PERIYAR UNIVERSITY

PERIYAR PALKALAI NAGAR

SALEM-636011

DEGREE OF BACHELOR OF SCIENCE

Syllabus for

B.Sc., Information Science

(SEMESTER PATTERN- CBCS)

(For Candidates admitted in the colleges affiliated to

Periyar university from 2023-2024 onwards)

Introduction

B.Sc. Information Science

Education is the key to development of any society. Role of higher education is crucial for securing right kind of employment and also to pursue further studies in best available world class institutes elsewhere within and outside India. Quality education in general and higher education in particular deserves high priority to enable the young and future generation of students to acquire skill, training and knowledge in order to enhance their thinking, creativity, comprehension and application abilities and prepare them to compete, succeed and excel globally. Learning Outcomes-based Curriculum Framework (LOCF) which makes it student-centric, interactive and outcome-oriented with well-defined aims, objectives and goals to achieve. LOCF also aims at ensuring uniform education standard and content delivery across the state which will help the students to ensure similar quality of education irrespective of the institute and location.

Computer Science is the study of quantity, structure, space and change, focusing on problem solving, application development with wider scope of application in science, engineering, technology, social sciences etc. throughout the world in last couple of decades and it has carved out a space for itself like any other disciplines of basic science and engineering. Computer science is a discipline that spans theory and practice and it requires thinking both in abstract terms and in concrete terms. Nowadays, practically everyone is a computer user, and many people are even computer programmers. Computer Science can be seen on a higher level, as a science of problem solving and problem solving requires precision, creativity, and careful reasoning. The ever-evolving discipline of computer science also has strong connections to other disciplines. Many problems in science, engineering, health care, business, and other areas can be solved effectively with computers, but finding a solution requires both computer science expertise and knowledge of the particular application domain. Computer science has a wide range of specialties. These include Computer Architecture, Software Systems, Graphics, Artificial Intelligence, Computational Science, and Software Engineering. Drawing from a common core of computer science knowledge, each specialty area focuses on specific challenges. Computer Science is practiced by mathematicians, scientists and engineers. Mathematics, the origins of Computer Science, provides reason and logic. Science provides the methodology for learning and refinement. Engineering provides the techniques for building hardware and software.

The Students completing this programme will be able to present Software application clearly and precisely, make abstract ideas precise by formulating them in the Computer languages. Completion of this programme will also enable the learners to join teaching profession, enhance their employability for government jobs, jobs in software industry, banking, insurance and investment sectors, data analyst jobs and jobs in various other public and private enterprises.

LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK GUIDELINES BASED REGULATIONS FOR UNDER GRADUATE PROGRAMME	
Programme:	**B.Sc., Information science**
Programme Code:	
Duration:	**3 years [UG]**
Programme Outcomes:	**PO1: Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study **PO2: 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. **PO3: 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. **PO4: 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. **PO5: Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints. **PO6: Research-related skills**: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, 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 **PO7: 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 **PO8: Scientific reasoning**: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective. **PO9: Reflective thinking**: Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society. **PO10 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. **PO 11 Self-directed learning**: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion. **PO 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. **PO 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 demon starting the ability to identify ethical issues related to one‟s work, avoid unethical behaviour 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. **PO 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. **PO 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.

Programme Specific Outcomes:	**PSO1**: To enable students to apply basic microeconomic, macroeconomic and monetary concepts and theories in real life and decision making. **PSO 2**: To sensitize students to various economic issues related to Development, Growth, International Economics, Sustainable Development and Environment. **PSO 3**: To familiarize students to the concepts and theories related to Finance, Investments and Modern Marketing. **PSO 4**: Evaluate various social and economic problems in the society and develop answer to the problems as global citizens. **PSO 5:** Enhance skills of analytical and critical thinking to analyze effectiveness of economic policies.

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
PSO 1	Y	Y	Y	Y	Y	Y	Y	Y
PSO 2	Y	Y	Y	Y	Y	Y	Y	Y
PSO3	Y	Y	Y	Y	Y	Y	Y	Y
PSO 4	Y	Y	Y	Y	Y	Y	Y	Y
PSO 5	Y	Y	Y	Y	Y	Y	Y	Y

3 – Strong, 2- Medium, 1- Low

Highlights of the Revamped Curriculum:

- Student-centric, meeting the demands of industry & society, incorporating industrial components, hands-on training, skill enhancement modules, industrial project, project with viva-voce, exposure to entrepreneurial skills, training for competitive examinations, sustaining the quality of the core components and incorporating application oriented content wherever required.
- The Core subjects include latest developments in the education and scientific front, advanced programming packages allied with the discipline topics, practical training, devising mathematical models and algorithms for providing solutions to industry / real life situations. The curriculum also facilitates peer learning with advanced mathematical topics in the final semester, catering to the needs of stakeholders with research aptitude.
- The General Studies and Mathematics based problem solving skills are included as mandatory components in the _Training for Competitive Examinations‘ course at the final semester, a first of its kind.
- The curriculum is designed so as to strengthen the Industry-Academia interface and provide more job opportunities for the students.
- The Industrial Statistics course is newly introduced in the fourth semester, to expose the students to real life problems and train the students on designing a mathematical model to provide solutions to the industrial problems.
- The Internship during the second year vacation will help the students gain valuable work experience, that connects classroom knowledge to real world experience and to narrow down and focus on the career path.
- Project with viva-voce component in the fifth semester enables the student, application of conceptual knowledge to practical situations. The state of art technologies in conducting a Explain in a scientific and systematic way and arriving at a precise solution is ensured. Such innovative provisions of the industrial training, project and internships will give students an edge over the counterparts in the job market.
- State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature are incorporated as Elective courses, covering conventional topics to the latest - Artificial Intelligence.

Value additions in the Revamped Curriculum:

Semester	Newly introduced Components	Outcome / Benefits
I	**Foundation Course** To ease the transition of learning from higher secondary to higher education, providing an overview of the pedagogy of learning Literature and analysing the world through the literary lens gives rise to a new perspective.	➢ Instill confidenceamong students ➢ Create interest for thesubject
I, II, III, IV	**Skill Enhancement papers** (Discipline centric / Generic / Entrepreneurial)	➢ Industry readygraduates ➢ Skilled human resource ➢ Students are equippedwith essential skills to make them employable
		➢ Training on language and communication skills enable the students gain knowledge and exposure in the competitive world.
		➢ Discipline centric skill will improve the Technical knowhow of solving real life problems.
III, IV, V & VI	Elective papers	➢ Strengthening thedomain knowledge ➢ Introducing thestakeholdersto theState-of Art techniques from the streams ofmulti-disciplinary, cross disciplinary andinter disciplinary nature ➢ Emerging topics inhigher education/industry/ communication network / health sectoretc. are introduced with hands-on-training.

IV	Elective Papers	➢ Exposure to industrymoulds students into solution providers ➢ Generates Industryready graduates ➢ Employment opportunities enhanced
V	Elective papers	➢ Self-learning isenhanced ➢ Application of the concept to real situationis conceived resulting in tangible outcome
VI	Elective papers	➢ Enriches the studybeyond the course. ➢ Developing a researchframework and presenting their independent and intellectual ideaseffectively.
Extra Credits: **For Advanced Learners / Honors degree**		➢ To cater to the needs ofpeer learners / research aspirants
Skills acquired from the Courses		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Credit Distribution for UG Programmes

Sem I	Credit	Hours	Sem II	Credit	Hours	Sem III	Credit	Hours	Sem IV	Credit	Hours	Sem V	Credit	Hours	Sem VI	Credit	Hours
Part 1. Language – Tamil	3	6	Part..1. Language – Tamil	3	6	Part..1. Language – Tamil	3	6	Part..1. Language – Tamil	3	6	5.1 Core Course – \CC IX	4	5	6.1 Core Course – CC XIII	4	6
Part.2 English	3	6	Part..2 English	3	6	Part..2 English	3	6	Part..2 English	3	6	5.2 Core Course – CC X	4	5	6.2 Core Course – CC XIV	4	6
1.3 Core Course – CC I	5	5	2..3 Core Course – CC III	5	5	3.3 Core Course – CC V	5	5	4.3 Core Course – CC VII Core Industry Module	5	5	5. 3.Core Course CC -XI	4	5	6.3 Core Course – CC XV	4	6
1.4 Core Course – CC II	5	5	2.4 Core Course – CC IV	5	5	3.4 Core Course – CC VI	5	5	4.4 Core Course – CC VIII	5	5	5. 4.Core Course –/ Project with viva-voce CC -XII	4	5	6.4 Elective -VII Generic/ Discipline Specific	3	5
1.5 Elective I Generic/ Discipline Specific	3	4	2.5 Elective II Generic/ Discipline Specific	3	4	3.5 Elective III Generic/ Discipline Specific	3	4	4.5 Elective IV Generic/ Discipline Specific	3	3	5.5 Elective V Generic/ Discipline Specific	3	4	6.5 Elective VIII Generic/ Discipline Specific	3	5
1.6 Skill Enhancement Course SEC-1	2	2	2.6 Skill Enhancement Course SEC-2	2	2	3.6 Skill Enhancement Course SEC-4, (Entrepreneurial Skill)	1	1	4.6 Skill Enhancement Course SEC-6	2	2	5.6 Elective VI Generic/ Discipline Specific	3	4	6.6 Extension Activity	1	-
1.7 Skill Enhancement - (Foundation Course)	2	2	2.7 Skill Enhancement Course – SEC-3	2	2	3.7 Skill Enhancement Course SEC-5	2	2	4.7 Skill Enhancement Course SEC-7	2	2	5.7 Value Education	2	2	6.7 Professional Competency Skill	2	2
						3.8 E.V.S.	-	1	4.8 E.V.S	2	1	5.8 Summer Internship /Industrial Training	2				
	23	**30**		**23**	**30**		**22**	**30**		**25**	**30**		**26**	**30**		**21**	**30**
Total – 140 Credits																	

Choice Based Credit System (CBCS), Learning Outcomes Based Curriculum Framework (LOCF) Guideline Based Credit and Hours Distribution System for all UG courses including Lab Hours

First Year – Semester-I

Part	List of Courses	Credit	No. of Hours
Part-1	Language – Tamil	3	6
Part-2	English	3	6
Part-3	Core Courses & Elective Courses [in Total]	13	14
Part-4	Skill Enhancement Course SEC-1	2	2
	Foundation Course	2	2
Total		**23**	**30**

Semester-II

Part	List of Courses	Credit	No. of Hours
Part-1	Language – Tamil	3	6
Part-2	English	3	6
Part-3	Core Courses & Elective Courses including laboratory [in Total]	13	14
Part-4	Skill Enhancement Course -SEC-2	2	2
	Skill Enhancement Course -SEC-3 (Discipline / Subject Specific)	2	2
Total		**23**	**30**

Second Year – Semester-III

Part	List of Courses	Credit	No. of Hours
Part-1	Language - Tamil	3	6
Part-2	English	3	6
Part-3	Core Courses & Elective Courses including laboratory [in Total]	13	14
Part-4	Skill Enhancement Course -SEC-4 (Entrepreneurial Based)	1	1
	Skill Enhancement Course -SEC-5 (Discipline / Subject Specific)	2	2
	E.V.S	-	1
Total		**22**	**30**

Semester-IV

Part	List of Courses	Credit	No. of Hours
Part-1	Language - Tamil	3	6
Part-2	English	3	6
Part-3	Core Courses & Elective Courses including laboratory [in Total]	13	13
Part-4	Skill Enhancement Course -SEC-6 (Discipline / Subject Specific)	2	2
	Skill Enhancement Course -SEC-7 (Discipline / Subject Specific)	2	2
	E.V.S	2	1
Total		**25**	**30**

Third Year

Semester-V

Part	List of Courses	Credit	No. of Hours
Part-3	Core Courses including Project / Elective Based	22	26
Part-4	Value Education	2	2
	Internship / Industrial Visit / Field Visit	2	2
Total		**26**	**30**

Semester-VI

Part	List of Courses	Credit	No. of Hours
Part-3	Core Courses including Project / Elective Based & LAB	18	28
Part-4	Extension Activity	1	-
	Professional Competency Skill	2	2
Total		**21**	**30**

Consolidated Semester wise and Component wise Credit distribution

Parts	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total Credits
Part I	3	3	3	3	-	-	12
Part II	3	3	3	3	-	-	12
Part III	13	13	13	13	22	18	92
Part IV	4	4	3	6	4	1	22
Part V	-	-	-	-	-	2	2
Total	23	23	22	25	26	21	**140**

***Part I. II, and Part III components will be separately taken into account for CGPA calculation and classification for the under graduate programme and the other components. IV, V have to be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree.**

Methods of Evaluation		
Internal Evaluation	Continuous Internal Assessment Test	25 Marks
	Assignments	
	Seminars	
	Attendance and Class Participation	
External Evaluation	End Semester Examination	75 Marks
	Total	100 Marks
Methods of Assessment		
Recall (K1)	Simple definitions, MCQ, Recall steps, Concept definitions	
Understand/ Comprehend (K2)	MCQ, True/False, Short essays, Concept explanations, Short summary or overview	
Application (K3)	Suggest idea/concept with examples, Suggest formulae, Solve problems, Observe, Explain	
Analyze (K4)	Problem-solving questions, Finish a procedure in many steps, Differentiate	
	between various ideas, Map knowledge	
Evaluate (K5)	Longer essay/ Evaluation essay, Critique or justify with pros and cons	
Create (K6)	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations	

B.Sc., Information Science Credit Distribution

SEMESTER - I				
Part	**Paper Code**	**List of courses**	**Credits**	**No. of Hrs**
Part I		Language – Tamil	3	6
Part II		English	3	6
Part-III	23UISCC01	CC1-Programming in C	5	5
	23UISCCP01	CC2 -Practical : C Programming Lab	3	3
		Elective Course -EC1 (Generic / Discipline Specific) –Choose from Annexure I	5	6
Part-IV		Skill Enhancement Course- SEC1 (Non Major Elective)	2	2
		Foundation Course FC – Problem Solving Techniques	2	2
		TOTAL	**23**	**30**

SEMESTER - II				
Part	**Paper Code**	**List of courses**	**Credits**	**No. of Hrs**
Part I		Language – Tamil	3	6
Part II		English	3	4
Part-II	NMSDC	Language Proficiency for Employability- Overview of English Communication	2	2
Part III	23UISCC02	CC3 –Data Structures and Algorithms	5	5
	23UISCCP02	CC4 – Practical: Data Structure and Algorithms Lab	3	3
		Elective Course - EC2 (Generic / Discipline Specific) –Choose from Annexure I	5	6
Part IV	**NMSDC**	**Overview of English Language Communication**	**2**	**2**
		Skill Enhancement Course -SEC2 (Non Major Elective)	2	2
		Skill Enhancement Course - SEC3 Choose from Annexure II	2	2
TOTAL			**25**	**30**

SEMESTER - III				
Part	**Paper Code**	**List of Courses**	**Credits**	**No. of Hrs**
Part I		Language – Tamil	3	6
Part II		English	3	6
Part III	23UISCC03	C C5 -Relational Database Management System	4	4
	23UISCCP03	CC6-Practical: RDBMS Lab	3	3
		Elective Course- EC3 (Generic / Discipline Specific) -Choose from Annexure I	5	6
Part IV	NMSDC	Computational Skills for Employability	2	2
		Skill Enhancement Course -SEC5 Choose from Annexure II	2	2
		Environmental Studies	-	1
		Health and Wellness		
TOTAL			**23**	**30**

Semester – IV				
Part	**Paper Code**	**List of Courses**	**Credits**	**No. of Hrs**
Part I		Language – Tamil	3	6
		English	3	6
Part III	23UISCC04	CC7-Programming in Java	4	4
	23UISCCP04	CC8- Practical: Java Programming Lab	3	3
		Elective Course - EC4 (Generic / Discipline Specific) Choose from Annexure I	5	6
Part IV		Skill Enhancement Course - SEC6 Choose from Annexure II	2	2
	NMSDC	**UI / UX Design**	**2**	**2**
		Environmental Studies	2	1
	TOTAL		**25**	**30**

Third Year – Semester – V				
Part	**Paper Code**	**List of Courses**	**Credits**	**No.of Hours**
Part III	23UISCC05	CC9- Operating System	4	5
	23UISCC06	CC10- Web Technology	4	5
	23UISCCP05	CC11-Practical: Web Technology Lab	4	5
		Elective Course - EC5 (Discipline Specific) Choose from Annexure I	3	4
		Elective Course – EC6 (Discipline Specific) Choose from Annexure I	3	4
	23UISCCPR1	CC12 - Project with Viva voce	4	5
Part IV		Value Education	2	2
		Internship / Industrial Training (Summer vacation at the end of IV semester activity)	2	-
TOTAL			**26**	**30**

Semester – VI				
Part	**Paper Code**	**List of Courses**	**Credits**	**No. of Hrs**
Part III	23UISCC07	CC13- Information Security	4	6
	23UISCC08	CC14- Python Programming	4	6
	23UISCCP06	CC15- Python Programming Lab	4	6
		Elective Course – EC7 (Discipline Specific) Choose from Annexure I	3	5
		Elective Course – EC8 (Discipline Specific) Choose from Annexure I	3	5
Part IV		Skill Enhancement Course - SEC8 Choose from Annexure II	2	2
		Extension Activity	1	-
TOTAL			**21**	**30**

Total Credits: 23 +25 +22 +25+26+21 =142 Credits

SUGGESTED CORE COMPONENTS

S.No	Paper Code	Paper Title
1	23UISCC09	Object Oriented Programming Using C++
2	23UISCCP07	C++ Programming Lab
3	23UISCC10	Data Communication and Networking
4	23UISCC11	Software Engineering
5	23UISCCP08	Software Engineering Lab
6	23UISCC12	Software Metrics
7	23UISCC13	Machine Learning
8	23UISCC14	Data Mining
9	23UISCCP09	Data analytics lab
10	23UISCC15	Mobile Application Development and more..

Annexure - I
Elective Course (EC1- EC8) (Generic / Discipline Specific)

Generic Specific

S.No	Paper Title
1	Mathematics-I
2	Mathematics-II
3	Mathematics Practical
4	Discrete Mathematics-I
5	Discrete Mathematics-II
6	Numerical Methods
7	Optimization Techniques
8	Introduction to Linear Algebra
9	Graph Theory and its Application
10	Numerical Methods-I
11	Numerical Methods-II
12	Statistical Methods and its Application-I

13	Statistical Methods and its Application-II
14	Statistical Practical
15	Physics-I
16	Physics Practical-I
17	Physics-II
18	Physics Practical-II
19	Digital Logic Fundamentals
20	Nano Technology
21	Financial Accounting
22	Cost and Management Accounting

Discipline Specific

S.No	Paper Code	Paper Title
1	23UISDE01	Natural Language Processing
2	23UISDE02	Analytics for Service Industry
3	23UISDE03	Cryptography
4	23UISDE04	Big Data Analytics
5	23UISDE05	IOT and its Applications
6	23UISDE06	Human Computer Interaction
7	23UISDE07	Fuzzy Logic
8	23UISDE08	Artificial Intelligence
9	23UISDE09	Robotics and its Applications
10	23UISDE10	Computational intelligence
11	23UISDE11	Grid Computing
12	23UISDE12	Cloud Computing
13	23UISDE13	Artificial Neural Network
14	23UISDE14	Agile Project Management and more..

[Pl. Note: In Semester-VI - For EC7 and EC8 subjects Instructional hours may be used as: 5 per cycle]

Annexure - II

Skill Enhancement Course (SEC1-SEC8)

S.No	Paper Code	Paper Title
1	23UISSE01	Office Automation
2	23UISSE02	Basics of Internet
3	23UISSE03	Problem Solving Techniques
4	23UISSE04	Fundamentals of Information Technology
5	23UISSE05	Introduction to HTML
6	23UISSE06	Web Designing
7	23UISSE07	Software Testing
8	23UISSE08	Quantitative Aptitude
9	23UISSE09	Multimedia Systems
10	23UISSE10	Advanced Excel
11	23UISSE11	Biometrics
12	23UISSE12	Cyber Forensics
13	23UISSE13	Pattern Recognition
14	23UISSE14	Enterprise Resource Planning
15	23UISSE15	Robotics its Applications
16	23UISSE16	Simulation Modelling
17	23UISSE17	Organization Behaviour and more..

Note: For Semester I & II [if other department select our paper as Non Major Elective choose from the above Skill Enhancement Course]

FIRST YEAR – SEMESTER – I

CORE1: PROGRAMMING IN C

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC1	5	0	0	I	5	5	25	75	100

Learning Objectives		
LO1	To familiarize the students with the understanding of code organization	
LO2	To improve the programming skills	
LO3	Learning the basic programming constructs.	
Unit	**Contents**	**No. of Hours**
I	**Studying Concepts of Programming Languages**- Language Evaluation Criteria - Language design - Language Categories - Implementation Methods – Programming Environments - Overview of C: History of C- Importance of C- Basic Structure of C Programs- Executing a C Program- Constants, Variables and Data types - Operators and Expressions - Managing Input and Output Operations	**15**
II	**Decision Making and Branching**: Decision Making and Looping - Arrays - Character Arrays and Strings	**15**
III	**User Defined Functions:** Elements of User Defined Functions- Definition of Functions- Return Values and their Types- Function Call- Function Declaration- Categories of Functions- Nesting of Functions- Recursion	**15**
IV	**Structures and Unions:** Introduction- Defining a Structure- Declaring Structure Variables Accessing Structure Members- Structure Initialization- Arrays of Structures- Arrays within Structures- Unions- Size of Structures.	**15**
V	**Pointers:** Understanding Pointers- Accessing the Address of a Variable- Declaring Pointer Variables- Initializing of Pointer Variables- Accessing a Variable through its Pointer- Chain of Pointers- Pointer Expressions- Pointer and Scale Factor- Pointer and Arrays- Pointers and Character Strings- Array of Pointers- Pointer as Function Arguments- Functions Returning Pointers- Pointers to Functions- **File Management in C**	**15**
TOTAL		**75**

CO	Course Outcomes
CO1	Outline the fundamental concepts of C programming languages, and its features
CO2	Demonstrate the programming methodology.
CO3	Identify suitable programming constructs for problem solving.
CO4	Select the appropriate data representation, control structures, functions and concepts based on the problem requirement.
CO5	Evaluate the program performance by fixing the errors.
Textbooks	
➢	Robert W. Sebesta, (2012), ―Concepts of Programming Languages‖, Fourth Edition, Addison Wesley (Unit I : Chapter – 1)
➢	E. Balaguruswamy, (2010), ―Programming in ANSI C‖, Fifth Edition, Tata McGraw Hill Publications
Reference Books	
1.	Ashok Kamthane, (2009), ―Programming with ANSI & Turbo C‖, Pearson Education
2.	Byron Gottfried, (2010), ―Programming with C‖, Schaums Outline Series, Tata McGraw Hill Publications
Web Resources	
1.	http://www.tutorialspoint.com/cprogramming/
2.	http://www.cprogramming.com/
3.	http://www.programmingsimplified.com/c-program-examples
4.	http://www.programiz.com/c-programming
5.	http://www.cs.cf.ac.uk/Dave/C/CE.html
6.	http://fresh2refresh.com/c-programming/c-function/

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**2**	**3**	**2**	**2**
CO2	**3**	**3**	**2**	**3**	**2**	**2**
CO3	**3**	**3**	**3**	**3**	**2**	**2**
CO4	**3**	**3**	**2**	**3**	**2**	**2**
CO5	**3**	**3**	**2**	**3**	**2**	**2**
Weightage of course contributed toeach PSO	**15**	**14**	**11**	**15**	**10**	**10**

FIRST YEAR – SEMESTER – I

CORE 2: C PROGRAMMING PRACTICAL

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC2	0	0	3	I	3	3	25	75	100

Learning Objectives

LO1	The Course aims to provide exposure to problem-solving through C programming
LO2	It aims to train the student to the basic concepts of the C -Programming language
LO3	Apply different concepts of C language to solve the problem

Prerequisites:

Contents

1. Programs using Input/ Output functions
2. Programs on conditional structures
3. Command Line Arguments
4. Programs using Arrays
5. String Manipulations
6. Programs using Functions
7. Recursive Functions
8. Programs using Pointers
9. Files
10. Programs using Structures & Unions

CO	Course Outcomes
CO1	Demonstrate the understanding of syntax and semantics of C programs.
CO2	Identify the problem and solve using C programming techniques.
CO3	Identify suitable programming constructs for problem solving.
CO4	Analyze various concepts of C language to solve the problem in an efficient way.
CO5	Develop a C program for a given problem and test for its correctness.

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	3	2	2
CO2	3	3	2	3	2	2
CO3	3	3	3	3	2	2
CO4	3	3	2	3	2	2
CO5	3	3	2	3	3	2
Weightage of course contributed toeach PSO	15	14	11	15	11	10

FIRST YEAR – SEMESTER – II

CORE 3: DATA STRUCTURES AND ALGORITHMS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC3	5	0	0	II	5	5	25	75	100

Learning Objectives	
LO1	Understand various data structures and their implementations
LO2	Design and analyze efficient algorithms to solve various problems.
LO3	Analyze the time and space complexity of algorithms and compare the efficiency of different algorithms.
LO4	Implement data structures and apply them to solve real-world problems.
LO5	Develop problem-solving skills by applying knowledge of data structures and algorithms to programming problems applicable in various domains.

Unit	Contents	No. of Hours
I	Introduction of algorithms, analyzing algorithms, Arrays: Representation of Arrays, Implementation of Stacks and queues, Application of Stack: Evaluation of Expression - Infix to postfix Conversion - Multiple stacks and Queues, Sparse Matrices.	15
II	Linked list: Singly Linked list - Linked stacks and queues - polynomial addition - More on linked Lists - Doubly linked List and Dynamic Storage Management - Garbage collection and compaction.	15
III	Trees: Basic Terminology - Binary Trees - Binary Tree representations - Binary trees - Traversal - More on Binary Trees- Threaded Binary trees - counting Binary trees. Graphs: Terminology and	15

	Representations - Traversals, connected components and spanning Trees, Single Source Shortest path problem.	
IV	Symbol Tables: Static Tree Tables - Dynamic Tree Tables - Hash Tables Hashing Functions - overflow Handling. External sorting : Storage Devices -sorting with Disks : K-way merging - sorting with tapes.	**15**
V	Internal Sorting: Insertion sort - Quick sort - 2 way Merge sort - Heap sort - shell sort - sorting on keys. Files: Files, Queries and sequential organizations - Index Techniques - File organization	**15**
TOTAL		**75**

CO	**Course Outcomes**
CO1	Outline the different fundamental concepts of data structures
CO2	Describe the different memory representation for datastorage and apply various operations
CO3	Construct an algorithm for different data structure operations.
CO4	Analyze the data structures applications.
CO5	Discover suitable techniques to provide solution for solving the problems.

Textbooks

➢	Ellis Horowitz, Sartaj Shani, ―Fundamentals of Data Structures‖, Galgotia publication.

Reference Books

1.	―Data structures Using C‖, Aaron M. Tenenbaum, Yedidyah Langsam, Moshe J.Augenstein, Kindersley (India) Pvt. Ltd.,
2.	―Data structure and Algorithms‖, Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, Pearson

NOTE: Latest Edition of Textbooks May be Used

Web Resources

1.	www.freetechbooks.com/a-practical-introduction-to-data-structures-and- algorithm-analysis-thirdedition-c-version-t804.html
2.	http://www.nptel.ac.in/courses/106101060/
3.	http://www.nptel.ac.in/courses/106104019/

MAPPING TABLE

CO/PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	**3**	**2**	**1**	**2**	**1**	**2**
CO2	**3**	**3**	**2**	**2**	**3**	**3**
CO3	**3**	**3**	**2**	**3**	**3**	**2**

CO4	**3**	**2**	**3**	**2**	**2**	**3**
CO5	**3**	**2**	**2**	**2**	**3**	**3**
Weightage of course contributed to each PSO	**15**	**12**	**10**	**11**	**12**	**13**

FIRST YEAR – SEMESTER – II

CORE 4: DATA STRUCTURE AND ALGORITHMS LAB

Title of the Course/ Paper	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
CC4	**DATA STRUCTURE AND ALGORITHMS LAB** [Note: Practicals may be offered through C / C++ / Python]	Core	-	-	3	-	3	3	25	75	100
Learning Objectives											
LO1	To understand the concepts of ADTs										
LO2	To learn linear data structures-lists, stacks, queues										
LO3	To learn Tree structures and application of trees										
LO4	To learn graph strutures and and application of graphs										
LO5	To understand various sorting and searching										
Sl. No	**Contents**										**No. of Hours**
1.	Write a program to implement the List ADT using arrays and linked lists.										
2.	Write a programs to implement the following using a singly linked list. • Stack ADT • Queue ADT										

3.	Write a program that reads an infix expression, converts the expression to postfix form and then evaluates the postfix expression (use stack ADT).	**60**
4.	Write a program to implement priority queue ADT.	
5.	Write a program to perform the following operations: • Insert an element into a binary search tree. • Delete an element from a binary search tree. • Search for a key element in a binary search tree.	
6.	Write a program to perform the following operations • Insertion into an AVL-tree • Deletion from an AVL-tree	
7.	Write a programs for the implementation of BFS and DFS for a given graph.	
8	Write a programs for implementing the following searching methods: • Linear search • Binary search.	
9.	Write a programs for implementing the following sorting methods: • Quick sort • Selection sort • Insertion sort	
	Total	**60**

Course Outcomes		**Programmem Outcome**
CO	On completion of this course, students will	
1	Understand the concept of Dynamic memory management, data types, algorithms, Big O notation	PO1,PO4,PO5
2	Understand basic data structures such as arrays, linked lists, stacks and queues	PO1, PO4,PO6
3	Describe the hash function and concepts of collision and its resolution methods	PO1,PO3,PO6
4	Solve problem involving graphs, trees and heaps	PO3,PO4
5	Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data	PO1,PO5,PO6

Text Book	
1	Mark Allen Weiss, ―Data Structures and Algorithm Analysis in C++‖, Pearson Education 2014, 4th Edition.
2	ReemaThareja, ―Data Structures Using C‖, Oxford Universities Press 2014, 2nd Edition

Reference Books	
1	Thomas H.Cormen,ChalesE.Leiserson,RonaldL.Rivest, Clifford Stein, ―Introduction to Algorithms‖, McGraw Hill 2009, 3rd Edition
2.	Aho, Hopcroft and Ullman, ―Data Structures and Algorithms‖, Pearson Education 2003
Web Resources	
1.	https://www.programiz.com/dsa
2.	https://www.geeksforgeeks.org/learn-data-structures-and-algorithms-dsa-tutorial/

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	1	3	2	3
CO 3	3	3	3	3	2	3
CO 4	3	3	3	3	2	3
CO 5	3	2	3	3	3	3
Weightage of course contributed to each PSO	15	15	13	15	13	15

S-Strong-3 M-Medium-2 L-Low-1

SECOND YEAR – SEMESTER – III

CORE 5: RELATIONAL DATABASE MANAGEMENT SYSTEM

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC5	**4**	**0**	**0**	**III**	**4**	**4**	**25**	**75**	**100**

Learning Objectives	
LO1	To understand the basic DBMS models and architecture
LO2	To learn how to query and normalize the database.
LO3	To study the data base design, transaction Processing and Management and Security Issues.

Unit	Contents	No. of Hours

I	Introduction to Databases: Introduction – Characteristics of the Database Approach – Actors on the Scene – Workers behind the scene – Advantages of using DBMS Approach. Overview of database and Architectures: Data Models, Schemas, and Instances – Three-schema Architecture and Data Independence – Database languages & Interfaces – Database System Environment– Centralized & Client Server Architecture for DBMS - Classification of DBMS.	**15**
II	Basic Relational Model: Relational Model Concepts – Relational Model Constraints and Relational Database Schemas – Update Operations, Tractions, Dealing with Constraint Violations – Formal Relational Languages: Unary Relational Operations: SELECT and PROJECT – Relational Algebra Operations from Set Theory – Binary Relational Operations: JOIN and DIVISION – Examples of Queries in Relational Algebra.	**15**
III	Conceptual Data Modeling using the ER Model: Using High-Level Conceptual Data Models for Database Design – An example DB application – Entity Types, Entity Sets, Attributes, and Keys – Relationship Types, Relationship sets, Roles, and Structural Constraints – Weak entity types – Example- Mapping a Conceptual Design into Logical Design: Relational Database Design using ER- Relational Mapping – Mapping EER Model Constructs to Relations	**15**
IV	Functional Dependencies and Normalization for Relational Database: Functional Dependencies – Definition of Functional Dependency – Normal Forms based on Primary Keys – Normalization of Relations – First Normal Form – Second Normal Form – Third Normal Form – BCNF- Fourth Normal Form- Fifth Normal Form.	**15**
V	SQL: The Relational Database Standard: Data definition, Constraints, and schema changes in SQL – Basic Queries in SQL – More complex SQL Queries – Insert, delete and update statements in SQL – Views in SQL. PL/SQL: Introduction to PL/SQL – More on PL/SQL – Error Handling in PL/SQL – Oracle_s Named Exception Handlers – Stored Procedures and Functions – Execution of Procedures and Functions – Advantages – Procedures Vs. Functions – Syntax for Creating Procedures and Functions – Deleting a Stored Procedure or Function – Oracle Packages – Database Triggers – Types Of Triggers – Deleting a Trigger – Raise-Application Error Procedure	**15**
TOTAL		**75**
CO	**Course Outcomes**	
CO1	Outline the fundamental RDBMS concepts and PL/SQL	

CO2	Apply database operations, mapping, normalization, SQL and
CO3	Analyze the requirements to implement relational database PL/SQL concepts
CO4	Evaluate the database based on various models and normalization.
CO5	Design and construct normalized tables and manipulate it effectively using SQL and PL/SQL database objects.
Textbooks	
➢	Ramez Elmasri, Shamkant B. Navathe (2014), ―Database Systems‖, Sixth edition, Pearson Education, New Delhi.
➢	Ivan Bayross (2003 Reprint), SQL, PL/SQL-The Programming Language of Oracle, Second Revised Edition, BPB Publications, New Delhi.
Reference Books	
1.	Abraham Silberschatz, Henry F.Korth, S.Sudarshan, Database System Concepts, Tata McGraw Hill Publication, 4th Edition.
NOTE: Latest Edition of Textbooks May be Used	
Web Resources	
1.	http://srikanthtechnologies.com/books/orabook/ch1.pdf
2.	Http://www.tmv.edu.in/pdf/Distance_education/BCA%20Books/BCA%20IV%20SEM/BC A-428%20Oracle.pdf
3.	http://www.tutorialspoint.com/sql/sql-rdbms-concepts.htm

CO/ PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**2**	**2**	**3**	**3**	**3**
CO2	**3**	**3**	**2**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**	**2**
CO4	**3**	**3**	**2**	**3**	**3**	**3**
CO5	**3**	**3**	**2**	**3**	**3**	**2**
Weightage of course contributed toeach PSO	**15**	**14**	**11**	**15**	**15**	**13**

SECOND YEAR – SEMESTER – III

CORE 6: RDBMS LAB

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC6	0	0	3	III	3	3	25	75	100

Learning Objectives	
LO1	Understand the basics of SQL and how to write simple queries to retrieve and manipulate data in a database.
LO2	Learn how to use more advanced SQL features, such as joins, subqueries, and aggregate functions, to perform complex data operations.
LO3	Learn how to write PL/SQL code to automate tasks and implement business logic within a database.
LO4	Develop proficiency in using SQL Developer and other tools to develop and test SQL and PL/SQL code.
LO5	Understand best practices for database security

List of Exercises

Demonstrate the following commands

SQL:

1. DDL Commands
2. DML Commands
3. DCL Commands
4. SQL Built-in functions
5. Using Sub Queries

PL/SQL:

6. Simple programs using PL/SQL
7. Procedures
8. User-defined functions
9. Exception Handling
10. Triggers

TOTAL	60

CO	Course Outcomes
CO1	Choose appropriate SQL queries and PL/SQL blocks for the database.
CO2	Implement SQL and PL/SQL blocks for the given problem effectively.
CO3	Analyze the problem and Exceptions using queries and PL/SQL blocks.
CO4	Validate the database for normalization using SQL and PL/SQL blocks.
CO5	Design Database tables, create Procedures, user-defined functions and Triggers.

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**2**	**2**	**2**	**3**	**3**	**2**
CO2	**3**	**3**	**2**	**3**	**2**	**3**
CO3	**2**	**3**	**3**	**3**	**2**	**3**
CO4	**2**	**3**	**2**	**3**	**3**	**3**
CO5	**2**	**2**	**2**	**3**	**3**	**2**
Weightage of course contributed toeach PSO	**11**	**13**	**11**	**15**	**13**	**13**

SECOND YEAR – SEMESTER – IV

CORE 7: PROGRAMMING IN JAVA

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC7	**4**	**0**	**0**	**IV**	**4**	**4**	**25**	**75**	**100**

Learning Objectives	
LO1	To provide knowledge on fundamentals of object-oriented programming
LO2	To have the ability to use the SDK environment to create, debug and run servlet programs

Unit	Contents	No. of Hours
I	Fundamentals of Object- Oriented Programming: Introduction – Object Oriented Paradigm – Concepts of Object – Oriented Programming – Benefits of OOP – Evolution: Java History- Java Features - Differs from C and C++ - Overview of Java Language: Java Program-Structure – Tokens – Java Statements – Java Virtual Machine – Command Line Arguments	**15**
II	Constants, Variables and Data Types – Operators and Expressions – Decision making and Branching – Looping – Arrays - Strings – Collection Interfaces and classes	**15**

III	Classes objects and methods: Introduction – Defining a class – Method Declaration – Constructors - Method Overloading – Static Members – Nesting of methods – Inheritance – Overriding – Final variables and methods – Abstract methods and classes	**15**
IV	Multiple Inheritance: Defining Interfaces – Extending Interfaces – Implementing Interfaces – Packages: Creating Packages – Accessing Packages – Using a Package – Managing Errors and Exceptions - Multithreaded Programming	**15**
V	Layout Managers - JDBC – Java Servlet: - Servlet Environment Role – Servlet API – Servlet Life Cycle – Servlet Context – HTTP Support – HTML to Servlet Communication	**15**
TOTAL		**75**

CO	**Course Outcomes**
CO1	Outline the basic terminologies of OOP, programming language techniques, JDBC and Internet programming concepts
CO2	Solve problems using basic constructs, mechanisms, techniquesand technologies of Java
CO3	Analyse and explain the behavior of simple programs involving different techniques such as Inheritance, Packages, Interfaces,Exception Handling and Thread and technologies such as JDBC and Servlets
CO4	Assess various problem-solving strategies involved in Java todevelop a high-level application.
CO5	Design GUI based JDBC applications and able to develop Servletsusing suitable OOP concepts and techniques

Textbooks

- E. Balagurusamy, ―Programming with Java‖, TataMc-Graw Hill, 5th Edition.
- C Xavier,‖Java Programming – A Practical Approach‖, Tata McGraw Hill Edition Private Ltd

Reference Books

1. Herbert Schildt, ―The complete reference Java‖, TataMc-Graw Hill, 7th Edition.

NOTE: Latest Edition of Textbooks May be Used

Web Resources

1. NPTEL & MOOC courses titled Java https://nptel.ac.in/courses/106105191/
2. https://www.geeksforgeeks.org/
3. https://www.tutorialspoint.com/java/

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	2	2	2
CO2	2	3	2	2	2	2
CO3	2	3	3	3	2	2
CO4	2	3	2	2	2	2
CO5	3	3	2	2	2	2
Weightage of course contributed toeach PSO	12	14	11	11	10	10

SECOND YEAR – SEMESTER – IV

CORE 8: JAVA PROGRAMMING--LAB

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC8	0	0	3	IV	3	3	25	75	100

Learning Objectives

LO1	Develop Java programs that use variables, conditional statements, loops, arrays, and functions to solve problems.
LO2	Use object-oriented programming (OOP) concepts, such as classes, objects, inheritance, and polymorphism, to develop Java programs.
LO3	Write Java code that interacts with databases to perform database operations, such as inserting, updating, and retrieving data.

List of Exercises

1. Basic Programs
2. Arrays and Strings
3. Classes and Objects
4. Interfaces
5. Inheritance
6. Packages
7. Exception Handling
8. Threads
9. Working with Database using JDBC
10. Web application using Servlet

TOTAL	60

CO	Course Outcomes

CO1	Identify and explain the way of solving the simple problems
CO2	Use appropriate software development environment to write, compile and run Object-oriented Java programs
CO3	Analyze the application development requirements and identify the necessary building blocks And mechanisms of Java needed to build the application
CO4	Test for defects and validate a Java program with different inputs
CO5	Design, develop and compile Core Java, GUI Applications that utilize OOPs concepts

CO/ PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	**3**	**1**	**2**	**1**	**1**	**2**
CO2	**2**	**2**	**2**	**2**	**2**	**2**
CO3	**2**	**2**	**2**	**2**	**2**	**2**
CO4	**3**	**2**	**2**	**3**	**2**	**2**
CO5	**3**	**3**	**2**	**3**	**3**	**2**
Weightage of course contributed to each PSO	**13**	**10**	**10**	**11**	**10**	**10**

THIRD YEAR – SEMESTER – V

CORE 9: OPERATING SYSTEM

Subject Code	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
							CIA	**External**	**Total**
CC9	**5**	**0**	**0**	**V**	**4**	**5**	**25**	**75**	**100**

Learning Objectives		
LO1	The objective of this course is to provide an introduction to the internal operation of modern operating systems	
LO2	To focus on the core concepts such as processes and threads, mutual exclusion, CPU scheduling, deadlock, memory management, and file systems.	
Unit	**Contents**	**No. of Hours**

I	Introduction: Definition of Operating System - OS Structures: OS Services - System Calls - Virtual Machines - Process Management: Process Concept - Process Scheduling - Operation on Processes - Co-operating Processes - Inter-process Communication	**15**
II	CPU Scheduling: Basic Concepts - Scheduling Criteria - Scheduling Algorithms - Process Synchronization: The Critical Section Problem - Semaphores - Classical Problems of Synchronization - Critical Regions	**15**
III	Deadlocks: System Model - Deadlock characterization – Methods for Handling Deadlocks Deadlock Prevention - Deadlock avoidance- Deadlock Detection - Recovery from Deadlock.	**15**
IV	Storage management: Memory management - Swapping – Contiguous Memory allocation. Paging – Segmentation –Segmentation with Paging –Virtual memory: Demand paging - Page replacement – Thrashing. Mass-Storage Structure: Disk Structure- Disk scheduling.	**15**
V	File-System Interface: File Concept-File Attributes-File Operations – Access Methods: Sequential Access – Direct Access –Directory Structure: Single-Level Directory- Two –Level Directory-Tree-Structured Directories	**15**
TOTAL		**75**

CO	**Course Outcomes**
CO1	Outline the fundamental concepts of an OS and their respective functionality
CO2	Illustrate the importance of open source operating system commands
CO3	Identify and stimulate management activities of operating system
CO4	Analyze the various services provided by the operating system.
CO5	Interpret different problems related to Process, Scheduling, Deadlock, memory and Files.

Textbooks

➢	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne (2012), ―Operating System Concepts‖, 9th edition, Wiley Student Edition.

Reference Books

1.	William Stallings, ―Operating Systems – Internals & Design Principles‖, 5th Edition, Prentice – Hall of India private Ltd, New Delhi, 2004.
2.	Sridhar Vaidyanathan, ―Operating System‖, 1st Edition, Vijay Nicole Publications, 2014

NOTE: Latest Edition of Textbooks May be Used

Web Resources

1.	http://www.tutorialspoint.com/operating_system/
2.	http://www.freetechbooks.com/introduction-to-operating-systems-t340.html

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	1	2	2	2	2	2
CO2	3	3	2	3	2	2
CO3	3	3	3	3	3	2
CO4	2	3	2	2	3	2
CO5	3	3	2	3	3	2
Weightage of course contributed toeach PSO	12	14	11	13	13	10

THIRD YEAR – SEMESTER – V

CORE 10: WEB TECHNOLOGY

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	WEB TECHNOLOGY	Elective	5	-	-	-	4	25	75	100

Learning Objectives	
LO1	To learn the basic web concepts and to create rich internet applications that use most recent client-side programming technologies.
LO2	To learn the basics of HTML
LO3	To know about , DHTMLand XML,.
LO4	To know about CSS, Java Script
LO5	To provide the knowledge about Ajax

UNIT	Contents	No. Of. Hours
I	HTML: HTML-Introduction-tag basics- page structure-adding comments working with texts, paragraphs and line break. Emphasizing test- heading and horizontal rules-list-font size,face and color-alignment- links-tables-frames	15

II	Forms & Images Using Html: Graphics: Introduction-How to work efficiently with images in web pages, image maps, GIF animation, adding multimedia, data collection with html forms textbox, password, list box, combo box, text area, tools for building web page front page	**15**
III	XML & DHTML: Cascading style sheet (CSS)-what is CSS-Why we use CSS-adding CSS to your web pages-Grouping styles-extensible markup language (XML).	**15**
IV	JavaScript: Client side scripting, What is JavaScript, How to develop JavaScript, simple JavaScript, variables, functions, conditions, loops and repetition.	**15**
V	Ajax: Introduction, advantages &disadvantages, Purpose of it, ajax based web application, alternatives of ajax Java Script & AJAX: Introduction to array-operators, making statements-date & time-mathematics- strings-Event handling-form properties. AJAX. Introduction to jQuery and AngularJS	**15**
TOTAL HOURS		**75**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Ability to Develop and publish Web pages using Hypertext Markup Language(HTML).	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Ability to optimize page styles and layout with CascadingStyle Sheets(CSS).	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Ability to Understand, analyze and apply the role of languages to create acapstone	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Website using client-side web programming languages like HTML, DHTML, CSS, XML, JavaScript, and AJAX	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Able to understand the concept of jQuery and AngularJS	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks

1. Pankaj Sharma, ―*Web Technology*‖, Sk Kataria &SonsBangalore,2011.(UNIT I, II, III &IV).
2. Achyut S Godbole & Atul Kahate, ―*Web Technologies*‖, 2002, 2nd Edition. (UNIT V:AJAX)

Reference Books

1. Laura Lemay, Rafe Colburn , Jennifer Kyrnin, ―Mastering HTML, CSS & Javascript Web Publishing‖,2016.
2. DT Editorial Services (Author), ―HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)‖, Paperback 2016, 2ndEdition

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	2	3	3	3	2	3
CO 3	3	3	3	3	2	2
CO 4	3	3	3	3	2	3
CO 5	3	3	3	3	3	3
Weightageof coursecontributedtoeachPSO	14	15	15	15	13	14

S-Strong-3 M-Medium-2 L-Low-1

THIRD YEAR – SEMESTER – V

CORE 11: WEB TECHNOLOGY LAB

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC11	**0**	**0**	**5**	**V**	**4**	**5**	**25**	**75**	**100**

Learning Objectives	
LO1	Learn to design and create web pages using HTML, CSS, and JavaScript.
LO2	Learn how to use web development tools like text editors and debuggers
LO3	Learn how to create and manage dynamic content on the web
LO4	Learn how to optimize web pages and create responsive design.
LO5	Learn how to test and debug web applications to ensure their reliability and security.

List of Exercises

1. Create a form having number of elements (Textboxes, Radio buttons, Checkboxes, and so on). Write JavaScript code to count the number of elements in a form.

2. Create a HTML form that has number of Textboxes. When the form runs in the Browser fill the Text boxes with data. Write JavaScript code that verifies that all textboxes has been filled. If a textboxes has been left empty, popup an alert indicating which textbox has been left empty.

3. Develop a HTML Form, which accepts any Mathematical expression. Write JavaScript code to Evaluates the expression and Displays the result.

4. Create a page with dynamic effects. Write the code to include layers and basic animation.

5. Write a JavaScript code to find the sum of N natural Numbers. (Use user-defined function)

6. Write a JavaScript code block using arrays and generate the current date in words, this should include the day, month and year.

7. Create a form for Student information. Write JavaScript code to find Total, Average, Result and Grade.

8. Create a form for Employee information. Write JavaScript code to find DA, HRA, PF, TAX, Gross pay, Deduction and Net pay.

9. Create a form consists of a two Multiple choice lists and one single choice list (a)The first multiple choice list, displays the Major dishes available (b)The second multiple choice list, displays the Starters available. (c)The single choice list, displays the Soft drinks available.

TOTAL	**75**

CO	**Course Outcomes**
CO1	Understand the fundamental principles of web development and their respective functions, including HTML, CSS, JavaScript
CO2	Identify the tools which will be suitable for the requirement of the webpage.
CO3	Implement HTML, Java script and Style Sheets effectively in the Web Pages
CO4	Analyze the different tools and built-in functions available to be applied in the Webpage.
CO5	Rate the design and effectiveness of the Web Pages created.

MAPPING TABLE

CO/ PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**2**	**2**	**3**	**3**	**3**	**2**
CO2	**1**	**3**	**2**	**3**	**2**	**1**
CO3	**3**	**2**	**3**	**3**	**3**	**2**
CO4	**3**	**2**	**2**	**2**	**1**	**2**
CO5	**2**	**3**	**1**	**3**	**3**	**3**

Weightage of course contributedto each PSO	**11**	**12**	**11**	**14**	**12**	**10**

THIRD YEAR – SEMESTER – VI

CORE 13: INFORMATION SECURITY

Subject Code	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
							CIA	**External**	**Total**
CC10	**6**	**0**	**0**	**V**	**4**	**6**	**25**	**75**	**100**

Learning Objectives		
LO1	Understand the principles of information security and the importance of protecting sensitive data.	
LO2	Learn how to identify potential security threats and vulnerabilities in computer systems and networks.	
LO3	Learn how to implement security controls and measures to protect against various types of attacks, such as viruses, malware, and phishing.	
LO4	Learn how to conduct risk assessments	
LO5	Understand the legal and ethical issues related to information security, including privacy laws and regulations.	
Unit	Contents	No. of Hours
I	The Language of Security- Threats and Vulnerabilities: Threats- Physical Threats- Vulnerabilities- The Information Security Manager- Information Security Job Roles -Training, Experience, and Professionalism- Getting Started in Security Management	15
II	Organizational Security : Security in Organizational Structures- Working with Specialist Groups -Working with Standards and Regulations- Working with Risk Management- Working with Enterprise Architecture- Working with Facilities Management- Information Security Implementation: Integration with Risk Management- Secure Development- Standards, Frameworks, Guidelines, and Legislation: Why Do We Need Standards? – Legislation- The ISO/IEC 27000 Series of Standards - Business Continuity -Risk Management Standards - COBIT - Payment Card Industry Data Security Standard - Health Insurance Portability and Accountability Act	15
III	Protection of Information: Information Classification- Identification, Authentication, and Authorization- Protection of People: Human	15

	Vulnerabilities- Building a Security Culture - Personnel Security Life Cycle - Protection of Premises: What Is Physical Security? - Start with a Risk Assessment- Perimeter Design- Internal Building Security	
IV	Protection of Systems -Introducing Malware- Threat Vectors-- Technical Countermeasures - Network Security- Digital Evidence and Incident Response: The Digital Forensic Process- Forensic Readiness- Incident Response and Digital Investigations-Investigating a Malware Out breach.	15
V	Cloud Computing Security: Cloud Computing 101- Cloud Security - Cloud Security Architectures-API Security: An Old Threat with New Targets – Virtualization- Industrial Control Systems: ICS Architectures- ICS Security- Secure Systems Development: Secure Development- Secure Development Business Processes- Security Testing- Auditing	15
TOTAL		75

CO	Course Outcomes
CO1	Understand the basic concepts and terminology of information security, including key terms such as confidentiality, integrity, and availability
CO2	Explain the principles of information security, including the key concepts of risk management, threat analysis, and vulnerability assessment
CO3	Apply information security principles and techniques to practical scenarios, such as evaluating the security of a network or system and implementing appropriate controls to mitigate risks.
CO4	Analyze complex security problems, such as identifying potential threats and assessing the effectiveness of security controls.
CO5	Evaluate the effectiveness of different security solutions and make informed decisions about which solutions are best suited to address specific security challenges.

Textbooks

➢	Tony Campbell Burns Beach , ―Practical Information Security Management: A Complete Guide to Planning and Implementation‖,Apress, 2016 (http://file.allitebooks.com/20161204/Practical%20Information%20Security%20Management.pdf)

Reference Books

1.	Mark Rhodes Ousley, ―The Information security the complete Reference‖, Second Edition ,2013
2.	Josiah Dykstra , ―Essential Cyber Security Science‖, First Edition, 2016

NOTE: Latest Edition of Textbooks May be Used

Web Resources

1.	www.geeksforgeeks.org/Informationsecurity

MAPPING TABLE						
CO/ PSO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	1	1	2
CO2	3	1	3	1	1	2
CO3	3	3	2	3	3	2
CO4	3	3	2	3	3	2
CO5	3	2	2	3	3	2
Weightage of coursecontributed to each PSO	15	11	10	11	11	10

THIRD YEAR – SEMESTER – VI

CORE 14 : PYTHON PROGRAMMING

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC13	6	0	0	VI	4	6	25	75	100

Learning Objectives	
LO1	Understand the concepts of Python programming.
LO2	To apply the OOPs concept in PYTHON programming.
LO3	To impart knowledge on demand and supply concepts
LO4	Learn to solve basic programming problems.
LO5	Learn how to work with files and external libraries in Python.

Unit	Contents	No. of Hours
I	**Basics of Python Programming:** History of Python-Features of Python-Literal-Constants-Variables - Identifiers–Keywords-Built-in Data Types-Output Statements – Input Statements-Comments – Indentation- Operators-Expressions-Type conversions. **Python Arrays:** Defining and Processing Arrays – Array methods.	15
II	**Control Statements:** Selection/Conditional Branching statements: if, if-else, nested if and if-elif-else statements. Iterative Statements: while loop, for loop, else suite in loop and	15

	nested loops. **Jump Statements:** break, continue and pass statements**.**	
III	**Functions:** Function Definition – Function Call – Variable Scope and its Lifetime-Return Statement. **Function Arguments**: Required Arguments, Keyword Arguments, Default Arguments and Variable Length Arguments- Recursion. **Python Strings:** String operations- Immutable Strings - Built-in String Methods and Functions - String Comparison. **Modules**: import statement- The Python module – dir() function – Modules and Namespace – Defining our own modules.	**15**
IV	**Lists:** Creating a list -Access values in List-Updating values in Lists-Nested lists -Basic list operations-List Methods. Tuples: Creating, Accessing, Updating and Deleting Elements in a tuple – Nested tuples– Difference between lists and tuples. **Dictionaries:** Creating, Accessing, Updating and Deleting Elements in a Dictionary – Dictionary Functions and Methods - Difference between Lists and Dictionaries.	**15**
V	**Python File Handling:** Types of files in Python - Opening and Closing files-Reading and Writing files: write() and writelines() methods- append() method – read() and readlines() methods – with keyword – Splitting words – File methods - File Positions- Renaming and deleting files.	**15**
TOTAL		**75**

CO	**Course Outcomes**
CO1	Outline the basic concepts in python language.
CO2	Interpret different looping and conditional statements in python language
CO3	Apply the various data types and identify the usage of control statements, loops, functions and Modules in python for processing the data
CO4	Analyze and solve problems using basic constructs and techniques of python.
CO5	Assess the approaches used in the development of interactive application.

Textbooks

- Reema Thareja, ―Python Programming using problem solving approach‖, First Edition, 2017, Oxford University Press.
- Dr. R. Nageswara Rao, ―Core Python Programming‖, First Edition, 2017, Dream tech Publishers

Reference Books

1. VamsiKurama, ―Python Programming: A Modern Approach‖, Pearson Education.
2. Mark Lutz, ‖Learning Python‖, Orielly.

NOTE: Latest Edition of Textbooks May be Used

Web Resources

1. https://www.programiz.com/python-programming

2.	https://www.guru99.com/python-tutorials.html

MAPPING TABLE						
CO/ PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	**3**	**2**	**2**	**3**	**2**	**2**
CO2	**2**	**3**	**2**	**3**	**2**	**2**
CO3	**2**	**3**	**2**	**2**	**3**	**1**
CO4	**1**	**2**	**2**	**1**	**3**	**2**
CO5	**2**	**2**	**2**	**1**	**3**	**3**
Weightage of course contributed to each PSO	**10**	**12**	**10**	**10**	**13**	**10**

THIRD YEAR – SEMESTER – VI

CORE 15: PYTHON PROGRAMMING-LAB

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC14	**0**	**0**	**6**	**VI**	**4**	**6**	**25**	**75**	**100**

Learning Objectives

LO1	Understand the fundamentals of programming using Python, such as variables, data types, control structures, and functions.
LO2	Learn how to use Python libraries and modules to solve problems.
LO3	Practice writing Python code to solve real-world problems and build basic applications.
LO4	Gain experience with common programming paradigms, such as object-oriented programming and functional programming.
LO5	Understand best practices for debugging and testing code.

List of Exercises

1. Program using variables, constants, I/O statements in Python.
2. Program using Operators in Python.
3. Program using Conditional Statements.
4. Program using Loops.

5. Program using Jump Statements.
6. Program using Functions.
7. Program using Recursion.
8. Program using Arrays.
9. Program using Strings.
10. Program using Modules.
11. Program using Lists.
12. Program using Tuples.
13. Program using Dictionaries.

Program for File Handling.

TOTAL	**90**

CO	**Course Outcomes**
CO1	Understand the significance of control statements, loops and functions in creating Simple programs.
CO2	Interpret the core data structures available in python to store, process and sort the data.
CO3	Develop the real time applications using python programming language.
CO4	Analyze the real time problem using suitable python concepts.
CO5	Assess the complex problems using appropriate concepts in python.

MAPPING TABLE

CO/ PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**2**	**3**	**2**	**3**	**3**
CO2	**3**	**3**	**2**	**2**	**3**	**3**
CO3	**3**	**2**	**2**	**3**	**3**	**2**
CO4	**3**	**2**	**3**	**3**	**2**	**2**
CO5	**3**	**3**	**3**	**3**	**3**	**2**
Weightage of course contributedto each PSO	**15**	**12**	**13**	**13**	**14**	**12**

SUGGESTED TOPICS IN CORE COMPONENT

OBJECT ORIENTED PROGRAMMING USING C++

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC14	5	0	0	-	4	5	25	75	100

Learning Objectives		
LO1	To inculcate knowledge on Object-oriented concepts and programming using C++.	
LO2	Demonstrate the use of various OOPs concepts with the help of programs	
Unit	**Contents**	**No. of Hours**
I	OOP Paradigm – Concepts of OOP – Benefits of OOP - Object Oriented Languages – Applications of OOP – OOP Design: Using UML as a Design Tool Beginning with C++	**15**
II	Tokens, Expressions and Control Structures - Functions in C++ : Function Prototyping – Call by Reference - Return by Reference – Inline Function – Default Arguments – Const Arguments – Recursion – Function Overloading – Classes and Objects	**15**
III	Constructors and Destructors: Constructors – Parameterized Constructors – Multiple Constructors – Constructor with default Arguments – Copy Constructors – Dynamic Constructor – Destructors – Operator Overloading and Type Conversions: Operator Overloading – Overloading Unary Operators – Overloading Binary operators – Rules for Operator Overloading – Type Conversions	**15**
IV	Inheritance: Introduction – Types of Inheritance – Virtual Base Classes – Abstract Classes – Pointers - Virtual Function - Polymorphism	15
V	Templates: Class Templates – Function Templates – Overloading of template Function – Exception Handling	15
TOTAL		75

CO	Course Outcomes
CO1	Outline the C++ programming fundamentals and the concepts of object-oriented programming like object and class, Encapsulation, inheritance and polymorphism.

CO2	Classify the control structures, types of constructors, inheritance and different type conversion mechanisms.
CO3	Analyze the importance of object oriented programming features like polymorphism, reusability, generic programming, data abstraction and the usage of exception handling.
CO4	Determine the use of object oriented features such as classes, inheritance and templates to develop C++ programs for complex problems.
CO5	Create a program in C++ by implementing the concepts of object-oriented programming.
Textbooks	
➢	E. Balaguruswamy, (2013), ―Object Oriented Programming using C++‖, 6th Edition, Tata McGraw Hill.
Reference Books	
1	Bjarne Stroustrup, ―The C++ Programming Language‖, Fourth Edition, Pearson Education.
2	Hilbert Schildt, (2009), ―C++ - The Complete Reference‖, 4th Edition, Tata McGrawHill
NOTE: Latest Edition of Textbooks May be Used	
Web Resources	
1.	http:/fahad.cprogramming.blogspot.com/p/c-simple-examples.html
2.	http://www.sitesbay.com/cpp/cpp-polymorphism

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	3	3	2
CO2	3	3	2	3	3	2
CO3	3	3	3	3	3	2
CO4	3	3	2	3	3	2
CO5	3	3	2	3	3	2
Weightage of course contributed toeach PSO	15	14	11	15	15	10

C++ Programming Lab

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total

CC14	0	0	5	-	4	5	25	75	100

Learning Objectives

LO1	To inculcate knowledge on Object-oriented concepts and programming using C++.
LO2	Demonstrate the use of various OOPs concepts with the help of programs

List of Excercises

Exercises:

1. Working with Classes and Objects
2. Using Constructors and Destructors
3. Using Function Overloading
4. Using Operator Overloading
5. Using Type Conversions
6. Using Inheritance
7. Using Polymorphism
8. Using Console I/O
9. Using Templates
10. Using Exceptions

TOTAL 75

CO	Course Outcomes
CO1	Understand the fundamentals of C++ programming structure
CO2	Identify the basic features of OOPS such as classes, objects, polymorphism, inheritance
CO3	Analyze the concept of inheritance with the understanding of early and late binding, usage of exception handling, constructors, destructors, generic programming and type conversions
CO4	Determine the use of various data structures such as stacks, queues and lists to solve va computing problems in C++ by incorporating OOPS concepts.
CO5	Develop a program in C++ with the concepts of object oriented programming to solve problems.

DATA COMMUNICATION AND NETWORKING

Subject Code	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
							CIA	**External**	**Total**

	0	5	0	-	4	**5**	**25**	**75**	**100**

Learning Objectives	
LO1	This course is to provide students with an overview of the concepts and fundamentals of data communication and computer networks
LO2	To familiarize the student with the basic taxonomy and terminology of the computer.

Prerequisites:

Unit	**Contents**	**No. of Hours**
I	Introduction: Data Communication-Networks: Distributed Processing-Network Criteria Physical Structures –Network Models-Categories of Network-Internetwork - The Internet Protocols and Standards – Network Models: Layers in the OSI Model - TCP/IP Protocol Suite.	**15**
II	Data and Signals: Analog and Digital Data - Analog and Digital Signals – Performance - Digital Transmission: Transmission Modes – Multiplexing: FDM – WDM - Synchronous TDM -Statistical TDM - Transmission Media: Guided media - Unguided Media.	**15**
III	Switching: Circuit Switched Networks - Datagram Networks-Virtual Circuit Network - Error Detection and Correction: Introduction - Block Coding - Linear Block Codes - Cyclic Codes: Cyclic Redundancy Check - Checksum. Data Link Control: Framing - Flow Control and Error Control - Noiseless Channel: Stop-and-wait Protocol.	**15**
IV	Wired LANs: Standard Ethernet-GIGABIT Ethernet-Wireless LAN: Bluetooth Connecting LANs: Connecting Devices**:** Passive Hubs-Repeaters-Active Hubs-Bridges-Two Layer Switches-Routers-Three layer Switches-Gateway-Network Layer: Internet Protocol: IPv4 – Ipv6-Transition from IPv4 to IPv6.	**15**
V	Network Layer: Delivery, Forwarding and Routing- Unicast Routing Protocols: Distance Vector Routing-Link state routing- Future & Current Trends in Computer Networks: 5G Network: Salient Features-Technology-Applications-Advanced Features-Advantages & Disadvantages-Internet of Things: key Features -Advantages & Disadvantages-IOT Hardware- IOT Technology and Protocols-IOT Common Uses-Applications-WiFi-WiMax Lifi- Lifi vs Wifi.	**15**
TOTAL		**75**

CO	Course Outcomes
CO1	Understand the fundamental concepts of computer networks and its application areas
CO2	Identify and use various networking techniques and components to establish networking connection and transmission
CO3	Analyze the services performed by different network layers and recent advancements in networking
CO4	Compare various networking models, layers, protocols and technologies.
CO5	Select the appropriate networking mechanisms to build a reliable network
Textbooks	
➢	Behrouz and Forouzan,(2006), Data Communication and Networking‖, 4th Edition, TMH.
➢	Ajit Pal,(2014), Data Communication and Computer Networks, PHI.
Reference Books	
1.	Jean Walrand (1998), ―Communication Networks,Second Edition‖, TataMcGraw Hill.
NOTE: Latest Edition of Textbooks May be Used	
Web Resources	
1.	http://www.tutorialspoint.com/data_communication_computer_network/
2.	http://www.slideshare.net/zafar_ayub/data-communication-and-network-11903853
3.	http://www.freetechbooks.com/data-communication-and-networks-f31.html

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	3	3	2
CO2	3	3	2	3	3	2
CO3	3	3	3	3	3	2
CO4	3	3	2	3	3	2
CO5	3	3	2	3	3	2
Weightage of course contributed toeach PSO	15	14	11	15	15	10

SOFTWARE ENGINEERING

Subject	L	T	P	S	Credits	Inst.	Marks

Code						Hours	CIA	External	Total
	0	**5**	**0**	**-**	**4**	**5**	**25**	**75**	**100**

Learning Objectives	
LO1	To introduce the software development life cycles
LO2	To introduce concepts related to structured and objected oriented analysis & design
LO3	To provide an insight into cost estimation
LO4	Learn to write test cases using different testing techniques.
LO5	The students should be able to specify software requirements and design the software using tools

Unit	**Contents**	**No. of Hours**
I	Introduction to Software Engineering: Definition - The changing nature of software - Software Myths - Terminologies - Role of Management in Software Development - Software Life Cycle Models: The Waterfall Model - Increment Process Model - Evolutionary Process Model - The Unified Process.	**15**
II	Software Requirements Analysis and Specifications: Requirements Engineering - Type of Requirements - Feasibility Studies - Requirements Elicitation - Requirements Analysis - Requirements Documentation - Requirements Validation	**15**
III	Software Project Planning: Size Estimation - Cost Estimation - The Constructive Cost Model (COCOMO) - COCOMO II - The Putnam Resource Allocation Model - Software Risk Management - Software Design: Definition - Modularity - Strategy of Design - Function Oriented Design.	**15**
IV	Software Testing: A Strategic Approach to Software Testing - Terminologies - Functional Testing - Structural Testing - Levels of Testing - Validation Testing - Testing Tools.	**15**
V	Software Reliability: Basic Concepts - Software Quality - McCall Software Quality Model - Boehm Software Quality Model - Capability Maturity Model - Software Maintenance: Definition - Process - Models - Configuration Management -Documentation.	**15**
TOTAL		**75**

CO	**Course Outcomes**
CO1	Define the basic terminologies involved in the entire software developmental life cycle
CO2	Identify suitable models, techniques and tools for the development of a software product

CO3	Apply software engineering perspective through requirements analysis, software design and construction, verification, and validation to develop solutions to modern problems
CO4	Compare and contrast different process, cost, quality models and testing techniques
CO5	Estimate the project cost using suitable cost estimation models, rate the software risks and evaluate management strategies for effective software development
Textbooks	
➢	K.K Agarwal, Yogesh Singh (2009), ―Software Engineering‖, 3 rd Edition, New Age International Publishers.
Reference Books	
3.	Roger S. Pressman, ―Software Engineering – A Practioners Approach‖, 5 th Edition, Tata Mc Graw Hill Publication.
4.	Thomas T. Baker, ―Writing Software Documentation – A task oriented approach‖, Second Edition, Pearson Education, 2004.
5.	Pankaj Jalote (2005), ―An Integrated Approach to Software Engineering‖, 3 rd Edition, Narosa Publication
NOTE: Latest Edition of Textbooks May be Used	
Web Resources	
2.	http://www/tutorialspoint.com/software_engineering

MAPPING TABLE						
CO/ PSO	**PSO1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**2**	**1**	**1**	**1**	**2**
CO2	**3**	**1**	**3**	**1**	**1**	**2**
CO3	**3**	**3**	**2**	**3**	**3**	**2**
CO4	**3**	**3**	**2**	**3**	**3**	**2**
CO5	**3**	**2**	**2**	**3**	**3**	**2**
Weightage of course contributed to eachPSO	**15**	**11**	**10**	**11**	**11**	**10**

SOFTWARE ENGINEERING LAB

Subject	**L**	**T**	**P**	**S**	**Credits**	**Inst.**	**Marks**

Code						Hours	CIA	External	Total
	0	0	5	-	4	5	25	75	100

Learning Objectives

LO1	To Impart Practical Training in Software Engineering
LO2	To understand about different Software Testing
LO3	Learn to write test cases using different testing techniques.

List of Exercises

Do the following 8 exercises for any project projects (Eg. Student Portal, Online exam registration)

1) Development of problem statement.
2) Preparation of Software Requirement Specification Document.
3) Preparation of Software Configuration Management and Risk Management related documents.
4) Draw the entity relationship diagram
5) Draw the data flow diagrams at level 0 and level 1
6) Draw use case diagram
7) Draw activity diagram of all use cases.
8) Performing the Design by using any Design phase CASE tools.
9) Develop test cases for unit testing and integration testing
10) Develop test cases for various white box and black box testing techniques

TOTAL	**75**

CO	Course Outcomes
CO1	An ability to use the methodology and tools necessary for engineering practice.
CO2	Ability to elicit, analyze and specify software requirements.
CO3	Analyze and translate specifications into a design.
CO4	Ability to derive test cases for different testing.
CO5	Apply software engineering perspective through requirements analysis, software design and

	construction, verification, and validation to develop solutions to modern problems

MAPPING TABLE						
CO/ PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	**3**	**2**	**3**	**2**	**2**	**2**
CO2	**2**	**3**	**3**	**3**	**3**	**2**
CO3	**2**	**2**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**2**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**	**3**
Weightage ofcourse contributed to each PSO	**13**	**12**	**14**	**14**	**14**	**13**

SOFTWARE METRICS

Subject Code	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
							CIA	**External**	**Total**
	0	**5**	**0**	**-**	**4**	**5**	**25**	**75**	**100**

Learning Objectives	
LO1	Gain a solid understanding of what software metrics are and their significance
LO2	Learn how to identify and select appropriate software metrics based on project goals
LO3	Acquire knowledge and skills in collecting and measuring software metrics
LO4	Learn how to analyze and interpret software metrics data to extract valuable insights
LO5	Gain the ability to evaluate software quality using appropriate metrics

Unit	**Contents**	**No. of Hours**
I	Fundamentals of Measurement: Need for *Measurement: Measurement in Software Engineering, Scope of Software Metrics,* The Basics of measurement*: The representational theory of measurement, Measurement and models, Measurement scales and scale types, meaningfulness in measurement*	**15**
II	A Goal-Based Framework For Software Measurement: *Classifying software measures, Determining what to Measure, Applying the*	**15**

	framework, Software measurement validation, Performing SoftwareMeasurementValidation Empirical investigation*: Principles of Empirical Studies, Planning Experiments, Planning case studies as quasi-experiments, Relevant and Meaningful Studies*	
III	Software Metrics Data Collection: *Defining good data, Data collection for incident reports, How to collect data, Reliability of data collection Procedures* Analyzing software measurement data: *Statistical distributions and hypothesis testing, Classical data analysis techniques, Examples of simple analysis techniques*	**15**
IV	Measuring internal product attributes: Size *Properties of Software Size, Code size, Design size, Requirements analysis and Specification size, Functional size measures and estimators, Applications of size measures* Measuring internal product attributes: Structure: *Aspects of Structural Measures, Control flow structure of program units, Design-levelAttributes, Object-oriented Structural attributes and measures*	**15**
V	Measuring External Product Attributes: *Modelling software quality, Measuring aspects of quality, Usability Measures, Maintainability measures,SecurityMeasures* Software Reliability: Measurement and Prediction: *Basics of reliability theory, The software reliability problem, Parametric reliability growth models, Predictive accuracy*	**15**
TOTAL		**75**

CO	**Course Outcomes**
CO1	Understand various fundamentals of measurement and software metrics
CO2	Identify frame work and analysis techniques for software measurement
CO3	Apply internal and external attributes of software product for effort estimation
CO4	Use appropriate analytical techniques to interpret software metrics data and derive meaningful insights
CO5	Recommend reliability models for predicting software quality

Textbooks

- Software Metrics A Rigorous and Practical Approach, Norman Fenton, James Bieman , Third Edition, 2014

Reference Books	
1	Software metrics, Norman E, Fenton and Shari Lawrence Pfleeger, International Thomson Computer Press, 1997
2	Metric and models in software quality engineering, Stephen H.Kan, Second edition, 2002, Addison Wesley Professional
3	Practical Software Metrics for Project Management and Process Improvement, Robert B.Grady, 1992, Prentice Hall.
NOTE: Latest Edition of Textbooks May be Used	
Web Resources	
1.	https://lansa.com/blog/general/what-are-software-metrics-how-can-i-measure-these-metrics/
2.	https://stackify.com/track-software-metrics/

MAPPING TABLE						
CO/ PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	**3**	**2**	**2**	**2**	**2**	**2**
CO2	**2**	**3**	**3**	**3**	**3**	**2**
CO3	**2**	**2**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**2**	**3**	**2**	**3**
CO5	**3**	**3**	**3**	**2**	**3**	**3**
Weightage ofcourse contributed to each PSO	**13**	**12**	**13**	**13**	**13**	**13**

MACHINE LEARNING

Subject Code	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
							CIA	**External**	**Total**
	0	**5**	**0**	**-**	**4**	**5**	**25**	**75**	**100**

Learning Objectives		
LO1	To comprehend the raw data and to design the same with the appropriate machine learning algorithms for a meaningful representation of data..	
Unit	**Contents**	**No. of Hours**

I	**Introduction:** Machine Learning – Examples of Machine Learning Applications. **Supervised Learning:** Learning a Class from Examples – Vapnik-Chervonenkis (VC) Dimension – Probably Approximately Correct (PAC) Learning – Noise – Learning Multiple Classes – Regression – Model Selection and Generalization – Dimensions of a Supervised Machine Learning Algorithm. **Bayesian Decision Theory:** Introduction – Classification – Losses and Risks – Discriminant Functions – Association Rules.	**15**
II	**Parametric Methods:** Maximum Likelihood Estimation – Evaluating an Estimator: Bias and Variance – The Bayes' Estimator – Parametric Classification – Regression – Tuning Model Complexity: Bias/Variance Dilemma – Model Selection Procedures. **Nonparametric Methods:** Nonparametric Density Estimation – Generalization to Multivariate Data – Nonparametric Classification – Condensed Nearest Neighbor – Distance-Based Classification – Outlier Detection – Nonparametric Regression: Smoothing Models	**15**
III	**Linear Discrimination** – Generalizing the Linear Model – Geometry of the Linear Discriminant – Pairwise Separation – Gradient Descent – Logistic Discrimination – Discrimination by Regression – Learning to Rank. **Multilayer Perceptrons:** The Perceptron – Training a Perceptron – Learning Boolean Functions – Multilayer Perceptrons – MLP as a Universal Approximator – Backpropagation Algorithm	**15**
IV	**Combining Multiple Learners:** Generating Diverse Learners – Model Combination Schemes – Voting – Bagging – Boosting – Stacked Generalization – Fine-Tuning an Ensemble – Cascading Reinforcement Learning: Elements of Reinforcement Learning – Model-Based Learning – Temporal Difference Learning – Generalization – Partially Observable States	**15**
V	**Machine Learning with Python**: Data Pre-processing, Analysis & Visualization - Training Data and Test Data – Techniques – Algorithms: List of Common Machine Learning Algorithms- Decision Tree Algorithm- Naïve Bayes Algorithm - K-Means-Random Forest- Dimensionality Reduction Algorithm- Boosting Algorithms – Applications: Social Media-Refinement of Search Engine Results- Product Recommendations-Detection of Online frauds.	**15**
TOTAL		**75**

CO	**Course Outcomes**
CO1	Outline the importance of machine learning in terms of designing intelligent machines
CO2	Identify suitable machine learning techniques for the real time applications
CO3	Analyze the theoretical concepts and how they relate to the practical aspects of machine learning.
CO4	Assess the significance of principles, algorithms and applications of machine learning through a hands-on approach
CO5	Compare the machine learning techniques with respective functionality

Textbooks

➢	Ethem Alpaydın, ―Introduction to Machine Learning‖ Third Edition, MIT, 2014. (Unit I – Unit IV) https://www.tutorialspoint.com/machine_learning_with_python/machine_learning_with_python_tutorial.pdf (**Unit V:** Machine learning with python tutorial)
Reference Books	
	1. Bertt Lantz, "Machine Learning with R," Packt Publishing, 2013
	2. Jason Bell, "Machine Learning: Hands-On for Developers and Technical Professionals," Wiley Publication, 2015.
NOTE: Latest Edition of Textbooks May be Used	
Web Resources	
	1. https://www.expertsystem.com/machine-learning-definition/
	2. https://searchenterpriseai.techtarget.com/definition/machine-learning-ML

DATA MINING

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC14	0	5	0	-	4	5	25	75	100

Learning Objectives		
LO1	To learn different data mining techniques	
LO2	To develop skills of using recent data mining software for solving practical problems.	
LO3	Gain knowledge of independent study and research	
Unit	**Contents**	**No. of Hours**
I	Introduction: Data Mining – Kinds of Data and Patterns to be Mined – Technologies used –Kinds of Applications are Targeted - Major Issues –Data objects and Attribute types – Basic statistical Descriptions of Data – Data Visualization : Pixel-oriented visualization techniques, Geometric projection visualization techniques - Data Preprocessing : Data Cleaning – Data Integration - Data Reduction - Data Transformation.	**18**

II	Data Preprocessing: Introduction – Data cleaning – Data Integration – Data Transformation – Data Reduction – Data Discretization	**18**
III	Association Rules Mining: Introduction - basics - task and a naïve algorithm-Apriori algorithm –Improve the efficient of the Apriori algorithm – Mining frequent pattern without candidate generation (FP-growth) – Performance evaluation of algorithms.	**18**
IV	Classification: Introduction –Decision tree – Building a Decision Tree : Tree Induction method – Split algorithm based on Information theory – Gini Index - Over fitting and pruning – Decision Tree rules – Bayes classification methods: Bayes theorem – Naïve Bayesian classification Classifiers accuracy	18
V	Clustering Techniques: cluster Analysis – Clustering Methods – Similarity and Distance Measures – Hierarchical Methods - Partitional Methods – Outlier Analysis	18
TOTAL		90

CO	Course Outcomes
CO1	Outline the fundamentals of Data Mining concepts
CO2	To develop skills of using recent data mining software for solving practical problems
CO3	Apply suitable different preprocessing techniques on data.
CO4	Analyze the various data mining algorithms with respect to functionality
CO5	Recommend appropriate data models for data warehousing and data mining techniques to solve real world problems

Textbooks

➢	Jiawei Han, Micheline Kamber, Jian Pei, ―Data Mining concepts and techniques‖, 3rd Edition, Elsevier publication, 2012.

Reference Books

1	G.K. Gupta, ―Introduction to Data mining with case studies‖, 2nd Edition, PHI Private limited, New Delhi, 2011
2	M. H.Dunham, 2003, ―Data Mining : Introductory and Advanced Topics‖ , Pearson Education, Delhi

NOTE: Latest Edition of Textbooks May be Used

Web Resources

1.	http://nptel.iitm.ac.in/video.php?subjectId=106106093
2.	https://nptel.ac.in/courses/106105174/

DATA ANALYTICS LAB

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC15	0	0	6	VI	4	5	25	75	100

Learning Objectives

LO1	Understand the process of collecting raw data
LO2	Learn how to analyze and explore data
LO3	Understand the concept of preprocessing
LO4	Learn to visualize the given data
LO5	Understand and select appropriate analytical techniques for a given problem.

List of Exercises

1. To perform data import/export (.CSV, .XLS, .TXT) operations using data frames in R
2. Numerical operations (MAX, MIN, AVG, SUM, SQRT, ROUND) using in R.
3. Statistical operations (Mean, Median, Mode and Standard deviation) using R
4. To perform data pre-processing operations- Handling Missing Data and Data Normaliztion
5. Matrix addition, subtraction, multiplication, inverse transpose and division operations using vector concept in R.
6. Dimensionality reduction operation using PCA for any Data Set
7. Simple Linear Regression with R.
8. K-Means clustering operation and visualization for any data set
9. Write R script to diagnose any disease using KNN classification and plot the results.
10. Perform market basket analysis using Association Rules (Apriori)

TOTAL	**75**

CO	Course Outcomes
CO1	Implement numerical and statistical analysis on various data sources
CO2	Apply data preprocessing and dimensionality reduction methods on raw data
CO3	Implement linear regression technique on numeric data for prediction
CO4	Execute clustering and association rule mining algorithms on different datasets
CO5	Implement and evaluate the performance of KNN algorithm on different datasets

MAPPING TABLE						
CO/ PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**2**	**3**	**2**	**2**
CO3	**3**	**2**	**3**	**3**	**3**	**2**
CO4	**3**	**2**	**3**	**2**	**3**	**3**
CO5	**2**	**3**	**3**	**3**	**3**	**3**
Weightage of course contributedto each PSO	**14**	**13**	**14**	**14**	**14**	**13**

MOBILE APPLICATION DEVELOPMENT

Subject Code	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
							CIA	**External**	**Total**
	0	**5**	**0**	**-**	**4**	**5**	**25**	**75**	**100**

Learning Objectives		
LO1	To provide the students with the basics of Android Software Development tools and development of software on mobile platform.	
Unit	**Contents**	**No. of Hours**
I	Introduction to Android Operating System – Configuration of Android Environment- Create the First Android Application. Layout: Vertical, Vertical Scroll, horizontal, horizontal Scroll, Table Layout arrangement. **Designing User Interface:** Label Text - TextView – Password Text Box - Button –ImageButton – CheckBox – Image - RadioButton – Slider – Autocomplete text View.	**15**
II	User Interface: Spinner – Switch – Side Bar- ListView - List Picker - Image Picker - Notifier - Time and Date Picker - Web Viewer	**15**

III	Media: Camcorder - Camera – Player – Speech Recognizer – Text to Speech – Video Player - Canvas	**15**
IV	Maps: Maps - Sensor: Location Sensor – Barcode Scanner Social components: Contact Picker – Email Picker – Phone Number Picker – Phone Call - Social: Texting	**15**
V	Storage: Cloud DB – Tiny DB – Experimental – Fire DB	**15**
TOTAL		**75**

CO	**Course Outcomes**
CO1	Chart the requirements needed for developing android application
CO2	Identify the results by executing the application in emulator or in android device
CO3	Apply proper interface setup, styles & themes, storing and management
CO4	Analyze the problem and add necessary user interface components, graphics and multimedia components into the application.
CO5	Evaluate the results by implementing the concept behind the problem with proper code.

Textbooks	
➢	Karen Lang and Selim Tezel, (2022), Become an App Inventor The official guide from MIT App Inventor, Miteen Press, Walker Books Limited.
Reference Books	
	Wei – Meng Lee, (2012), Beginning Android 4 Application Development, Wiley India Edition.
	Deital, Android for Programmers-An App-Driven Approach,Second Edition.
NOTE: Latest Edition of Textbooks May be Used	
Web Resources	
	http://ai2.appinventor.mit.edu/reference/
.	http://appinventor.mit.edu/explore/paint-pot-extended-camera

Annexure – I

Elective course (EC1-EC8)

Discipline Specific

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	NATURAL LANGUAGE PROCESSING	**Elect**	6	-	-		5	25	75	100

Learning Objectives	
LO1	To understand approaches to syntax and semantics in NLP.
LO2	To learn natural language processing and to learn how to apply basic algorithms in this field.
LO3	To understand approaches to discourse, generation, dialogue and summarization within NLP.
LO4	Toget acquainted with the algorithmic description of the main language levels: morphology, syntax, semantics, pragmatics etc.
LO5	To understand current methods for statistical approaches to machine translation.

UNIT	**Contents**	**No. Of. Hours**
I	**Introduction :** Natural Language Processing tasks in syntax, semantics, and pragmatics – Issue- Applications – The role of machine learning – Probability Basics –Information theory – Collocations -N-gram Language Models – Estimating parameters and smoothing – Evaluating language models.	**12**
II	**Word level and Syntactic Analysis:**Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging.Syntactic Analysis: Context-free Grammar-Constituency-Parsing-Probabilistic Parsing.	**12**
III	**Semantic analysis and Discourse Processing:** Semantic Analysis: Meaning Representation-Lexical Semantics- Ambiguity-Word Sense Disambiguation. Discourse Processing: cohesion-Reference Resolution-Discourse Coherence and Structure.	**12**
IV	**Natural Language Generation:** Architecture of NLG Systems-Generation Tasks and Representations- Application of NLG. Machine Translation: Problems in Machine Translation. Characteristics of Indian Languages- Machine Translation Approaches-Translation involving Indian Languages.	**12**
V	**Information retrieval and lexical resources:** Information Retrieval: Design features of Information Retrieval Systems-Classical, Non-classical, Alternative Models of Information Retrieval – valuation Lexical	**12**

	Resources: WorldNet-Frame NetStemmers- POS Tagger- Research Corpora SSAS.	
Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Describe the fundamental concepts and techniques of natural language processing. Explain the advantages and disadvantages of different NLP technologies and their applicability in different business situations.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Distinguish among the various techniques, taking into account the assumptions, strengths, and weaknesses of each Use NLP technologies to explore and gain a broad understanding of text data.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Use appropriate descriptions, visualizations, and statistics to communicate the problems and their solutions. Use NLP methods to analyse sentiment of a text document.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Analyze large volume text data generated from a range of real-world applications. Use NLP methods to perform topic modelling.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Develop robotic process automation to manage business processes and to increase and monitor their efficiency and effectiveness. Determine the framework in which artificial intelligence and the Internet of things may function, including interactions with people, enterprise functions, and environments.	PO1, PO2, PO3, PO4, PO5, PO6
Textbooks		
1	Daniel Jurafsky, James H. Martin, ―Speech & language processing‖, Pearson publications.	
2	Allen, James. Natural language understanding. Pearson, 1995.	
Reference Books		
1.	Pierre M. Nugues, ―An Introduction to Language Processing with Perl and Prolog‖,Springer	
Web Resources		

1.	https://en.wikipedia.org/wiki/Natural_language_processing
2.	https://www.techtarget.com/searchenterpriseai/definition/natural-language-processing-NLP

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	2	3	3	3	2	3
CO 3	3	3	3	3	3	3
CO 4	3	2	3	3	2	3
CO 5	3	3	3	3	3	3
Weightageof coursecontributedtoeachPSO	14	14	15	15	13	15

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	ANALYTICS FOR SERVICE INDUSTRY	**Elect**	6	-	-	V-	5	25	75	100

Learning Objectives	
LO1	Recognize challenges in dealing with data sets in service industry.
LO2	Identify and apply appropriate algorithms for analyzing the healthcare, Human resource, hospitality and tourism data.
LO3	Make choices for a model for new machine learning tasks.
LO4	To identify employees with high attrition risk.
LO5	To Prioritizing various talent management initiatives for your organization.

UNIT	Contents	No. Of. Hours
I	**Healthcare Analytics :** Introduction to Healthcare Data Analytics- Electronic Health Records– Components of EHR- Coding Systems- Benefits of EHR- Barrier to Adopting HER Challenges-Phenotyping Algorithms. Biomedical Image Analysis and Signal Analysis- Genomic	**12**

	Data Analysis for Personalized Medicine. Review of Clinical Prediction Models.	
II	**Healthcare Analytics Applications :** Applications and Practical Systems for Healthcare– Data Analytics for Pervasive Health- Fraud Detection in Healthcare- Data Analytics for Pharmaceutical Discoveries- Clinical Decision Support Systems- Computer- Assisted Medical Image Analysis Systems- Mobile Imaging and Analytics for Biomedical Data.	**12**
III	**HR Analytics:** Evolution of HR Analytics, HR information systems and data sources, HR Metric and HR Analytics, Evolution of HR Analytics; HR Metrics and HR Analytics; Intuition versus analytical thinking; HRMS/HRIS and data sources; Analytics frameworks like LAMP, HCM:21(r) Model.	**12**
IV	**Performance Analysis:** Predicting employee performance, Training requirements, evaluating training and development, Optimizing selection and promotion decisions.	**12**
V	**Tourism and Hospitality Analytics:** Guest Analytics – Loyalty Analytics – Customer Satisfaction – Dynamic Pricing – optimized disruption management – Fraud detection in payments.	**12**
	TOTAL HOURS	**60**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Understand and critically apply the concepts and methods of business analytics	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Identify, model and solve decision problems in different settings.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Interpret results/solutions and identify appropriate courses of action for a given managerial situation whether a problem or an opportunity.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Create viable solutions to decision making problems.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Instill a sense of ethical decision-making and a commitment to the long-run welfare of both organizations and the communities they serve.	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks

1	Chandan K. Reddy and Charu C Aggarwal, ―Healthcare data analytics‖, Taylor & Francis, 2015.
2	Edwards Martin R, Edwards Kirsten (2016),―Predictive HR Analytics: Mastering the HR Metric‖, Kogan Page Publishers, ISBN-0749473924

3	Fitz-enzJac (2010), ―The new HR analytics: predicting the economic value of your company‘s human capital investments‖, AMACOM, ISBN-13: 978-0-8144-1643-3
4	RajendraSahu, Manoj Dash and Anil Kumar. Applying Predictive Analytics Within the Service Sector.
Reference Books	
1.	Hui Yang and Eva K. Lee, ―Healthcare Analytics: From Data to Knowledge to Healthcare Improvement, Wiley, 2016
2.	Fitz-enzJac, Mattox II John (2014), ―Predictive Analytics for Human Resources‖, Wiley, ISBN- 1118940709.
Web Resources	
1.	https://www.ukessays.com/essays/marketing/contemporary-issues-in-marketing-marketing-essay.php
2.	https://yourbusiness.azcentral.com/examples-contemporary-issues-marketing-field-26524.html

Mapping with Programme Outcomes:

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO 1	3	3	3	3	3	3
CO 2	2	3	3	3	3	3
CO 3	3	3	2	3	3	2
CO 4	3	3	3	3	3	3
CO 5	3	3	3	3	3	3
Weightageof coursecontributedtoeachPSO	14	15	14	15	15	14

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Marks**		
								CIA	**External**	**Total**
	CRYPTOGRAPHY	**Elect**	6	-	-	-	5	25	75	100
Learning Objectives										
LO1	To understand the fundamentals of Cryptography									
LO2	To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.									
LO3	To understand the various key distribution and management schemes.									
LO4	To understand how to deploy encryption techniques to secure data in transit across									

	data networks	
LO5	To design security applications in the field of Information technology	
UNIT	**Contents**	**No. Of. Hours**
I	**Introduction:** The OSI security Architecture – Security Attacks – Security Mechanisms – Security Services – A model for network Security.	**12**
II	**Classical Encryption Techniques:** Symmetric cipher model – **Substitution Techniques:** Caesar Cipher – Monoalphabetic cipher – Play fair cipher – Poly Alphabetic Cipher – Transposition techniques – Stenography	**12**
III	**Block Cipher and DES:** Block Cipher Principles – DES – The Strength of DES –**RSA:** The RSA algorithm.	**12**
IV	**Network Security Practices**: IP Security overview - IP Security architecture – Authentication Header. **Web Security**: SecureSocket Layer and Transport Layer Security – Secure Electronic Transaction.	**12**
V	Intruders – Malicious software – Firewalls.	**12**
	TOTAL HOURS	**60**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Analyze the vulnerabilities in any computing system and hence be able to design a security solution.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Apply the different cryptographic operations of symmetric cryptographic algorithms	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Apply the different cryptographic operations of public key cryptography	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Apply the various Authentication schemes to simulate different applications.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Understand various Security practices and System security standards	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks	
1	**William Stallings, —**Cryptography and Network Security Principles andPractices‖.

Reference Books	
1.	**Behrouz A. Foruzan, —**Cryptography and Network Security‖, Tata McGraw-Hill, 2007.
2	**AtulKahate**, **—***Cryptography and Network Security*‖, Second Edition, 2003,TMH.
3	**M.V. Arun Kumar**, **—***Network Security*‖, 2011, First Edition,USP.

	Web Resources
1	https://www.tutorialspoint.com/cryptography/
2	https://gpgtools.tenderapp.com/kb/how-to/introduction-to-cryptography

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	2	3	2
CO 2	3	2	3	2	3	3
CO 3	3	3	3	2	3	3
CO 4	2	3	3	3	2	3
CO 5	3	2	3	3	3	3
Weightage of course contributed to each PSO	14	13	15	12	14	14

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Big Data Analytics	Core	6	-	-	-	5	6	25	75	100

Course Objective	
C1	Understand the Big Data Platform and its Use cases, Map Reduce Jobs
C2	To identify and understand the basics of cluster and decision tree
C3	To study about the Association Rules, Recommendation System
C4	To learn about the concept of stream
C5	Understand the concepts of NoSQL Databases

UNIT	Details	No. of Hours	Course Objective
I	Evolution of Big data — Best Practices for Big data Analytics — Big data characteristics — Validating — The Promotion of the Value of Big Data — Big Data	12	C1

	Use Cases- Characteristics of Big Data Applications — Perception and Quantification of Value -Understanding Big Data Storage — A General Overview of High-Performance Architecture — HDFS — MapReduce and YARN — Map Reduce Programming Model		
II	Advanced Analytical Theory and Methods: Overview of Clustering — K-means — Use Cases — Overview of the Method — Determining the Number of Clusters — Diagnostics — Reasons to Choose and Cautions .- Classification: Decision Trees — Overview of a Decision Tree — The General Algorithm — Decision Tree Algorithms — Evaluating a Decision Tree — Decision Trees in R — Naïve Bayes — Bayes? Theorem — Naïve Bayes Classifier.	12	C2
III	Advanced Analytical Theory and Methods: Association Rules — Overview — Apriori Algorithm — Evaluation of Candidate Rules — Applications of Association Rules — Finding Association& finding similarity — Recommendation System: Collaborative Recommendation- Content Based Recommendation — Knowledge Based Recommendation- Hybrid Recommendation Approaches.	12	C3
IV	Introduction to Streams Concepts — Stream Data Model and Architecture — Stream Computing, Sampling Data in a Stream — Filtering Streams — Counting Distinct Elements in a Stream — Estimating moments — Counting oneness in a Window — Decaying Window — Real time Analytics Platform(RTAP) applications — Case Studies — Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics	12	C4
V	NoSQL Databases : Schema-less Models?: Increasing	12	C5

	Flexibility for Data Manipulation-Key Value Stores- Document Stores — Tabular Stores — Object Data Stores — Graph Databases Hive — Sharding —Hbase — Analyzing big data with twitter — Big data for E-Commerce Big data for blogs — Review of Basic Data Analytic Methods using R.		
	Total	**60**	

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Work with big data tools and its analysis techniques.	PO1
2	Analyze data by utilizing clustering and classification algorithms.	PO1, PO2
3	Learn and apply different mining algorithms and recommendation systems for large volumes of data.	PO4, PO6
4	Perform analytics on data streams.	PO4, PO5, PO6
5	Learn NoSQL databases and management.	PO3, PO8

Text Book

1	AnandRajaraman and Jeffrey David Ullman, ―Mining of Massive Datasets‖, Cambridge University Press, 2012.

Reference Books

1.	David Loshin, ―Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph‖, Morgan Kaufmann/El sevier Publishers, 2013
2.	EMC Education Services, ―Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data‖, Wiley publishers, 2015.

Web Resources

1.	https://www.simplilearn.com
2.	https://www.sas.com/en_us/insights/analytics/big-data-analytics.html

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO 1	S							
CO 2	M	S						

CO 3				S		S		
CO 4				S	S	M		
CO 5			S					S

S-Strong M-Medium L-Low

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
	Internet of Things and its applications	Core	Y	-	-	-	5	6	25	75	100

Course Objective	
C1	Use of Devices, Gateways and Data Management in IoT.
C2	Design IoT applications in different domain and be able to analyze their performance
C3	Implement basic IoT applications on embedded platform
C4	To gain knowledge on Industry Internet of Things
C5	To Learn about the privacy and Security issues in IoT

UNIT	**Details**	**No. of Hours**	**Course Objective**
I	IoT & Web Technology, The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.	12	C1
II	M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural	12	C2

	Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.		
III	**:** IoT Architecture -State of the Art – Introduction, State of the art, Architecture. Reference Model-Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture-Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views	12	C3
IV	IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and GasIndustry, Opinions on IoT Application and Value for Industry, Home Management	12	C4
V	Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security	12	C5
	Total	**60**	

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Work with big data tools and its analysis techniques.	PO1
2	Analyze data by utilizing clustering and classification algorithms.	PO1, PO2
3	Learn and apply different mining algorithms and recommendation systems for large volumes of data.	PO4, PO6
4	Perform analytics on data streams.	PO4, PO5, PO6
5	Learn NoSQL databases and management.	PO3, PO8

Text Book

1	Vijay Madisetti and Arshdeep Bahga, ―Internet of Things: (A Hands-on Approach)‖, Universities Press (INDIA) Private Limited 2014, 1st Edition.
Reference Books	
1.	Michael Miller, ―The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World‖, kindle version.
2.	Francis daCosta, ―Rethinking the Internet of Things: A Scalable Approach to Connecting Everything‖, Apress Publications 2013, 1st Edition,.
3	WaltenegusDargie, ChristianPoellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice‖ 4..CunoPfister, ―Getting Started with the Internet of Things‖, O‟Reilly Media 2011
Web Resources	
1.	https://www.simplilearn.com
2.	https://www.javatpoint.com
3.	https://www.w3schools.com

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO 1	S							
CO 2	M	S						
CO 3				S		S		
CO 4				S	S	M		
CO 5			S					S

S-Strong M-Medium L-Low

Subject	**Subject Name**	**Cat**	**L**	**T**	**P**	**S**	**C**	**I**	**Marks**

Code									CIA	External	Total
	Human Computer Interaction	Elective	-	Y	-	V	5	6	25	75	100
Course Objective											
C1	To learn about the foundations of Human Computer Interaction.										
C2	To learn the design and software process technologies.										
C3	To learn HCI models and theories.										
C4	To learn Mobile Ecosystem.										
C5	To learn the various types of Web Interface Design.										

UNIT	Details	No. of Hours
I	**FOUNDATIONS OF HCI :** • The Human: I/O channels – Memory • Reasoning and problem solving; The Computer: Devices – Memory – processing and networks; • Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms. - Case Studies	12
II	**DESIGN & SOFTWARE PROCESS:** • Interactive Design: • Basics – process – scenarios • Navigation: screen design Iteration and prototyping. • HCI in software process: • Software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules: principles, standards, guidelines, rules. Evaluation Techniques – Universal Design	12
III	**MODELS AND THEORIES:** • HCI Models : Cognitive models:- Socio-Organizational issues and stakeholder requirements Communication and collaboration models-Hypertext, Multimedia and WWW.	12
IV	**Mobile HCI:** • Mobile Ecosystem: Platforms, Application frameworks	12

	• Types of Mobile Applications: Widgets, Applications, Games • Mobile Information Architecture, Mobile 2.0, • Mobile Design: Elements of Mobile Design, Tools. - Case Studies	
V	**WEB INTERFACE DESIGN:** Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow - Case Studies	12
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Understand the fundementals of HCI.	PO1
2	Understand the design and software process technologies.	PO1, PO2
3	Understand HCI models and theories.	PO4, PO6
4	Understand Mobile Ecosystem, types of Mobile Applications, mobile Architecture and design.	PO4, PO5, PO6
5	Understand the various types of Web Interface Design.	PO3, PO8

Text Book

1	Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, ‖Human -Computer Interaction‖, III Edition, Pearson Education, 2004 (UNIT I, II & III)
2	Brian Fling, —‖Mobile Design and Development‖, I Edition, O_Reilly Media Inc., 2009(UNIT–IV)
3	Bill Scott and Theresa Neil, —Designing Web Interfaces‖, First Edition, O_Reilly, 2009. (UNIT-V)

Reference Books

1.	Shneiderman, —Designing the User Interface: Strategies for Effective Human-Computer Interaction‖, V Edition, Pearson Education.

Web Resources

1.	https://www.interaction-design.org/literature/topics/human-computer-interaction
2.	https://link.springer.com/10.1007/978-0-387-39940-9_192
3.	https://en.wikipedia.org/wiki/Human%E2%80%93computer_interaction

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	**S**							
CO 2	**S**	**S**						
CO 3				**S**		**S**		
CO 4				**S**	**S**	**S**		
CO 5			**S**					**S**

S-Strong M-Medium L-Low

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Fuzzy Logic	Elective	Y	-	-	V	5	6	25	75	100

Course Objective	
CO1	To understand the basic concept of Fuzzy logic
CO2	To learn the various operations on relation properties
CO3	To study about the membership functions
CO4	To learn about the Defuzzification and Fuzzy Rule-Based System
CO5	To learn the concepts of Applications of Fuzzy Logic

UNIT	Details	No. of Hours	Course Objective
I	Introduction to Fuzzy Logic- Fuzzy Sets- Fuzzy Set Operations, Properties of Fuzzy Sets, Classical and Fuzzy Relations: Introduction-Cartesian Product of Relation-Classical Relations-Cardinality of Crisp Relation.	12	C1
II	Operations on Crisp Relation-Properties of Crisp Relations-Composition Fuzzy Relations, Cardinality of Fuzzy Relations-Operations on Fuzzy Relations-Properties of Fuzzy Relations-Fuzzy Cartesian Product and Composition-Tolerance and Equivalence Relations ,Crisp Relation.	12	C2

III	Membership Functions: Introduction, Features of Membership Function, Classification of Fuzzy Sets, Fuzzification, Membership Value Assignments, Intuition, Inference, Rank Ordering.	12	C3
IV	Defuzzification: Introduction, Lambda Cuts for Fuzzy Sets, Lambda Cuts for Fuzzy Relations, Defuzzification Methods, Fuzzy Rule-Based System: Introduction, Formation of Rules, Decomposition of Rules, Aggregation of Fuzzy Rules, Properties of Set of Rules.	12	C4
V	Applications of Fuzzy Logic: Fuzzy Logic in Automotive Applications, Fuzzy Antilock Brake System-Antilock-Braking System and Vehicle Speed-Estimation Using Fuzzy Logic.	12	C5
	Total		

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Understand the basics of Fuzzy sets, operation and properties.	PO1
2	Apply Cartesian product and composition on Fuzzy relations and usethe tolerance and Equivalence relations.	PO1, PO2
3	Analyze various fuzzification methods and features of membership Functions.	PO4, PO6
4	Evaluate defuzzification methods for real time applications.	PO4, PO5, PO6
5	Design an application using Fuzzy logic and its Relations.	PO3, PO8

Text Book

1	S. N. Sivanandam, S. Sumathi and S. N. Deepa-Introduction to Fuzzy Logic using MATLAB, Springer-Verlag Berlin Heidelberg 2007.

Reference Books

1.	Guanrong Chen and Trung Tat Pham- Introduction to Fuzzy Sets, Fuzzy Logic and Fuzzy Control Systems
2.	Timothy J Ross , Fuzzy Logic with Engineering Applications
Web Resources	
1.	https://www.javatpoint.com/fuzzy-logic
2.	https://www.guru99.com/what-is-fuzzy-logic.html

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO 1	S							
CO 2	M	S						
CO 3				S		S		
CO 4				S	S	M		
CO 5			S					S

S-Strong M-Medium L-Low

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
	Artificial Intelligence	Elective	-	Y	-	-	5	6	25	75	100

Course Objective		
C1	To learn various concepts of AI Techniques.	
C2	To learn various Search Algorithm in AI.	
C3	To learn probabilistic reasoning and models in AI.	
C4	To learn about Markov Decision Process.	
C5	To learn various type of Reinforcement learning.	
UNIT	**Details**	**No. of Hours**
I	Introduction: Concept of AI, history, current status, scope, agents, environments, Problem Formulations, Review of tree and graph structures, State space representation, Search graph and Search tree	12

II	Search Algorithms : Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, Best first search, A* algorithm, Game Search	12
III	Probabilistic Reasoning : Probability, conditional probability, Bayes Rule, Bayesian Networks- representation, construction and inference, temporal model, hidden Markov model.	12
IV	Markov Decision process : MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs.	12
V	Reinforcement Learning : Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning- Q learning	12
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Understand the various concepts of AI Techniques.	PO1
2	Understand various Search Algorithm in AI.	PO1, PO2
3	Understand probabilistic reasoning and models in AI.	PO4, PO6
4	Understand Markov Decision Process.	PO4, PO5, PO6
5	Understand various type of Reinforcement learning Techniques.	PO3, PO8

Text Book

1	Stuart Russell and Peter Norvig, ―Artificial Intelligence: A Modern Approach‖ , 3rd Edition, Prentice Hall.
	Elaine Rich and Kevin Knight, ―Artificial Intelligence‖, Tata McGraw Hill

Reference Books

1.	Trivedi, M.C., ―A Classical Approach to Artifical Intelligence‖, Khanna Publishing House, Delhi.
2.	Saroj Kaushik, ―Artificial Intelligence‖, Cengage Learning India, 2011
3.	David Poole and Alan Mackworth, ―Artificial Intelligence: Foundations for Computational Agents‖, Cambridge University Press 2010

Web Resources

1.	NPTEL&MOOCcoursestitledArtificialIntelligenceandExpertSystems
2.	https://nptel.ac.in/courses/106106140/

3.	**https://nptel.ac.in/courses/106106126/**

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	**S**							
CO 2	**S**	**S**						
CO 3				**S**		**S**		
CO 4				**S**	**S**	**S**		
CO 5			**S**					**S**

S-Strong M-Medium L-Low

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Robotics and Its Applications	Elective	Y	-	-	-	5	6	25	75	100

Course Objective	
C1	To understand the robotics fundamentals
C2	Understand the sensors and matrix methods
C3	Understand the Localization: Self-localizations and mapping
C4	To study about the concept of Path Planning, Vision system
C5	To learn about the concept of robot artificial intelligence

UNIT	Details	No. of Hours	Course Objective
I	Introduction: Introduction, brief history, components of robotics, classification, workspace, work-envelop, motion of robotic arm, end-effectors and its types, service robot and its application, Artificial Intelligence in Robotics.	12	CO1

II	Actuators and sensors :Types of actuators, stepper-DC-servo-and brushless motors- model of a DC servo motor-types of transmissions-purpose of sensor-internal and external sensor-common sensors-encoders tachometers-strain gauge based force torque sensor-proximity and distance measuring sensors Kinematics of robots: Representation of joints and frames, frames transformation, homogeneous matrix, D-H matrix, Forward and inverse kinematics: two link planar (RR) and spherical robot (RRP). Mobile robot Kinematics: Differential wheel mobile robot	12	CO2
III	Localization: Self-localizations and mapping - Challenges in localizations – IR based localizations – vision based localizations – Ultrasonic based localizations - GPS localization systems.	12	CO3
IV	Path Planning: Introduction, path planning-overview-road map path planning-cell decomposition path planning potential field path planning-obstacle avoidance-case studies Vision system: Robotic vision systems-image representation-object recognition-and categorization-depth measurement- image data compression-visual inspection-software considerations	12	CO4
V	Application: Ariel robots-collision avoidance robots for agriculture-mining-exploration-underwater-civilian- and military applications-nuclear applications-space Applications-Industrial robots-artificial intelligence in robots-application of robots in material handling-continuous arc welding-spot welding-spray painting-	12	CO5

	assembly operation-cleaning-etc.		
	Total	**60**	

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Describe the different physical forms of robot architectures.	PO1
2	Kinematically model simple manipulator and mobile robots.	PO1, PO2
3	Mathematically describe a kinematic robot system	PO4, PO6
4	Analyze manipulation and navigation problems using knowledge of coordinate frames, kinematics, optimization, control, and uncertainty.	PO4, PO5, PO6
5	Program robotics algorithms related to kinematics, control, optimization, and uncertainty.	PO3, PO8

Text Book	
1	RicharedD.Klafter. Thomas Achmielewski and MickaelNegin, Robotic Engineering and Integrated Approach, Prentice Hall India-Newdelhi-2001
2	SaeedB.Nikku, Introduction to robotics, analysis, control and applications, Wiley-India, 2 nd edition 2011
Reference Books	
1.	Industrial robotic technology-programming and application by M.P.Groover et.al, McGrawhill2008
2.	Robotics technology and flexible automation by S.R.Deb, THH-2009
Web Resources	
1.	https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_robotics.htm
2.	https://www.geeksforgeeks.org/robotics-introduction/

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO 1	S							
CO 2	M	S						
CO 3				S		S		
CO 4				S	S	M		

CO 5			S					S

S-Strong M-Medium L-Low

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
	Computational Intelligence	Elective	Y	-	-	-	5	6	25	75	100

Course Objective	
C1	To identify and understand the basics of AI and its search.
C2	To study about the Fuzzy logic systems.
C3	Understand and apply the concepts of Neural Network and its functions.
C4	Understand the concepts of Artifical Neural Network
C5	To study about the Genetic Algorithm.

UNIT	**Details**	**No. of Hours**	**Course Objective**
I	**Introduction to AI**: Problem formulation – AI Applications – Problems – State Space and Search – Production Systems – Breadth First and Depth First – Travelling Salesman Problem – Heuristic search techniques: Generate and Test – Types of Hill Climbing.	12	C1
II	**Fuzzy Logic Systems:** Notion of fuzziness – Operations on fuzzy sets – T-norms and other aggregation operators – Basics of Approximate Reasoning – Compositional Rule of Inference – Fuzzy Rule Based Systems – Schemes of Fuzzification – Inferencing – Defuzzification – Fuzzy Clustering – fuzzy rule-based classifier.	12	C2
III	**Neural Networks:** What is Neural Network, Learning	12	C3

	rules and various activation functions, Single layer Perceptions, Back Propagation networks, Architecture of Backpropagation (BP) Networks, Back propagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications		
IV	**Artificial Neural Networks:** Fundamental Concepts – Basic Models of Artificial Neural Networks – Important Terminologies of ANNs – McCulloch-Pitts Neuron – Linear Separability – Hebb Network.	12	C4
V	**Genetic Algorithm:** Introduction – Biological Background – Genetic Algorithm Vs Traditional Algorithm – Basic Terminologies in Genetic Algorithm – Simple GA – General Genetic Algorithm – Operators in Genetic Algorithm	12	C5
	Total	**60**	

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Describe the fundamentals of artificial intelligence concepts and searching techniques.	PO1
2	Develop the fuzzy logic sets and membership function and defuzzification techniques.	PO1, PO2
3	Understand the concepts of Neural Network and analyze and apply the learning techniques	PO4, PO6
4	Understand the artificial neural networks and its applications.	PO4, PO5, PO6
5	Understand the concept of Genetic Algorithm and Analyze the optimization problems using GAs.	PO3, PO8

Text Book

1	S.N. Sivanandam and S.N. Deepa, ―Principles of Soft Computing‖, 2nd Edition, Wiley India Pvt. Ltd.
2	Stuart Russell and Peter Norvig, ―Artificial Intelligence - A Modern Approach‖, 2nd Edition, Pearson Education in Asia.
3	S. Rajasekaran, G. A. Vijayalakshmi, ―Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications‖, PHI.

Reference Books

1.	F. Martin, Mc neill, and Ellen Thro, ―Fuzzy Logic: A Practical approach‖, AP Professional, 2000. Chin Teng Lin, C. S. George Lee,‖ Neuro-Fuzzy Systems‖, PHI
2.	Chin Teng Lin, C. S. George Lee,‖ Neuro-Fuzzy Systems‖, PHI.

Web Resources	
1.	https://www.javatpoint.com/artificial-intelligence-tutorial
2.	https://www.w3schools.com/ai/

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	S							
CO 2	M	S						
CO 3				S		S		
CO 4				S	S	M		
CO 5			S					S

S-Strong M-Medium L-Low

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Grid Computing	Elective	-	Y	-	-	5	6	25	75	100

Course Objective	
C1	To learn the basic construction and application of Grid computing.
C2	To learn grid computing organization and their Role.
C3	To learn Grid Computing Anotomy.
C4	To learn Grid Computing road map.
C5	To learn various type of Grid Architecture.

UNIT	Details	No. of Hours
I	Introduction: Early Grid Activity, Current Grid Activity, Overview of Grid Business areas, Grid Applications, Grid Infrastructures.	12
II	Grid Computing organization and their Roles: Organizations Developing Grid Standards, and Best Practice Guidelines, Global Grid Forum (GCF), #Organization Developing Grid Computing Toolkits and Framework#, Organization and building and using grid based solutions to solve computing, commercial organization building and Grid Based solutions.	12

III	Grid Computing Anatomy: The Grid Problem, The conceptual of virtual organizations, # Grid Architecture # and relationship to other distributed technology.	12
IV	The Grid Computing Road Map: Autonomic computing, Business on demand and infrastructure virtualization, Service-Oriented Architecture and Grid, #Semantic Grids#.	12
V	Merging the Grid services Architecture with the Web Services Architecture: Service-Oriented Architecture, Web Service Architecture, #XML messages and Enveloping#, Service message description Mechanisms, Relationship between Web Services and Grid Services, Web services Interoperability and the role of the WS-I Organization.	12
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	To understand the basic elements and concepts of Grid computing.	PO1
2	To understand the Grid computing toolkits and Framework.	PO1, PO2
3	To understand the concepts of Anotomy of Grid Computing.	PO4, PO6
4	To understand the concept of service oriented architecture.	PO4, PO5, PO6
5	To Gain knowledge on grid and web service architecture.	PO3, PO8

Text Book

1	Joshy Joseph and Craig Fellenstein, Grid computing, Pearson / IBM Press, PTR, 2004.

Reference Books

1.	1. Ahmer Abbas and Graig computing, A Practical Guide to technology and applications, Charles River Media, 2003.

Web Resources

1.	https://en.wikipedia.org/wiki/Grid_computing
2.	https://link.springer.com/chapter/10.1007/978-1-84882-409-6_4
3.	https://www.redbooks.ibm.com/redbooks/pdfs/sg246778.pdf

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	**S**							
CO 2	**S**	**S**						
CO 3				**S**		**S**		
CO 4				**S**	**S**	**S**		
CO 5			**S**					**S**

S-Strong M-Medium L-Low

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Cloud Computing	Elective	-	Y	-	-	5	6	25	75	100

Course Objective		
C1	Learning fundamental concepts and Technologies of Cloud Computing.	
C2	Learning various cloud service types and their uses and pitfalls.	
C3	To learn about Cloud Architecture and Application design.	
C4	To know the various aspects of application design, benchmarking and security on the Cloud.	
C5	To learn the various Case Studies in Cloud Computing.	
UNIT	**Details**	**No. of Hours**
I	Introduction to Cloud Computing: Definition of Cloud Computing – Characteristics of Cloud Computing – Cloud Models – Cloud Service Examples – Cloud-based Services and Applications. Cloud Concepts and Technologies: Virtualization – Load balancing – Scalability and Elasticity – Deployment – Replication – Monitoring – Software Defined Networking – Network Function Virtualization – MapReduce – Identity and Access Management – Service Level Agreements – Billing.	12

II	Cloud Services Compute Services: Amazon Elastic Computer Cloud - Google Compute Engine - Windows Azure Virtual Machines Storage Services: Amazon Simple Storage Service - Google Cloud Storage - Windows Azure Storage Database Services: Amazon Relational Data Store - Amazon Dynamo DB - Google Cloud SQL - Google Cloud Data Store - Windows Azure SQL Database - Windows Azure Table Service Application Services: Application Runtimes and Frameworks - Queuing Services - Email Services - Notifiction Services - Media Services Content Delivery Services: Amazon CloudFront - Windows Azure Content Delivery Network Analytics Services: Amazon Elastic MapReduce - Google MapReduce 12Service - Google BigQuery - Windows Azure HDInsight Deployment and Management Services: Amazon Elastic Beanstack - Amazon CloudFormation Identity and Access Management Services: Amazon Identiy and Access Management - Windows Azure Active Directory Open Source Private Cloud Software: CloudStack – Eucalyptus - OpenStack	12
III	**Cloud Application Design:** Introduction – Design Consideration for Cloud Applications – Scalability – Reliability and Availability – Security – Maintenance and Upgradation – Performance – Reference Architectures for Cloud Applications – Cloud Application Design Methodologies: Service Oriented Architecture (SOA), Cloud Component Model, IaaS, PaaS and SaaS Services for Cloud Applications, Model View Controller (MVC), RESTful Web Services – Data Storage Approaches: Relational Approach (SQL), Non-Relational Approach (NoSQL).	12

IV	**Cloud Application Benchmarking and Tuning:** Introduction to Benchmarking – Steps in Benchmarking – Workload Characteristics – Application Performance Metrics – Design Consideration for Benchmarking Methodology – Benchmarking Tools and Types of Tests – Deployment Prototyping. **Cloud Security:** Introduction – CSA Cloud Security Architecture – Authentication (SSO) – Authorization – Identity and Access Management – Data Security : Securing data at rest, securing data in motion – Key Management – Auditing.	12
V	**Case Studies:** Cloud Computing for Healthcare – Cloud Computing for Energy Systems - Cloud Computing for Transportation Systems - Cloud Computing for Manufacturing Industry - Cloud Computing for Education.	12
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Understand the fundamental concepts and Technologies in Cloud Computing.	PO1
2	Able to understand various cloud service types and their uses and pitfalls.	PO1, PO2
3	Able to understand Cloud Architecture and Application design.	PO4, PO6
4	Understand the various aspects of application design, benchmarking and security in the Cloud.	PO4, PO5, PO6
5	Understand various Case Studies in Cloud Computing.	PO3, PO8

Text Book

1	ArshdeepBahga, Vijay Madisetti, *Cloud Computing – A Hands On Approach*, Universities Press (India) Pvt. Ltd., 2018

Reference Books

1.	Anthony T Velte, Toby J Velte, Robert Elsenpeter, *Cloud Computing: A Practical Approach*, Tata McGraw-Hill, 2013.
2.	Barrie Sosinsky, *Cloud Computing Bible*, Wiley India Pvt. Ltd., 2013.

3.	David Crookes, *Cloud Computing in Easy Steps*, Tata McGraw Hill, 2015.
4.	Dr. Kumar Saurabh, *Cloud Computing*, Wiley India, Second Edition 2012.
Web Resources	
1.	https://en.wikipedia.org/wiki/Cloud_computing
2.	https://link.springer.com/chapter/10.1007/978-3-030-34957-8_7
3.	https://webobjects.cdw.com/webobjects/media/pdf/solutions/cloud-computing/121838-CDW-Cloud-Computing-Reference-Guide.pdf

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO 1	**S**							
CO 2	**S**	**S**						
CO 3				**S**		**S**		
CO 4				**S**	**S**	**S**		
CO 5			**S**					**S**

S-Strong M-Medium L-Low

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
	Artificial Neural Networks	Core	-	Y	-	-	5	6	25	75	100
Course Objective											
C1	**Understand the basics of artificial neural networks, learning process, single layer and multi-layer perceptron networks.**										
C2	Understand the Error Correction and various learning algorithms and tasks.										
C3	Identify the various Single Layer Perception Learning Algorithm.										
C4	Identify the various Multi-Layer Perception Network.										
C5	Analyze the Deep Learning of various Neural network and its Applications.										
UNIT	**Details**										**No. of Hours**
I	Artificial Neural Model- Activation functions- Feed forward and										12

	Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem - Multilayer Networks. Learning Algorithms-Error correction - Gradient Descent Rules, Perception Learning Algorithm, Perception Convergence Theorem.	
II	Introduction, Error correction learning, Memory-based learning, Hebbian learning, Competitive learning, Boltzmann learning, credit assignment problem, Learning with and without teacher, learning tasks, Memory and Adaptation.	15
III	.Single layer Perception: Introduction, Pattern Recognition, Linear classifier, Simple perception, Perception learning algorithm, Modified Perception learning algorithm, Adaptive linear combiner, Continuous perception, Learning in continuous perception. Limitation of Perception.	12
IV	Multi-Layer Perception Networks: Introduction, MLP with 2 hidden layers, Simple layer of a MLP, Delta learning rule of the output layer, Multilayer feed forward neural network with continuous perceptions, Generalized delta learning rule, Back propagation algorithm	12
V	Deep learning- Introduction- Neuro architectures building blocks for the DL techniques, Deep Learning and Neocognitron, Deep Convolutional Neural Networks, Recurrent Neural Networks (RNN), feature extraction, Deep Belief Networks, Restricted Boltzman Machines, Training of DNN and Applications	12
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	**Students will learn the basics of artificial neural networks with single layer and multi-layer perception networks.**	PO1
2	Learn about the Error Correction and various learning algorithms and tasks.	PO1, PO2
3	Learn the various Perception Learning Algorithm.	PO4, PO6
4	Learn about the various Multi-Layer Perception Network.	PO4, PO5, PO6
5	Understand the Deep Learning of various Neural	PO3, PO8

	network and its Applications.	
Text Book		
1	Neural Networks A Classroom Approach- Satish Kumar, McGraw Hill- Second Edition.	
2.	―Neural Network- A Comprehensive Foundation‖- Simon Haykins, Pearson Prentice Hall, 2nd Edition, 1999.	
Reference Books		
1.	Artificial Neural Networks-B. Yegnanarayana, PHI, New Delhi 1998.	
Web Resources		
1.	https://www.w3schools.com/ai/ai_neural_networks.asp	
2.	https://en.wikipedia.org/wiki/Artificial_neural_network	
3.	https://link.springer.com/chapter/10.1007/978-3-642-21004-4_12	

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO 1	**S**							
CO 2	**S**	**S**						
CO 3				**S**		**S**		
CO 4				**S**	**S**	**S**		
CO 5			**S**					**S**

S-Strong M-Medium L-Low

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
	Agile Project Management	Elective	-	Y	-	-	5	6	25	75	100
Course Objective											
C1	Learning of software design, software technologies and APIs.										

C2	Detailed demonstration about Agile development and testing techniques.	
C3	Learning about Agile Planning and Execution.	
C4	Learning of Agile Management Design and Quality Check.	
C5	Detailed examination of Agile development and testing techniques.	
UNIT	**Details**	**No. of Hours**
I	**Introduction:Modernizing Project Management:** Project Management Needed a Makeover – Introducing Agile Project Management. **Applying the Agile Manifesto and Principles:** Understanding the Agile manifesto – Outlining the four values of the Agile manifesto – Defining the 15 Agile Principles – Adding the Platinum Principles – Changes as a result of Agile Values – The Agile litmus test. **Why Being Agile Works Better:** Evaluating Agile benefits – How Agile approaches beat historical approaches – Why people like being Agile.	12
II	**Being Agile** **Agile Approaches:** Diving under the umbrella of Agile approaches – Reviewing the Big Three: Lean, Scrum, Extreme Programming - Summary **Agile Environments in Action:** Creating the physical environment – Low-tech communicating – High-tech communicating – Choosing tools. **Agile Behaviours in Action:** Establishing Agile roles – Establishing new values – Changing team philosophy.	12
III	**Agile Planning and Execution** **Defining the Product Vision and Roadmap:** Agile planning – Defining the product vision – Creating a product roadmap – Completing the product backlog.	12

	Planning Releases and Sprints: Refining requirements and estimates – Release planning – Sprint planning. **Working Throughout the Day:** Planning your day – Tracking progress – Agile roles in the sprint – Creating shippable functionality – The end of the day. **Showcasing Work, Inspecting and Adapting:** The sprint review – The sprint retrospective. **Preparing for Release:** Preparing the product for deployment (the release sprint) – Preparing the operational support – Preparing the organization for product deployment - Preparing the marketplace for product deployment	
IV	**Agile Management** **Managing Scope and Procurement:** What‘s different about Agile scope management – Managing Agile scope – What‘s different about Agile procurement – Managing Agile procurement. **Managing Time and Cost:** What‘s different about Agile time management – Managing Agile schedules – What‘s different about Agile cost management – Managing Agile budgets. **Managing Team Dynamics and Communication:** What‘s different about Agile team dynamics – Managing Agile team dynamics – What‘s different about Agile communication – Managing Agile communication. **Managing Quality and Risk:** What‘sdifferent about Agile quality – Managing Agile quality – What‘s different about Agile risk management – Managing Agile risk.	12
V	**Implementing Agile** **Building a Foundation:** Organizational and individual commitment – Choosing the right pilot team members – Creating and environment that enables Agility – Support Agility initially and over time. **Being a Change Agent:** Becoming Agile requires change – why change doesn‘t happen on its own – Platinum Edge‘s Change Roadmap – Avoiding pitfalls – Signs your changes are slipping. **Benefits, Factors for Success and Metrics:** Ten key benefits of Agile	12

	project management – Ten key factors for project success – Ten metrics for Agile Organizations.	
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Understanding of software design, software technologies and APIs using Agile Management.	PO1
2	Understanding of Agile development and testing techniques.	PO1, PO2
3	Understanding about Agile Planning and Execution using Sprint.	PO4, PO6
4	Understanding of Agile Management Design, scope , Procurement, managing Time and Cost and Quality Check.	PO4, PO5, PO6
5	Analysing of Agile development and testing techniques.	PO3, PO8

Text Book	
1	Mark C. Layton, Steven J. Ostermiller, Agile Project Management for Dummies, 2nd Edition, Wiley India Pvt. Ltd., 2018.
	Jeff Sutherland, Scrum – The Art of Doing Twice the Work in Half the Time, Penguin, 2014.
Reference Books	
1.	Mark C. Layton, David Morrow, *Scrum for Dummies*, 2nd Edition, Wiley India Pvt. Ltd., 2018.
2.	Mike Cohn, Succeeding with Agile – Software Development using Scrum, Addison-Wesley Signature Series, 2010.
3.	Alex Moore, Agile Project Management, 2020.
4.	Alex Moore, *Scrum*, 2020.
5.	Andrew Stellman and Jennifer Greene, *Learning Agile: Understanding Scrum, XP, Lean, and Kanban*, Shroff/O'Reilly, First Edition, 2014.
Web Resources	
1.	www.agilealliance.org/resources

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	**S**							
CO 2	**S**	**S**						
CO 3				**S**		**S**		
CO 4				**S**	**S**	**S**		
CO 5			**S**					**S**

S-Strong M-Medium L-Low

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
SEC1	**OFFICE AUTOMATION**	Specific Elective		Y	-	-	2	2	25	75	100

Course Objective	
C1	Understand the basics of computer systems and its components.
C2	Understand and apply the basic concepts of a word processing package.
C3	Understand and apply the basic concepts of electronic spreadsheet software.
C4	Understand and apply the basic concepts of database management system.
C5	Understand and create a presentation using PowerPoint tool.

UNIT	**Details**	**No. of Hours**
I	**Introductory concepts:** Memory unit– CPU-Input Devices: Key board, Mouse and Scanner.Outputdevices:Monitor,Printer.IntroductiontoOperatingsystems &itsfeatures:DOS– UNIX–Windows. IntroductiontoProgrammingLanguages.	6
II	**Word Processing:** Open, Save and close word document; Editing text – tools, formatting, bullets;SpellChecker - Document formatting – Paragraph alignment, indentation, headers and footers,numbering;printing–Preview,options,merge.	6
III	**Spreadsheets:**Excel– opening,enteringtextanddata,formatting,navigating;Formulas– entering,handlingand copying;Charts–creating,formatting and printing,analysistables,preparationoffinancialstatements,introductiont odataanalytics.	6
IV	**Database Concepts:** The concept of data base management system; Data field, records, and files,Sorting and indexing data; Searching records. Designing queries, and reports; Linking of datafiles; Understanding Programming environment in DBMS; Developing menu drive applicationsinquerylanguage(MS–Access).	6
V	**Power point:** Introduction to Power point - Features – Understanding slide typecasting & viewingslides – creating slide shows. Applying special object – including objects & pictures – Slidetransition–Animationeffects,audioinclusion,timers.	6
	Total	**30**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Possess the knowledge on the basics of computers	PO1,PO2,PO3,PO6,PO8

	and its components	
2	Gain knowledge on Creating Documents, spreadsheet and presentation.	PO1,PO2,PO3,PO6
3	Learn the concepts of Database and implement the Query in Database.	PO3,PO5,PO7
4	Demonstrate the understanding of different automation tools.	PO3,PO4,PO5,PO7
5	Utilize the automation tools for documentation, calculation and presentation purpose.	PO4,PO6,PO7,PO8
Text Book		
1	PeterNorton,—IntroductiontoComputers‖–TataMcGraw-Hill.	
Reference Books		
1.	Jennifer Ackerman Kettel, Guy Hat-Davis, Curt Simmons, —Microsoft 2003‖, Tata McGrawHill.	
Web Resources		
1.	https://www.udemy.com/course/office-automation-certificate-course/	
2.	https://www.javatpoint.com/automation-tools	

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO 1	M	S	M			M		L
CO 2	S	M	S			M		
CO 3		S	S		M		L	
CO 4			S	L	M		M	
CO 5				M		S	M	S

S-Strong M-Medium L-Low

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Marks**		
								CIA	**External**	**Total**
SEC2	**BASICS OF INTERNET**	Specific Elective	2	-	-		2	25	75	100
Learning Objectives										
LO1	Knowledge of Internet medium									

LO2	Internet as a mass medium
LO3	Features of Internet Technology,
LO4	Internet as source of infotainment
LO5	Study of internet audiences and about cyber crime

UNIT	Contents	No. Of. Hours
I	The emergence of internet as a mass medium – the world of _world wide web‘.	**6**
II	Features of internet as a technology.	**6**
III	Internet as a source of infotainment – classification based on content and style.	**6**
IV	Demographic and psychographic descriptions of internet _audiences‘ – effect of internet onthe values and life-styles.	**6**
V	Present issues such as cyber crime and future possibilities.	**6**
	TOTAL HOURS	**30**

CO	Course Outcomes
CO1	Knows the basic concept in HTML Concept of resources in HTML
CO2	Knows Design concept. Concept of Meta Data Understand the concept of save the files.
CO3	Understand the page formatting. Concept of list
CO4	Creating Links. Know the concept of creating link to email address
CO5	Concept of adding images Understand the table creation.

Textbooks

1	—Mastering HTML5 and CSS3 Made Easy‖, TeachUComp Inc., 2014.
2	**Thomas Michaud, “Foundations of Web Design: Introduction to HTML & CSS”**

Web Resources

1.	https://www.teachucomp.com/samples/html/5/manuals/Mastering-HTML5-CSS3.pdf
2.	https://www.w3schools.com/html/default.asp

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	PROBLEM SOLVING TECHNIQUES	Specific Elective	Y	-	-	-	2	2	25	75	100

Course Objective	
C1	Understand the systematic approach to problem solving.
C2	Know the approach and algorithms to solve specific fundamental problems.
C3	Understand the efficient approach to solve specific factoring-related problems.
C4	Understand the efficient array-related techniques to solve specific problems.
C5	Understand the efficient methods to solve specific problems related to text processing. Understand how recursion works.

UNIT	Details	No. of Hours
I	**Introduction:** Notion of algorithms and programs – Requirements for solving problems by computer – The problem-solving aspect: Problem definition phase, Getting started on a problem, The use of specific examples, Similarities among problems, Working backwards from the solution – General problem-solving strategies - Problem solving using top-down design – Implementation of algorithms – The concept of Recursion.	6
II	**Fundamental Algorithms**: Exchanging the values of two variables – Counting - Summation of a set of numbers - Factorial computation - Sine function computation - Fibonacci Series generation - Reversing the digits of an integer – Base Conversion.	6
III	**Factoring Methods**: Finding the square root of a number – The smallest divisor of an integer – Greatest common divisor of two integers - Generating prime numbers – Computing the prime factors of an integer – Generation of pseudo-random numbers - Raising a number to a large power – Computing the *n*th Fibonacci number.	6
IV	**Array Techniques**: Array order reversal – Array counting or histograming – Finding the maximum number in a set - Removal of duplicates from an ordered array - Partitioning an array – Finding the k^{th} smallest element – Longest monotone subsequence.	6
V	**Text Processing and Pattern Searching**: Text line length adjustment – Left and right justification of text – Keyword searching in text – Text line editing – Linear pattern search. **Recursive algorithms**: Towers of Hanoi – Permutation generation.	6
	Total	**30**

Course Outcomes		Programme Outcome
CO	On completion of this course, students will	
1	Understand the logic of problem and analyses implementation of algorithm and TopDown	PO1,PO6

	approach and concept of Recursion	
2	Able to understand the Sequence of Numbers and Series Fibonacci, Reversing ,Base Conversion.	PO2
3	Able to do Algebraic operations	PO2,PO4
4	Coverage of Arrays and its Logics	PO6,PO8
5	Text Processing and Pattern Searching Approach	PO7
Text Book		
1	R. G. Dromey, *How to Solve it by Computer*, Pearson India, 2007	
Reference Books		
1.	George Polya, Jeremy Kilpatrick, *The Stanford Mathematics Problem Book: With Hints and Solutions*, Dover Publications, 2009 (Kindle Edition 2013).	
2.	Greg W. Scragg, *Problem Solving with Computers*, Jones & Bartlett 1st edition, 1996.	
Web Resources		
1.	https://www.studytonight.com/	
2.	https://www.w3schools.com/	

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO 1	M					S		
CO 2		M						
CO 3		S		L				
CO 4						S		M
CO 5							M	

S-Strong M-Medium L-Low

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	FUNDAMENTALS OF INFORMATION TECHNOLOGY	Specific Elective	2	-	-	I	2	25	75	100

Learning Objectives	
LO1	Understand basic concepts and terminology of information technology.
LO2	Have a basic understanding of personal computers and their operation
LO3	Be able to identify data storage and its usage
LO4	Get great knowledge of software and its functionalities
LO5	Understand about operating system and their uses

UNIT	Contents	No. Of. Hours
I	**Introduction to Computers:** Introduction, Definition, .Characteristics of computer, Evolution of Computer, Block Diagram Of a computer, Generations of Computer, Classification Of Computers, Applications of Computer, Capabilities and limitations of computer	**6**
II	**Basic Computer Organization:** Role of I/O devices in a computer system. Input Units: Keyboard, Terminals and its types. Pointing Devices, Scanners and its types, Voice Recognition Systems, Vision Input System, Touch Screen, Output Units: Monitors and its types. Printers: Impact Printers and its types. Non Impact Printers and its types, Plotters, types of plotters, Sound cards, Speakers.	**6**
III	**Storage Fundamentals:** Primary Vs Secondary Storage, Data storage & retrieval methods. Primary Storage: RAM ROM, PROM, EPROM, EEPROM. Secondary Storage: Magnetic Tapes, Magnetic Disks. Cartridge tape, hard disks, Floppy disks Optical Disks, Compact Disks, Zip Drive, Flash Drives	**6**
IV	**Software:** Software and its needs, Types of S/W. System Software: Operating System, Utility Programs Programming Language: Machine Language, Assembly Language, High Level Language their advantages & disadvantages. Application S/W and its types: Word Processing, Spread Sheets Presentation, Graphics, DBMS s/w	**6**

V	**Operating System:** Functions, Measuring System Performance, Assemblers, Compilers and Interpreters.Batch Processing, Multiprogramming, Multi Tasking, Multiprocessing, Time Sharing, DOS, Windows, Unix/Linux.	**6**
	TOTAL HOURS	**30**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Learn the basics of computer, Construct the structure of the required things in computer, learn how to use it.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Develop organizational structure using for the devices present currently under input or output unit.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Concept of storing data in computer using two header namely RAM and ROM with different types of ROM with advancement in storage basis.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Work with different software, Write program in the software and applications of software.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Usage of Operating system in information technology which really acts as a interpreter between software and hardware.	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks

1	Anoop Mathew, S. Kavitha Murugeshan (2009), ― Fundamental of Information Technology‖, Majestic Books.
2	Alexis Leon, Mathews Leon,‖ Fundamental of Information Technology‖, 2nd Edition.
3	S. K Bansal, ―Fundamental of Information Technology‖.

Reference Books

1.	Bhardwaj Sushil Puneet Kumar, ―Fundamental of Information Technology‖
2.	GG WILKINSON, ―Fundamentals of Information Technology‖, Wiley-Blackwell
3.	A Ravichandran , ―Fundamentals of Information Technology‖, Khanna Book Publishing

Web Resources

1.	https://testbook.com/learn/computer-fundamentals
2.	https://www.tutorialsmate.com/2020/04/computer-fundamentals-tutorial.html
3.	https://www.javatpoint.com/computer-fundamentals-tutorial
4.	https://www.tutorialspoint.com/computer_fundamentals/index.htm
5.	https://www.nios.ac.in/media/documents/sec229new/Lesson1.pdf

Mapping with Programme Outcomes:

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO 1	3	3	3	3	3	3
CO 2	3	3	3	3	3	3

CO 3	3	3	3	3	3	3
CO 4	3	3	3	3	2	3
CO 5	3	3	2	3	3	2
Weightage of course contributed to each PSO	15	15	14	15	14	14

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Marks**		
								CIA	**External**	**Total**
	INTRODUCTION TO HTML	Specific Elective	2	-	-		2	25	75	100

Learning Objectives	
LO1	Insert a graphic within a web page.
LO2	Create a link within a web page.
LO3	Create a table within a web page.
LO4	Insert heading levels within a web page.
LO5	Insert ordered and unordered lists within a web page. Create a web page.

UNIT	**Contents**	**No. Of. Hours**
I	Introduction :Web Basics: What is Internet – Web browsers – What is Web page – HTML Basics:Understanding tags.	**6**
II	Tags for Document structure(HTML, Head, Body Tag). Block level text elements: Headingsparagraph(<p> tag) – Font style elements: (bold, italic, font, small, strong, strike, big tags)	**6**
III	Lists: Types of lists: Ordered, Unordered – Nesting Lists – Other tags: Marquee, HR, BR- Using Images – Creating Hyperlinks.	**6**
IV	Tables: Creating basic Table, Table elements, Caption – Table and cell alignment – Rowspan, Colspan –Cell padding.	**6**
V	Frames: Frameset – Targeted Links – No frame – Forms : Input, Textarea, Select, Option.	**6**
	TOTAL HOURS	**30**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Knows the basic concept in HTML Concept of resources in HTML	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Knows Design concept. Concept of Meta Data Understand the concept of save the files.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Understand the page formatting. Concept of list	PO1, PO2, PO3, PO4, PO5, PO6

CO4	Creating Links. Know the concept of creating link to email address	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Concept of adding images Understand the table creation.	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks

1	—Mastering HTML5 and CSS3 Made Easy‖, TeachUComp Inc., 2014.
2	**Thomas Michaud, "Foundations of Web Design: Introduction to HTML & CSS"**

Web Resources

1.	https://www.teachucomp.com/samples/html/5/manuals/Mastering-HTML5-CSS3.pdf
2.	https://www.w3schools.com/html/default.asp

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	2	3	3	3
CO 3	2	3	3	3	3	3
CO 4	3	3	3	3	3	3
CO 5	3	3	3	2	3	3
Weightage of course contributed to each PSO	14	15	14	14	15	15

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst.	Marks		
									CIA	External	Total
	WEB DESIGNING	Specific Elective	Y	-	-	-	2	2	25	75	100

Course Objective

C1	Understand the basics of HTML and its components
C2	To study about the Graphics in HTML
C3	Understand and apply the concepts of XML and DHTML
C4	Understand the concept of JavaScript
C5	To identify and understand the goals and objectives of the Ajax

UNIT	Details	No. of Hours	Course

			Objective
I	HTML: HTML-Introduction-tag basics- page structure-adding comments working with texts, paragraphs and line break. Emphasizing test- heading and horizontal rules-list-font size, face and color-alignment links-tables-frames.	6	C1
II	Forms & Images Using Html: Graphics: Introduction-How to work efficiently with images in web pages, image maps, GIF animation, adding multimedia, data collection with html forms textbox, password, list box, combo box, text area, tools for building web page front page.	6	C2
III	XML & DHTML: Cascading style sheet (CSS)-what is CSS-Why we use CSS-adding CSS to your web pages-Grouping styles-extensible markup language (XML).	6	C3
IV	Dynamic HTML: Document object model (DCOM)-Accessing HTML & CSS through DCOM Dynamic content styles & positioning-Event bubbling-data binding. JavaScript: Client-side scripting, What is JavaScript, How to develop JavaScript, simple JavaScript, variables, functions, conditions, loops and repetition,	6	C4
V	Advance script, JavaScript and objects, JavaScript own objects, the DOM and web browser environments, forms and validations.	6	C5
	Total	**60**	

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Develop working knowledge of HTML	PO1, PO3, PO6, PO8
2	Ability to Develop and publish Web pages using Hypertext Markup Language (HTML).	PO1,PO2,PO3,PO6
3	Ability to optimize page styles and layout with Cascading Style Sheets (CSS).	PO3, PO5
4	Ability to develop a java script	PO1, PO2, PO3, PO7
5	An ability to develop web application using Ajax.	P02, PO6, PO7

Text Book	
1	Pankaj Sharma, ―Web Technology‖, SkKataria& Sons Bangalore 2011.
2	Mike Mcgrath, ―Java Script‖, Dream Tech Press 2006, 1st Edition.
3	Achyut S Godbole&AtulKahate, ―Web Technologies‖, 2002, 2nd Edition.
Reference Books	
1.	Laura Lemay, RafeColburn , Jennifer Kyrnin, ―Mastering HTML, CSS &Javascript Web Publishing‖, 2016.
2.	DT Editorial Services (Author), ―HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)‖, Paperback 2016, 2nd Edition.
Web Resources	
1.	NPTEL & MOOC courses titled Web Design and Development.
2.	https://www.geeksforgeeks.org

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO 1	S		M			L		M
CO 2	S	M	L			M		
CO 3			S		M			
CO 4	S	M	M				L	
CO 5		M				L	M	

S-Strong M-Medium L-Low

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
	SoftwareTesting	Specific Elective	Y	-	-	-	2	2	25	75	100
Course Objective											
C1	To study fundamental concepts in software testing										
C2	To discuss various software testing issues and solutions in software unit test, integration and system testing.										
C3	To study the basic concept of Data flow testing and Domain testing.										
C4	To Acquire knowledge on path products and path expressions.										
C5	To learn about Logic based testing and decision tables										

UNIT	Details	No. of Hours	Course Objective
I	Introduction: Purpose–Productivity and Quality in Software–TestingVsDebugging–Model for Testing–Bugs–Types of Bugs – Testing and Design Style.	6	C1
II	Flow / Graphs and Path Testing – Achievable paths – Path instrumentation Application Transaction FlowTesting Techniques.	6	C2
III	Data Flow Testing Strategies - Domain Testing:Domains and Paths – Domains and Interface Testing.	6	C3
IV	Linguistic –Metrics – Structural Metric – Path Products and Path Expressions.SyntaxTesting–Formats–Test Cases	6	C4
V	Logic Based Testing–Decision Tables–Transition Testing–States, State Graph, StateTesting.	6	C5
	Total	**30**	

Course Outcomes		Program Outcomes
CO	On completion of this course, students will	
1	Students learn to apply software testing knowledge and engineering methods	PO1
2	Have an ability to identify the needs of software test automation, and define and develop a test tool to support test automation.	PO1, PO2
3	Have an ability understand and identify various software testing problems, and solve these problems by designing and selecting software test models, criteria, strategies, and methods.	PO4, PO6
4	Have basic understanding and knowledge of contemporary issues in software testing, such as component-based software testing problems	PO4, PO5, PO6
5	Have an ability to use software testing methods and modern software testing tools for their testing projects.	PO3, PO8

Text Book	
1	B.Beizer,—SoftwareTestingTechniques‖,IIEdn.,DreamTechIndia,NewDelhi,2003.
2	K.V.K.Prasad,—SoftwareTestingTools‖,DreamTech.India,NewDelhi,2005
Reference Books	
1.	I.Burnstein,2003,—PracticalSoftwareTesting‖,SpringerInternationalEdn.
2.	E. Kit, 1995, —Software Testing in the Real World: Improving the Process‖, PearsonEducation,Delhi.
3.	R. Rajani,andP.P.Oak,2004,—SoftwareTesting‖,TataMcgrawHill,New Delhi.
Web Resources	
1.	https://www.javatpoint.com/software-testing-tutorial

2.	https://www.guru99.com/software-testing.html

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO 1	S							
CO 2	M	S						
CO 3				S		S		
CO 4				S	S	M		
CO 5			S					S

S-Strong M-Medium L-Low

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
	Quantitative Aptitude	Specific Elective	Y	-	-	-	2	2	25	75	100

Course Objective	
C1	To understand the basic concepts of numbers
C2	Understand and apply the concept of percentage, profit & loss
C3	To study the basic concepts of time and work, interests
C4	To learn the concepts of permutation, probability, discounts
C5	To study about the concepts of data representation, graphs

UNIT	**Details**	**No. of Hours**	**Course Objective**
I	Numbers-HCF and LCM of numbers-Decimal fractions-Simplification-Squareroot and cuberoots - Average-problems on Numbers.	6	CO1
II	Problems on Ages - Surds and Indices - percentage - profits and loss - ratio and proportion-partnership-Chainrule.	6	CO2
III	Time and work - pipes and cisterns - Time and Distance - problems on trains -Boats and streams - simple interest - compound interest - Logarithms - Area-Volume and	6	CO3

	surfacearea -races and Gamesofskill.		
IV	Permutation and combination-probability-True Discount-Bankers Discount – Height and Distances-Oddmanout & Series.	6	CO4
V	Calendar - Clocks - stocks and shares - Data representation - Tabulation - BarGraphs-Piecharts-Linegraphs.	6	CO5
	Total	**60**	

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	understand the concepts, application and the problems of numbers	PO1
2	To have basic knowledge and understanding about percentage, profit & loss related processings	PO1, PO2
3	To understand the concepts of time and work	PO4, PO6
4	Speaks about the concepts of probability, discount	PO4, PO5, PO6
5	Understanding the concept of problem solving involved in stocks & shares, graphs	PO3, PO8

Text Book	
1	—QuantitativeAptitude‖,R.S.AGGARWAL.,S.Chand&CompanyLtd.,
Reference Books	
1.	
Web Resources	
1.	https://www.javatpoint.com/aptitude/quantitative
2.	https://www.toppr.com/guides/quantitative-aptitude/

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO 1	S							
CO 2	M	S						
CO 3				S		S		
CO 4				S	S	M		
CO 5			S					S

S-Strong M-Medium L-Low

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Multimedia Systems	Specific Elective	Y	-	-	-	2	2	25	75	100

Course Objective	
C1	Understand the basics of Multimedia
C2	To study about the Image File Formats,Sounds Audio File Formats
C3	Understand the concepts of Animation and DigitalVideoContainers
C4	To study about the Stage of Multimedia Project
C5	Understand the concept of OwnershipofContentCreatedforProjectAcquiringTalent

UNIT	Details	No. of Hours	Course Objective
I	Multimedia Definition-Use Of Multimedia-Delivering Multimedia- Text:About Fonts and Faces - Using Text in Multimedia -Computers and Text Font Editing and DesignTools-HypermediaandHypertext.	12	C1
II	Images: Plan Approach - Organize Tools - Configure Computer Workspace -Making Still Images - Color - Image File Formats. Sound: The Power of Sound - DigitalAudio-MidiAudio-Midivs.DigitalAudio-MultimediaSystemSounds Audio File Formats - Vaughan's Law of Multimedia Minimums - Adding SoundtoMultimediaProject	12	C2
III	Animation:The Power of Motion-Principles of Animation-Animation by Computer - Making Animations that Work. Video: Using Video - Working with Video and Displays-DigitalVideoContainers-ObtainingVideo Clips - ShootingandEditingVideo	12	C3
IV	Making Multimedia: The Stage of Multimedia Project - The Intangible Needs -The Hardware Needs - The Software Needs - An Authoring Systems Needs-MultimediaProductionTeam.	12	C4
V	PlanningandCosting:TheProcessofMakingMultimedia-Scheduling-Estimating - RFPs and Bid Proposals. Designing and Producing - Content andTalent:AcquiringContent-OwnershipofContentCreatedforProject-	12	C5

	AcquiringTalent		
	Total	**60**	

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	understand the concepts, importance, application and the process of developing multimedia	PO1
2	to have basic knowledge and understanding about image related processings	PO1, PO2
3	To understand the framework of frames and bit images to animations	PO4, PO6
4	Speaks about the multimedia projects and stages of requirement in phases of project.	PO4, PO5, PO6
5	Understanding the concept of cost involved in multimedia planning, designing, and producing	PO3, PO8

Text Book	
1	TayVaughan,"Multimedia:MakingItWork",8thEdition,Osborne/McGraw-Hill,2001.
Reference Books	
1.	RalfSteinmetz&KlaraNahrstedt"MultimediaComputing,Communication&Applications",PearsonEducation,2012.
Web Resources	
1.	https://www.geeksforgeeks.org/multimedia-systems-with-features-or-characteristics/

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO 1	S							
CO 2	M	S						
CO 3				S		S		
CO 4				S	S	M		
CO 5			S					S

S-Strong M-Medium L-Low

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
		Specific	Y	-	-	-	2	2	25	75	100

	Advanced Excel	Elective									
Course Objective											
C1	Handle large amounts of data										
C2	Aggregate numeric data and summarize into categories and subcategories										
C3	Filtering, sorting, and grouping data or subsets of data										
C4	Create pivot tables to consolidate data from multiple files										
C5	Presenting data in the form of charts and graphs										

UNIT	**Details**	**No. of Hours**	**Course Objective**
I	Basics of Excel- Customizing common options- Absolute and relative cells- Protecting and un-protecting worksheets and cells- Working with Functions - Writing conditional expressions - logical functions - lookup and reference functions- VlookUP with Exact Match, Approximate Match- Nested VlookUP with Exact Match- VlookUP with Tables, Dynamic Ranges- Nested VlookUP with Exact Match- Using VLookUP to consolidate Data from Multiple Sheets	6	C1
II	Data Validations - Specifying a valid range of values - Specifying a list of valid values- Specifying custom validations based on formula - Working with Templates Designing the structure of a template- templates for standardization of worksheets - Sorting and Filtering Data - Sorting tables- multiple-level sorting- custom sorting- Filtering data for selected view - advanced filter options- Working with Reports Creating subtotals- Multiple-level subtotal.	6	C2
III	Creating Pivot tables Formatting and customizing Pivot tables- advanced options of Pivot tables- Pivot charts- Consolidating data from multiple sheets and files using Pivot tables- external data sources- data consolidation feature to consolidate data- Show Value As % of Row, % of Column, Running Total, Compare with Specific Field- Viewing Subtotal under Pivot- Creating Slicers.	6	C3

IV	More Functions Date and time functions- Text functions- Database functions- Power Functions - Formatting Using auto formatting option for worksheets- Using conditional formatting option for rows, columns and cells- WhatIf Analysis - Goal Seek- Data Tables- Scenario Manager.	6	C4
V	Charts - Formatting Charts- 3D Graphs- Bar and Line Chart together- Secondary Axis in Graphs- Sharing Charts with PowerPoint / MS Word, Dynamically- New Features Of Excel Sparklines, Inline Charts, data Charts- Overview of all the new features.	6	C5
	Total	**30**	

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Work with big data tools and its analysis techniques.	PO1
2	Analyze data by utilizing clustering and classification algorithms.	PO1, PO2
3	Learn and apply different mining algorithms and recommendation systems for large volumes of data.	PO4, PO6
4	Perform analytics on data streams.	PO4, PO5, PO6
5	Learn NoSQL databases and management.	PO3, PO8

Text Book	
1	**Excel 2019 All**
2	**Microsoft Excel 2019 Pivot Table Data Crunching**
Reference Books	
Web Resources	
1.	https://www.simplilearn.com
2	https://www.javatpoint.com
3	https://www.w3schools.com

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**

CO 1	S							
CO 2	M	S						
CO 3				S		S		
CO 4				S	S	M		
CO 5			S					S

S-Strong M-Medium L-Low

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
	Biometrics	Specific Elective	Y	-	-	-	2	2	25	75	100

Course Objectives	
CO1	Identify the various biometric technologies.
CO2	Design of biometric recognition.
CO3	Develop simple applications for privacy
CO4	Understand the need of biometric in the society
CO5	Understand the scope of biometric techniques

UNIT	**Details**	**No. of Hours**	**Course Objectives**
I	**Introduction**: What is Biometrics, History,Types of biometric Traits, General architecture of biometric systems, Basic working of biometric matching, Biometric system error and performance measures, Design of biometric system, Applications of biometrics, Biometrics versus traditional authentication methods. **Face Biometrics:** Introduction, Background of Face Recognition, Design of Face Recognition System, Neural Network for Face Recognition, Face Detection in Video Sequences, Challenges in Face Biometrics, .7 Face Recognition Methods, Advantages and Disadvantages.	6	CO1
II	**Retina and Iris Biometrics:** Introduction, Performance of Biometrics, Design of Retina Biometrics, Design of Iris Recognition System, Iris Segmentation Method , Determination of Iris Region, Determination of Iris Region, Applications of Iris Biometrics, Advantages and Disadvantages	6	CO2

	Vein and Fingerprint Biometrics: Introduction, Biometrics Using Vein Pattern of Palm, Fingerprint Biometrics, Fingerprint Recognition System, Minutiae Extraction, Fingerprint Indexing, Experimental Results, Advantages and Disadvantages.		
III	**Privacy Enhancement Using Biometrics:** Introduction, Privacy Concerns Associated with Biometric Deployments, Identity and Privacy, Privacy Concerns, Biometrics with Privacy Enhancement, Comparison of Various Biometrics in Terms of Privacy, Soft Biometrics. **Multimodal Biometrics:** Introduction to Multimodal Biometrics , Basic Architecture of Multimodal Biometrics, Multimodal Biometrics Using Face and Ear, Characteristics and Advantages of Multimodal Biometrics, Characteristics and Advantages of Multimodal Biometrics.	6	CO3
IV	**WatermarkingTechniques:** Introduction, Data Hiding Methods, Basic Framework of Watermarking, Classification of Watermarking, Applications of Watermarking, Attacks on Watermarks, Performance Evaluation, Characteristics of Watermarks, General Watermarking Process, Image Watermarking Techniques, Watermarking Algorithm, Experimental Results, Effect of Attacks on Watermarking Techniques, Attacks on Spatial Domain Watermarking.	6	CO4
V	**Scope and Future:** Scope and Future Market of Biometrics, Biometric Technologies, Applications of Biometrics, Biometrics and Information Technology Infrastructure, Role of Biometrics in Enterprise Security, Role of Biometrics in Border Security, Smart Card Technology and Biometrics, Radio Frequency Identification (RFID) Biometrics, DNA Biometrics, Comparative Study of Various Biometric Techniques. **Biometric Standards:** Introduction, Standard Development Organizations, Application Programming Interface (API), Information Security and Biometric Standards, Biometric Template Interoperability.	6	CO5
	Total	**30**	

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	To understand the basic concepts and the functionality of the Biometrics, Face Biometrics, Types, Architecture and Applications.	PO1, PO3, PO6, PO8
CO2	To know the concepts Retina and Iris Biometrics and Vein and Fingerprint Biometrics.	PO1,PO2,PO3,PO6

CO3	To analyse the Privacy Enhancement and Multimodal Biometrics.	PO3, PO5
CO4	To get analyticalidea on Watrmarking Techniques	PO1, PO2, PO3, PO7
CO5	To Gain knowledge on Future scope of Biometrics,and Study of various Biometric Techniques.	PO2, PO6, PO7
Recommended Text		
1.	Biometrics: Concepts and Applications by G.R Sinha and SandeepB.Patil , Wiley, 2013	
References Books		
1.	Guide to Biometrics by Ruud M. Bolle , SharathPankanti, Nalinik.Ratha, Andrew W.Senior, Jonathan H. Connell , Springer 2009	
2.	Introduction to Biometrics by Anil k. Jain, Arun A. Ross, KarthikNandakumar	
3.	Hand book of Biometrics by Anil K. Jain, Patrick Flynn, ArunA.Ross.	
Web Resources		
1.	https://www.tutorialspoint.com/biometrics/index.htm	
2.	https://www.javatpoint.com/biometrics-tutorial	
3.	https://www.thalesgroup.com/en/markets/digital-identity-and-security/government/inspired/biometrics	

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO 1	S		M			L		M
CO 2	S	M	L			M		
CO 3			S		M			
CO 4	S	M	M				L	
CO 5		M				L	M	

S-Strong M-Medium L-Low

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**C**	**I**	**Marks**

									CIA	External	Total
	Cyber Forensics	Specific Elective	Y	-	-	-	2	2	25	75	100

Course Objective	
C1	Understand the definition of computer forensics fundamentals.
C2	To study about the Types of Computer Forensics Evidence
C3	Understand and apply the concepts of Duplication and Preservation of Digital Evidence
C4	Understand the concepts of Electronic Evidence and Identification of Data
C5	To study about the Digital Detective, Network Forensics Scenario, Damaging Computer Evidence.

UNIT	**Details**	**No. of Hours**	**Course Objective**
I	**Overview of Computer Forensics Technology:** Computer Forensics Fundamentals: What is Computer Forensics? Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/Employment Proceedings, Computer Forensics Services, Benefits of professional Forensics Methodology, Steps taken by Computer Forensics Specialists. Types of Computer. Forensics Technology: Types of Business Computer Forensic, Technology–Types of Military Computer Forensic Technology–Types of Law Enforcement–Computer Forensic. Technology–Types of Business Computer Forensic Technology.	6	C1
II	**Computer Forensics Evidence and capture:** Data Recovery: Data Recovery Defined, Data Back–up and Recovery, The Role of Back –up in Data Recovery, The Data –Recovery Solution. Evidence Collection and Data Seizure: Collection Options, Obstacles, Types of Evidence, The Rules of Evidence, Volatile Evidence, General Procedure, Collection and Archiving, Methods of Collections, Artefacts, Collection Steps, Controlling Contamination: The chain of custody.	6	C2

III	**Duplication and Preservation of Digital Evidence:** Processing steps, Legal Aspects of collecting and Preserving Computer forensic Evidence. Computer image Verification and Authentication: Special needs of Evidential Authentication, Practical Consideration, Practical Implementation.	6	C3
IV	**Computer Forensics Analysis:** Discovery of Electronic Evidence: Electronic Document Discovery: A Powerful New Litigation Tool. Identification of Data: Time Travel, Forensic Identification and Analysis of Technical Surveillance Devices.	6	C4
V	**Reconstructing Past Events:** How to Become a Digital Detective, Useable File Formats, Unusable File Formats, Converting Files. Networks: Network Forensics Scenario, a technical approach, Destruction Of E–Mail, Damaging Computer Evidence, Documenting The Intrusion on Destruction of Data, System Testing.	6	C5
	Total	**30**	

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Understand the definition of computer forensics fundamentals.	PO1
2	Evaluate the different types of computer forensics technology.	PO1, PO2
3	Analyze various computer forensics systems.	PO4, PO6
4	Apply the methods for data recovery, evidence collection and data seizure.	PO4, PO5, PO6
5	Gain your knowledge of duplication and preservation of digital evidence.	PO3, PO8

Text Book

1	John R. Vacca, ―Computer Forensics: Computer Crime Investigation‖, 3/E ,Firewall Media, New Delhi, 2002.

Reference Books

1.	Nelson, Phillips Enfinger, Steuart,―Computer Forensics and Investigations‖ Enfinger, Steuart, CENGAGE Learning, 2004.
2.	Anthony Sammes and Brian Jenkinson,‖Forensic Computing: A Practitioner's Guide‖, Second Edition, Springer–Verlag London Limited, 2007.
3.	.Robert M.Slade,‖ Software Forensics Collecting Evidence from the Scene of a Digital Crime‖, TMH 2005.

Web Resources	
1.	https://www.vskills.in
2.	https://www.hackingarticles.in/best-of-computer-forensics-tutorials/

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	S							
CO 2	M	S						
CO 3				S		S		
CO 4				S	S	M		
CO 5			S					S

S-Strong M-Medium L-Low

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Pattern Recognition	Specific Elective	Y	-	-	-	2	2	75	25	100

Course Objective	
CO1	To learn the fundamentals of Pattern Recognition techniques
CO2	To learn the various Statistical Pattern recognition techniques
CO3	To learn the linear discriminant functions and unsupervised learning and clustering
CO4	To learn the various Syntactical Pattern recognition techniques
CO5	To learn the Neural Pattern recognition techniques

UNIT	Details	No. of Hours	Course Objective
I	PATTERN RECOGNITION OVERVIEW: Pattern recognition, Classification and Description-Patterns and feature Extraction with Examples-Training and Learning in PR systems-Pattern recognition Approaches	6	CO1
II	STATISTICAL PATTERN RECOGNITION: Introduction to statistical Pattern Recognition-supervised Learning using Parametric and Non-Parametric Approaches.	6	CO2
III	LINEAR DISCRIMINANT FUNCTIONS AND UNSUPERVISED LEARNING AND CLUSTERING: Introduction-Discrete and binary Classification Problems-Techniques to directly Obtain linear Classifiers -	6	CO3

	Formulation of Unsupervised Learning Problems-Clustering for unsupervised learning and classification		
IV	SYNTACTIC PATTERN RECOGNITION: Overview of Syntactic Pattern Recognition-Syntactic recognition via parsing and other grammars–Graphical Approaches to syntactic pattern recognition-Learning via grammatical inference.	6	CO4
V	NEURAL PATTERN RECOGNITION: Introduction to Neural Networks-Feedforward Networks and training by Back Propagation-Content Addressable Memory Approaches and Unsupervised Learning in Neural PR	6	CO5
	Total		

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	understand the concepts, importance, application and the process of developing Pattern recognition over view	PO1
2	to have basic knowledge and understanding about parametric and non-parametric related concepts.	PO1, PO2
3	To understand the framework of frames and bit images to animations	PO4, PO6
4	Speaks about the multimedia projects and stages of requirement in phases of project.	PO4, PO5, PO6
5	Understanding the concept of cost involved in multimedia planning, designing, and producing	PO3, PO8

Text Book

1	Robert Schalkoff, ―Pattern Recognition: Statistical Structural and Neural Approaches‖, John wiley & sons.
2	Duda R.O., P.E.Hart & D.G Stork, ― Pattern Classification‖, 2nd Edition, J.Wiley.
3	Duda R.O.& Hart P.E., ―Pattern Classification and Scene Analysis‖, J.wiley.
4	Bishop C.M., ―Neural Networks for Pattern Recognition‖, Oxford University Press.

Reference Books

1.	1. Earl Gose, Richard johnsonbaugh, Steve Jost, ―Pattern Recognition and Image Analysis‖, Prentice Hall of India, Pvt Ltd, New Delhi.

Web Resources

1.	https://www.geeksforgeeks.org/pattern-recognition-introduction/
2.	https://www.mygreatlearning.com/blog/pattern-recognition-machine-learning/

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	S							
CO 2	M	S						
CO 3				S		S		
CO 4				S	S	M		
CO 5			S					S

S-Strong M-Medium L-Low

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
	ERP	Specific Elective	Y	-	-	-	4	4	25	75	100

Course Objectives	
CO1	To understand the basic concepts, Evolution and Benefits of ERP.
CO2	To know the need and Role of ERP in logical and Physical Integration.
CO3	Identify the important business functions provided by typical business software such as enterprise resource planning and customer relationship managemen
CO4	To train the students to develop the basic understanding of how ERP enriches the business organizations in achieving a multidimensional growth
CO5	To aim at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills

UNIT	**Details**	**No. of Hours**	**Course Objectives**
I	ERP Introduction, Benefits, Origin, Evolution and Structure: Conceptual Model of ERP, the Evolution of ERP, the Structure of ERP, Components and needs of ERP, ERP Vendors; Benefits & Limitations of ERP Packages.	6	CO1
II	Need to focus on Enterprise Integration/ERP; Information mapping; Role of common shared Enterprise database; System Integration, Logical vs. Physical System Integration, Benefits & limitations of System Integration, ERP‘s Role in Logical and Physical Integration. Business Process Reengineering, Data ware Housing, Data Mining, Online Analytic Processing (OLAP), Product Life Cycle Man-	6	CO2

	agement (PLM), LAP, Supply chain Management.		
III	ERP Marketplace and Marketplace Dynamics: Market Overview, Marketplace Dynamics, the Changing ERP Market. ERP- Functional Modules: Introduction, Functional Modules of ERP Software, Integration of ERP, Supply chain and Customer Relationship Applications. Cloud and Open Source, Quality Management, Material Management, Financial Module, CRM and Case Study.	6	CO3
IV	ERP Implementation Basics, , ERP implementation Strategy, ERP Implementation Life Cycle ,Pre-Implementation task,Role of SDLC/SSAD, Object Oriented Architecture, Consultants, Vendors and Employees.	6	CO4
V	ERP & E-Commerce, Future Directives- in ERP, ERP and Internet, Critical success and failure factors, Integrating ERP into or-ganizational culture. Using ERP tool: either SAP or ORACLE format to case study.	6	CO5
	Total	**30**	

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Understand the basic concepts of ERP.	PO1, PO2, PO6
CO2	Identify different technologies used in ERP	PO2, PO3, PO8
CO3	Understand and apply the concepts of ERP Manufacturing Perspective and ERP Modules	PO1, PO3, PO7
CO4	Discuss the benefits of ERP	PO2, PO6
CO5	Apply different tools used in ERP	PO1, PO3, PO8

Reference Text :	
1.	Enterprise Resource Planning – Alexis Leon, Tata McGraw Hill.
References :	
1.	Enterprise Resource Planning – Diversified by Alexis Leon, TMH.
2.	Enterprise Resource Planning – Ravi Shankar & S. Jaiswal , Galgotia
Web Resources	
1.	1. https://www.tutorialspoint.com/management_concepts/enterprise_resource_planning.htm
2.	1. https://www.saponlinetutorials.com/what-is-erp-systems-enterprise-resource-planning/
3.	1. https://www.guru99.com/erp-full-form.html
4.	2. https://www.oracle.com/in/erp/what-is-erp/

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**

CO 1	M		L			M		
CO 2	M	S			L	M		
CO 3		L	M					M
CO 4				M		L	M	
CO 5	M		L		M			S

S-Strong M-Medium L-Low

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
	Robotics and Its Applications	Specific Elective	Y	-	-	-	2	2	25	75	100

Course Objective	
C1	To understand the robotics fundamentals
C2	Understand the sensors and matrix methods
C3	Understand the Localization: Self-localizations and mapping
C4	To study about the concept of Path Planning, Vision system
C5	To learn about the concept of robot artificial intelligence

UNIT	**Details**	**No. of Hours**	**Course Objective**
I	Introduction: Introduction, brief history, components of robotics, classification, workspace, work-envelop, motion of robotic arm, end-effectors and its types, service robot and its application, Artificial Intelligence in Robotics.	6	CO1
II	Actuators and sensors :Types of actuators, stepper-DC-servo-and brushless motors- model of a DC servo motor-types of transmissions-purpose of sensor-internal and external sensor-common sensors-encoders tachometers-strain gauge based force torque sensor-proximity and distance measuring sensors Kinematics of robots: Representation of joints and frames, frames transformation, homogeneous matrix, D-H matrix, Forward and inverse kinematics: two link planar (RR) and spherical robot (RRP). Mobile robot Kinematics: Differential wheel mobile robot	6	CO2

III	Localization: Self-localizations and mapping - Challenges in localizations – IR based localizations – vision based localizations – Ultrasonic based localizations - GPS localization systems.	6	CO3
IV	Path Planning: Introduction, path planning-overview-road map path planning-cell decomposition path planning potential field path planning-obstacle avoidance-case studies Vision system: Robotic vision systems-image representation-object recognition-and categorization-depth measurement- image data compression-visual inspection-software considerations	6	CO4
V	Application: Ariel robots-collision avoidance robots for agriculture-mining-exploration-underwater-civilian- and military applications-nuclear applications-space Applications-Industrial robots-artificial intelligence inrobots-application of robots in material handling-continuous arc welding-spot welding-spray painting-assembly operation-cleaning-etc.	6	CO5
	Total		

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Describe the different physical forms of robot architectures.	PO1
2	Kinematically model simple manipulator and mobile robots.	PO1, PO2
3	Mathematically describe a kinematic robot system	PO4, PO6
4	Analyze manipulation and navigation problems using knowledge of coordinate frames, kinematics, optimization, control, and uncertainty.	PO4, PO5, PO6
5	Program robotics algorithms related to kinematics, control, optimization, and uncertainty.	PO3, PO8

Text Book

1	RicharedD.Klafter. Thomas Achmielewski and MickaelNegin, Robotic Engineering and Integrated Approach, Prentice Hall India-Newdelhi-2001
2	SaeedB.Nikku, Introduction to robotics, analysis, control and applications, Wiley-India, 2 nd edition 2011

Reference Books

1.	Industrial robotic technology-programming and application by M.P.Groover et.al, McGrawhill2008

2.	Robotics technology and flexible automation by S.R.Deb, THH-2009
Web Resources	
1.	https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_robotics.htm
2.	https://www.geeksforgeeks.org/robotics-introduction/

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	S							
CO 2	M	S						
CO 3				S		S		
CO 4				S	S	M		
CO 5			S					S

S-Strong M-Medium L-Low

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Simulation and Modeling	Specific Elective	Y	-	-	-	4	4	25	75	100

Course Objectives			
CO1	Generates computer simulation technologies and techniques, lays the groundwork for students to comprehend computer simulation requirements, and implements and tests a variety of simulation and data analysis libraries and programmes. This course focuses on what is required to create simulation software environments rather than just simulations using pre-existing packages		
CO2	Discuss the concepts of modelling layers of critical infrastructure networks in society.		
CO3	Create tools for viewing and controlling simulations and their results.		
CO4	Understand the concept of Entity modelling, Path planning		
CO5	To learn about the Algorithms and Modelling.		
UNIT	**Details**	**No. of Hours**	**Course Objectives**

I	Introduction To Modeling & Simulation – What is Modeling and Simulation? – Complexity Types – Model Types – Simulation Types – M&S Terms and Definitions Input Data Analysis – Simulation Input Modeling – Input Data Collection - Data Collection Problems - – Input Modeling Strategy - Histograms -Probability Distributions - Selecting a Probability Distribution.	6	CO1
II	Random Variate Generation – Random Numbers – Random Number Generators – General principles – Inverse Transform Method –Acceptance Rejection Method –Composition Method –Relocate and Rescale Method - Specific distributions-Output Data Analysis – Introduction -Types of Simulation With Respect to Output Analysis - Stochastic Process and Sample Path - Sampling and Systematic Errors - Mean, Standard Deviation and Confidence Interval - Analysis of Finite-Horizon Simulations - Single Run - Independent Replications - Sequential Estimation – Analysis of Steady-State Simulations - Removal of Initialization Bias (Warm-up Interval) - Replication-Deletion Approach - Batch-Means Method .	6	CO2
III	Comparing Systems via Simulation – Introduction – Comparison Problems - Comparing Two Systems - Screening Problems - Selecting the Best - Comparison with a Standard - Comparison with a Fixed Performance Discrete Event Simulations – Introduction - Next-Event Time Advance - Arithmetic and Logical Relationships - Discrete-Event Modeling Approaches – Event-Scheduling Approach – Process Interaction Approach.	6	CO3
IV	Entity Modeling – Entity Body Modeling – Entity Body Visualization – Entity Body Animation – Entity Interaction Modeling – Building Modeling Distributed Simulation – High Level Architecture (HLA) – Federation Development and Execution Process (FEDEP) – SISO RPR FOM Behavior Modeling –	6	CO4

	General AI Algorithms - Decision Trees - Neural Networks - Finite State Machines - Logic Programming - Production Systems – Path Planning - Off-Line Path Planning - Incremental Path Planning - Real-Time Path Planning – Script Programming -Script Parsing - Script Execution.		
V	Optimization Algorithms – Genetic Algorithms – Simulated Annealing Examples: Sensor Systems Modeling – Human Eye Modeling – Optical Sensor Modeling – Radar Modeling.	6	CO5
	Total	**30**	

Course Outcomes

Course Outcomes	On completion of this course, students will;	**Programme Outcomes**
CO1	Introduction To Modeling & Simulation, Input Data Analysis and Modeling.	PO1
CO2	Random Variate and Number Generation. Analysis of Simulations and methods.	PO1, PO2
CO3	Comparing Systems via Simulation	PO4, PO6
CO4	Entity Body Modeling, Visualization, Animation.	PO4, PO5, PO6
CO5	Algorithms and Sensor Modeling.	PO3, PO8

Text Books

1.	Jerry Banks, ―Handbook of Simulation: Principles, Methodology, Advances, Applications, and Practice‖, John Wiley & Sons, Inc., 1998.
2.	George S. Fishman, ―Discrete-Event Simulation: Modeling, Programming and Analysis‖, Springer-Verlag New York, Inc., 2001.

References Books

1.	Andrew F. Seila, Vlatko Ceric, Pandu Tadikamalla, ―Applied Simulation Modeling‖, Thomson Learning Inc., 2003.

Web Resources

1.	https://www.tutorialspoint.com/modelling_and_simulation/index.htm
2.	https://www.javatpoint.com/verilog-simulation-basics

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	S							
CO 2	M	S						
CO 3				S		S		
CO 4				S	S	M		
CO 5			S					S

S-Strong(3) M-Medium (2) L-Low (1)

Subject Code	Subject Name	Category	L	T	P	O	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Organizational Behaviour	Specific Elective	Y	-	-	-	2	2	25	75	100

Learning Objectives	
CLO1	To have extensive knowledge onOB and the scope of OB.
CLO2	To create awareness of Individual Benaviour.
CLO3	To enhance the understanding of Group Behaviour
CLO4	To know the basics of Organisaitonal Culture and Organisational Structure
CLO5	To understand Organisational Change, Conflict and Power

UNIT	Details	No. of Hours	Learning Objectives
I	INTRODUCTION : Concept of Organizational Behavior (OB): Nature, Scope and Role of OB: Disciplines that contribute to OB; Opportunities for OB (Globalization, Indian workforce diversity, customer service, innovation and change, networked organizations, work-life balance, people skills, positive work environment, ethics)	6	CLO1
II	INDIVIDUAL BEHAVIOUR: 1. Learning, attitude and Job satisfaction: Concept of learning, conditioning, shaping and reinforcement. Concept of attitude, components, behavior and attitude. Job satisfaction: causation; impact of satisfied employees on workplace. 2. Motivation : Concept; Theories (Hierarchy of needs, X and Y, Two factor, McClelland, Goal setting, Self-efficacy, Equity theory); Job characteristics model; Redesigning jobs, 3. Personality and Values : Concept of personality; Myers-Briggs Type Indicator (MBTI); Big Five model. Relevance of	6	CLO2

	values; Linking personality and values to the workplace (person-job fit, person-organization fit) 4. Perception, Decision Making : Perception and Judgements; Factors; Linking perception to individual decision making:		
III	GROUP BEHAVIOUR : 1. Groups and Work Teams : Concept : Five Stage model of group development; Group norms, cohesiveness ; Group think and shift ; Teams; types of teams; Creating team players from individuals and team based work(TBW) 2. Leadership : Concept; Trait theories; Behavioral theories (Ohio and Michigan studies); Contingency theories (Fiedler, Hersey and Blanchard, Path-Goal);	6	CLO3
IV	ORGANISATIONAL CULTURE AND STRUCTURE : Concept of culture; Impact (functions and liability); Creating and sustaining culture: Concept of structure, Prevalent organizational designs: New design options	6	CLO4
V	ORGANISATIONAL CHANGE, CONFLICT AND POWER: Forces of change; Planned change; Resistance; Approaches (Lewin's model, Organisational development);. Concept of conflict, Conflict process; Types, Functional/ Dysfunctional. Introduction to power and politics.	6	CLO5
		30	

Course Outcomes	On Completion of the course the students will	**Program Outcomes**
CO1	To define OrganisationalBehaviour, Understand the opportunity through OB.	PO1, PO2, PO6, PO7
CO2	To apply self-awareness, motivation, leadership and learning theories at workplace.	PO2,PO4. PO5, PO6
CO3	To analyze the complexities and solutions of group behaviour.	PO1, PO2, PO4, PO5, PO6
CO4	To impact and bring positive change in the culture of the organisaiton.	PO2, PO3, PO4 PO5, PO8
CO5	To create a congenial climate in the organization.	PO1, PO2, PO5 PO6, PO8

Reading List

1.	NeharikaVohra Stephen P. Robbins, Timothy A. Judge , *Organizational Behaviour*, Pearson Education, 18th Edition, 2022.
2.	Fred Luthans, *Organizational Behaviour*, Tata McGraw Hill, 2017.
3.	Ray French, Charlotte Rayner, Gary Rees & Sally Rumbles, *Organizational Behaviour*, John Wiley & Sons, 2011
4.	Louis Bevoc, Allison Shearsett, Rachael Collinson, *Organizational Behaviour Reference*, Nutri Niche System LLC (28 April 2017)
5.	Dr. Christopher P. Neck, Jeffery D. Houghton and Emma L. Murray, *Organizational*

	Behaviour: A Skill-Building Approach, SAGE Publications, Inc; 2nd edition (29 November 2018).
References Books	
1.	Uma Sekaran, Organizational Behaviour Text & cases, 2nd edition, Tata McGraw Hill Publishing CO. Ltd
2.	GangadharRao, Narayana, V.S.P Rao, Organizational Behaviour 1987, Reprint 2000, Konark Publishers Pvt. Ltd, 1st edition
3.	S.S. Khanka, Organizational Behaviour, S. Chand & Co, New Delhi.
4.	J. Jayasankar, Organizational Behaviour, Margham Publications, Chennai, 2017.