4:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	Nil	**4**	**0**	**0**	**4**

UNIT-I : OVERVIEW OF COMPUTER NETWORKS **12**

Network hardware- Network software- Protocol Hierarchies – Layering – Interfaces, services, primitives – OSI reference Model – TCP/IP reference model – physical layer – transmission media - Wireless transmission – switching.

UNIT – II : DATA LINK LAYER **12**

The Data Link Layer: Data Link Layer Design Issues – Error Detection and Correction – Elementary Data Link Protocols – Sliding Window Protocols – Example Data Link Protocols - The Medium Access Control Sublayer: The Channel Allocation Problem – Multiple Access Protocols – Ethernet – Wireless LAN's – Broadband Wireless – Data Link Layer Switching

UNIT-III: NETWORK LAYER **12**

The Network Layer: Network Layer Design Issues – Routing Algorithms: The Optimality Principle – Shortest Path Algorithm – Flooding – Distance Vector Routing – Congestion Control Algorithms – Quality of Service – Internetworking – The Network Layer in the Internet

UNIT- IV : TRANSPORTATION LAYER **12**

The Transport Service – Elements of Transport Protocols – Congestion Control – The Internet Transport Protocols – UDP – TCP

UNIT- V: APPLICATION LAYER **12**

The Application Layer: Domain Name System – Electronic Mail – The World Wide Web – Streaming Audio and Video – Content Delivery

	LECTURE	**TUTORIAL**	**PRACTICALS**	**TOTAL**
	60	**0**	**0**	**60**

TEXT

1.Andrew S. Tanenbaum and David J. Wetherall, "Computer Networks", Prentice Hall, 5th Edition, 2013, ISBN: 78-0- 13-212695-3

2.Larry Peterson and Bruce Davie, Computer Networks: A Systems Approach, 4th Ed. 2007.

REFERENCES

1 Kurise James F and Ross Keith W, "Computer Networking", Pearson, 6th Edition, 2017, ISBN: 9789332585492

2. Brijendra Singh, "Data Communications and Computer Networks", Prentice Hall, 4th

Edition, 2014, ISBN: 8120349075
3. William Stallings, “Data and Computer Communications”, Pearson, 10th Edition, 2017, ISBN: 9789332586932
4. Behrouz A Forouzan, “Data Communications and Networking”, McGraw Hill Education, 5th Edition, 2017, ISBN: 1259064751
5. Dhanashree K Toradmalle, “Computer Networks and Network Design”, Wiley India, 1st Edition, 2020, ISBN: 9390395097

E REFERENCES

1. http://nptel.ac.in/courses/106105081/
2. Computer Network Topology, Prof.Sujoy Gosh, http://nptel.ac.in/video.php?subjectId=10610 5081

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	3	2	2	2	1	1	3	2
CO 2	3	3	2	2	2	1	1	3	2
CO 3	3	3	2	2	2	1	1	3	2
CO 4	3	2	2	2	2	1	1	3	2
CO 5	2	2	2	2	2	1	1	3	2
Total	14	13	10	10	10	5	5	15	10
Course	3	3	2	2	2	1	1	3	2

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS503B CLOUD COMPUTING

Course Outcomes:

CO1	C	Understand	**Illustrate** the basic concepts of cloud computing.
CO2	C	Understand	**Outline** the cloud computing platforms.
CO3	C	Apply	**Utilize** cloud services and applications.
CO4	C	Understand	**Summarize** the cloud infrastructure.
CO5	C	Understand	**Defends** make use of cloud applications.

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS503B	**CLOUD COMPUTING**	**4**	**0**	**0**	**4**
C:P:A = 4:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	Nil	**4**	**0**	**0**	**4**

UNIT-I : OVERVIEW OF CLOUD COMPUTING **12**

Defining Cloud Computing: Definition of cloud computing - Cloud Types - Characteristics of Cloud computing - Role of Open Standards. Cloud Architecture: Exploring the Cloud Computing Stack - Connecting to the Cloud. Services and Applications: Infrastructure as a Service - Platform as a Service - Software as a Service - Identity as a Service - Compliance as a Service.

UNIT- II: CLOUD COMPUTING PLATFORMS **12**

Abstraction and Virtualization: Using Virtualization Technologies - Load Balancing and Virtualization - Understanding Hypervisors - Machine Imaging - Porting Applications.

UNIT- III: SERVICES AND APPLICATIONS **12**

Exploring Platform as a Service: Defining Services - PaaS Application Frameworks - Google Web Services: Exploring Google Applications - Surveying the Google Application Portfolio - Exploring the Google Toolkit - Google App Engine. Amazon Web Services: Understanding Amazon Web Services - AWS Components and Services - Elastic Compute Cloud - Amazon Storage Systems - Amazon Database Services.

UNIT- IV: CLOUD INFRASTRUCTURE **12**

Managing the Cloud: Administering the Clouds - Cloud Management Products - Emerging Cloud Management Standards - Cloud Security: Securing the Cloud - Securing Data - Establishing Identity and Presence. Service Oriented Architecture: Introduction to Service Oriented Architecture - Defining SOA Communications - Managing and Monitoring SOA - Relating SOA and Cloud Computing

UNIT- V: CLOUD APPLICATIONS **12**

Moving Applications to the Cloud: Applications in the Clouds - Applications and Cloud APIs. Webmail Services: Cloud Mail Services - Syndication Services - Communicating with the Cloud: Instant Messaging - Collaboration Technologies - Social Networks. Mobile Cloud: Working with Mobile Devices - Defining the Mobile Market - Using Smartphones with the Cloud.

	LECTURE	**TUTORIAL**	**TOTAL**
	60	**0**	**60**

TEXT

1. Barrie Sosinsky, Cloud Computing Bible, Wiley, ISBN: 978-0-470-90356-8.
REFERENCES
1.Anthony T Velte, Toby J Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", First Edition, 2017, McGraw Hill, ISBN: 978-0-07-162695-8. 2. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, Mastering Cloud Computing, McGraw Hill, ISBN13 : 978-1259029950. 3. Sarishma Abhirup Khanna, Mobile Cloud Computing: Principles and Paradigms.
E REFERENCE

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	2	2	2	1	1	2	2	3
CO 2	3	2	2	2	1	1	2	2	3
CO 3	3	2	2	2	1	1	2	2	3
CO 4	2	2	2	2	1	1	2	2	3
CO 5	2	2	2	2	1	1	2	2	2
Total	13	10	10	10	5	5	10	10	14
Course	3	2	2	2	1	1	2	2	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS503C EXPLORATORY DATA ANALYSIS

Course Outcomes:

CO1	C	Remembering	**Illustrate** the basic concepts of Exploratory Data Analysis.
CO2	C	Understanding	**Outline** the EDA assumptions.
CO3	C	Analyzing	**Utilize** EDA techniques
CO4	C	Understanding	**Summarize** Graphical techniques for EDA
CO5	C	Applying	**Apply** on EDA case studies

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS503C	**EXPLORATORY DATA ANALYSIS**	**4**	**0**	**0**	**4**
C:P:A = 4:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	Data Analytics	**4**	**0**	**0**	**4**

UNIT-I : INTRODUCTION	**12**
Introduction to Exploratory Data Analysis, Difference between classic data analysis and exploratory data analysis, difference between summary analysis and data exploratory analysis.	
UNIT- II: EDA	**12**
Basic EDA assumptions, importance of underlying assumptions, techniques for testing assumptions, interpretation of 4-Plot, consequences of non-randomness, non-fixed parameters like location and variation parameters, consequences related to distributional assumptions.	
UNIT- III: EDA TECHNIQUES	**12**
EDA techniques, analysis questions, graphical techniques, auto correlation plot for random data, moderate correlation, strong and autoregressive correlation, sinusoidal correlation, Various Plot.	
UNIT- IV: ANOVA	**12**
Graphical techniques for EDA, Quantitative techniques, ANOVA, Bartlett's test, probability distributions, family of probability distribution, location and scale parameters, estimation of parameters, various distributions.	
UNIT- V: CASE STUDIES	**12**
EDA case studies – Random distribution, Random walk, standard resistor, Heat flow meter.	

	LECTURE	**TUTORIAL**	**TOTAL**
	60	**0**	**60**

TEXT BOOKS:

1. Exploratory Data Analysis by John W. Tukey (1977) – 2016 Reprint. 2. Exploratory Data Analysis with R by Roger Peng (2016).

REFERENCES

1. Think Stats: Exploratory Data Analysis (2nd edition) by Allen B. Downey (2014)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	2	2	2	1	1	2	2	3
CO 2	3	2	2	2	1	1	2	2	3
CO 3	3	2	2	2	1	1	2	2	3
CO 4	2	2	2	2	1	1	2	2	3
CO 5	2	2	2	2	1	1	2	2	2
Total	13	10	10	10	5	5	10	10	14
Course	3	2	2	2	1	1	2	2	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS505 ARTIFICIAL INTELLIGENCE LABORATORY

Course Outcomes:

CO1	C	Understanding	**Summarize** the basics of python programming.
CO2	C	Apply	make **Use** of data preprocessing techniques.
CO3	C	Analyze	**Analyze** data using numpy
CO4	C	Analyze	**Analyze** cross tabulation
CO5	C	Creating	explore data to **Solve** data science problems..

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS505	**ARTIFICIAL INTELLIGENCE LABORATORY**	**0**	**0**	**1**	**1**
C:P:A = 1:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	Introduction to Python Lab or R Programming	**0**	**0**	**2**	**2**
				15	

1.Write a prolog program to calculate the sum of two numbers.
2. Write a prolog program to find the maximum of two numbers.
3. Write a prolog program to calculate the nth Fibonacci number.
4. Write a prolog program, insert_nth(item, n, into_list, result) that asserts that result is the list into_list with item inserted as the n‘th element into every list at all levels.
5. Write a Prolog program to remove the Nth item from a list.
6. Write a Prolog program, remove-nth(Before, After) that asserts the After list is the Before list with the removal of every n‘th item from every list at all levels.
7. Write a Prolog program to implement append for two lists.
8. Write a Prolog program to implement palindrome(List).
9. Write a Prolog program to implement max(X,Y,Max) so that Max is the greater of two numbers X and Y.
10. Write a Prolog program to implement maxlist(List,Max) so that Max is the greatest number in the list of numbers List.
11. Write a Prolog program to implement sumlist(List,Sum) so that Sum is the sum of a given list of numbers List.
12. Write a Prolog program to implement reverse(List,ReversedList) that reverses lists.
13. Write a Prolog program to implement maxlist(List,Max) so that Max is the greatest number in the list of numbers List using cut predicate.
14. Write a prolog program that implements Semantic Networks/Frame Structures.

LECTURE	**PRACTICAL**	**TOTAL**
0	**15**	**15**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	3	2	2	2	1	2	3	3
CO 2	3	3	2	2	2	1	2	3	3
CO 3	3	2	2	2	2	1	2	3	3
CO 4	3	3	2	2	2	1	2	2	3
CO 5	3	2	2	2	2	1	2	2	3
Total	15	13	10	10	10	5	10	13	15
Course	3	2	2	2	2	1	1	3	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS506A- JAVA PROGRAMMING LABORATORY

Course Outcomes:

CO1	C	Apply	**Implement** the class, packages and interfaces
CO2	C	Apply	**Implement** the inheritance concepts
CO3	C	Apply	**Implement** various types of exception and its handling methods
CO4	C	Apply	**Illustrate** the Applets methods in Graphics, AWT controls and event handling
CO5	C	Apply	**Computes** an application using event handling method

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS506A	**JAVA PROGRAMMING LABORATORY**	**0**	**0**	**1**	**1**
C:P:A = 1:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	Object Oriented Programming with C++ Laboratory	**0**	**0**	**2**	**2**
					15

Lab

1. Program to implement simple programs based on operators, Loop and decision making statements.
2. Program to implement array
3. Program to implement a class and instantiate its object.
4. Program to demonstrate the use of interfaces.
5. Program to implement user-defined and pre-defined packages.
6. Program to implement constructor and overloading concepts
7. Program to implement wrapper classes.
8. Program to implement string class and string buffer class.
9. Program to implement single level and multi level inheritance.
10. Program to implement exception handling.
11. Program to implement a simple applet.
12. Program to implement an applet using graphics class.

	LECTURE	**TUTORIAL**	**PRACTICAL**	**TOTAL**
	0	**0**	**15**	**15**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	3	3	3	3	1	2	3	3
CO 2	3	3	2	2	2	1	2	3	3
CO 3	3	3	2	2	2	1	2	3	3
CO 4	3	3	2	2	2	1	2	2	3
CO 5	3	3	2	2	2	1	2	2	3
Total	15	15	11	11	11	5	10	13	15
Course	3	3	2	2	2	1	1	3	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS506B- RDBMS and SQL LABORATORY

Course Outcomes:

CO1	C	Create	**Create** database and form tables
CO2	C	Apply	**Operates** with basic operations on RDBMS
CO3	C	Apply	**Constructing** groups on tables
CO4	C	Apply	**Uses** the basic numeric functions on tables.
CO5	C	Apply	**Computes** string functions.

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS506B	**RDBMS and SQL LABORATORY**	**0**	**0**	**1**	**1**
C:P:A = 1:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	Database Management Systems Laboratory	**0**	**0**	**2**	**2**
					15

Lab

1. Creating a database
2. Creating a table
3. Inserting records in a table
4. Altering the table structure.
5. Deleting data from table
6. Updating data from table.
7. Select command
8. Where clause
9. Aggregate functions
10. Numeric functions (Absolute, ceiling, floor, modulo, round off, square, Square Root, power)
11. Constraints
12. Group By, Having
13. Operators (and, or, not between, In , not in, is null, is not null, like, Order By)
14. String Functions (Lower, Upper, Replace, left-trim, right-trim, substring, Length, rename)
15. Drop (table, database)
16. Truncate

LECTURE	**TUTORIAL**	**PRACTICAL**	**TOTAL**
0	**0**	**15**	**15**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	3	3	3	3	1	2	3	3
CO 2	3	3	2	2	2	1	2	3	3
CO 3	3	3	2	2	2	1	2	3	3
CO 4	3	3	2	2	2	1	2	2	3
CO 5	3	3	2	2	2	1	2	2	3
Total	15	15	11	11	11	5	10	13	15
Course	3	3	2	2	2	1	1	3	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS506C - DATA SCIENCE USING PYTHON LABORATORY

Course Outcomes:

CO1	C	Create	**Create** database and form tables
CO2	C	Apply	**Operates** with basic operations on RDBMS
CO3	C	Apply	**Constructing** groups on tables
CO4	C	Apply	**Uses** the basic numeric functions on tables.
CO5	C	Apply	**Computes** string functions.

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS506C	**DATA SCIENCE USING PYTHON LABORATORY**	**0**	**0**	**1**	**1**
C:P:A = 1:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	Introduction to Python Laboratory	**0**	**0**	**2**	**2**
					15

1. Functions in Python Libraries usingNumpy.
2. Functions in Python Library using Pandas.
3. Functions in Python Library usingScikit
4. Perform Data exploration and preprocessing in Python
5. Implement regularised Linear regression
6. Implement Naive Bayes classifier for dataset stored as CSV file.
7. Implement regularized logistic regression
8. Build models using different Ensembling techniques
9. Build models using Decision trees
10. Build model using SVM with different kernels
11. Implement K-NN algorithm to classify a dataset.
12. Build model to perform Clustering using K-means after applying PCA and determining the value of K using Elbow method.

LECTURE	**TUTORIAL**	**PRACTICAL**	**TOTAL**
0	**0**	**15**	**15**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	3	3	3	3	1	2	3	3
CO 2	3	3	2	2	2	1	2	3	3
CO 3	3	3	2	2	2	1	2	3	3
CO 4	3	3	2	2	2	1	2	2	3
CO 5	3	3	2	2	2	1	2	2	3
Total	15	15	11	11	11	5	10	13	15
Course	3	3	2	2	2	1	1	3	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS601 INTRODUCTION TO IOT

Course Outcomes:

CO1	C	Remember	**Defines** fundamental concepts of IoT
CO2	C	Understand	**Defends** roles of sensors in IoT
CO3	C	Remember	**Describes** different protocols used for IoT design
CO4	C	Analyze	**Analyze** with data handling and analytics tools in IoT
CO5	C	Understand	**Translate** the role of big data, cloud computing and data analytics in a typical IoT system.

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS601	**INTRODUCTION TO IOT**	**2**	**0**	**0**	**2**
C:P:A = 2:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	Nil	**2**	**0**	**0**	**2**

UNIT-I : FUNDAMENTALS OF IOT — **10**

Introduction, Definitions & Characteristics of IoT, IoT Architectures, Physical & Logical Design of IoT, Enabling Technologies in IoT, History of IoT, About Things in IoT, The Identifiers in IoT, About the Internet in IoT, IoT frameworks, IoT and M2M.

UNIT- II: SENSORS NETWORKS — **10**

Definition, Types of Sensors, Types of Actuators, Examples and Working, IoT Development Boards: Arduino IDE and Board Types, RaspberriPi Development Kit, RFID Principles and components, Wireless Sensor Networks: History and Context, The node, Connecting nodes, Networking Nodes, WSN and IoT.

UNIT- III: TECHNOLOGIES & APPLICATIONS — **10**

WPAN Technologies for IoT: IEEE 802.15.4, Zigbee, HART, NFC, Z-Wave. IP Based Protocols for IoT IPv6, 6LowPAN, RPL. Data Handling& Analytics: Introduction, Bigdata, Types of data, Characteristics of Big data, Data handling Technologies, Flow of data, Data acquisition, Data Storage, Introduction to Hadoop. Introduction to data Analytics, Types of Data analytics, Local Analytics, Cloud analytics and applications. Applications of IoT: Home Automation, Smart Cities, Energy,

LECTURE	**TUTORIAL**	**TOTAL**
30	**0**	**30**

TEXT BOOKS:

1. Hakima Chaouchi, — "The Internet of Things Connecting Objects to the Web" ISBN : 978-1- 84821-140-7, Wiley Publications
2. Olivier Hersent, David Boswarthick, and Omar Elloumi, — "The Internet of Things: Key Applications and Protocols", WileyPublications
3. Vijay Madisetti and ArshdeepBahga, — "Internet of Things (A Hands-on-Approach)", 1 st Edition, VPT, 2014.
4. J. Biron and J. Follett, "Foundational Elements of an IoT Solution", O'Reilly Media, 2016.
5. Keysight Technologies, "The Internet of Things: Enabling Technologies and Solutions for Design and Test", Application Note, 2016.

REFERENCES

1. Daniel Minoli, — "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications

2. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
3. https://onlinecourses.nptel.ac.in/noc17_cs22/course
4. http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html

E REFERENCES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	2	2	2	1	1	2	2	3
CO 2	3	2	2	2	1	1	2	2	3
CO 3	3	2	2	2	1	1	2	2	3
CO 4	2	2	2	2	1	1	2	2	3
CO 5	2	2	2	2	1	1	2	2	2
Total	13	10	10	10	5	5	10	10	14
Course	3	2	2	2	1	1	2	2	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS602A BIG DATA ANALYTICS

Course Outcomes:

CO1	C	Understand	**Describes** the basic concepts of big data
CO2	C	Understand	**Infers** the technologies of big data
CO3	C	Remember	**Outlines** concept of the Hadoop
CO4	C	Analyze	**Analyzing** Big data with hadoop concept
CO5	C	Understand	**Summarize** the Mapreduce concepts

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS602A	**BIG DATA ANALYTICS**	**4**	**0**	**0**	**4**
C:P:A = 4:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	Data Analytics	**4**	**0**	**0**	**4**

UNIT-I : INTRODUCTION	**12**
Introduction to Big Data, Characteristics and its Use Case 9 Introduction – Why Big data - What is big data – Facts about Big Data - importance of Big Data Evaluation of Big Data – Market Trends – Sources of Data Explosion – Types of Data – Case Study for Netflix and the house of card.	
UNIT- II: ANALYTICS	**12**
Need of Big Data – Big Data and its sources – Characteristics of Big Data – Difference between Traditional IT Approach and Big Data Technology – Capabilities of Big Data – Handling Limitations of Big Data - Technologies Supporting Big Data - Big Data Use Cases.	
UNIT- III: INTRODUCTION TO HADOOP	**12**
Introduction – Why Hadoop – What is Hadoop – History and Milestone of Hadoop – Core Components of Hadoop – Difference between Regular File System and HDFS – Common Hadoop Shell Commands – Hadoop Configuration.	
UNIT- IV: HADOOP DISTRIBUTED FILE SYSTEM (HDFS)	**12**
Concepts and Architecture - Data Flow (File Read, File Write) - Fault Tolerance - Different Daemons in Hadoop cluster (NameNode, Secondary NameNode, Job Tracker, Task Tracker and DataNode) .	
UNIT- V: INTRODUCTION OF MAPREDUCE	**12**
Introduction-Analogy of MapReduce – MapReduce Architecture - Example of MapReduce – Sorting, Shuffling – Reducing – Combiner – Partitioner – Creating MapReduce program by using Eclipse.	

LECTURE	**TUTORIAL**	**TOTAL**
60	**0**	**60**

TEXT BOOKS:

1. SeemaAcharya (Author), SubhashiniChellappan, Big Data and Analytics (2015). Wiley Publication.
2. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data (2015), EMC Education Services

REFERENCES

1. Big Data, Black Book: Covers Hadoop
2, MapReduce, Hive, YARN, Pig, R and Data Visualization (2016), DT Editorial Services 2.

Tom White, Hadoop: The Definitive Guide, 4th Edition (2015)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	2	2	2	1	1	2	2	3
CO 2	3	2	2	2	1	1	2	2	3
CO 3	3	2	2	2	1	1	2	2	3
CO 4	2	2	2	2	1	1	2	2	3
CO 5	2	2	2	2	1	1	2	2	2
Total	13	10	10	10	5	5	10	10	14
Course	3	2	2	2	1	1	2	2	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS602B BUSINESS INTELLIGENCE

Course Outcomes:

CO1	C	Understand	**Understand** the essentials of BI & data analytics and the corresponding terminologies
CO2	C	Understand	**Analyze** the steps involved in the BI - Analytics process
CO3	C	Remember	**Illustrate** competently on the topic of analytics
CO4	C	Analyze	**Understand & Implement** the K-Means Clustering with Iris Dataset
CO5	C	Understand	**Demonstrate** the real time scenario (Case study) by using BI & Analytics techniques

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS602B	**BUSINESS INTELLIGENCE**	**4**	**0**	**0**	**4**
C:P:A = 4:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	Artificial Intelligence	**4**	**0**	**0**	**4**

UNIT-I : INTRODUCTION	**12**
Introduction - History and Evolution: Effective and Timely decisions, Data Information and Knowledge, Architectural Representation, Role of mathematical Models, Real Time Business Intelligent System.	
UNIT- II: BI – DATA MINING & WAREHOUSING	**12**
Data Mining - Introduction to Data Mining, Architecture of Data Mining and How Data mining works(Process) , Functionalities & Classifications of Data Mining, Representation of Input Data, Analysis Methodologies. Data Warehousing - Introduction to Data Warehousing, Data Mart, Online Analytical Processing (OLAP) – Tools, Data Modelling, Difference between OLAP and OLTP, Schema – Star and Snowflake Schemas, ETL Process – Role of ETL	
UNIT- III: BI – DATA PREPARTTION	**12**
Data Validation - Introduction to Data Validation, Data Transformation – Standardization and Feature Extraction, Data Reduction – Sampling, Selection, PCA, Data Discretization	
UNIT- IV: BI – DATA ANALYTICS PROCESS	**12**
ANALYTICS PROCESS - Introduction to analytics process, Types of Analytical Techniques in BI – Descriptive, Predictive, Perspective, Social Media Analytics, Behavioral, Iris Datasets	
UNIT- V: IMPLEMENTATION OF BI – ANALYTICS PROCESS	**12**
Operational Intelligence: Technological – Business Activity Monitoring, Complex Event Processing, Business Process Management, Metadata, Root Cause Analysis.	

	LECTURE	**TUTORIAL**	**TOTAL**
	60	**0**	**60**

TEXT BOOKS:

1. Carlo-Vercellis, “Business Intelligence Data Mining and Optimization for Decision-Making”, First Edition Link : https://bit.ly/3d6XxOr
2. Drew Bentely, “Business Intelligence and Analytics” ,@2017 Library Pres., ISBN: 978-1-9789- 2136-8 Link : https://www.academia.edu/40285447/Business_Intelligence_and_Analytics

REFERENCES

1.Cindi Howson, “Successful Business Intelligence”, Second Edition, McGraw-Hill Education, 2013

E REFERENCES

1.Ramesh Sharda, Dursun Delen, Efraim Turban, “Business Intelligence A Managerial Perspective on Analytics”, Third Edition, Pearson Publications. Link : https://bit.ly/2YcuLHK

Mooc:

1.https://www.coursera.org/learn/business-intelligence-data-analytics (Free Course in Course era)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	2	2	2	1	1	2	2	3
CO 2	3	2	2	2	1	1	2	2	3
CO 3	3	2	2	2	1	1	2	2	3
CO 4	2	2	2	2	1	1	2	2	3
CO 5	2	2	2	2	1	1	2	2	2
Total	13	10	10	10	5	5	10	10	14
Course	3	2	2	2	1	1	2	2	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS602C MACHINE LEARNING

Course Outcomes:

CO1	C	Understand	**Identify** various machine learning algorithms and terminologies and perform data pre-processing using standard ML library
CO2	C	Understand	**Design** a predictive model using appropriate supervised learning algorithms to solve any given problem.
CO3	C	Understand	**Develop** an application using appropriate unsupervised learning algorithms for performing clustering and dimensionality reduction.
CO4	C	Understand	**Solve** complex problems using artificial neural networks and kernel machines.
CO5	C	Understand	**Implement** probabilistic graphical models for suitable applications.

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS602C	**MACHINE LEARNING**	**4**	**0**	**0**	**4**
C:P:A = 4:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	DataMining and Data Warehousing	**4**	**0**	**0**	**4**

UNIT-I : INTRODUCTION	**12**
Introduction to machine learning, types of learning, Learning Input-Output Functions, Designing a learning system, perspectives and issues in machine learning. Basic algorithms methods, Inferring Rudimentary Rules, Simple Probabilistic Modelling.	
UNIT- II: ALGORITHMS	**12**
Divide and Conquer: Constructing Decision Trees, Covering Algorithms: Constructing Rules, Mining Association Rules, Linear Models, Instance-based Learning, Clustering, Multi-Instance Learning.	
UNIT- III: SUPERVISED LEARNING ALGORITHMS	**12**
Supervised Machine Learning Algorithms, working of supervised machine learning algorithm, Naive Bayes algorithm, decision tree, Support Vector Machines, KNN, Random Forest algorithm.	
UNIT- IV: UNSUPERVISED LEARNING ALGORITHMS	**12**
Unsupervised Machine Learning Algorithms, working of unsupervised machine learning algorithm, clustering, neural networks, Blind Signal Separation Techniques like Principal Component Analysis, Singular Value Decomposition.	
UNIT- V: MACHINE LEARNING USE CASES	**12**
Machine Learning Use cases of machine learning implementation in various industry domains: Banking, Healthcare, Ecommerce, and Human Resource.	

	LECTURE	**TUTORIAL**	**TOTAL**
	60	**0**	**60**

TEXT

1. Machine Learning by Tom M. Mitchell. 2014 Reprint.McGraw-Hill Science

2. Data Mining: Practical Machine Learning Tools and Techniques by Ian H Witten, Eibe Frank, Mark A Hall, Christopher J Pal. Third Edition. Morgan Kaufmann Series in Data Management Systems
3. Reinforcement Learning: An Introduction by Richard S Sutton and Andrew G. Barto. (2016). MIT Press.

REFERENCES

1. Understanding Machine Learning: From Theory To Algorithms by ShaiShalevShwartz (2015). 2. Simpler: Using Machine Learning Algorithms in R by Darrin Thomas (2017)

E REFERENCES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	2	2	2	1	1	2	2	3
CO 2	3	2	2	2	1	1	2	2	3
CO 3	3	2	2	2	1	1	2	2	3
CO 4	2	2	2	2	1	1	2	2	3
CO 5	2	2	2	2	1	1	2	2	2
Total	13	10	10	10	5	5	10	10	14
Course	3	2	2	2	1	1	2	2	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS603A DATA VISUALIZATION

Course Outcomes:

CO1	C	Understand	**Understand** basics of Data Visualization
CO2	C	Understand	**Implement** visualization of distributions
CO3	C	Understand	**Describes** visualization of time series, proportions & associations
CO4	C	Understand	**Explains** visualization on Trends and uncertainty
CO5	C	Understand	**Apply** on Graphics

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS603A	**DATA VISUALIZATION**	**4**	**0**	**0**	**4**
C:P:A = 4:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	Nil	**4**	**0**	**0**	**4**

UNIT-I : CORE SKILLS FOR VISUAL ANALYSIS	**12**
Information visualization – effective data analysis – traits of meaningful data – visual perception –making abstract data visible – building blocks of information visualization – analytical interaction – analytical navigation – optimal quantitative scales – reference lines and regions – trellises and crosstabs – multiple concurrent views – focus and context – details on demand – over-plotting reduction – analytical patterns – pattern examples.	
UNIT- II: TIME-SERIES, RANKING, AND DEVIATION ANALYSIS	**12**
Time-series analysis – time-series patterns – time-series displays – time-series best practices – part-to-whole and ranking patterns – part-to-whole and ranking displays – best practices – deviation analysis – deviation analysis displays – deviation analysis best practices.	
UNIT- III: DISTRIBUTION, CORRELATION, AND MULTIVARIATE ANALYSIS	**12**
Distribution analysis – describing distributions – distribution patterns – distribution displays – distribution analysis best practices – correlation analysis – describing correlations – correlation patterns – correlation displays – correlation analysis techniques and best practices – multivariate analysis – multivariate patterns – multivariate displays.	
UNIT- IV: INFORMATION DASHBOARD DESIGN	**12**
Information dashboard – Introduction– dashboard design issues and assessment of needs – Considerations for designing dashboard-visual perception – Achieving eloquence.	
UNIT- V: GRAPHICS	**12**
Advantages of Graphics _Library of Graphs – Designing Bullet Graphs – Designing Sparklines – Dashboard Display Media – Putting it all together- Unveiling the dashboard.	

LECTURE	**TUTORIAL**	**TOTAL**
60	**0**	**60**

TEXT BOOKS:

1. Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", O'Reilly, 2008.

2.Edward R. Tufte, "The visual display of quantitative information", Second Edition, Graphics Press, 2001.

3. Evan Stubbs, "The value of business analytics: Identifying the path to profitability", Wiley,

2011.

4.Gert H. N. Laursen and Jesper Thorlund, "Business Analytics for Managers: Taking business intelligence beyond reporting", Wiley, 2010.

REFERENCES

1.Nathan Yau, "Data Points: Visualization that means something", Wiley, 2013.

2.Stephen Few, "Information dashboard design: Displaying data for at-a-glance monitoring", second edition, Analytics Press, 2013.

3.Stephen Few, "Now you see it: Simple Visualization techniques for quantitative analysis", Analytics Press, 2009.

4.Tamara Munzner, Visualization Analysis and Design, AK Peters Visualization Series, CRC Press, Nov. 2014

E REFERENCES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	2	2	2	1	1	2	2	3
CO 2	3	2	2	2	1	1	2	2	3
CO 3	3	2	2	2	1	1	2	2	3
CO 4	2	2	2	2	1	1	2	2	3
CO 5	2	2	2	2	1	1	2	2	2
Total	13	10	10	10	5	5	10	10	14
Course	3	2	2	2	1	1	2	2	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS603B DATA WRANGLING WITH DBMS

Course Outcomes:

CO1	C	Understand	**Understand** on Data wrangling
CO2	C	Understand	**Apply** on files
CO3	C	Understand	**Apply** on PDFs
CO4	C	Understand	**Implement** cleanup on data.
CO5	C	Understand,	**Summarize** the concepts

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS603B	**DATA WRANGLING WITH DBMS**	**4**	**0**	**0**	**4**
C:P:A = 4:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	Database Management Systems	**4**	**0**	**0**	**4**

UNIT- I: INTRODUCTION TO DATA WRANGLING **12**

Data Wrangling- Importance of Data Wrangling -Data Wrangling performance- Tasks of Data Wrangling-Data Wrangling Tools-Introduction to Python-Python Basics-Data Meant to Be Read by Machines-CSV Data-JSON Data-XML Data.

UNIT- II: WORKING WITH EXCEL FILES AND PDFS **12**

Installing Python Packages-Parsing Excel Files-Parsing Excel Files -Getting Started with Parsing-PDFs and Problem Solving in Python-Programmatic Approaches to PDF Parsing-Converting PDF to Text-Parsing PDFs Using pdf miner-Acquiring and Storing Data-Databases: A Brief Introduction-Relational Databases: MySQL and PostgreSQL-Non-Relational Databases: NoSQL-When to Use a Simple File-Alternative Data Storage

UNIT- III: DATA CLEANUP **12**

Clean Data- Data Cleanup Basics-Identifying Values for Data Cleanup-Formatting Data-Finding Outliers and Bad Data-Finding Duplicates-Fuzzy Matching-RegEx Matching-Normalizing and Standardizing the Data-Saving the Data-Determining suitable Data Cleanup-Scripting the CleanupTesting with New Data

UNIT-IV: DATA EXPLORATION AND ANALYSIS **12**

Exploring Data-Importing Data-Exploring Table Functions-Joining Numerous Datasets-Identifying Correlations-Identifying Outliers-Creating Groupings-Analyzing Data-Separating and Focusing the DataPresenting Data-Visualizing the Data-Charts-Time-Related Data-Maps-Interactives-Words-Images, Video, and Illustrations-Presentation Tools-Publishing the Data-Open Source Platforms.

UNIT –V: WEB SCRAPING **12**

What to Scrape and How-Analyzing a Web Page-Network/Timeline-Interacting with JavaScript-In-Depth Analysis of a Page-Getting Pages-Reading a Web Page-Reading a Web Page with LXML-XPath-Advanced Web Scraping-Browser-Based Parsing-Screen Reading with Selenium-Screen Reading with Ghost.PySpidering the Web-Building a Spider with Scrapy-Crawling Whole Websites with Scrapy.

	LECTURE	**PRACTICAL**	**TUTORIAL**	**TOTAL**
	60	**0**	**0**	**60**

TEXT

1. Jacqueline Kazil & Katharine Jarmul," Data Wrangling with Python", O'Reilly Media, Inc,2016

REFERENCES

1. Dr. Tirthajyoti Sarkar, Shubhadeep," Data Wrangling with Python: Creating actionable data from raw sources", Packt Publishing Ltd,2019.
2. Stefanie Molin," Hands-On Data Analysis with Pandas", Packt Publishing Ltd,2019
3. Allan Visochek," Practical Data Wrangling", Packt Publishing Ltd,2017
4. Tye Rattenbury, Joseph M. Hellerstein, Jeffrey Heer, Sean Kandel, Connor Carreras," Principles of Data Wrangling: Practical Techniques for Data Preparation", O'Reilly Media, Inc,2017

E- BOOK:

1. http://www.gbv.de/dms/ilmenau/toc/827365454.PDF

MOOC:

1.https://www.udemy.com/course/data-wrangling-with-python/
2.http://www.openculture.com/free-online-data-science-courses
3.https://www.classcentral.com/course/dataanalysiswithpython-11177

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	3	2	2	2	1	2	3	3
CO 2	3	3	2	2	2	1	2	3	3
CO 3	3	2	2	2	2	1	2	3	3
CO 4	3	3	2	2	2	1	2	3	3
CO 5	3	2	2	2	2	1	2	3	3
Total	15	13	10	10	10	5	10	15	15
Course	3	3	2	2	2	1	1	3	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS603C DATA INTEGRITY

Course Outcomes:

CO1	C	Understand	**Describes** security over the data
CO2	C	Understand	**Characterize** encryption techniques and key management
CO3	C	Understand	**Describe** the mobile network layer and IP packet delivery
CO4	C	Understand	**Comprehend** authentication, integrity and access control
CO5	C	Understand	**Summarize** security applications

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS5603C	**DATA INTEGRITY**	**4**	**0**	**0**	**4**
C:P:A = 4:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	Basic Concepts of Programming, Design	**4**	**0**	**0**	**4**

UNIT-I : FUNDAMENTALS OF SECURITY	**12**
Computer Security Concepts - Threats, Attacks and Assets – Security Functional Requirements – Fundamental Security Design Principles – Attack Surfaces and Attack Trees. Computer Security Strategy– Number Theory: Prime Numbers and Factorization, Modular Arithmetic, GCD and Euclidean Algorithm, Chinese Remainder Theorem, Multiplication Modulo m and the Totient Function, Problems, Fermat and Euler Theorem. Primitive Roots and the Structure of F*p, Number in other Bases, Fast Computation of Powers in Z/mZ, Multiplicative Functions, Group Theory, Fields and Problems	
UNIT- II: ENCRYPTION TECHNIQUES AND KEY MANAGEMENT	**12**
Symmetric Encryption Principles – Data Encryption Standard – Advanced Encryption Standard – Stream Ciphers and RC4 - Cipher Block Modes Operation – Digital Signatures - Key Distributions - Public Key Cryptosystem: RSA, Elliptic Curve Cryptography - Key Exchange Algorithms: Diffie Hellmen and ELGamal Key Exchange	
UNIT- III: AUTHENTICATION, INTEGRITY AND ACCESS CONTROL	**12**
Authentication: Security Hash Function – HMAC – Electronic User Authentication Principles, Password Based Authentication, Token Based and Remote Authentication; Internet Authentication Applications: Kerberos X.509 – Public Key Infrastructure; Access Control: Access Control Principles - Subjects, Objects, and Access Rights - Discretionary Access Control - Example: UNIX File Access Control – Role Based Access Control - Attribute-Based Access Control - Identity, Credential, and Access Management - Trust Frameworks	
UNIT- IV: SECURITY	**12**
System Security: Firewall, Viruses, Worms, Ransomeware, Keylogger, Greyware, IDS, DDoS Network Security: SSL – TLs – HTTPS –IP Security; OS Security: Introduction to Operating System Security - System Security Planning - Operating Systems Hardening - Application Security - Security Maintenance - Linux/Unix Security - Windows Security - Virtualization Security; Wireless Security: Risks and Threats of Wireless- Wireless LAN Security- Wireless Security Policy-Wireless Security Architectures-Wireless security Tools	
UNIT- V: SECURITY APPLICATIONS	**12**
IOT security: Introduction- Architectures- Security challenges- Security requirements- Trust, Data confidentiality, and privacy in IOT- Security in future IOT systems; Cloud Security: Security requirements - Security patterns and Architectural elements- Cloud Security ArchitectureSecurity Management in the Cloud- Availability Management- SaaS Availability ManagementPaaS Availability Management- IaaS Availability Management- Access control-	

Security Vulnerability, Patch and Configuration Management.			
	LECTURE	**TUTORIAL**	**TOTAL**
	60	**0**	**60**

TEXT BOOKS:

1. William Stallings, "Cryptography and Network Security Principles and Practice", Fifth Edition, 2011, Pearson Education International
2. William Stallings and Lawrie Brown, "Computer Security Principles and Practice", Third Edition,2015, Pearson Education International

REFERENCES

1. Tim Mather, Subra Kumaraswamy and Shahed Latif, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance", 2009, Oreilly
2. Mikhail Gloukhovtsev, "IoT Security: Challenges, Solutions & Future Prospects", 2018, Knowledge Sharing Article, Dell Inc.
3. Pradip KumarDas, Hrudaya Kumar Tripathy, Shafiz Affendi Mohd yusuf, Privacy and Security Issues in Big Data, An Analytical View on Business Intelligence. Springer 2021.

E REFERENCES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	2	2	2	1	1	2	2	3
CO 2	3	2	2	2	1	1	2	2	3
CO 3	3	2	2	2	1	1	2	2	3
CO 4	2	2	2	2	1	1	2	2	3
CO 5	2	2	2	2	1	1	2	2	2
Total	13	10	10	10	5	5	10	10	14
Course	3	2	2	2	1	1	2	2	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS604 INTRODUCTION TO IOT LABORATORY

Course Outcomes:

CO1	C	Understand	**Identify** the sensors and actuators required for their application and control through simple programs.
CO2	C	Create	**Create** network connectivity over different components by applying network protocol for interoperability
CO3	C	Understand	**Differentiate** the two basic IoT gateways Raspberry pi / Arduino and select the one which is suitable for their requirement
CO4	C	Apply	**Develop** a system which satisfy the real-time requirements for automation
CO5	C	Apply	**Describe** the difference between Healthcare and other applications and their security.

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS604	**INTRODUCTION TO IOT LABORATORY**	**0**	**0**	**1**	**1**
C:P:A = 1:0:0					
		L	**T**	**P**	**H**
PREREQUISITE		**0**	**0**	**2**	**2**
				15	

Arduino Lab

1. Basics of Internet of Things: Sensors, Actuators, IoT architecture and Gateway.
2. IoT Networking: Connectivity technologies, Protocols and Interoperability in IoT. 3. Blinking LED through Raspberry pi or Arduino.
4. IoT sensors interface with Raspberry pi or Arduino (Temperature/Light sensors).
5. Integration of Actuators with Raspberry pi or Arduino (Servo motor/Relay).
6. Capture Image with Raspberry pi or Arduino.
7. Design Traffic control system: using Raspberry pi or Arduino.
8. Design Temperature dependent auto cooling system: Using Raspberry pi or Arduino.
9. IoT applications in home automation: Implementing IoT home application using Raspberry pi or Arduino.
10. Case study: Emergence of IoT Healthcare.

	LECTURE	**PRACTICAL**	**TOTAL**
	0	**15**	**15**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	3	2	2	2	1	2	3	3
CO 2	3	3	2	2	2	1	2	3	3
CO 3	3	2	2	2	2	1	2	3	3
CO 4	3	3	2	2	2	1	2	2	3
CO 5	3	2	2	2	2	1	2	2	3
Total	15	13	10	10	10	5	10	13	15
Course	3	2	2	2	2	1	1	3	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS605A BIG DATA ANALYTICS LABORATORY

Course Outcomes:

CO1	C	Create	Design, device, and query relational databases for operative data.
CO2	C	Evaluate	evaluate the key concepts of big data analytics..
CO3	C	Understanding	recognize on the fundamental concepts of big data analytics
CO4	C	Apply	Computes file concepts on big data set
CO5	C	Create	design, implement, populate and query data warehouses for informational data .

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS605A	**BIG DATA ANALYTICS LABORATORY**	**0**	**0**	**1**	**1**
C:P:A = 1:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	Hadoop or MongoDB and Map Reduce programming	**0**	**0**	**2**	**2**
				15	

1. Hadoop installation
2. Hadoop lab - hellohdfs
3. File management in hadoop
4. To perform nosql database using mongodb to create, update and insert.
5. To study and implement basic functions and commands in r programming.

LECTURE	**PRACTICAL**	**TOTAL**
0	**15**	**15**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	3	2	2	2	1	2	3	3
CO 2	3	3	2	2	2	1	2	3	3
CO 3	3	2	2	2	2	1	2	3	3
CO 4	3	3	2	2	2	1	2	2	3
CO 5	3	2	2	2	2	1	2	2	3
Total	15	13	10	10	10	5	10	13	15
Course	3	2	2	2	2	1	1	3	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS605B BUSINESS INTELLIGENCE LABORATORY

Course Outcomes:

CO1	C	Create	Understand the Statistical operations
CO2	C	Analyze	Analyze the steps involved in the BI
CO3	C	Understanding	Implement mathematical aggregation operators
CO4	C	Apply	Understand & Implement the K-Means Clustering with Iris Dataset
CO5	C	Create	Demonstrate the real time scenario (Case study) by using BI & Analytics techniques

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS605B	**BUSINESS INTELLIGENCE LABORATORY**	**0**	**0**	**1**	**1**
C:P:A = 1:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	Power BI / Tabula/ R	**0**	**0**	**2**	**2**
				15	

BUSINESS INTELLIGENCE

1. Import the legacy data from different sources such as (Excel, SqlServer, Oracle etc.) and load in the target system.

DATA ANALYTICS

1. To get the input from user and perform numerical operations (MAX, MIN, AVG, SUM, SQRT, ROUND) using in R
2. To perform data import/export (.CSV, .XLS, .TXT) operations using data frames in R.
3. To perform data pre-processing operations i) Handling Missing data ii) Min-Max normalization
4. To perform statistical operations (Mean, Median, Mode and Standard deviation) using R. 5. To perform K-Means clustering operation and visualize for iris data set
6. Write R script to diagnose any disease using KNN classification and plot the results.

LECTURE	**PRACTICAL**	**TOTAL**
0	**15**	**15**

	PO 1	PO2	PO3	PO4	PO 5	PO6	PO7	PSO1	PSO2
CO 1	3	3	2	2	2	1	2	3	3
CO 2	3	3	2	2	2	1	2	3	3
CO 3	3	2	2	2	2	1	2	3	3
CO 4	3	3	2	2	2	1	2	2	3
CO 5	3	2	2	2	2	1	2	2	3
Total	15	13	10	10	10	5	10	13	15
Course	3	2	2	2	2	1	1	3	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

XDS605C MACHINE LEARNING LABORATORY

Course Outcomes:

CO1	C	Understand	**Starts** to work with Python concepts
CO2	C	Apply	**Apply** the basic programs alog with trim method
CO3	C	Apply	**Apply** program with function
CO4	C	Apply	**Compute** program for classification algorithms
CO5	C	Apply	**Organizes** the function with parameter passing

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XDS605C	**MACHINE LEARNING LABORATORY**	**0**	**0**	**1**	**1**
C:P:A = 1:0:0					
		L	**T**	**P**	**H**
PREREQUISITE	Nil	**0**	**0**	**2**	**2**
				15	

1. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
2. Assuming a set of documents that need to be classified, use the naïve Bayesian algorithm.
3. Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
4. Write a program to implement k-Nearest Neighbour algorithm to classify the iris. print both correct and wrong predictions. Java/Python ML library classes can be used for this problem. 5. Write a program to implement Logistic Regression algorithm to classify the housing price data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
6. Write a program to implement and compare SVM, KNN and Logistic regression algorithm to classify the iPhone purchase records data set. Print both correct and wrong predictions. Java/ Python ML library classes can be used for this problem.

E – References:

	LECTURE	**PRACTICAL**	**TOTAL**
	0	**15**	**15**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO 1	3	3	2	2	2	1	2	3	3
CO 2	3	3	2	2	2	1	2	3	3
CO 3	3	2	2	2	2	1	2	3	3
CO 4	3	3	2	2	2	1	2	2	3
CO 5	3	2	2	2	2	1	2	2	3
Total	15	13	10	10	10	5	10	13	15
Course	3	2	2	2	2	1	1	3	3

0-No relation 3- Highly relation 2- Medium relation 1– Low relation

Course Code	C	P	A	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	L	T	P	C
XDS103	4	0	0	14	10	10	5	5	5	5	7	5	4	0	0	4
XDS104	5	0	0	15	5	0	0	5	0	5	0	0	4	1	0	5
XDS105	4	0	0	14	13	10	10	10	5	5	10	10	4	0	0	4
XUMA001	1	0	0	0	0	0	0	4	11	2	0	0	1	0	0	1
XDS203	4	0	0	14	13	10	10	10	5	10	13	13	4	0	0	4
XDS204	5	0	0	13	10	10	10	5	5	10	10	14	4	1	0	5
XDS205	4	0	0	14	13	10	10	10	5	5	15	10	4	0	0	4
XDS206	4	0	0	15	13	10	10	10	5	10	15	13	4	0	0	4
XUMA002	1	0	0	2	0	12	1	0	14	9	9	9	1	0	0	1
XDS303	2	0	0	15	13	10	10	10	5	10	15	15	2	0	0	2
XDS305	4	0	0	15	13	10	10	10	5	10	15	15	4	0	0	4
XDS306	4	0	0	14	13	10	10	10	5	10	13	13	4	0	0	4
XDS304	5	0	0	13	10	10	10	5	5	10	10	14	4	1	0	5
XDS403	2	0	0	15	13	10	10	10	5	10	13	13	2	0	0	2
XDS404	4	0	0	13	10	10	10	5	5	10	10	14	4	0	0	4
XDS405	4	0	0	13	10	10	10	5	5	10	10	14	4	0	0	4
XDS404	5	0	0	13	10	10	10	5	5	10	10	14	4	1	0	5
XDS501	2	0	0	13	10	10	10	5	5	10	10	14	2	0	0	2
XDS502A	4	0	0	15	15	11	11	11	5	10	13	15	4	0	0	4
XDS502B	4	0	0	13	10	10	10	5	5	10	10	14	4	0	0	4
XDS502C	4	0	0	13	10	10	10	5	5	10	10	14	4	0	0	4
XDS503A	4	0	0	14	13	10	10	10	5	5	15	10	4	0	0	4
XDS503B	4	0	0	13	10	10	10	5	5	10	10	14	4	0	0	4
XDS503C	4	0	0	13	10	10	10	5	5	10	10	14	4	0	0	4
XDS601	2	0	0	13	10	10	10	5	5	10	10	14	2	0	0	2
XDS602A	4	0	0	13	10	10	10	5	5	10	10	14	4	0	0	4
XDS602B	4	0	0	13	10	10	10	5	5	10	10	14	4	0	0	4
XDS602C	4	0	0	13	10	10	10	5	5	10	10	14	4	0	0	4
XDS603A	4	0	0	13	10	10	10	5	5	10	10	14	4	0	0	4
XDS603B	4	0	0	15	13	10	10	10	5	10	15	15	4	0	0	4
XDS603C	4	0	0	13	10	10	10	5	5	10	10	14	4	0	0	4
													2	0	0	2
				386	310	283	267	200	160	266	318	366				

Annexures:

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 பெறுல்.	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, மூவலூர் 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, ஞமஜ 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 - ஜூன் 2015, சிவகுரு பதிப்பகம், 7.40, கிழக்குச் செட்டித்தெரு, பரங்கிமலை, சென்னை — 16.

Course Code		L	T	P	C
Course Name	அடிப்படைத் 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	உயிர் எழுத்துக்கள் - மெய்யெழுத்துகள் வகைப்படுத்தி நினைவூட்டல்.	Cognitive	Remember
CO2	உடல் உறுப்புப் பெயர்கள் - எளிய சொற்களை தொகுத்துக் கூறுதல்	Cognitive	Remember
CO3	ஒலி வேறுபாடுகளைப் புரிந்து கொள்ளும் திறன் பெறல்	Cognitive	Understand
CO4	தமிழில் உரையாடல் - இயற்கையை வருணித்தல்.	Cognitive	Apply
CO5	அறநெறிக் கருத்துக்களை வகைப்படுத்தும் திறன் பெறல்.	Cognitive	Analyze

அலகு– 1	எழுத்துக்களின் வகைகள்	9
உயிர் எழுத்துக்கள் - மெய்யெழுத்துகள் - பிரித்து எழுதுதல் - சேர்த்து எழுதுதல் - பொருள் விளக்கம் அறிதல்		
அலகு– 2	எளிய தமிழ்ச் சொற்களை வகைப்படுத்துதல்	9
உடல் உறுப்புப் பெயர்கள் - எளிய தமிழ்ச் சொற்கள் வகைப்படுத்துதல்		
அலகு– 3	ஒலி வேறுபாட்டுத் திறன்	9
ஒலி வேறுபாடுகள் - சொல் வகைகள்		
அலகு– 4	உரையாடல்	9
தமிழில் உரையாடல் - இயற்கையைப் பற்றி அறிதல் - வருணனை செய்தல்		
அலகு– 5	அறநெறிக் கருத்துக்களைப் பின்பற்றுதல்	9
விழாக்கள் - அறநெறிக் கதைகள் - பிழையின்றிப் படித்தல், எழுதுதல்		

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

பாடநூல்கள்:

1. முனைவர் கோ.பெரியண்ணன் - அடிப்படை எளிய தமிழ் இலக்கணம் -2003, வனிதா பதிப்பகம், 11, நானா தெரு, பாண்டி பஜார், தி.நகர், சென்னை - 17.
2. முனைவர் ந.லெனின் - பிழையின்றித் தமிழை எழுதுக (எளியமுறை) ஆண்-2020, பிருந்தா பதிப்பகம், தஞ்சாவூர் - 05.

பார்வை நூல்கள்:

1. தமிழ்நாடு அரசு வெளியிட்டுள்ள தமிழ்ப் பாட நூல்கள், வகுப்பு - 6, 7, 8.

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	Remembering
CO2	***Explain*** the process of listening and speaking	Cognitive	Understanding
CO3	***Adapt*** important methods of reading	Cognitive	Creating
CO4	***Demonstrate*** the basic writing skills	Cognitive	Understanding

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	XGT201	L	T	P	C
Course Name	தமிழ்-II	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 இலக்கணக் குறிப்புகள், கலைச்சொல்லாக்க உத்திகள் போன்றவற்றைத் தமிழ்மொழி மூலம் அறிந்து கொள்ளல்.	Cognitive	Remember
CO2	Choose (தெரிவு செய்தல்) வடமொழிக் கலைச்சொற்கள், ஒலி வேறுபாடறிந்து, பழந்தமிழ் இலக்கியங்கள் மூலம் அறிந்து கொள்ளல்.	Cognitive	Remember
CO3	Describe (விளக்குதல்) திருக்குறள் மூலம் அறச் செய்திகளை உணர்தல்.	Cognitive	Understand
CO4	Apply (விளக்குதல்) பல்வேறு அலுவல் சார்ந்த கடிதப் பிரிவுகள், குறித்துத் தெளிவு பெறல்.	Cognitive	Apply
CO5	Analyze (பகுத்தல்) கலைகளின் தோற்றம் மற்றும் வளர்ச்சிநிலை சமுதாயப் பங்கு குறித்துத் தெளிவு பெறுதல்.	Cognitive	Analyze

அலகு-1	**இலக்கணம்**	9

பொருத்துதல்: பொருத்தமான பொருளைத் தேர்வு செய்தல், புகழ் பெற்ற நூல் மற்றும் நூலாசிரியர், தொடரால் குறிக்கப்பெறும் சான்றோர், அடைமொழியால் குறிக்கப்பெறும் நூல்கள்.
பிரித்து எழுதுக: எதிர்ச்சொல்லை எடுத்து எழுதுக, பொருந்தாச் சொல்லைக் கண்டறிதல், பிழைத் திருத்தம், சந்திப்பிழையை நீக்குதல், ஒருமை பன்மை பிழைகளை நீக்குதல், மரபுப் பிழைகள் - வழுஉச்சொல் - பிறமொழிச் சொற்களை நீக்குதல்.

அலகு-2	**கலைச்சொல் அறிதல்**	9

ஆங்கிலச் சொல்லுக்கு நேரான தமிழ்ச் சொல்லை அறிதல் - ஒலி வேறுபாடறிந்து சரியான பொருளை அறிதல், ஒரெழுத்து ஒருமொழிக்குரிய பொருளைக் கண்டறிதல் - வேர்ச்சொல் வினைமுற்று—வினையெச்சம் - தொழிற்பெயர், அகர வரிசைப்படுத்துதல்.

அலகு-3	**இலக்கியம்**	9

திருக்குறள் தொடர்பான செய்திகள் மேற்கோள்கள் தொடரை நிரப்புதல், அன்பு, பண்பு, கல்வி, கேள்வி, அறிவு, அடக்கம், ஒழுக்கம், பொறை, நட்பு, கேள்வி, அறிவு - வாய்மை, காலம், இடக்கமுடையை, இன்னா செய்யாமை. அறநூல்கள்: நாலடியார், நான்மணிக்கடிகை, பழமொழி, திரிகடுகம், இன்னா நாற்பது பாடல்கள் தொடர்பான செய்திகள்

அலகு-4	**பயன்பாட்டுத்தமிழ்**	9

அலுவல்கள் கடிதம், ஆசிரியர் கடிதம், நூலாக்கப் பணி, மெய்ப்புத் திருத்தல், விளம்பரத் தமிழ்

அலகு-5	**பல்வேறு கலைகளில் கல்விச் சிந்தனை**	9

மொழியியல் கல்வி, சமுதாயக் கல்வி, சேய்மைக் கல்வி, இக்காலக் கல்வி, கலை அறிவியல் என்பனவற்றின் விளக்கங்கள்

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

பாட நூல்கள்

1. காப்பட்டாபிராமன், மொழிப் பயன்பாடு, நியூ செஞ்சுரி புக் ஹவுஸ் (பி) லிட்., 41,பி., சிட்கோ இண்டஸ்ட்ரியல் எஸ்டேட், அம்பத்தூர், சென்னை.

2. முனைவர் கா.செல்வகுமார், (தொ.) 2022. துரைகோ பதிப்பகம், அரும்பாக்கம், சென்னை - 106.
3. முனைவர் ந.லெனின், மார்ச் - 2016, முகில் தமிழ் இலக்கிய இலக்கண வினா-விடைகள், பிருந்தா பதிப்பகம், தஞ்சாவூர் - 5.
4. முனைவர் இராஜா வரதராஜா - பயன்முறைத் தமிழ் - ஜூன் 2015, சிவகுரு பதிப்பகம், 7/40, கிழக்குச் செட்டித்தெரு, பரங்கிமலை, சென்னை - 16

பார்வை நூல்கள்:

1. முனைவர் இராஜ.வரதராஜா - பயன்முறைத் தமிழ்
2. டாக்டர் வா.செ.குழந்தைசாமி - அறிவியல் தமிழ் - ஜூன் 2006 (ஏழாம் பதிப்பு) –பாரதி பதிப்பகம் - 126/108, உஸ்மான் சாலை, தி.நகர், சென்னை - 17.
3. முனைவர் கோ.பெரியண்ணன் - அடிப்படை எளிய தமிழ் இலக்கணம் - 2003 –வனிதா பதிப்பகம், 11- நானா தெரு, பாண்டி பஜார், தி.நகர், சென்னை - 17.

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

COURSEOUTCOMES:		**Domain**	**Level**
CO1	***Explain*** the basic grammar and using it in proper context	Cognitive	Understand
CO2	***Categorize*** the process of listening and speaking	Cognitive	Analyze
CO3	***Examine*** the important methods of reading	Cognitive	Evaluate
CO4	***Compose*** the basic writing skills	Cognitive	Create

SYLLABUS		**HOURS**
UNIT-I	**Advanced Reading**	
i. Reading texts of different genres and of varying length ii. Different strategies of comprehension iii. Reading and interpreting non-linguistic texts iv. Reading and understanding incomplete texts (Cloze of varying lengths and gaps; distorted texts.)		12
UNIT-II	**Advanced Writing**	
v. Analysing a topic for an essay or a report vi. Editing the drafts arrived at and preparing the final draft vii. Re-draft a piece of text with a different perspective (Manipulation exercise) viii. Summarize a piece of prose or poetry ix. Using phrases, idioms and punctuation appropriately		11
UNIT-III	**Principles of communication and communicative competence**	
x. Introduction to communication–principles and process xi. Types of communication–verbal and non-verbal xii. Identifying and overcoming problems of communication xiii. Communicative competence		11
UNIT-IV	**Cross Cultural Communication**	

xiv. Cross-cultural communication	11
Total Hours	**45**

Textbooks

1) Bailey, Stephen(2003).Academic Writing. London and New York, Routledge.
2) Department of English, Delhi University(2006).Fluency in English Part II. New Delhi, OUP
3) Grellet, F (1981).Developing Reading Skills: A Practical Guide to Reading Skills. New York, CUP
4) Hedge, T.(2005). Writing. London, OUP
5) Kumar, S and Pushp Lata (2015).Communication Skills. New Delhi, OUP
6) Lazar, G.(2010).Literature and Language Teaching. Cambridge, CUP
7) Nuttall, C(1996).Teaching Reading Skills in a Foreign Language. London, Macmillan
8) Raman,MeenakshiandSangeetaSharma(2011).TechnicalCommunication:PrinciplesandPractice.NewDelhi, OUP

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	2	0	0	0	0	0	2	0	0
CO2	2	0	0	0	0	0	2	0	0
CO3	1	0	0	0	0	0	1	0	0
CO4	2	0	0	0	0	0	1	0	0
Total	7	0	0	0	0	0	6	0	0
Scaled Value	2	0	0	0	0	0	2	0	0
	1	0	0	0	0	0	1	0	0

1-5= 1, 6-10 = 2, 11-15= 3

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