PERIYAR UNIVERSITY

PERIYAR PALKALAI NAGAR

SALEM-636011

DEGREE OF BACHELOR OF SCIENCE

Syllabus for

B.Sc., INTERNET OF THINGS

(SEMESTER PATTERN- CBCS)

(For Candidates admitted in the colleges affiliated to

Periyar university from 2023-2024 onwards)

1. Introduction

B.Sc. Internet of Things

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., Internet of Things**
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 thestakeholders to theState-of Art techniquesfrom thestreams ofmulti-disciplinary, cross disciplinary and inter disciplinary nature ➢ Emerging topics inhigher education/industry/ communication network / health sectoretc. are introduced with hands-on-training.

IV	Elective Papers	➢ Exposure to industry moulds students into solution providers ➢ Generates Industryready graduates ➢ Employment opportunities enhanced
V Semester	Elective papers	➢ Self-learning isenhanced ➢ Application of the concept to real situationis conceived resulting in tangible outcome
VI Semester	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 Programme

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.**

Credit Distribution for B.Sc. Internet of Things				
Semester I				
Component	**Paper Code**	**Course Title**	**Credit**	**Hours**
Part-I		Language – Tamil	3	6
Part-II		English	3	6
Part III	23UIOCC01	CC1 -Principles of Electronic Circuit Design	4	5
	23UIOCCP01	CC2 - Circuit Design Lab	3	3
		Elective Course-ECI (Generic/Discipline Specific)- Choose from Annexure I	6	6
Part IV		Skill Enhancement Course-SEC1 (Non Major Elective)	2	2
		Foundation Course-FC Fundamentals of IoT and Applications	2	2
TOTAL			**23**	**30**

Semester II				
Component	**Paper Code**	**Course Title**	**Credit**	**Hours**
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	23UIOCC02	CC3-Embedded System and Microcontroller	4	5
	23UIOCCP02	CC4-Embedded Systems Lab	3	3
		Elective Course-EC2 (Generic/Discipline Specific)- Choose from Annexure I	6	6
Part IV		Skill Enhancement Course-SEC2 (Non Major Elective)	2	2
		Skill Enhancement Course-SEC3 Choose from Annexure I	2	2
TOTAL			**25**	**30**

Semester III				
Component	**Paper Code**	**Course Title**	**Credit**	**Hours**
Part-I		Language – Tamil	3	6
Part-II		English	3	6
Part III	23UIOCC03	CC5-RFID and Sensor Networks	4	5
	23UIOCCP03	CC6-Network Simulator Lab	3	3
		Elective Course-EC3 (Generic/Discipline Specific) -Choose from Annexure I	6	6
Part IV	**NMSDC**	**Computational Skills for Employability**	**2**	**2**
		Skill Enhancement Course-SEC5 Choose from Annexure II	2	2
		Environmental Studies	-	1
TOTAL			**23**	**30**

Semester IV				
Component	**Paper Code**	**Course Title**	**Credit**	**Hours**
Part-I		Language – Tamil	3	6
Part-II		English	3	6
Part III	23UIOCC04	CC7-Core Industry Module Ardunio And Sensors	4	4
	23UIOCCP04	CC8- Ardunio And Sensors Lab	3	3
		Elective Course-EC4 (Generic/Discipline Specific)-Choose from Annexure I	6	6
Part IV		Skill Enhancement Course SEC 6 Choose from Annexure II	2	2
		Skill Enhancement Course SEC7 Choose from Annexure II	2	2
		Environmental Studies	2	1
TOTAL			**25**	**30**

Semester V				
Component	**Paper Code**	**Course Title**	**Credit**	**Hours**
Part III	23UIOCC05	CC9-Implementing IoT with Raspberry Pi	4	5
	23UIOCCP05	CC10-Raspberry Pi Lab	4	5
	23UIOCC06	CC11-Network Communication and Security	4	5
		Elective Course-EC5 (Discipline Specific) Choose from Annexure I	3	4
		Elective Course-EC6 (Discipline Specific) Choose from Annexure I	3	4
	23UIOCCPR1	CC12- Project with viva voce	4	5
Part IV		Value Education	2	2
		Summer Internship/ Industrial Training (Summer Vacation at the end of IV Semester activity	2	-
TOTAL			**26**	**30**

Semester VI				
Component	**Paper Code**	**Course Title**	**Credit**	**Hours**
Part III	23UIOCC07	CC13-Python Programming	4	6
	23UIOCCP06	CC14-Python Programming Lab	4	6
	23UIOCC08	CC15-Android Application Development	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
Part V		Extension Activity	1	-
TOTAL			**21**	**30**
Total Credits				**140**

SUGGESTED CORE COMPONENTS

S.No	Paper Code	Paper Title
1	23UIOCC09	Object Oriented Programming Using C++
2	23UIOCCP07	C++ Programming Lab
3	23UIOCC10	Data Structures
4	23UIOCC11	PHP Scripting
5	23UIOCC12	Software Quality Assurance
6	23UIOCC13	Software Project Management
7	23UIOCC14	Software Enineering
8	23UIOCCP08	Software Engineering Lab
9	23UIOCC15	Software Metrics
10	23UIOCC16	Machine Learning
11	23UIOCC17	Network Security
12	23UIOCC18	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	23UIODE01	Natural Language Processing
2	23UIODE02	Analytics for Service Industry
3	23UIODE03	Cryptography
4	23UIODE04	Big Data Analytics
5	23UIODE05	IOT and its Applications
6	23UIODE06	Human Computer Interaction
7	23UIODE07	Fuzzy Logic
8	23UIODE08	Artificial Intelligence
9	23UIODE09	Robotics and its Applications
10	23UIODE10	Computational Intelligence
11	23UIODE11	Grid Computing
12	23UIODE12	Trends in Computing
13	23UIODE13	Artificial Neural Network
14	23UIODE14	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	23UIOSE01	Office Automation
2	23UIOSE02	Basics of Internet
3	23UIOSE03	Problem Solving Techniques
4	23UIOSE04	Fundamentals of Information Technology
5	23UIOSE05	Introduction to HTML
6	23UIOSE06	Web Designing
7	23UIOSE07	Software Testing
8	23UIOSE08	Quantitative Aptitude
9	23UIOSE09	Multimedia Systems
10	23UIOSE10	Advanced Excel
11	23UIOSE11	Biometrics
12	23UIOSE12	Cyber Forensics
13	23UIOSE13	Pattern Recognition
14	23UIOSE14	Enterprise Resource Planning
15	23UIOSE15	Robotics and Its Applications
16	23UIOSE16	Simulation and Modelling
17	23UIOSE17	Organization Behaviour and more

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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

CORE – I: PRINCIPLES OF ELECTRONIC CIRCUIT DESIGN

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

Learning Objectives	
LO1	To enable the students to understand and gain the knowledge on Electronic Circuit Design Principles
LO2	to acquaint the students with construction, theory and characteristics of the various kinds of electronic devices

Prerequisites:

Unit	Contents	No. of Hours
I	**Fundamentals of Electronics:** AC and DC Fundamentals- Resistors – Capacitors – Inductors – Series and parallel connections – Ohms Law – KCL- KVL – Super position theorem - Maximum power transfer theorem. Semiconductors- Types - Energy band Structure- Working and characteristics of PN Junction Diode- BJT- JFET- MOSFET- LED – LDR- Solar Cell- Photo Diode	**15**
II	**Rectifiers and power supply:** Rectifier – Half wave rectifier – full wave rectifier – bridge rectifier Compression - Filters – Capacitor Filter, Inductor Filter, L section and π section filters – Regulators –78XX and 79XX IC regulators – Single andDual regulated power supply design using IC regulators.	**15**
III	**Amplifier:** Definition – feedbacks – effect of negative feedback in amplifiers – Common emitter amplifier – Multistage amplifiers – RC Coupled amplifiers – Transformer coupled amplifier – Direct coupled amplifier – frequency response.	**15**
IV	**Oscillator and Wave Shaping circuits:** Condition for Oscillation – Barkhausen criterion – Types of Oscillators – Hartley oscillator – Colpitt‟s oscillator – Crystal oscillator - RC phase shift oscillator – Astable Multivibrator – Mono stable Multivibrator – Bistable multivibrator – Schimit trigger – UJT Relaxation oscillator - Clipesr-Clampers.	**15**
V	**Linear ICs:** OpAmp: Ideal OpAmp – OpAmp Stages - OpAmp parameters – inverting and non inverting amplifiers – Adder and Subtractor – Multiplier and Divider – Differentiator – integrator - V to I and I to V converter – sample and hold circuit – Instrumentation amplifier. **IC555 Timer:** Pin details of IC 555 – Block Diagram – Astable multivibrator - Mono stable multivibrator – Bistable Multivibrator.	**15**
TOTAL		**75**

CO	Course Outcomes
CO1	Recognize the fundamental concepts of solid state devices
CO2	Understand the types and characteristics of various rectifiers, filtersand regulators.
CO3	Apply the operation of the devices on various amplifier designs
CO4	Illustrate the functionality of different kinds of oscillator and waveshaping circuits
CO5	Analyze the characteristics of the Linear IC‟s in different aspects.

Textbooks	
➢	V.K. Metha, Rohit Metha - Principles of Electronics-S.Chand 12th edition

➢	R.S Sedha –A Textbook of Applied Electronics - Revised Edition – 2008.
➢	A. Sudhakar, Shyammohan S. Palli -Circuits and Networks: Analysis and Synthesis
Reference Books	
1.	S. Salivahanan, N. SureshKumar-Electronic Devices and Circuits –4th Edi -2017
2.	Isaak D. Mayergoyz, W. Lawson - Basic Electric Circuit Theory
NOTE: Latest Edition of Textbooks May be Used	
Web Resources	
1.	https://www.edx.org/course/principle-of-semiconductor-devices-part-i-semicond
2.	https://www.edx.org/course/principles-of-electronic-biosensors

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**

CORE – II: CIRCUIT DESIGN LAB

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

Learning Objectives

LO1	To enable the students to understand and gain the knowledge on Electronic Circuit Design Principles
LO2	to acquaint the students with construction, theory and characteristics of the various kinds of electronic devices

List of Experiments:

1. Data acquisition using Multimeter and oscillographic recorder
2. Connect an LED to GPIO pin 25 and control it through the command line.
3. Connect an LED to GPIO pin 24 and a Switch to GPIO 25 and control the LED with the switch.
4. The state of LED should toggle with every press of the switch Use DHT11 temperature sensor and print the temperature and humidity of the room with an interval of 15 seconds
5. Use joystick and display the direction on the screen
6. Use Light Dependent Resistor (LDR) and control an LED that should switch-on/off depending on the light.
7. Create a traffic light signal with three colored lights (Red, Orange and Green) with a duty cycleof 5-2-10 seconds.
8. Switch on and switch of a DC motor based on the position of a switch.
9. Convert an analog voltage to digital value and show it on the screen.
10. Create a door lock application using a reed switch and magnet and give a beep when the dooris opened.
11. Control a 230V device (Bulb) with Raspberry Pi using a relay.

12. Control a 230V device using a threshold temperature, using a temperature sensor.
13. Create an application that has three LEDs (Red, Green and white). The LEDs should follow the cycle (All Off, Red On, Green On, White On) for each clap (use sound sensor).
14. Create a web application for the above applications wherever possible with suitable modifications to get input and to send output.

CO	Course Outcomes
CO1	Recognize the fundamental concepts of solid state devices
CO2	Understand the types and characteristics of various rectifiers, filtersand regulators.
CO3	Apply the operation of the devices on various amplifier designs
CO4	Illustrate the functionality of different kinds of oscillator and waveshaping circuits
CO5	Analyze the characteristics of the Linear IC‟s in different aspects.

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**

FOUNDATION COURSE – I: FUNDAMENTALS OF IOT AND APPLICATIONS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
	2	0	0	I	**2**	**2**	**25**	**75**	**100**

Learning Objectives

LO1	To acquire the basic knowledge of students in Internet of Things and designmini projects based on its application

Prerequisites:

Unit	Contents	No. of Hours
I	**Fundamentals of IoT:** Introduction, Definitions & Characteristics of IoT, IoTArchitectures, Physical& Logical Design of IoT, Enabling Technologies in IoT, History of IoT, About Things in IoT, The Identifiers in IoT,About the Internet in IoT, IoT frameworks, IoT and M2M.	**6**
II	**Sensors Networks :**Definition, Types of Sensors, Types ofActuators, Examples and Working, IoT Development Boards: Arduino IDE and Board Types, Raspberr Pi Development Kit, RFID Principles and components, Wirel ess Sensor Networks: History and Context, The node,Connecting nodes, Networking Nodes, WSN and IoT.	**6**
III	**Wireless Technologies for IoT:** WPAN Technologies forIoT: IEEE 802.15.4, Zigbee, HART, NFC, Z-Wave, BLE, Bacnet, Modbus.IP Based Protocols for IoT IPv6,6LowPAN,	**6**

	RPL, REST, AMPQ, CoAP, MQTT.Edge connectivity and protocols.	
IV	**Data Handling& Analytics:**Introduction, Bigdata, Types of data, Characteristics of Big data,Data handling Technologies, Flow of data, Data acquisition, Data Storage, Introduction to Hadoop. Introduction to data Analytics, Types of Data analytics, Local Analytics, Cloud analytics and applications.	**6**
V	**Applications of IoT:**Home Automation, Smart Cities, Energy, Retail Management, Logistics,Agriculture, Health and Lifestyle, Industrial IoT, Legal challenges, IoT design Ethics, IoT in Environmental Protection.	**6**
TOTAL		**30**

CO	**Course Outcomes**
CO1	Recognize and understand the fundamentals of IoT Architectureand layer
CO2	Understand the concept of sensor network
CO3	Demonstrate the design procedures wireless access technologies
CO4	Simplify the various data handling problems
CO5	Categorize and analyse the applications of IOT

Textbooks	
➢	HakimaChaouchi, — ‐The Internet of Things Connecting Objects to the Web‖ISBN :978-1-84821-140-7, Wiley Publications
➢	Olivier Hersent, David Boswarthick, and Omar Elloumi, — ‐The Internet ofThings:Key Applications and Protocols‖, WileyPublications
➢	Vijay Madisetti and ArshdeepBahga, — ‐Internet of Things (A Hands-on-

Reference Books	
1.	Daniel Minoli, — ‐Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications‖, ISBN: 978-1-118-47347-4, Willy Publications
2.	Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling

NOTE: Latest Edition of Textbooks May be Used

Web Resources	
1.	https://www.edx.org/course/build-your-first-iot-application-with-arm?index=product&queryID=5909fc91a84332af2fd85a3475af41b8&position=1
2.	https://www.edx.org/course/iot-systems-and-industrial-applications-with- design-thinking?index=product&queryID=5909fc91a84332af2fd85a3475af41b8&position=2

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**

CORE – III: EMBEDDED SYSTEMS AND MICROCONTROLLER

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

Learning Objectives	
LO1	To understand the Concept of PIC microcontroller Architecture and itsApplications
LO2	To develop the programming skills in PIC16F877 microcontroller.

Prerequisites:

Unit	**Contents**	**No. of Hours**
I	**PIC 16F87X Microcontroller:** Device overview –architecture – memory organization – status register –option register – INTCON register – PCON register – I/Oports – data EEPROM – instruction set: Byte oriented operations – Bit oriented operations – Literal and Control operations.	**15**
II	**Peripheral Features of 16F87X Microcontrollers:** TIMER0 Module – TIMER1 Module – TIMER2 Module – Capture/Compare/PWM Modules – I2 C transmission and reception – USART – ADC Module - Special features of the CPU : oscillator selection – power on reset – power up timer – oscillator start up timer – brown out reset – interrupts – watchdog timer – SLEEP	**15**
III	**Introduction to Embedded Systems:** Definition and classification – Overview of microprocessor, Microcontroller, and DSP – exemplary high performance processors – CISC and RISC architecture – hardware unit inan embedded System-software embedded into a system –exemplary applications – embedded systems on a chip and in VLSI circuit	**15**
IV	**Real Time Operating Systems:** Definitions of process, tasks, and threads – Operating system services – goals – structures kernel – process management – memory management – device management – file system organization and implementation – I/O sub systems – interrupt routine handling in RTOS – RTOS task scheduling models – handling of task scheduling – latency – deadlines - round robin scheduling – cyclic scheduling – preemptive - critical session – static real time scheduling – IPC and synchronization – use of semaphore – priority inversion – deadlock – IPC using signals – mutex- flag-message queues – mailboxes – pipes- virtual sockets – remote procedure calls	**15**
V	**RTOS Programming Tools: Micro C/OS-II and Vx Works:** Study of MicroC/OS-II – VxWorks – other popular RTOS – RTOS system level functions – task service functions – time delay functions – memory allocation related functions – semaphore related functions – mailbox related functions – queue related functions case studies of Programming with RTOS – understanding case definition - multiple tasks and their functions – creating a list of tasks- functions and IPCs – exemplary coding steps	**15**

TOTAL	75

CO	Course Outcomes
CO1	Identify and understands the function of different blocks of PICmicrocontroller.
CO2	Understand the various instruction set programming techniques of PICmicrocontroller.
CO3	Demonstrate the use of interrupts and other programming techniques related to micro-controllers.
CO4	Analyze of RTOS based system design.
CO5	Develop the programs for data transfer, arithmetic, logical and I/Oport operations.

Textbooks	
➢	Embedded Systems Architecture, Programming and Design, - Rajkamal, TATAMcGraw- Hill, First reprint, 2003.
➢	PIC 16F87X data book, Microchip Technology Inc., 2001

Reference Books	
1.	Programming 8 bit PIC microcontroller in C- Martin P. Bates
2.	Embedded Controller Hardware Design - Ken Arnold
3.	Designing Embedded Systems with PIC Microcontrollers Principles and applications – Tim Wilmshurst.

NOTE: Latest Edition of Textbooks May be Used

Web Resources	
3.	https://onlinecourses.nptel.ac.in/noc20_ee98/preview
4.	https://nptel.ac.in/courses/108107029

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

CORE – IV: EMBEDDED SYSTEMS LAB

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

Learning Objectives	
LO1	To develop the ability to design Microcomputer-based Embedded systems.
LO2	To learn Microcomputer interfacing from both a Hardware and Software perspective

List of Experiments:	
1. Arithmetic and logical operation 2. Switch and LED interfacing. 3. 4X4 matrix Keypad interfacing 4. 7 Segment Display Interface 5. Single digit timer using seven segment displays. 6. Temperature measurement. 7. DAC interface. 8. ADC Interface. 9. LCD interface. 10. Stepper motor control. 11. Serial communication using RS232C. 12. Serial Communication using I2C Protocol 13. DC Motor speed control using PWM	
CO	**Course Outcomes**
CO1	Identify the functionality of development boards to implementembedded application.
CO2	Understand basic concepts in the embedded computing systemsarea
CO3	Apply knowledge and demonstrate the various addressing modesand data transfer instructions.
CO4	Analyze assembly language programs; select appropriate assemble into machine a cross assembler utility microcontroller.
CO5	Evaluate assembly language programs and download the machinecode that will provide solutions real-world control problems.

CO/ PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
14. CO1	**15. 3**	**16. 2**	**17. 2**	**18. 3**	**19. 2**	**20. 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**

CORE – V: RFID AND SENSOR NETWORKS

Subject Code	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
							CIA	**External**	**Total**
	5	0	0	I	**4**	**5**	**25**	**75**	**100**
Learning Objectives									
LO1	Understand and designing Radio frequency identification (RFID) systems, middlewarearchitectures for real-world applications.								
LO2	Understanding RFID and related Architectures, RFID Principles and security issues								
LO3	Determine road map for transformation of flexible electronics from foils to textiles								
LO4	Understanding the implementation, challenges and design constraints of WSN								
LO5	Knowing about the MAC layer and routing protocols in WSN								
Prerequisites:									

Unit	Contents	No. of Hours
I	Introduction of RFID, Automatic Identification Systems, A Comparison of Different ID Systems, Components of an RFID System, Differentiation Features of RFID Systems, Transponder Construction Formats, Frequency, Range and Coupling , Active and Passive Transponders, Information Processing in the Transponder , Selection Criteria for RFID Systems, Fundamental Operating Principles.	**15**
II	Frequency Ranges and Radio Licensing Regulations, Coding and Modulation, Data Integrity, Multi-Access Procedures – Anticollision, Security of RFID Systems, Attacks on RFID Systems	**15**
III	Wireless Sensor Networks- Introduction, Challenges and Constraints, Applications, Node Architecture, Operating Systems, Physical Layer	**15**
IV	Medium Access Control: Characteristics of MAC Protocols in Sensor Networks, Contention- Free MAC Protocols, Contention-Based MAC Protocols, Network Layer: Various Routing Protocols.	**15**
V	Security in WSN: Challenges of Security in Wireless Sensor Networks, Security Attacks inSensor Networks, Protocols and Mechanisms for Security, IEEE 802.15.4 and ZigBee Security	**15**
TOTAL		**75**

CO	Course Outcomes
CO1	Students will be familiar with RFID technology, various components involved.
CO2	Getting familiar with various RFID standards, Students learn various Security issuesinvolved in RFID.
CO3	Students learn about Wireless Sensor Networks
CO4	Familiar with WSN protocols routing algorithms.
CO5	Various Security issues involved in Wireless Sensor Networks

Textbooks

➢	RFID Handbook, Klaus Finkenzeller,WILEY & SONS
➢	Fundamentals of Wireless Sensor Networks: theory and practice by Waltenegus Dargie,Christian Poellabauer

Reference Books

1.	RFID and Sensor Networks Architecture, Protocols, Security and integration by YanZhang, Laurence T. Yang, Jining.
2.	Ian F. Akyildiz, and Mehmet Can Vuran, Wireless Sensor Networks, 2010, Wiley,USA.
3.	Wireless Sensor Networks Technology, protocols and applications by KAZEM SOHRABY, DANIEL MINOLI TAIEB ZNATI, JOHN WILEY & SONS, INC Publication.
4.	REILLY, RFID Essentials By Bill Glover, Himanshu Bhatt.
5.	W. Dargie and C. Poellabauer, Fundamentals of Wireless Sensor Networks, 2010,Wiley, USA.
6.	Holger Karl and Andreas Willig, Protocols and Architectures for Wireless SensorNetworks, 2011, Wiley, USA.

NOTE: Latest Edition of Textbooks May be Used

Web Resources

5.	http://www.redbooks.ibm.com/redpapers/pdfs/redp5242.pdf

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

CORE – VI: NETWORK SIMULATOR LAB

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

Learning Objectives

LO1	To study various trace file formats of network simulators.
LO2	To implement and compare various MAC layer and routing protocols.

List of Experiments:

1. Introduction to network simulators used for wireless Ad Hoc and Sensor Networks.
2. Introduction to TCL scripting: demonstration of one small network simulation script.
3. To study various trace file formats of network simulators.
4. To implement and compare various MAC layer protocols.
5. To implement and compare AODV and DSR routing algorithms in MANET
6. To implement DSDV routing algorithms in MANET
7. To implement signal strength based link management routing protocols.
8. To calculate and compare average throughput for various TCP variants
9. To implement and compare various routing protocols for wireless sensor networks

CO	Course Outcomes
CO1	Identify the functionality of development boards to implementembedded application.
CO2	Understand basic concepts in the embedded computing systemsarea
CO3	Apply knowledge and demonstrate the various addressing modesand data transfer instructions.
CO4	Analyze assembly language programs; select appropriate assemble into machine a cross assembler utility microcontroller.
CO5	Evaluate assembly language programs and download the machinecode that will provide solutions real-world control problems.

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
21. CO1	22. 3	23. 2	24. 2	25. 3	26. 2	27. 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**

CORE – VII: ARDUINO AND SENSORS

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

Learning Objectives	
LO1	To understand the interconnection and integration of the physical world and the cyber space
LO2	To design & develop IOT Devices.

Prerequisites:

Unit	Contents	No. of Hours
I	**Introduction to Arduino:** Pin configuration and architecture - Device and platform features - Concept of digital and analog ports - Familiarizing with Arduino Interfacing Board Introduction to Embedded C and Arduino platform - Arduino data types - Variables and constants - Operators - Control Statements - Arrays - Functions.	**15**
II	**Arduino i/o Functions**: Pins Configured as INPUT - Pull-up Resistors - Pins Configured as OUTPUT- pinMode() Function- digitalWrite() Function- analogRead() function-Arduino Interrupts.	**15**
III	**Arduino Displays:** Working with Serial Monitor - Line graph via serial monitor- Interfacing a 8 bit LCD to Arduino - Fixedone line static message display – Running Message display – Using the LCD Library of Arduino.	**15**
IV	**Analog and Digital Sensors:** **Analog Sensors:** Resistance-based sensors Voltage-basedsensors Current-based sensors. **Digital Sensors:** Buttons and switches On/o_ devices I2C devices SPI devices RS-232 devices Other sensors.	**15**
V	**Interfacing Sensors and Actuators:** **Interfacing Sensors:** Button 60 - Analog input 61- I2C 65 -SPI 77 - Other protocols. **Interfacing Actuators:** Switching devices - DC motors - Servos Stepper motors - Analog voltages - Human attention actuators.	**15**
TOTAL		**75**

CO	Course Outcomes
CO1	To understand the concept of Arduino Boards and tools
CO2	To learn input and output function of ATmega Microcontroller
CO3	To understand the knowledge of Display Interfacing with Arduinoboard
CO4	To handle the Analog/Digital sensors application and interfacing
CO5	To learn and understand the connection of motor functions

Textbooks	
➢	Veneri, Giacomo, and Antonio Capasso- Hands-on Industrial Internet of Things:Create a Powerful Industrial IoT Infrastructure Using Industry 4.0, 1stEd., Packt Publishing Ltd, 2018
➢	D. Jude Hemanth and J. Anitha George A. Tsihrintzis- Internet of Medical Things Remote Healthcare Systems and Applications, covered by Scopus.
Reference Books	
1.	Alasdair Gilchrist- Industry 4.0: The Industrial Internet of Things, 1st Ed., Apress,2017.
2.	Reis, Catarina I., and Marisa da Silva Maximiano, eds.- Internet of Things andadvanced application in Healthcare, 1st Ed., IGI Global, 2016.
NOTE: Latest Edition of Textbooks May be Used	
Web Resources	
1.	https://books.google.com/books?id=P-xrzQEACAAJ&dq=arduino+book&hl=en&newbks=1&newbks_redir=0&sa=X&ved=2ahUKEwjd34WU6Jn9AhUM7jgGHdx8Dd0Q6wF6BAgKEAE
2.	https://www.pdfdrive.com/arduino-home-automation-projects-automate-your-home- using-the-powerful-arduino-platform-d182643833.html

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**

CORE – VIII: ARDUINO AND SENSORS LAB

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

Learning Objectives	
LO1	To understand the design and Analysis of a various Communication Circuits

List of Experiments:

1. LED blinking using Arduino
2. Switch interface using Arduino
3. LCD interface using Arduino
4. DC motor speed control using Arduino
5. Servo motor control
6. Trafficlight control with Arduino
7. PWM generation with Arduino
8. LDR with Arduino
9. PIR sensor with Arduino
10. Ultra Sonic sensor with Arduino

11. Temperature and Humidity sensor with Arduino

CO	Course Outcomes
CO1	To be able to design hardware for IoT on different platforms for devices that can be connected to internet
CO2	To be able to design software for IoT nodes and system
CO3	To develop understanding for IoT based system design for different situations
CO4	Recognize the functionality of micro controller, latest version processors and its applications
CO5	Acquire design thinking capability, ability to design a component with realistic constraints, to solve real worldengineering problems and analyse the results.

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	28. 3	29. 2	30. 2	31. 3	32. 2	33. 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

CORE – IX: IMPLEMENTING IOT WITH RASPBERRY PI

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

Learning Objectives	
LO1	to be equipped with a solid theoretical foundation,systematic professional knowledge and strong practical skills in the Raspberry Pi.
LO2	To design and deploy multiple IoT devices that could connect to the gateway.

Prerequisites:

Unit	Contents	No. of Hours
I	Getting Started with Raspberry Pi: Basic functionality of Raspberry Pi B+ board, setting up the board, configuration and use, implications of an operating system on the behavior of the Raspberry Pi as an IoT device, booting Raspberry Pi 3, Downloading an Operating System, format an SD	15

	card and booting the OS, Basics of Linux and its use, main features including navigating the file system and managing processes, text based user interface through the shell, overview of the graphic user interface for Raspian Linux distribution.	
II	Interfacing Hardware with the Raspberry Pi, Raspberry Pi Remote Access, operate the Raspberry Pi in ―headless mode‖, Bash Command line, operating Raspberry Pi without needing a GUI interface. **Basics of the Python programming language**, programming on the Raspberry Pi. Python on Raspberry Pi, Python Programming Environment, Python Expressions, Strings, Functions and Function arguments, Lists, List Methods, Control Flow.	**15**
III	Communication with devices through the pins of the Raspberry Pi, RPi.GPIO library, Python Functions, setting up the pins, General purpose IO Pins, Protocol Pins, GPIO Access, applying digital voltages, and generating Pulse Width Modulated signals, Tkinter Python library, accessing pins through a graphic user interface	**15**
IV	IoT Physical Servers and Cloud Offerings: Introduction to Cloud Storage models and communication APIs. Webserver – Web server for IoT, Cloud for IoT, Python web application framework. Designing a RESTful web API. Connecting to APIs	**15**
V	**IoT Design using Raspberry Pi** IoT Applications based on Pi, LAMP Web-server, GPIO Control over Web Browser, Creating Custom Web Page for LAMP, Communicating data usingon-board module, Home automation using Pi, Node-RED, MQTT Protocol, Using Node-RED Visual Editor on Rpi	**15**
TOTAL		**75**

CO	**Course Outcomes**
CO1	To learn the concept of Basic Concepts of Linux
CO2	To understand Python Programming and libraries
CO3	To apply the knowledge of basic concepts of Mobile Cloud Computing
CO4	To anlyze the development technology for IoT
CO5	To design real time IoT Devices

Textbooks

➢	Simon Monk, ―Programming the Raspberry Pi: Getting Started with Python‖, January2012, McGraw Hill Professional

Reference Books

1.	Eben Upton and Gareth Halfacree, ―Raspberry Pi User Guide‖, August 2016, 4thedition, John Wiley & Sons
2.	Alex Bradbury and Ben Everard, ―Learning Python with Raspberry Pi‖, Feb 2014,JohnWiley & Sons
3.	Michael Margolis, ―Arduino Cookbook‖, First Edition, March 2011, O'Reilly Media,Inc

NOTE: Latest Edition of Textbooks May be Used

Web Resources	
3.	https://www.raspberrypi.org/magpi-issues/Projects_Book_v1.pdf
4.	https://www.pdfdrive.com/arduino-home-automation-projects-automate-your-home- using-the-powerful-arduino-platform-d182643833.html

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

CORE – VIII: RASPBERRY PI LAB

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

Learning Objectives	
LO1	To design and deploy multiple IoT devices that could connect to the gateway.

List of Experiments:

1. Getting started with Raspberry Pi, Install Raspian on your SD card
2. Linux basic commands.
3. Coding simple programs in Python.
4. How to use Python-based IDE (integrated development environments) for theRaspberry Pi and how to trace and debug Python code on the device
5. How to have your Raspberry Pi interact with online services through the use of publicAPIs and SDKs
6. Understanding the connectivity of Raspberry-Pi with IR sensor. Write an application todetect obstacle and notify user using LEDs.
7. Design APP Using MIT App Inventor and Connect to Temperature Sensor

CO	Course Outcomes
CO1	To learn the concept of Basic Concepts of Linux
CO2	To understand Python Programming and libraries
CO3	To apply the knowledge of basic concepts of Mobile Cloud Computing
CO4	To anlyze the development technology for IoT
CO5	To design real time IoT Devices

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	34. 3	35. 2	36. 2	37. 3	38. 2	39. 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**

CORE – XI: NETWORK COMMUNICATION AND SECURITY

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

Learning Objectives	
LO1	To Describe various communications networks and their components, andto
LO2	To Identify the function of a firewall, and how it keeps a computer secure and safe from viruses. Prepare a plan for anti-virus protection

Prerequisites:

Unit	Contents	No. of Hours
I	**Transmission Methods:** Digital Signal Analog Transmission – Baud Rate - Analog Signal Digital Transmission – Parallel & Serial Communication – Asynchronous & Synchronous Communication – Simplex – Half Duplex - Full Duplex – Multiplexing - De-multiplexing - Types of Multiplexing.	15
II	**Network Topologies:** Mesh Topology – Star Topology – Tree Topology – Ring – Bus – Hybrid – Basics of Switching – Router & Routing – Internet Topology – Architecture of an ISP – Logical Types of Topology.	15
III	**Network Protocols:** OSI Model – Physical Layer – Data LinkLayer – Network Layer – Transport Layer – Session Layer – Presentation Layer – Application Layer – Overview of Network Protocols.	15
IV	**LAN Topologies:** Introduction – LAN Hardware – Implementing LAN – Fast LANS - Nonstandard LANS – Extending LANS – Virtual LANS – Token Passing Networks – FDDI – MAN – WAN.	15
V	**Internet access & network security:** Introduction – Dialup Access – Leased lines – DSL - Cable Modems – DTE – DCEInterface – RS-232 & RS-449 Interface – SONET. Network Security: Introduction – Types of Computer Attacks – Firewall – Virtual Private Network-Cryptography.	15
TOTAL		**75**

CO	Course Outcomes
CO1	Identify the components associated with Transmission methods.
CO2	Understand the complete network architecture, Topology andswitching and routing technologies.
CO3	Illustrate the operations of various electronic circuits andtheir applications.
CO4	Demonstrate the variousnetworks protocols and networkmanagement skills
CO5	Evaluate the issues in providing Quality-Of-Service for network multimedia applications such as Internet, telephony& networksecurity

Textbooks

➢	Roberta Bragg, Mark Rhodes-Ousley, Keith Strassberg –Network Security: The Complete Reference‖ July 2017, McGraw Hill Education

Reference Books

1.	Behrouz and Forouzan,(2006), Data Communication and Networking‖, 4th Edition, TMH.

2.	Ajit Pal,(2014), Data Communication and Computer Networks, PHI.
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	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

CORE XIII: PYTHON PROGRAMMING

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	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.

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 nested loops. **Jump Statements:** break, continue and pass statements**.**	**15**
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 contributedto each PSO	**10**	**12**	**10**	**10**	**13**	**10**

CORE XIV: PYTHON PROGRAMMING-LAB

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC10	**0**	**0**	**6**	**V**	**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.
14. Program for File Handling.

TOTAL	**75**

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**

CORE XV: ANDROID APPLICATION DEVELOPMENT

Subject Code	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
							CIA	**External**	**Total**
	0	**0**	**5**	**-**	**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	
1	Wei – Meng Lee, (2012), Beginning Android 4 Application Development, Wiley India Edition.
2	Deital, Android for Programmers-An App-Driven Approach,Second Edition.
NOTE: Latest Edition of Textbooks May be Used	
Web Resources	
1.	http://ai2.appinventor.mit.edu/reference/
2. .	http://appinventor.mit.edu/explore/paint-pot-extended-camera

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 CORE COMPONENTS

OBJECT ORIENTED PROGRAMMING USING C++

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
	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
	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 various computin C++ by incorporating OOPS concepts.
CO5	Develop a program in C++ with the concepts of object oriented programming to solve real-world prob

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

DATA STRUCTURES

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

Learning Objectives

LO1	To become familiar with the various data structures and their applications
LO2	to increase the understanding of basic concepts of the design and use of algorithms

Prerequisites:

Unit	Contents	No. of Hours
I	Introduction and overview: Basic Terminology – Data Structures – Operations - Algorithms: Complexity – Time Space – Algorithmic Notation – Control Structures – Complexity of Algorithms – Notations Arrays: Representation – Operations - Linear Search – Binary Search	12
II	Stack: Representation – Arithmetic expressions: Polish Notation – Recursion: Towers of Hanoi - Queue –Priority Queue - Linked Lists: Introduction – Representation of Linked Lists – Traversing a Linked Lists – Searching a Linked List	12
III	Insertion into a Linked List – Deletion into Linked List – Header Linked Lists – Two-way Lists –Doubly Linked List - Trees : Binary Trees – Representation – Traversal using Recursion – Binary Search Trees	12
IV	Sorting : Bubble Sort Insertion Sort, Selection Sort, Merge Sort, Quick Sort, Heap Sort	12
V	Graph – Graph Theory Terminology –Sequential Representation – Warshalls Algorithm – Shortest Path – Linked Representation - Traversals – Dynamic Programming – All Pairs Shortest Path - Greedy – Knapsack – Back Tracking – 8 Queens	12
TOTAL		**60**

THEORY 100%

CO	Course Outcomes
CO1	Outline the different fundamental concepts of data structures
CO2	Make use of different memory representation for data storage and apply various operations

CO3	Construct an algorithm for different data structure operations.
CO4	Analyse the data structures applications.
CO5	Discover suitable techniques to provide solution for solving the problems.
Textbooks	
➢	Seymour Lipschutz (1986), ―Theory and Problems of Data Structures‖, Tata McGraw- Hill Edition
Reference Books	
1.	E.Horowitz, S.Sahni, S.Rajasekaran (1998), ―Computer Algorithms‖, Galgotia Publications.
2.	Robert Kruse, C.L.Tondo, Bruce Leung, ―Data Structures and Program Design in C‖, Second Edition, Prientice Hall Publications
NOTE: Latest Edition of Textbooks May be Used	
Web Resources	
1.	http://www.cs.sunysb.edu/~skiena/214/lectures/
2.	http://datastructures.itgo.com/graphs/dfsbfs.htm
3.	http://oopweb.com/Algorithms/Documents/PLDS210/VolumeFrames.html
4.	http://discuss.codechef.com/questions/48877/data-structures-and-algorithms
5.	http://code.tutsplus.com/tutorials/algorithms-and-data-structures--cms-20437
6.	ttps://www.tutorialspoint.com/data_structures_algorithms/insertion_sort_algorithm.htm (Unit IV : Insertion Sorting)

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**

PHP SCRIPTING – PRACTICAL

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

Learning Objectives

LO1	To enable the students to understand, analyze and build dynamic webpages using PHP and jQuery with MySql database

Prerequisites:

Unit	Contents	No. of Hours
I	Introduction to PHP : Language Basics : Lexical Structure – Data Types – Variables - Expressions and Operators – Flow – Control statements – Embedding PHP in Web Pages Exercises: 1. Control Structures 2. Working with Forms.	**15**
II	Functions : Defining a function – Variable Scope - Function Parameters – Strings : Encoding and Escaping – Comparing Strings – Manipulating and Searching Strings – Arrays: Single and Multidimensional Arrays – Traversing Arrays – Sorting Exercises: 3. String Manipulations 4. Arrays 5. Functions 6. Sorting	**15**
III	Classes and Objects – Introspection – Serialization – Web Techniques: Processing Forms – Setting Response Headers – Maintaining State : Cookies and Session-Graphics Exercises: 7. Classes and Objects 8. Cookies and Sessions 9. Graphics	**15**
IV	Working with MySQL Database: Select data from a single table – Select data from multiple tables- Performing DML operations Exercises: 10. Working with single table 11. Working with multiple tables	**15**
V	jQuery Fundamentals: Requirements of jQuery- JavaScript Premier – jQuery Core – DOM Selection and Manipulation – Event Handling – HTML Forms and Data – jQuery with PHP Exercises: 12. Event Handling 13. Handling HTML Forms with jQuery	**15**
	TOTAL	**75**

CO	Course Outcomes
CO1	Demonstrate simple programs using PHP and jQuery
CO2	Apply the interface setup, styles & themes for the given application
CO3	Analyze the problem and add necessary user interface components, multimedia components and web data source into the application

CO4	Evaluate the results by implementing the correct techniques on the web form
CO5	Construct web applications with the facilitated components in PHP and jQuery
Textbooks	
➢	Kevin Tatroe, Peter MacIntyre, Rasmus Lerdorf, ―Programming PHP‖, O_Reilly Publications, Third Edition
➢	Joel Murach, Ray Harris (2010), –PHP and MySQL‖, Shroff Publishers & Distributors
➢	Cesar Otero, Rob Lorsen (2012), –Professional jQuery‖, John Wiley Sons & Inc
Reference Books	
1.	W. Jason Gilmore (2010), –Beginning PHP & MySql‖, Apress
2.	Larry Ullman (2008), –PHP 6 and MySQL 5‖, Pearson Education
3.	John Coggeshall (2006), –PHP 5‖, Pearson Education
4.	Michale C. Glass (2004), -Beginning PHP, Apache, MySQL Web Development‖, Wiley DreamTech Press
5.	Robin Nixon (2013), -Learning PHP, MySQL, JavaScript & CSS‖, O_Reilly, 2nd Edition
6.	Jack Franlin (2013), -Beginning jQuery‖, Apress, Springer Science
NOTE: Latest Edition of Textbooks May be Used	
Web Resources	
1.	http://www.w3schools.com/jquery/
2.	http://www.ccc.commnet.edu/faculty/sfreeman/cst%20250/jQueryNotes.pdf
3.	http://www.w3schools.com/php/
4.	http://www.tutorialspoint.com/php/
5.	http://www.tutorialspoint.com/mysql/

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**	**2**	**2**	**3**
CO3	**3**	**2**	**3**	**2**	**2**	**3**
CO4	**3**	**2**	**2**	**2**	**2**	**3**
CO5	**3**	**2**	**2**	**3**	**2**	**2**
Weightage of course contributed toeach PSO	**15**	**11**	**11**	**12**	**11**	**13**

Software Quality Assurance

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

Learning Objectives	
LO1	To enable the students to learn the Concepts and Principles of SQA.
LO2	To learn the principles of SQA and must be able to judge the quality of software.

Prerequisites:

Unit	Contents	No. of Hours
I	Introduction to software quality – Software modeling – Scope of the software quality program – Establishing quality goals – Purpose, quality of goals – SQA planning software – Productivity and documentation.	**12**
II	Software quality assurance plan – Purpose and Scope, Software quality assurance management -Organization – Quality tasks – Responsibilities – Documentation.	**12**
III	Standards, Practices, Conventions and Metrics, Reviews and Audits – Management, Technical - review – Software inspection process – Walk through process – Audit process – Test processes –ISO, CMM compatibility – Problem reporting and corrective action.	**12**
IV	Tools, Techniques and methodologies, Code control, Media control, Supplier control, Records collection, Maintenance and retention, Training and risk management	**12**
V	ISO 9000 model, CMM model, Comparisons, ISO 9000 weaknesses, cmm weaknesses, SPICE –Software process improvement and capability determination.	**12**
TOTAL		**60**

CO	Course Outcomes
CO1	Understand the basics of software quality, modeling, and software qualityassurance planning software.
CO2	Knowledge on software quality assurance plan, quality tasks and documentation.
CO3	Understand the standards, practices, metrics, software inspection process, ISOCMM.
CO4	Understand the tools and techniques in software quality control, maintenance andtraining, risk management.
CO5	Knowledge in software quality standards and standard ISO 9000 model and itsweakness, SPICE.

Textbooks

➢	Mordechai Ben, Meachem and Garry S. Marliss, Software Quality – Producing Practical,Consistent Software, International Thompson Computer Press, 1997
➢	Watt. S. Humphrey, Managing Software Process, Addison Wesley, 1998.

Reference Books

1.	Philip.B.Crosby, Quality is Free: The Art of Making Quality Certain, Mass Market, 1992.

NOTE: Latest Edition of Textbooks May be Used

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**

SOFTWARE PROJECT MANAGEMENT

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

Learning Objectives		
LO1	To define and highlight importance of software project management.	
LO2	To formulate and define the software management metrics & strategy in managing projects	
LO3	Understand to apply software testing techniques in commercial environment	
Unit	**Contents**	**No. of Hours**
I	Introduction to Competencies - Product Development Techniques - Management Skills - Product Development Life Cycle - Software Development Process and models - The SEI CMM - International Organization for Standardization.	**12**
II	Managing Domain Processes - Project Selection Models - Project Portfolio Management - Financial Processes - Selecting a Project Team - Goal and Scope of the Software Project -Project Planning - Creating the Work Breakdown Structure - Approaches to Building a WBS - Project Milestones - Work Packages - Building a WBS for Software.	**12**
III	Tasks and Activities - Software Size and Reuse Estimating - The SEI CMM - Problems and Risks - Cost Estimation - Effort Measures - COCOMO: A Regression Model - COCOMO II - SLIM: A Mathematical Model - Organizational Planning - Project Roles and Skills Needed.	**12**
IV	Project Management Resource Activities - Organizational Form and Structure - Software Development Dependencies - Brainstorming - Scheduling Fundamentals - PERT and CPM - Leveling Resource Assignments - Map the Schedule to a Real Calendar - Critical Chain Scheduling.	**12**
V	Quality: Requirements – The SEI CMM - Guidelines - Challenges - Quality Function Deployment - Building the Software Quality Assurance - Plan - Software Configuration Management: Principles - Requirements - Planning and Organizing - Tools - Benefits - Legal Issues in Software - Case Study	**12**
TOTAL		**60**

CO	**Course Outcomes**
CO1	Understand the principles and concepts of project management
CO2	Knowledge gained to train software project managers
CO3	Apply software project management methodologies.
CO4	Able to create comprehensive project plans
CO5	Evaluate and mitigate risks associated with software development process

Textbooks	
➢	Robert T. Futrell, Donald F. Shafer, Linda I. Safer, –Quality Software Project Management‖, Pearson Education Asia 2002.
Reference Books	
1.	Pankaj Jalote, –Software Project Management in Practice‖, Addison Wesley 2002.
2.	Hughes, —Software Project Management‖, Tata McGraw Hill 2004, 3rd Edition.
NOTE: Latest Edition of Textbooks May be Used	
Web Resources	
1.	NPTEL & MOOC courses titled Software Project Management
2.	www.smartworld.com/notes/software-project-management

MAPPING TABLE						
CO/ PSO	**PSO1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**2**	**1**	**2**	**2**	**2**
CO2	**3**	**1**	**3**	**2**	**2**	**2**
CO3	**2**	**3**	**2**	**3**	**3**	**3**
CO4	**3**	**3**	**2**	**3**	**3**	**2**
CO5	**2**	**2**	**2**	**3**	**3**	**3**
Weightage of course contributed to eachPSO	**13**	**11**	**10**	**13**	**13**	**12**

SOFTWARE ENGINEERING

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
	5	0	0	V	**3**	5	**25**	**75**	**100**

Learning Objectives	
LO1	This paper familiarizes the students about the processes, forms, tasks, techniques and tools involved in Software Engineering
LO2	To use the necessary for software engineering practice.

Prerequisites:

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 - Requireents 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	**15**

	Design - Function Oriented Design.	
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**

THEORY & PROBLEM

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

1.	Roger S. Pressman, ―Software Engineering – A Practioners Approach‖, 5 th Edition, Tata Mc Graw Hill Publication.
2.	Panaj Jalote (2005), ―An Integrated Approach to Software Engineering‖, 3 rd Edition, Narosa Publication.
3.	Thomas T. Baker, ―Writing Software Documentation – A task oriented approach‖, Second Edition, Pearson Education, 2004.
4.	Rajib Mall, ―Fundamentals of Software Engineering‖, Second Edition, Prentice Hall.

NOTE: Latest Edition of Textbooks May be Used

Web Resources

1.	http://www/tutorialspoint.com/software_engineering
2.	http://www.nada.kth.se/lectures/
3.	http://www2.latech.edu/

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 ENGINEERING LAB

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC10	**0**	**0**	**5**	**V**	**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**
	5	**0**	**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 framework, Software measurement validation, Performing SoftwareMeasurementValidation *Empirical investigation*: Principles of Empirical Studies, Planning Experiments, Planning case studies as quasi-experiments, Relevant and Meaningful Studies	**15**
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**
	5	**0**	**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	
	Bertt Lantz, "Machine Learning with R," Packt Publishing, 2013
	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

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**

NETWORK SECURITY

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

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

Learning Objectives		
LO1	To familiarize on the model of network security, Encryption techniques	
LO2	To understand the design concept of cryptography and authentication	
LO3	To develop experiments on algorithm used for security	
LO4	To understand about virus and threats, firewalls, and implementation of Cryptography	
UNIT	**Details**	**No. of Hours**
I	Model of network security – Security attacks, services and attacks – OSI security architecture – Classical encryption techniques – SDES – Block cipher PrinciplesDES – Strength of DES – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – RC4 - Differential and linear cryptanalysis – Placement of encryption function – traffic confidentiality.	15
II	Number Theory – Prime number – Modular arithmetic – Euclid‘s algorithm - Fermet‘s and Euler‘s theorem – Primality – Chinese remainder theorem – Discrete logarithm – Public key cryptography and RSA – Key distribution – Key management – Diffie Hellman key exchange – Elliptic curve cryptography	15
III	Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA - HMAC – CMAC - Digital signature and authentication protocols – DSS.	15
IV	Authentication applications – Kerberos – X.509 Authentication services - E- mail security – IP security - Web security	15
V	Intruder – Intrusion detection system – Virus and related threats – Countermeasures – Firewalls design principles – Trusted systems – Practical implementation of cryptography and security	15
	Total	**75**

Course Outcomes	
Course Outcomes	On completion of this course, students will;
CO1	Understand public-key cryptography, RSA and other public-key cryptosystems such as Diffie-Hellman Key Exchange, ElGamal Cryptosystem.
CO2	Understand the security issues.
CO3	Apply key management and distribution schemes design. User Authentication
CO4	Analyze and design hash and MAC algorithms, and digital signatures. Analyze and design classical encryption techniques and block ciphers.
CO5	Assess Intruders and Intruder Detection mechanisms, Types of Malicious software,

Reference Text :

1. William Stallings, ‒Cryptography & Network Security‖, Pearson Education, Fourth Edition 2010.

References :	
1.	CharlieKaufman,RadiaPerlman,MikeSpeciner,—NetworkSecurity,Privatecommunicationinpublicworld‖,PHISecondEdition,2002
2.	Bruce Schneier, Neils Ferguson, –Practical Cryptography‖, Wiley Dreamtech India Pvt Ltd, First Edition, 2003.
3.	DouglasRSimson—Cryptography–Theoryandpractice‖,CRCPress,FirstEdition,1995
Web Resources	
1.	https://www.javatpoint.com/computer-network-security
2.	https://www.tutorialspoint.com/information_security_cyber_law/network_security.htm
3.	https://www.geeksforgeeks.org/network-security/

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**

MOBILE APPLICATION DEVELOPMENT

Subject Code	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
							CIA	**External**	**Total**
	5	**0**	**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:	**15**

	Texting	
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

1	Wei – Meng Lee, (2012), Beginning Android 4 Application Development, Wiley India Edition.
2	Deital, Android for Programmers-An App-Driven Approach,Second Edition.
3	

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	NATURAL LANGUAGE PROCESSING	**Elect**	4	-	-		3	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 Resources: WorldNet-Frame NetStemmers- POS Tagger-Research Corpora SSAS.	**12**

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.	
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.	

CO3	Use appropriate descriptions, visualizations, and statistics to communicate the problems and their solutions. Use NLP methods to analyse sentiment of a text document.
CO4	Analyze large volume text data generated from a range of real-world applications. Use NLP methods to perform topic modelling.
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.
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

ANALYTICS FOR SERVICE INDUSTRY

Subject Code	Category	L	T	P	S	Credits	Marks		
							CIA	External	Total
	Elect	4	-	-	-	3	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 Data Analysis for Personalized Medicine. Review of Clinical Prediction Models.	**12**
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	
CO	On completion of this course, students will
CO1	Understand and critically apply the concepts and methods of business analytics
CO2	Identify, model and solve decision problems in different settings.
CO3	Interpret results/solutions and identify appropriate courses of action for a given managerial situation whether a problem or an opportunity.
CO4	Create viable solutions to decision making problems.
CO5	Instill a sense of ethical decision-making and a commitment to the long-run welfare of both organizations and the communities they serve.

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

CRYPTOGRAPHY

Subject Code	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Marks**		
							CIA	**External**	**Total**
	Elect	4	-	-	-	3	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**, –*NetworkSecurity*‖, 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

BIG DATA ANALYTICS

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
	Core	4	-	-	-	3	5	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
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 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	12
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
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
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
V	NoSQL Databases : Schema-less Models?: Increasing 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.	12

	Total	**60**
Course Outcomes		
CO	On completion of this course, students will	
1	Work with big data tools and its analysis techniques.	
2	Analyze data by utilizing clustering and classification algorithms.	
3	Learn and apply different mining algorithms and recommendation systems for large volumes of data.	
4	Perform analytics on data streams.	
5	Learn NoSQL databases and management.	
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:

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

S-Strong M-Medium L-Low

INTERNET OF THINGS AND ITS APPLICATIONS

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
										External	**Total**
		Core	Y	-	-	-	3	4	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 Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.	12	C2
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	12	C5

	Smart Cities, Security		
	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**	**Category**	**L**	**T**	**P**	**S**	**Credit**	**Marks**

Code									CIA	External	Total
	Human Computer Interaction	Elective	-	Y	-	V	3	4	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 • Types of Mobile Applications: Widgets, Applications, Games • Mobile Information Architecture, Mobile 2.0, • Mobile Design: Elements of Mobile Design, Tools. - Case Studies	12
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	PO1, PO2

	technologies.	
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	3	4	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**	**Course Objective**

		Hours	
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	-	-	3	4	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	-	-	-	3	4	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	12	CO5

	robots-artificial intelligence in robots-application of robots in material handling-continuous arc welding-spot welding-spray painting-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		
										External	Total
	Computational Intelligence	Elective	4	-	-	-	3	4	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 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	12	C3
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

Subjec	**Subject Name**	**C a r**	**L**	**T**	**P**	**S**	**C**	**r**	**Marks**

t Code									CIA	External	Total
	Grid Computing	Elective	-	Y	-	-	3	4	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
	Trends in Computing	Elective	-	Y	-	-	3	4	25	75	100

Course Objective	
C1	Learning current trends in various computer science and information technology fields.
C2	Learning various fields of Cloud computing, Green computing ,the Edge and Fog computing technology.
C3	To learn about Architecture and Application design of Cloud, Edge & fog computing.
C4	To know computing and to improve security services of computing technologies.
C5	To learn the various Case Studies in Cloud, Edge & fog Computing.

UNIT	Details	No. of Hours
I	**Era of Cloud Computing**: Introduction – Components of Cloud Computing – Cloud Types: Private, Public and Hybrid clouds – Limitations of the Cloud - **Virtualization**: Structure and Mechanisms.	12
II	**Cloud computing Services**: Software as a Service(SaaS) – Platform as a Service(PaaS)- Infrastructure as a Service(IaaS)-Database as a Service (DBaaS)- Recent Trends in cloud computing and Standards-**Data Security in Cloud** – Risks and Challenges with Cloud Data- Security as a Service.	12

III	**Edge Computing:** Edge Computing and Its Essentials: Introduction- Edge Computing Architecture- Advantages and Limitations of Edge Computing Systems- Edge Computing Interfaces and Devices - Edge Analytics: Edge Data Analytics – Potential of Edge Analytics – Architecture of Edge Analytics – Case study	12
IV	**Edge Data storage Security:** Edge-Based Attack Detection and Prevention-Edge Computing Use Cases and Case Studies: Edge Computing High- Potential Use Cases. **Introduction to green computing**–Calculating carbon footprint-**Choosing Green PC path:** A green make over – Buying green computer- Choosing Earth Friendly peripherals	12
V	Fog Computing: Introduction to Fog computing – Architecture - Characteristics - Fog Computing Services – Fog Resource Estimation and Its Challenges-Fog computing on 5G networks – Fog computing Use cases and Case studies.	12
	Total	**60**
Course Outcomes		
CO	On completion of this course, students will	
1	Outline the concepts, applications, benefits and limitations of various computing paradigms.	
2	Classify the computing technologies based on its architecture and infrastructure and identify its strategies.	
3	Examine various cloud services, Security threat exposure within a cloud computing infrastructure.	
4	Asses the problems and solutions involved in various stages of different computing environments.	
5	Discuss the importance of cloud, edge and Fog technology and implement innovative ideas and practices for regulating green IT.	
Text Book		
1	Kailas Jayaswal,Jagannath Kallakurchi,Donald J.Houde,Dr.Devan Shah ― Cloud Computing –Black Book‖ Edition :2020 (UNIT I & II : CHAPTER 1,2,3,9,11)	
2	K. Anitha Kumari G. Sudha Sadasivam D. Dharani M. Niranjanamurthy, –EDGE COMPUTING Fundamentals, Advances and Applications‖, First Edition 2022, CRC Press. (UNIT III & IV : CHAPTER 1, 2 , 3, 4,5,6)	
3	Woody Leonhard and Katherine Murray (2009) ,Green Home Computing for Dummies,Willey Publishing Inc. (UNIT IV : CHAPTER 2 ,5,6,7)	
4	Evangelos Markakis, George Mastorakis, Constandinos X.Mavromoutakis and Evangelos pallis ―Cloud and Fog computing in 5G mobile Networks‖ ,First edition 2017. (UNIT V: CHAPTER 2)	
Reference Books		
1.	RajKumar Buyya, ChristianVecchiola, S.ThamaraiSelvi, (2013), Mastering Cloud Computing,McGraw Hill Education.	
2.	Michael Miller, (2009), Cloud Computing, Pearson Education.	
3.	Shijun Liu Bedir Tekinerdogan Mikio Aoyama Liang-Jie Zhang‖ Edge Computing – EDGE ― 2018.	

4.	FlavioBonomi, Rodolfo Milito, Jiang Zhu, SateeshAddepalli, ―Fog Computing and Its Role in the Internet of Things‖, MCC'12, August 17, 2012, Helsinki, Finland. Copyright 2012.
5	Amir M. Rahmani · Pasi Liljeberg Jürgo-Sören Preden –Fog Computing in the Internet of Things‖Springer,2018. (UNIT V: PART/CHAPTER (1.4,2.5)
Web Resources	
1.	https://static.googleusercontent.com/media/www.google.com/en//green/pdfs/google-green- computing.pdf (Case Study)
2.	http://whatiscloud.com/basic_concepts_and_terminology/cloud
3.	http://www.computerweekly.com/guides/Using-green-computing-for-improving-energy- efficiency

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	-	-	3	4	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 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.	12
II	Introduction, Error correction learning, Memory-based learning,	15

	Hebbian learning, Competitive learning, Boltzmann learning, credit assignment problem, Learning with and without teacher, learning tasks, Memory and Adaptation.	
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 network and its Applications.	PO3, PO8

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	-	-	3	4	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. **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	12
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 project anagement – Ten key factors for project success – Ten metrics for Agile Organizations.	12
	Total	**60**
Course Outcomes		
CO	On completion of this course, students will	
1	Understanding of software design, software technologies and APIs using Agile Management.	
2	Understanding of Agile development and testing techniques.	
3	Understanding about Agile Planning and Execution using Sprint.	

4	Understanding of Agile Management Design, scope , Procurement, managing Time and Cost and Quality Check.
5	Analysing of Agile development and testing techniques.
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. Output devices: Monitor, Printer. Introduction to Operating systems & its features: DOS– UNIX–Windows. Introduction to Programming Languages.	6
II	**Word Processing:** Open, Save and close word document; Editing text – tools, formatting, bullets; Spell Checker - Document formatting – Paragraph alignment, indentation, headers and footers, numbering; printing–Preview, options, merge.	6
III	**Spreadsheets :** Excel–opening, entering text and data, formatting, navigating; Formulas–entering, handling and copying; Charts–creating, formatting and printing, analysis tables, preparation of financial statements, introduction to data analytics.	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 applications in query language (MS–Access).	6
V	**Power point:** Introduction to Power point - Features – Understanding slide typecasting & viewing slides – creating slide shows. Applying special object – including objects & pictures – Slide transition–Animation effects, audio inclusion, 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 and its components	PO1,PO2,PO3,PO6,PO8
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	Peter Norton,―Introduction to Computers‖–Tata Mc Graw-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 approach and concept of Recursion	PO1,PO6
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,	**6**

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

CO 5		M				L

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**
CO 1	S					
CO 2	M	S				
CO 3				S		S
CO 4				S	S	M
CO 5			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 -	6	CO2

	profits and loss - ratio and proportion-partnership-Chainrule.		
III	Time and work - pipes and cisterns - Time and Distance - problems on trains -Boats and streams - simple interest - compound interest - Logarithms - Area-Volume and surfacearea -races and Gamesofskill.	6	CO3
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**
CO 1	S					
CO 2	M	S				
CO 3				S		S
CO 4				S	S	M
CO 5			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-AcquiringTalent	12	C5
	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**
CO 1	S					
CO 2	M	S				
CO 3				S		S
CO 4				S	S	M
CO 5			S			

S-Strong M-Medium L-Low

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
	Advanced Excel	Specific Elective	Y	-	-	-	2	2	25	75	100
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	
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**
CO 1	S					
CO 2	M	S				
CO 3				S		S
CO 4				S	S	M
CO 5			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	6	CO1

	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.		
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 **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.	6	CO2
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	6	CO5

	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.		
	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**	**Credits**	**Inst. Hours**	**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**
CO 1	S					
CO 2	M	S				
CO 3				S		S
CO 4				S	S	M
CO 5			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 - Formulation of Unsupervised Learning Problems-Clustering for unsupervised learning and classification	6	CO3
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	PO4, PO6

	animations	
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**
	Enterprise Resource Planning	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**
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
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 Management (PLM), LAP, Supply chain Management.	6
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, Management, Material Management, Financial Module, CRM and Case Study.	6
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
V	ERP & E-Commerce, Future Directives- in ERP, ERP and Internet, Critical success and failure factors, Integrating ERP into organizational culture. Using ERP tool: either SAP or ORACLE format to case study.	6
	Total	**30**
Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Understand the basic concepts of ERP.	
CO2	Identify different technologies used in ERP	
CO3	Understand and apply the concepts of ERP Manufacturing Perspective and ERP Modules	
CO4	Discuss the benefits of ERP	
CO5	Apply different tools used in ERP	
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_resour	

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

S-Strong M-Medium L-Low

Subject Code	Subject Name	Category	L	T	P	S		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 in robots-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**
CO 1	S					
CO 2	M	S				
CO 3				S		S
CO 4				S	S	M

CO 5			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 oInitialization 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 -	6	CO3

	Arithmetic and Logical Relationships - Discrete-Event Modeling Approaches – Event-Scheduling Approach – Process Interaction Approach.		
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 – 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.	6	CO4
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	
LO1	To have extensive knowledge onOB and the scope of OB.
LO2	To create awareness of Individual Benaviour.
LO3	To enhance the understanding of Group Behaviour
LO4	To know the basics of Organisaitonal Culture and Organisational Structure
LO5	To understand Organisational Change, Conflict and Power

UNIT	**Details**	**No. of Hours**
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
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 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:	6
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
IV	ORGANISATIONAL CULTURE AND STRUCTURE : Concept of culture; Impact (functions and liability); Creating and sustaining culture: Concept of structure, Prevalent organizational	6

	designs: New design options	
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
		30
Course Outcomes	On Completion of the course the students will	
CO1	To define OrganisationalBehaviour, Understand the opportunity through OB.	
CO2	To apply self-awareness, motivation, leadership and learning theories at workplace.	
CO3	To analyze the complexities and solutions of group behaviour.	
CO4	To impact and bring positive change in the culture of the organisaiton.	
CO5	To create a congenial climate in the organization.	
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.	

	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