



**THIRUVALLUVAR UNIVERSITY**

**SERKKADU, VELLORE-632115**

**B.C.A. COMPUTER APPLICATIONS**

**SYLLABUS**

**FROM THE ACADEMIC YEAR**

**2023 - 2024**

## **Introduction**

### **BCA(Bachelor of Computer Application)**

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 Application 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 Application 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 Application 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 Application 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 Application 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 Application 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.

Programme Outcome, Programme Specific Outcome and Course Outcome

Computer Application 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. The key core areas of study in Mathematics include Algebra, Analysis (Real & Complex), Differential Equations, Geometry, and Mechanics.

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.C.A.,</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</p>

	<p>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 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</p> <p><b>PO8: Scientific reasoning:</b> 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.</p> <p><b>PO9: Reflective thinking:</b> Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society.</p> <p><b>PO10 Information/digital literacy:</b> 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.</p> <p><b>PO 11 Self-directed learning:</b> Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.</p> <p><b>PO 12 Multicultural competence:</b> 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.</p> <p><b>PO 13: Moral and ethical awareness/reasoning:</b> 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.</p> <p><b>PO 14: Leadership readiness/qualities:</b> 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.</p> <p><b>PO 15: Lifelong learning:</b> 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.</p>
<p><b>Programme Specific Outcomes:</b></p>	<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>

	<b>PSO 5:</b> Enhance skills of analytical and critical thinking to analyze effectiveness of economic policies.
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	<b>PO 1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>
<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
I	<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>
I, II, III, IV	<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>

III, IV, V & VI	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>
IV	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>
V Semester	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>
VI Semester	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

Sem I	Credit	H	Sem II	Credit	H	Sem III	Credit	H	Sem IV	Credit	H	Sem V	Credit	H	Sem VI	Credit	H
Part 1. Language – Tamil	3	6	Part..1. Language – Tamil	3	6	Part..1. Language – Tamil	3	6	Part..1. Language – Tamil	3	6	5.1 Core Course – \CC IX	4	5	6.1 Core Course – CC XIII	4	6
Part.2 English	3	6	Part..2 English	3	6	Part..2 English	3	6	Part..2 English	3	6	5.2 Core Course – CC X	4	5	6.2 Core Course – CC XIV	4	6
1.3 Core Course – CC I	5	6	2..3 Core Course – CCIII	5	5	3.3 Core Course – CC V	5	5	4.3 Core Course – CC VII Core Industry Module	5	5	5. 3.Core Course CC -XI	4	5	6.3 Core Course – CC XV	4	6
1.4 Core Course – CCII	5	5	2.4 Core Course – CCIV	5	5	3.4 Core Course – CC VI	5	5	4.4 Core Course – CC VIII	5	5	5. 4.Core Course –/ Project with viva-voce CC -XII	4	5	6.4 Elective -VII Generic/ Discipline Specific	3	5
1.5 Elective I Generic/ Discipline Specific	3	5	2.5 Elective II Generic/ Discipline Specific	3	6	3.5 Elective III Generic/ Discipline Specific	3	5	4.5 Elective IV Generic/ Discipline Specific	3	6	5.5 Elective V Generic/ Discipline Specific	3	4	6.5 Elective VIII Generic/ Discipline Specific	3	5
1.6 Skill Enhancement Course SEC-1	2	2	2.6 Skill Enhancement Course SEC-2	2	2	3.6 Skill Enhancement Course SEC-4, (Entrepreneurial Skill)	1	1	4.6 Skill Enhancement Course SEC-6	2	2	5.6 Elective VI Generic/ Discipline Specific	3	4	6.6 Extension Activity	1	-

1.7 Skill Enhancement - (Foundation Course)	2	2	2.7 Skill Enhancement Course – SEC-3	2	2	3.7 Skill Enhancement Course SEC-5	2	2	4.7 Skill Enhancement Course SEC-7	2	2	5.7 Value Education	2	2	6.7 Professional Competency Skill	2	2
						3.8 E.V.S.	2	2				5.8 Summer Internship /Industrial Training	2				
	<b>23</b>	<b>32</b>		<b>23</b>	<b>32</b>		<b>24</b>	<b>32</b>		<b>23</b>	<b>32</b>		<b>26</b>	<b>30</b>		<b>21</b>	<b>30</b>
<b>Total – 140 Credits</b>																	

**CREDIT DISTRIBUTION FOR U.G.**

<b>3 – Year UG Programme Credits Distribution</b>			
		<b>No. of Papers</b>	<b>Credits</b>
<b>Part I</b>	Tamil( 3 Credits )	4	12
<b>Part II</b>	English( 3 Credits)	4	12
<b>Part III</b>	Core Courses (4 Credits)	15	60
	Elective Courses :Generic / Discipline Specific ( 3 Credits)	8	24
<b>Total</b>			<b>108</b>
<b>Part IV</b>	NME ( 2 Credits)	2	4
	Ability Enhancement Compulsory Courses Soft Skill( 2 Credits)	4	8
	Skill Enhancement Courses (7 courses) Entrepreneurial Skill -1 Professional Competency Skill Enhancement Course	1	2
	EVS ( 2 Credits)	1	2
	Value Education ( 2 Credits)	1	2
	<b>Part IV Credits</b>		
<b>Part V</b>	Extension Activity (NSS / NCC / Physical Education)		1
<b>Total Credits for the UG Programme</b>			<b>140</b>

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

<b>Parts</b>	<b>Sem I</b>	<b>Sem II</b>	<b>Sem III</b>	<b>Sem IV</b>	<b>Sem V</b>	<b>Sem VI</b>	<b>Total Credits</b>
<b>Part I</b>	3	3	3	3	-	-	12
<b>Part II</b>	3	3	3	3	-	-	12
<b>Part III</b>	11	11	11	11	22	18	84
<b>Part IV</b>	6	6	6	7	3	3	31
<b>Part V</b>	-	-	-	-	-	1	1
<b>Total</b>	23	23	23	24	25	22	<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	

**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	16
Part-4	Skill Enhancement Course SEC-1	2	2
	Foundation Course	2	2
		<b>23</b>	<b>32</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	16
Part-4	Skill Enhancement Course -SEC-2	2	2
	Skill Enhancement Course -SEC-3 (Discipline / Subject Specific)	2	2
		<b>23</b>	<b>32</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	15
Part-4	Skill Enhancement Course -SEC-4 (Entrepreneurial Based)	1	1
	Skill Enhancement Course -SEC-5 (Discipline / Subject Specific)	2	2
	E.V.S	2	2
		<b>24</b>	<b>32</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	16
Part-4	Skill Enhancement Course -SEC-6 (Discipline / Subject Specific)	2	2
	Skill Enhancement Course -SEC-7 (Discipline / Subject Specific)	2	2
		<b>23</b>	<b>32</b>

**Third Year  
Semester-V**

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>No. of Hours</b>
<b>Part-3</b>	Core Courses including Project / Elective Based	22	28
<b>Part-4</b>	Value Education	2	2
	Internship / Industrial Visit / Field Visit	2	-
		<b>26</b>	<b>30</b>

### Semester-VI

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

### SEMESTER-III

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language	3	6
Part-II	English	3	6
Part-III	CC5– Data Structures and Algorithm	5	5
	CC6-Practical: Data Structures and Algorithm Lab	5	5
	<b>Elective Course –III</b> (Generic/Discipline Specific) {choose one from thelist) 1. Introduction to Data Science 2. Office Automation	3	5
Part-IV	<b>Skill Enhancement Course-SEC-4</b> Problem Solving Techniques	1	1
	<b>Skill Enhancement Course -SEC-5</b> (Discipline / Subject Specific) PHP Programming	2	2
	Environmental Studies	2	2
		<b>24</b>	<b>32</b>

### SEMESTER-IV

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language	3	6
Part-II	English	3	6
Part-III	CC7– Java Programming	5	5
	CC8-Practical: Java Programming Lab	5	5
	<b>Elective Course –IV</b> (choose one from thelist) 1. Network Security 2. Multimedia System	3	6
Part-IV	<b>Skill Enhancement Course-SEC-6</b> Web Designing	2	2
	<b>Skill Enhancement Course -SEC-7</b> (Discipline / Subject Specific) Cyber Forensics	2	2
		<b>23</b>	<b>32</b>

### SEMESTER-V

Part	List of Courses	Credit	Hours per week (L/T/P)
	CC9– Operating System	3	4
Part-III	CC10– Operating System Lab	3	4
	CC11- Data Base Management System	3	4
	CC12-Practical: Data Base Management System Lab	3	3
	<b>Elective Course –V</b> (choose one from the list) 1. Mobile Computing 2. Artificial Intelligence 3. Big Data Analytics	3	4
	<b>Elective Course –VI</b> (choose one from the list) 1. Computer Networks 2. Software Testing 3. Cryptography	3	4
	CC13 - Project with Viva voce	4	5
Part-IV	Value Education	2	2
	Internship / Industrial Training (Summer vacation at the end of IV semester activity)	2	-
		<b>26</b>	<b>30</b>

### SEMESTER-VI

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-III	CC14– Machine Learning	3	4
	CC15– Machine Learning Lab	3	4
	CC16-Data Analytics using R Programming	3	5
	CC17-Practical: Data Analytics using R Programming Lab	3	5
	<b>Elective Course –VII</b> (choose one from the list) 1. IOT and its Applications 2. Software Project Management 3. Enterprise Resource Planning	3	5
	<b>Elective Course –VIII</b> (choose one from the list) 1. Natural Language Processing 2. Cloud Computing 3. Robotics and its Applications	3	5
Part-IV	<b>Skill Enhancement Course - SEC8</b> Open Source Technology	2	2
Part-V	Extension Activity	1	
		<b>21</b>	<b>30</b>

**SEMESTER – III**

Title of the Course/ Paper	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	M a r k s		
									CIA	External	Total
CC5	Data Structure and Algorithms	Core	5	-	-	-	5	5	25	75	100
<b>Learning Objectives</b>											
LO1	To understand the concepts of ADTs										
LO2	To learn linear data structures-lists, stacks, queues										
LO3	To learn Tree structures and application of trees										
LO4	To learn graph structures and application of graphs										
LO5	To understand various sorting and searching										
<b>UNIT</b>	<b>Contents</b>									<b>No. of Hours</b>	
I	Abstract Data Types (ADTs)- List ADT-array-based implementation-linked list implementation singly linked lists-circular linked lists-doubly-linked lists-applications of lists-Polynomial Manipulation- All operations-Insertion-Deletion-Merge-Traversal									15	
II	Stack ADT-Operations- Applications- Evaluating arithmetic expressions – Conversion of infix to postfix expression-Queue ADT-Operations-Circular Queue- Priority Queue- deQueue applications of queues.									15	
III	Tree ADT-tree traversals-Binary Tree ADT-expression trees-applications of trees-binary search tree ADT- Threaded Binary Trees-AVL Trees- B-Tree- B+ Tree – Heap-Applications of heap.									15	
IV	Definition- Representation of Graph- Types of graph-Breadth first traversal – Depth first traversal-Topological sort- Bi-connectivity – Cut vertex- Euler circuits-Applications of graphs.									15	
V	Searching- Linear search-Binary search-Sorting-Bubble sort-Selection sort-Insertion sort-Shell sort-Radix sort-Hashing-Hash functions-Separate chaining- Open Addressing-Rehashing Extendible Hashing									15	
	<b>Total</b>									<b>75</b>	
<b>Course Outcomes</b>									<b>Programme Outcome</b>		
CO	On completion of this course, students will										

CO1	Understand the concept of Dynamic memory management, data types, algorithms, Big O notation	PO1,PO6
CO2	Understand basic data structures such as arrays, linked lists, stacks and queues	PO2
CO3	Describe the hash function and concepts of collision and its resolution methods	PO2,PO4
CO4	Solve problem involving graphs, trees and heaps	PO4,PO6
CO5	Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data	PO5,PO6
<b>Text Book</b>		
1	1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Pearson Education 2014, 4th Edition.	
2	ReemaThareja, "Data Structures Using C", Oxford Universities Press 2014, 2nd Edition	
<b>Reference Books</b>		
1.	Thomas H.Cormen,ChalesE.Leiserson,RonaldL.Rivest, Clifford Stein, "Introduction to Algorithms", McGraw Hill 2009, 3rd Edition.	
2.	Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education 2003	
3.	P Rizwan Ahmed, C++ and Data Structure , Margham Pubications, 2015	
<b>Web Resources</b>		
1.	<a href="https://www.programiz.com/dsa">https://www.programiz.com/dsa</a>	
2.	<a href="https://www.geeksforgeeks.org/learn-data-structures-and-algorithms-dsa-tutorial/">https://www.geeksforgeeks.org/learn-data-structures-and-algorithms-dsa-tutorial/</a>	

### Mapping with Programme Outcomes:

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

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

Title of the Course/ Paper	Subject Name	Category	L	T	P	S	Credi	Inst.	M a r k s			
									CI	A	Ex ter	To tal
CC6	<b>Data Structure and Algorithms Lab</b> [Note: Practicals may be offered through C / C++ / Python]	Core	-	-	4	-	5	5	25	75	100	
<b>Learning Objectives</b>												
LO1	To understand the concepts of ADTs											
LO2	To learn linear data structures-lists, stacks, queues											
LO3	To learn Tree structures and application of trees											
LO4	To learn graph structures and application of graphs											
LO5	To understand various sorting and searching											
Sl. No	Contents										No. of Hours	
1.	Write a program to implement the List ADT using arrays and linked lists.										<b>60</b>	
2.	Write a programs to implement the following using a singly linked list. <ul style="list-style-type: none"> <li>• Stack ADT</li> <li>• Queue ADT</li> </ul>											
3.	Write a program that reads an infix expression, converts the expression to postfix form and then evaluates the postfix expression (use stack ADT).											
4.	Write a program to implement priority queue ADT.											
5.	Write a program to perform the following operations: <ul style="list-style-type: none"> <li>• Insert an element into a binary search tree.</li> <li>• Delete an element from a binary search tree.</li> <li>• Search for a key element in a binary search tree.</li> </ul>											
6.	Write a program to perform the following operations <ul style="list-style-type: none"> <li>• Insertion into an AVL-tree</li> <li>• Deletion from an AVL-tree</li> </ul>											
7.	Write a programs for the implementation of BFS and DFS for a given graph.											
8.	Write a programs for implementing the following searching methods: <ul style="list-style-type: none"> <li>• Linear search</li> <li>• Binary search.</li> </ul>											
9.	Write a programs for implementing the following sorting methods: <ul style="list-style-type: none"> <li>• Bubble sort</li> <li>• Selection sort</li> <li>• Insertion sort</li> <li>• Radix sort.</li> </ul>											
<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 concept of Dynamic memory management,								PO1,PO4,PO5			

	data types, algorithms, Big O notation	
2	Understand basic data structures such as arrays, linked lists, stacks and queues	PO1, PO4, PO6
3	Describe the hash function and concepts of collision and its resolution methods	PO1, PO3, PO6
4	Solve problem involving graphs, trees and heaps	PO3, PO4
5	Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data	PO1, PO5, PO6
<b>Text Book</b>		
1	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Pearson Education 2014, 4th Edition.	
2	Reema Thareja, "Data Structures Using C", Oxford Universities Press 2014, 2nd Edition	
<b>Reference Books</b>		
1	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", McGraw Hill 2009, 3rd Edition	
2.	Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education 2003	
<b>Web Resources</b>		
1.	<a href="https://www.programiz.com/dsa">https://www.programiz.com/dsa</a>	
2.	<a href="https://www.geeksforgeeks.org/learn-data-structures-and-algorithms-dsa-tutorial/">https://www.geeksforgeeks.org/learn-data-structures-and-algorithms-dsa-tutorial/</a>	

**Mapping with Programme Outcomes:**

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

**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
EC3	Introduction to Data Science	Elective	4	-	-	-	3	4	25	75	100
<b>Learning Objectives</b>											
LO1	To learn about basics of Data Science and Big data.										
LO2	To learn about overview and building process of Data Science.										
LO3	To learn about various Algorithms in Data Science.										
LO4	To learn about Hadoop Framework.										
LO5	To learn about case study about Data Science.										
UNIT	Contents										No. of Hours
I	<b>Introduction:</b> Benefits and uses – Facts of data – Data science process – Big data ecosystem and data science										12
II	<b>The Data science process:</b> Overview – research goals - retrieving data - transformation – Exploratory Data Analysis – Model building .										12
III	<b>Algorithms :</b> Machine learning algorithms – Modeling process – Types – Supervised – Unsupervised - Semi-supervised										12
IV	<b>Introduction to Hadoop :</b> Hadoop framework – Spark – replacing MapReduce– NoSQL – ACID – CAP – BASE – types										12
V	<b>Case Study:</b> Prediction of Disease - Setting research goals - Data retrieval – preparation - exploration - Disease profiling - presentation and automation										12
<b>Total</b>										<b>60</b>	
Course Outcomes							Programme Outcome				
CO	On completion of this course, students will										
CO1	Understand the basics in Data Science and Big data.										PO1
CO2	Understand overview and building process in Data Science.										PO1, PO2
CO3	Understand various Algorithms in Data Science.										PO3, PO6
CO4	Understand Hadoop Framework in Data Science.										PO4, PO5

CO5	Case study in Data Science.	PO3, PO5
<b>Text Book</b>		
1	Davy Cielen, Arno D. B. Meysman, Mohamed Ali, “Introducing Data Science”, manning publications 2016	
<b>Reference Books</b>		
1.	Roger Peng, “The Art of Data Science”, lulu.com 2016.	
2.	MurtazaHaider, “Getting Started with Data Science – Making Sense of Data with Analytics”, IBM press, E-book.	
3.	Davy Cielen, Arno D.B. Meysman, Mohamed Ali, “Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools”, Dreamtech Press 2016.	
4.	Annalyn Ng, Kenneth Soo, “Numsense! Data Science for the Layman: No Math Added”, 2017, 1st Edition.	
5.	Cathy O'Neil, Rachel Schutt, “Doing Data Science Straight Talk from the Frontline”, O'Reilly Media 2013.	
6.	Lillian Pierson, “Data Science for Dummies”, 2017 II Edition	
<b>Web Resources</b>		
1.	<a href="https://www.w3schools.com/datascience/">https://www.w3schools.com/datascience/</a>	
2.	<a href="https://en.wikipedia.org/wiki/Data_science">https://en.wikipedia.org/wiki/Data_science</a>	
3.	<a href="http://www.cmap.polytechnique.fr/~lepenec/en/post/references/refs/">http://www.cmap.polytechnique.fr/~lepenec/en/post/references/refs/</a>	

#### Mapping with Programme Outcomes:

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>

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
EC3	Office Automation	Elective	2	-	-	-	3	4	25	75	100
<b>Learning Objectives</b>											
LO1	Understand the basics of computer systems and its components.										
LO2	Understand and apply the basic concepts of a word processing package.										
LO3	Understand and apply the basic concepts of electronic spreadsheet software.										
LO4	Understand and apply the basic concepts of database management system.										
LO5	Understand and create a presentation using PowerPoint tool.										
UNIT	Contents									No. of Hours	
I	Introductory concepts: Memory unit– CPU-Input Devices: Key board, Mouse and Scanner.Outputdevices:Monitor,Printer.IntroductiontoOperatingsystems &itsfeatures:DOS– UNIX–Windows. Introduction to Programming Languages.									6	
II	<b>Word Processing:</b> Open, Save and close word document; Editing text – tools, formatting, bullets Spell Checker - Document formatting – Paragraph alignment, indentation, headers and footers, numbering; printing–Preview, options, merge.									6	
III	<b>Spreadsheets:</b> Excel– opening,enteringtextanddata,formatting,navigating;Formulas– entering,handlingand copying; Charts–creating, formatting and printing,analysistables,preparationoffinancialstatements,introductionto dataanalytics.									6	
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 &viewing slides – creating slide shows. Applying special object – including objects & pictures – Slide transition–Animation effects,audio inclusion,timers.									6	

	<b>Total</b>	<b>30</b>
<b>Course Outcomes</b>		<b>Programme Outcomes</b>
CO	On completion of this course, students will	
CO1	Possess the knowledge on the basics of computers and its components	PO1,PO2,PO3,PO6,PO8
CO2	Gain knowledge on Creating Documents, spreadsheet and presentation.	PO1,PO2,PO3,PO6
CO3	Learn the concepts of Database and implement the Query in Database.	PO3,PO5,PO7
CO4	Demonstrate the understanding of different automation tools.	PO3,PO4,PO5,PO7
CO5	Utilize the automation tools for documentation, calculation and presentation purpose.	PO4,PO6,PO7,PO8
<b>Text Book</b>		
1	PeterNorton,“IntroductiontoComputers”–TataMcGraw-Hill.	
2.	P.Rizwan Ahmed, Office Automation, Margham Publications, 2019	
<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:**

<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>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>

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
SEC4	Problem Solving Techniques	FC	2	-	-	-	1	1	25	75	100
<b>Learning Objectives</b>											
LO1	Familiarize with writing of algorithms, fundamentals of C and philosophy of problem solving.										
LO2	Implement different programming constructs and decomposition of problems into functions.										
LO3	Use data flow diagram, Pseudo code to implement solutions.										
LO4	Define and use of arrays with simple applications										
LO5	Understand about operating system and their uses										
UNIT	Contents								No. Of. Hours		
I	<b>Introduction:</b> History, characteristics and limitations of Computer. Hardware/Anatomy of Computer: CPU, Memory, Secondary storage devices, Input Devices and Output devices. Types of Computers: PC, Workstation, Minicomputer, Main frame and Supercomputer. Software: System software and Application software. <b>Programming Languages:</b> Machine language, Assembly language, High-level language, 4 GL and 5GL-Features of good programming language. Translators: Interpreters and Compilers.								<b>6</b>		
II	<b>Data:</b> Data types, Input, Processing of data, Arithmetic Operators, Hierarchy of operations and Output. Different phases in Program Development Cycle (PDC). <b>Structured Programming: Algorithm:</b> Features of good algorithm, Benefits and drawbacks of algorithm. <b>Flowcharts:</b> Advantages and limitations of flowcharts, when to use flowcharts, flowchart symbols and types of flowcharts. <b>Pseudocode:</b> Writing a pseudocode. Coding, documenting and testing a program: Comment lines and types of errors. <b>Program design:</b> Modular Programming.								<b>6</b>		
III	<b>Selection Structures:</b> Relational and Logical Operators - Selecting from Several Alternatives – Applications of Selection Structures. <b>Repetition Structures:</b> Counter Controlled Loops –Nested Loops– Applications of Repetition Structures.								<b>6</b>		
IV	<b>Data:</b> Numeric Data and Character Based Data. <b>Arrays:</b> One Dimensional Array - Two Dimensional Arrays – Strings as Arrays of Characters.								<b>6</b>		
V	<b>Data Flow Diagrams:</b> Definition, DFD symbols and types of DFDs. <b>Program Modules:</b> Subprograms-Value and Reference parameters- Scope of a variable - Functions – Recursion. <b>Files:</b> File Basics-Creating and reading a sequential file- Modifying Sequential Files.								<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	Study the basic knowledge of Computers. Analyze the programming languages.		PO1, PO2, PO3, PO4, PO5, PO6
CO2	Study the data types and arithmetic operations. Know about the algorithms. Develop program using flow chart and pseudocode.		PO1, PO2, PO3, PO4, PO5, PO6
CO3	Determine the various operators. Explain about the structures. Illustrate the concept of Loops		PO1, PO2, PO3, PO4, PO5, PO6
CO4	Study about Numeric data and character-based data. Analyze about Arrays.		PO1, PO2, PO3, PO4, PO5, PO6
CO5	Explain about DFD Illustrate program modules. Creating and reading Files		PO1, PO2, PO3, PO4, PO5, PO6
<b>Textbooks</b>			
1	<b>Stewart Venit</b> , “Introduction to Programming: Concepts and Design”, Fourth Edition, 2010, Dream Tech Publishers.		
<b>Web Resources</b>			
1.	<a href="https://www.codesansar.com/computer-basics/problem-solving-using-computer.htm">https://www.codesansar.com/computer-basics/problem-solving-using-computer.htm</a>		
2.	<a href="http://www.nptel.iitm.ac.in/video.php?subjectId=106102067">http://www.nptel.iitm.ac.in/video.php?subjectId=106102067</a>		
3.	<a href="http://utubersity.com/?page_id=876">http://utubersity.com/?page_id=876</a>		

### Mapping with Programme Outcomes:

<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>CO 1</b>	3	3	3	3	3	3
<b>CO 2</b>	3	3	3	3	3	3
<b>CO 3</b>	3	2	3	3	3	3
<b>CO 4</b>	3	3	2	3	3	3
<b>CO 5</b>	3	3	3	3	3	2
<b>Weightage of course contributed to each PSO</b>	15	14	14	15	15	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
SEC5	PHP PROGRAMMING	Skill Enha. Course (SEC)	2	-	-	-	2	2	25	75	100
<b>Learn ing Objectives</b>											
LO1	To provide the necessary knowledge on basics of PHP.										
LO2	To design and develop dynamic, database-driven web applications using PHP version.										
LO3	To get an experience on various web application development techniques.										
LO4	To learn the necessary concepts for working with the files using PHP.										
LO5	To get a knowledge on OOPS with PHP.										
UNIT	Contents								No. of Hours		
I	Introduction to PHP -Basic Knowledge of websites - Introduction of Dynamic Website -Introduction to PHP -Scope of PHP -XAMPP and WAMP Installation								6		
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		
III	Switch() Statements -Using the while() Loop -Using the for() Loop PHP Functions. PHP Functions -Creating an Array - Modifying Array Elements -Processing Arrays with Loops - Grouping Form Selections with Arrays -Using Array Functions.								6		
IV	PHP Advanced Concepts -Reading and Writing Files -Reading Data from a File.								6		
V	Managing Sessions and Using Session Variables -Destroying a Session -Storing Data in Cookies -Setting Cookies.								6		
<b>Total</b>								<b>30</b>			
Course Outcomes						Programme Outcomes					
CO	On completion of this course, students will										
CO1	Write PHP scripts to handle HTML forms					PO1,PO4,PO6					
CO2	Write regular expressions including modifiers, operators, and metacharacters.					PO2,PO5,PO7.					
CO3	Create PHP Program using the concept of array.					PO3,PO4,PO5.					
CO4	Create PHP programs that use various PHP					PO2,PO3,PO5					

	library functions	
CO5	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.	Open source digital libraries: PHP Programming	
2.	<a href="https://www.w3schools.com/php/default.asp">https://www.w3schools.com/php/default.asp</a>	

**Mapping with Programme Outcomes:**

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

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

**SEMESTER – IV**

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	Ext	Total
CC7	Java Programming	Core	5	-	-	-	5	5	25	75	100
<b>Learning Objectives</b>											
LO1	To provide fundamental knowledge of object-oriented programming										
LO2	To equip the student with programming knowledge in Core Java from the basics up.										
LO3	To enable the students to use AWT controls, Event Handling and Swing for GUI.										
LO4	To provide fundamental knowledge of object-oriented programming.										
LO5	To equip the student with programming knowledge in Core Java from the basics up.										
UNIT	Contents							No. of Hours			
I	<b>Introduction:</b> Review of Object Oriented concepts – History of Java – Java buzzwords – JVM architecture - Datatypes - Variables - Scope and life time of variables - arrays - operators – control statements - type conversion and casting - simple java program - constructors - methods - Static block - Static Data – Static Method String and String Buffer Classes.							15			
II	<b>Inheritance:</b> Basic concepts - Types of inheritance - Member access rules - Usage of this and Super key word - Method Overloading - Method overriding - Abstract classes - Dynamic method dispatch - Usage of final keyword. <b>Packages:</b> Definition-Access Protection – Importing Packages. <b>Interfaces:</b> Definition–Implementation–Extending Interfaces. <b>Exception Handling:</b> <i>try – catch- throw - throws – finally</i> – Built-in exceptions - Creating own Exception classes.							15			
III	<b>Multithreaded Programming:</b> Thread Class - Runnable interface –Synchronization–Using synchronized methods– Using synchronized statement- Inter thread Communication –Deadlock.  <b>I/O Streams:</b> Concepts of streams - Stream classes- Byte and Character stream - Reading console Input and							15			

	Writing Console output - File Handling.	
IV	<p><b>AWT Controls:</b> The AWT class hierarchy - user interface components- Labels - Button - Text Components - Check Box - Check Box Group - Choice - List Box - Panels – Scroll Pane - Menu - Scroll Bar. Working with Frame class - Colour - Fonts and layout managers.</p> <p><b>Event Handling:</b> Events - Event sources - Event Listeners - Event Delegation Model (EDM) - Handling Mouse and Keyboard Events - Adapter classes - Inner classes</p>	15
V	<p><b>Swing:</b> Introduction to Swing - Hierarchy of swing components. Containers - Top level containers - JFrame - JWindow - JDialog - JPanel - JButton - JToggleButton - JCheckBox - JRadioButton - JLabel, JtextField - JTextArea - JList - JComboBox - JScrollPane.</p>	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 the basic Object-oriented concepts. Implement the basic constructs of Core Java.	PO1, PO2, PO6
<b>CO2</b>	Implement inheritance, packages, interfaces and exception handling of Core Java.	PO2, PO3, PO8
<b>CO3</b>	Implement multi-threading and I/O Streams of Core Java	PO1, PO3, PO5
<b>CO4</b>	Implement AWT and Event handling.	PO2, PO6
<b>CO5</b>	Use Swing to create GUI.	PO1, PO3, PO6
<b>Text Books:</b>		
1.	Herbert Schildt, The Complete Reference, Tata McGraw Hill, New Delhi, 7th Edition, 2010	
2.	Gary Cornell, <i>Core Java 2 Volume I – Fundamentals</i> , Addison Wesley, 1999	
<b>References :</b>		
1.	Head First Java, O’Rielly Publications,	
2.	Y. Daniel Liang, <i>Introduction to Java Programming</i> , 7th Edition, Pearson Education India, 2010	
3.	P.Rizwan Ahmed, Java Programming, 3 <sup>rd</sup> Edition, Margham Publications, 2017	
<b>Web Resources</b>		

1.	<a href="https://javabeginnerstutorial.com/core-java-tutorial">https://javabeginnerstutorial.com/core-java-tutorial</a>
2.	<a href="http://docs.oracle.com/javase/tutorial/">http://docs.oracle.com/javase/tutorial/</a>
3.	<a href="https://www.coursera.org/">https://www.coursera.org/</a>

**Mapping with Programme Outcomes:**  
**S-Strong-3 M-Medium-2 L-Low-1**

<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>2</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>
<b>CO3</b>	<b>2</b>	<b>2</b>	<b>1</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>2</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>1</b>
<b>Weightage of course contributed to each PSO</b>	<b>14</b>	<b>14</b>	<b>13</b>	<b>14</b>	<b>14</b>	<b>11</b>

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
CC8	Java Programming Lab	Core	-	-	4	-	5	5	25	75	100
<b>Learning Objectives</b>											
LO1	To provide fundamental knowledge of object-oriented programming.										
LO2	To equip the student with programming knowledge in Core Java from the basics up.										
LO3	To enable the students to know about Event Handling .										
LO4	To enable the students to use String Concepts.										
LO5	To equip the student with programming knowledge in to creat GUI using AWT controls.										
<b>EXCERCIS E</b>	<b>Details</b>										
1	Write a Java program that prompts the user for an integer and then prints out all the prime numbers up to that Integer										
2	Write a Java program to multiply two given matrices.										
3	Write a Java program that displays the number of characters, lines and words in a text										
4	Generate random numbers between two given limits using Random class and print messages according to the range of the value generated.										
5	Write a program to do String Manipulation using CharacterArray and perform the following string operations: a. String length b. Finding a character at a particular position c. Concatenating two strings										
6	Write a program to perform the following string operations using String class:										

	<ul style="list-style-type: none"> <li>a. String Concatenation</li> <li>b. Search a substring</li> <li>c. To extract substring from given string</li> </ul>	
7	<p>Write a program to perform string operations using String Buffer class:</p> <ul style="list-style-type: none"> <li>a. Length of a string</li> <li>b. Reverse a string</li> <li>c. Delete a substring from the given string</li> </ul>	
8	<p>Write a java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.</p>	
9	<p>Write a threading program which uses the same method asynchronously to print the numbers 1to10 using Thread1 and to print 90 to100 using Thread2.</p>	
10	<p>Write a program to demonstrate the use of following exceptions.</p> <ul style="list-style-type: none"> <li>a. Arithmetic Exception</li> <li>b. Number Format Exception</li> <li>c. ArrayIndexOutOfBoundsException</li> <li>d. NegativeArraySizeException</li> </ul>	
11	<p>Write a Java program that reads on file name from the user, then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes</p>	
12	<p>Write a program to accept a text and change its size and font. Include bold italic options. Use frames and controls.</p>	
13	<p>Write a Java program that handles all mouse events and shows the event</p>	

	name at the center of the window when a mouse event is fired. (Use adapter classes).	
14	Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -, *, % operations. Add a text field to display the result. Handle any possible exceptions like divide by zero.	
15	Write a Java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with “stop” or “ready” or “go” should appear above the buttons in a selected color. Initially there is no message shown.	
<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 basic Object-oriented concepts. Implement the basic constructs of Core Java.	PO1
2	Implement inheritance, packages, interfaces and exception handling of Core Java.	PO1, PO2
3	Implement multi-threading and I/O Streams of Core Java	PO4, PO6
4	Implement AWT and Event handling.	PO4, PO5, PO6
5	Use Swing to create GUI.	PO3, PO6
<b>Text Book</b>		
1	Herbert Schildt, The Complete Reference, Tata McGraw Hill, New Delhi, 7th Edition, 2010.	
2.	Gary Cornell, <i>Core Java 2 Volume I – Fundamentals</i> , Addison Wesley, 1999.	
<b>Reference Books</b>		
1.	Head First Java, O’Rielly Publications,	
2.	Y. Daniel Liang, <i>Introduction to Java Programming</i> , 7th Edition, Pearson Education India, 2010.	
<b>Web Resources</b>		
1.	<a href="https://www.w3schools.com/java/">https://www.w3schools.com/java/</a>	

2.	<a href="http://java.sun.com">http://java.sun.com</a>
3.	<a href="http://www.afu.com/javafaq.html">http://www.afu.com/javafaq.html</a>

**Mapping with Programme Outcomes:**

<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>2</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>
<b>CO3</b>	<b>2</b>	<b>2</b>	<b>1</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>2</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>Weightage of course contributed to each PSO</b>	<b>14</b>	<b>14</b>	<b>13</b>	<b>14</b>	<b>14</b>	<b>12</b>

**S-Strong    M-Medium    L-Low**

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
<b>EC4</b>	<b>Network Security</b>	Elective	5	-	-	-	3	3	25	75	100
<b>Course Objectives</b>											
CO1	To familiarize on the model of network security, Encryption techniques										
CO2	To understand the concept of Number Theory , theorems										
CO3	To understand the design concept of cryptography and authentication										
CO4	To develop experiments on algorithm used for security										
CO5	To understand about virus and threats, firewalls, and implementation of Cryptography										
<b>UNIT</b>	<b>Contents</b>							<b>No. of Hours</b>			
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>	Analyze and design classical encryption techniques and							PO1, PO3, PO6			

	block ciphers.	
<b>CO2</b>	Understand and analyze public-key cryptography, RSA and other public-key cryptosystems such as Diffie-Hellman Key Exchange, ElGamal Cryptosystem, etc	PO1,PO2,PO3,PO5
<b>CO3</b>	Understand key management and distribution schemes and design User Authentication	PO4, PO5
<b>CO4</b>	Analyze and design hash and MAC algorithms, and digital signatures.	PO1, PO2, PO3, PO6
<b>CO5</b>	Know about Intruders and Intruder Detection mechanisms, Types of Malicious software,	P02, PO6
<b>Reference Text :</b>		
1.	William Stallings, “Cryptography & Network Security”, Pearson Education, Fourth Edition 2010.	
<b>References</b>		
1.	CharlieKaufman,RadiaPerlman,MikeSpeciner,“NetworkSecurity,Privatecommunicationinpublicworld”,PHISecondEdition,2002	
2.	Bruce Schneier, Neils Ferguson, “Practical Cryptography”, Wiley Dreamtech India Pvt Ltd, First Edition, 2003.	
3.	DouglasRSimson“Cryptography–Theoryandpractice”,CRCPress,FirstEdition,1995	
4.	P.Rizwan Ahmed, Cryptography, Margham Publications, 2014	
<b>Web Resources</b>		
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>	

**Mapping with Programme Outcomes:**

<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>2</b>	<b>3</b>	<b>2</b>	<b>2</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>3</b>	<b>2</b>	<b>3</b>	<b>3</b>
<b>CO5</b>	<b>2</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>14</b>	<b>12</b>	<b>13</b>	<b>13</b>	<b>14</b>	<b>13</b>

**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
EC4	Multimedia Systems	Elective	2	-	-	-	3	3	25	75	100
<b>Learning Objectives</b>											
LO1	Understand the definition of Multimedia										
LO2	To study about the Image File Formats, SoundsAudio File Formats										
LO3	Understand the concepts of Animation and Digital Video Containers										
LO4	To study about the Stage of Multimedia Project										
LO5	Understand the concept of Ownership of Content Created for Project Acquiring Talent										
UNIT	Contents						No. of Hours	Course Objective			
I	Multimedia Definition-Use Of Multimedia-Delivering Multimedia- Text: About Fonts and Faces - Using Text in Multimedia -Computers and Text Font Editing and Design Tools-Hypermedia and Hypertext.						6				
II	Images: Plan Approach - Organize Tools - Configure Computer Workspace -Making Still Images - Color - Image File Formats. Sound: The Power of Sound -DigitalAudio-MidiAudio-Midivis.DigitalAudio-MultimediaSystemSoundsAudio File Formats - Vaughan's Law of Multimedia Minimums - Adding Sound to Multimedia Project						6				
III	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						6				
IV	Making Multimedia: The Stage of Multimedia Project - The Intangible Needs -The Hardware Needs - The Software Needs - An Authoring Systems Needs-Multimedia Production Team.						6				
V	Planning and Costing: The Process of Making Multimedia-Scheduling-Estimating - RFPs and Bid Proposals. Designing and Producing - Content andTalent:AcquiringContent-OwnershipofContentCreatedforProject-AcquiringTalent						6				
<b>Total</b>						<b>30</b>					
<b>Course Outcomes</b>							<b>Programme Outcomes</b>				

<b>CO</b>	On completion of this course, students will	
<b>CO1</b>	understand the concepts, importance, application and the process of developing multimedia	PO1
<b>CO2</b>	to have basic knowledge and understanding about image related processings	PO1, PO2
<b>CO3</b>	To understand the framework of frames and bit images to animations	PO4, PO6
<b>CO4</b>	Speaks about the multimedia projects and stages of requirement in phases of project.	PO4, PO5, PO6
<b>CO5</b>	Understanding the concept of cost involved in multimedia planning, designing, and producing	PO3, PO6
<b>Text Book</b>		
<b>1</b>	TayVaughan,"Multimedia:MakingItWork",8thEdition,Osborne/McGraw-Hill,2001.	
<b>Reference Books</b>		
<b>1.</b>	RalfSteinmetz&KlaraNahrstedt"MultimediaComputing,Communication&Applications",PearsonEducation,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:**

<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>2</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>1</b>
<b>CO3</b>	<b>1</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>10</b>	<b>12</b>	<b>11</b>	<b>14</b>	<b>12</b>	<b>10</b>

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst.	Marks		
									CIA	External	Total
SEC6	WEB DESIGNING	Skill Enha. Course (SEC)	2	-	-	-	2	2	25	75	100
<b>Learning Objectives</b>											
LO1	Understand the basics of HTML and its components										
LO2	To study about the Graphics in HTML										
LO3	Understand and apply the concepts of XML and DHTML										
LO4	Understand the concept of JavaScript										
LO5	To identify and understand the goals and objectives of the Ajax										
UNIT	Details						No. of Hours				
I	HTML: HTML-Introduction-tag basics- page structure-adding comments working with texts, paragraphs and line break. Emphasizing test-heading and horizontal rules-list-font size, face and color-alignment links-tables-frames.						6				
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				
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				
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						6				

	JavaScript, How to develop JavaScript, simple JavaScript, variables, functions, conditions, loops and repetition,	
V	Advance script, JavaScript and objects, JavaScript own objects, the DOM and web browser environments, forms and validations.	6
<b>Total</b>		<b>30</b>
<b>Course Outcomes</b>		<b>Programme Outcome</b>
CO	On completion of this course, students will	
CO1	Develop working knowledge of HTML	PO1, PO3, PO6, PO8
CO2	Ability to Develop and publish Web pages using Hypertext Markup Language (HTML).	PO1,PO2,PO3,PO6
CO3	Ability to optimize page styles and layout with Cascading Style Sheets (CSS).	PO3, PO5
CO4	Ability to develop a java script	PO1, PO2, PO3, PO7
CO5	An ability to develop web application using Ajax.	P02, 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:

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

**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
SEC7	Cyber Forensics	Skill Enha. Course (SEC)	2	-	-	-	2	2	25	75	100
<b>Learning Objectives</b>											
<b>LO1</b>	Understand the definition of computer forensics fundamentals.										
<b>LO2</b>	To study about the Types of Computer Forensics Evidence										
<b>LO3</b>	Understand and apply the concepts of Duplication and Preservation of Digital Evidence										
<b>LO4</b>	Understand the concepts of Electronic Evidence and Identification of Data										
<b>LO5</b>	To study about the Digital Detective, Network Forensics Scenario, Damaging Computer Evidence.										
<b>UNIT</b>	<b>Contents</b>								<b>No. of Hours</b>		
<b>I</b>	<b>Overview of Computer Forensics Technology:</b> Computer Forensics Fundamentals: What is Computer Forensics Use of Computer Forensics in Law Enforcement, Computer Forensics Services,. Types of Computer. Forensics Technology: Types of Business Computer Forensic, Technology–Types of Military Computer Forensic Technology–Types of Law Enforcement–Computer Forensic.								6		
<b>II</b>	<b>Computer Forensics Evidence and capture:</b> Data Recovery: Data Recovery Defined, Data Back–up and Recovery, The Role of Back – up in Data Recovery, The Data –Recovery Solution. Evidence Collection and Data Seizure: Collection Options, Obstacles, Types of Evidence.								6		
<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.								6		
<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								6		
<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.								6		
	<b>Total</b>								<b>30</b>		
<b>Course Outcomes</b>									<b>Programme Outcomes</b>		
<b>CO</b>	On completion of this course, students will										
<b>CO1</b>	Understand the definition of computer forensics fundamentals.										
<b>CO2</b>	Evaluate the different types of computer forensics technology.										

<b>CO3</b>	Analyze various computer forensics systems.	PO4, PO6
<b>CO4</b>	Apply the methods for data recovery, evidence collection and data seizure.	PO4, PO5, PO6
<b>CO5</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:**

<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>1</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO2</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>1</b>
<b>CO3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>1</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>3</b>
<b>Weightage of course contributed to each PSO</b>	<b>14</b>	<b>12</b>	<b>9</b>	<b>14</b>	<b>14</b>	<b>10</b>

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

**SEMESTER – V**

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
CC9	Operating Systems	Core	Y	-	-	-	3	4	25	75	100
<b>Course Objective</b>											
LO1	Understanding the design of the Operating System										
LO2	Imparting knowledge on CPU scheduling, Process and Memory Management.										
LO3	To code specialized programs for managing overall resources and operations of the computer.										
LO4	To study about the concept of Job and processor scheduling										
LO5	To learn about te concept of memory organization and multiprogramming										
UNIT	Details								No. of Hours		
	<p><b>Introduction:</b> operating system, history (1990s to 2000 and beyond), distributed computing, parallel computation. <b>Process concepts:</b> definition of process, process states-Life cycle of a process, process management- process state transitions, process control block(PCB), process operations , suspend and resume, context switching, Interrupts -Interrupt processing, interrupt classes, Inter process communication-signals, message passing.</p>								15		
II	<p><b>Asynchronous concurrent processes:</b> mutual exclusion- critical section, mutual exclusion primitives, implementing mutual exclusion primitives, Peterson’s algorithm,software solutions to the mutual Exclusion Problem-, n-thread mutual exclusion-Lamports Bakery Algorithm. Semaphores – Mutual exclusion with Semaphores, thread synchronization with semaphores, counting semaphores, implementing semaphores.</p> <p><b>Concurrent programming:</b> monitors, message passing</p>								15		
III	<p><b>Deadlock and indefinite postponement:</b> Resource concepts, four necessary conditions for deadlock, deadlock prevention, deadlock avoidance and Dijkstra’s Banker’s algorithm, deadlock detection, deadlock recovery.</p>								15		
IV	<p><b>Job and processor scheduling:</b> scheduling levels, scheduling objectives, scheduling criteria, preemptive vs non-preemptive scheduling, interval timer or interrupting clock, priorities, scheduling algorithms- FIFO scheduling, RR scheduling, quantum size, SJF scheduling, SRT scheduling, HRN scheduling, multilevel feedback queues, Fair share scheduling.</p>								15		
V	<p><b>Real Memory organization and Management::</b> Memory organization, Memory management, Memory hierarchy, Memory management strategies, contiguous vs non-contiguous memory allocation, single user contiguous memory allocation, fixed partition multiprogramming, variable partition multiprogramming,</p>								15		

	Memory swapping <b>Virtual Memory organization:</b> virtual memory basic concepts, multilevel storage organization, block mapping, paging basic concepts, segmentation, paging/segmentation systems. <b>Virtual Memory Management:</b> Demand Paging, Page replacement strategies	
	<b>Total</b>	7 5
<b>Course Outcomes</b>		<b>Programme Outcomes</b>
CO	On completion of this course, students will	
1	Define the fundamentals of OS and identify the concepts relevant to process , process life cycle, Scheduling Algorithms, Deadlock and Memory management	PO1
2	know the critical analysis of process involving various algorithms, an exposure to threads and semaphores	PO1, PO2
3	Have a complete study about Deadlock and its impact over OS. Knowledge of handling Deadlock with respective algorithms and measures to retrieve from deadlock. .	PO4, PO6
4	Have complete knowledge of Scheduling Algorithms and its types.	PO4, PO5, PO6
5	understand memory organization and management	PO3, PO8
<b>Text Book</b>		
1	H.M. Deitel, Operating Systems, Third Edition, Pearson Education Asia, 2011	
<b>Reference Books</b>		
1.	William Stallings, Operating System: Internals and Design Principles, Seventh Edition, Prentice-Hall of India, 2012.	
2.	A. Silberschatz, and P.B. Galvin., Operating Systems Concepts, Ninth Edition, John Wiley & Sons(ASIA) Pte Ltd.,2012	
3.	P.Rizwan Ahmed, Operating System, Margham Publications, 2019	

**Mapping with Programme Outcomes:**

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	-	1	2	-	1
CO 2	2	3	1	2	-	1
CO 3	3	2	-	3	-	1
CO 4	1	3	1	1	3	2
CO 5	3	-	1	3	2	1
<b>WEIGHTAGE OF COURSE CONTRIBUTED TO EACH PSO</b>	<b>12</b>	<b>8</b>	<b>4</b>	<b>11</b>	<b>5</b>	<b>6</b>

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
CC10	Operating System lab	Core	-	-	5	-	4	3	25	75	100
<b>Learning Objectives</b>											
LO1	. To learn about the basics of UNIX commands and shell programming										
LO2	To understand the programming knowledge of scheduling algorithms.										
LO3	To understand the working of semaphores in operating system										
LO4	To understand how to code various algorithm used in operating system.										
LO5	To understand how to code and working procedure of file management concepts in operating system.										
	<b>List of Exercises:</b>							<b>No. of Hours</b>	<b>Course Objective</b>		
	1.Shell Programming. 2. Implement the following CPU scheduling algorithms a) Round Robin b) SJF c) FCFS d) Priority 3. Implement all file allocation strategies a) Sequential b) Indexed c) Linked 4. Implement Semaphore 5. Implement all File Organization Techniques a) Single level directory b) Two level c) Hierarchical d) DAG 6. Implement Bankers Algorithm for Dead Lock Avoidance 7. Implement an Algorithm for Dead Lock Detection 8. Implement e all page replacement algorithms a) FIFO b) LRU c) LFU 9. Implement Shared memory and IPC 10. Implement Paging Technique of memory management. 11. Implement Threading & Synchronization Applications.							3	60 Hrs		
	<b>Total</b>										
<b>Course Outcomes</b>							<b>Programme Outcomes</b>				
CO	On completion of this course, students will										

CO1	Able to understand the basics of UNIX commands and shell programming.	PO1
CO2	Able to understand the programming knowledge of scheduling algorithms.	PO1, PO2
CO3	Able to understand the working of semaphores in operating system	PO4, PO6
CO4	Able to understand how to code various algorithm used in operating system.	PO4, PO5, PO6
CO5	. Able to understand how to code and working procedure of file management concepts in operating system.	PO3, PO4
<b>Text Book</b>		
1	H.M. Deitel, Operating Systems, Third Edition, Pearson Education Asia, 2011	
2	William Stallings, Operating System: Internals and Design Principles, Seventh Edition, Prentice-Hall of India, 2012.	
<b>Reference Books</b>		
1.	A. Silberschatz, and P.B. Galvin., Operating Systems Concepts, Nineth Edition, John Wiley & Sons(ASIA) Pte Ltd.,2012	
<b>Web Resources</b>		
1.	Web resources from NDL Library, E-content from open-source libraries	

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
CC11	Database Management System	Core	5	-	-	-	3	4	25	75	100
<b>Learning Objectives</b>											
LO1	To enable the students to learn the designing of data base systems, foundation on the relational model of data and normal forms.										
LO2	To understood the concepts of data base management system, design simple Database models										
LO3	To learn and understand to write queries using SQL, PL/SQL.										
LO4	To enable the students to learn the designing of data base systems, foundation on the relational model of data and normal forms.										
LO5	To understood the concepts of data base management system, design simple Database models										
UNIT	Contents								No. of Hours		
I	<b>Database Concepts:</b> Database Systems - Data vs Information - Introducing the database -File system - Problems with file system – Database systems. Data models - Importance - Basic Building Blocks - Business rules - Evolution of Data models - Degrees of Data Abstraction								15		
II	<b>Design Concepts:</b> Relational database model - logical view of data-keys -Integrity rules - relational set operators - data dictionary and the system catalog - relationships -data redundancy revisited - indexes - codd's rules. Entity relationship model - ER diagram								15		
III	<b>Normalization of Database Tables:</b> Database tables and Normalization – The Need for Normalization –The Normalization Process – Higher level Normal Form. <b>Introduction to SQL:</b> Data Definition Commands – Data Manipulation Commands – SELECT Queries – Additional Data Definition Commands – Additional SELECT Query Keywords – Joining Database Tables.								15		

IV	<b>Advanced SQL:</b> Relational SET Operators: UNION – UNION ALL – INTERSECT - MINUS.SQL Join Operators: Cross Join – Natural Join – Join USING Clause – JOIN ON Clause – Outer Join. <b>Sub Queries and Correlated Queries:</b> WHERE – IN – HAVING – ANY and ALL – FROM. SQL Functions: Date and Time Function – Numeric Function – String Function – Conversion Function	15
V	<b>PL/SQL:</b> A Programming Language: History – Fundamentals – Block Structure – Comments – Data Types – Other Data Types – Variable Declaration – Assignment operation –Arithmetic operators. <b>Control Structures and Embedded SQL:</b> Control Structures – Nested Blocks – SQL in PL/SQL – Data Manipulation – Transaction Control statements. <b>PL/SQL Cursors and Exceptions:</b> Cursors – Implicit Cursors, Explicit Cursors and Attributes – Cursor FOR loops – SELECT...FOR UPDATE – WHERE CURRENT OF clause – Cursor with Parameters – Cursor Variables – Exceptions – Types of Exceptions.	15
<b>Total</b>		<b>75</b>
<b>Course Outcomes</b>		<b>Programme Outcomes</b>
CO	On completion of this course, students will	
CO1	Understand the various basic concepts of Data Base System. Difference between file system and DBMS and compare various data models.	PO1
CO2	Define the integrity constraints. Understand the basic concepts of Relational Data Model, Entity-Relationship Model.	PO1, PO2
CO3	Design database schema considering normalization and relationships within database. Understand and construct database using Structured Query Language. Attain a good practical skill of managing and retrieving of data using Data Manipulation Language (DML)	PO4, PO6
CO4	Classify the different functions and various join operations and enhance the knowledge of handling multiple tables.	PO4, PO5, PO6
CO5	Learn to design Data base operations and implement using PL/SQL programs. Learn basics of PL/SQL	PO3, PO5

	and develop programs using Cursors, Exceptions
<b>Text Book</b>	
1	Coronel, Morris, Rob, "Database Systems, Design, Implementation and Management", Ninth Edition
2	Nilesh Shah, "Database Systems Using Oracle", 2nd edition, Pearson Education India, 2016
<b>Reference Books</b>	
1.	Abraham Silberschatz, Henry F.Korth and S.Sudarshan, "Database System Concepts", McGraw Hill International Publication, VI Edition
2.	Shio Kumar Singh, "Database Systems", Pearson publications, II Edition
3.	P.Rizwan Ahmed, RDBMS, Margham Publications, 2016
<b>Web Resources</b>	
1.	Web resources from NDL Library, E-content from open-source libraries

**Mapping with Programme Outcomes:**

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

**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
CC12	Database Management System lab	Core	-	-	5	-	4	5	25	75	100
<b>Learning Objectives</b>											
LO1	To enable the students to learn the designing of data base systems, foundation on the relational model of data and normal forms.										
LO2	To understood the concepts of data base management system, design simple Database models										
LO3	To learn and understand to write queries using SQL, PL/SQL.										
LO4	To enable the students to learn the designing of data base systems, foundation on the relational model of data and normal forms.										
LO5	To understood the concepts of data base management system, design simple Database models										
<b>List of Exercises:</b>							<b>No. of Hours</b>				
<p><b><i>I. SQL</i></b></p> <ol style="list-style-type: none"> <li>1. DDLCOMMANDS</li> <li>2. DMLCOMMANDS</li> <li>3. TCLCOMMANDS</li> </ol> <p><b><i>II. PL/SQL</i></b></p> <ol style="list-style-type: none"> <li>4. FIBONACCI SERIES</li> <li>5. FACTORIAL</li> <li>6. STRING REVERSE</li> <li>7. SUM OF SERIES</li> <li>8. TRIGGER</li> </ol> <p><b><i>III. CURSOR</i></b></p> <ol style="list-style-type: none"> <li>9. STUDENT MARK ANALYSIS USING CURSOR</li> </ol>							75				

	<b>IV. APPLICATION</b>  10. LIBRARY MANAGEMENTSYSTEM  11. STUDENT MARK ANALYSIS		
	<b>Total</b>		<b>75</b>
<b>Course Outcomes</b>		<b>Programme Outcomes</b>	
CO	On completion of this course, students will		
CO1	Understand the various basic concepts of Data Base System. Difference between file system and DBMS and compare various data models.	PO1	
CO2	Define the integrity constraints. Understand the basic concepts of Relational Data Model, Entity-Relationship Model.	PO1, PO2	
CO3	Design database schema considering normalization and relationships within database. Understand and construct database using Structured Query Language. Attain a good practical skill of managing and retrieving of data using Data Manipulation Language (DML)	PO4, PO6	
CO4	Classify the different functions and various join operations and enhance the knowledge of handling multiple tables.	PO4, PO5, PO6	
CO5	Learn to design Data base operations and implement using PL/SQL programs. Learn basics of PL/SQL and develop programs using Cursors, Exceptions	PO3, PO4	
<b>Text Book</b>			
1	Coronel, Morris, Rob, "Database Systems, Design, Implementation and Management", Ninth Edition		
2	Nilesh Shah, "Database Systems Using Oracle", 2nd edition, Pearson Education India, 2016		
<b>Reference Books</b>			
1.	Abraham Silberschatz, Henry F.Korth and S.Sudarshan, "Database System Concepts", McGraw Hill International Publication ,VI Edition		
2.	Shio Kumar Singh , "Database Systems ", Pearson publications ,II Edition		
<b>Web Resources</b>			
1.	Web resources from NDL Library, E-content from open-source libraries		

**Mapping with Programme Outcomes:**

<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>3</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO4</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>1</b>
<b>CO5</b>	<b>2</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>12</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>14</b>	<b>11</b>

**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
EC5	Mobile Computing	Elective	5	-	-	-	3	4	25	75	100
<b>Learning Objectives</b>											
LO1	To provide the knowledge on wireless communication fundamentals										
LO2	To study the basic concepts of medium access control and telecommunication system										
LO3	To study a set of wireless networks										
LO4	To study about mobile network layer.										
LO5	To study the basic concepts of wireless application protocol										
UNIT	Contents							No. of Hours	Course Objectives		
I	Introduction–Applications–A short History of wireless Communications–Wireless Transmission – Frequencies for Radio transmission–Signals–Antennas–Signal Propagation– Multiplexing–Modulations–Amplitude shift keying–Frequency shift keying–Phase shift keying–Spread Spectrum							15			
II	SDMA–FDMA–TDMA–Fixed TDM–Classical Aloha–CDMA–Global System for Mobile Communications –GPRS–Satellite Systems –Basics –Applications–Broadcast Systems – Digital Audio Broadcasting – Digital Video Broadcasting. learn development of applications in mobile computing platform.							15			
III	Infrared vs. Radio Transmission– Infrastructure Networks–Ad hoc Networks – IEEE 802.11 –System Architecture–Protocol Architecture–Bluetooth–User scenarios–Bluetooth Architecture–Introduction to Wireless ATM –Services–Location Reference Model							15			
IV	Mobile IP–Goals– Assumption–Entities and Terminology– IP Packet delivery – Agent advertisement and discovery–Registration–Tunnelling and encapsulation–Optimizations– Dynamic Host Configuration Protocol (DHCP) –Routing –DSDV–DSR – Alternative Metrics							15			
V	Introduction–Protocol Architecture–Wireless Markup Language (WML)–WML Script–Applications–Wireless Telephony Application (WTA) – Wireless Telephony Application Architecture							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>	To understand basic concepts of mobile computing.	PO1, PO3, PO6, PO8
<b>CO2</b>	To learn the basics of mobile telecommunication system	PO1,PO2,PO3,PO6
<b>CO3</b>	To comprehend wireless LAN and cellular systems.	PO3, PO5
<b>CO4</b>	To understand protocols at network and transport layer	PO1, PO2, PO3, PO5
<b>CO5</b>	To understand protocols at network and transport layer	PO2, PO4, PO6
<b>Text Books (Latest Editions)</b>		
1.	“Mobile Communications”, Jochen Schiller –PHI/Pearson Education, Second Edition, 2003	
<b>References Books (Latest editions)</b>		
1.	“Principles of Wireless Networks”, KavehPahalavan, PrasanthKrishnamoorthy, PHI/Pearson Education, 2003	
2.	“ Mobile Computing”, Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal – Tata McGraw Hill Publications, Second edition, 2010	
3.	P Rizwan Ahmed, Mobile Computing, Margham Publications, 2014	

#### **Mapping with Programme Outcomes:**

<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 ofcoursecontributedto eachPSO</b>	<b>15</b>	<b>12</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>

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
EC5	Artificial Intelligence	Elective	4	-	-	-	3	4	25	75	100
<b>Course Objective</b>											
C1	To learn various concepts of AI Techniques.										
C2	To learn various Search Algorithm in AI.										
C3	To learn probabilistic reasoning and models in AI.										
C4	To learn about Markov Decision Process.										
C5	To learn various type of Reinforcement learning.										
UNIT	Contents										No. of Hours
I	Introduction: Concept of AI, history, current status, scope, agents, environments, Problem Formulations, Review of tree and graph structures, State space representation, Search graph and Search tree										12
II	Search Algorithms : Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, Best first search, A* algorithm, Game Search										12
III	Probabilistic Reasoning : Probability, conditional probability, Bayes Rule, Bayesian Networks- representation, construction and inference, temporal model, hidden Markov model.										12
IV	Markov Decision process : MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs.										12
V	Reinforcement Learning : Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning- Q learning										12
<b>Total</b>										<b>60</b>	
Course Outcomes							Programme Outcome				
CO	On completion of this course, students will										
1	Understand the various concepts of AI Techniques.						PO1				

2	Understand various Search Algorithm in AI.	PO1, PO2
3	Understand probabilistic reasoning and models in AI.	PO4, PO6
4	Understand Markov Decision Process.	PO4, PO5, PO6
5	Understand various type of Reinforcement learning Techniques.	PO3, PO4
<b>Text Book</b>		
1	Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach” , 3rd Edition, Prentice Hall.	
2.	Elaine Rich and Kevin Knight, “Artificial Intelligence”, Tata McGraw Hill	
3.	P.Rizwan Ahmed, Artificial Intelligence, Margham Publications, 2014	
<b>Reference Books</b>		
1.	Trivedi, M.C., “A Classical Approach to Artificial Intelligence”, Khanna Publishing House, Delhi.	
2.	SarojKaushik, “Artificial Intelligence”, Cengage Learning India, 2011	
3.	David Poole and Alan Mackworth, “Artificial Intelligence: Foundations for Computational Agents”, Cambridge University Press 2010	
<b>Web Resources</b>		
1.	<a href="https://github.com/dair-ai/ML-Course-Notes">https://github.com/dair-ai/ML-Course-Notes</a>	
2.	<a href="https://web.cs.hacettepe.edu.tr/~erkut/ain311.f21/index.html">https://web.cs.hacettepe.edu.tr/~erkut/ain311.f21/index.html</a>	
3.	<a href="https://www.toolify.ai/?gclid=CjwKCAjwvdajBhBEEiwAeMh1U6tlqU1LXIRFbcghLMZVwICm_4PkIRcDRE-VYq_wTDcuaQeq_bCHnhoCcm4QAvD_BwE">https://www.toolify.ai/?gclid=CjwKCAjwvdajBhBEEiwAeMh1U6tlqU1LXIRFbcghLMZVwICm_4PkIRcDRE-VYq_wTDcuaQeq_bCHnhoCcm4QAvD_BwE</a>	

**Mapping with Programme Outcomes:**

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
<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>

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
EC5	Big Data Analytics	Elective	4	-	-	-	3	4	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	Contents								No. of Hours		
I	Evolution of Big data — Best Practices for Big data Analytics — Big data characteristics — Validating — The Promotion of the Value of Big Data — Big Data Use Cases- Characteristics of Big Data Applications — Perception and Quantification of Value - Understanding Big Data Storage — A General Overview of High-Performance Architecture — HDFS — Map Reduce and YARN — Map Reduce Programming Model								12		
II	Advanced Analytical Theory and Methods: Overview of Clustering — K-means — Use Cases — Overview of the Method — Determining the Number of Clusters — Diagnostics — Reasons to Choose and Cautions .- Classification: Decision Trees — Overview of a Decision Tree — The General Algorithm — Decision Tree Algorithms — Evaluating a Decision Tree — Decision Trees in R — Naïve Bayes — Bayes Theorem — Naïve Bayes Classifier.								12		
III	Advanced Analytical Theory and Methods: Association Rules — Overview — Apriori Algorithm — Evaluation of Candidate Rules — Applications of Association Rules — Finding Association& finding similarity — Recommendation System: Collaborative Recommendation- Content Based Recommendation — Knowledge Based Recommendation-								12		

	Hybrid Recommendation Approaches.	
IV	Introduction to Streams Concepts — Stream Data Model and Architecture — Stream Computing, Sampling Data in a Stream — Filtering Streams — Counting Distinct Elements in a Stream — Estimating moments — Counting oneness in a Window — Decaying Window — Real time Analytics Platform(RTAP) applications — Case Studies — Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics	12
V	NoSQL Databases : Schema-less Models : Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores — Tabular Stores — Object Data Stores — Graph Databases Hive — Sharding —Hbase — Analyzing big data with twitter — Big data for E-Commerce Big data for blogs — Review of Basic Data Analytic Methods using R.	12
<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, PO5
4	Perform analytics on data streams.	PO3, PO5, PO6
5	Learn NoSQL databases and management.	PO3, PO4
<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.

[https://www.sas.com/en\\_us/insights/analytics/big-data-analytics.html](https://www.sas.com/en_us/insights/analytics/big-data-analytics.html)
**Mapping with Programme Outcomes:**

<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>3</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>2</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>2</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</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>13</b>

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
EC6	Computer Networks	Core	5	-	-	-	3	4	25	75	100
<b>Course Objective</b>											
LO1	To learn the basic concepts of Data communication and Computer network										
LO2	To learn about wireless Transmission										
LO3	To learn about networking and data link layer.										
LO4	To study about Network communication.										
LO5	To learn the concept of Transport layer										
UNIT	Contents										No. of Hours
I	Introduction – Network Hardware – Software – Reference Models – OSI and TCP/IP Models – Example Networks: Internet, ATM, Ethernet and Wireless LANs - Physical Layer – Theoretical Basis for Data Communication - Guided Transmission Media										15
II	Wireless Transmission - Communication Satellites – Telephone System: Structure, Local Loop, Trunks and Multiplexing and Switching. Data Link Layer: Design Issues – Error Detection and Correction.										15
III	Elementary Data Link Protocols - Sliding Window Protocols – Data Link Layer in the Internet - Medium Access Layer – Channel Allocation Problem – Multiple Access Protocols – Bluetooth.										15
IV	Network Layer - Design Issues - Routing Algorithms - Congestion Control Algorithms – IP Protocol – IP Addresses – Internet Control Protocols.										15
V	Transport Layer - Services - Connection Management - Addressing, Establishing and Releasing a Connection – Simple Transport Protocol – Internet Transport Protocols (ITP) - Network Security: Cryptography										15
	<b>Total</b>										<b>75</b>
Course Outcomes								Programme Outcome			
CO	On completion of this course, students will										
CO1	To Understand the basics of Computer Network architecture, OSI and TCP/IP reference models							PO1			

CO2	To gain knowledge on Telephone systems using wireless network	PO1, PO2
CO3	To understand the concept of MAC	PO4, PO6
CO4	To analyze the characteristics of Routing and Congestion control algorithms	PO4, PO5, PO6
CO5	To understand network security and define various protocols such as FTP, HTTP, Telnet, DNS	PO3, PO4
<b>Text Book</b>		
1	A. S. Tanenbaum, "Computer Networks", 4th Edition, Prentice-Hall of India, 2008.	
<b>Reference Books</b>		
1.	B. A. Forouzan, "Data Communications and Networking", Tata McGraw Hill, 4th Edition, 2017	
2.	F. Halsall, "Data Communications, Computer Networks and Open Systems", Pearson Education, 2008	
3.	D. Bertsekas and R. Gallager, "Data Networks", 2nd Edition, PHI, 2008.	
4.	Lamarca, "Communication Networks", Tata McGraw- Hill, 2002	
<b>Web Resources</b>		
1.	<a href="https://en.wikipedia.org/wiki/Computer_network">https://en.wikipedia.org/wiki/Computer_network</a>	
2.	<a href="https://citationsy.com/styles/computer-networks">https://citationsy.com/styles/computer-networks</a>	

**Mapping with Programme Outcomes:**

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

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
EC6	Software Testing	Elective	Y	-	-	-	3	4	25	75	100
<b>Learning Objectives</b>											
LO1	To study fundamental concepts in software testing										
LO2	To discuss various software testing issues and solutions in software unit test, integration and system testing.										
LO3	To study the basic concept of Data flow testing and Domain testing.										
LO4	To Acquire knowledge on path products and path expressions.										
LO5	To learn about Logic based testing and decision tables										
UNIT	Contents						No. of Hours				
I	Introduction: Purpose–Productivity and Quality in Software–TestingVsDebugging–Model for Testing–Bugs–Types of Bugs – Testing and Design Style.						6				
II	Flow / Graphs and Path Testing – Achievable paths – Path instrumentation Application Transaction FlowTesting Techniques.						6				
III	Data Flow Testing Strategies - Domain Testing:Domains and Paths – Domains and Interface Testing.						6				
IV	Linguistic –Metrics – Structural Metric – Path Products and Path Expressions. Syntax Testing–Formats–Test Cases						6				
V	Logic Based Testing–Decision Tables–Transition Testing–States, State Graph, State Testing.						6				
<b>Total</b>						<b>30</b>					
Course Outcomes							Program Outcomes				
CO	On completion of this course, students will										
CO1	Students learn to apply software testing knowledge and engineering methods						PO1				
CO2	Have an ability to identify the needs of software test automation, and define and develop a test tool to support test automation.						PO1, PO2				
CO3	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				
CO4	Have basic understanding and knowledge of contemporary issues in software testing, such as						PO4, PO5, PO6				

	component-based software testing problems	
<b>CO5</b>	Have an ability to use software testing methods and modern software testing tools for their testing projects.	PO3, PO8
<b>Text Book</b>		
<b>1</b>	B.Beizer,“SoftwareTestingTechniques”,IIEdn.,DreamTechIndia,NewDelhi,2003.	
<b>2</b>	K.V.K.Prasad,“SoftwareTestingTools”,DreamTech.India,NewDelhi,2005	
<b>Reference Books</b>		
<b>1.</b>	I.Burnstein,2003,“PracticalSoftwareTesting”,SpringerInternationalEdn.	
<b>2.</b>	E. Kit, 1995, “Software Testing in the Real World: Improving the Process”, PearsonEducation,Delhi.	
<b>3.</b>	P.Rizwan Ahmed, Software Testing, Margham Publications, 2016	
<b>Web Resources</b>		
<b>1.</b>	<a href="https://www.javatpoint.com/software-testing-tutorial">https://www.javatpoint.com/software-testing-tutorial</a>	
<b>2.</b>	<a href="https://www.guru99.com/software-testing.html">https://www.guru99.com/software-testing.html</a>	

**Mapping with Programme Outcomes:**

<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>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>

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
EC6	Cryptography	Elect	4	-	-	-	3	25	75	100
<b>Learning Objectives</b>										
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	<b>Introduction:</b> The OSI security Architecture – Security Attacks – Security Mechanisms – Security Services – A model for network Security.								12	
II	<b>Classical Encryption Techniques:</b> Symmetric cipher model – <b>Substitution Techniques:</b> Caesar Cipher – Monoalphabetic cipher – Play fair cipher – Poly Alphabetic Cipher – Transposition techniques – Stenography								12	
III	<b>Block Cipher and DES:</b> Block Cipher Principles – DES – The Strength of DES – <b>RSA:</b> The RSA algorithm.								12	
IV	<b>Network Security Practices:</b> IP Security overview - IP Security architecture – Authentication Header. <b>Web Security:</b> SecureSocketLayer and Transport Layer Security – Secure Electronic Transaction.								12	
V	Intruders – Malicious software – Firewalls.								12	
<b>TOTAL HOURS</b>								<b>60</b>		
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
<b>Textbooks</b>		
1	<b>William Stallings</b> , “Cryptography and Network Security Principles and Practices”.	
<b>Reference Books</b>		
1.	<b>Behrouz A. Foruzan</b> , “Cryptography and Network Security”, Tata McGraw-Hill, 2007.	
2	<b>AtulKahate</b> , “ <i>Cryptography and Network Security</i> ”, Second Edition, 2003, TMH.	
3	<b>V. Arun Kumar</b> , “ <i>Network Security</i> ”, 2011, First Edition, USP.	
4.	P.Rizwan Ahmed, Cryptography, Margham Publications, 2014	
<b>Web Resources</b>		
1	<a href="https://www.tutorialspoint.com/cryptography/">ps://www.tutorialspoint.com/cryptography/</a>	
2	<a href="https://gpgtools.tenderapp.com/kb/how-to/introduction-to-cryptography">ps://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
<b>CO 1</b>	3	3	3	2	3	2
<b>CO 2</b>	3	2	3	2	3	3
<b>CO 3</b>	3	3	3	2	3	3
<b>CO 4</b>	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	Marks		
								CIA	External	Total
	<b>Project with Viva voce</b>		4	-	-		4	25	75	100
<b>Learning Objectives</b>										
LO1	Advance from an intellectually curious student to a creator/maker and an industry professional									
LO2	Apply verbal and written communication skills to explain technical problem solving techniques and solutions to an increasingly diverse and global audience									
LO3	Collaborate within and across disciplinary boundaries to solve problems									
LO4	Apply mathematical and/or statistical methods to facilitate problem solving.									
LO5	Exercise computational thinking over the entire software life cycle									

### Project Work

SL	Area of Work	Maximum Marks
	<b>PROJECT WORK:</b>	10
1.	(i) Project Proposal and Plan	
	(ii) Execution of the Project Proposal and Plan / Collection of data, Documentation and Presentation of the report.	40
2.	Viva Voce Examination	25
<b>TOTAL</b>		<b>75</b>

\* CIA Marks =25 marks (Project Review 1, Project Review2 and Project Review 3)

Course Outcomes		Programme Outcomes
CO	On successful completion of this course, students will be able to	
1	show leadership skills and learn time management	PO1, PO2, PO3, PO4, PO5, PO6
2	identify various tools to be applied to a specific problem	PO1, PO2, PO3, PO4, PO5, PO6
3	evaluate the reports	PO1, PO2, PO3, PO4, PO5, PO6
4	take part in a team as well as manage it to deliver stunning outcomes	PO1, PO2, PO3, PO4, PO5, PO6
5	assess and develop the individual skills to present and organize projects	PO1, PO2, PO3, PO4, PO5, PO6

### Mapping with Programme Outcomes:

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

<b>CO1</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>
<b>CO3</b>	<b>2</b>	<b>2</b>	<b>1</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>2</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>1</b>
<b>Weightage of course contributed to each PSO</b>	<b>14</b>	<b>14</b>	<b>13</b>	<b>14</b>	<b>14</b>	<b>11</b>

### **Guidelines for Documentation of Project**

After completion of the project work, every student will submit a project report which should contain the following:

1. Cover Page (as per annexure 1)
2. Title page (as per annexure 1)
3. Declaration by the Student (as per annexure 2)
4. Certificate by the Guide (as per annexure 3)
5. Acknowledgment (The candidate may thank all those who helped in the execution of the project.)
6. Abstract (It should be in one page and include the purpose of the study; the methodology used and a summary of the major findings.)
7. Table of Contents
8. Detailed description of the project (This should be split in various chapters/sections with each chapter/section describing a project activity in totality). This portion of report should contain all relevant diagrams, tables, flow charts, software programs, print outs, photographs etc., which are properly labeled.
9. Conclusion & Recommendations
10. Appendices
  - Appendices are provided to give supplementary information, which if included in the main text may serve as a distraction and cloud the central theme.
  - Appendices should be numbered using Arabic numerals, e.g. Appendix 1, Appendix 2.
  - Appendices shall carry the title of the work reported and the same title shall be listed in the Contents page also
11. References (The listing of references should be typed 2 spaces below the heading "REFERENCES" in alphabetical order in single spacing left – justified. It should be numbered consecutively (in square [ ] brackets, throughout the text and should be collected together in the reference list at the end of the report. The references should be numbered in the order they are used in the text. The name of the author/authors should be immediately followed by the year and other details).

	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	<b>Internship / Industrial Training</b>	-	-	-	-		2	25	75	100
<b>Learning Objectives</b>										
LO1	Advance from an intellectually curious student to a creator/maker and an industry professional									
LO2	Apply verbal and written communication skills to explain technical problem solving techniques and solutions to an increasingly diverse and global audience									
LO3	Collaborate within and across disciplinary boundaries to solve problems									
LO4	Apply mathematical and/or statistical methods to facilitate problem solving.									
LO5	Exercise computational thinking over the entire software life cycle									

### Internship / Industrial Training:

The students to undergo 2 weeks of Internship / Industrial Training in the Industry

Sl.No	Area of Work	Maximum Marks
	a) Work Related performance – Work Attitude/ Academic preparation/ problem solving ability/ Adaptability / Overall Attendance / Progress towards learning goals	10
	b) Organizational skills – Time management skills / Planning skills/ communication skills	20
	c) Relationship with others – Willingness to cooperate with co-works/ Ability to work with supervisor / Acceptance of constructive comments / Ability to take direction	20
	Internship Report / Viva Voce Examination	25
	<b>Total</b>	75

\* CIA Marks =25 marks (Internship Review 1, Review2 and Review 3)

Course Outcomes		Programme Outcomes
CO	On successful completion of this course , students will be able to	
1	Find their specific areas of interest , refine their skills and abilities	PO1, PO2, PO3, PO4, PO5, PO6

2	Show a greater sense of self-awareness and appreciation for others	PO1, PO2, PO3, PO4, PO5, PO6
3	Apply problem solving and critical thinking skills to solve real time problem	PO1, PO2, PO3, PO4, PO5, PO6
4	Design various solution approaches for addressing IT business needs.	PO1, PO2, PO3, PO4, PO5, PO6
5	Apply best practices of IT industries by working in the Product or service domain.	PO1, PO2, PO3, PO4, PO5, PO6

**Mapping with Programme Outcomes:**

<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>1</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO2</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>1</b>
<b>CO3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>1</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>3</b>
<b>Weightage of course contributed to each PSO</b>	<b>14</b>	<b>12</b>	<b>9</b>	<b>14</b>	<b>14</b>	<b>10</b>

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

### **Guidelines for internship**

- Internship should be of 2 weeks duration.
- A student is expected to find internship by himself or herself. However, the institution should assist their students in getting internship in good organizations.
- **The home institution cannot be taken as the place of internship.**
- Internship can be on any topic covered in the syllabus mentioned in the syllabus, not restricted to the specialization.
- Internship can be done, in one of the following, but not restricted to, types of organizations:
  - Software development firms
  - Hardware/ manufacturing firms
  - Any small scale industries, service providers like banks
  - Clinics/ NGOs/professional institutions like that of CA, Advocate etc
  - Civic Depts like Ward office/post office/police station/ punchayat.

### **Guidelines for making Internship Report**

A student is expected to make a report based on the internship he or she has done in an organization. It should contain the following:

- **Certificate:** A certificate in the prescribed Performa (given in appendix 1) from the organization where the internship done.
- **Evaluation form:** The form filled by the supervisor or to whom the intern was reporting, in the prescribed Performa (given in appendix 2).
- **Title:** A suitable title giving the idea about what work the student has performed during the internship.
- **Description of the organization:** A small description of 1 to 2 pages on the organization where the student has interned
- **Description about the activities done by the section where the intern has worked:** A description of 2 to 4 pages about the section or cell of the organization where the intern actually worked. This should give an idea about the type of activity a new employee is expected to do in that section of the organization.
- **Description of work allotted and actually done by the intern:** A detailed description of the work allotted and actual work performed by the intern during

the internship period. Intern may give a weekly report of the work by him or her if needed. It shall be of around 7 to 10 pages.

- **Self assessment:** A self assessment by the intern on what he or she has learnt during the internship period. It shall contain both technical as well as interpersonal skills learned in the process. It shall be of around 2 to 3 pages.

The internship report may be around 20 to 30 pages and this needs to be submitted to the external examiner at the time of University examination.

### ***Appendix 1***

(Proforma for the certificate for internship in official letter head)

This is to certify that Mr/Ms \_\_\_\_\_ of \_\_\_\_\_ College/Institution worked as an intern as part of her B.Sc. course in Computer Science of Thiruvalluvar University. The particulars of internship are given below:

Internship starting date: \_\_\_\_\_

Internship ending date: \_\_\_\_\_

Actual number of days worked: \_\_\_\_\_

Tentative number of hours worked: \_\_\_\_\_ Hours

Broad area of work: \_\_\_\_\_

A small description of work done by the intern during the period:

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Signature:

Name:

Designation:

Contact  
number:

Email:

(Seal of the organization)

## **Appendix 2**

(Proforma for the Evaluation of the intern by the supervisor/to whom the intern was reporting in the organization)

### **Professional Evaluation of intern**

Name of intern: \_\_\_\_\_

College/institution: \_\_\_\_\_

[Note: Give a score in the 1-5 scale by putting  $\surd$  in the respective cells]

<b>S. No</b>	<b>Particular</b>	<b>Excellent</b>	<b>Very Good</b>	<b>Good</b>	<b>Moderate</b>	<b>Satisfactory</b>
1	Attendance					
2	Punctuality					
3	Adaptability					
4	Ability to shoulder responsibility					
5	Ability to work in a team					
6	Written and oral communication skills					
7	Problem solving skills					
8	Ability to grasp new concepts					
9	Ability to complete task					
10	Quality of work done					

Comments:

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Signature:

Name:

Designation:

Contact number:

Email:

(Seal of the organization)

**SEMESTER – VI**

Subject Code	Subject Name	Category	L	T	P	S	Credits	Instruction hour	Marks		
									CIA	External	Total
CC14	<b>Machine Learning</b>	Core	5	-	-	-	3	4	25	75	100
<b>Learning Objectives</b>											
LO1	To Learn about Machine Intelligence and Machine Learning applications										
LO2	To implement and apply machine learning algorithms to real-world applications										
LO3	To identify and apply the appropriate machine learning technique to classification, pattern recognition, optimization and decision problems										
LO4	To create instant based learning										
LO5	To apply advanced learning										
<b>UNIT</b>	<b>Contents</b>									<b>No. Of. Hours</b>	
I	<b>Introduction Machine Learning</b> - Difference between AI, Machine Learning and Big data. Supervised and unsupervised learning, parametric vs non-parametric models, parametric models for classification and regression- Linear Regression, Logistic Regression, Naïve Bayes classifier, simple non-parametric classifier-K-nearest neighbour, support vector machines									<b>15</b>	
II	<b>Neural networks and genetic algorithms</b> Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning.									<b>15</b>	
III	<b>Bayesian and computational learning</b> Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.									<b>15</b>	
IV	<b>Instant based learning</b> K- Nearest Neighbour Learning – Locally weighted Regression – Radial Basis Functions – Case Based Learning.									<b>15</b>	
V	<b>Advanced learning</b> Recommendation systems – opinion mining, sentiment analysis. Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning.									<b>15</b>	

		<b>TOTAL HOURS</b>	<b>75</b>
<b>Course Outcomes</b>			<b>Program me Outcomes</b>
CO	On completion of this course, students will		
CO1	Appreciate the importance of visualization in the data analytics solution		PO1, PO2, PO3, PO4, PO5, PO6
CO2	Apply structured thinking to unstructured problems		PO1, PO2, PO3, PO4, PO5, PO6
CO3	Understand a very broad collection of machine learning algorithms and problems		PO1, PO2, PO3, PO4, PO5, PO6
CO4	Learn algorithmic topics of machine learning and mathematically deep enough to introduce the required theor		PO1, PO2, PO3, PO4, PO5, PO6
CO5	Develop an appreciation for what is involved in learning from data.		PO1, PO2, PO3, PO4, PO5, PO6
1	Tom M. Mitchell, —Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.		
2	Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning" 2015, MIT Press		
<b>Reference Books</b>			
1.		EthemAlpaydin, —Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.	
2		Stephen Marsland, —Machine Learning: An Algorithmic Perspective, CRC Press, 2009.	

**Mapping with Programme Outcomes:**

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	3	3	2	3
CO 3	3	3	3	3	3	3
CO 4	3	3	2	3	3	3
CO 5	3	3	3	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
CC15	MACHINE LEARNING LAB		-	-	5	-	3	25	75	100
<b>Learning Objectives:</b> To apply the concepts of Machine Learning to solve real-world problems and to implement basic algorithms in clustering & classification applied to text & numeric data										
<b>LAB EXERCISES</b>									Required Hour	
<ol style="list-style-type: none"> <li>1. Solving Regression &amp; Classification using Decision Trees</li> <li>2. Root Node Attribute Selection for Decision Trees using Information Gain</li> <li>3. Bayesian Inference in Gene Expression Analysis</li> <li>4. Pattern Recognition Application using Bayesian Inference</li> <li>5. Bagging in Classification</li> <li>6. Bagging, Boosting applications using Regression Trees</li> <li>7. Data &amp; Text Classification using Neural Networks</li> <li>8. Using Weka tool for SVM classification for chosen domain application</li> <li>9. Data &amp; Text Clustering using K-means algorithm</li> <li>10. Data &amp; Text Clustering using Gaussian Mixture Models</li> </ol>									<b>75</b>	

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
CC16	Data Analytics using R Programming	Core	5	-	-	-	4	6	25	75	100
<b>Course Objective</b>											
C1	To understand the problem solving approaches										
C2	To learn the basic programming constructs in R Programming										
C3	To learn the basic programming constructs in R Programming										
C4	To use R Programming data structures - lists, tuples, and dictionaries.										
C5	To do input/output with files in R Programming.										
UNIT	Contents								No. of Hours		
I	Evolution of Big data — Best Practices for Big data Analytics — Big data characteristics — Validating — The Promotion of the Value of Big Data — Big Data Use Cases- Characteristics of Big Data Applications — Perception and Quantification of Value - Understanding Big Data Storage — A General Overview of High-Performance Architecture — HDFS — MapReduce and YARN — Map Reduce Programming Model								15		
II	CONTROL STRUCTURES AND VECTORS -Control structures, functions, scoping rules, dates and times, Introduction to Functions, preview of Some Important R Data Structures, Vectors, Character Strings, Matrices, Lists, Data Frames, Classes Vectors: Generating sequences, Vectors and subscripts, Extracting elements of a vector using subscripts, Working with logical subscripts, Scalars, Vectors, Arrays, and Matrices, Adding and Deleting Vector Elements, Obtaining the Length of a Vector, Matrices and Arrays as Vectors Vector Arithmetic and Logical Operations, Vector Indexing, Common Vector Operations								15		
III	LISTS- Lists: Creating Lists, General List Operations, List Indexing Adding and Deleting List Elements, Getting the Size of								15		

	a List, Extended Example: Text Concordance Accessing List Components and Values Applying Functions to Lists, Data Frames, Creating Data Frames, Accessing Data Frames, Other Matrix-Like Operations	
IV	FACTORS AND TABLES - Factors and Levels, Common Functions Used with Factors, Working with Tables, Matrix/Array-Like Operations on Tables , Extracting a Sub table, Finding the Largest Cells in a Table, Math Functions, Calculating a Probability, Cumulative Sums and Products, Minima and Maxima, Calculus, Functions for Statistical Distributions R PROGRAMMING .	15
V	OBJECT-ORIENTED PROGRAMMING S Classes, S Generic Functions, Writing S Classes, Using Inheritance, S Classes, Writing S Classes, Implementing a Generic Function on an S Class, visualization, Simulation, code profiling, Statistical Analysis with R, data manipulation	15
<b>Total</b>		<b>75</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, PO3
3	Learn and apply different mining algorithms and recommendation systems for large volumes of data.	PO2, PO6
4	Perform analytics on data streams.	PO4, PO5, PO6
5	Learn NoSQL databases and management.	PO5, PO6
<b>Text Book</b>		
1	Roger D. Peng,” R Programming for Data Science “, 2012	
2	Norman Matloff,”The Art of R Programming- A Tour of Statistical Software Design”, 2011	
<b>Reference Books</b>		
1.	1. Garrett Golemund, Hadley Wickham,”Hands-On Programming with R: Write Your Own Functions and Simulations” , 1st Edition, 2014	

2.	Venables ,W.N.,andRipley,"S programming“, Springer, 2000.
<b>Web Resources</b>	
1.	<a href="https://www.simplilearn.com">https://www.simplilearn.com</a>

**Mapping with Programme Outcomes:**

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
<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>2</b>	<b>3</b>	<b>2</b>	<b>2</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>3</b>	<b>2</b>	<b>3</b>	<b>3</b>
<b>CO5</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>Weightageof coursecontribute dtoeach PSO</b>	<b>14</b>	<b>13</b>	<b>14</b>	<b>14</b>	<b>14</b>	<b>13</b>

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	M a r k s		
									CIA	External	Total
CC17	Data Analytics using R Programming Lab	Core	-	-	4	-	4	6	25	75	100
<b>Course Objective</b>											
C1	To understand the problem solving approaches										
C2	To learn the basic programming constructs in R Programming										
C3	To practice various computing strategies for R Programming -based solutions to real world problems										
C4	To use R Programming data structures - lists, tuples, and dictionaries.										
C5	To do input/output with files in R Programming.										
<b>Sl. No</b>	<b>Contents</b>										
1.	Program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon user's choice.									<b>60</b>	
2.	Program, to find the area of rectangle, square, circle and triangle by accepting suitable input parameters from user.										
3.	Write a program to find list of even numbers from 1 to n using R-Loops.										
4.	Create a function to print squares of numbers in sequence.										
5.	Write a program to join columns and rows in a data frame using cbind() and rbind() in R.										
6.	Implement different String Manipulation functions in R.										
7.	Implement different data structures in R (Vectors, Lists, Data Frames)										
8	Write a program to read a csv file and analyze the data in the file in R.										
9	Create pie chart and bar chart using R.										

10	10. Create a data set and do statistical analysis on the data using R.	
11	Program to find factorial of the given number using recursive function	
12	Write a R program to count the number of even and odd numbers from array of N numbers.	
<b>Total</b>		<b>60</b>
<b>Course Outcomes</b>		<b>Programme Outcome</b>
CO	On completion of this course, students will	
1	Acquire programming skills in core R Programming	PO1,PO4,PO5
2	Acquire Object-oriented programming skills in R Programming.	PO1, PO4,PO6
3	Develop the skill of designing graphical-user interfaces (GUI) in R Programming	PO1,PO3,PO6
4	Acquire R Programming skills to move into specific branches	PO3,PO4
5		PO1,PO5,PO6
<b>Text Book</b>		
1	Roger D. Peng," R Programming for Data Science ", 2012	
2	Norman Matloff,"The Art of R Programming- A Tour of Statistical Software Design", 2011	
<b>Reference Books</b>		
1	Garrett Golemund, Hadley Wickham,"Hands-On Programming with R: Write Your Own Functions and Simulations" , 1st Edition, 2014	
2.	Venables ,W.N.,andRipley,"S programming", Springer, 2000.	
<b>Web Resources</b>		
1.	<a href="https://www.simplilearn.com">https://www.simplilearn.com</a>	

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
EC7	Internet of Things and its applications	Elective	4	-	-	-	3	5	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		
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		
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		
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		
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		

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
<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, PO5
<b>Text Book</b>		
1	Vijay Madiseti and ArshdeepBahga, "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	
4.	P.Rizwan Ahmed, Internet of Things, Margham Publications, 2017	
<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:**

<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>3</b>
<b>CO2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO3</b>	<b>3</b>	<b>2</b>	<b>3</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>3</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>Weightage ofcoursecontributedtoea chPSO</b>	<b>15</b>	<b>12</b>	<b>11</b>	<b>15</b>	<b>15</b>	<b>14</b>

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
EC7	Software Project Management	Elective	4	-	-	-	3	5	25	75	100
<b>Learning Objectives</b>											
LO1	To define and highlight importance of software project management.										
LO2	To formulate and define the software management metrics & strategy in managing projects										
LO3	To famialarize in Software Project planning										
LO4	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
<b>TOTAL</b>										<b>60</b>	
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
<b>Textbooks</b>	
1	Robert T. Futrell, Donald F. Shafer, Linda I. Safer, “Quality Software Project Management”, Pearson Education Asia 2002.
<b>Reference Books</b>	
1.	PankajJalote, “Software Project Management in Practice”, Addison Wesley 2002.
2.	Hughes, “Software Project Management”, Tata McGraw Hill 2004, 3rd Edition.
3.	P.Rizwan Ahmed, Software Project Management, Margham Publications, 2017
<b>NOTE: Latest Edition of Textbooks May be Used</b>	
<b>Web Resources</b>	
1.	Software Project Management e-resources from Digital libraries
2.	<a href="http://www.smartworld.com/notes/software-project-management">www.smartworld.com/notes/software-project-management</a>

**Mapping with Programme Outcomes:**

<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>Weightageof coursecontributed toeachPSO</b>	<b>13</b>	<b>11</b>	<b>10</b>	<b>13</b>	<b>13</b>	<b>12</b>

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
EC7	Enterprise Resource Planning	Elective	2	-	-	-	3	5	25	75	100
<b>Learning Objectives</b>											
LO1	To understand the basic concepts, Evolution and Benefits of ERP.										
LO2	To know the need and Role of ERP in logical and Physical Integration.										
LO3	Identify the important business functions provided by typical business software such as enterprise resource planning and customer relationship management										
LO4	To train the students to develop the basic understanding of how ERP enriches the business organizations in achieving a multidimensional growth										
LO5	To aim at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills										
UNIT	Details								No. of Hours		
I	ERP Introduction, Benefits, Origin, Evolution and Structure: Conceptual Model of ERP, the Evolution of ERP, the Structure of ERP, Components and needs of ERP, ERP Vendors; Benefits & Limitations of ERP Packages.								6		
II	Need to focus on Enterprise Integration/ERP; Information mapping; Role of common shared Enterprise database; System Integration, Logical vs. Physical System Integration, Benefits & limitations of System Integration, ERP's Role in Logical and Physical Integration. Business Process Reengineering, Data ware Housing, Data Mining, Online Analytic Processing (OLAP), Product Life Cycle Man-agement (PLM), LAP, Supply chain Management.								6		
III	ERP Marketplace and Marketplace Dynamics: Market Overview, Marketplace Dynamics, the Changing ERP Market. ERP- Functional Modules: Introduction, Functional Modules of ERP Software, Integration of ERP, Supply chain and Customer Relationship Applications. Cloud and Open Source, Quality Management, Material Management, Financial Module, CRM and Case Study.								6		
IV	ERP Implementation Basics, , ERP implementation Strategy, ERP Implementation Life Cycle ,Pre- Implementation task,Role of SDLC/SSAD, Object Oriented Architecture, Consultants, Vendors and Employees.								6		
V	ERP & E-Commerce, Future Directives- in ERP, ERP and Internet, Critical success and failure factors, Integrating ERP into or-ganizational culture. Using ERP tool: either SAP or ORACLE format to case study.								6		
<b>Total</b>									<b>30</b>		

<b>Course Outcomes</b>		
<b>Course Outcomes</b>	On completion of this course, students will;	
<b>CO1</b>	Understand the basic concepts of ERP.	PO1, PO2, PO6
<b>CO2</b>	Identify different technologies used in ERP	PO2, PO3, PO4
<b>CO3</b>	Understand and apply the concepts of ERP Manufacturing Perspective and ERP Modules	PO1, PO3, PO6
<b>CO4</b>	Discuss the benefits of ERP	PO2, PO6
<b>CO5</b>	Apply different tools used in ERP	PO1, PO3, PO5
<b>Reference Text :</b>		
1.	Enterprise Resource Planning – Alexis Leon, Tata McGraw Hill.	
2.	Enterprise Resource Planning – Diversified by Alexis Leon, TMH.	
<b>References :</b>		
1.	Enterprise Resource Planning – Ravi Shankar & S. Jaiswal , Galgotia	
2.	P.Rizwan Ahmed, Enterprise Resource Planning, Margham Publications, 2014	
<b>Web Resources</b>		
1.	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.	1. <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.	1. <a href="https://www.guru99.com/erp-full-form.html">https://www.guru99.com/erp-full-form.html</a>	
4.	2. <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:**

<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>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</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>3</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>
<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>15</b>	<b>14</b>	<b>12</b>	<b>13</b>	<b>11</b>

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
EC8	<b>NATURAL LANGUAGE PROCESSING</b>	Elect	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>Total hours</b>								<b>60</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.								PO1, PO2, PO3, PO4,	

	Explain the advantages and disadvantages of different NLP technologies and their applicability in different business situations.	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
<b>Textbooks</b>		
1	Daniel Jurafsky, James H. Martin, “Speech & language processing”, Pearson publications.	
2	Allen, James. Natural language understanding. Pearson, 1995.	
<b>Reference Books</b>		
1.	Pierre M. Nugues, “An Introduction to Language Processing with Perl and Prolog”, Springer	
<b>Web Resources</b>		
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>	

### Mapping with Programme Outcomes:

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
EC8	Cloud Computing	Elective	4	-	-	-	3	5	25	75	100
<b>Course Objective</b>											
LO1	Learning fundamental concepts and Technologies of Cloud Computing.										
LO2	Learning various cloud service types and their uses and pitfalls.										
LO3	To learn about Cloud Architecture and Application design.										
LO4	To know the various aspects of application design, benchmarking and security on the Cloud.										
LO5	To learn the various Case Studies in Cloud Computing.										
UNIT	Contents									No. of Hours	
I	<p>Introduction to Cloud Computing: Definition of Cloud Computing – Characteristics of Cloud Computing – Cloud Models – Cloud Service Examples – Cloud-based Services and Applications.</p> <p>Cloud Concepts and Technologies: Virtualization – Load balancing – Scalability and Elasticity – Deployment – Replication – Monitoring – Software Defined Networking – Network Function Virtualization – MapReduce – Identity and Access Management – Service Level Agreements – Billing.</p>									12	
II	<p>Cloud Services</p> <p>Compute Services: Amazon Elastic Computer Cloud - Google Compute Engine - Windows Azure Virtual Machines</p> <p>Storage Services: Amazon Simple Storage Service - Google Cloud Storage - Windows Azure Storage</p> <p>Database Services: Amazon Relational Data Store - Amazon Dynamo DB - Google Cloud SQL - Google Cloud Data Store - Windows Azure SQL Database - Windows Azure Table Service</p> <p>Application Services: Application Runtimes and Frameworks - Queuing Services - Email Services - Notification Services - Media Services</p> <p>Content Delivery Services: Amazon CloudFront - Windows Azure Content Delivery Network</p>									12	

III	<b>Cloud Application Design:</b> Introduction – Design Consideration for Cloud Applications – Scalability – Reliability and Availability – Security – Maintenance and Upgradation – Performance – Reference Architectures for Cloud Applications – Cloud Application Design Methodologies: Service Oriented Architecture (SOA), Cloud Component Model, IaaS, PaaS and SaaS Services for Cloud Applications, Model View Controller (MVC), RESTful Web Services – Data Storage Approaches: Relational Approach (SQL), Non-Relational Approach (NoSQL).	12
IV	<b>Cloud Application Benchmarking and Tuning:</b> Introduction to Benchmarking – Steps in Benchmarking – Workload Characteristics – Application Performance Metrics – Design Consideration for Benchmarking Methodology – Benchmarking Tools and Types of Tests – Deployment Prototyping.	12
V	<b>Case Studies:</b> Cloud Computing for Healthcare – Cloud Computing for Energy Systems - Cloud Computing for Transportation Systems - Cloud Computing for Manufacturing Industry - Cloud Computing for Education.	12
	<b>Total</b>	<b>60</b>
<b>Course Outcomes</b>		<b>Programme Outcome</b>
CO	On completion of this course, students will	
CO 1	Understand the fundamental concepts and Technologies in Cloud Computing.	PO1
CO 2	Able to understand various cloud service types and their uses and pitfalls.	PO1, PO2
CO 3	Able to understand Cloud Architecture and Application design.	PO4, PO5
CO 4	Understand the various aspects of application design, benchmarking and security in the Cloud.	PO4, PO5, PO6
CO 5	Understand various Case Studies in Cloud Computing.	PO3, PO6
<b>Text Book</b>		
1	Arshdeep Bahga, Vijay Madiseti, <i>Cloud Computing – A Hands On Approach</i> , Universities Press (India) Pvt. Ltd., 2018	
<b>Reference Books</b>		
1.	Anthony T Velte, Toby J Velte, Robert Elsenpeter, <i>Cloud Computing: A Practical</i>	

	<i>Approach</i> , Tata McGraw-Hill, 2013.
2.	Barrie Sosinsky, <i>Cloud Computing Bible</i> , Wiley India Pvt. Ltd., 2013.
3.	David Crookes, <i>Cloud Computing in Easy Steps</i> , Tata McGraw Hill, 2015.
4.	Dr. Kumar Saurabh, <i>Cloud Computing</i> , Wiley India, Second Edition 2012.
<b>Web Resources</b>	
1.	<a href="https://en.wikipedia.org/wiki/Cloud_computing">https://en.wikipedia.org/wiki/Cloud_computing</a>
2.	<a href="https://link.springer.com/chapter/10.1007/978-3-030-34957-8_7">https://link.springer.com/chapter/10.1007/978-3-030-34957-8_7</a>
3.	<a href="https://webobjects.cdw.com/webobjects/media/pdf/solutions/cloud-computing/121838-CDW-Cloud-Computing-Reference-Guide.pdf">https://webobjects.cdw.com/webobjects/media/pdf/solutions/cloud-computing/121838-CDW-Cloud-Computing-Reference-Guide.pdf</a>

**Mapping with Programme Outcomes:**

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>

S-Strong-3    M-Medium-2    L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	C	Inst. Hours	Marks		
									CIA	External	Total
EC8	Robotics and its Applications	Elective	4	-	-	-	3	6	25	75	100
<b>Learning Objectives</b>											
LO1	To understand the robotics fundamentals										
LO2	Understand the sensors and matrix methods										
LO3	Understand the Localization: Self-localizations and mapping										
LO4	To study about the concept of Path Planning, Vision system										
LO5	To learn about the concept of robot artificial intelligence										
UNIT	Details							No. of Hours			
I	Introduction: Introduction, brief history, components of robotics, classification, workspace, work-envelop, motion of robotic arm, end-effectors and its types, service robot and its application, Artificial Intelligence in Robotics.							12			
II	Actuators and sensors :Types of actuators, stepper-DC-servo- and brushless motors- model of a DC servo motor-types of transmissions-purpose of sensor-internal and external sensor-common sensors-encoders tachometers-strain gauge based force torque sensor-proximity and distance measuring sensors Kinematics of robots: Representation of joints and frames, frames transformation, homogeneous matrix, D-H matrix, Forward and inverse kinematics: two link planar (RR) and spherical robot (RRP). Mobile robot Kinematics: Differential wheel mobile robot							12			
III	Localization: Self-localizations and mapping - Challenges in localizations – IR based localizations – vision based localizations – Ultrasonic based localizations - GPS localization systems.							12			
IV	Path Planning: Introduction, path planning-overview-road map path planning-cell decomposition path planning potential field path planning-obstacle avoidance-case studies Vision system: Robotic vision systems-image representation-object recognition-and categorization-depth measurement-image data compression-visual inspection-software considerations							12			
V	Application: Ariel robots-collision avoidance robots for agriculture-mining-exploration-underwater-civilian- and military applications-nuclear applications-space Applications-Industrial robots-artificial intelligence in robots-application of robots in material handling-continuous arc welding-spot							12			

	welding-spray painting-assembly operation-cleaning-etc.	
	<b>Total</b>	<b>60</b>
<b>Course Outcomes</b>		<b>Programme Outcomes</b>
CO	On completion of this course, students will	
CO1	Describe the different physical forms of robot architectures.	PO1
CO2	Kinematically model simple manipulator and mobile robots.	PO1, PO2
CO3	Mathematically describe a kinematic robot system	PO4, PO6
CO4	Analyze manipulation and navigation problems using knowledge of coordinate frames, kinematics, optimization, control, and uncertainty.	PO4, PO5, PO6
CO5	Program robotics algorithms related to kinematics, control, optimization, and uncertainty.	PO3, PO8
<b>Text Book</b>		
1	Richard D. Klatner, Thomas Achmielewski and Michael Negin, Robotic Engineering and Integrated Approach, Prentice Hall India-New Delhi-2001	
2	Saeed B. Nikku, Introduction to robotics, analysis, control and applications, Wiley-India, 2nd edition 2011	
<b>Reference Books</b>		
1.	Industrial robotic technology-programming and application by M.P. Groover et al, McGraw Hill 2008	
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:

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>

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
SEC8	Open Source Technology	Skill Enha.Co urse	C	-	-	-	2	2	25	75	100
<b>Course Objective</b>											
LO1	Able to Acquire and understand the basic concepts in Java,application of OOPS concepts.										
LO2	Acquire knowledge about operators and decision-making statements.										
LO3	To Identify the significance and application of Classes, arrays and interfaces and analyzing java arrays										
LO4	Understand about the applications of OOPS concepts and analyze overriding and packages through java programs.										
LO5	Can Create window-based programming using applet and graphics programming.										
UNIT	Details										No. of Hours
I	Open Source – open source vs. commercial software – What is Linux – Free Software – Where I can use Linux – Linux kernel – Linux distributions.										6
II	: Introduction Linux Essential Commands – File System concept – Standard Files –The Linux Security Model – Introduction to Unix – Unix Components Unix Files – FileAttributes and Permission – Standard I/O – Redirection – Pipes and Filters – Grep and Stream Editor										6
III	Introduction - Apache Explained – Starting, Stopping and Restarting Apache –Modifying the Default configuration – Securing Apache – Set user and Group										6
IV	MySQL: Introduction to MySQL – The show databases and table – The USE command –Create Database and Tables – Describe Table – Select, Insert, Update and Delete statement database.										6
V	Introduction –PHP Form processing – Database Access with PHP – MySQL, MySQL Functions – Inserting Records – Selecting Records – Deleting Records – Update Records.										6
<b>Total</b>										<b>30</b>	
Course Outcomes								Programme Outcome			
CO	On completion of this course, students will										
1	Acquire and understand the basic concepts in Java,application of OOPS concepts.										PO1
2	Acquire knowledge about operators and decision-making statements.										PO1,PO2
3	Identify the significance and application of Classes, arrays and interfaces and analyzing java arrays										PO4,PO6
4	Understand about the applications of OOPS concepts and										PO4,PO5,PO6

	analyze overriding and packages through java programs.	
5	Create window-based programming using applet and graphics programming.	PO3,PO8
<b>Text Book</b>		
1	James Lee and Brent Ware “Open Source Web Development with LAMP using	
2	LINUX, Apache, MySQL, Perl and PHP”, Dorling Kindersley (India) Pvt. Ltd, 2008.	
3.	P.Rizwan Ahmed, Open Source Programming, Margham Publications, 2020	
<b>Reference Books</b>		
1.	Eric Rosebrock, Eric Filson, “Setting up LAMP: Getting Linux, Apache, MySQL and PHP and working together”, John Wiley and Sons, 2004.	
2.	2. Anthony Butcher , “Teach Yourself MySQL in 21 days”, 2nd Edition, Sams Publication.	
3.	3. Rich Bower, Daniel Lopez Ridreejo, Alian Liska , “Apache Administrator’s Handbook”, Sams Publication.	
4.	4. Tammy Fox, “RedHat Enterprise Linux 5 Administration Unleashed”, Sams Publication.	
5.	5. Naramore Eligabette, Gerner Jason, Wrox Press, Wiley Dreamtech Press, “Beginning PHP5, Apache, MySQL Web Development”, 2005.	
<b>Web Resources</b>		
1.	<a href="#">Introduction to Open-Source and its benefits - GeeksforGeeks</a>	
2.	<a href="https://www.bing.com/">https://www.bing.com/</a>	

**Mapping with Programme Outcomes:**

<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>CO 1</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1</b>
<b>CO 2</b>	<b>3</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>
<b>CO 3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>-</b>	<b>2</b>	<b>1</b>
<b>CO 4</b>	<b>2</b>	<b>-</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>1</b>
<b>CO 5</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>WEIGHTAGE OF COURSE CONTRIBUTED TO EACH PSO</b>	<b>12</b>	<b>9</b>	<b>13</b>	<b>10</b>	<b>12</b>	<b>8</b>

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