

**B.sc.,**  
**COMPUTER SCIENCE WITH**  
**COGNITIVE SYSTEM**

**SYLLABUS**

**FROM THE ACADEMIC YEAR**  
**2023 - 2024**

**TAMILNADU STATE COUNCIL FOR HIGHER**  
**EDUCATION, CHENNAI – 600 005**

## **1. Introduction**

### **B.Sc. Computer Science with Cognitive Systems**

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.

<b>LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK GUIDELINES BASED REGULATIONS FOR UNDER GRADUATE PROGRAMME</b>	
<b>Programme:</b>	<b>B.Sc., Computer Science with Cognitive Systems</b>
<b>Programme Code:</b>	
<b>Duration:</b>	<b>3 years [UG]</b>
<b>Programme Outcomes:</b>	<p><b>PO1: Disciplinary knowledge:</b> Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study</p> <p><b>PO2: Communication Skills:</b> 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.</p> <p><b>PO3: Critical thinking:</b> 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.</p> <p><b>PO4: Problem solving: Capacity</b> 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.</p> <p><b>PO5: Analytical reasoning:</b> 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.</p> <p><b>PO6: Research-related skills:</b> 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</p> <p><b>PO7: Cooperation/Team work:</b> Ability to work effectively</p>

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 demonstrating 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.

<b>Programme Specific Outcomes:</b>	<p><b>PSO1:</b> To enable students to apply basic microeconomic, macroeconomic and monetary concepts and theories in real life and decision making.</p> <p><b>PSO 2:</b> To sensitize students to various economic issues related to Development, Growth, International Economics, Sustainable Development and Environment.</p> <p><b>PSO 3:</b> To familiarize students to the concepts and theories related to Finance, Investments and Modern Marketing.</p> <p><b>PSO 4:</b> Evaluate various social and economic problems in the society and develop answer to the problems as global citizens.</p> <p><b>PSO 5:</b> Enhance skills of analytical and critical thinking to analyze effectiveness of economic policies.</p>
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	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
<b>PSO 1</b>	Y	Y	Y	Y	Y	Y	Y	Y
<b>PSO 2</b>	Y	Y	Y	Y	Y	Y	Y	Y
<b>PSO3</b>	Y	Y	Y	Y	Y	Y	Y	Y
<b>PSO 4</b>	Y	Y	Y	Y	Y	Y	Y	Y
<b>PSO 5</b>	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
<b>I</b>	<b>Foundation Course</b> 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.	<ul style="list-style-type: none"> <li>➤ Instill confidence among students</li> <li>➤ Create interest for the subject</li> </ul>
<b>I, II, III, IV</b>	<b>Skill Enhancement papers</b> (Discipline centric / Generic / Entrepreneurial)	<ul style="list-style-type: none"> <li>➤ Industry ready graduates</li> <li>➤ Skilled human resource</li> <li>➤ Students are equipped with essential skills to make them employable</li> </ul>
		<ul style="list-style-type: none"> <li>➤ Training on language and communication skills enable the students gain knowledge and exposure in the competitive world.</li> </ul>
		<ul style="list-style-type: none"> <li>➤ Discipline centric skill will improve the Technical knowhow of solving real life problems.</li> </ul>
<b>III, IV, V &amp; VI</b>	Elective papers	<ul style="list-style-type: none"> <li>➤ Strengthening the domain knowledge</li> <li>➤ Introducing the stakeholders to the State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature</li> <li>➤ Emerging topics in higher education/ industry/ communication network / health sector etc. are introduced with hands-on-training.</li> </ul>



<b>IV</b>	Elective Papers	<ul style="list-style-type: none"> <li>➤ Exposure to industry moulds students into solution providers</li> <li>➤ Generates Industry ready graduates</li> <li>➤ Employment opportunities enhanced</li> </ul>
<b>V Semester</b>	Elective papers	<ul style="list-style-type: none"> <li>➤ Self-learning is enhanced</li> <li>➤ Application of the concept to real situation is conceived resulting in tangible outcome</li> </ul>
<b>VI Semester</b>	Elective papers	<ul style="list-style-type: none"> <li>➤ Enriches the study beyond the course.</li> <li>➤ Developing a research framework and presenting their independent and intellectual ideas effectively.</li> </ul>
<b>Extra Credits: For Advanced Learners / Honors degree</b>		<ul style="list-style-type: none"> <li>➤ To cater to the needs of peer learners / research aspirants</li> </ul>
<b>Skills acquired from the Courses</b>		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill



### Credit Distribution for UG Programmes

[illegible]

**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**

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>No. of Hours</b>
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
		<b>23</b>	<b>30</b>

**Semester-II**

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>No. of Hours</b>
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
		<b>23</b>	<b>30</b>

**Second Year – Semester-III**

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>No. of Hours</b>
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
		<b>22</b>	<b>30</b>

**Semester-IV**

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>No. of Hours</b>
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
		<b>25</b>	<b>30</b>

**Third Year  
Semester-V**

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

**Semester-VI**

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

**Consolidated Semester wise and Component wise Credit distribution**

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

**\*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.**

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

**B.Sc., Computer Science with Cognitive Systems Credit Distribution**

<b>First Year – Semester – I</b>			
<b>Part</b>	<b>List of courses</b>	<b>Credits</b>	<b>No. of Hrs</b>
<b>Part I</b>	Language – Tamil	3	6
<b>Part II</b>	English	3	6
<b>Part-III</b>	<b>Core Course- I</b> IT Cognition and Problem Solving	5	5
	<b>Core Course – II</b> Problem Solving using Advanced Excel – Practical	5	5
	<b>Elective Course I (Generic / Discipline Specific)</b> Choose from Annexure –I	3	4
<b>Part-IV</b>	<b>Skill Enhancement Course SEC-I</b> (NME) Choose from Annexure – II	2	2
	<b>Foundation Course</b> – Office Automation	2	2
<b>TOTAL</b>		<b>23</b>	<b>30</b>
<b>First Year – Semester – II</b>			
<b>Part</b>	<b>List of courses</b>	<b>Credits</b>	<b>No. of Hrs</b>
<b>Part I</b>	Language – Tamil	3	6
<b>Part II</b>	English	3	6
<b>Part III</b>	<b>Core Course III</b> – Programming in C	5	5
	<b>Core Course IV</b> – C Programming Practical	5	5
	<b>Elective Course II (Generic / Discipline Specific)</b> Choose from Annexure –I	3	4
<b>Part IV</b>	<b>Skill Enhancement Course SEC 2</b> (NME) - Choose from Annexure – II	2	2
	<b>Skill Enhancement Course SEC-3</b> (Discipline/Generic specific) Choose from Annexure –II	2	2
<b>TOTAL</b>		<b>23</b>	<b>30</b>

Second Year – Semester – III			
Part	List of Courses	Credits	No. of Hrs
Part I	Language – Tamil	3	6
Part II	English	3	6
	<b>Core Course –V RDBMS using Oracle</b>	5	5
Part III	(Theory & Practical)		
	<b>Core Course –VI Infrastructure Management (Theory &amp; Practical)</b>	5	5
	<b>Elective Course III (Generic / Discipline Specific)</b> Choose from Annexure – I	3	4
Part IV	<b>Skill Enhancement Course SEC 4</b> (Entrepreneurial Skills) Choose from Annexure – II	1	1
	<b>Skill Enhancement Course SEC 5</b> (Discipline / Generic Specific) Choose from Annexure – II	2	2
	EVS	-	1
<b>TOTAL</b>		<b>22</b>	<b>30</b>
Second Year – Semester – IV			
Part	List of Courses	Credits	No. of Hrs
Part I	Language – Tamil	3	6
Part II	English	3	6
Part III	<b>Core Course –VII Industry Module Python Programming and Data Structures</b>	5	5
	<b>Core Course –VIII Python Programming– Lab</b>	5	5
	<b>Elective Course IV (Generic / Discipline Specific)</b> Choose from Annexure – I	3	3
Part IV	<b>Skill Enhancement Course SEC 6 (Generic / Discipline Specific)</b> Choose from Annexure – II	2	2
	<b>Skill Enhancement Course SEC 7 (Generic / Discipline Specific)</b> Choose from Annexure – II	2	2
	EVS	2	1
<b>TOTAL</b>		<b>25</b>	<b>30</b>



Third Year – Semester – V			
Part	List of Courses	Credits	No.of Hours
Part III	<b>Core Course IX</b> Computer Networks	4	5
	<b>Core Course X</b> Computer Networks Lab	4	5
	<b>Core Course XI</b> Client Relationship Management (Theory & Practical)	4	5
	<b>Core Course / Project with Viva Voce CC-XII</b> Project (Individual)	4	5
	<b>Elective Course V (Generic / Discipline Specific)</b> Choose from Annexure – I	3	4
	<b>Elective Course VI (Generic / Discipline Specific)</b> Choose from Annexure – I	3	4
Part IV	Value Education	2	2
	Summer Internship/Industrial Training(Summer Vacation at the end of IV Semester activity)	2	
<b>TOTAL</b>		<b>26</b>	<b>30</b>
Third Year – Semester – VI			
Part	List of Courses	Credits	No. of Hrs
Part III	<b>Core Course XIII</b> Virtualization and Cloud (Theory & Practical)	4	6
	<b>Core Course XIV</b> Intelligent Systems	4	6
	<b>Core Course XV</b> Digital Technologies	4	6
	<b>Elective Course VII (Generic / Discipline Specific)</b> Choose from Annexure – I	3	5
	<b>Elective Course VIII(Generic / Discipline Specific)</b> Choose from Annexure – I	3	5
Part IV	<b>Professional Competency Skill Enhancement Course</b>	2	2
	Extension Activity	1	
<b>TOTAL</b>		<b>21</b>	<b>30</b>
<b>TOTALCREDITS: 140 Credits</b>			

## **Annexure I**

### **Suggested topics in Core component**

1. Java Programming
2. Java Programming Lab
3. Operating Systems
4. Operating Systems Lab
5. Software Engineering
6. Network Security
7. Artificial Neural Network
8. Machine Learning
9. Process Management
10. Mobile Application Development and more..

### **Suggested topics in Elective Course**

#### **Generic Specific**

1. Discrete Mathematics – I
2. Discrete Mathematics-II
3. Statistical Methods and its Application-I
4. Statistical Methods and its Application-II
5. Optimization Techniques
6. Nano Technology
7. Introduction to Linear Algebra
8. Graph Theory and its Application
9. Financial Accounting
10. Cost and Management Accounting
11. Digital Logic Fundamentals
12. Numerical Methods

#### **Elective course – (1- 8)-Discipline Specific**

1. Natural Language Processing
2. Cryptography
3. Big Data Analytics
4. IOT and its Applications
5. Human Computer Interaction
6. Fuzzy Logic
7. Software Project Management

8. Image Processing
9. Information Security
10. Data Mining and Warehousing
11. Grid Computing
12. Cyber Forensics
13. Pattern Recognition
14. Robotics and its applications
15. Agile Project Management and more..

## **Annexure II**

### **Suggested topics in Skill Enhancement(SEC1-SEC8) Course**

#### **Skill Enhancement Course**

1. Fundamentals of Information Technology
2. Understanding Internet
3. Multimedia Lab
4. Web Designing
5. Software Testing
6. PHP Programming
7. Office Automation
8. Quantitative Aptitude
9. Multimedia Systems
10. Biometrics
11. Enterprise Resource Planning
12. Organization Behaviour
13. Simulation and Modeling
14. Virtual Reality
15. Computer Graphics and more..

## **FIRST YEAR – SEMESTER – I**

### **CORE – I: IT COGNITION AND PROBLEM SOLVING**

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC1	5	0	0	I	4	5	25	75	100
LO1	Acquire basic knowledge of cognitive psychology								
LO2	Acquire knowledge of how human cognition works from attention, sensation, perception, action, language processes, problemsolving and thinking to learning and memory								
LO3	Develop a scientific attitude comprising the ability of reflection and logic reasoning								
LO4	Develop an ability of critical thinking including respect for scientific data and ethical values								
LO5	Evaluate the performance of cognitive systems using appropriate metrics and methodologies								
Unit	Contents								No. of Hours
I	Introduction to Cognition: Meaning cognitive processes, Development of cognitive psychology: Structuralism, Functionalism, Behaviorism, Memory Research, Gestalt psychology, Emergence of cognitive psychology, Information Processing, Connectionism, Alternate approaches to cognitive psychology, Research Methods in Cognitive Psychology								15
II	Perceptual Processes: Object Recognition- theories of object recognition, Bottom-Up and Top-Down Processing, Face Perception, Change Blindness. Attention: Divided attention, Selective: Varieties, Subliminal Perception. Visual Perception-Perceptual Organizational -Processes, Multisensory interaction and Integration – Synthesis, Comparing the senses, Perception and Action								15
III	Memory- Working Memory: Research on Working Memory, Factors affecting the capacity of working Memory, Baddeley's Working Memory Approach. Long Term Memory: Encoding and Retrieval in Long Term Memory, Autobiographical Memory. Memory Strategies: Practice, Mnemonics using Imagery, Mnemonics using organization, The Multimodal Approach, Improving Prospective Memory. Meta cognition: Meta memory, TOT, Meta comprehension.								15
IV	Problem Solving, Reasoning and Decision Making: VUCA World Problem Solving– Types of problem, Understanding the problem, Problem-Solving Approaches, Factors that influence Problem Solving, creativity, Reasoning – Inductive and Deductive Reasoning Decision Making – Heuristics in decision making – representativeness, availability and Anchoring and adjustment. The Framing effect, Overconfidence in decisions, The Hindsight Bias.								15

V	Future Skills: Critical thinking, Adaptive thinking, Cognitive Load Management, Design thinking, VirtualCollaboration and Cultural Sensitivity	15
TOTAL		75
CO	Course Outcomes	
CO1	Understand the foundations of computer science	
CO2	Acquire a comprehensive understanding of cognitive systems	
CO3	Apply cognitive techniques to problem-solving	
CO4	Analyze the integrating computer science principles and acquire the skills to design and develop cognitive systems	
CO5	Evaluate and optimize cognitive system performance	
Textbooks		
1.	Matlin M.W. (2003) ‘Cognition’ 5 <sup>th</sup> Edition, Wiley Publication	
2.	Riegler, B.R., Reigler, G.L. (2008), Cognitive Psychology – Applying the Science of Mind. 2 <sup>nd</sup> Edition, Pearson Education.	
Reference Books		
1.	Benjafield J G (2007). ‘Cognition’ 3 <sup>rd</sup> Edition. Oxford University Press	
2.	Goldstein B.E.(2008) ‘Cognitive Psychology’ 2 <sup>nd</sup> Edition, Wadsworth.	
NOTE: Latest Edition of Textbooks May be Used		
Web Resources		
1.	<a href="https://www.engati.com/glossary/cognitive-science">https://www.engati.com/glossary/cognitive-science</a>	
2.	<a href="https://www.psychologicalscience.org/observer/cognition-and-perception-is-there-really-a-distinction">https://www.psychologicalscience.org/observer/cognition-and-perception-is-there-really-a-distinction</a>	
3.	<a href="https://pubmed.ncbi.nlm.nih.gov/9496622/">https://pubmed.ncbi.nlm.nih.gov/9496622/</a>	

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

### FIRST YEAR – SEMESTER – I

#### CORE – II: PROBLEM SOLVING USING ADVANCED EXCEL – PRACTICAL

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC2	0	0	5	I	4	5	25	75	100
Learning Objectives									
LO1	Gain the necessary skills to work with worksheets to perform formula coding and to prepare accurate data Reports								
LO2	Acquire skills to automate tasks using VBA code and reuse the code for other tasks								
LO3	Analyze and interpret data using advanced functions								
LO4	Communicate and present data effectively through clear and concise visualizations.								
LO5	Apply problem-solving skills to real-world scenarios								
List of Exercises									
1. Simple Functions and Formulae 2. Working with Sheets 3. Working with Workbooks 4. Data Analysis 5. Data Visualization 6. Import/ export data 7. User forms 8. Generating Reports Software Essentials: Microsoft office 2019									
TOTAL									75
CO	Course Outcomes								
CO1	Understand the basic functions in worksheets								

CO2	Writing simple function to perform simple tasks
CO3	Creating the user forms
CO4	Applying function in generating reports
CO5	Import and Export Data from different applications

MAPPING TABLE						
CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2	2	2
CO2	3	2	2	2	2	2
CO3	3	2	2	2	3	3
CO4	3	2	2	2	2	3
CO5	3	2	2	3	2	2
Weightage of course contributed to each PSO	15	11	10	11	11	12

### **FIRST YEAR – SEMESTER – II**

#### **CORE - III: PROGRAMMING IN C**

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC3	5	0	0	I	4	5	25	75	100
Learning Objectives									
LO1	To familiarize the students with the understanding of code organization								
LO2	To improve the programming skills								
LO3	Learning the basic programming constructs.								
Prerequisites:									
Unit	Contents								No. of Hours
I	Studying Concepts of Programming Languages- Language Evaluation Criteria - Language design - Language Categories - Implementation Methods – Programming Environments - Overview of C: History of C- Importance of C- Basic Structure of C Programs-Executing a C Program- Constants, Variables and Data types - Operators and Expressions - Managing Input and Output Operations								15
II	Decision Making and Branching: Decision Making and Looping - Arrays - Character Arrays and Strings								15
III	User Defined Functions: Elements of User Defined Functions- Definition of Functions- Return Values and their Types- Function Call- Function Declaration- Categories of Functions- Nesting of Functions-Recursion								15
IV	Structures and Unions: Introduction- Defining a Structure- Declaring Structure Variables Accessing Structure Members- Structure Initialization- Arrays of Structures- Arrays within Structures- Unions- Size of Structures.								15



V	<b>Pointers:</b> Understanding Pointers- Accessing the Address of a Variable- Declaring Pointer Variables- Initializing of Pointer Variables- Accessing a Variable through its Pointer- Chain of Pointers- Pointer Expressions- Pointer and Scale Factor- Pointer and Arrays- Pointers and Character Strings- Array of Pointers- Pointer as Function Arguments- Functions Returning Pointers- Pointers to Functions- <b>File Management in C</b>	<b>15</b>
<b>TOTAL</b>		<b>75</b>
<b>CO</b>	<b>Course Outcomes</b>	
CO1	Outline the fundamental concepts of C programming languages, and its features	
CO2	Demonstrate the programming methodology.	
CO3	Identify suitable programming constructs for problem solving.	
CO4	Select the appropriate data representation, control structures, functions and concepts based on the problem requirement.	
CO5	Evaluate the program performance by fixing the errors.	
<b>Textbooks</b>		
□	Robert W. Sebesta, (2012), —Concepts of Programming Languages, Fourth Edition, Addison Wesley (Unit I : Chapter – 1)	
□	E. Balaguruswamy, (2010), —Programming in ANSI C, Fifth Edition, Tata McGraw Hill Publications	
<b>Reference Books</b>		
1.	Ashok Kamthane, (2009), —Programming with ANSI & Turbo C, Pearson Education	
1.	Byron Gottfried, (2010), —Programming with C, Schaums Outline Series, Tata McGraw Hill Publications	
<b>NOTE: Latest Edition of Textbooks May be Used</b>		
<b>Web Resources</b>		
1.	<a href="http://www.tutorialspoint.com/cprogramming/">http://www.tutorialspoint.com/cprogramming/</a>	
2.	<a href="http://www.cprogramming.com/">http://www.cprogramming.com/</a>	
2.	<a href="http://www.programmingsimplified.com/c-program-examples">http://www.programmingsimplified.com/c-program-examples</a>	
3.	<a href="http://www.programiz.com/c-programming">http://www.programiz.com/c-programming</a>	
4.	<a href="http://www.cs.cf.ac.uk/Dave/C/CE.html">http://www.cs.cf.ac.uk/Dave/C/CE.html</a>	
5.	<a href="http://fresh2refresh.com/c-programming/c-function/">http://fresh2refresh.com/c-programming/c-function/</a>	

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 to each PSO	15	14	11	15	10	10

### **FIRST YEAR – SEMESTER – I**

#### **CORE - IV: C PROGRAMMING PRACTICAL**

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC4	0	0	5	I	4	5	25	75	100
Learning Objectives									
LO1	The Course aims to provide exposure to problem-solving through C programming								
LO2	It aims to train the student to the basic concepts of the C -Programming language								
LO3	Apply different concepts of C language to solve the problem								
Prerequisites:									
Contents									
1. Programs using Input/ Output functions 2. Programs on conditional structures 3. Command Line Arguments 4. Programs using Arrays 5. String Manipulations 6. Programs using Functions 7. Recursive Functions 8. Programs using Pointers 9. Files 10. Programs using Structures & Unions									
CO	Course Outcomes								
CO1	Demonstrate the understanding of syntax and semantics of C programs.								

CO2	Identify the problem and solve using C programming techniques.
CO3	Identify suitable programming constructs for problem solving.
CO4	Analyze various concepts of C language to solve the problem in an efficient way.
CO5	Develop a C program for a given problem and test for its correctness.

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	3	2	2
CO2	3	3	2	3	2	2
CO3	3	3	3	3	2	2
CO4	3	3	2	3	2	2
CO5	3	3	2	3	3	2
<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>14</b>	<b>11</b>	<b>15</b>	<b>11</b>	<b>10</b>

### **SECOND YEAR – SEMESTER – III**

#### **CORE – V: RDBMS USING ORACLE (THEORY & PRACTICAL)**

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC5	3	0	2	III	4	5	25	75	100

#### **Learning Objectives**

<b>LO1</b>	Learn the role and nature of relational database management systems (RDBMS) in today's IT environment, understand need for normalization
<b>LO2</b>	Learn how to convert conceptual data models into relational database schemas using the SQL Data Definition Language (DDL)
<b>LO3</b>	Learn how to Query and manipulate databases using the SQL Data Manipulation Language (DML)
<b>LO4</b>	Acquire Programming and Software Engineering skills and techniques using SQL and PL/SQL
<b>LO5</b>	Learn to create Procedures, Functions, Packages, and Triggers with PL/SQL

Unit	Contents	No. of Hours
I	<b>Database Concepts</b> A Relational approach: Database – Relationships – DBMS – Relational Data Model – Integrity Rules – Theoretical Relational Languages. Database Design: Data Modeling and Normalization: Data Modeling – Dependency – Database Design – Normal forms – Dependency Diagrams – Denormalization – Examples of Normalization	<b>9</b>

II	<b>Oracle9i</b> Overview: Personal Databases – Client/Server Databases – Oracle9i an introduction – SQL *Plus Environment – SQL – Logging into SQL *Plus - SQL *Plus Commands – Errors & Help – Alternate Text Editors - SQL *Plus Worksheet - SQL *Plus. Oracle Tables: DDL: Naming -Rules and conventions – Data Types – Constraints – Creating Oracle Table – Displaying Table Information – Altering an Existing Table – Dropping, Renaming, Truncating Table – Table Types – Spooling – Error codes	9
III	Data Management and Retrieval: DML – adding a new Row / Record – Customized Prompts – Updating and Deleting an Existing Rows / Records – retrieving Data from Table – Arithmetic Operations – restricting Data with WHERE clause – Sorting – Revisiting Substitution Variables – DEFINE command – CASE structure. Functions and Grouping: Built-in functions –Grouping Data. Multiple Tables: Join – Set operations	9
IV	<b>PL/SQL</b> A Programming Language: History – Fundamentals – Block Structure – Comments – Data Types – Other Data Types – Declaration – Assignment operation – Bind variables – Substitution Variables – Printing – Arithmetic Operators. Control Structures and Embedded SQL: Control Structures – Nested Blocks – SQL in PL/SQL – Data Manipulation – Transaction Control statements. PL/SQL Cursors and Exceptions: Cursors – Implicit & Explicit Cursors and Attributes – Cursor FOR loops – SELECT...FOR UPDATE – WHERE CURRENT OF clause – Cursor with Parameters – Cursor Variables – Exceptions – Types of Exceptions.	9
V	<b>PL/SQL Composite Data Types</b> Records – Tables – Varrays, Named Blocks: Procedures Functions – Packages – Triggers – Data Dictionary Views	9
<b>List of Exercises</b>		

	<p>a) Write queries to create the following tables</p> <p>a.i) EMPLOYEE( employee-name, street, city)</p> <p>a.ii) WORKS ( employee-name, company-name,salary)</p> <p>a.iii) COMPANY(company-name,city)</p> <p>MANAGERS ( employee-name, manager-name) Use insert command to add data according to the need of queries.</p> <p>a.iv)</p> <p>b) Find the names of all employees who work for a particular company from the following tables.</p> <p>b.i)EMPLOYEE( employee-name, street, city)</p> <p>b.ii) ii) COMPANY(company-name,city)</p> <p>c) Find the names, street address and city of residence of all employees who work for a</p>	<p><b>30</b></p>
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particular company and earn more than Rs. 2,00,000 per annum. (Nested subquery) from the following tables.

- c.i) EMPLOYEE( employee-name, street, city)
- c.ii) WORKS ( employee-name, company-name,salary)
- c.iii) COMPANY(company-name,city)

d) Find the names of employees who are living in a particular city for a particular company (use group by)

- d.i) EMPLOYEE( employee-name, street, city)
- d.ii) WORKS ( employee-name, company-name,salary)
- d.iii) COMPANY(company-name,city)

e) Find the names of the employees whose salary is greater than the average salary of the particular company (subquery)

- e.i) EMPLOYEE( employee-name, street, city)
- e.ii)WORKS ( employee-name, company-name,salary)

f) Find the total and average salary of each company employees

- f.i) EMPLOYEE( employee-name, street, city)
- f.ii) WORKS ( employee-name, company-name,salary)

### **PL/SQL Block**

- Write a PL/SQL program to insert ten values in a table, check each value is odd or even and insert the output into the table
- Use a cursor to select the five highest paid employees from the emp table.
- Create a master and a transaction table. Write a PL/SQL code to update the master using transaction table.
- Create a package, which consists of two procedures named hire\_employee which will insert new employee details into emp table and another procedure named fire\_employee which will delete an employee details from the database.
- • Write a PL/SQL block to select only those rows where the ordered is 2000 from the item table and update the price to be three times the quantity and set the actual price column of the table to the value in price.

### **Procedures**

- Create a procedure to calculate simple interest. Principal, rate of interest and no. of years are given as input.

### **Functions**

- Create a function that returns the empno of employees working in admin dept.

### **Trigger**

- Create a trigger to update the “Product\_price\_history” table when the price of the product is updated in the “Product” table. Create the “Product” table and “Product\_price\_history” table with the following fields respectively
  - a. Product\_price\_history (product\_id number(5), product\_name varchar2(32), supplier\_name varchar2(32), unit\_price number(7,2) )
  - b. Product (product\_id number(5), product\_name varchar2(32),

	supplier_name varchar2(32), unit_price number(7,2) )	
TOTAL		75
CO	Course Outcomes	
CO1	Define the fundamental elements of database management system. Understanding of normalization theory and extends such knowledge to the normalization of a database	
CO2	Demonstrate about oracle 9i	
CO3	Apply the SQL Commands and PL/SQL to manipulate data	
CO4	Asses the usage of <b>SQL and</b> PL/SQL code constructs	
CO5	Develop the code using Oracle SQL and PL/SQL which includes the use of Procedures, Functions, Packages, and Triggers	
Textbooks		
<input type="checkbox"/>	Nilesh Shah, “Database Systems Using ORACLE”, PHI, 2 <sup>nd</sup> Edition, 2015	
<input type="checkbox"/>	“Fundamentals of Database Management Systems”, Alexis Leon, Mathews Leon, Vijay Nicole Imprints Private Limited. (Unit-III)	
<input type="checkbox"/>	“Database Systems Using Oracle”,Nilesh Shah,2 <sup>nd</sup> edition,PHI.UNIT-IV: Chapters 10 & 11	
Reference Books		
1.	Database Management Systems – Arun Majumdar & Pritimoy, Bhattacharya, 2007, TMH	
2.	Database Management Systems – Gerald V. Post, 3rd edition, TMH	
NOTE: Latest Edition of Textbooks May be Used		
Web Resources		
1.	<a href="https://www.w3schools.com/sql">https://www.w3schools.com/sql</a>	
2.	<a href="https://www.tutorialspoint.com/sql">https://www.tutorialspoint.com/sql</a>	
3.	<a href="https://livesql.oracle.com">https://livesql.oracle.com</a>	

MAPPING TABLE						
CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	3	3	3
CO2	3	3	3	3	3	3
CO3	3	3	3	3	3	3
CO4	3	3	3	3	3	3
CO5	3	3	3	3	3	3

<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>14</b>	<b>14</b>	<b>15</b>	<b>15</b>	<b>15</b>
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### **SECOND YEAR – SEMESTER – III**

#### **CORE – VI: INFRASTRUCTURE MANAGEMENT (THEORY & PRACTICAL)**

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC6	3	0	1	III	4	4	25	75	100

#### **Learning Objectives**

<b>LO1</b>	Learn the installation and configuration process for System Center 2012 R2 Operations Manager standard and Data Center features
<b>LO2</b>	Acquire knowledge on monitor services, devices, and operations for many computers in a single console by showing state, health, and performance information, as well as alerts generated for availability, performance, configuration and security situations

Unit	Contents	No. of Hours
<b>I</b>	<b>Introducing Windows 10</b> Overview of Deploying Windows 10- Configure Devices and Drivers- Perform Post installation Configuration Task- Managing Apps in Window.	<b>9</b>
<b>II</b>	<b>SCCM Basics</b> Overview of System Center 2012 R2 Configuration Manager-Planning and Deploying a StandAlone Primary Site- Planning and Configuring Role-Based Administration- Planning and Deploying a Multiple-Site Hierarchy- Replicating Data and Managing Content in Configuration Manager 2012-Planning Resource Discovery and Client Deployment- Configuring Internet and Cloud-Based Client Management Maintaining and Monitoring System Center 2012 Configuration Manager.	<b>9</b>
<b>III</b>	<b>Overview of System Center 2012 R2 Operations Manager:</b> Operations Manager Introduction and Basic Concepts- Reason to use Operations Manager- What's New in 2012 R2 Operations Manager- System Requirements- Operations Manager Components. Planning & Installation: Deployment Scenarios- Order of Installation- Installation Process- SQL Server Configuration- Operations Console- Web Console.	<b>9</b>
<b>IV</b>	<b>Administration</b> Agent Deployment- Security of manual agent- Agent and Agent less managed systems- Role Based Security- Reporting server- Object Discovery. Management Packs: Management Pack Overview- PreInstalled Management Packs- Importing Management Packs- Overrides.	<b>9</b>
<b>V</b>	<b>Monitoring Overview</b> Overriding of MPs- Creating Rules and Monitors- Agentless Monitoring- Demo on Role Based Security- Creating Groups- Configuring Notifications. Operations Manager Reporting: Installing SQL Reporting Services- Installing Operations Manager	<b>9</b>



	Reporting- Creating, Viewing and Customizing ReportsDashboard- Considerations for High Availability and Disaster Recovery.	
<b>List of Exercises</b>		
	<ul style="list-style-type: none"> <li>Working with SCCM</li> <li>Working with SCOM</li> </ul>	<b>15</b>
<b>TOTAL</b>		<b>60</b>
<b>CO</b>	<b>Course Outcomes</b>	
CO1	Understand the Installation of a new System Center 2012 Operations Manager Management Group	
CO2	Design and provision custom views to relevant support teams	
CO3	Understand how to deploy agents	
CO4	Work with management packs	
CO5	Create dashboards and custom visualizations	

<b>MAPPING TABLE</b>						
<b>CO/ PSO</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>	<b>PSO 6</b>
<b>CO1</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>

### **SECOND YEAR – SEMESTER – IV**

#### **CORE – VII: PYTHON PROGRAMMING AND DATA STRUCTURES**

<b>Subject Code</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>S</b>	<b>Credits</b>	<b>Inst. Hours</b>	<b>Marks</b>		
							<b>CIA</b>	<b>External</b>	<b>Total</b>
<b>CC7</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>IV</b>	<b>4</b>	<b>5</b>	<b>25</b>	<b>75</b>	<b>100</b>
<b>Learning Objectives</b>									
<b>LO1</b>	Acquire problem solving and programming capability using Python								
<b>LO2</b>	Learn how to Master the principles of object-oriented programming and the interplay of algorithms and data structures in well-written modular code.								
<b>Unit</b>	<b>Contents</b>								<b>No. of Hours</b>

I	Python interpreter and interactive mode, Values and types: int, float, Boolean, string, and list, expressions, statements, Tuple assignment, precedence of operators, comments, modules and functions, function definition and use, flow of execution, parameters and arguments.	15
II	Boolean values and operators, conditional statements, Iteration, functions Recursion, Strings: string slices, immutability, string functions and methods	15
III	Lists: list operations, list parameters; Lists as arrays, Tuples: Tuple assignment, tuple as return value, Dictionaries: operations and methods: Advanced list processing. Files, Exception, Modules and Packages.	15
IV	Introduction to algorithms, Analysis of Algorithms using Notations, Arrays, Lists, Stack, Queue, recursion	15
V	Linked List- Divide and Conquer-Merge Sort and Quick Sort- Searching- Linear and Binary Search-Introduction to Trees and Graphs.	15
TOTAL		75
CO	Course Outcomes	
CO1	Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python	
CO2	Express different Decision-Making statements and Functions	
CO3	Interpret Object oriented programming in Python	
CO4	Understand and summarize different File handling operations	
CO5	Provide a comprehensive introduction of common data structures, and algorithm design and analysis	
Textbooks		
□	Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist’’, 2nd edition, Updated for Python 3, Shroff/O’Reilly Publishers, 2016.	
□	Guido van Rossum and Fred L. Drake Jr, “An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.	

<input type="checkbox"/>	Charles Dierbach, “Introduction to Computer Science using Python: A Computational Problem Solving Focus, Wiley India Edition, 2013
<input type="checkbox"/>	John V Guttag, “Introduction to Computation and Programming Using Python”, Revised and expanded Edition, MIT Press, 2013
<input type="checkbox"/>	Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, Data Structures and Algorithms in Python ,Wiley, July 2013

#### Reference Books

1.	Wes Mckinney, (2013), “Python for Data Analysis,” O’reilly Media.
2.	Mark Lutz, (2013), “Learning Python Powerful Object Oriented Programming”, O’reilly Media, 5 th Edition.
3.	Timothy A. Budd, (2011), “Exploring Python”, Tata MCGraw Hill Education Private Limited, First Edition.

**NOTE: Latest Edition of Textbooks May be Used**

#### Web Resources

1.	<a href="http://docs.python.org/3/tutorial/index.html">http://docs.python.org/3/tutorial/index.html</a>
2.	<a href="http://interactivepython.org/courselib/static/pythonds">http://interactivepython.org/courselib/static/pythonds</a>
3.	<a href="http://www.ibiblio.org/g2swap/byteofpython/read/">http://www.ibiblio.org/g2swap/byteofpython/read/</a>
4.	Data Structures and Algorithms in Python, the complete beginners guide, 2019 edition by DS Publishing, ebook Kindle Edition

MAPPING TABLE						
CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	1	2	2	2	2
CO2	2	3	2	3	3	1
CO3	2	2	2	3	3	2
CO4	3	2	1	3	3	2
CO5	3	3	2	3	3	3
Weightage ofcourse contributed to each PSO	13	11	9	14	14	10

### SECOND YEAR – SEMESTER – IV

### CORE – VIII: PYTHON PROGRAMMING--LAB

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks
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							<b>CIA</b>	<b>External</b>	<b>Total</b>
<b>CC8</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>IV</b>	<b>4</b>	<b>4</b>	<b>25</b>	<b>75</b>	<b>100</b>

### Learning Objectives

<b>LO1</b>	Gain knowledge in developing python basic programs
<b>LO2</b>	Learn to implement data structures using python
<b>LO3</b>	Develop graphical user interfaces (GUIs) to create interactive applications.
<b>LO4</b>	Use object-oriented programming (OOP) concepts, such as classes, objects, inheritance, and polymorphism, to develop Python programs.

### List of Exercises

1. Finding Factorial using Looping
2. Fibonacci series using recursion
3. Program using Modules
4. Program for String manipulation
5. Program for Exceptions
6. Find the minimum and maximum of a list of numbers
7. Insertion sort and merge sort
8. First n prime numbers using classes and objects
9. Insert a number in a list of sorted numbers
10. Program to find GCD of two numbers using recursion.
11. Program to sum an array of numbers.
12. Program to find linear search and binary search in an array
13. Program using Tuples
14. Program for list operations such as ; list slices, list methods, list loop, mutability, aliasing, cloning lists
15. Program using Dictionaries and Sets
16. Program to implement Polymorphism and Inheritance
17. Program for drawing histogram
18. Program to find word count in a file
19. Program to copy the content of one file to another file

<b>TOTAL</b>	<b>60</b>
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<b>CO</b>	<b>Course Outcomes</b>
CO1	Understand the fundamental concepts in python
CO2	Acquire programming skills in python.
CO3	Apply the different data structures using python
CO4	Analyze and select proper concepts to execute python script.
CO5	To develop python script to solve the given problems.

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
<b>CO1</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>2</b>

<b>CO2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO4</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>Weightage of course contributed to each PSO</b>	<b>13</b>	<b>10</b>	<b>10</b>	<b>11</b>	<b>10</b>	<b>10</b>

### **THIRD YEAR – SEMESTER – V**

#### **CORE – IX: COMPUTER NETWORKS**

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									
LO	Provide in depth knowledge of the various network layers, network security and client server computing.								
Unit	Contents								No. of Hours
I	Introduction - Network Hardware – Software – OSI Reference Models – Internet– ATM - Physical layer - Transmission media - wireless transmission – switching (circuit switching, packet switching, hybrid switching) methods – Communication Satellites								15
II	Data link layer Design issues – error detection and correction – elementary data link protocols – Sliding window protocols – Data link Layer in the Internet								15
III	Medium Access Layer – Channel Allocation Problem – Multiple Access Protocols – Ethernet – Ethernet Cabling- Manchester Encoding-Ethernet MAC Sublayer Protocol - Wireless LANs								15
IV	Network layer – design issues – Routing algorithms – Congestion control algorithms – Internet Working – IP protocol – IP Address – Internet Control Protocol								15
V	Transport layer – Elements of Transport Protocols – Addressing, Establishing & Releasing A connection – Internet Transport Protocol (TCP) – The application layer-DNS-The domain name system-Electronic mail-the– Cryptography								15
TOTAL								75	
CO	Course Outcomes								
CO1	Understanding of the fundamental concepts of computer networking								

CO2	Provides a overview of the different design issues and functionality of data link layer
CO3	Understand the terminology of Channel Allocation Problem and Ethernet
CO4	Understand and Analyze about IP Addressing, behaviors and limitations of various routing algorithms and protocols
CO5	Learn about Transport Protocol, Email and Cryptography

#### **Textbooks**

□	Andrew.S.Tanenbaum , David J. Wetherall ; Computer Networks, Pearson, 5th Edition, (2014)
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#### **Reference Books**

1.	Achyut Godbole; Data Communication and Networks, TMH; (2007)
2.	Uyless Black; COMPUTER NETWORKS Protocols, Standards, and Interfaces, Second Edition, PHI.
3.	Behrouz A. Forouzan; Data Communications and Networking, Tata McGraw-Hill, Second Edition, (2003)
4.	Pete Loshin; TCP/IP For Everyone, Academic Press, (1995)

**NOTE: Latest Edition of Textbooks May be Used**

#### **Web Resources**

1.	<a href="http://www.tutorialspoint.com/data_communication_computer_network/">http://www.tutorialspoint.com/data_communication_computer_network/</a>
2.	<a href="http://www.slideshare.net/zafar_ayub/data-communication-and-network-11903853">http://www.slideshare.net/zafar_ayub/data-communication-and-network-11903853</a>
3.	<a href="http://freevidelectures.com/Course/2278/Data-Communication">http://freevidelectures.com/Course/2278/Data-Communication</a>
4.	<a href="https://en.wikipedia.org/wiki/Computer_network">https://en.wikipedia.org/wiki/Computer_network</a>
5.	<a href="https://www.tutorialspoint.com/5g/5g_tutorial.pdf">https://www.tutorialspoint.com/5g/5g_tutorial.pdf</a>

<b>MAPPING TABLE</b>						
<b>CO/ PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>
<b>CO1</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO2</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>
<b>CO3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO4</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO5</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>
<b>Weightage of course contributed to each PSO</b>	<b>12</b>	<b>10</b>	<b>9</b>	<b>10</b>	<b>9</b>	<b>10</b>

#### **THIRD YEAR – SEMESTER – V**

**CORE – X: COMPUTER NETWORKS 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									
LO	This course imparts a detailed knowledge on various protocols used in communication, managing, and configuring devices in designing the network.								
List of Exercises									
<ul style="list-style-type: none"><li>• Modes in Switches</li><li>• Switch Authentication</li><li>• Switching in Half-duplex mode</li><li>• Connecting PCs and assigning IP Address</li><li>• Telnet</li><li>• Port Security</li><li>• Virtual LAN (VLAN)</li><li>• VLAN Trunking Protocol (VTP)</li><li>• Spanning Tree Protocol (STP)</li><li>• Static /Dynamic Routing Protocols</li></ul>									
TOTAL								75	
CO	Course Outcomes								
CO1	Design and setup networking environment								
CO2	Understand and apply the networking concepts								
CO3	Apply socket configuration skills to design network a network								
CO4	Implement and evaluate routing protocols for network								
CO5	Gain awareness on configuring internetworking devices to design a network								

<b>MAPPING TABLE</b>						
<b>CO/ PSO</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>	<b>PSO 6</b>

<b>CO1</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO2</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>1</b>
<b>CO3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO4</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>2</b>
<b>CO5</b>	<b>2</b>	<b>3</b>	<b>1</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>Weightage of course contributed to each PSO</b>	<b>11</b>	<b>12</b>	<b>11</b>	<b>14</b>	<b>12</b>	<b>10</b>

### **THIRD YEAR – SEMESTER – V**

#### **CORE – XI: CLIENT RELATIONSHIP MANAGEMENT (THEORY & PRACTICAL)**

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
<b>CC11</b>	<b>4</b>	<b>0</b>	<b>1</b>	<b>V</b>	<b>4</b>	<b>5</b>	<b>25</b>	<b>75</b>	<b>100</b>
<b>Learning Objectives</b>									
<b>LO1</b>	Acquire knowledge about Service Now platform.								
<b>LO2</b>	To get comprehensive knowledge in ITSM principles and architecture.								
<b>LO3</b>	To acquire various features of Service Now platform and tool.								
<b>Unit</b>	<b>Contents</b>								<b>No. of Hours</b>
<b>I</b>	<b>Service Now Intermediate Level</b> Administrator-Service Now Introduction-Service Now Platform UI Service Now ITSM overview Managing Users, Groups and Roles, departments, companies and Assignment Rules-Tables, Columns, Attributes, Dictionary Entries, Schema Map-Managing Forms, Layouts and Lists - Dictionary Overrides and Simple Reference Qualifiers.								<b>12</b>
<b>II</b>	<b>System Properties</b> Incident management - - Problem management- - Change management- Overview of other ITSM Modules - Overview of other ITSM Modules- SLA Basics-Introduction to Client and Server Side Scriptingserver-side scripting - Server Side Glide API -server-side scripting - Server Side Glide API -Server Side script Debugging-Server Side Scripting Best Practices-Business Rules-Client Side APIs-UI Policies and Data Policies-Client Scripts -Client Side script Debugging								<b>12</b>



III	<b>Client Scripts &amp; Client Glide Apis-Best Practices</b> Client-side scripting & policies (UI and Data)-Modularize programming using UI Actions (both Server and Client Side)-Script Include-Glide AJAX-UI Pages and UI Macros-Managing Update SetsCustom Applications Automated Test Framework –Events-Inbound/Out Bound notifications-Mail Templates and Scripts.	<b>12</b>
IV	<b>Manage Workflows</b> Managing Stage Sets -Manage Workflows -Manage Workflows -Flow Designer (Over view)- Service Catalogs, Categories, Items and variables-Manage Execution Plans and workflows-Cart LayoutsClient scripts and UI policies-Record Producers-Order Guides & Scriptable Order Guides-Scheduled Jobs. VTB Agent Intelligence ( Over View)-Restrict access to applications and application modulesAutomatically create application Access Controls -Manually create, test, and debug Access ControlsManaging ServiceNow imports and exports-Managing Import Sets and Transform Map-Configure and run Reports and Dashboards Security Controls-Database Views.	<b>12</b>
V	<b>Service now Service Portals Overview</b> Service Now Service portals core components -Scripting in Service Portal-ITSM Virtual Agent – Overview-Performance Analytics Overview-Service Now on Mobile-Service Now Integration Overview.	<b>12</b>
<b>List of Exercises</b>		
<ul style="list-style-type: none"><li>• Creating tickets for servicing requests from clients</li><li>• Creating reports of status of client service</li></ul>		<b>15</b>
<b>TOTAL</b>		<b>75</b>
<b>CO</b>	<b>Course Outcomes</b>	
CO1	Understand about Service Now Intermediate Level	
CO2	Identify System Properties	
CO3	Use Client Scripts & Client Glide Apis	
CO4	Apply Flows and Workflows for process automation	
CO5	Create users, groups, roles, database structure: tables, records, and fields and various script types usedthroughout the platform	
<b>Textbooks</b>		
<input type="checkbox"/>	Tim Woodruff, “Learning ServiceNow: Administration and development on the Now platform, for powerful IT automation”, 2nd Edition, Packt Publishing Ltd., 2018.	
<input type="checkbox"/>	AshishRudraSrivastava “ServiceNow Cook Book” Packt Publishing Ltd, 2017.	
<input type="checkbox"/>	Andrew Kindred , “Mastering ServiceNow Scripting” Packt Publishing2018.	

Reference Books	
1.	Customer Centricity –Focus on right customer for strategic advantage, by Peter Fader, Wharton Digital Press, 2012
2.	David A. Po-Chedley, “Client Relationship Management: How to Turn Client Relationships into a Competitive Advantage”, 2015
<b>NOTE: Latest Edition of Textbooks May be Used</b>	
Web Resources	
1.	<a href="https://www.servicenow.com/products/it-service-management.html">https://www.servicenow.com/products/it-service-management.html</a>
2.	<a href="https://www.servicenow.com/content/dam/servicenow-assets/public/en-us/doc-type/resourcecenter/data-sheet/ds-itsm.pdf">https://www.servicenow.com/content/dam/servicenow-assets/public/en-us/doc-type/resourcecenter/data-sheet/ds-itsm.pdf</a>
3.	<a href="https://www.guru99.com/servicenow-tutorial.html">https://www.guru99.com/servicenow-tutorial.html</a>

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

### **THIRD YEAR – SEMESTER – VI**

#### **CORE – XIII: VIRTUALIZATION AND CLOUD (THEORY & PRACTICAL)**

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC13	4	0	2	VI	4	6	25	75	100
Learning Objectives									
LO1	Understand basic concepts of distributed computing								
LO2	Understand the basic principles of Cloud Computing, Virtualization and Data centers								

Unit	Contents	No. of Hours
I	<b>Distributed Systems</b> Distribute a system - Distributed algorithm - Distributed Data Stores - Distributed Computing – File Systems - Distributed Messaging - Distributed Applications – Distributed Transaction - Parallel and distributed computing - Applications.	12
II	<b>Cloud Concepts</b> Introduction Cloud Computing - Advantages of Cloud - Public Cloud - five essential characteristics - three service models - Four deployment models - Benefits of Cloud Computing - Cloud Vendors - Traditional Infrastructure setup and Challenges – AWS.	12
III	<b>Virtualization</b> Introduction to vsphere and the Software - Defined Data Center Creating Virtual Machines – vcenter Server - Configuring and Managing - Virtual Networks Configuring and Managing Virtual Storage – Virtual Machine Management - Resource Management and Monitoring.	12
IV	<b>Virtual Machines</b> Vsphere HA - vsphere Fault Tolerance - Protecting Data vsphere DRS - Network Scalability - vsphere Update Manager and Host Maintenance - Storage Scalability - Securing Virtual Machines.	12
V	<b>Datacenter</b> Data center overview -Components - Provisions - Need of Data Center - Data Center Architecture -Different Racks - Data center architecture for cloud computing - role of data center in cloud computing.	12
List of Exercises		
	<ul style="list-style-type: none"><li>Working with hypervisors</li><li>Creating account in AWS</li><li>Exploring AWS services like storage, machine image, pricing models, data bases</li></ul>	30
TOTAL		90
CO	Course Outcomes	
CO1	Recognize the basic concepts of cloud computing	
CO2	Understand about Distributed systems and Cloud Computing	
CO3	Apply the concept of Virtualization and hypervisors in cloud environment	
CO4	Analyze and identify different Cloud Types and Cloud Service Deployment Models (IaaS*, PaaS*,SaaS*)	
CO5	Learn to Create Virtual Machines (VM) using vSphere, Data centers and to work with AWS	
Textbooks		
□	Jean Dollimore formerly of Queen Mary, Tim Kindberg, “Distributed Systems Concepts and Design”, 5 <sup>th</sup> Edition Cambridge University, University of London	
□	VenkataJosyula , Malcolm Orr , Greg Page, “Cloud Computing: Automating the VirtualizedDataCenter”, 1st Edition.	

□	Brian J.S. Chee, Curtis Franklin Jr., “Cloud Computing: Technologies and Strategies of the Ubiquitous Data Center”, 1st Edition.
<b>Reference Books</b>	
1.	Rajkumar Buyya, Christian Vecchiola, S Tamarai Selvi, (2013), “Mastering Cloud Computing”, First Edition, McGraw Hill publications.
2.	Barrie Sosinsky, (2011), “Cloud Computing Bible”, First Edition, Wiley India Private Ltd.
<b>NOTE: Latest Edition of Textbooks May be Used</b>	
<b>Web Resources</b>	
1.	<a href="https://onlinecourses.nptel.ac.in/noc21_cs14/preview">https://onlinecourses.nptel.ac.in/noc21_cs14/preview</a>
2.	<a href="https://www.w3schools.in/cloud-computing/cloud-computing-architecture/">https://www.w3schools.in/cloud-computing/cloud-computing-architecture/</a>
3.	<a href="https://www.javatpoint.com/virtualization-in-cloud-computing">https://www.javatpoint.com/virtualization-in-cloud-computing</a>
4.	<a href="https://www.kaspersky.co.in/resource-center/definitions/what-is-cloud-security">https://www.kaspersky.co.in/resource-center/definitions/what-is-cloud-security</a>
5.	<a href="https://www.tutorialspoint.com/cloud_computing/cloud_computing_applications.htm">https://www.tutorialspoint.com/cloud_computing/cloud_computing_applications.htm</a>

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

**THIRD YEAR – SEMESTER – VI**  
**CORE – XIV: INTELLIGENT SYSTEMS**

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC14	5	0	0	VI	4	5	25	75	100
Learning Objectives									
LO1	To acquire knowledge on various intelligent system techniques and methodologies								
LO2	Learn about Knowledge representation, problem solving, and learning methods in solving engineering problems								
Unit	Contents								No. of Hours
I	Artificial Intelligence: AI problems-AI technique-Problem Search:-Production Systems – Problem Characteristics – Production system characteristics- Heuristic Search techniques: Generate and Test – Hill Climbing – Constraint Satisfaction, Means-end analysis								15
II	Knowledge representation issues: Representations and mappings – Approaches to Knowledge representations –Frame problem –. Using Predicate Logic: Representing simple facts in logic-Representing Instance and ISA relationships – Computable functions and predicates – Resolution								15
III	Representing knowledge using rules: Procedural Vs Declarative knowledge – Logic programming – Forward Vs Backward reasoning – Matching – Control knowledge. Knowledge representation summary: Syntactic and Semantic spectrum of representation-Logic and slot – and-filler structures-Other representational techniques								15
IV	Rule-based expert systems: Introduction- Rules as a knowledge representation technique- players- Structure- Forward chaining and backward chaining inference techniques- Fuzzy expert systems: Introduction- Fuzzy sets- Linguistic variables and hedges- Operations - Fuzzy rules- - Building a fuzzy expert system								15
V	Artificial neural networks: Neuron- perceptron- Multilayer neural networks- - The Hopfield network- Robotics: Introduction-Robot hardware-Perception-Moving- Robotic software architecture.								15
TOTAL								75	
CO	Course Outcomes								
CO1	Outline the applicability, strength and weakness of artificial intelligence in solving computational problems								
CO2	Demonstrate the role of knowledge representation, problem solving and learning in Intelligent-system engineering								
CO3	Identify the characteristics of AI, Knowledge representation, Experts systems and its variants with ANN and robotics.								
CO4	Analyze a comprehensive background in both software and hardware to work with the future of robotics and adaptive systems								
CO5	Assess the scientific background through various real time examples								
Textbooks									

<input type="checkbox"/>	Elaine rich and Kelvin Knight, “Artificial Intelligence “, Tata McGraw hill Publication, 3rd Edition, 2009. [Unit - I,II,III] Unit I : Chapters 1, 2, 3 Unit II : Chapters 4, 5 Unit III : Chapters 6, 11
<input type="checkbox"/>	Artificial Intelligence: A Guide to Intelligent Systems, 3rd edition, Michael Negnevitsky, Addison Wesley, 2011.[Unit IV-Chapter 1,2,4,V-Chapter 6]
<input type="checkbox"/>	Artificial Intelligence a modern Approach “– Stuart Russell & Peter Norvig, 3 <sup>rd</sup> Edition Pearson Education[Unit V-Chapter 25-Robotics]

#### Reference Books

1.	“Artificial Intelligence a modern Approach “– Stuart Russell & Peter Norvig, 3 <sup>rd</sup> Edition, Pearson Education
2.	“Artificial Intelligence “, George F Luger , 4th Edition , Pearsons Education Publ, 2002.
3.	“Foundations of Artificial Intelligent And Expert Systems”, V S Janaki Raman, K Sarukesi, P Gopalakrishnan, Macmillan India Limited

**NOTE: Latest Edition of Textbooks May be Used**

#### Web Resources

1	<a href="https://www.techopedia.com/definition/190/artificial-intelligence-ai">https://www.techopedia.com/definition/190/artificial-intelligence-ai</a>
2	<a href="https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligent_systems.htm">https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligent_systems.htm</a>
3	<a href="https://data-flair.training/blogs/heuristic-search-ai/">https://data-flair.training/blogs/heuristic-search-ai/</a>
4	<a href="http://teaching.csse.uwa.edu.au/units/CITS7212/Lectures/Students/Fuzzy.pdf">http://teaching.csse.uwa.edu.au/units/CITS7212/Lectures/Students/Fuzzy.pdf</a>
5	<a href="http://engineering.nyu.edu/mechatronics/smart/pdf/Intro2Robotics.pdf">http://engineering.nyu.edu/mechatronics/smart/pdf/Intro2Robotics.pdf</a>

#### MAPPING TABLE

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	1	2	1	2
CO2	3	3	2	2	3	3
CO3	3	3	2	3	3	2
CO4	3	2	3	2	2	3
CO5	3	2	2	2	3	3
Weightage of course contributed to each PSO	15	12	10	11	12	13

**THIRD YEAR – SEMESTER – VI**  
**CORE XV – DIGITAL TECHNOLOGIES**

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC15	5	0	0	VI	4	5	25	75	100
Learning Objectives									
LO1	Understand about cloud , big data and digital marketing								
LO2	Apply digital technology for industries								
LO3	Understand the principles of Automatix and Bots								
LO4	Knowledge about Automation Anywhere								
Unit	Contents								No. of Hours
I	<b>Digital Primer</b> Why is Digital Different?- Digital Metaphors On Cloud 9-A Small Intro to Big Data-Social Media & Digital Marketing-Artificial Intelligence- Unchain the Block chain-Internet of Everything-Immersive Technology.								15
II	<b>Digital for Industries</b> Manufacturing and Hi-tech-Banking and Financial Services Insurance and Healthcare-Retail-Travel & Hospitality Communications, Media & Information Services-Government.								15
III	<b>Automatix</b> Art of RPA-Introduction – Setting the Context-RPA Prelude-RPA Demystified-RPA vs BPM RPA Implementations-RPA in Industries-RPA Tools-Automatix – Art of RPA								15
IV	<b>Automation Anywhere</b> Getting Started with AA Enterprise - Exploring AA Enterprise-AA Enterprise – Architecture.								15
V	<b>Knowing Bots</b> More about Task Bots-AA Enterprise – All about Recorders-Designers-MetaBots-Cognitive RPA.								15
TOTAL								75	
CO	Course Outcomes								
CO1	Understand the concepts of cloud, big data and digital marketing								
CO2	Identify the principles of Artificial Intelligence and Block chain technology								
CO3	Use of Digital technology in various Industries								
CO4	Analyze the use of Automatix, Automation Anywhere and Bots in Cognitive Systems								
CO5	Assess the implementation of different digital technologies in Industry								
Textbooks									
□	Richard Murdoch, “Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become an RPA Consultant”								

□	Kelly Wibbenmeyer, “The Simple Implementation Guide to Robotic Process Automation (RPA): How to Best Implement RPA in an Organization”
<b>Reference Books</b>	
1.	"Digital Systems: Principles and Applications" Ronald J. Tocci, Neal S. Widmer, and Gregory L. Moss, 2th Edition, Pearson, 2016
2.	"Designing Bots: Creating Conversational Experiences" Amir Shevat, O'Reilly Media, 2017
<b>NOTE: Latest Edition of Textbooks May be Used</b>	
<b>Web Resources</b>	
1	<a href="https://en.wikipedia.org/wiki/Robotic_process_automation">https://en.wikipedia.org/wiki/Robotic_process_automation</a>
2	<a href="https://en.wikipedia.org/wiki/Automatix_(software)">https://en.wikipedia.org/wiki/Automatix_(software)</a>
3	<a href="https://www.automationanywhereuniversity.com/">https://www.automationanywhereuniversity.com/</a>
4	<a href="https://www.automationanywhere.com/in/products/iq-bot">https://www.automationanywhere.com/in/products/iq-bot</a>

<b>MAPPING TABLE</b>						
<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>
<b>CO1</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>2</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>
<b>CO3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO4</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO5</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>
<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>12</b>	<b>11</b>	<b>11</b>	<b>12</b>	<b>12</b>

### **SUGGESTED TOPICS IN CORE COMPONENT**

#### **JAVA PROGRAMMING**

<b>Subject Code</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>S</b>	<b>Credits</b>	<b>Inst. Hours</b>	<b>Marks</b>		
							<b>CIA</b>	<b>External</b>	<b>Total</b>
<b>CC</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>-</b>	<b>4</b>	<b>5</b>	<b>25</b>	<b>75</b>	<b>100</b>



Learning Objectives		
LO1	To enable the students to learn the basic concepts of Java programming	
LO2	To use class and objects to create applications	
LO3	To have an overview of interfaces, packages, multithreading and exceptions.	
Unit	Contents	No. of Hours
I	Fundamentals of Object- Oriented Programming: Introduction – Object Oriented Paradigm – Concepts of Object – Oriented Programming – Benefits of OOP – Evolution: Java History- Java Features - Differs from C and C++ - Overview of Java Language: Java Program- Structure – Tokens – Java Statements – Java Virtual Machine – Command Line Arguments	15
II	Constants, variables and Data Types – Operators and Expressions – Decision making and Branching – Looping – Arrays, Strings and vectors.	15
III	Classes objects and methods: Introduction – Defining a class – Method Declaration –Constructors - Method Overloading – Static Members – Nesting of methods – Inheritance – Overriding – Final variables and methods – Abstract methods and classes	15
IV	Multiple Inheritance: Defining Interfaces – Extending Interfaces – Implementing Interfaces – Packages: Creating Packages – Accessing Packages – Using a Package – Managing Errors and Exceptions - Multithreaded Programming – Applets – Graphics Programming	15
V	Layout Managers - JDBC – Java Servlet: - Servlet Environment Role – Servlet API – Servlet Life Cycle – Servlet Context – HTTP Support – HTML to Servlet Communication	15
TOTAL		75
CO	Course Outcomes	
CO1	Outline the basic terminologies of OOP, programming language techniques, JDBC and Internet programming concepts	
CO2	Solve problems using basic constructs, mechanisms, techniques and technologies of Java	
CO3	Analyse and explain the behaviour of simple programs involving different techniques such as Inheritance, Packages, Interfaces, Exception Handling and Thread and technologies such as JDBC, Applets and Servlets	
CO4	Assess various problem-solving strategies involved in Java to develop a high-level application.	
CO5	Design GUI based JDBC applications and able to develop Servlets using suitable OOP concepts and techniques	
Textbooks		

□	E Balagurusamy, “Programming with Java”, Tata McGraw Hill Edition India Private Ltd, 4th Edition
□	C Xavier, “Java Programming – A Practical Approach”, Tata McGraw Hill Edition Private Ltd.

#### Reference Books

1.	P.Naughton and H.Schildt (1999), “Java 2 The Complete Reference”, TMH, 3rd Edition.
2.	Jaison Hunder & William Crawford (2002), “Java Servlet Programming”, O'Reilly
3.	Jim Keogh (2002), “J2EE: The Complete Reference”, Tata McGraw Hill Edition

**NOTE: Latest Edition of Textbooks May be Used**

#### Web Resources

1.	<a href="http://javabeginnerstutorial.com/core-java/">http://javabeginnerstutorial.com/core-java/</a>
2.	<a href="http://www.tutorialspoint.com/java/">http://www.tutorialspoint.com/java/</a>
3.	<a href="http://beginnersbook.com/java-tutorial-for-beginners-with-examples/">http://beginnersbook.com/java-tutorial-for-beginners-with-examples/</a>
4.	<a href="http://www.homeandlearn.co.uk/java/java.html">http://www.homeandlearn.co.uk/java/java.html</a>
5.	<a href="http://www.journaldev.com/1877/servlet-tutorial-java">http://www.journaldev.com/1877/servlet-tutorial-java</a> (Unit V : Servlet API)

#### MAPPING TABLE

CO/ PSO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	2	2
CO2	3	2	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 each PSO	13	12	10	13	13	12

#### JAVA PROGRAMMING LAB

Subject	L	T	P	S	Credits	Inst.	Marks
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Code						Hours	CIA	External	Total
CC	0	0	5	-	4	5	25	75	100
<b>Learning Objectives</b>									
<b>LO1</b>	To implement programs using Classes and Objects								
<b>LO2</b>	To design and develop applications using different Java programming language techniques, JDBC, applets and Servlets.								
	<b>LIST OF EXERCISES</b>								
	1. Simple Programs, Command Line Arguments 2. Arrays 3. Strings, Vectors 4. Classes and Objects 5. Abstract classes 6. Interfaces 7. Inheritance 8. Packages 9. Exception Handling 10. Threads 11. Using JDBC 12. Applets 13. Working with Graphics using Applets. 14. Servlets 15. HTML to Servlet								
	<b>TOTAL</b>								<b>75</b>
<b>CO</b>	<b>Course Outcomes</b>								
CO1	Identify and explain the way of solving the simple problems								
CO2	Use appropriate software development environment to write, compile and run object-oriented Java programs								

CO3	Analyze the application development requirements and identify the necessary building blocks and mechanisms of Java needed to build the application
CO4	Test for defects and validate a Java program with different inputs
CO5	Design, develop and compile Core Java , GUI , JDBC and servlet applications that utilize OOP concepts

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

## OPERATING SYSTEMS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC	5	0	0	-	4	5	25	75	100
Learning Objectives									
LO1	This course provides the basic operating system structure, process management, synchronization and CPU scheduling								
LO2	The course is designed to cover deadlock, memory management, virtual memory, file concepts and user authentication.								
Unit	Contents								No. of Hours
I	Introduction: What Operating Systems Do - Operating System operations. Operating System Structures: Operating System Services - User and Operating System Interface - System Calls - System Programs - Operating System Design and Implementation - Operating System Debugging - Operating System Generation - Types of System Calls								15

II	Process Management: Process Concept - Process Scheduling - Operations on Processes. Threads: Overview - Multicore Programming - Multithreading Models. Process Synchronization: Synchronization Hardware - Mutex Locks - Semaphores. CPU Scheduling: Basic Concepts - Scheduling Criteria - Scheduling Algorithms - Thread Scheduling	15
III	Deadlock: System Model - Deadlock Characterization - Methods for Handling Deadlocks - Deadlock Prevention- Deadlock Avoidance- Deadlock Detection- Recovery from Deadlock. Memory Management: Address Binding –Dynamic Loading and Linking- Logical and Physical Address Space-swapping-Contiguous Allocation- Internal & External Fragmentation. Non-Contiguous Allocation: Paging-Implementation-Hardware-Protection-Sharing—structure of page table-Segmentation	15
IV	Virtual Memory: Demand Paging-Page Replacement-Page Replacement Algorithms-Thrashing	15
V	File System: File Concepts-Access Methods -Directory Structures -Protection Consistency Semantics File System Structures– Allocation Methods-Free Space Management. System, Security: Security Problems –Program Threats – System and Network Threats – User Authentication	15
TOTAL		75
CO	Course Outcomes	
CO1	Recognize the basic concepts of operating system	
CO2	Understand the process and thread concepts	
CO3	Distinguish the concepts of deadlocks and memory management in operating system concepts	
CO4	Discusses about virtual memory, paging and thrashing	
CO5	Apply various file system concepts, allocation methods and authentication	
Textbooks		
□	Silberschatz, Galvin, Gagne; Operating System Concepts , John Wiley Private Limited, 9 <sup>th</sup> Edition,2012	
□	Silberschatz, Galvin, Gagne; Operating System Concepts , John Wiley Private Limited, 10 <sup>th</sup> Edition 2017	
Reference Books		
1.	Milan Milenkovic (2003), “Operating System Concepts and Design”, McGraw Hill	
2.	Andrew S. Tanenbaum, (2001), “Modern Operating Systems”, 2 <sup>nd</sup> Edition, Prentice Hall of India	
3.	Deital and Deital (1990), “Introduction to Operating System”, Pearson Education	

4.	William Stallings (1997), “Operating Systems”, Prentice Hall of India
<b>NOTE: Latest Edition of Textbooks May be Used</b>	
<b>Web Resources</b>	
1.	<a href="http://www.tutorialspoint.com/operating_system/">http://www.tutorialspoint.com/operating_system/</a>
2.	<a href="http://www.reallylinux.com/docs/files.shtml">http://www.reallylinux.com/docs/files.shtml</a>
3.	<a href="http://www.tutorialspoint.com/operating_system/os_linux.htm">http://www.tutorialspoint.com/operating_system/os_linux.htm</a>
4.	<a href="http://www.ics.uci.edu/~ics143/lectures.html">http://www.ics.uci.edu/~ics143/lectures.html</a>

<b>MAPPING TABLE</b>						
<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>
<b>CO1</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>2</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>
<b>CO3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO4</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>
<b>CO5</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>
<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>12</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>

## OPERATING SYSTEMS LAB

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC	0	0	5	-	4	5	25	75	100
Learning Objectives									
LO1	Provide skills on installation of client / server windows in Virtual machine								
LO2	Equip the students to perform file, role, storage, partitioning management operations in the operating system								
List of Exercises									

1. Installation of client windows 10 in Virtual machine
2. Installation of Windows server 2016 in Virtual machine
3. Add roles and features
4. Disk Partitioning in MBR and GPT
5. Server Backup
6. Configuring Active Directory domain service
7. Configuring, managing and installation of DNS
8. Configuring, managing and installation of DHCP
9. IIS Configuration and Deployment
10. Mapping network drive

#### Software Essentials: OS – Windows/Linux

TOTAL		75
CO	Course Outcomes	
CO1	Understand the installation of client / server windows in virtual machine	
CO2	Illustrate adding roles and features in OS Server	
CO3	Apply disk partitioning and backup operations in OS Server	
CO4	Configuring, managing and installation of DNS	
CO5	Configuring Active Directory domain service	
Textbooks		
<input type="checkbox"/>	William PanekTylor Wentworth, “Microsoft Windows 10 Administration”, Wiley Publishing, 2010 (check the latest version)	
<input type="checkbox"/>	William PanekTylor Wentworth, “Microsoft Windows server 2012 R2 ”, Wiley Publishing, (check the latest version)	
Reference Books		
1.	Mitch Tulloch, “Windows 7 Essential Guidance”, 2009	
2.	Charles Edge, Chris Barker EhrenSchwiebert, “Beginning MacOSX Snow Leopard Server”, 2010	
3.	Greg Tomsho, “Guide to Operating System”, 5 <sup>th</sup> Edition, 2017	

MAPPING TABLE						
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

<b>CO5</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>14</b>	<b>11</b>	<b>15</b>	<b>15</b>	<b>10</b>

## SOFTWARE ENGINEERING

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
<b>CC</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>-</b>	<b>4</b>	<b>5</b>	<b>25</b>	<b>75</b>	<b>100</b>
<b>Learning Objectives</b>									
<b>LO1</b>	To introduce the software development life cycles								
<b>LO2</b>	To introduce concepts related to structured and objected oriented analysis & design								
<b>LO3</b>	To provide an insight into cost estimation								
<b>LO4</b>	Learn to write test cases using different testing techniques.								
<b>LO5</b>	The students should be able to specify software requirements and design the software using tools								
<b>Unit</b>	<b>Contents</b>							<b>No. of Hours</b>	
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.							<b>15</b>	
II	Software Requirements Analysis and Specifications: Requirements Engineering - Type of Requirements - Feasibility Studies – Requirements Elicitation - Requirements Analysis - Requirements Documentation - Requirements Validation							<b>15</b>	
III	Software Project Planning: Size Estimation - Cost Estimation - The Constructive Cost Model (COCOMO) - COCOMO II - The Putnam Resource Allocation Model - Software Risk Management - Software Design: Definition - Modularity - Strategy of Design - Function Oriented Design.							<b>15</b>	



IV	Software Testing: A Strategic Approach to Software Testing - Terminologies -Functional Testing - Structural Testing - Levels of Testing - Validation Testing - Testing Tools.	15
V	Software Reliability: Basic Concepts - Software Quality - McCall Software Quality Model - Boehm Software Quality Model - Capability Maturity Model - Software Maintenance: Definition - Process - Models - Configuration Management -Documentation.	15
TOTAL		75
CO	Course Outcomes	
CO1	Define the basic terminologies involved in the entire software developmental life cycle	
CO2	Identify suitable models, techniques and tools for the development of a software product	
CO3	Apply software engineering perspective through requirements analysis, software design and construction, verification, and validation to develop solutions to modern problems	
CO4	Compare and contrast different process, cost, quality models and testing techniques	
CO5	Estimate the project cost using suitable cost estimation models, rate the software risks and evaluate management strategies for effective software development	
Textbooks		
<input type="checkbox"/>	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.	Thomas T. Baker, “Writing Software Documentation – A task oriented approach”, Second Edition, Pearson Education, 2004.	
3.	Pankaj Jalote (2005), “An Integrated Approach to Software Engineering”, 3 rd Edition, Narosa Publication	
NOTE: Latest Edition of Textbooks May be Used		
Web Resources		
1.	<a href="http://www.tutorialspoint.com/software_engineering">http://www.tutorialspoint.com/software_engineering</a>	

### MAPPING TABLE

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

### NETWORK SECURITY

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
CC	Network Security	CORE	5	-	-	-	4	5	25	75	100
<b>Course Objectives</b>											
CO1	To familiarize on the model of network security, Encryption techniques										
CO2	To understand the design concept of cryptography and authentication										
CO3	To develop experiments on algorithm used for security										
CO4	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	
	<b>Total</b>	<b>75</b>	
<b>Course Outcomes</b>			
<b>Course Outcomes</b>	On completion of this course, students will;		
<b>CO1</b>	Understand public-key cryptography, RSA and other public-key cryptosystems such as Diffie-Hellman Key Exchange, ElGamal Cryptosystem.		

<b>CO2</b>	Understand the security issues.	
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<b>CO3</b>	Apply key management and distribution schemes design. User Authentication	
<b>CO4</b>	Analyze and design hash and MAC algorithms, and digital signatures. Analyze and design classical encryption techniques and block ciphers.	
<b>CO5</b>	Assess Intruders and Intruder Detection mechanisms, Types of Malicious software,	

**Reference Text :**

1.	William Stallings, “Cryptography & Network Security”, Pearson Education, Fourth Edition 2010.
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**References :**

1.	CharlieKaufman,RadiaPerlman,MikeSpeciner,“NetworkSecurity,P rivatecommunicationinpublicworld”,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.	<a href="https://www.javatpoint.com/computer-network-security">https://www.javatpoint.com/computer-network-security</a>
2.	<a href="https://www.tutorialspoint.com/information_security_cyber_law/network_security.htm">https://www.tutorialspoint.com/information_security_cyber_law/network_security.htm</a>
3.	<a href="https://www.geeksforgeeks.org/network-security/">https://www.geeksforgeeks.org/network-security/</a>

										CIA	External	Total
CC	Artificial Neural Networks	Core	-	Y	-	-	4	5		25	75	100
<b>Course Objective</b>												
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, Hebbian learning, Competitive learning, Boltzmann learning, credit assignment problem, Learning with and without teacher, learning tasks, Memory and Adaptation.	15
III	.Single layer Perception: Introduction, Pattern Recognition, Linear classifier, Simple perception, Perception learning algorithm, Modified Perception learning algorithm, Adaptive linear combiner, Continuous perception, Learning in continuous perception. Limitation of Perception.	12
IV	Multi-Layer Perception Networks: Introduction, MLP with 2 hidden layers, Simple layer of a MLP, Delta learning rule of the output layer, Multilayer feed forward neural network with continuous perceptions, Generalized delta learning rule, Back propagation algorithm	12
V	Deep learning- Introduction- Neuro architectures building blocks for the DL techniques, Deep Learning and Neocognitron, Deep Convolutional Neural Networks, Recurrent Neural Networks (RNN), feature extraction, Deep Belief Networks, Restricted Boltzman Machines, Training of DNN and Applications	12
	<b>Total</b>	<b>60</b>
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
<b>Text Book</b>		
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.	
<b>Reference Books</b>		
1.	Artificial Neural Networks-B. Yegnanarayana, PHI, New Delhi 1998.	
<b>Web Resources</b>		
1.	<a href="https://www.w3schools.com/ai/ai_neural_networks.asp">https://www.w3schools.com/ai/ai_neural_networks.asp</a>	
2.	<a href="https://en.wikipedia.org/wiki/Artificial_neural_network">https://en.wikipedia.org/wiki/Artificial_neural_network</a>	
3.	<a href="https://link.springer.com/chapter/10.1007/978-3-642-21004-4_12">https://link.springer.com/chapter/10.1007/978-3-642-21004-4_12</a>	

<b>MAPPING TABLE</b>						
<b>CO/ PSO</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>	<b>PSO 6</b>
<b>CO1</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>14</b>	<b>11</b>	<b>15</b>	<b>15</b>	<b>10</b>

## MACHINE LEARNING

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
	5	0	0	-	4	5	25	75	100
<b>Learning Objectives</b>									
<b>LO1</b>	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	<b>Introduction:</b> Machine Learning – Examples of Machine Learning Applications. <b>Supervised Learning:</b> 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. <b>Bayesian Decision Theory:</b> Introduction – Classification – Losses and Risks – Discriminant Functions – Association Rules.	15
II	<b>Parametric Methods:</b> Maximum Likelihood Estimation – Evaluating an Estimator: Bias and Variance – The Bayes’ Estimator – Parametric Classification – Regression – Tuning Model Complexity: Bias/Variance Dilemma – Model Selection Procedures. <b>Nonparametric Methods:</b> Nonparametric Density Estimation – Generalization to Multivariate Data – Nonparametric Classification – Condensed Nearest Neighbor – Distance-Based Classification – Outlier Detection – Nonparametric Regression: Smoothing Models	15
III	<b>Linear Discrimination</b> – Generalizing the Linear Model – Geometry of the Linear Discriminant – Pairwise Separation – Gradient Descent – Logistic Discrimination – Discrimination by Regression – Learning to Rank. <b>Multilayer Perceptrons:</b> The Perceptron – Training a Perceptron – Learning Boolean Functions – Multilayer Perceptrons – MLP as a Universal Approximator – Backpropagation Algorithm	15
IV	<b>Combining Multiple Learners:</b> 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	<b>Machine Learning with Python:</b> 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.	<b>15</b>
<b>TOTAL</b>		<b>75</b>
<b>CO</b>	<b>Course Outcomes</b>	
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	
<b>Textbooks</b>		
□	Ethem Alpaydın, “Introduction to Machine Learning” Third Edition, MIT, 2014. (Unit I – Unit IV) <a href="https://www.tutorialspoint.com/machine_learning_with_python/machine_learning_with_python_tutorial.pdf">https://www.tutorialspoint.com/machine_learning_with_python/machine_learning_with_python_tutorial.pdf</a> ( <b>Unit V:</b> Machine learning with python tutorial)	
<b>Reference Books</b>		
	1. Bertt Lantz, "Machine Learning with R," Packt Publishing, 2013	
	2. Jason Bell, "Machine Learning: Hands-On for Developers and Technical Professionals," Wiley Publication, 2015.	
<b>NOTE: Latest Edition of Textbooks May be Used</b>		
<b>Web Resources</b>		
	1. <a href="https://www.expertsystem.com/machine-learning-definition/">https://www.expertsystem.com/machine-learning-definition/</a>	
	2. <a href="https://searchenterpriseai.techtarget.com/definition/machine-learning-ML">https://searchenterpriseai.techtarget.com/definition/machine-learning-ML</a>	



MAPPING TABLE						
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 to each PSO	15	14	11	15	15	10

### PROCESS MANAGEMENT

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Process Management	Core	5	-	-	-	4	5	25	75	100
Course Objective											
C1	Understand the concept of a business process, its components, and its role in achieving organizational goals										
C2	Identify process improvement opportunities										
C3	Learn techniques for analyzing and modeling business processes										
C4	Explore various process improvement methodologies										
C5	Develop skills in designing and implementing process changes to enhance efficiency, productivity, and customer satisfaction										
UNIT	Details						No. of Hours		Course Objective		

I	<b>Software And Software Engineering</b> The Nature of Software –The Unique Nature of WebApps-Software Engineering- Software ProcessSoftware Engineering Practice-Software Myths. Software Process Model: A Generic Process ModelProcess Assessment and Improvement – Perspective Process Models-Specialized Process Model-The Unified Process.	12	C1
II	<b>Agile</b> Agile Methodology-Manifesto-Principles of Agile-Agile Methodologies-Challenges with Agile. Scrum: Overview of Scrum-Scrum Roles-Scrum Ceremonies-Scrum Artifacts-Extreme programming vs Scrum.	12	C2
III	<b>Devops</b>	12	C3

	Introduction to Devops-Principles-Automation-Performance Measurement through KPIS and Metrics-Agile and Devops-Agile Infrastructure- Velocity-Lean Startup UPS.		
IV	<b>Lean Ux and Agile Anti-Patterns</b> Sprint -Staggered sprints -Sprint zero and design sprints- Dual-track Agile- Listening to Scrum’s rhythms- Listening to Scrum’s rhythms- Participation- Design is a team sport- Coordinating multiple Lean UX teams- Managing up and out – Agile anti-patterns.	12	C4
V	<b>DesignThinking</b> Introduction to Design Thinking – Lean thinking - Actionable Strategy- The Problem with Complexity - Vision and Strategy - Defining Actionable Strategy Act to Learn - Leading Teams to Win.	12	C5
	<b>Total</b>	<b>60</b>	
<b>Course Outcomes</b>		<b>Programme Outcomes</b>	
CO	On completion of this course, students will		
1	Gives basic understanding of software development practices and process models	PO1	
2	Understand Agile development and testing in Scrum	PO1, PO2	
3	Differentiate Devops and Agile principles	PO4, PO6	
4	Usage of Lean UX, Sprint and Scrum	PO4, PO5, PO6	
5	Usage of design thinking principles for software development	PO3, PO8	
<b>Text Book</b>			
1	Roger S Pressman, “Software Engineering A Practioners Approach”, 7 <sup>th</sup> Edition 2010		
2	KalloriVikraman, “Introduction to Devops”, 1 <sup>st</sup> Edition, 2016		
3	Stephen Haunts, “Essential of Scrum” Addison-Wesley Professional; 1 <sup>st</sup> Edition, 2012		
<b>Reference Books</b>			

1.	Jeff Gothelf, Josh Seiden, “Lean UX”, 2nd Edition, 2016
2.	Jonny Schneider, “Understanding Design Thinking, Lean, and Agile” O’Reilly Media 2017
3.	Jeff Gothelf , "Lean vs. Agile vs. Design Thinking”, Sense and Respond Press,2017.
<b>Web Resources</b>	
1.	<a href="https://www.tutorialspoint.com/sdlc/sdlc_overview.htm">https://www.tutorialspoint.com/sdlc/sdlc_overview.htm</a>
2	<a href="https://existek.com/blog/sdlc-models/">https://existek.com/blog/sdlc-models/</a>
3	<a href="https://www.agilealliance.org/agile101/">https://www.agilealliance.org/agile101/</a>

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

### MOBILE APPLICATION DEVELOPMENT

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC	5	0	0	-	4	5	25	75	100
<b>Learning Objectives</b>									
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. <b>Designing User Interface:</b> Label Text - TextView – Password Text Box - Button –ImageButton – CheckBox – Image - RadioButton – Slider – Autocomplete text View.	15
II	User Interface: Spinner – Switch – Side Bar- ListView - List Picker - Image Picker - Notifier - Time and Date Picker - Web Viewer	15
III	Media: Camcorder - Camera – Player – Speech Recognizer – Text to Speech – Video Player - Canvas	15
IV	Maps: Maps - Sensor: Location Sensor – Barcode Scanner Social components: Contact Picker – Email Picker – Phone Number Picker – Phone Call - Social: Texting	15
V	Storage: Cloud DB – Tiny DB – Experimental – Fire DB	15
TOTAL		75
CO	Course Outcomes	
CO1	Chart the requirements needed for developing android application	
CO2	Identify the results by executing the application in emulator or in android device	
CO3	Apply proper interface setup, styles & themes, storing and management	
CO4	Analyze the problem and add necessary user interface components, graphics and multimedia components into the application.	
CO5	Evaluate the results by implementing the concept behind the problem with proper code.	
Textbooks		
□	Karen Lang and Selim Tezel, (2022), Become an App Inventor The official guide from MIT App Inventor, Miteen Press, Walker Books Limited.	
Reference Books		

	Wei – Meng Lee, (2012), Beginning Android 4 Application Development, Wiley India Edition.
	Deital, Android for Programmers-An App-Driven Approach,Second Edition.
<b>NOTE: Latest Edition of Textbooks May be Used</b>	
<b>Web Resources</b>	
	<a href="http://ai2.appinventor.mit.edu/reference/">http://ai2.appinventor.mit.edu/reference/</a>
	<a href="http://appinventor.mit.edu/explore/paint-pot-extended-camera">http://appinventor.mit.edu/explore/paint-pot-extended-camera</a>

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
<b>CO 1</b>	M	S	M	M		L		M
<b>CO 2</b>	M	M	L			M		
<b>CO 3</b>	M		S	M	M			
<b>CO 4</b>	M	M	M		L		L	

## ANNEXURE I

### Elective course – (EC1-EC8)-Discipline Specific Syllabus

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	<b>NATURAL LANGUAGE PROCESSING</b>	<b>Elect</b>	4	-	-		3	25	75	100
<b>Learning Objectives</b>										
<b>LO1</b>	To understand approaches to syntax and semantics in NLP.									
<b>LO2</b>	To learn natural language processing and to learn how to apply basic algorithms in this field.									

<b>LO3</b>	To understand approaches to discourse, generation, dialogue and summarization within NLP.	
<b>LO4</b>	To get acquainted with the algorithmic description of the main language levels: morphology, syntax, semantics, pragmatics etc.	
<b>LO5</b>	To understand current methods for statistical approaches to machine translation.	
<b>UNIT</b>	<b>Contents</b>	<b>No. Of. Hours</b>
I	<b>Introduction :</b> 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.	<b>12</b>
II	<b>Word level and Syntactic Analysis:</b> 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.	<b>12</b>
III	<b>Semantic analysis and Discourse Processing:</b> Semantic Analysis: Meaning Representation-Lexical Semantics- Ambiguity-Word Sense Disambiguation. Discourse Processing: cohesion-Reference Resolution-Discourse Coherence and Structure.	<b>12</b>
IV	<b>Natural Language Generation:</b> 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.	<b>12</b>
V	<b>Information retrieval and lexical resources:</b> 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.	<b>12</b>
<b>Course Outcomes</b>		<b>Programme Outcomes</b>
CO	On completion of this course, students will	
CO1	Describe the fundamental concepts and techniques of natural language processing.  Explain the advantages and disadvantages of different NLP technologies and their applicability in different business situations.	PO1, PO2, PO3, PO4, PO5, PO6

CO2	Distinguish among the various techniques, taking into account the assumptions, strengths, and weaknesses of each  Use NLP technologies to explore and gain a broad understanding of text data.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Use appropriate descriptions, visualizations, and statistics to communicate the problems and their solutions.  Use NLP methods to analyse sentiment of a text document.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Analyze large volume text data generated from a range of real-world applications.  Use NLP methods to perform topic modelling.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Develop robotic process automation to manage business processes and to increase and monitor their efficiency and effectiveness.  Determine the framework in which artificial intelligence and the Internet of things may function, including interactions with people, enterprise functions, and environments.	PO1, PO2, PO3, PO4, PO5, PO6
Textbooks		
1	Daniel Jurafsky, James H. Martin, “Speech & language processing”, Pearson publications.	
2	Allen, James. Natural language understanding. Pearson, 1995.	
Reference Books		
1.	Pierre M. Nugues, “An Introduction to Language Processing with Perl and Prolog”,Springer	
Web Resources		
1.	<a href="https://en.wikipedia.org/wiki/Natural_language_processing">https://en.wikipedia.org/wiki/Natural_language_processing</a>	
2.	<a href="https://www.techtarget.com/searchenterpriseai/definition/natural-language-processing-NLP">https://www.techtarget.com/searchenterpriseai/definition/natural-language-processing-NLP</a>	



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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	Exter nal	Total
	CRYPTOGRAPHY	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.								15	
II	Classical Encryption Techniques: Symmetric cipher model – Substitution Techniques: Caesar Cipher – Monoalphabetic cipher – Play fair cipher – Poly Alphabetic Cipher – Transposition techniques – Stenography								15	
III	Block Cipher and DES: Block Cipher Principles – DES – The Strength of DES –RSA: The RSA algorithm.								15	
IV	Network Security Practices: IP Security overview - IP Security architecture – Authentication Header. Web Security: SecureSocket Layer and Transport Layer Security – Secure Electronic Transaction.								15	
V	Intruders – Malicious software – Firewalls.								15	
TOTAL HOURS								75		
Course Outcomes								Programme Outcomes		

CO	On completion of this course, students will	
CO1	Analyze the vulnerabilities in any computing system and hence be able to design a security solution.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Apply the different cryptographic operations of symmetric cryptographic algorithms	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Apply the different cryptographic operations of public key cryptography	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Apply the various Authentication schemes to simulate different applications.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Understand various Security practices and System security standards	PO1, PO2, PO3, PO4, PO5, PO6
Textbooks		
1	William Stallings, “Cryptography and Network Security Principles andPractices”.	
Reference Books		
1.	Behrouz A. Foruzan, “Cryptography and Network Security”, Tata McGraw-Hill, 2007.	
2	AtulKahate, “Cryptography and Network Security”, Second Edition, 2003,TMH.	
3	M.V. Arun Kumar, “Network Security”, 2011, First Edition,USP.	
Web Resources		
1	<a href="https://www.tutorialspoint.com/cryptography/">https://www.tutorialspoint.com/cryptography/</a>	
2	<a href="https://gpgtools.tenderapp.com/kb/how-to/introduction-to-cryptography">https://gpgtools.tenderapp.com/kb/how-to/introduction-to-cryptography</a>	

### 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

<b>CO 5</b>	3	2	3	3	3	3
<b>Weightage of course contributed to each PSO</b>	14	13	15	12	14	14

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	<b>Big Data Analytics</b>	Core	4	-	-	-	3	5	25	75	100
<b>Course Objective</b>											
C1	Understand the Big Data Platform and its Use cases, Map Reduce Jobs										
C2	To identify and understand the basics of cluster and decision tree										
C3	To study about the Association Rules, Recommendation System										
C4	To learn about the concept of stream										
C5	Understand the concepts of NoSQL Databases										
UNIT	Details							No. of Hours	Course Objective		
I	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	C1		

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

V	NoSQL Databases : Schema-less Models?: Increasing 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	C5
	<b>Total</b>	<b>60</b>	
<b>Course Outcomes</b>		<b>Programme Outcomes</b>	
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	
<b>Text Book</b>			
1	AnandRajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.		
<b>Reference Books</b>			
1.	David Loshin, “Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph”, Morgan Kaufmann/Elsevier Publishers, 2013		
2.	EMC Education Services, “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, Wiley publishers, 2015.		
<b>Web Resources</b>			
1.	<a href="https://www.simplilearn.com">https://www.simplilearn.com</a>		
2.	<a href="https://www.sas.com/en_us/insights/analytics/big-data-analytics.html">https://www.sas.com/en_us/insights/analytics/big-data-analytics.html</a>		

**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
	<b>IoT and its Applications</b>	Core	Y	-	-	-	3	4	25	75	100
<b>Course Objective</b>											
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 Smart Cities, Security	12	C5
	<b>Total</b>	<b>60</b>	
<b>Course Outcomes</b>		<b>Programme Outcomes</b>	
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	
<b>Text Book</b>			
1	Vijay Madisetti and Arshdeep Bahga, “Internet of Things: (A Hands-on Approach)”, Universities Press (INDIA) Private Limited 2014, 1st Edition.		
<b>Reference Books</b>			
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
<b>Web Resources</b>	
1.	<a href="https://www.simplilearn.com">https://www.simplilearn.com</a>
2.	<a href="https://www.javatpoint.com">https://www.javatpoint.com</a>
3.	<a href="https://www.w3schools.com">https://www.w3schools.com</a>

### 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
EC	Human Computer Interaction	Elective	-	Y	-	V	3	4	25	75	100
<b>Course Objective</b>											
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	<b>FOUNDATIONS OF HCI :</b> <ul style="list-style-type: none"> <li>• The Human: I/O channels – Memory</li> <li>• Reasoning and problem solving; The Computer: Devices – Memory – processing and networks;</li> <li>• Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms. - Case Studies</li> </ul>	12
II	<b>DESIGN &amp; SOFTWARE PROCESS:</b> <ul style="list-style-type: none"> <li>• Interactive Design:</li> <li>• Basics – process – scenarios</li> <li>• Navigation: screen design Iteration and prototyping.</li> <li>• HCI in software process:</li> <li>• Software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules: principles, standards, guidelines, rules. Evaluation Techniques – Universal Design</li> </ul>	12
III	<b>MODELS AND THEORIES:</b> <ul style="list-style-type: none"> <li>• HCI Models : Cognitive models:- Socio-Organizational issues and stakeholder requirements Communication and collaboration models-Hypertext, Multimedia and WWW.</li> </ul>	12
IV	<b>Mobile HCI:</b> <ul style="list-style-type: none"> <li>• Mobile Ecosystem: Platforms, Application frameworks</li> <li>• Types of Mobile Applications: Widgets, Applications, Games</li> <li>• Mobile Information Architecture, Mobile 2.0,</li> <li>• Mobile Design: Elements of Mobile Design, Tools. - Case Studies</li> </ul>	12

V	<b>WEB INTERFACE DESIGN:</b> Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow - Case Studies	12
	<b>Total</b>	<b>60</b>
<b>Course Outcomes</b>		<b>Programme Outcome</b>
CO	On completion of this course, students will	
1	Understand the fundamentals of HCI.	PO1
2	Understand the design and software process technologies.	PO1, PO2
3	Understand HCI models and theories.	PO4, PO6
4	Understand Mobile Ecosystem, types of Mobile Applications, mobile Architecture and design.	PO4, PO5, PO6
5	Understand the various types of Web Interface Design.	PO3, PO8
<b>Text Book</b>		
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)	
<b>Reference Books</b>		
1.	Shneiderman, “Designing the User Interface: Strategies for Effective Human-Computer Interaction”, V Edition, Pearson Education.	
<b>Web Resources</b>		
1.	<a href="https://www.interaction-design.org/literature/topics/human-computer-interaction">https://www.interaction-design.org/literature/topics/human-computer-interaction</a>	
2.	<a href="https://link.springer.com/10.1007/978-0-387-39940-9_192">https://link.springer.com/10.1007/978-0-387-39940-9_192</a>	
3.	<a href="https://en.wikipedia.org/wiki/Human%E2%80%93computer_interaction">https://en.wikipedia.org/wiki/Human%E2%80%93computer_interaction</a>	

#### Mapping with Programme Outcomes:

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>
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<b>CO 1</b>	<b>S</b>							
<b>CO 2</b>	<b>S</b>	<b>S</b>						
<b>CO 3</b>				<b>S</b>		<b>S</b>		
<b>CO 4</b>				<b>S</b>	<b>S</b>	<b>S</b>		
<b>CO 5</b>			<b>S</b>					<b>S</b>

**S-Strong    M-Medium    L-Low**

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
EC	<b>Fuzzy Logic</b>	Elective	Y	-	-	V	3	4	25	75	100
<b>Course Objective</b>											
CO1	To understand the basic concept of Fuzzy logic										
CO2	To learn the various operations on relation properties										
CO3	To study about the membership functions										
CO4	To learn about the Defuzzification and Fuzzy Rule-Based System										
CO5	To learn the concepts of Applications of Fuzzy Logic										
UNIT	Details							No. of Hours	Course Objective		
I	Introduction to Fuzzy Logic- Fuzzy Sets- Fuzzy Set Operations, Properties of Fuzzy Sets, Classical and Fuzzy Relations: Introduction-Cartesian Product of Relation-Classical Relations-Cardinality of Crisp Relation.							12	C1		
II	Operations on Crisp Relation-Properties of Crisp Relations-Composition Fuzzy Relations, Cardinality of Fuzzy Relations-Operations on Fuzzy Relations-Properties of Fuzzy Relations-Fuzzy Cartesian Product and Composition-Tolerance and Equivalence Relations							12	C2		

	,Crisp Relation.		
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
	<b>Total</b>		
<b>Course Outcomes</b>		<b>Programme Outcomes</b>	
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 use the 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	
<b>Text Book</b>			

1	S. N. Sivanandam, S. Sumathi and S. N. Deepa-Introduction to Fuzzy Logic using MATLAB, Springer-Verlag Berlin Heidelberg 2007.
<b>Reference Books</b>	
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
<b>Web Resources</b>	
1.	<a href="https://www.javatpoint.com/fuzzy-logic">https://www.javatpoint.com/fuzzy-logic</a>
2.	<a href="https://www.guru99.com/what-is-fuzzy-logic.html">https://www.guru99.com/what-is-fuzzy-logic.html</a>

#### 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 Name	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
SOFTWARE PROJECT MANAGEMENT	4	0	0	-	3	4	25	75	100
<b>Learning Objectives</b>									
<b>LO1</b>	To define and highlight importance of software project management.								
<b>LO2</b>	To formulate and define the software management metrics & strategy in managing projects								
<b>LO3</b>									
<b>LO4</b>	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.
<b>NOTE: Latest Edition of Textbooks May be Used</b>	
<b>Web Resources</b>	
1.	NPTEL & MOOC courses titled Software Project Management
2.	<a href="http://www.smartworld.com/notes/software-project-management">www.smartworld.com/notes/software-project-management</a>

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

<b>Subject Code</b>	<b>Subject Name</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>S</b>	<b>Credits</b>	<b>Inst. Hours</b>	<b>Marks</b>		
									<b>CIA</b>	<b>External</b>	<b>Total</b>
	<b>Image Processing</b>	Elective	-	Y	-	-	3	4	25	75	100
<b>Course Objective</b>											
C1	To learn fundamentals of digital image processing.										
C2	To learn about various 2D Image transformations										
C3	To learn about various image enhancement processing methods and filters										
C4	To learn about various classification of Image segmentation techniques										
C5	To learn about various image compression techniques										
<b>UNIT</b>	<b>Details</b>										<b>No. of Hours</b>



I	<b>Digital Image Fundamentals:</b> Image representation - Basic relationship between pixels, Elements of DIP system -Applications of Digital Image Processing - 2D Systems - Classification of 2D Systems - Mathematical Morphology- Structuring Elements- Morphological Image Processing - 2D Convolution - 2D Convolution Through Graphical Method -2D Convolution Through Matrix Analysis	12
II	2D Image transforms: Properties of 2D-DFT - Walsh transform - Hadamard transform- Haar transform- Discrete Cosine Transform- Karhunen-Loeve Transform -Singular Value Decomposition	12
III	Image Enhancement: Spatial domain methods- Point processing- Intensity transformations - Histogram processing- Spatial filtering- smoothing filter- Sharpening filters - Frequency domain methods: low pass filtering, high pass Filtering- Homomorphic filter.	12
IV	Image segmentation: Classification of Image segmentation techniques - Region approach – Clustering techniques - Segmentation based on thresholding - Edge based segmentation - Classification of edges- Edge detection - Hough transform- Active contour.	12
V	Image Compression: Need for compression -Redundancy- Classification of image- Compression schemes- Huffman coding- Arithmetic coding- Dictionary based compression -Transform based compression,	12
	<b>Total</b>	<b>60</b>
<b>Course Outcomes</b>		<b>Programme Outcome</b>
CO	On completion of this course, students will	
1	Understand the fundamental concepts of digital image processing.	PO1
2	Understand various 2D Image transformations	PO1, PO2
3	Understand image enhancement processing techniques and filters	PO4, PO6
4	Understand the classification of Image segmentation techniques	PO4, PO5, PO6
5	Understand various image compression techniques	PO3, PO8
<b>Text Book</b>		

**Mapping with  
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me  
Outcomes:**

1	S Jayaraman, S Esakkirajan, T Veerakumar, Digital image processing ,Tata McGraw Hill, 2015
2	Gonzalez Rafel C, Digital Image Processing, Pearson Education, 2009
<b>Reference Books</b>	
1.	1. Jain Anil K , Fundamentals of digital image processing: , PHI,1988
2.	Kenneth R Castleman , Digital image processing:, Pearson Education,2/e,2003
3.	Pratt William K , Digital Image Processing: , John Wiley,4/e,2007
<b>Web Resources</b>	
1.	<a href="https://kanchiuniv.ac.in/coursematerials/Digital%20image%20processing%20-Vijaya%20Raghavan.pdf">https://kanchiuniv.ac.in/coursematerials/Digital%20image%20processing%20-Vijaya%20Raghavan.pdf</a>
2.	<a href="http://sdeuoc.ac.in/sites/default/files/sde_videos/Digital%20Image%20Processing%203rd%20ed.%20-%20R.%20Gonzalez%2C%20R.%20Woods-ilovepdf-compressed.pdf">http://sdeuoc.ac.in/sites/default/files/sde_videos/Digital%20Image%20Processing%203rd%20ed.%20-%20R.%20Gonzalez%2C%20R.%20Woods-ilovepdf-compressed.pdf</a>
3.	<a href="https://dl.acm.org/doi/10.5555/559707">https://dl.acm.org/doi/10.5555/559707</a>
4.	<a href="https://www.ijert.org/image-processing-using-web-2-0-2">https://www.ijert.org/image-processing-using-web-2-0-2</a>

	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
EC	Information Security	Elective	Y	-	-	-	3	4	25	75	100

<b>Course Objectives</b>			
CO1	To know the objectives of information security		
CO2	Understand the importance and application of each of confidentiality, integrity, authentication and availability		
CO3	Understand various cryptographic algorithms		
CO4	Understand the basic categories of threats to computers and networks		
CO5	To study about the concepts of security in networks, web security		
<b>UNIT</b>	<b>Details</b>	<b>No. of Hours</b>	<b>Course Objectives</b>
I	Introduction to Information Security : Security mindset, Computer Security Concepts (CIA), Attacks, Vulnerabilities and protections, Security Goals, Security Services, Threats, Attacks, Assets, malware, program analysis and mechanisms	12	CO1
II	The Security Problem in Computing: The meaning of computer Security, Computer Criminals, Methods of Defense. Cryptography: Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption	12	CO2
III	Symmetric and Asymmetric Cryptographic Techniques : DES, AES, RSA algorithms .Authentication and Digital Signatures : Use of Cryptography for authentication, Secure Hash function, Key management – Kerberos	12	CO3
IV	Program Security : Non-malicious Program errors – Buffer overflow, Incomplete mediation, Time-of-check to Time-of-use Errors, Viruses, Trapdoors, Salami attack, Man-in-the-middle attacks, Covert channels. File protection Mechanisms, User Authentication Designing Trusted O.S: Security policies, models of security, trusted O.S design, Assurance in trusted O.S. Implementation examples	12	CO4

V	Security in Networks : Threats in networks, Network Security Controls – Architecture, Encryption, Content Integrity, Strong Authentication, Access Controls, Wireless Security, Honeypots, Traffic flow security. Web Security: Web security considerations, Secure Socket Layer and Transport Layer Security, Secure electronic transaction	12	CO5
	<b>Total</b>	<b>60</b>	
<b>Course Outcomes</b>			
<b>Course Outcomes</b>	On completion of this course, students will;	<b>Programme Outcomes</b>	
<b>CO1</b>	Understand network security threats, security services, and countermeasures	PO1	
<b>CO2</b>	Understand vulnerability analysis of network security	PO1, PO2	
<b>CO3</b>	Acquire background on hash functions; authentication; firewalls; intrusion detection techniques	PO4, PO6	
<b>CO4</b>	Gain hands-on experience with programming and	PO4, PO5, PO6	
	simulation techniques for security protocols.		
<b>CO5</b>	Apply methods for authentication, access control, intrusion detection and prevention	PO3, PO8	
<b>Text Books</b> <b>(Latest Editions)</b>			
1.	Security in Computing, Fourth Edition, by Charles P. Pfleeger, Pearson Education		
2.	Cryptography And Network Security Principles And Practice, Fourth or Fifth Edition, William Stallings, Pearson		
<b>References Books</b> <b>(Latest editions, and the style as given below must be strictly adhered to)</b>			
1.	Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition		

2.	Cryptography and Network Security : Forouzan Mukhopadhyay, Mc Graw Hill, 2"d Edition
3.	Information Security, Principles and Practice: Mark Stamp, Wiley India
4.	Principles of Computer Scurity: WM.Arthur Conklin, Greg White, TMH
<b>Web Resources</b>	
1.	<a href="https://www.geeksforgeeks.org/what-is-information-security/">https://www.geeksforgeeks.org/what-is-information-security/</a>
2.	<a href="https://www.tutorialspoint.com/what-is-information-security#:~:text=Information%20security%20is%20designed%20and,destruction%2C%20alteration%2C%20and%20disruption.">https://www.tutorialspoint.com/what-is-information-security#:~:text=Information%20security%20is%20designed%20and,destruction%2C%20alteration%2C%20and%20disruption.</a>

**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	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
EC	DataMining and Warehousing	Elective	Y	-	-	-	3	4	25	75	100
<b>Course Objectives</b>											
CO1	To provide the knowledge on Data Mining and Warehousing concepts and techniques										
CO2	To study the basic concepts of Data Mining, Architecture and Comparison.										
CO3	To study a set of Mining Association Rules, Data Warehouses.										

CO4	To study about Classification and Prediction, Classifier Accuracy		
CO5	To study the basic concepts of cluster analysis, Cluster Methods		
UNIT	Details	No. of Hours	Course Objectives
I	Introduction: Data mining – Functionalities – Classification – Introduction to Data Warehousing – Data Preprocessing: Preprocessing the Data – Data cleaning – Data Integration and Transformation – Data Reduction	12	CO1
II	Data Mining, Primitives, Languages and System Architecture: Data Mining – Primitives – Data Mining Query Language, Architecture of Data mining Systems. Concept Description, Characterization and Comparison: Concept Description, Data Generalization and Summarization, Analytical Characterization, Mining Class Comparison – Statistical Measures.	12	CO2
III	Mining Association Rules: Basic Concepts – Single Dimensional Boolean Association Rules From Transaction Databases, Multilevel Association Rules from transaction databases – Multi dimension Association Rules from Relational Database and Data Warehouses.	12	CO3
IV	Classification and Prediction: Introduction – Issues – Decision Tree Induction – Bayesian Classification – Classification of Back Propagation. Classification based on Concepts from Association Rule Mining – Other Methods. Prediction – Introduction – Classifier Accuracy	12	CO4
V	Cluster Analysis: Introduction – Types of Data in Cluster Analysis, Partitioning Methods – Hierarchical Methods-Density Based Methods – GRID Based Method – Model based Clustering Method	12	CO5
	<b>Total</b>	<b>60</b>	
<b>Course Outcomes</b>			
<b>Course Outcomes</b>	On completion of this course, students will;		

<b>CO1</b>	To understand the basic concepts and the functionality of the various data mining and data warehousing component	PO1, PO3, PO6, PO8
<b>CO2</b>	To know the concepts of Data mining system architectures	PO1,PO2,PO3,PO6
<b>CO3</b>	To analyse the principles of association rules	PO3, PO5
<b>CO4</b>	To get analytical idea on Classification and prediction methods	PO1, PO2, PO3, PO7
<b>CO5</b>	To Gain knowledge on Cluster analysis and its methods.	PO2, PO6, PO7
<b>Text Books</b> <b>(Latest Editions)</b>		
1.	Han and M. Kamber, “Data Mining Concepts and Techniques”, 2001, Harcourt India Pvt. Ltd, New Delhi.	
<b>References Books</b> <b>(Latest editions)</b>		
1.	K.P. Soman, ShyamDiwakar, V. Ajay “Insight into Data Mining Theory and Practice “,Prentice Hall of India Pvt. Ltd, New Delhi	
2.	Parteek Bhatia, ‘Data Mining and Data Warehousing: Principles and Practical Techniques’, Cambridge University Press, 2019	
<b>Web Resources</b>		
1.	<a href="https://www.topcoder.com/thrive/articles/data-warehousing-and-data-mining#:~:text=Data%20warehousing%20is%20a%20method,compiled%20in%20the%20data%20warehouse.">https://www.topcoder.com/thrive/articles/data-warehousing-and-data-mining#:~:text=Data%20warehousing%20is%20a%20method,compiled%20in%20the%20data%20warehouse.</a>	
2.	<a href="https://www.javatpoint.com/data-mining-cluster-vs-data-warehousing">https://www.javatpoint.com/data-mining-cluster-vs-data-warehousing</a>	
3.	<a href="https://www.tutorialspoint.com/Data-Warehousing-and-Data-Mining">https://www.tutorialspoint.com/Data-Warehousing-and-Data-Mining</a>	

<b>Mapping with Programme Outcomes:</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>
<b>CO 1</b>	S		M			L		M
<b>CO 2</b>	S	M	L			M		
<b>CO 3</b>			S		M			

<b>CO 4</b>	S	M	M				L	
<b>CO 5</b>		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
EC	<b>Grid Computing</b>	Elective	-	Y	-	-	3	4	25	75	100
<b>Course Objective</b>											
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 Anatomy.										
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										12



	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.	
	<b>Total</b>	<b>60</b>
<b>Course Outcomes</b>		<b>Programme Outcome</b>
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 Anatomy 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
<b>Text Book</b>		
1	Joshy Joseph and Craig Fellenstein, Grid computing, Pearson / IBM Press, PTR, 2004.	
<b>Reference Books</b>		
1.	1. Ahmer Abbas and Graig computing, A Practical Guide to technology and applications, Charles River Media, 2003.	
<b>Web Resources</b>		
1.	<a href="https://en.wikipedia.org/wiki/Grid_computing">https://en.wikipedia.org/wiki/Grid_computing</a>	
2.	<a href="https://link.springer.com/chapter/10.1007/978-1-84882-409-6_4">https://link.springer.com/chapter/10.1007/978-1-84882-409-6_4</a>	
3.	<a href="https://www.redbooks.ibm.com/redbooks/pdfs/sg246778.pdf">https://www.redbooks.ibm.com/redbooks/pdfs/sg246778.pdf</a>	

#### 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						

<b>CO 3</b>				<b>S</b>		<b>S</b>		
<b>CO 4</b>				<b>S</b>	<b>S</b>	<b>S</b>		
<b>CO 5</b>			<b>S</b>					<b>S</b>

**S-Strong      M-Medium      L-Low**

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
EC	Cyber Forensics	Elective	Y	-	-	-	3	4	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.						12		C1		
II	Computer Forensics Evidence and capture: Data						12		C2		

	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.		
<b>III</b>	<b>Duplication and Preservation of Digital Evidence:</b> 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.	12	C3
<b>IV</b>	<b>Computer Forensics Analysis:</b> 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.	12	C4
<b>V</b>	<b>Reconstructing Past Events:</b> 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.	12	C5
	<b>Total</b>	<b>60</b>	
<b>Course Outcomes</b>		<b>Programme Outcomes</b>	
<b>CO</b>	On completion of this course, students will		
<b>1</b>	Understand the definition of computer forensics fundamentals.	PO1	
<b>2</b>	Evaluate the different types of computer forensics technology.	PO1, PO2	
<b>3</b>	Analyze various computer forensics systems.	PO4, PO6	
<b>4</b>	Apply the methods for data recovery, evidence collection and data seizure.	PO4, PO5, PO6	

<b>5</b>	Gain your knowledge of duplication and preservation of digital evidence.	PO3, PO8
<b>Text Book</b>		
<b>1</b>	John R. Vacca, “Computer Forensics: Computer Crime Investigation”, 3/E ,Firewall Media, New Delhi, 2002.	
<b>Reference Books</b>		
<b>1.</b>	Nelson, Phillips Enfinger, Steuart, “Computer Forensics and Investigations” Enfinger, Steuart, CENGAGE Learning, 2004.	
<b>2.</b>	Anthony Sammes and Brian Jenkinson, ”Forensic Computing: A Practitioner’s Guide”, Second Edition, Springer–Verlag London Limited, 2007.	
<b>3.</b>	.Robert M.Slade,” Software Forensics Collecting Evidence from the Scene of a Digital Crime”, TMH 2005.	
<b>Web Resources</b>		
<b>1.</b>	<a href="https://www.vskills.in">https://www.vskills.in</a>	
<b>2.</b>	<a href="https://www.hackingarticles.in/best-of-computer-forensics-tutorials/">https://www.hackingarticles.in/best-of-computer-forensics-tutorials/</a>	

#### Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
<b>CO 1</b>	S							
<b>CO 2</b>	M	S						
<b>CO 3</b>				S		S		
<b>CO 4</b>				S	S	M		
<b>CO 5</b>			S					S

S-Strong      M-Medium      L-Low

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
EC	Pattern Recognition	Specific Elective	Y	-	-	-	3	4	75	25	100
<b>Course Objective</b>											
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	12	CO1
II	STATISTICAL PATTERN RECOGNITION: Introduction to statistical Pattern Recognition-supervised Learning using Parametric and Non-Parametric Approaches.	12	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	12	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.	12	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	12	CO5
	<b>Total</b>	60	
Course Outcomes		Programme Outcomes	
CO	On completion of this course, students will		
1	understand the concepts, importance, application and the process of developing Pattern recognition over view	PO1	
2	to have basic knowledge and understanding about parametric and non-parametric related concepts.	PO1, PO2	
3	To understand the framework of frames and bit images to animations	PO4, PO6	
4	Speaks about the multimedia projects and stages of requirement in phases of project.	PO4, PO5, PO6	
5	Understanding the concept of cost involved in multimedia planning, designing, and producing	PO3, PO8	

Text Book	
1	Robert Schalkoff, “Pattern Recognition: Statistical Structural and Neural Approaches”, John wiley & sons.
2	Duda R.O., P.E.Hart & D.G Stork, “ Pattern Classification”, 2nd Edition, J.Wiley.
3	Duda R.O.& Hart P.E., “Pattern Classification and Scene Analysis”, J.wiley.
4	Bishop C.M., “Neural Networks for Pattern Recognition”, Oxford University Press.
Reference Books	
1.	1. Earl Gose, Richard johnsonbaugh, Steve Jost, “Pattern Recognition and Image Analysis”, Prentice Hall of India, Pvt Ltd, New Delhi.
Web Resources	
1.	<a href="https://www.geeksforgeeks.org/pattern-recognition-introduction/">https://www.geeksforgeeks.org/pattern-recognition-introduction/</a>
2.	<a href="https://www.mygreatlearning.com/blog/pattern-recognition-machine-learning/">https://www.mygreatlearning.com/blog/pattern-recognition-machine-learning/</a>

#### 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
EC	Robotics and its Applications	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		
<b>UNIT</b>	<b>Details</b>	<b>No. of Hours</b>	<b>Course Objective</b>
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.	15	CO1
II	Actuators and sensors :Types of actuators, stepper-DC-servo-and brushless motors- model of a DC servo	15	CO2

	<p>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</p> <p>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</p>		
III	<p>Localization: Self-localizations and mapping - Challenges in localizations – IR based localizations – vision based localizations – Ultrasonic based localizations - GPS localization systems.</p>	15	CO3
IV	<p>Path Planning: Introduction, path planning-overview-road map path planning-cell decomposition path planning potential field path planning-obstacle avoidance-case studies</p> <p>Vision system: Robotic vision systems-image representation-object recognition-and categorization-depth measurement- image data compression-visual inspection-software considerations</p>	15	CO4
V	<p>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-</p>	15	CO5



	assembly operation-cleaning-etc.		
	<b>Total</b>		
<b>Course Outcomes</b>		<b>Programme Outcomes</b>	
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	
<b>Text Book</b>			
1	RichardD.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		
<b>Reference Books</b>			
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		
<b>Web Resources</b>			
1.	<a href="https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_robotics.htm">https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_robotics.htm</a>		
2.	<a href="https://www.geeksforgeeks.org/robotics-introduction/">https://www.geeksforgeeks.org/robotics-introduction/</a>		

#### Mapping with Programme Outcomes:

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

<b>CO 2</b>	M	S						
<b>CO 3</b>				S		S		
<b>CO 4</b>				S	S	M		
<b>CO 5</b>			S					S
<b>S-Strong</b>			<b>M-Medium</b>		<b>L-Low</b>			

Subject	Subject Name	C	L	T	P	S	C	I	Marks		
Code									CIA	External	Total
EC	<b>Agile Project Management</b>	Elective	-	Y	-	-	2	2	25	75	100
<b>Course Objective</b>											
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	ing of Agile Management Design and Quality Check.										
C5	Detailed examination of Agile development and testing techniques.										
UNIT	Details									No. of Hours	
I	<p><b>Introduction:Modernizing Project Management:</b> Project Management Needed a Makeover – Introducing Agile Project Management.</p> <p><b>Applying the Agile Manifesto and Principles:</b> 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.</p> <p><b>Why Being Agile Works Better:</b> Evaluating Agile benefits – How Agile approaches beat historical approaches – Why people like being Agile.</p>									15	
II	<p><b>Being Agile</b></p> <p><b>Agile Approaches:</b> Diving under the umbrella of Agile approaches – Reviewing the Big Three: Lean, Scrum, Extreme Programming - Summary</p>									15	

	<p><b>Agile Environments in Action:</b> Creating the physical environment – Low-tech communicating – High-tech communicating – Choosing tools.</p> <p><b>Agile Behaviours in Action:</b> Establishing Agile roles – Establishing new values – Changing team philosophy.</p>	
III	<p><b>Agile Planning and Execution</b></p> <p><b>Defining the Product Vision and Roadmap:</b> Agile planning – Defining the product vision – Creating a product roadmap – Completing the product backlog.</p> <p><b>Planning Releases and Sprints:</b> Refining requirements and estimates – Release planning – Sprint planning.</p> <p><b>Working Throughout the Day:</b> Planning your day – Tracking progress – Agile roles in the sprint – Creating shippable functionality – The end of the day.</p> <p><b>Showcasing Work, Inspecting and Adapting:</b> The sprint review – The sprint retrospective.</p> <p><b>Preparing for Release:</b> Preparing the product for deployment (the release sprint) – Preparing the operational support – Preparing the organization for product deployment - Preparing the marketplace for product deployment</p>	1 5
IV	<p><b>Agile Management</b></p> <p><b>Managing Scope and Procurement:</b> What’s different about Agile scope management – Managing Agile scope – What’s different about Agile procurement – Managing Agile procurement.</p> <p><b>Managing Time and Cost:</b> What’s different about Agile time management – Managing Agile schedules – What’s different about Agile cost management – Managing Agile budgets.</p> <p><b>Managing Team Dynamics and Communication:</b> What’s different</p>	1 5

	about Agile team dynamics – Managing Agile team dynamics – What’s different about Agile communication – Managing Agile communication.  <b>Managing Quality and Risk:</b> What’s different about Agile quality – Managing Agile quality – What’s different about Agile risk management – Managing Agile risk.	
V	<b>Implementing Agile</b> <b>Building a Foundation:</b> Organizational and individual commitment – Choosing the right pilot team members – Creating an environment that enables Agility – Support Agility initially and over time. <b>Being a Change Agent:</b> Becoming Agile requires change – why change doesn’t happen on its own – Platinum Edge’s Change Roadmap – Avoiding pitfalls – Signs your changes are slipping. <b>Benefits, Factors for Success and Metrics:</b> Ten key benefits of Agile project management – Ten key factors for project success – Ten metrics for Agile Organizations.	15
	<b>Total</b>	<b>75</b>
Course Outcomes		Programme Outcome
CO	On completion of this course, students will	
1	Understanding of software design, software technologies and APIs using Agile Management.	PO1
2	Understanding of Agile development and testing techniques.	PO1, PO2
3	Understanding about Agile Planning and Execution using Sprint.	PO4, PO6
4	Understanding of Agile Management Design, scope, Procurement, managing Time and Cost and Quality Check.	PO4, PO5, PO6

5	Analysing of Agile development and testing techniques.	PO3, PO8
<b>Text Book</b>		
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.	
<b>Reference Books</b>		
1.	Mark C. Layton, David Morrow, <i>Scrum for Dummies</i> , 2 <sup>nd</sup> 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, <i>Scrum</i> , 2020.	
5.	Andrew Stellman and Jennifer Greene, <i>Learning Agile: Understanding Scrum, XP, Lean, and Kanban</i> , Shroff/O'Reilly, First Edition, 2014.	
<b>Web Resources</b>		
1.	<a href="http://www.agilealliance.org/resources">www.agilealliance.org/resources</a>	

#### 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

## Annexure II

### Suggested topics in Skill Enhancement(SEC1-SEC8) Course

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
SEC	<b>FUNDAMENTALS OF INFORMATION TECHNOLOGY</b>	SEC	2	-	-	I	2	25	75	100
<b>Learning Objectives</b>										
<b>LO1</b>	Understand basic concepts and terminology of information technology.									
<b>LO2</b>	Have a basic understanding of personal computers and their operation									
<b>LO3</b>	Be able to identify data storage and its usage									
<b>LO4</b>	Get great knowledge of software and its functionalities									
<b>LO5</b>	Understand about operating system and their uses									
<b>UNIT</b>	<b>Contents</b>								<b>No. Of. Hours</b>	
I	<b>Introduction to Computers:</b> 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	<b>Basic Computer Organization:</b> 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	<b>Storage Fundamentals:</b> 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	<b>Software:</b> Software and its needs, Types of S/W. System Software: Operating System, Utility Programs Programming Language: Machine Language, Assembly Language, High Level Language their advantages & disadvantages. Application S/W and its types: Word Processing, Spread Sheets Presentation, Graphics, DBMS s/w								6	

V	<b>Operating System:</b> Functions, Measuring System Performance, Assemblers, Compilers and Interpreters. Batch Processing, Multiprogramming, Multi Tasking, Multiprocessing, Time Sharing, DOS, Windows, Unix/Linux.	<b>6</b>
<b>TOTAL HOURS</b>		<b>30</b>
<b>Course Outcomes</b>		<b>Programme Outcomes</b>
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
<b>Textbooks</b>		
1	Anoop Mathew, S. Kavitha Murugesan (2009), “ Fundamental of Information Technology”, Majestic Books.	
2	Alexis Leon, Mathews Leon,” Fundamental of Information Technology”, 2 <sup>nd</sup> Edition.	
3	S. K Bansal, “Fundamental of Information Technology”.	
<b>Reference Books</b>		
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	
<b>Web Resources</b>		
1.	<a href="https://testbook.com/learn/computer-fundamentals">https://testbook.com/learn/computer-fundamentals</a>	
2.	<a href="https://www.tutorialsmate.com/2020/04/computer-fundamentals-tutorial.html">https://www.tutorialsmate.com/2020/04/computer-fundamentals-tutorial.html</a>	
3.	<a href="https://www.javatpoint.com/computer-fundamentals-tutorial">https://www.javatpoint.com/computer-fundamentals-tutorial</a>	
4.	<a href="https://www.tutorialspoint.com/computer_fundamentals/index.htm">https://www.tutorialspoint.com/computer_fundamentals/index.htm</a>	
5.	<a href="https://www.nios.ac.in/media/documents/sec229new/Lesson1.pdf">https://www.nios.ac.in/media/documents/sec229new/Lesson1.pdf</a>	

**Mapping with Programme Outcomes:**

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



<b>CO 1</b>	3	3	3	3	3	3
<b>CO 2</b>	3	3	3	3	3	3
<b>CO 3</b>	3	3	3	3	3	3
<b>CO 4</b>	3	3	3	3	2	3
<b>CO 5</b>	3	3	2	3	3	2
<b>Weightage of course contributed to each PSO</b>	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
SEC	UNDERSTANDING INTERNET		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.
<b>Textbooks</b>	
1	“Mastering HTML5 and CSS3 Made Easy”, TeachUComp Inc., 2014.
2	<b>Thomas Michaud, “Foundations of Web Design: Introduction to HTML &amp; CSS”</b>
<b>Web Resources</b>	
1.	<a href="https://www.teachucomp.com/samples/html/5/manuals/Mastering-HTML5-CSS3.pdf">https://www.teachucomp.com/samples/html/5/manuals/Mastering-HTML5-CSS3.pdf</a>
2.	<a href="https://www.w3schools.com/html/default.asp">https://www.w3schools.com/html/default.asp</a>

### 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		S		L	
CO 4			S	L	M		M	
CO 5				M		S	M	S

S-Strong      M-Medium      L-Low

### Multimedia Lab

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
SEC	0	0	2	-	1	2	25	75	100
<b>Learning Objectives</b>									
LO1	Understands the basics of multimedia								
LO2	Acquire knowledge of image editing and animation techniques.								
LO3	Apply multimedia concepts to real world projects								

<b>Unit</b>	<b>Contents</b>	<b>No. of Hours</b>
I	GIMP's Tools- Taking Advantage of Paths - Working with Layers and masks - Using Channels Exercises: <ol style="list-style-type: none"> <li>1. Enlarge a Logo using path</li> <li>2. Create an ink drawing using path</li> <li>3. Replace Background of image using Channels</li> </ol>	<b>6</b>
II	Manipulating Images: Transforming Images - Using The Image Tools - Adjusting Colors - Working with Text - Painting in Gimp: Creating new brushes - Enhancing Photos - Exploring Filters and Effects. Exercises: <ol style="list-style-type: none"> <li>1. Design Front Cover for a Book.</li> <li>2. Create a customized logo</li> <li>3. Use clone tool to remove text from an image</li> <li>4. Remove Red eye using Filter.</li> </ol>	<b>6</b>
III	Using GIMP animation package - Managing the Frames of Image	<b>6</b>
IV	Flash: Introduction - Creating and Editing Objects - Color and Text. Animations: Frame- by- frame animation-Motion Tweening- Motion Guides <ol style="list-style-type: none"> <li>1. Creating Frame-by-frame Animation</li> <li>2. Create a Motion Tween for Graphic and Text Object</li> <li>3. Create a Motion guide Layer</li> </ol>	<b>6</b>
V	Shape Tweening - Masking - Interactivity: Adding Script to Buttons - Testing and Publishing. Exercises: <ol style="list-style-type: none"> <li>1. Create a Shape Tween for Graphic Object</li> <li>2. Create a Mask Layer</li> <li>3. Adding buttons with Action Script</li> </ol>	<b>6</b>
<b>TOTAL</b>		<b>30</b>
CO	<b>Course Outcomes</b>	
CO1	Demonstrate understanding and use of multimedia fundamentals	
CO2	Implement appropriate techniques required for editing images and designing animated system	
CO3	Solve various design and implementation issues materialize on the development of multimedia systems	

CO4	Assess different Photo Editing, Video Editing and animation tools and select the appropriate tool based on the requirements
CO5	Design and develop Multimedia Projects
<b>Textbooks</b>	
□	1. Jason Van Gumster& Robert Shimonski (2010), “GIMP Bible”, Wiley, 2nd edition. 2. Chris Gover, 2010, “Flash CS5: The missing Manual”, 1st Edition, O’ Reilly India.
<b>Reference Books</b>	
1	Juan Manuel Ferreyra (2011), “GIMP 2.6 Cookbook”, PACK publishing Ltd.
2	Robert Reinhard (2003), “Macromedia Flash MX Bible”, Wiley Dreamtech India Pvt Ltd.
<b>NOTE: Latest Edition of Textbooks May be Used</b>	
<b>Web Resources</b>	
1.	<a href="https://www.youtube.com/watch?v=T8NIK3RdoIc">https://www.youtube.com/watch?v=T8NIK3RdoIc</a> (Unit IV: Gimp Video Editing)
2.	<a href="https://www.youtube.com/watch?v=Jz9WrbELGYA">https://www.youtube.com/watch?v=Jz9WrbELGYA</a>

	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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst.	Marks		
									CIA	Exter nal	Total

SEC	WEB DESIGNING	-	Y	-	-	-	2	2	25	75	100
<b>Course Objective</b>											
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										
<b>UNIT</b>	<b>Details</b>						<b>No. of Hours</b>			<b>Course Objective</b>	
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
	<b>Total</b>	<b>60</b>	
<b>Course Outcomes</b>		<b>Programme Outcome</b>	
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.	PO2, PO6, PO7	
<b>Text Book</b>			
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.		
<b>Reference Books</b>			
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.		
<b>Web Resources</b>			

1.	NPTEL & MOOC courses titled Web Design and Development.
2.	<a href="https://www.geeksforgeeks.org">https://www.geeksforgeeks.org</a>

**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
SEC	Software Testing	-	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.	<a href="https://www.javatpoint.com/software-testing-tutorial">https://www.javatpoint.com/software-testing-tutorial</a>		



2.	<a href="https://www.guru99.com/software-testing.html">https://www.guru99.com/software-testing.html</a>
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### 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
SEC	PHP PROGRAMMING	-	Y				2	2	25	75	100
<b>Course Objective</b>											
C1	To provide the necessary knowledge on basics of PHP.										
C2	To design and develop dynamic, database-driven web applications using PHP version.										
C3	To get an experience on various web application development techniques.										
C4	To learn the necessary concepts for working with the files using PHP.										
C5	To get a knowledge on OOPS with PHP.										
UNIT	Details								No. of Hours	Course Objectives	
I	Introduction to PHP -Basic Knowledge of websites -Introduction of Dynamic Website -Introduction to PHP -Scope of PHP -XAMPP and WAMP Installation								6	CO1	
II	PHP Programming Basics -Syntax of PHP -Embedding PHP in HTML -Embedding HTML in PHP. Introduction to PHP Variable -Understanding Data Types -Using Operators -Using Conditional Statements -If(), else if() and else if condition Statement.								6	CO2	

III	Switch() Statements -Using the while() Loop -Using the for() Loop PHP Functions -Creating an Array -Modifying Array Elements - Processing Arrays with Loops - Grouping Form Selections with Arrays -Using Array Functions.	6	CO3
IV	PHP Advanced Concepts -Reading and Writing Files -Reading Data from a File.	6	CO4
V	Managing Sessions and Using Session Variables -Destroying a Session -Storing Data in Cookies -Setting Cookies.	6	CO5
	<b>Total</b>	<b>30</b>	
<b>Course Outcomes</b>		<b>Programme Outcomes</b>	
CO	On completion of this course, students will		
1	Write PHP scripts to handle HTML forms	PO1,PO4,PO6,PO8.	
2	Write regular expressions including modifiers, operators, and metacharacters.	PO2,PO5,PO7.	
3	Create PHP Program using the concept of array.	PO3,PO6,PO8.	
4	Create PHP programs that use various PHP library functions	PO2,PO3,PO5,PO8.	
5	Manipulate files and directories.	PO3,PO5,PO6.	
<b>Text Book</b>			
1	Head First PHP & MySQL: A Brain-Friendly Guide- 2009-Lynn mighley and Michael Morrison.		
2	The Joy of PHP: A Beginner's Guide to Programming Interactive Web Applications with PHP and MySQL- Alan Forbes		
<b>Reference Books</b>			
1.	PHP: The Complete Reference-Steven Holzner.		
2.	DT Editorial Services (Author), “HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)”, Paperback 2016, 2 <sup>nd</sup> Edition.		
<b>Web Resources</b>			
1.	Refer MOOC Courses like NPTEL and SWAYAM		
2.	<a href="https://www.w3schools.com/php/default.asp">https://www.w3schools.com/php/default.asp</a>		

**Mapping with Programme Outcomes:**

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

<b>CO 3</b>			M			L		S
<b>CO 4</b>		M	S		L			S
<b>CO 5</b>			S		L	M		

**S-Strong      M-Medium      L-Low**

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
SEC	OFFICE AUTOMATION	-		Y	-	-	2	2	25	75	100
<b>Course Objective</b>											
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	<b>Introductory concepts:</b> Memory unit– CPU-Input Devices: Key board, Mouse and Scanner.Outputdevices:Monitor,Printer.IntroductiontoOperatingsystems&itsfeatures:DOS– UNIX–Windows. IntroductiontoProgrammingLanguages.										6
II	<b>Word Processing:</b> Open, Save and close word document; Editing text – tools, formatting, bullets;SpellChecker - Document formatting – Paragraph alignment, indentation, headers and footers,numbering;printing– Preview,options,merge.										6
III	<b>Spreadsheets:</b> Excel– opening,enteringtextanddata,formatting,navigating;Formulas– entering,handlingand copying;Charts–creating,formatting and										6

	printing,analysistables,preparationoffinancialstatements,introductiontodataa nalytics.	
IV	<b>Database Concepts:</b> The concept of data base management system; Data field, records, and files,Sorting and indexing data; Searching records. Designing queries, and reports; Linking of datafiles; Understanding Programming environment in DBMS; Developing menu drive applicationsinquerylanguage(MS–Access).	6
V	<b>Power point:</b> Introduction to Power point - Features – Understanding slide typecasting & viewingslides – creating slide shows. Applying special object – including objects & pictures – Slidetransition– Animationeffects,audioinclusion,timers.	6
	<b>Total</b>	<b>30</b>
<b>Course Outcomes</b>		<b>Programme Outcomes</b>
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
<b>Text Book</b>		
1	PeterNorton,“IntroductiontoComputers”–TataMcGraw-Hill.	
<b>Reference Books</b>		
1.	Jennifer Ackerman Kettel, Guy Hat-Davis, Curt Simmons, “Microsoft 2003”, Tata McGrawHill.	
<b>Web Resources</b>		
1.	<a href="https://www.udemy.com/course/office-automation-certificate-course/">https://www.udemy.com/course/office-automation-certificate-course/</a>	
2.	<a href="https://www.javatpoint.com/automation-tools">https://www.javatpoint.com/automation-tools</a>	

#### 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		

<b>CO 3</b>		S	S		M		L	
<b>CO 4</b>			S	L	M		M	
<b>CO 5</b>				M		S	M	S

**S-Strong      M-Medium      L-Low**

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
SEC	Quantitative Aptitude	-	Y	-	-	-	2	2	25	75	100
Course Objective											
C1	To understand the basic concepts of numbers										
C2	Understand and apply the concept of percentage, profit & loss										
C3	To study the basic concepts of time and work, interests										
C4	To learn the concepts of permutation, probability, discounts										
C5	To study about the concepts of data representation, graphs										
UNIT	Details							No. of Hours	Course Objective		
I	Numbers-HCF and LCM of numbers-Decimal fractions-Simplification-Squareroot and cuberoots - Average-problems on Numbers.							6	CO1		
II	Problems on Ages - Surds and Indices - percentage - profits and loss - ratio and proportion-partnership-Chainrule.							6	CO2		
III	Time and work - pipes and cisterns - Time and Distance - problems on trains -Boats and streams - simple interest - compound interest - Logarithms - Area-Volume and 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.	<a href="https://www.javatpoint.com/aptitude/quantitative">https://www.javatpoint.com/aptitude/quantitative</a>	
2.	<a href="https://www.toppr.com/guides/quantitative-aptitude/">https://www.toppr.com/guides/quantitative-aptitude/</a>	

#### 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
SEC	Multimedia Systems	-	Y	-	-	-	2	2	25	75	100
Course Objective											

<b>C1</b>	Understand the basics of Multimedia		
<b>C2</b>	To study about the Image File Formats, Sounds Audio File Formats		
<b>C3</b>	Understand the concepts of Animation and Digital Video Containers		
<b>C4</b>	To study about the Stage of Multimedia Project		
<b>C5</b>	Understand the concept of Ownership of Content Created for Project Acquiring Talent		
<b>UNIT</b>	<b>Details</b>	<b>No. of Hours</b>	<b>Course Objective</b>
<b>I</b>	Multimedia Definition-Use Of Multimedia-Delivering Multimedia- Text: About Fonts and Faces - Using Text in Multimedia - Computers and Text Font Editing and Design Tools-Hypermedia and Hypertext.	12	C1
<b>II</b>	Images: Plan Approach - Organize Tools - Configure Computer Workspace - Making Still Images - Color - Image File Formats. Sound: The Power of Sound - Digital Audio-Midi Audio-Midi vs. Digital Audio-Multimedia System Sounds Audio File Formats - Vaughan's Law of Multimedia Minimums - Adding Sound to Multimedia Project	12	C2
<b>III</b>	Animation: The Power of Motion-Principles of Animation-Animation by Computer - Making Animations that Work. Video: Using Video - Working with Video and Displays-Digital Video Containers-Obtaining Video Clips - Shooting and Editing Video	12	C3
<b>IV</b>	Making Multimedia: The Stage of Multimedia Project - The Intangible Needs - The Hardware Needs - The Software Needs - An Authoring Systems Needs-Multimedia Production Team.	12	C4
<b>V</b>	Planning and Costing: The Process of Making Multimedia - Scheduling-Estimating - RFPs and Bid Proposals. Designing and Producing - Content and Talent: Acquiring Content-Ownership of Content Created for Project-Acquiring Talent	12	C5
	<b>Total</b>	<b>60</b>	
<b>Course Outcomes</b>		<b>Programme Outcomes</b>	
<b>CO</b>	On completion of this course, students will		
<b>1</b>	understand the concepts, importance, application and the process of developing multimedia	PO1	
<b>2</b>	to have basic knowledge and understanding about image related processings	PO1, PO2	
<b>3</b>	To understand the framework of frames and bit images to animations	PO4, PO6	

<b>4</b>	Speaks about the multimedia projects and stages of requirement in phases of project.	PO4, PO5, PO6
<b>5</b>	Understanding the concept of cost involved in multimedia planning, designing, and producing	PO3, PO8
<b>Text Book</b>		
<b>1</b>	Tay Vaughan, "Multimedia: Making It Work", 8th Edition, Osborne/McGraw-Hill, 2001.	
<b>Reference Books</b>		
<b>1.</b>	Ralf Steinmetz & Klara Nahrstedt "Multimedia Computing, Communication & Applications", Pearson Education, 2012.	
<b>Web Resources</b>		
<b>1.</b>	<a href="https://www.geeksforgeeks.org/multimedia-systems-with-features-or-characteristics/">https://www.geeksforgeeks.org/multimedia-systems-with-features-or-characteristics/</a>	

#### Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
<b>CO 1</b>	S							
<b>CO 2</b>	M	S						
<b>CO 3</b>				S		S		
<b>CO 4</b>				S	S	M		
<b>CO 5</b>			S					S

S-Strong      M-Medium      L-Low

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
SEC	Biometrics	-	Y	-	-	-	2	2	25	75	100
<b>Course Objectives</b>											
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	<p><b>Introduction:</b> What is Biometrics, History, Types of biometric Traits, General architecture of biometric systems, Basic working of biometric matching, Biometric system error and performance measures, Design of biometric system, Applications of biometrics, Biometrics versus traditional authentication methods.</p> <p><b>Face Biometrics:</b> 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.</p>	6	CO1
II	<p><b>Retina and Iris Biometrics:</b> 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</p> <p><b>Vein and Fingerprint Biometrics:</b> Introduction, Biometrics Using Vein Pattern of Palm, Fingerprint Biometrics, Fingerprint Recognition System, Minutiae Extraction, Fingerprint Indexing, Experimental Results, Advantages and Disadvantages.</p>	6	CO2
III	<p><b>Privacy Enhancement Using Biometrics:</b> 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.</p> <p><b>Multimodal Biometrics:</b> 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.</p>	6	CO3

IV	<b>WatermarkingTechniques:</b> 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	<b>Scope and Future:</b> Scope and Future Market of Biometrics, Biometric Technologies, Applications of Biometrics, Biometrics and Information Technology Infrastructure, Role of Biometrics in Enterprise Security, Role of Biometrics in Border Security, Smart Card Technology and Biometrics, Radio Frequency Identification (RFID) Biometrics, DNA Biometrics, Comparative Study of Various Biometric Techniques.  <b>Biometric Standards:</b> Introduction, Standard Development Organizations, Application Programming Interface (API), Information Security and Biometric Standards, Biometric Template Interoperability.	6	CO5
	<b>Total</b>	<b>30</b>	
<b>Course Outcomes</b>			
<b>Course Outcomes</b>	On completion of this course, students will;		
<b>CO1</b>	To understand the basic concepts and the functionality of the Biometrics, Face Biometrics, Types, Architecture and Applications.	PO1, PO3, PO6, PO8	
<b>CO2</b>	To know the concepts Retina and Iris Biometrics and Vein and Fingerprint Biometrics.	PO1,PO2,PO3,PO6	
<b>CO3</b>	To analyse the Privacy Enhancement and Multimodal Biometrics.	PO3, PO5	
<b>CO4</b>	To get analyticalidea on Watrmarking Techniques	PO1, PO2, PO3, PO7	
<b>CO5</b>	To Gain knowledge on Future scope of Biometrics,and Study of various Biometric Techniques.	PO2, PO6, PO7	
<b>Recommended Text</b>			
1.	Biometrics: Concepts and Applications by G.R Sinha and SandeepB.Patil , Wiley, 2013		
<b>References Books</b>			

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.
<b>Web Resources</b>	
1.	<a href="https://www.tutorialspoint.com/biometrics/index.htm">https://www.tutorialspoint.com/biometrics/index.htm</a>
2.	<a href="https://www.javatpoint.com/biometrics-tutorial">https://www.javatpoint.com/biometrics-tutorial</a>
3.	<a href="https://www.thalesgroup.com/en/markets/digital-identity-and-security/government/inspired/biometrics">https://www.thalesgroup.com/en/markets/digital-identity-and-security/government/inspired/biometrics</a>

#### 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	

ENTERPRISE RESOURCE PLANNING												
SEC	Enterprise Resource Planning	-	Y	-	-	-	4	4	25	75	100	
Course Objectives												
CO1	To understand the basic concepts, Evolution and Benefits of ERP.											
CO2	To know the need and Role of ERP in logical and Physical Integration.											
CO3	Identify the important business functions provided by typical business software such as enterprise resource planning and customer relationship managemen											
CO4	To train the students to develop the basic understanding of how ERP enriches the business organizations in achieving a multidimensional growth											
CO5	To aim at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills											
UNIT	Details								No. of Hours		Course Objectives	

I	ERP Introduction, Benefits, Origin, Evolution and Structure: Conceptual Model of ERP, the Evolution of ERP, the Structure of ERP, Components and needs of ERP, ERP Vendors; Benefits & Limitations of ERP Packages.	6	CO1
II	Need to focus on Enterprise Integration/ERP; Information mapping; Role of common shared Enterprise database; System Integration, Logical vs. Physical System Integration, Benefits & limitations of System Integration, ERP's Role in Logical and Physical Integration. Business Process Reengineering, Data ware Housing, Data Mining, Online Analytic Processing (OLAP), Product Life Cycle Management (PLM), LAP, Supply chain Management.	6	CO2
III	ERP Marketplace and Marketplace Dynamics: Market Overview, Marketplace Dynamics, the Changing ERP Market. ERP- Functional Modules: Introduction, Functional Modules of ERP Software, Integration of ERP, Supply chain and Customer Relationship Applications. Cloud and Open Source, Quality Management, Material Management, Financial Module, CRM and Case Study.	6	CO3
IV	ERP Implementation Basics, , ERP implementation Strategy, ERP Implementation Life Cycle ,Pre-Implementation task,Role of SDLC/SSAD, Object Oriented Architecture, Consultants, Vendors and Employees.	6	CO4
V	ERP & E-Commerce, Future Directives- in ERP, ERP and Internet, Critical success and failure factors, Integrating ERP into or-ganizational culture. Using ERP tool: either SAP or ORACLE format to case study.	6	CO5
	<b>Total</b>	<b>30</b>	

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Understand the basic concepts of ERP.	PO1, PO2, PO6
CO2	Identify different technologies used in ERP	PO2, PO3, PO8
CO3	Understand and apply the concepts of ERP Manufacturing Perspective and ERP Modules	PO1, PO3, PO7
CO4	Discuss the benefits of ERP	PO2, PO6
CO5	Apply different tools used in ERP	PO1, PO3, PO8
Reference Text :		
1.	Enterprise Resource Planning – Alexis Leon, Tata McGraw Hill.	
References :		

1.	Enterprise Resource Planning – Diversified by Alexis Leon, TMH.
2.	Enterprise Resource Planning – Ravi Shankar & S. Jaiswal , Galgotia
<b>Web Resources</b>	
1.	<a href="https://www.tutorialspoint.com/management_concepts/enterprise_resource_planning.htm">https://www.tutorialspoint.com/management_concepts/enterprise_resource_planning.htm</a>
2.	<a href="https://www.saponlinetutorials.com/what-is-erp-systems-enterprise-resource-planning/">https://www.saponlinetutorials.com/what-is-erp-systems-enterprise-resource-planning/</a>
3.	<a href="https://www.guru99.com/erp-full-form.html">https://www.guru99.com/erp-full-form.html</a>
4.	<a href="https://www.oracle.com/in/erp/what-is-erp/">https://www.oracle.com/in/erp/what-is-erp/</a>

#### Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
<b>CO 1</b>	M		L			M		
<b>CO 2</b>	M	S			L	M		
<b>CO 3</b>		L	M					M
<b>CO 4</b>				M		L	M	
<b>CO 5</b>	M		L		M			S

**S-Strong      M-Medium      L-Low**

Subject Code	Subject Name	Category	L	T	P	O	Credits	Inst. Hours	Marks		
									CIA	External	Total
SEC	<b>Organizational Behaviour</b>	-	Y	-	-	-	2	2	25	75	100
<b>Learning Objectives</b>											
CLO1	To have extensive knowledge on OB and the scope of OB.										
CLO2	To create awareness of Individual Behaviour.										
CLO3	To enhance the understanding of Group Behaviour										
CLO4	To know the basics of Organisational Culture and Organisational Structure										
CLO5	To understand Organisational Change, Conflict and Power										
<b>UNIT</b>	<b>Details</b>							<b>No. of Hours</b>	<b>Learning Objectives</b>		

I	INTRODUCTION : Concept of Organizational Behavior (OB): Nature, Scope and Role of OB: Disciplines that contribute to OB; Opportunities for OB (Globalization, Indian workforce diversity, customer service, innovation and change, networked organizations, work-life balance, people skills, positive work environment, ethics)	6	CLO1
II	INDIVIDUAL BEHAVIOUR:  1. Learning, attitude and Job satisfaction: Concept of learning, conditioning, shaping and reinforcement. Concept of attitude, components, behavior and attitude. Job satisfaction: causation; impact of satisfied employees on workplace.  2. Motivation : Concept; Theories (Hierarchy of needs, X and Y, Two factor, McClelland, Goal setting, Self-efficacy, Equity theory); Job characteristics model; Redesigning jobs,  3. Personality and Values : Concept of personality; Myers-Briggs Type Indicator (MBTI); Big Five model. Relevance of 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	CLO2
III	GROUP BEHAVIOUR : 1. Groups and Work Teams : Concept : Five Stage model of group development; Group norms, cohesiveness ; Group think and shift ; Teams; types of teams; Creating team players from individuals and team based work(TBW) 2. Leadership : Concept; Trait theories; Behavioral theories (Ohio and Michigan studies); Contingency theories (Fiedler, Hersey and Blanchard, Path-Goal);	6	CLO3
IV	ORGANISATIONAL CULTURE AND STRUCTURE : Concept of culture; Impact (functions and liability); Creating and sustaining culture: Concept of structure, Prevalent organizational designs: New design options	6	CLO4
V	ORGANISATIONAL CHANGE, CONFLICT AND POWER: Forces of change; Planned change; Resistance; Approaches (Lewin's model, Organisational development);. Concept of conflict, Conflict process; Types, Functional/ Dysfunctional. Introduction to power and politics.	6	CLO5
		<b>30</b>	

Course Outcomes	On Completion of the course the students will	Program Outcomes
CO1	To define OrganisationalBehaviour, Understand the opportunity through OB.	PO1, PO2, PO6, PO7
CO2	To apply self-awareness, motivation, leadership and learning theories at workplace.	PO2,PO4. PO5, PO6
CO3	To analyze the complexities and solutions of group behaviour.	PO1, PO2, PO4, PO5, PO6
CO4	To impact and bring positive change in the culture of the organisaiton.	PO2, PO3, PO4 PO5, PO8
CO5	To create a congenial climate in the organization.	PO1, PO2, PO5 PO6, PO8
Reading List		
1.	NeharikaVohra Stephen P. Robbins, Timothy A. Judge , <i>Organizational Behaviour</i> , Pearson Education, 18 <sup>th</sup> Edition, 2022.	
2.	Fred Luthans, <i>Organizational Behaviour</i> , Tata McGraw Hill, 2017.	
3.	Ray French, Charlotte Rayner, Gary Rees & Sally Rumbles, <i>Organizational Behaviour</i> , John Wiley & Sons, 2011	
4.	Louis Bevoc, Allison Shearsett, Rachael Collinson, <i>Organizational Behaviour Reference</i> , Nutri Niche System LLC (28 April 2017)	
5.	Dr. Christopher P. Neck, Jeffery D. Houghton and Emma L. Murray, <i>Organizational Behaviour: A Skill-Building Approach</i> , SAGE Publications, Inc; 2nd edition (29 November 2018).	
References Books		
1.	Uma Sekaran, Organizational Behaviour Text & cases, 2 <sup>nd</sup> edition, Tata McGraw Hill Publishing CO. Ltd	
2.	GangadharRao, Narayana, V.S.P Rao, Organizational Behaviour 1987, Reprint 2000, Konark Publishers Pvt. Ltd, 1 <sup>st</sup> edition	
3.	S.S. Khanka, Organizational Behaviour, S. Chand & Co, New Delhi.	
4.	J. Jayasankar, Organizational Behaviour, Margham Publications, Chennai, 2017.	

#### 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
SEC	<b>Simulation and Modeling</b>	Specific Elective	Y	-	-	-	2	2	25	75	100
<b>Course Objectives</b>											
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						6		CO1		
	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.										



II	<p>Random Variate Generation – Random Numbers – Random Number Generators – General principles – Inverse Transform Method –Acceptance Rejection Method –Composition Method –Relocate and Rescale Method - Specific distributions-Output Data Analysis – Introduction -Types of Simulation With Respect to Output Analysis - Stochastic Process and Sample Path - Sampling and Systematic Errors - Mean, Standard Deviation and Confidence Interval - Analysis of Finite-Horizon Simulations - Single Run - Independent Replications - Sequential Estimation – Analysis of Steady-State Simulations - Removal of Initialization Bias (Warm-up Interval) - Replication-Deletion Approach - Batch-Means Method .</p>	6	CO2
III	<p>Comparing Systems via Simulation – Introduction – Comparison Problems - Comparing Two Systems - Screening Problems - Selecting the Best - Comparison with a Standard - Comparison with a Fixed Performance Discrete Event Simulations – Introduction - Next-Event Time Advance - Arithmetic and Logical Relationships - Discrete-Event Modeling Approaches – Event-Scheduling Approach – Process Interaction Approach.</p>	6	CO3
IV	<p>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 –</p>	6	CO4

	General AI Algorithms - Decision Trees - Neural Networks - Finite State Machines - Logic Programming - Production Systems – Path Planning - Off-Line Path Planning - Incremental Path Planning - Real-Time Path Planning – Script Programming -Script Parsing - Script Execution.		
V	Optimization Algorithms – Genetic Algorithms – Simulated Annealing Examples: Sensor Systems Modeling – Human Eye Modeling – Optical Sensor Modeling – Radar Modeling.	6	CO5
	<b>Total</b>	<b>30</b>	
<b>Course Outcomes</b>			
<b>Course Outcomes</b>	On completion of this course, students will;	<b>Programme Outcomes</b>	
<b>CO1</b>	Introduction To Modeling & Simulation, Input Data Analysis and Modeling.	PO1	
<b>CO2</b>	Random Variate and Number Generation. Analysis of Simulations and methods.	PO1, PO2	
<b>CO3</b>	Comparing Systems via Simulation	PO4, PO6	
<b>CO4</b>	Entity Body Modeling, Visualization, Animation.	PO4, PO5, PO6	
<b>CO5</b>	Algorithms and Sensor Modeling.	PO3, PO8	
<b>Text Books</b>			
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.		
<b>References Books</b>			
1.	Andrew F. Seila, Vlatko Ceric, Pandu Tadikamalla, “Applied Simulation Modeling”, Thomson Learning Inc., 2003.		
<b>Web Resources</b>			
1.	<a href="https://www.tutorialspoint.com/modelling_and_simulation/index.htm">https://www.tutorialspoint.com/modelling_and_simulation/index.htm</a>		
2.	<a href="https://www.javatpoint.com/verilog-simulation-basics">https://www.javatpoint.com/verilog-simulation-basics</a>		

**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)**

### VIRTUAL REALITY

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
SEC	2	-	-	-	2	2	25	75	100
	<b>Learning Objectives</b>								
LO1	To provide knowledge on basic principles of virtual & augmented reality								
LO2	To have the ability to use its technology as a platform for real-world applications.								
Unit	<b>Contents</b>							<b>No. of Hours</b>	
I	Virtual Reality: The Three I's of VR – History – Early commercial VR Technology – Components of a VR System –Input Devices: Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces							6	
II	Output Devices: Graphics Displays – Sound Displays – Haptic Feedback - Computer Architecture for VR: The Rendering Pipeline- PC Graphics Architecture - VR Programming: Toolkits and Scene Graphs – Traditional and Emerging Applications of VR							6	
III	Augmented Reality: Introduction – Augmented Reality Concepts: Working Principle of AR –Concepts related to AR- Ingredients of an Augmented Reality Experience							6	
IV	Augmented Reality Hardware– Augmented Reality Software– Software to create content for AR Application – Tools and Technologies							6	
V	Augmented Reality Content: Introduction- Creating Content for Visual, Audio, and other senses – Interaction in AR - Mobile Augmented Reality: Introduction – Augmented Reality Applications Areas- Collaborative Augmented Reality							6	
	<b>TOTAL</b>							<b>30</b>	

CO	Course Outcomes
CO1	Outline the basic terminologies, techniques and applications of VR and AR
CO2	Describe different architectures and principles of VR and AR systems
CO3	Use suitable hardware and software technologies for different varieties of virtual and augmented reality applications
CO4	Analyze and explain the behavior of VR and AR technology relates to human perception and cognition
CO5	Assess the importance of VR/AR content and interactions to implement for the real-world problem
<b>Textbooks</b>	
1.	Grigore C. Burdea and Philippe Coiffet, “Virtual Reality Technology”, Wiley Student Edition , Second Edition (Unit I: Chapter 1,2 & Unit II: Chapter 3,4,6,8 & 9)
2.	Alan B. Craig(2013), “Understanding Augmented Reality: Concepts and Applications”(Unit III: Chapter 1, 2, Unit IV : Chapter 3, 4 & Unit V: Chapter 5,6,8)
3.	Jon Peddie (2017), “Augmented Reality: Where We Will All Live”, Springer, Ist Edition (Unit IV: Chapter 7 (Tools & Technologies)
<b>Reference Books</b>	
1.	Alan Craig & William R. Sherman & Jeffrey D. Will, Morgan Kaufmann(2009), “Developing Virtual Reality Applications: Foundations of Effective Design”, Elsevier( Morgan Kaufmann Publishers)
2.	Paul Mealy (2018), “Virtual and Augmented Reality”, Wiley
3.	Bruno Arnaldi & Pascal Guitton & Guillaume Moreau(2018), “Virtual Reality and Augmented Reality: Myths and Realities”, Wiley
<b>NOTE: Latest Edition of Textbooks May be Used</b>	
<b>Web Resources</b>	
1.	<a href="http://msl.cs.uiuc.edu/vr/">http://msl.cs.uiuc.edu/vr/</a>
2.	<a href="http://www.britannica.com/technology/virtual-reality/Living-in-virtual-worlds">http://www.britannica.com/technology/virtual-reality/Living-in-virtual-worlds</a>
3.	<a href="https://mobidev.biz/blog/augmented-reality-development-guide">https://mobidev.biz/blog/augmented-reality-development-guide</a>

MAPPING TABLE						
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

<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>14</b>	<b>11</b>	<b>15</b>	<b>15</b>	<b>10</b>
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### COMPUTER GRAPHICS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
SEC	2	-	-	VI	2	2	25	75	100

#### Learning Objectives

<b>LO</b>	To analyze the various components of a graphics system and to familiarize the building approach of graphics system components and algorithms related to them	
<b>Unit</b>	<b>Contents</b>	<b>No. of Hours</b>
<b>I</b>	A survey of computer graphics – Overview of Graphics Systems: Video display devices: Refresh Cathode Ray tubes, Raster-scan display, Random-scan display, Color CRT Monitors, Direct-view Storage tubes, Flat Panel Display – Raster scan systems- Random scan systems - Input Devices.	6
<b>II</b>	Output Primitives: Points and lines - Line Drawing Algorithm: DDAAtributes of Output Primitives: Line Attributes-Curve Attributes-Color and Grayscale levels – Area Fill Attributes-Character Attributes.	6
<b>III</b>	Two-dimensional Geometric Transformations: Basic Transformations – Matrix Representations – Homogeneous coordinates-Two-Dimensional Viewing: Viewing Pipeline Clipping Operations	6
<b>IV</b>	Graphical User Interfaces and Interactive Input Methods: The User dialogue - Input of graphical data. Three-dimensional concepts: Three-Dimensional Display methods – Three-Dimensional Geometric and Modeling Transformations: Translation, Rotation, Scaling, and Other	6
<b>V</b>	Visible- Surface Detection Methods– Color Models and Color Applications: Properties of light – Intuitive Color Concepts – RGB color model – YIQ color model – Computer Animation: Design of Animation Sequences – Motion Specifications	6
TOTAL		30
<b>CO</b>	Course Outcomes	
<b>CO1</b>	Explain different graphics systems with its applications and computer animation basics with design	
<b>CO2</b>	Outline the computer graphics core concepts including viewing, clipping,	

	modeling and transformation in two and three dimensions
<b>CO3</b>	Select various algorithms for drawing and filling objects
<b>CO4</b>	Apply geometric transformations on graphics objects, clipping methods and its transformation to graphics display device
<b>CO5</b>	Assess the projections and visible surface detection techniques for display of 3D scene on 2D screen
<b>Textbooks</b>	
<b>1.</b>	Donold Hearn, M.Pauline Baker (2004), —Computer Graphics - C Version   - Second Edition, Pearson Education.
<b>Reference Books</b>	
<b>1.</b>	W.M.Newmann and R.F.Sproull (1979), —Principles of Interactive Computer Graphics  , McGrow Hill.
<b>2.</b>	Foley, Van Dan, Feiner, Hughes (2000), —Computer Graphics   - Addison Wesley.
NOTE: Latest Edition of Textbooks May be Used	
<b>Web Resources</b>	
<b>1</b>	<a href="https://www.dgp.toronto.edu/~hertzman/418notes.pdf">https://www.dgp.toronto.edu/~hertzman/418notes.pdf</a>
<b>2</b>	<a href="http://www.tutorialspoint.com/computer_graphics/computer_graphics_tutorial.pdf">http://www.tutorialspoint.com/computer_graphics/computer_graphics_tutorial.pdf</a>

<b>MAPPING TABLE</b>						
<b>CO/PSO</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>	<b>PSO 6</b>
<b>CO1</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>
<b>CO2</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>
<b>CO3</b>	<b>3</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>
<b>Weightage of course contribute d to each PO/PSO</b>	<b>15</b>	<b>13</b>	<b>5</b>	<b>10</b>	<b>5</b>	<b>5</b>