M.Sc. COMPUTER SCIECE

(Effective from the academic year 2024 - 2025)

Vision of the Department:

The survival and growth of the society shall solely depend upon continuous of knowledge based upon innovations. The Pursuit of knowledge alone shall lead the individual, families and nation's prosperity and so vision of the department is "Excellence in education and commitment to social responsibility"

Mission:

To provide Strong fundamentals and technical skills in the field of Computer science and Applications. To transform lives of the students by nurturing ethical values, creativity and novelty to become Entrepreneurs and establish start-ups. To inculcate learning of the emerging technologies to pursue higher studies.

Eligibility for admission to M.Sc. Computer Science:

A candidate who has passed the B.C.A/ B.Sc. Degree Examination with a score of 50% and above in Computer science of this University or an Examination of any other University accepted by the Syndicate as equivalent thereto shall be eligible for admission to M.Sc. Degree Programme in Computer Science.

Objectives:

- To provide an in-depth knowledge in Computer Science.
- To acquire skill and competency in practical.
- To expose the students to the recent trends in Computer Science and its Technologies.
- To motivate the students for life-long learning and train students towards research.
- To train economically backward students and make them eligible for higher education and job opportunities.
- To tap out the talents through extracurricular and co-curricular activities.
- To get sensitized to social and environmental realities.

Highlights of the Revamped Curriculum:

1. 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.
2. 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.
3. The General Studies and Computer Science 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.
4. The curriculum is designed so as to strengthen the Industry-Academia interface and provide more job opportunities for the students.
5. 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.
6. 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.
7. 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.
8. 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 – Statistics with R Programming, Data Science, Machine learning. Internet of Things and Artificial Intelligence etc.

Value additions in the Revamped Curriculum:

Semester	Newly introduced Components	Outcome / Benefits
I	**Foundation Course in Computer Science** To ease the transition of learning from higher secondary to higher education, providing an overview of the pedagogy of learning abstract concepts to real world.	• Instil confidence among students • Create interest for the subject
II, III & IV	**Skill Enhancement papers** (Discipline centric/Generic/ Entrepreneurial)	• Industry ready graduates • Skilled human resource • Students are equipped with essential skills to make them employable • Training on Computing / Computational skills enable the students gain knowledge and exposure on latest computational aspects • Data analytical skills will enable students gain internships, apprenticeships, field work involving data collection, compilation, analysis etc. • Entrepreneurial skill training will provide an opportunity for independent livelihood • Generates self – employment • Create small scale entrepreneurs • Training to girls leads to women empowerment • Discipline centric skill will improve the Technical knowhow of solving real life problems using ICT tools
I, II, III, IV	Elective papers- An open choice of topics categorized under Generic and Discipline Centric	• Strengthening the domain knowledge • Introducing the stakeholders to the state-of art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature • Students are exposed to Latest topics on Computer Science / IT, that require strong background • Emerging topics in higher education / industry / communication network / health

		sector etc. are introduced with hands-on-training, in the respective sectors
III	Industrial Statistics	• Exposure to industry moulds students into solution providers • Generates Industry ready graduates • Employment opportunities enhanced
III Year Vacation activity	Internship / Industrial Training	• Practical training at the Industry/ Banking Sector / Private/ Public sector organizations / Educational institutions, enable the students gain professional experience and also become responsible citizens.
IV Semester	Project with Viva – voce	• Self-learning is enhanced • Application of the concept to real situation is conceived resulting in tangible outcome
IV Semester	Introduction of Professional Competency component	• Curriculum design accommodates all category of learners; 'Advanced Explain' component will comprise of advanced topics in and allied fields, for those in the peer group / aspiring researchers; • 'Training for Competitive Examinations' – caters to the needs of the aspirants towards most sought - after services of the nation viz, UPSC, CDS, NDA, Banking Services, CAT, TNPSC group services, etc.

Skills acquired from the Courses	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

TANSCHE BASED PROGRAMME STRUCTURE FOR M.Sc. COMPUTER SCIENCE

(For the candidates admitted from the academic year 2024-2025)

Sem	Part	Category	Paper Code	Title	Hours/ Week	Exam		Credits	Marks
						Th	Pr		
I	A	Core I	PCCSA24	Analysis & Design of Algorithms	5	3	-	4	40+60
		Core II	PCCSB24	Python Programming	5	3	-	4	40+60
		Core III	PCCSC24	Practical - I: Algorithms and OOPS Lab	4	-	3	3	40+60
			PCCSD24	Practical – II: Python Programming Lab	4	-	3	3	40+60
		Elective I (Discipline Centric)	PECSA24	Elective: Advanced Software Engineering	5	3	-	3	40+60
			PECSB24	Elective: Object Oriented Analysis and Design &C++					
		Elective II (Generic)	PECSC24	Elective: Internet of Things	5	3	-	3	40+60
			PECSD24	Elective: Multimedia Systems					
	B			Human Rights	1	-	-	-	-
				Value Education	1	-	-	-	-
				Total	**30**			**20**	**600**
II	A	Core IV	PCCSE24	Data Mining and Warehousing	5	3	-	4	40+60
		Core V	PCCSF24	Advanced Java Programming	5	3	-	4	40+60
		Core VI	PCCSG24	Practical – III: Data Mining Lab using R	4	-	3	3	40+60
			PCCSH24	Practical – IV: Advanced Java Lab	4	-	3	3	40+60
		Elective III (Discipline Centric)	PECSE24	Elective: Artificial Intelligence & Machine Learning	4	3	-	3	40+60
			PECSF24	Elective: Critical Thinking, Design Thinking and Problem Solving					
		Elective IV (Generic)	PECSG24	Elective: Mobile Computing	4	3	-	3	40+60
			PECSH24	Elective: Web Services					
	B	Skill Enhancement Course [SEC I]	PSCS124	SEC: Digital Forensics	2	-	3	2	100
			PNHRA24	Human Rights	1	2	-	2	40+60
				Value Education	1	-	-	-	-
			POCS24	Online Course	-	-	-	1	-
				Total	**30**			**25**	**800**

Sem	Part	Category	Paper Code	Title	Hours/ Week	Exam		Credits	Marks
						Th	Pr		
III	A	Core VII	PCCSI24	Digital Image Processing	5	3	-	4	40+60
		Core VIII	PCCSJ24	Cloud Computing	5	3	-	4	40+60
		Core IX	PCCSK24	Advanced Operating Systems	6	3	-	5	40+60
		Core X	PCCSL24	Practical V: Digital Image Processing Lab using MATLAB	4	-	3	3	40+60
			PCCSM24	Practical VI: Cloud Computing Lab	4	-	3	3	40+60
		Elective V	PECSI24	Elective: Network Security and Cryptography	3	3	-	3	40+60
			PECSJ24	Elective: Embedded Systems					
	B	Skill Enhancement Course [SEC II]	PSCS224	SEC: Big Data Analytics	2	3	-	2	100
			PICS24	Internship	-	-	-	2	
				Value Education	1	-	-	-	-
				Total	**30**			**26**	**700**
IV	A	Core XI	PCCSN24	Data Science & Analytics	6	3	-	5	40+60
		Core XII	PCCSO24	Block Chain Technology	6	3	-	5	40+60
		Project	PCCSP24	Project with Viva Voce	10	-	3	7	40+60
		Elective VI	PECSK24	Elective: Web Application Development and Hosting	4	-	3	3	40+60
			PECSL24	Elective: Wireless Communication and Networks					
	B	Professional Competency Skill	PPCS24	Robotics Process Automation	3	-	3	2	100
				Value Education	1	-	-	-	-
	C		PXTEN24	Extension Activity (30 hours)	-	-	-	1	-
				Total	**30**			**23**	**500**
				Grand Total	**120**			**94**	**2600**

- Any one course of the following to be completed during III semester (15 hours teaching and 15 hours activities):
  - i) Teaching and Research Aptitude
  - ii) Artificial Intelligence Tools
  - iii) Entrepreneur Skill
  - iv) Photography

Methods of Evaluation						
S. No.	**Category**	**Assessment Tool**	**Maximum Marks**	**Exam Theory**	**Weightage**	
1	Core Courses/Generic & Discipline Specific Electives	I Continuous Assessment (ICA)	50	1 ½ h	35	40
		II Continuous Assessment (IICA)	50	1 ½ h		
		Innovative Component (IC)	5	-	5	
		End Semester Examination	100	3 h	-	60
2	Professional Competency	I Continuous Assessment (ICA)	30	1 h	35	40
		II Continuous Assessment (IICA)	30	1 h		
		Innovative Component (IC)	5	-	5	
		End Semester Examination	60	2 h	-	60
3	HR	Continuous Assessment (IICA)	25	1 h	-	40
		Innovative Component (IC)	25	-	-	
		End Semester Examination	60	2 h	-	60

Activity-based Assessment for Skill Enhancement Courses:

Activity 1 for Unit I: (Nature of Activity) – 20 marks

Activity 2 for Unit II: (Nature of Activity) – 20 marks

Activity 3 for Unit III: (Nature of Activity) – 20 marks

Activity 4 for Unit IV: (Nature of Activity) – 20 marks

Activity 5 for Unit V: (Nature of Activity) – 20 marks

Nature of Activity – Project (Individual or Group)/Exhibits/Model making/Hands on training/Lab practice/Debate/Report writing/Case study/Interpretation of data or results/Quiz (LMS)/Problem solving/ Designing/Role play/Start-up proposal/Research proposal/Poster presentation/Oral presentation (live or video recorded)/Group discussion/Problem solving/Interviews/Concept mapping/Mind mapping /MCQ etc.

Record of Assessment will be maintained by the course instructors and verified by the Head of the department.

Cognitive Levels of Assessment	
Recall (K1)	Simple definitions, MCQ, Recall steps, Concept definitions
Understand/ Comprehend (K2)	MCQ, True/False, Short essays, Concept explanations, short summary or Overview
Application (K3)	Suggest idea/concept with examples, suggest formulae, Solve problems, Observe, Explain
Analyze (K4)	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge
Evaluate (K5)	Longer essay/Evaluation essay, Critique or justify with pros and cons
Create (K6)	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

PROGRAMME OUTCOMES (PO)

On completion of the PG Programme, students will be able to:

PO1: Problem Solving Skill

Apply knowledge of Management theories and Human Resource practices to solve business problems through research in Global context.

PO2: Decision Making Skill

Foster analytical and critical thinking abilities for data-based decision-making.

PO3: Ethical Value

Ability to incorporate quality, ethical and legal value-based perspectives to all organizational activities.

PO4: Communication Skill

Ability to develop communication, managerial and interpersonal skills.

PO5: Individual and Team Leadership Skill

Capability to lead themselves and the team to achieve organizational goals.

PO6: Employability Skill

Inculcate contemporary business practices to enhance employability skills in the competitive environment.

PROGRAMME SPECIFIC OUTCOMES (PSO)

On completion of the PG Programme in Computer Science, students will be able to;

PSO1 – Placement

To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors and beliefs and apply diverse frames of reference to decisions and actions.

PSO 2 - Entrepreneur

To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations.

PSO3 – Research and Development

Design and implement HR systems and practices grounded in researches that comply with employment laws, leading the organization towards growth and development.

PSO4 – Contribution to Business World

To produce employable, ethical and innovative professionals to sustain in the dynamic business world.

PSO5 – Contribution to the Society

To contribute to the development of the society by collaborating with stakeholders for mutual benefit.

PSO6 – Multicultural competence

Possess knowledge of the values and beliefs of multiple cultures and
a global perspective.

PSO/PO	PO1	PO2	PO3	PO4	PO5	PO6
PSO1	L	M	L	H	L	M
PSO2	M	H	L	L	M	L
PSO3	H	M	H	L	M	M
PSO4	M	L	M	M	L	H
PSO5	L	M	L	M	L	M
PSO6	M	L	H	M	L	M

(HIGH - 3, MODERATE - 2, LOW - 1)

<table>
<tr><td>Title of the Course</td><td colspan="7">ANALYSIS AND DESIGN OF ALGORITHMS</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td>Credits</td><td>4</td><td>Course Code</td><td>PCCSA24</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>5</td><td>-</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• Enable the students to learn the Elementary Data Structures and algorithms.
• Presents an introduction to the algorithms, their analysis and design
• Discuss various methods like Basic Traversal And Search Techniques, divide and conquer method, Dynamic programming, backtracking
• Understood the various design and analysis of the algorithms.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (15hours) (K1, K2, K3, K4, K5& K6)
1.1 Introduction: - Algorithm Definition and Specification
1.2 Space complexity-Time Complexity- Asymptotic Notations
1.3 Elementary Data Structure: Stacks and Queues
1.4 Binary Tree - Binary Search Tree
1.5 Heap – Heap sort
1.6 Graph.</td></tr>
<tr><td></td><td colspan="7">UNIT II (15 hours) (K1, K2, K3, K4, K5 & K6)
2.1 Basic Traversal and Search Techniques
2.2 Techniques for Binary Trees
2.3 Techniques for Graphs
2.4 Divide and Conquer: - General Method
2.5 Binary Search
2.6 Merge Sort – Quick Sort.</td></tr>
<tr><td></td><td colspan="7">UNIT III (15 hours) (K1, K2, K3, K4& K5)
3.1 The Greedy Method
3.2 General Method
3.3 Knapsack Problem
3.4 Minimum Cost Spanning Tree
3.5 Single Source Shortest Path.</td></tr>
</table>

	UNIT IV (15 hours) (K1, K2, K3, K4& K5) 4.1 Dynamic Programming -General Method 4.2 Multistage Graphs 4.3 All Pair Shortest Path 4.4 Optimal Binary Search Trees – 0/1 Knapsacks 4.5 Traveling Salesman Problem 4.6 Flow Shop Scheduling.
	UNIT V (13 hours) (K1, K2, K3, K4& K5) 5.1 Backtracking: General Method 5.2 8 -Queens Problem–Sum of Subsets 5.3 Graph Coloring 5.4 Hamiltonian Cycles 5.5 Branch And Bound: - The Method -Traveling Salesperson.
Text Books	1. Ellis Horowitz, "Fundamentals of Computer Algorithms", Second Edition, Universities Press Private Ltd, 2018 2. Alfred V.Aho, John E.Hop croft, Jeffrey D.Ullman, "Data Structures and Algorithms", First Edition, Pearson Education, 2010
Reference Books	1. Goodrich, "Data Structures & Algorithms in Java", Third edition, 2014. 2. Skiena, "The Algorithm Design Manual", Second Edition, Springer, 2008 3. AnanyLevith," Introduction to the Design and Analysis of algorithm", Pearson Education Asia, 2003. 4. Robert Sedgewick, PhillipeFlajolet," An Introduction to the Analysis of Algorithms", Second Edition, 2013
Web resources	1. https://nptel.ac.in/courses/106/106/106106131/ 2. https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm 3. https://www.javatpoint.com/daa-tutorial

CO	Course Outcomes
On completion of this course, students will be able to;	
CO1	Get knowledge about algorithms and determines their time complexity. Demonstrate specific search and sort algorithms using divide and conquer technique.
CO2	Gain good understanding of Greedy method and its algorithm.
CO3	Able to describe about graphs using dynamic programming technique.
CO4	Exercise C programs that uses array and string.
CO5	Develop user defined functions to solve real time problems

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	M	M	L	M	L
CO2	L	H	H	L	M	L
CO3	M	L	M	M	L	M
CO4	H	L	L	M	M	M
CO5	L	L	L	M	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	L	M	L	M	M	L
CO2	M	L	M	L	M	L
CO3	L	M	L	M	H	L
CO4	L	H	L	M	L	L
CO5	M	L	L	M	L	H

<table>
<tr><td>Title of the Course</td><td colspan="7">PYTHON PROGRAMMING</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core II</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td>Credits</td><td>4</td><td>Course Code</td><td>PCCSB24</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>5</td><td>-</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• Presents an introduction to Python, creation of web applications, network applications and working in the clouds
• Use functions for structuring Python programs
• Understand different Data Structures of Python.
• Represent compound data using Python lists, tuples and dictionaries</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (15 hours) (K1, K2, K3, K4, K5 & K6)
1.1 Python: Introduction
1.2 Numbers
1.3 Strings
1.4 Variables–Lists
1.5 Tuples–Dictionaries
1.6 Sets– Comparison.</td></tr>
<tr><td></td><td colspan="7">UNIT II (15 hours) (K1, K2, K3, K4, K5 & K6)
2.1 Code Structures: if, else if, and else
2.2 Repeat with while
2.3 Iterate with for – Comprehensions
2.4 Functions – Generators
2.5 Decorators – Namespaces and Scope
2.6 Handle Errors with try and except – User Exceptions.</td></tr>
<tr><td></td><td colspan="7">UNIT III (15 hours) (K1, K2, K3, K4& K5)
3.1 Modules, Packages, and Programs
3.2Standalone Programs – Command-Line Arguments
3.3 Modules and the import Statement – The Python Standard Library
3.4 Objects and Classes: Define a Class with class
3.5 Inheritance – Override a Method – Add a Method – Get Help from Parent with super– Inself Defense –Get and Set Attribute Values with Properties –Name mangling for Privacy
3.6 Method Types – Duck Typing – Special Methods –Composition.</td></tr>
</table>

	UNIT IV (13 hours) (K1, K2, K3, K4& K5) 4.1 Data Types: Text Strings–Binary Data. 4.2 Storing and Retrieving Data:File Input / Output– Structured Text Files 4.3 Structured Binary Files 4.4 Relational Databases 4.5 No SQL Data Stores
	UNIT V (15hours) (K1, K2, K3, K4& K5) 5.1 Systems: Files–Directories–Programs and Processes–Calendars and Clocks. 5.2 Concurrency: Queues– Processes 5.3 Threads–Green Threads and event–twisted–Redis. 5.4 Networks**:** Patterns – The Publish-Subscribe Model 5.5 TCP/IP – Sockets
Text Books	1. Bill Lubanovic, "Introducing Python", O'Reilly, First Edition-Second Release,2014. 2. Mark Lutz,"Learning Python", O'Reilly, Fifth Edition, 2013.
Reference Books	1. David M. Beazley, " Python Essential Reference ", Developer's Library, Fourth Edition,2009. **2.** SheetalTanejaNaveen Kumar, "Python Programming-A Modular Approach", Pearson Publications. 2017
Web resources	1. https://www.programiz.com/python-programming/ 2. https://www.tutorialspoint.com/python/index.html 3. https://onlinecourses.swayam2.ac.in/aic20_sp33/preview

CO	Course Outcomes
On completion of this course, students will be able to;	
CO1	Understand the basic concepts of Python Programming
CO2	Understand File operations, Classes and Objects
CO3	Acquire Object Oriented Skills in Python
CO4	Develop web applications using Python
CO5	Develop Client Server Networking applications

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	M	L	M	L
CO2	L	H	L	M	M	L
CO3	M	L	M	M	L	M
CO4	H	L	L	M	M	M
CO5	L	M	L	M	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	L	H	L	M	M	L
CO2	M	L	H	L	M	L
CO3	L	M	L	L	H	L
CO4	L	H	M	M	L	L
CO5	M	L	M	L	L	H

<table>
<tr><td>Title of the Course</td><td colspan="7">PRACTICAL I: ALGORITHM AND OOPS LAB</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core III</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td>Course Code</td><td>PCCSC20</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>-</td><td colspan="3">-</td><td colspan="2">4</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• This course covers the basic data structures like Stack, Queue, Tree, List.
• Thiscourseenablesthestudentstolearntheapplicationsofthedatastructuresusing various techniques
• It also enable the students to understand C++ language with respect to OOAD concepts
• Application of OOPS concepts</td></tr>
<tr><td>Course Outline</td><td colspan="7">Exercises
1. Write a program to solve the tower of Hanoi using recursion.
2. Write a program to traverse through binary search tree using traversals.
3. Write a program to perform various operations on stack using linked list.
4. Write a program to perform various operations in circular queue.
5. Write a program to sort an array of an elements using quick sort.
6. Write a program to solve number of elements in ascending order using heap sort.
7. Write a program to solve the knapsack problem using greedy method
8. Write a program to search for an element in a tree using divide & conquer strategy.
9. Write a program to place the 8 queens on an 8X8 matrix so that not won queens Attack.
10. Write a C++ program to perform Virtual Function
11. Write a C++ program to perform Parameterized constructor
12. Write a C++ program to perform Friend Function
13. Write a C++ program to perform Function Overloading
14. Write a C++ program to perform Single Inheritance
15. Write a C++ program to perform Employee Details using files</td></tr>
<tr><td>Text Books</td><td colspan="7">1. Good rich,“Data Structures & Algorithms inJava”,Third Edition, 2014
2. Skiena,”The Algorithm Design Manual”,Second Edition,Springer,2008</td></tr>
</table>

Reference Books	1. AnanyLevith," Introduction to the Design and Analysis of algorithm", Pearson Education Asia, 2003. **2.** Robert Sedgewick,PhillipeFlajolet,"An Introduction to the Analysis of Algorithms", Second Edition, 2013
Web resources	1. https://onlinecourses.nptel.ac.in/noc19_cs48/preview 2. https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs19/ 3.https://www.tutorialspoint.com/object_oriented_analysis_design/ooad_object_oriented_analysis.

CO	Course Outcomes
On completion of this course, students will be able to;	
CO1	Understand the concepts of object oriented with respect to C++
CO2	Able to understand and implement OOPS concepts
CO3	Implementation of data structures like Stack, Queue, Tree, List using C++
CO4	Application of the data structures for Sorting, Searching using different techniques
CO5	Understand and Employ file Management

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	L	M	L	M	L
CO2	L	L	M	L	L	M
CO3	M	L	L	M	L	L
CO4	L	M	M	L	L	M
CO5	M	L	H	M	L	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	L	L	M	M	H	L
CO2	M	L	H	L	M	M
CO3	L	M	L	M	H	L
CO4	L	M	L	M	L	L
CO5	L	L	M	M	H	L

<table>
<tr><td>Title of the Course</td><td colspan="7">PRACTICAL – II: PYTHON PROGRAMMING LAB</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">PCCSD20</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td>-</td><td colspan="3">4</td><td colspan="2">4</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course presents an overview of elementary data items, lists, dictionaries, sets and tuples
To understand and write simple Python programs
To Understand the OOPS concepts of Python
To develop web applications using Python</td></tr>
<tr><td>Course Outline</td><td colspan="7">Exercises (15 hours) (K1, K2, K3, K4, K5 & K6)

1. Programs using elementary data items, lists, dictionaries and tuples
2. Programs using conditional branches,
3. Programs using loops.
4. Programs using functions
5. Programs using exception handling
6. Programs using inheritance
7. Programs using polymorphism
8. Programs to implement file operations.
9. Programs using modules.
10. Programs for creating dynamic and interactive web pages using forms.</td></tr>
</table>

Text Books	1. Bill Lubanovic,“ Introducing Python”,O’Reilly,FirstEdition-SecondRelease,2014. 2. Mark Lutz,“ Learning Python”, O’Reilly, Fifth Edition, 2013.
Reference Books	1. David M. Beazley, “ Python Essential Reference,” Developer’s Library, Fourth Edition, 2009. 2. SheetalTaneja, Naveen Kumar, “Python Programming-A Modular Approach”, Pearson Publications
Web resources	1. https://www.programiz.com/python-programming/ 2. https://www.tutorialspoint.com/python/index.htm 3. https://onlinecourses.swayam2.ac.in/aic20_sp33/preview

CO	Course Outcomes
On completion of this course, students will be able to;	
CO1	Understand the concepts of object oriented with respect to C++
CO2	Able to understand and implement OOPS concepts
CO3	Implementation of data structures like Stack, Queue, Tree, List using C++
CO4	Application of the data structures for Sorting, Searching using different techniques
CO5	Implementation of Exception handling concepts

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	L	M	L	M	L
CO2	L	L	M	L	L	M
CO3	M	L	L	M	L	L
CO4	L	M	M	L	L	M
CO5	M	L	H	M	L	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	L	L	M	M	H	L
CO2	M	L	H	L	M	M
CO3	L	M	L	M	H	L
CO4	L	M	L	M	L	L
CO5	L	L	M	M	H	L

<table>
<tr><td>Title of the Course</td><td colspan="7">ELECTIVE I A: ADVANCED SOFTWARE ENGINEERING</td></tr>
<tr><td>Paper No.</td><td colspan="7">Elective 1 A</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">PECSA24</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>5</td><td>-</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">1. Introduce to Software Engineering, Design, Testing and Maintenance.
2. Enable the students to learn the concepts of Software Engineering.
3. Learn about Software Project Management, Software Design &Testing</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (15 hours) (K1, K2, K3, K4, K5 & K6)
1.1 Introduction: The Problem Domain – Software Engineering Challenges
1.2 Software Engineering Approach
1.3 Software Processes: Software Process
1.4 Characteristics of a Software Process
1.5 Software Development Process Models
1.6 Other software processes.</td></tr>
<tr><td></td><td colspan="7">UNIT II (15 hours) (K1, K2, K3, K4, K5 & K6)
2.1 Software Requirements Analysis and Specification: Requirement engineering
2.2 Type of Requirements – Feasibility Studies – Requirements Elicitation
2.3 Requirement Analysis – Requirement Documentation
2.4 Requirement Validation – Requirement Management – SRS
2.5 Formal System Specification – Axiomatic Specification – Algebraic Specification
2.6 Case study: Student Result management system. Software Quality Management – Software Quality, Software Quality Management System, ISO 9000, SEI CMM.</td></tr>
<tr><td></td><td colspan="7">UNIT III (15 hours) (K1, K2, K3, K4& K5)
3.1Software Project Management: Responsibilities of a software project manager
3.2 Project planning – Metrics for Project size estimation
3.3 Project Estimation Techniques – Empirical Estimation Techniques – COCOMO – Hallstead’s software science
3.4 Staffing level estimation – Scheduling– Organization and Team Structures
3.5 Staffing – Risk management</td></tr>
</table>

	3.6 Software Configuration Management – Miscellaneous Pl
	UNIT IV(15 hours) (K1, K2, K3, K4& K5) 4.1 Software Design: Outcome of a Design process 4.2 Characteristics of a good software design – Cohesion and coupling 4.3 Strategy of Design – Function Oriented Design 4.4 Object Oriented Design - Detailed Design 4.5 IEEE Recommended Practice for Software Design Descriptions.
	UNIT V (13 hours) (K1, K2, K3, K4& K5) 5.1 Software Testing: A Strategic approach to software testing – Terminologies 5.2 Functional testing– Structural testing – Levels of testing 5.3 Validation testing - Regression testing – Art of Debugging 5.4 Testingtools-Metrics-Reliability Estimation. Software Maintenance 5.5 Maintenance Process - Reverse Engineering – Software Re-engineering - Configuration Management Activities
Text Books	1. An Integrated Approach to Software Engineering–PankajJalote, Narosa Publishing House, Delhi, 4th Edition, 2019. **2.** Fundamentals of Software Engineering –Rajib Mall, PHI Publication, 5th Edition, 2019.
Reference Books	1. Software Engineering–K.K.Aggarwal and YogeshSingh,New Age International Publishers, 4th edition,2022. 2. A Practitioners Approach-Software Engineering, -R.S.Pressman, McGraw Hill, 2016 **3.** Fundamentals of Software Engineering – Carlo Ghezzi M. Jarayeri, D. Manpdrioli, PHI Publication, 2015.
Web resources	1. https://www.javatpoint.com/software-engineering-tutorial 2. https://onlinecourses.swayam2.ac.in/cec20_cs07/preview 3. https://onlinecourses.nptel.ac.in/noc19_cs69/preview

CO	Course Outcomes
On completion of this course, students will be able to;	
CO1	Understand about Software Engineering process
CO2	Understand about Software project management skills, design and quality management.
CO3	Analyze on Software Requirements and Specification
CO4	Analyze on Software Testing, Maintenance and Software Re-Engineering.
CO5	Design and conduct various types and levels of software quality for a software project

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	M	M	L	M	L
CO2	L	H	M	L	M	L
CO3	M	L	M	L	L	M
CO4	M	L	L	M	L	M
CO5	L	M	L	M	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	L	L	M	M	H	L
CO2	M	L	H	L	M	M
CO3	L	M	L	M	H	L
CO4	L	M	L	M	L	L
CO5	L	L	M	M	H	L

<table>
<tr><td>Title of the Course</td><td colspan="7">ELECTIVE I B: OBJECT ORIENTED ANALYSIS AND DESIGN &C++</td></tr>
<tr><td>Paper No.</td><td colspan="7">Elective I B</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">PECSB24</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>5</td><td>-</td><td colspan="2">-</td><td colspan="3">5</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• Present the object model, classes and objects, object orientation, machine view and model management view.
• Enables the students to learn the basic functions, principles and concepts of object oriented analysis and design.
• Enable the students to understand C++ language with respect to OOAD</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (15 hours) (K1, K2, K3, K4, K5 & K6)
1.1 The Object Model -The Evolution of the Object Model
1.2 Elements of the Object Model
1.3 Applying the Object Model.
1.4 Classes and Objects: The Nature of an Object
1.5 Relationship among Objects</td></tr>
<tr><td></td><td colspan="7">UNIT II (15 hours) (K1, K2, K3, K4, K5 & K6)
2.1 Classes and Object: Nature of Class
2.2 Relationship Among classes
2.3 The Interplay of classes and Objects.
2.4 Classification: The importance of Proper Classification
2.5 Identifying classes and objects
2.6 Key Abstractions and Mechanism</td></tr>
<tr><td></td><td colspan="7">UNIT III (15 hours) (K1, K2, K3, K4& K5)
3.1 Introduction to C++
3.2 Input and output statements in C++
3.3 Declarations
3.4 Control structures
3.5 Functions in C++.</td></tr>
</table>

	UNIT IV (13 hours) (K1, K2, K3, K4& K5) 4.1 Classes and Objects 4.2 Constructors and Destructors 4.3 Operators overloading 4.4 Type Conversion 4.5 Inheritance 4.6 Pointers and Arrays.
	UNIT V (13 hours) (K1, K2, K3, K4& K5) 5.1 Memory Management Operators 5.2 Polymorphism 5.3 Virtual functions 5.4 Files 5.5 Exception Handling – String Handling 5.6 Templates.
Text Books	1. "Object Oriented Analysis and Design with Applications", Grady Booch, Third Edition, Pearson Education, 2015. 2. "Object-Oriented Programming with ANSI & Turbo C++", Ashok N.Kamthane, First Indian Print – July 2006, Pearson Education.
Reference Books	1. Balagurusamy "Object Oriented Programming with C++", TMH, Seventh Edition, 2020.
Web resources	1. https://onlinecourses.nptel.ac.in/noc19_cs48/preview 2. https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs19/ 3.https://www.tutorialspoint.com/object_oriented_analysis_design/ooad_object_oriented_analysis.htm

CO	Course Outcomes
On completion of this course, students will be able to;	
CO1	Understand the concept of Object-Oriented development and modeling techniques.
CO2	Gain knowledge about the various steps performed during object design.
CO3	Abstract object-based views for generic software systems.
CO4	Link OOAD with C++ language
CO5	Apply the basic concept of OOPs and familiarize to write C++ program.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	M	L	M	L	M	L
CO2	L	H	L	L	M	L
CO3	L	L	H	M	L	M
CO4	M	L	L	M	M	M
CO5	L	H	L	M	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	L	M	L	M	L	H
CO2	H	L	M	L	M	L
CO3	L	M	L	H	L	M
CO4	L	M	L	M	L	L
CO5	M	L	L	M	H	L

<table>
<tr><td>Title of the Course</td><td colspan="7">ELECTIVE II A: INTERNET OF THINGS</td></tr>
<tr><td>Paper No.</td><td colspan="7">Elective II A</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">PECSC24</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>5</td><td>-</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">About Internet of Things where various communicating entities are controlled and managed for decision making in the application domain.
Enable students to learn the Architecture of IoT and IoT Technologies
Developing IoT applications and Security in IoT, Basic Electronics for IoT, Arduino IDE, Sensors and Actuators Programming NODEMCU using Arduino IDE</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (12hours) (K1, K2, K3, K4, K5 & K6)
1.1 Introduction to IoT: Evolution of IoT
1.2 Definition & Characteristics of IoT
1.3 Architecture of IoT– Technologies for IoT
1.4 Developing IoT Applications
1.5 Applications of IoT – Industrial IoT
1.6 Security in IoT</td></tr>
<tr><td></td><td colspan="7">UNIT II (12 hours) (K1, K2, K3, K4, K5 & K6)
2.1 Basic Electronics for IoT: Electric Charge, Resistance, Current and Voltage
2.2 Binary Calculations
2.3 Logic Chips & Microcontrollers
2.4 Multipurpose Computers
2.5 Electronic Signals – A/D and D/A Conversion –
2.6 Pulse Width Modulation.</td></tr>
</table>

	UNIT III (12 hours) (K1, K2, K3, K4& K5) 3.1 Programming Fundamentals with C using Arduino IDE 3.2 Installing and Setting up the Arduino IDE – Basic Syntax 3.3 Data Types/ Variables/ Constant 3.4 Operators – Conditional Statements and Loops 3.5 Using Arduino C Library Functions for Serial, delay and other invoking Functions 3.6 Strings and Mathematics Library Functions.
	UNIT IV (10 hours) (K1, K2, K3, K4& K5) 4.1 Sensors and Actuators 4.2 Analog and Digital Sensors 4.3 Interfacing temperature sensor 4.4 ultrasound Sensor and infrared (IR) sensor with Arduino 4.5 Interfacing LED and Buzzer with Arduino.
	UNIT V (12hours) (K1, K2, K3, K4& K5) 5.1 Sending Sensor Data Over Internet 5.2 Introduction to ESP8266 NODEMCU WiFi Module 5.3 Programming NODEMCU using Arduino IDE 5.4 Arduino IDE 5.5 Using WiFi and NODEMCU to transmit data from temperature sensor to Open Source IoT cloud platform (ThingS peak).
Text Books	1. ArshdeepBahga, Vijay Madisetti, "Internet of Things: A Hands - On Approach", 2014. ISBN: 978-0996025515. 2. Boris Adryan, DominikObermaier, Paul Fremantle, "The Technical Foundations of IoT", Artech Houser Publishers, 2017.
Reference Books	1.Michael Margolis, "Arduino Cook book",O"Reilly,2011. 2.Marco Schwartz, "Internet of Things with ESP8266", Packt Publishing, 2016. 3.DhivyaBala, "ESP8266: Step by Step Tutorial for ESP8266IoT, Arduino NO DEMCU Dev. Kit", 2018.
Web resources	1.https://onlinecourses.nptel.ac.in/noc20_cs66/preview 2.https://www.javatpoint.com/iot-internet-of-things 3.https://www.tutorialspoint.com/internet_of_things/index.htm

CO	Course Outcomes
On completion of this course, students will be able to;	
CO1	Understand about IoT, its Architecture and its Applications.
CO2	Understand basic electronics used in IoT & its role
CO3	Develop applications with C using Arduino IDE
CO4	Analyze about sensors and actuators
CO5	Design IoT in real time applications using today's internet & wireless technologies

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	M	M	M	L	M	L
CO2	L	M	L	L	M	L
CO3	M	L	M	L	L	M
CO4	H	L	L	M	M	M
CO5	L	M	L	M	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	M	L	M	L	L
CO2	M	L	M	L	H	M
CO3	L	M	L	M	L	L
CO4	L	H	L	M	L	M
CO5	M	L	H	M	L	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ELECTIVE II B: MULTIMEDIA SYSTEMS</td></tr>
<tr><td>Elective II B:</td><td colspan="7">Elective II B</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">PECSD24</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>5</td><td>-</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• To introduce the students the concepts of Multimedia, Images &Animation.
• To introduce Multimedia authoring tools
• To understand the role of Multimedia in Internet
• To know about High Definition Television and Desktop Computing– Knowledge based Multimedia systems</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (12hours) (K1, K2, K3, K4, K5 & K6)
1.1 What is Multimedia?
1.2 Introduction to making Multimedia
1.3 Types of Multimedia
1.4 Macintosh platforms
1.5 Windows Production platforms
1.6 Basic Software tools.</td></tr>
<tr><td></td><td colspan="7">UNIT II (12 hours) (K1, K2, K3, K4, K5 & K6)
2.1 Making Instant Multimedia
2.2 Multimedia authoring tools
2.3 Multimedia building blocks
2.4 Text
2.5 Sound
2.6 Objects</td></tr>
</table>

	UNIT III (10 hours) (K1, K2, K3, K4& K5) 3.1 Images 3.2 Animation 3.3 Video 3.4 Text Flitering 3.5 Shapes
	UNIT IV (12 hours) (K1, K2, K3, K4& K5) 4.1 Multimedia and the Internet 4.2 The Internet and how it works 4.3 Internet Protocol 4.4 Firewall 4.5 Tools for World Wide Web 4.6 Designing for the World Wide Web.
	UNIT V (12hours) (K1, K2, K3, K4& K5) 5.1 High Definition Television 5.2 Desktop Computing 5.3 Knowledge based Multimedia systems. 5.4 Elements of Multimedia System 5.5 Storage for Multimedia System.
Text Books	1. Tay Vaughan, "Multimedia making it work",FifthEdition,TataMc GrawHill. 2. JohnF .KoegelBufford,"MultimediaSystems",Pearson Education.
Reference Books	**1.** Judith Jeffloate,"Multimedia in Practice(Technology and Applications)",PHI,2003.
Web resources	1. https://www.tutorialspoint.com/multimedia/index.htm 2.https://www.tutorialspoint.com/basics_of_computer_science/basics_of_computer_science_multimedia.htm 3. https://nptel.ac.in/courses/117/105/117105083/

CO	Course Outcomes
On completion of this course, students will be able to;	
CO1	Understand the basic concepts of Multimedia
CO2	Demonstrate Multimedia authoring tools
CO3	Analyze the concepts of Sound, Images, Video &Animation
CO4	Apply and Analyze the role of Multimedia in Internet and real time applications
CO5	Analyze multimedia applications using HDTV

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	L	M	L	M	L
CO2	M	H	L	H	M	L
CO3	M	L	H	M	L	M
CO4	M	H	L	M	L	M
CO5	M	L	L	M	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	L	M	L	M	M	L
CO2	L	L	H	L	M	M
CO3	L	M	L	L	H	L
CO4	L	H	L	M	L	L
CO5	M	L	L	M	L	H

<table>
<tr><td>Title of the Course</td><td colspan="7">DATA MINING AND WAREHOUSING</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core IV</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">PCCSE24</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>5</td><td>-</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">Enable the students to learn the concepts of Mining tasks, classification, clustering and Data Warehousing.
Develop skills of using recent data mining software for solving practical problems.
Develop and apply critical thinking, problem-solving, and decision-making skills.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (12hours) (K1, K2, K3, K4, K5 & K6)
1.1 Basic data mining tasks – data mining versus knowledge discovery in databases
1.2 Data mining issues – data mining metrics
1.3 Social implications of data mining
1.4 Data mining from a database perspective.
1.5 Data mining techniques: Introduction – a statistical perspective on data mining – similarity measures
1.6Decision trees – neural networks – genetic algorithms.</td></tr>
<tr><td></td><td colspan="7">UNIT II (12 hours) (K1, K2, K3, K4, K5 & K6)
2.1 Classification: Introduction
2.2 Statistical –based algorithms
2.3 Distance–based algorithms-decision tree-basedalgorithms
2.4 Neuralnetwork–basedalgorithms–rule-basedalgorithms
2.5 CombiningTechniques.</td></tr>
</table>

	UNIT III (12 hours) (K1, K2, K3, K4& K5) 3.1 Clustering: Introduction–Similarity and Distance Measures–Outliers 3.2 Hierarchical Algorithms-Partitional Algorithms. 3.3 Association rules: Introduction - large item sets - basic algorithms 3.4 Parallel &distributed algorithms 3.5 Comparing approaches- incremental rules 3.6 Advanced association rules techniques – measuring the quality of rules.
	UNIT IV (11 hours) (K1, K2, K3, K4& K5) 4.1Data warehousing: introduction – characteristics of a data warehouse 4.2 Data marts – other aspects Of data mart. 4.3 Online analytical processing: introduction –OLTP & OLAP systems 4.4 Data modeling –star schema for multidimensional view –data modeling – multi fact star schema or snow flake schema 4.5 OLAP TOOLS – State of the market – OLAP TOOLS and the internet.
	UNIT V (11hours) (K1, K2, K3, K4& K5) 5.1 Developing a data WAREHOUSE: why and how to build a data warehouse 5.2 Data warehouse architectural strategies and organization issues 5.3 Design consideration – data content – metadata distribution of data – tools for data warehousing performance considerations 5.4 Crucial decisions in designing a data warehouse. 5.5 Applications of data warehousing and data mining in government: Introduction - national data warehouses 5.6 Other areas for data warehousing and data mining.
Text Books	1. MargaretH. Dunham, "Data Mining: Introductory and Advanced Topics", First Edition, Pearson education, 2012. 2. C.S.R. Prabhu, "Data Warehousing Concepts, Techniques, Products and Applications", PHI, Third Edition, 2008.
Reference Books	1. ArunK. Pujari, "Data Mining Techniques", First Edition,Universities Press (India) Pvt. Ltd., 2003. 2. AlexBerson, Stephen J.Smith,"DataWarehousing,Data Mining and OLAP", First Edition, TMCH, 2001. 3. Rajanchattamvelli "Data Mining Methods", Second Editon, Narose Publishing House Pvt.Ltd, New Delhi,2016.

Web resources	1. https://www.javatpoint.com/data-warehouse 2. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs12/ 3.https://www.btechguru.com/training--it--database-management-systems--file-structures--introduction-to-data-warehousing-and-olap-2-video-lecture--12054--26--151.html

CO	Course Outcomes
On completion of this course, students will be able to;	
CO1	Understand the basic data mining techniques and algorithms
CO2	Understand the Association rules, Clustering techniques and Data warehousing contents
CO3	Compare and evaluate different data mining techniques like classification, prediction, Clustering and association rule mining
CO4	Design data warehouse with dimensional modeling and apply OLAP operations
CO5	Identify appropriate data mining algorithms to solve real world problems

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	M	M	L	M	L
CO2	M	H	L	H	M	L
CO3	M	L	M	M	L	M
CO4	M	H	L	M	M	M
CO5	M	L	L	M	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	L	M	H	M	L	M
CO2	M	L	M	L	M	H
CO3	L	M	L	M	H	L
CO4	L	H	L	M	L	M
CO5	M	L	L	M	L	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ADVANCED JAVA PROGRAMMING</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core V</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">PCCSF24</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>5</td><td>-</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• Enable the students to learn the basic functions, principles and concepts of advanced java programming.
• Provide knowledge on concepts needed for distributed Application Architecture.
• Learn JDBC, Servlet packages, J Query, Java Server Pages and JAR file format</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (12hours) (K1, K2, K3, K4, K5 & K6)
1.1 Java Basics Review
1.2 Components and event handling
1.3 Threading concepts
1.4 Networking features
1.5 Media techniques</td></tr>
<tr><td></td><td colspan="7">UNIT II (12 hours) (K1, K2, K3, K4, K5 & K6)
2.1 Remote Method Invocation
2.2 Distributed Application Architecture
2.3 Creating stubs and skeletons
2.4 Defining Remote objects
2.5 Remote Object Activation-Object Serialization
2.6 Java Spaces</td></tr>
<tr><td></td><td colspan="7">UNIT III (10 hours) (K1, K2, K3, K4& K5)
3.1 Java in Databases
3.2 JDBC principles
3.3Database access
3.4 Interacting-database search
3.4 Creating multimedia databases
3.6 Database support in web applications</td></tr>
</table>

	UNIT IV (12 hours) (K1, K2, K3, K4& K5) 4.1 Java Servlets: Java Servlet and CGI programming 4.2 A simple java Servlet-Anatomy of a java Servlet 4.3 Reading data from a client-Reading http request header- sending data to a client and writing the http response header - working with cookies 4.4 Java Server Pages: JSP Overview-Installation-JSP tags 4.5 Components of a JSP page-Expressions- Script lets 4.6 Directives-Declarations-A complete example
	UNIT V (12hours) (K1, K2, K3, K4& K5) 5.1 JAR File 5.2 JAR File format creation 5.3 Internationalization 5.4 Swing Programming 5.5 Advanced java techniques
Text Books	1. Jamie Jaworski, "Java Unleashed", SAMS Tech media Publications, 4th Revised *Edition*, 2010. 2. Campione, Walrath and Huml,"The Java Tutorial",Addison Wesley,2001.
Reference Books	1. Jim Keogh, "The Complete Reference J2EE", Tata McGraw Hill Publishing Company Ltd, 2010. 2.David Sawyer McFarland, "JavaScript And JQuery-The Missing Manual",Oreilly Publications, 3rd Edition, 2011. 3. Deitel and Deitel, "Java How to Program", Third Edition, PHI/Pearson Education Asia, Ninth Edition, 2012.
Web resources	1. https://www.javatpoint.com/servlet-tutorial 2. https://www.tutorialspoint.com/java/index.htm 3. https://onlinecourses.nptel.ac.in/noc19_cs84/preview

CO	Course Outcomes
On completion of this course, students will be able to;	
CO1	Understand the advanced concepts of Java Programming
CO2	Understand JDBC and RMI concepts
CO3	Apply and analyze Java in Database
CO4	Handle different event in java using the delegation event model, event listener and class
CO5	Design interactive applications using Java Servlet, JSP and JDBC

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	M	M	L	M	L
CO2	M	H	L	L	M	L
CO3	H	L	M	M	L	M
CO4	L	M	L	M	M	M
CO5	L	L	L	M	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	L	M	M	L	M	L
CO2	M	H	L	L	M	L
CO3	H	L	M	M	L	M
CO4	L	M	L	M	M	M
CO5	L	L	L	M	L	H

<table>
<tr><td>Title of the Course</td><td colspan="7">PRACTICAL III: DATA MINING LAB USING R</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core VI</td></tr>
<tr><td>Category</td><td>Core</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td>Course Code</td><td>PCCSG24</td></tr>
<tr><td></td><td></td><td>Semester</td><td>II</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td></td><td>-</td><td>-</td><td colspan="3">4</td><td colspan="2">4</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• To enable the students to learn the concepts of Data Mining algorithms namely classification, clustering, regression
• To understand & write programs using the DM algorithms
• To apply statistical interpretations for the solutions
• Able to use visualizations techniques for interpretations</td></tr>
<tr><td>Course Outline</td><td colspan="7">Exercises
1. Implement A priori algorithm to extract association rule of data mining.
2. Implement k-means clustering technique.
3. Implement any one Hierarchal Clustering.
4. Implement Classification algorithm.
5. Implement Decision Tree.
6. Linear Regression.
7. Data Visualization.</td></tr>
<tr><td>Text Books</td><td colspan="7">1. MargaretH. Dunham, “Data Mining: Introductory and Advanced Topics”, First Edition, Pearson education, 2012.
2. C.S.R. Prabhu, “Data Warehousing Concepts, Techniques, Products and Applications”, PHI, Third Edition, 2008.</td></tr>
<tr><td>Reference Books</td><td colspan="7">1. ArunK. Pujari, “Data Mining Techniques”, First Edition,Universities Press (India) Pvt. Ltd., 2003.
2. AlexBerson, Stephen J.Smith,“DataWarehousing,Data Mining and OLAP”, First Edition, TMCH, 2001.
3. Rajanchattamvelli “Data Mining Methods”, Second Editon, Narose Publishing House Pvt.Ltd, New Delhi,2016.</td></tr>
<tr><td>Web resources</td><td colspan="7">1. https://www.javatpoint.com/data-warehouse
2. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs12/
3.https://www.btechguru.com/training--it--database-management-systems--file-structures--introduction-to-data-warehousing-and-olap-2-video-lecture--12054--26--151.html</td></tr>
</table>

CO	Course Outcomes
On completion of this course, students will be able to;	
CO1	Understand the advanced concepts of Java Programming
CO2	Understand JDBC and RMI concepts
CO3	Apply and analyze Java in Database
CO4	Handle different event in java using the delegation event model, event listener and class
CO5	Design interactive applications using Java Servlet, JSP and JDBC

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	M	M	L	M	L
CO2	M	H	L	L	M	L
CO3	H	L	M	M	L	M
CO4	L	M	L	M	M	M
CO5	L	L	L	M	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	L	M	L	L	M
CO2	L	M	L	L	M	H
CO3	L	M	L	M	L	M
CO4	M	L	L	M	L	L
CO5	M	H	L	M	L	H

<table>
<tr><td>Title of the Course</td><td colspan="7">PRACTICAL IV: ADVANCED JAVA LAB</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core Practical IV</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">PCCSH24</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td></td><td>-</td><td colspan="3">4</td><td colspan="2">4</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• To enable the students to implement the simple programs using JSP,JAR
• To provide knowledge on using Servlets, Applets
• To introduce JDBC and navigation of records
• To understand RMI& its implementation
• To introduce to Socket programming</td></tr>
<tr><td>Course Outline</td><td colspan="7">Exercises
1. Display a welcome message using Servlet.
2. Design a Purchase Order form using Html form and Servlet.
3. Develop a program for calculating the percentage of marks of a student using JSP.
4. Design a Purchase Order form using Html form and JSP.
5. Prepare an Employee pay slip using JSP.
6. Write a program using JDBC for creating a table, Inserting, Deleting records and list out the records.
7. Write a program using Java servlet to handle form data.
8. Write a simple Servlet program to create a table of all the header sit receives along with their associated values.
9. Write a program in JSP by using session object.
10. Write a program to build a simple Client Server application using RMI.
11. Create an applet for a calculator application.
12. Program to send a text message to another system and receive the text message from the system (use socket programming).</td></tr>
</table>

Text Books	1. Jamie Jaworski, "Java Unleashed", SAMS Tech media Publications, 4th Revised *Edition*, 2010. 2. Campione, Walrath and Huml,"The Java Tutorial",Addison Wesley,2001.
Reference Books	1. Jim Keogh, "The Complete Reference J2EE", Tata McGraw Hill Publishing Company Ltd, 2010. 2.David Sawyer McFarland, "JavaScript And JQuery-The Missing Manual",Oreilly Publications, 3rd Edition, 2011. 3. Deitel and Deitel, "Java How to Program", Third Edition, PHI/Pearson Education Asia, Ninth Edition, 2012.
Web resources	1. https://www.javatpoint.com/servlet-tutorial 2. https://www.tutorialspoint.com/java/index.htm 3. https://onlinecourses.nptel.ac.in/noc19_cs84/preview

CO	Course Outcomes
On completion of this course, students will be able to;	
CO1	Understand to the implement concepts of Java using HTML forms, JSP &JAR
CO2	Must be capable of implementing JDBC and RMI concepts
CO3	Able to write Applets with Event handling mechanism
CO4	To Create interactive web based applications using servlets and jsp
CO5	Develop and Understand Exception handling

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	M	M	M	L	M	L
CO2	L	L	L	L	M	L
CO3	M	L	M	M	L	M
CO4	M	L	H	M	M	M
CO5	L	M	L	M	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	L	L	M	L	H	L
CO2	M	L	M	L	M	M
CO3	L	M	L	M	H	L
CO4	L	M	M	H	L	M
CO5	M	L	L	M	L	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ELECTIVE III A: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING</td></tr>
<tr><td>Paper No.</td><td colspan="7">Elective III A</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">PECSE24</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>4</td><td>-</td><td colspan="2">-</td><td colspan="3">4</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• Enable the students to learn the basic functions of AI, Heuristic Search Techniques.
• Provide knowledge on concepts of Representations and Mappings and Predicate Logic.
• Introduce Machine Learning with respect Data Mining, Big Data and Cloud.
• Study about Applications & Impact of ML.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (12hours) (K1, K2, K3, K4, K5 & K6)
1.1 Introduction: AI Problems
1.2 Al techniques
1.3 Criteria for success. Problems, Problem Spaces
1.4 Search: State space search
1.5 Production Systems - Problem Characteristics
1.6 Issues in design of Search.</td></tr>
<tr><td></td><td colspan="7">UNIT II (12 hours) (K1, K2, K3, K4, K5 & K6)
2.1 Heuristic Search techniques: Generate and Test
2.2 Hill Climbing- Best-First, Problem Reduction
2.3 Constraint Satisfaction, Means-end analysis.
2.4 Knowledge representation issues: Representations and mappings
2.5 Approaches to Knowledge representations -Issues in Knowledge representations
2.6 Frame Problem</td></tr>
</table>

	UNIT III (12 hours) (K1, K2, K3, K4& K5) 3.1 Using Predicate logic: Representing simple facts in logic 3.2 Representing Instance and Isa relationships - Computable functions and predicates 3.3 Resolution - Natural deduction. 3.4 Representing knowledge using rules: Procedural Vs Declarative knowledge 3.5 Logic programming 3.6 Forward Vs Backward reasoning -Matching-Control knowledge.
	UNIT IV (12 hours) (K1, K2, K3, K4& K5) 4.1 Understanding Machine Learning: What Is Machine Learning? 4.2 Defining Big Data- Big Data in Context with Machine Learning 4.3 The Importance of the Hybrid Cloud-Leveraging the Power of Machine Learning 4.4 The Roles of Statistics and Data Mining with Machine Learning 4.5 Putting Machine Learning in Context-Approaches to Machine Learning.
	UNIT V (10hours) (K1, K2, K3, K4& K5) 5.1 Looking Inside Machine Learning 5.2 The Impact of Machine Learning 5.3 Machine Learning Applications 5.4 Data Preparation 5.5 The Machine Learning Cycle.
Text Books	1. Elaine Rich and Kevin Knight," Artificial Intelligence", Tata McGraw Hill Publishers company Pvt Ltd, Third Edition, 2017. 2. George FLuger," Artificial Intelligence", 4th Edition, Pearson Education Publication, 2016.
Reference Books	1. Machine Learning For Dummies, IBM Limited Edition by Judith Hurwitz, Daniel Kirsch, 2018.
Web resources	1. https://www.ibm.com/downloads/cas/GB8ZMQZ3 2. https://www.javatpoint.com/artificial-intelligence-tutorial 3. https://nptel.ac.in/courses/106/105/106105077/

CO	Course Outcomes
On completion of this course, students will be able to;	
CO1	Demonstrate AI problems and techniques
CO2	Understand machine learning concepts
CO3	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning
CO4	Analyze the impact of machine learning on applications
CO5	Analyze and design a real world problem for implementation and understand the dynamic behavior of a system

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	L	L	M	M	L
CO2	M	L	L	M	L	H
CO3	L	M	L	M	H	L
CO4	M	M	L	L	M	H
CO5	M	L	M	L	M	L

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	M	M	M	L	M	L
CO2	L	L	L	L	M	L
CO3	M	L	M	M	L	M
CO4	M	L	H	M	M	M
CO5	L	M	L	M	L	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ELECTIVE: CRITICAL THINKING, DESIGN THINKING AND PROBLEM SOLVING</td></tr>
<tr><td>Paper No.</td><td colspan="7">Elective III B</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">PECSF24</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>-</td><td colspan="3">-</td><td colspan="2">4</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• Learn critical thinking and its related concepts
• Learn design thinking and its related concepts
• Develop Thinking patterns, Problem solving &Reasoning</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (12hours) (K1, K2, K3, K4, K5 & K6)
1.1 Critical Thinking: Definition, Conclusions and Decisions
1.2 Beliefs and Claims, Evidence –finding, evaluation, Inferences,
1.3 Facts – opinion
1.4 Probable truth, probably false, Venn diagram.
1.5 Applied critical thinking: Inference, Explanation, Evidence, Credibility, Two Case Studies,
1.6 Critical thinking and science, critical evaluation, self assessment.</td></tr>
<tr><td></td><td colspan="7">UNIT II (12 hours) (K1, K2, K3, K4, K5 & K6)
2.1 Design Thinking: Introduction, Need of Design Thinking, problem to question
2.2 Design thinking process, Traditional Problem Solving versus Design Thinking
2.3 Phases of Design Thinking, problem exploration
2.4 Stake holder assessment
2.5 Design thinking for manufacturers
2.6 Smart Idea to implementation.</td></tr>
</table>

	UNIT III (12 hours) (K1, K2, K3, K4& K5) 3.1 Thinking to confidence, fear management 3.2 duty Vs passion, Team management 3.3 Tools for Thinking, prototype design, 3.4 Relevance of Design and Design Thinking in engineering 3.5 human centered design, case study: apply design thinking in problem.
	UNIT IV (10 hours) (K1, K2, K3, K4& K5) 4.1Problem solving: problem definition, problem solving methods 4.2 selecting and using information, data processing, 4.3 solution methods, solving problems by searching, 4.4 recognizing patterns, spatial Reasoning , necessity and sufficiency, 4.5 choosing and using models, making choices and decisions
	UNIT V (12hours) (K1, K2, K3, K4& K5) 5.1Reasoning: Deductive and hypothetical reasoning 5.2 computational problem solving; generating, implementing, and evaluating solutions 5.3 interpersonal problem solving. Advanced problem solving 5.4 Combining skills – using imagination, developing models, Carrying out investigations 5.5 Data analysis and inference. Graphical methods of solution, Probability 5.6 tree diagrams and decision trees
Text Books	1. John Butter worth and Geoff Thwaites, Thinking skills: Critical Thinking and Problem Solving, Cambridge University Press, 2013. 2.H.S.FoglerandS.E.LeBlanc, Strategies for Creative Problem Solving, 2nd edition, Pearson, Upper Saddle River, NJ, 2008.
Reference Books	1. A. Whimbey and J. Lochhead, Problem Solving & Comprehension, 6th edition, Lawrence Erlbaum, Mahwah, NJ, 1999. 2.M. Levine, Effective Problem Solving, 2nd edition, Prentice Hall, Upper Saddle River, NJ, 1994. 3.Michael Baker,The Basic of Critical Thinking, The Critical Thinking Copress, 2015. 4. David Kelley and TomKelley, Creative Confidence, 2013.

Web resources	1. https://www.tutorialspoint.com/critical_thinking/index.htm 2. https://www.tutorialspoint.com/design_thinking/design_thinking_quick_guide.htm 3. https://nptel.ac.in/courses/109/104/109104109/

CO	Course Outcomes
On completion of this course, students will be able to;	
CO1	Understand the concepts of Critical thinking and its related technology
CO2	Focus on the explicit development of critical thinking and problem solving skills
CO3	Apply design thinking in problems
CO4	Make a decision and take actions based on analysis
CO5	Analyze the concepts of Thinking patterns, Problem solving & Reasoning in real time applications

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	M	M	L	M	L	L
CO2	L	H	L	H	M	L
CO3	L	L	H	L	L	M
CO4	H	L	M	M	L	M
CO5	L	M	L	L	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	L	M	L	M	L	M
CO2	M	L	M	L	M	L
CO3	L	M	L	M	L	M
CO4	L	H	L	M	L	H
CO5	M	L	L	M	L	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ELECTIVE: MOBILE COMPUTING</td></tr>
<tr><td>Paper No.</td><td colspan="7">Elective IV A</td></tr>
<tr><td>Category</td><td>Elective</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td>Course Code</td><td>PECSG24</td></tr>
<tr><td></td><td></td><td>Semester</td><td>II</td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>-</td><td colspan="3">-</td><td colspan="2">4</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• Present the overview of Mobile computing, Applications and Architectures.
• Describe the futuristic computing challenges.
• Enable the students to learn the concept of mobile computing.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (12hours) (K1, K2, K3, K4, K5 & K6)
1.1 Introduction: Mobile Computing
1.2 Advantages of Digital Information
1.3 Introduction to Telephone Systems
1.4 Mobile communication: Need for Mobile Communication
1.5 Requirements of Mobile Communication
1.6 History of Mobile Communication.</td></tr>
<tr><td></td><td colspan="7">UNIT II (12 hours) (K1, K2, K3, K4, K5 & K6)
2.1 Introduction to Cellular Mobile Communication
2.2 Mobile Communication Standards
2.3 Mobility Management
2.4 Frequency Management
2.5 Cordless Mobile Communication Systems.</td></tr>
<tr><td></td><td colspan="7">UNIT III (12 hours) (K1, K2, K3, K4& K5)
3.1 Mobile Computing: History of data networks
3.2 Classification of Mobile data networks
3.3 CDPD System – Satellites in Mobile Communication: Satellite classification
3.4 Global Satellite Communication
3.5 Changeover from one satellite to other – Global Mobile Communication
3.6 Interferences in Cellular Mobile Communication.</td></tr>
</table>

	UNIT IV (11 hours) (K1, K2, K3, K4& K5) 4.1 Important Parameters of Mobile Communication System 4.2 Mobile Internet: Working of Mobile IP 4.3 Wireless Network Security 4.4 Wireless Local Loop Architecture: Components in WLL – Problems in WLL 4.5 Modern Wireless Local Loop – Local Multipoint Distribution Service 4.6 Wireless Application Protocol.
	UNIT V (11hours) (K1, K2, K3, K4& K5) 5.1 WCDMA Technology 5.2Fiber Optic Microcellular Mobile Communication 5.3 Ad hoc Network and Bluetooth technology 5.4 Intelligent Mobile Communication system 5.5 Fourth Generation Mobile Communication systems.
Text Books	1. T.G. Palanivelu, R. Nakkeeran, "Wireless and Mobile Communication", PHI Limited, 2009. 2. Jochen Schiller, "Mobile Communications", Second Edition, Pearson Education, 2007.
Reference Books	**1.** AsokeKTalukder, Hasan Ahmed, RoopaYavagal, "Mobile Computing", TMH, 2010.
Web resources	1. https://www.tutorialspoint.com/mobile_computing/index.m 2. https://www.javatpoint.com/mobile-computing 3. https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs13/

CO	**Course Outcomes**
On completion of this course, students will be able to;	
CO1	Understand the need and requirements of mobile communication
CO2	Focus on mobile computing applications and techniques
CO3	Demonstrate satellite communication in mobile computing
CO4	Analyze about wireless local loop architecture
CO5	Analyze various mobile communication technologies

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	M	L	L	M	M	L
CO2	L	M	L	H	M	L
CO3	L	L	M	L	L	M
CO4	H	L	M	M	L	M
CO5	L	M	L	L	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	L	M	L	M	M	L
CO2	L	M	M	L	M	L
CO3	M	L	M	L	H	M
CO4	L	H	L	M	L	L
CO5	M	L	L	M	L	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ELECTIVE: WEB SERVICES</td></tr>
<tr><td>Paper No.</td><td colspan="7">Elective IV B</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">PECSH24</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>-</td><td colspan="3">-</td><td colspan="2">4</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• Present the Web Services , Building real world Enterprise applications using Web Services with Technologies XML, SOAP , WSDL , UDDI
• Get overview of Distributed Computing, XML, and its technologies
• Update with QoS and its features
• Develop Standards and future of Web Services</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (12hours) (K1, K2, K3, K4, K5 & K6)
1.1 Introduction to web services – Overview of Distributed Computing
1.2 Evolution and importance of web services-Industry standards
1.3 Technologies and concepts underlying web services
1.4 Web services and enterprises-web services standards organization
1.5 Web services platforms.</td></tr>
<tr><td></td><td colspan="7">UNIT II (12 hours) (K1, K2, K3, K4, K5 & K6)
2.1 XML Fundamentals
2.2 XML documents
2.3 XML Namespaces
2.4 XML Schema
2.5 Processing XML.</td></tr>
<tr><td></td><td colspan="7">UNIT III (12 hours) (K1, K2, K3, K4& K5)
3.1 SOAP: The SOAP model
3.2 SOAP messages-SOAP encoding
3.3 WSDL: WSDL structure interface definitions
3.4 Bindings-services-Using SOAP and WSDL
3.5 UDDI: About UDDI- UDDI registry Specification-
3.6 Core data structures-Accessing UDDI</td></tr>
</table>

	UNIT IV (12 hours) (K1, K2, K3, K4& K5) 4.1 Advanced web services technologies and standards: Conversations overvie 4.2 Web services conversation language-WSCL interface components. Workflow: 4.3 Business process management 4.4 Workflows and workflow management systems Security 4.5 Basics-data handling and forwarding- data storage-errors 4.6 Web services security issues.
	UNIT V (10hours) (K1, K2, K3, K4& K5) 5.1 Quality of Service: Importance of QoS for web services 5.2 QoS metrics-holes-design patterns 5.3 QoS enabled web services 5.4 QoS enabled applications. 5.5 Web services management 5.6 Web services standards and future trends.
Text Books	1. SandeepChatterjee, James Webber, "Developing Enterprise Web Services: An Architects Guide", Prentice Hall, Nov 2004. 2. Keith Ballinger, "NET Web services: Architecture and Implementation with .Net", Pearson Education, First Edition, Feb 2003.
Reference Books	1. RameshNagappan, "Developing Java Web Services: Architecting and developing secure Web Services Using Java", John Wiley and Sons, first Edition Feb 2003. 2. EricA Marks and MarkJWerrell, "Executive Guide to Web services", John Wileyand sons, March 2003. **3.** Anne Thomas Manes, "Web Services: A managers Guide", Addison Wesley,June2003.
Web resources	1.https://www.tutorialspoint.com/webservices/index.htm 2.https://www.javatpoint.com/web-services-tutorial **3.**https://www.btechguru.com/training--programming--xml--web-services--web-services-part-1-video-lecture--11801--24--147.html

CO	Course Outcomes
On completion of this course, students will be able to;	
CO1	Understand web services and its related technologies
CO2	Understand XML concepts
CO3	Analyze on SOAP and UDDI model
CO4	Demonstrate the roadmap for the standards and future of web services
CO5	Analyze QoS enabled applications in web services

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	M	L	L	M	M	L
CO2	L	M	L	H	M	L
CO3	L	L	M	L	L	M
CO4	H	L	M	M	L	M
CO5	L	M	L	L	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	L	L	M	L	L	H
CO2	M	L	M	L	M	L
CO3	L	M	L	M	L	L
CO4	L	H	L	M	L	M
CO5	M	M	L	M	L	H

<table>
<tr><td>Title of the Course</td><td colspan="7">SEC: DIGITAL FORENSICS</td></tr>
<tr><td>Paper No.</td><td colspan="7">Practical</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td>Course Code</td><td>PGCSA224</td></tr>
<tr><td>Semester</td><td>II</td><td colspan="2"></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>2</td><td>-</td><td colspan="3">-</td><td colspan="2">2</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• To learn the procedures for identification, preservation and acquisition of digital evidence.
• To study techniques and tools used in digital forensics for malware investigation.
• To understand the tools for E-mail Forensics and Browser.
• To explore crime forensics investigations.
• Explain new technologies of Open Source tools of FTK Imager and Autopsy</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (12hours) (K1, K2, K3, K4, K5 & K6)
1.1 Introduction to Digital Forensics
1.2 Evolution and Benefits of digital forensics.
1.3 Cyber Crime
1.4 Role of Forensic Investigator.
1.5Introduction to computer crime investigation – Initial Decision-making Process.
1.6Stages of Computer forensics process.</td></tr>
<tr><td></td><td colspan="7">UNIT II (12 hours) (K1, K2, K3, K4, K5 & K6)
2.1 Acquire the data: Build Computer Investigation Toolkit – preparing Computer Investigation.
2.2 Analyze the data: Network data – Host data – storage media.
2.3 Types of Investigation.
2.4 Report the Investigation.
2.5 Digital Evidence
2.6 Techniques of Digital Forensics: Cross-drive analysis – Live analysis – recovery of deleted files.</td></tr>
</table>

	UNIT III (12 hours) (K1, K2, K3, K4& K5) 3.1 Introduction to Open source tools of FTK Imager and Autopsy. 3.2 Working process of FTK Imager and Autopsy. 3.3 Timeline report. 3.4 E-Mail Forensics and its tools. 3.5 Types of E-Mail Service. 3.6 E-Mail Attacks and Crimes: E-Mail Hacking – Spoofing – spams – phishing.
	UNIT IV (12 hours) (K1, K2, K3, K4& K5) 4.1 Introduction to Mobile Forensics. 4.2 Mobile Forensic Process. 4.3 Forensic Acquisition Tools. 4.4 Report Preparation – Web Browser Forensics. 4.5 Case Study: Crime Forensics Scenarios.
	UNIT V (12hours) (K1, K2, K3, K4& K5) 5.1 Analysis of forensic images using open source tools of FTK Imager. 5.2 Creating and adding a case using Autopsy. 5.3 Generate a timeline report using Autopsy. 5.4 E-Mail Analysis.
Text Books	1. JeetendraPande, Ajay Prasad, "Digital Forensics", March 2016. 2. Cory Altheide, Harlan Carvey, "Digital Forensics with an Open Source Tools, 2nd Edition, 2015
Reference Books	1.Digital Evidence and Computer Crime: Forensic Science, Computers and the Internet, 3rd Edition. 2. Michael Hale Ligh, Andrew Case " Mobile Forensics" 1stEdition, Wiley Publication.
Web resources	1.https://www.studocu.com/in/n/52339428?sid=01716647723 2.https://www.studocu.com/in/document/university-of-mumbai/digital-forensics/expt-1-ftk-imager-and-autopsy/52339428 3. https://www.geeksforgeeks.org/analysis-of-data-source-using-autopsy/

CO	Course Outcomes
On completion of this course, students will be able to;	
CO1	Understand the concepts of various forensic tools and use them to acquire, analyze data.
CO2	Verification of E-Mails and Browser.
CO3	Demonstrate Timeline Report analysis using forensics tools.
CO4	Learn the concepts of crime forensics investigations.
CO5	Apply the open source tools of FTK Imager and Autopsy.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	M	L	L	M	L	L
CO2	M	L	M	H	M	L
CO3	L	M	L	M	L	M
CO4	L	M	H	L	M	L
CO5	L	H	L	M	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	L	M	L	M	L	M
CO2	L	M	H	L	M	L
CO3	L	H	L	M	L	M
CO4	L	H	L	M	L	M
CO5	M	H	L	M	L	H

<table>
<tr><td>Title of the Course</td><td colspan="7">DIGITAL IMAGE PROCESSING</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core VII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">PCCSI24</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>5</td><td>-</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">Learn basic image processing techniques for solving real problems.
Gain knowledge in image transformation and Image enhancement techniques.
Learn Image compression and Segmentation procedures.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (12 hours) (K1, K2, K3, K4& K5)
1.1 Introduction: What is Digital image processing?
1.2 The origin of DIP – Examples of fields that use DIP
1.3 Fundamentals steps in DIP – Components an image processing system.
1.4 Digital Image Fundamentals: Elements of Visual perception – Light and the electromagnetic spectrum
1.5 Image sensing and acquisition – Image sampling and Quantization
1.6 Some Basic relationship between Pixels – Linear & Nonlinear operations.</td></tr>
<tr><td></td><td colspan="7">UNIT II (12 hours) (K1, K2, K3, K4, K5 & K6)
2.1 Image Enhancement in the spatial domain:- Background
2.2 Some basic Gray level Transformations
2.3 Histogram Processing – Enhancement using Arithmetic / Logic operations
2.4 Basics of spatial filtering – Smoothing spatial filters
2.5 Sharpening spatial filters
2.6 Combining spatial enhancement methods.</td></tr>
</table>

	UNIT III (12 hours) (K1, K2, K3, K4& K5) 3.1 Image Restoration: A model of the Image Degradation / Restoration Process 3.2 Noise models – Restoration is the process of noise only 3.3 Spatial Filtering – Periodic Noise reduction by frequency domain filtering – Linear 3.4 Portion – Invariant Degradations – Estimating the degradation function 3.5 Inverse filtering – Minimum mean square Error Filtering 3.6 Constrained least squares filtering – Geometric mean filter – Geometric Transformations.
	UNIT IV (11 hours) (K1, K2, K3, K4 , K5 & K6) 4.1 Image Compression 4.2 Fundamentals–Image compression models 4.3 Elements of Information Theory 4.4 Error Free compression 4.5 Lossy compression 4.6 Image compression standards.
	UNIT V (11hours) (K1, K2, K3, K4& K5) 5.1 Image Segmentation: Detection and Discontinuities 5.2 Edge Linking and Boundary deduction 5.3 Thresholding – Region-Based segmentation 5.4 Segmentation by Morphological watersheds 5.5 The use of motion in segmentation.
Text Books	1.Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Fourth Edition, PHI/Pearson Education, 2018. **2.**B. Chanda, D. DuttaMajumder, "Digital Image Processing and Analysis", PHI, Second Edition, 2011.
Reference Books	1.Nick Efford, "Digital Image Processing a practical introducing using Java", Pearson Education, 2018.

Web resources	1. https://nptel.ac.in/courses/117/105/117105135/ 2. https://www.tutorialspoint.com/dip/index.html 3. https://www.javatpoint.com/digital-image-processing-tutorial

CO	Course Outcomes
On completion of this course, students will be able to;	
CO1	Understand the fundamentals of Digital Image Processing.
CO2	Understand them a thematically foundations for digital image representation, image acquisition, image transformation, and image enhancement.
CO3	Apply, Design and Implement and get solutions for digital image processing problems.
CO4	Apply the concepts of filtering and segmentation for digital image retrieval.
CO5	Explore the concepts of Multi-resolution process and recognize the objects in an efficient manner.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	L	M	L	M	L
CO2	L	M	L	H	M	L
CO3	H	L	L	L	M	M
CO4	L	L	L	M	M	M
CO5	L	M	L	M	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	L	M	L	M	L
CO2	L	M	L	M	L	M
CO3	L	M	L	M	H	L
CO4	L	H	L	M	L	L
CO5	M	L	L	M	L	H

<table>
<tr><td>Title of the Course</td><td colspan="7">CLOUD COMPUTING</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core VIII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">PCCSJ24</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>5</td><td>-</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">Gain knowledge on cloud computing, cloud services, architectures and applications.
Enable the students to learn the basics of cloud computing with real time usage.
How to store and share, in and from cloud?</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (12 hours) (K1, K2, K3, K4& K5)
1.1 Introduction Cloud Computing Introduction, From, Collaboration to cloud
1.2 Working of cloud computing, pros and cons
1.3 Benefits, developing cloud computing services
1.4 Cloud service development
1.5 Discovering cloud services.</td></tr>
<tr><td></td><td colspan="7">UNIT II (12 hours) (K1, K2, K3, K4, K5 & K6)
2.1 Cloud Computing For Everyone Centralizing email communications
2.2 Cloud computing for community, collaborating on schedules
2.3 Collaborating on group projects and events
2.4 Cloud computing for corporation, mapping
2.5 Schedules, managing projects, presenting on road.</td></tr>
<tr><td></td><td colspan="7">UNIT III (12 hours) (K1, K2, K3, K4& K5)
3.1 Using Cloud Services Collaborating on calendars
3.2 Schedules and task management, exploring on line scheduling and planning
3.3 Collaborating on event management
3.4 Collaborating on contact management, collaborating on project management
3.5 Collaborating on word processing
3.6 Spreadsheets, and Databases</td></tr>
</table>

	UNIT IV (12 hours) (K1, K2, K3, K4 , K5 & K6) 4.1 Outside the cloud Evaluating web mail services 4.2 Evaluating instant messaging, Evaluating web conference tools 4.3 Creating groups on social networks 4.4 Evaluating online Groupware 4.5 Collaborating via blogs and wikis.
	UNIT V (10 hours) (K1, K2, K3, K4& K5) 5.1 Storing and Sharing Understanding cloud storage 5.2 Evaluating on line file storage 5.3 Exploring on line book marking services 5.4 Exploring on line photo editing applications 5.5 Exploring photo sharing communities 5.6 Controlling it with web based desktops.
Text Books	1. Michael Miller, "Cloud Computing", Pearson Education, New Delhi, 2009.
Reference Books	1. Anthony T. Velte, "Cloud Computing: A Practical Approach", 1st Edition, Tata McGraw Hill Education Private Limited, 2010.
Web resources	1. https://nptel.ac.in/courses/106/105/106105167/ 2. https://www.tutorialspoint.com/cloud_computing/index.htm 3. https://www.javatpoint.com/cloud-computing-tutorial

CO	Course Outcomes
On completion of this course, students will be able to;	
CO1	Understand the concepts of Cloud and its services.
CO2	Collaborate Cloud for Event & Project Management.
CO3	Analyze on cloud in – Word Processing, Spread Sheets, Mail, Calendar, Database.
CO4	Analyze cloud in social networks.
CO5	Explore cloud storage and sharing.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	M	L	M	L	M	L
CO2	M	M	L	H	L	L
CO3	H	L	L	L	L	M
CO4	H	L	L	M	L	M
CO5	L	M	L	L	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	L	L	M	L	M	L
CO2	M	L	M	L	M	M
CO3	L	M	L	M	H	L
CO4	M	H	L	M	M	L
CO5	M	L	L	M	L	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ADVANCED OPERATING SYSTEMS</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core IX</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2">PCCSK24</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>6</td><td colspan="2">-</td><td colspan="2">-</td><td colspan="2">6</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">Enable the students to learn the different types of operating systems and their functioning.
Gain knowledge on Distributed Operating Systems
Gain insight into the components and management aspects of real time and mobile operating systems.
Learn case studies in Linux Operating Systems</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (12 hours) (K1, K2, K3, K4& K5)
1.1 Basics of Operating Systems: What is an Operating System?
1.2 Main frame Systems –Desktop Systems – Multiprocessor Systems
1.3 Distributed Systems – Clustered Systems –Real-Time Systems – Handheld Systems
1.4 Feature Migration – Computing Environments
1.5 Process Scheduling – Cooperating Processes – Inter Process Communication
1.6 Deadlocks –Prevention – Avoidance – Detection – Recovery.</td></tr>
<tr><td></td><td colspan="7">UNIT II (12 hours) (K1, K2, K3, K4, K5 & K6)
2.1 Distributed Operating Systems: Issues – Communication Primitives
2.2 Lamport‟s Logical Clocks – Deadlock handling strategies
2.3 Issues in deadlock detection and resolution
2.4 Distributed file systems
2.5 Design issues – Case studies
2.6 The Sun Network File System-Coda.</td></tr>
<tr><td></td><td colspan="7">UNIT III (10 hours) (K1, K2, K3, K4& K5)
3.1 Real time Operating Systems: Introduction
3.2 Applications of Real Time Systems
3.3 Basic Model of Real Time System
3.4 Characteristics – Safety and Reliability
3.5 Real Time Task Scheduling</td></tr>
</table>

	UNIT IV (12 hours) (K1, K2, K3, K4 , K5 & K6) 4.1 Operating Systems for Handheld Systems: Requirements 4.2 Technology Overview 4.3 Handheld Operating Systems– Palm OS 4.4 Symbian Operating System 4.5 Android– Architecture of android
	UNIT V (12 hours) (K1, K2, K3, K4& K5) 5.1 Case Studies: Linux System: Introduction 5.2 Memory Management 5.3 Process Scheduling – Scheduling Policy 5.4 Managing I/O devices – Accessing Files 5.5iOS: Architecture and SDK Framework -Media Layer - Services Layer - Core OS Layer 5.6 File System.
Text Books	1. Abraham Silber schatz; Peter Baer Galvin; Greg Gagne, "Operating System Concepts", Seventh Edition, John Wiley & Sons, 2005. 2. MukeshSinghal and Niranjan G. Shivaratri, "Advanced Concepts in Operating Systems –Distributed, Database, and Multiprocessor Operating Systems", Tata McGraw-Hill, 2001.
Reference Books	1. Rajib Mall, "Real-Time Systems: The ory and Practice", Pearson Education India, 2006. 2. Pramod Chandra P.Bhatt, An introduction to operating systems, concept and practice, PHI, Third edition, 2010. 3. Daniel P. Bovet &MarcoCesati, "UnderstandingtheLinuxkernel",3rd edition,O"Reilly,2005 4. NeilSmyth, "iPhoneiOS4DevelopmentEssentials–Xcode", Fourth Edition, Payload media, 2011.
Web resources	1. https://onlinecourses.nptel.ac.in/noc20_cs04/preview 2. https://www.udacity.com/course/advanced-operating-systems--ud189 3. https://minnie.tuhs.org/CompArch/Resources/os-notes.pdf

CO	Course Outcomes
On completion of this course, students will be able to;	
CO1	Understand the design issues associated with operating systems.
CO2	Master various process management concepts including scheduling, deadlocks and distributed file systems.
CO3	Prepare Real Time Task Scheduling
CO4	Understand the concept of Process Scheduling.
CO5	Explore core Operating System and its Architecture.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	M	L	L	M	L
CO2	L	H	L	L	M	L
CO3	H	L	M	M	L	M
CO4	M	L	H	M	M	M
CO5	L	L	L	M	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	L	M	L	L	M
CO2	M	L	M	L	M	H
CO3	L	M	L	M	M	L
CO4	L	H	L	M	L	L
CO5	M	L	L	M	L	H

<table>
<tr><td>Title of the Course</td><td colspan="7">PRACTICAL V: DIGITAL IMAGE PROCESSING LAB USING MATLAB</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core X</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">PCCSL24</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td>-</td><td colspan="3">4</td><td colspan="2">4</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• To understand the basics of Digital Image Processing fundamentals, image enhancement and image restoration techniques
• To enable the students to learn the fundamentals of image compression and segmentation
• To understand Image Restoration &Filtering Techniques
• Implementation of the above using MATLAB</td></tr>
<tr><td>Course Outline</td><td colspan="7">1. Implement Image enhancement Technique.
2. Histogram Equalization
3. Image Restoration.
4. Implement Image Filtering.
5. Edge detection using Operators(Roberts, Prewitts and Sobels operators)
6. Implement image compression.
7. Image Subtraction
8. Boundary Extraction using morphology.
9. Image Segmentation</td></tr>
<tr><td>Text Books</td><td colspan="7">1. Rafael C. Gonzalez, Richard E. Woods, “Digital Image Processing”, Fourth Edition, PHI/Pearson Education, 2018.
2.B. Chanda, D. DuttaMajumder, “Digital Image Processing and Analysis”, PHI, Second Edition, 2011.</td></tr>
<tr><td>Reference Books</td><td colspan="7">1. Nick Efford, “Digital Image Processing a practical introducing using Java”, Pearson Education, 2018.</td></tr>
</table>

Web resources	1.https://nptel.ac.in/courses/117/105/117105135/ 2.https://www.tutorialspoint.com/dip/index.htm 3.https://www.javatpoint.com/digital-image-processing-tutorial

CO	Course Outcomes
On completion of this course, students will be able to;	
CO1	To write programs in MATLAB for image processing using the techniques.
CO2	To able to implement Image Enhancements & Restoration techniques.
CO3	Capable of using Compression techniques in an Image.
CO4	Must be able to manipulate the image and Segment it.
CO5	Able to implement Image segmentation.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	L	M	L	M	L
CO2	L	M	L	H	M	L
CO3	M	L	M	L	L	M
CO4	H	L	M	M	L	L
CO5	L	M	L	M	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	L	L	M	H	L
CO2	M	L	M	L	M	M
CO3	L	M	L	M	H	L
CO4	M	M	L	M	L	M
CO5	M	L	L	M	L	H

<table>
<tr><td>Title of the Course</td><td colspan="7">PRACTICAL VI: CLOUD COMPUTING LAB</td></tr>
<tr><td>Paper No.</td><td colspan="7">Practical VI</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td>Credits</td><td>3</td><td>Course Code</td><td>PCCSM24</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td colspan="2">-</td><td colspan="2">4</td><td colspan="2">4</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• This course covers the basic data structures like Stack, Queue, Tree, List.
• This course enables the students to learn the applications of the data structures using various techniques
• It also enable the students to understand C++ language with respect to OOAD concepts
• Application of OOPS concepts</td></tr>
<tr><td>Course Outline</td><td colspan="7">1. Working with Google Drive to make spread sheet and notes.
2. Launch a Linux Virtual Machine.
3. To host a static website
4. Exploring Google cloud for the following a)Storage b)Sharing of data c)manage your calendar, to-do lists, d) a document editing tool
5. Working and installation of Google App Engine
6. Working and installation of Microsoft Azure
7. To Connect Amazon Red shift with S3 bucket
8. To Create and Query a No SQL Table</td></tr>
<tr><td>Text Books</td><td colspan="7">1. Michael Miller, “Cloud Computing”, Pearson Education, New Delhi, 2009.</td></tr>
<tr><td>Reference Books</td><td colspan="7">1. Anthony T. Velte, “Cloud Computing: A Practical Approach”, 1st Edition, Tata McGraw Hill Education Private Limited, 2010.</td></tr>
<tr><td>Web resources</td><td colspan="7">1.https://nptel.ac.in/courses/106/105/106105167/
2.https://www.tutorialspoint.com/cloud_computing/index.htm
3.https://www.javatpoint.com/cloud-computing-tutorial</td></tr>
</table>

CO	Course Outcomes
On completion of this course, students will be able to;	
CO1	Understand the concepts of object oriented with respect to C++
CO2	Able to understand and implement OOPS concepts.
CO3	Able to understand Stack, Queue, Tree and List.
CO4	Implementation of data structures like Stack, Queue, Tree, List using C++.
CO5	Application of the data structures for Sorting, Searching using different techniques.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	M	M	L	M	L
CO2	L	M	L	H	M	L
CO3	M	L	M	L	L	M
CO4	H	L	L	M	L	M
CO5	L	M	L	M	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	M	L	M	M	L
CO2	L	M	L	M	L	M
CO3	L	M	H	M	L	L
CO4	L	H	L	M	M	L
CO5	M	M	L	M	L	M

<table>
<tr><td>Title of the Course</td><td colspan="7">ELECTIVE V: NETWORK SECURITY AND CRYPTOGRAPHY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Elective V A</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">PECSI24</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>3</td><td colspan="2">-</td><td colspan="2">-</td><td colspan="2">3</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• Enable students to learn the Introduction to Cryptography, Web Security and Case studies in Cryptography.
• To gain knowledge on classical encryption techniques and concepts of modular arithmetic and number theory.
• To explore the working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes and message digests, and public key algorithms.
• To explore the design issues and working principles of various authentication Applications and various secure communication standards including Kerberos, IPsec, and SSL/TLS and email.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (12 hours) (K1, K2, K3, K4& K5)
1.1Introduction to Cryptography – Security Attacks.
1.2 Security Services –Security Algorithm-
1.3 Stream cipher and Block cipher
1.4 Symmetric and Asymmetric-key Cryptosystem Symmetric Key Algorithms
1.5 Introduction – DES – Triple DES
1.6 AES – IDEA – Blowfish – RC5.</td></tr>
<tr><td></td><td colspan="7">UNIT II (12 hours) (K1, K2, K3, K4, K5 & K6)
2.1 Public-key Crypto system: Introduction to Number Theory
2.2 RSA Algorithm
2.3 Key ManagementDiffie-Hellman Key exchange</td></tr>
</table>

	2.4 Elliptic Curve Cryptography Message Authentication and Hash functions 2.5 Hash and Mac Algorithm 2.6 Digital Signatures and Authentication Protocol.
	UNIT III (12 hours) (K1, K2, K3, K4& K5) 3.1 Network Security Practice: Authentication Applications 3.2 Kerberos 3.3 X.509Authentication services and Encryption Techniques. 3.4 E-mail Security – PGP – S / MIME 3.5 IP Security.
	UNIT IV (13 hours) (K1, K2, K3, K4 , K5 & K6) 4.1 Web Security-Secure Socket Layer 4.2 Secure Electronic Transaction 4.3 System Security 4.4 Intruders and Viruses 4.5 Firewalls– Password Security.
	UNIT V (15 hours) (K1, K2, K3, K4& K5) 5.1 Case Study: Implementation of Cryptographic Algorithms–RSA–DSA–ECC(C/JAVA Programming). 5.2 Network Forensic – Security Audit 5.3 Other Security Mechanism 5.4 Introduction to: Stenography 5.5 Quantum Cryptography – Water Marking 5.6 DNA Cryptography
Text Books	1. William Stallings, "Cryptography and Network Security", PHI/ Pearson Education, Seventh Edition, 2017. 2. Bruce Schneir," Applied Cryptography", CRC Press, 2018.
Reference Books	9. A. Menezes, P Van Oorschot and S.Vanstone, "Hand Book of Applied Cryptography", CRC Press,2011 10. AnkitFadia," Network Security", Mac Millan, 2017.

Web resources	1. https://nptel.ac.in/courses/106/105/106105031/ 2. http://www.nptelvideos.in/2012/11/cryptography-and-network-security.html 3. https://www.tutorialspoint.com/cryptography/index.html.

	Course Outcomes
On completion of this course, students will be able to;	
CO1	Understand the process of the crypto graphical algorithms.
CO2	Compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication.
CO3	Apply and analyze appropriate security techniques to solve network security problem.
CO4	Explore suitable crypto graphical algorithms.
CO5	Analyze different digital signature algorithms to achieve authentication and design secure applications.

CO/PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	M	L	M	L	M	L
CO2	L	M	L	H	M	L
CO3	M	L	M	L	M	M
CO4	H	M	L	M	L	M
CO5	L	M	L	M	L	H

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	L	L	M	L	M	L
CO2	M	L	M	L	L	L
CO3	L	M	L	M	H	L
CO4	L	H	L	H	L	L
CO5	M	L	M	M	L	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ELECTIVE: EMBEDDED SYSTEMS</td></tr>
<tr><td>Paper No.</td><td colspan="7">Elective V B</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td>Credits</td><td>3</td><td>Course Code</td><td>PECSJ24</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>3</td><td colspan="2">-</td><td colspan="2">-</td><td colspan="2">3</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• Present the introduction to 8051 Micro controller Instruction Set, concepts on RTOS & Software tools.
• Gain the knowledge about the embedded software development.
• Learn about Micro controller and software tools in the embedded systems.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (12 hours) (K1, K2, K3, K4& K5)
1.1 8051 Microcontroller: Introduction- 8051 Architecture.
1.2 Input - Output Pins.
1.3 Ports and Circuits.
1.4 External Memory.
1.5 Counters - Timers - Serial Data Input.
1.6 Output –Interrupts</td></tr>
<tr><td></td><td colspan="7">UNIT II (12 hours) (K1, K2, K3, K4, K5 & K6)
2.1 Instruction Set and Programming Moving Data-Addressing Modes.
2.2 Logical operations- Arithmetic Operation-Jump and Call Instructions.
2.3 Simple Program. Applications: Keyboard Interface- Display Interface.
2.4 Pulse Measurements - DIA and AID Conversions.
2.5 Multiple Interrupts.</td></tr>
<tr><td></td><td colspan="7">UNIT III (12 hours) (K1, K2, K3, K4& K5)
3.1 CONCEPTS ON RTOS: Introduction to RTOS-Selecting an RTOS-Task and Task states.
3.2 Tasks and data- Semaphores and shared data.
3.3 MORE operating systems services: Interrupt Process communication.
3.4 Message Queues, Mailboxes and pipes.
3.5 Timer Functions-Events - Memory Management.
3.6 Interrupt Routines in an RTOS Environment.</td></tr>
</table>

	UNIT IV (10 hours) (K1, K2, K3, K4 , K5 & K6) 4.1 Basic Design using a RTOS: Principles. 4.2 Encapsulating semaphores and Queues. 4.3 Hard real time scheduling considerations. 4.4 Saving memory space and power. 4.5 introductions to RTL &QNX.
	UNIT V (12 hours) (K1, K2, K3, K4& K5) 5.1 SOFTWARE TOOLS : Embedded software Development Tools: Hosts and Target Machines. 5.2 Linker/Locators for Embedded software-getting Embedded software into the Target systems. 5.3 Debugging Techniques: Testing on your Host machine. 5.4 Instruction set simulators. 5.5 The assert macro- using laboratory tools.
Text Books	1. David E. Simon, "An Embedded Software primer" Pearson Education Asia, 2003. 2. Kenneth J Ayala, "The 8051 Micro controller and Architecture programming and application", Second Edition, Penram International.
Reference Books	1. Raj Kamal, "Embedded Systems –Architecture, programming and design", Tata Mc Graw– Hill, 2003.
Web resources	1. https://onlinecourses.nptel.ac.in/noc20_cs14/preview. 2. https://www.javatpoint.com/embedded-system-tutorial. **3.** https://www.tutorialspoint.com/embedded_systems/index.htmL.

CO	Course Outcomes
On completion of this course, students will be able to;	
CO1	Understand the concept of 8051 micro controller.
CO2	Understand the Instruction Set and Programming.
CO3	Analyze the concepts of RTOS.
CO4	Analyze and design various real time embedded systems using RTOS.
CO5	Debug the malfunctioning system using various debugging techniques

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	M	L	M	L	M	L
CO2	H	L	M	L	M	L
CO3	L	M	H	M	L	M
CO4	H	L	M	M	L	L
CO5	L	M	L	H	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	L	L	M	M	L	M
CO2	L	M	H	M	L	M
CO3	L	H	M	M	L	M
CO4	L	H	H	M	L	M
CO5	M	H	L	M	L	M

<table>
<tr><td>Title of the Course</td><td colspan="7">SEC: BIG DATA ANALYTICS</td></tr>
<tr><td>Paper No.</td><td colspan="7">Skill Development Course II</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td>Credits</td><td>2</td><td>Course Code</td><td>PGCSB324</td></tr>
<tr><td>Semester</td><td>III</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>2</td><td>-</td><td colspan="3">-</td><td colspan="2">2</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• To learn more about the trends in Big Data and how they impact the business world like Risk Marketing – Healthcare - Financial Services - etc.
• To study the basic technologies that forms the foundations of Big data.
• Explains this new technology and how companies can use them effectively to gather the data that they need and glean critical insights.
• To understand the Big data platform and Usecases.
• To study different types case studies on the current research and applications of the Hadoop and big data in industry.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (12 hours) (K1, K2, K3, K4& K5)
1.1 Understanding Big Data: Types of Digital Data.
1.2 Classification of digital data.
1.2 Introduction to Big data.
1.3 Characteristics of data.
1.4 Evolution of Big data - Definition of Big data.
1.5 Challenges with Big data.
1.6 Sudden Hype around Big Data Analytics.</td></tr>
<tr><td></td><td colspan="7">UNIT II (12 hours) (K1, K2, K3, K4, K5 & K6)
2.1Classification of Analytics - Data Science.
2.2 Terminologies used in Big Data Environments - Few Top Analytics tools.
2.3 NoSQL - Types of NoSQL Databases - Advantages of NoSQL.
2.4 Basics of Hadoop: Introduction to Hadoop.
2.5 Basics – RDBMS vsHadoop.
2.6 Distributed computing challenges.</td></tr>
</table>

	UNIT III (12 hours) (K1, K2, K3, K4& K5) 3.1 History of Hadoop. 3.2 Hadoop overview -Use case of Hadoop. 3.3 Hadoop distributors. 3.4 Hadoop Distributed File system. 3.5 Processing data with Hadoop.
	UNIT IV (12 hours) (K1, K2, K3, K4 , K5 & K6) 4.1 MongoDB: Introduction to MongoDB – Basics of MongoDB. 4.2 Terms used in RDBMS and MongoDB. 4.3 Data Types in MongoDB. 4.4 MongoDB Query Language. 4.5 Cassandra: Introduction to Cassandra - Features of Cassandra. 4.6 Introduction to MAPREDUCE Programming.
	UNIT V (12hours) (K1, K2, K3, K4& K5) 5.1 Hive: Introduction to Hive - Hive Architecture. 5.2 Hive Data Types - Hive File Format - Hive Query Language. 5.3 RCFile Implementation – User Defined Function (UDF). 5.4 Streams and Parallelism. 5.5 Case Study: Advertising on the Web.
Text Books	1. Jure Leskovec, AnandRajaraman& Jeffrey David Ullman (2014). Mining of Massive Datasets. Cambridge University Press. Second Edition. 2. SeemaAcharya and SubhashiniChellappan (2015). Big Data and Analytics. Wiley Publication.
Reference Books	1. Michael Minelli, Michelle Chambers and AmbigaDhiraj (2013). Big Data and Big Analytics. Wiley Publication. **2.** Jiawei Han, MichelineKamber&Jian Pei (2011). Data Mining Concepts and Techniques. Morgan Kaufman Publications. Third Edition.

Web resources	1. https://www.youtube.com/watch?v=HwmEcudlv44&list=PL4OCRJojkV1jN-Ed6RkQpWfBvqe0utRd6 2. https://www.youtube.com/watch?v=SRTSVxUnsNI

CO	Course Outcomes
On completion of this course, students will be able to;	
CO1	Define the big data, types of data and understand the need of big data analytics.
CO2	Describe the Hadoop architecture and File system.
CO3	Apply the MapReduce Programming model for real-world problems.
CO4	Learn the concepts of streams and parallelism.
CO5	Demonstrate the working process of web.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	M	L	M	L	L
CO2	L	H	M	L	M	L
CO3	M	L	H	M	L	M
CO4	H	L	M	L	M	L
CO5	L	H	L	M	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	L	M	L	M	L
CO2	H	L	M	M	L	M
CO3	L	H	L	M	M	L
CO4	L	H	L	M	L	M
CO5	M	H	L	M	L	H

<table>
<tr><td>Title of the Course</td><td colspan="7">DATA SCIENCE AND ANALYTICS</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core XI</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2">PCCSN24</td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>6</td><td>-</td><td colspan="3">-</td><td colspan="2">6</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">Introduce the students to data science, big data &its ecosystem.
Learn data analytics &its life cycle.
To explore the programming language R, with respect to the data mining algorithms.
Relate the relationship between artificial intelligence, machine learning and data science.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (12 hours) (K1, K2, K3, K4& K5)
1.1 Introduction of Data Science
1.2 Data science and big data
1.3 Facets of data-data science process
1.4 Ecosystem- The Data Science process
1.5 Six steps
1.6 Machine Learning.</td></tr>
<tr><td></td><td colspan="7">UNIT II (12 hours) (K1, K2, K3, K4, K5 & K6)
2.1 Data Analytics life cycle
2.2 Review of data analytics
2.3 Advanced data Analytics
2.4 Technology
2.5 Data Analytics Tools.</td></tr>
<tr><td></td><td colspan="7">UNIT III (12 hours) (K1, K2, K3, K4& K5)
3.1 Basic Data Analytics using R : R Graphical User Interfaces
3.2 Data Import and Export – Attribute and Data Types
3.3 Descriptive Statistics – Exploratory Data Analysis
3.4 Visualization Before Analysis – Dirty Data
3.5 Visualizing a Single Variable – Examining Multiple Variables
3.6 Data Exploration Versus Presentation.</td></tr>
</table>

	UNIT IV (12 hours) (K1, K2, K3, K4 , K5 & K6) 4.1 Overview of Clustering : K-means – Use Cases 4.2 Overview of the Method – Perform a K-means Analysis using R 4.3 Classification – Decision Trees 4.4 Overview of a Decision Tree – Decision Tree Algorithms – Evaluating a Decision Tree 4.5 Decision Tree in R – Bayes' Theorem 4.6 Naïve Bayes Classifier – Smoothing – Naïve Bayes in R.
	UNIT V (10hours) (K1, K2, K3, K4& K5) 5.1 Artificial intelligence 5.2 Machine Learning and deep learning in data science 5.3 Clustering, association rules 5.4 Linear regression-logistic regression 5.5 Additional regression methods.
Text Books	1. Davy Cielen, Arno D.B. Meysman, and Mohammed Ali "Introducing-Data-Science-Big-Data-Machine-Learning-and-more-using-Python-tools" ,2016. 2. Wiley "Data science in big data analytics", 2015 John Wiley &SonS
Reference Books	1. Lars Nielson , "A simple introduction to Data Science",New Street Communications LLC, 2015 2. Roger D.Peng , "R Programming for Data Science", Lulu.com, 2016 John Wiley & Sons, Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Indianpolis, 2015
Web resources	1. https://www.tutorialspoint.com/python_data_science/index.htm 2. https://www.javatpoint.com/data-science 3. https://nptel.ac.in/courses/106/106/106106179/

CO	Course Outcomes
On completion of this course, students will be able to;	
CO1	Understand the concept to data science and its techniques
CO2	Review data analytics
CO3	Apply and determine appropriate Data Mining techniques using R to real time applications
CO4	Analyze on clustering algorithms
CO5	Analyze on regression methods in AI

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	M	M	L	M	L	L
CO2	L	H	M	L	M	L
CO3	M	L	M	M	L	M
CO4	H	L	M	H	M	L
CO5	L	H	L	M	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	L	M	L	M	L
CO2	H	L	M	M	L	M
CO3	L	M	L	M	M	L
CO4	L	H	L	M	L	M
CO5	M	H	L	M	L	H

<table>
<tr><td>Title of the Course</td><td colspan="7">BLOCK CHAIN TECHNOLOGY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core XII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2">PCCSO24</td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>6</td><td colspan="2">-</td><td colspan="2">-</td><td colspan="2">6</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• Understand the fundamentals of block chain and crypto currency.
• Understand the influence and role of block chain in various other fields.
• Learn security features and its significance.
• Identify problems & challenges posed by Block Chain.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (12 hours) (K1, K2, K3, K4& K5)
1.1 Introduction to Block chain - The big picture of the industry – size, growth, structure, players.
1.2 Bit coin versus Crypto currencies versus Block chain
1.3 Distributed Ledger Technology (DLT).
1.4 Strategic analysis of the space
1.5 Block chain platforms, regulators, application providers.
1.6 The major application: currency, identity, chain of custody.</td></tr>
<tr><td></td><td colspan="7">UNIT II (12 hours) (K1, K2, K3, K4, K5 & K6)
2.1 Advantage over conventional distributed database
2.2 Block chain Network, Mining Mechanism,
2.3 Distributed Consensus
2.4 Block chain 1.0, 2.0 and 3.0 – transition
2.5 Advancements and features. Privacy
2.6 Security issues in Block chain.</td></tr>
<tr><td></td><td colspan="7">UNIT III (12 hours) (K1, K2, K3, K4& K5)
3.1 Crypto currency - History, Distributed Ledger, Bit coin protocols
3.2 Symmetric-key cryptography - Public-key cryptography
3.3 Digital Signatures -High and Low trust societies
3.4 Types of Trust model: Peer-to-Peer, Leviathan, and Intermediary
3.5 Application of Cryptography to Block chain</td></tr>
</table>

	UNIT IV (11 hours) (K1, K2, K3, K4 , K5 & K6) 4.1 Crypto currency Regulation-Stakeholders, 4.2 Roots of Bit coin, Legal views -exchange of crypto currency 4.3 Black Market – Global Economy 4.4 Crypto economics – assets, supply and Demand , 4.5 Inflation and deflation – Regulatio
	UNIT V (11hours) (K1, K2, K3, K4& K5) 5.1 Opportunities and challenges in Block Chain 5.2 Application of block chain: Industry 4.0 5.3 machine to machine communication –Datamanagementinindustry4.0 5.4 Future prospects.Block chain in Health 4.0 – Block chain properties 5.5 Healthcare Costs - Healthcare Quality - Healthcare Value 5.6 Challenges for using block chain for healthcare data
Text Books	1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Gold feder, "Bitcoin and Crypto currency Technologies: A Comprehensive Introduction", Princeton University Press (July 19, 2016). **2.** Antonopoulos, "Mastering Bitcoin: Unlocking Digital Crypto currencies"
Reference Books	1. Satoshi Nakamoto, "Bitcoin: A Peer-to-Peer Electronic Cash System" 2. Rodrigoda Rosa Righi,Antonio Marcos Alberti, MadhusudanSingh,"Block chain Technology for Industry 4.0" Springer 2020.
Web resources	1. https://www.javatpoint.com/blockchain-tutorial 2. https://www.tutorialspoint.com/blockchain/index.htm 3. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs01/

CO	Course Outcomes
On completion of this course, students will be able to;	
CO1	Demonstrate block chain technology and crypto currency
CO2	Understand the mining mechanism in block chain
CO3	Apply and identify security measures, and various types of services that allow people to trade and transact with bit coins
CO4	Apply and analyze Block chain in health care industry
CO5	Analyze security, privacy, and efficiency of a given Block chain system.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	L	M	L	M	L
CO2	L	M	H	M	M	L
CO3	H	L	L	L	M	M
CO4	L	M	L	M	M	M
CO5	L	M	L	M	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	L	L	M	L	M	L
CO2	L	M	H	M	L	M
CO3	L	M	L	M	H	L
CO4	L	H	L	M	L	L
CO5	M	H	L	M	L	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ELECTIVE: WEB APPLICATION DEVELOPMENT AND HOSTING</td></tr>
<tr><td>Paper No.</td><td colspan="7">Elective VI</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">PECSK24</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td colspan="2">-</td><td colspan="2">-</td><td colspan="2">4</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• Able to design a web page using HTML tags
• To enable the students to use Frame sets, hyper links and different formatting features of HTML tags
• Enable the students to use Forms & other controls in a webpage
• To create interactive applications using PHP</td></tr>
<tr><td>Course Outline</td><td colspan="7">1. Develop a website for your college using advanced tags of HTML.
2. Write names of several countries in a paragraph and store it as an HTML document, world.html. Each country name must be a hot text. When you click India (for example), it must open india.html and it should provide a brief introduction about India.
3. Develop a HTML document to i)display Text with Bullets / Numbers - Using Lists ii) to display the Table Format Data
4. Develop a Complete Web Page using Frames and Framesets which gives the Information about a Hospital using HTML.
5. Write a HTML document to print your Bio-Data in an eat format using several components.
6. Develop a HTML document to display a Registration Form for an inter-collegiate function.
7. Using HTML form accept Customer details like Name, City, Pin code, Phone number and Email address and validate the data and display appropriate messages for violations using PHP
(Eg. Name is Mandatory field; Pin code must be 6 digits, etc.).</td></tr>
</table>

	8. Write a program to accept two numbers n1 and n2 using HTML form and display the Prime Numbers between n1 and n2 using PHP.
Text Books	**1.** Ivan Bayross, "Web Enabled Commercial Applications Development Using HTML, JavaScript, DHTML and PHP", BPB Publications, 4th Revised Edition, 2010.
Reference Books	**1.** A.K.Saini and SumintTuli,"MasteringXML",First Edition ,New Delhi, 2004.
Web resources	1. https://www.tutorialspoint.com/xml/index.htm 2. https://www.tutorialspoint.com/internet_technologies/websites_development.htm 3. https://www.youtube.com/watch?v=PlxWf493en4

CO	Course Outcomes
On completion of this course, students will be able to;	
CO1	Understand & implement the basic HTML tags to create static web pages
CO2	Capable of using hyperlinks, frames, images,tablesin a webpage
CO3	Able to write dynamic web applications using HTML forms.
CO4	Must be able to write dynamic web applications in PHP & HTML tags using XAMPP.
CO5	Able to write HTML Forms.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	M	L	M	M	L
CO2	M	L	M	L	M	M
CO3	L	M	L	M	H	L
CO4	L	H	L	M	L	M
CO5	M	L	L	H	L	L

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	L	M	L	M	L
CO2	L	M	L	H	M	L
CO3	M	L	M	M	H	M
CO4	H	L	M	M	L	M
CO5	M	M	L	M	L	H

<table>
<tr><td>Title of the Course</td><td colspan="8">ELECTIVE: WIRELESS COMMUNICATION AND NETWORKS</td></tr>
<tr><td>Paper No.</td><td colspan="8">Elective VI</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td>Course Code</td><td colspan="2">PECSL24</td></tr>
<tr><td>Semester</td><td>IV</td><td colspan="3"></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td colspan="2">-</td><td colspan="3">-</td><td colspan="2">4</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">• To provide an overview of Wireless Communication Networks area and its applications
• To enable students to compare and contrast multiple division techniques, mobile communication systems, and existing wireless networks.
• To explain the various terminology, principles, devices, schemes, concepts, algorithms and different methodologies used in Wireless Communication Networks.
• List and describe different network standards and protocols.
• This course introduces the fundamentals of networking and principles of network operations. It also provides knowledge on various generations of cellular systems.</td></tr>
<tr><td>Course Outline</td><td colspan="8">UNIT I (12 hours) (K1, K2, K3, K4, K5 & K6)
1.1 Introduction to Wireless Communications and Networks – Cellular Mobile - Wireless Networks: Description of Cellular Systems
1.2 Propagation Models for Wireless Networks – Mobile Communication Antennas
1.3 Evolution of Modern Mobile Wireless Communication Systems: Personal Area Networks (PAN) – Low-Tier Wireless System
1.4 Public Wide-area Wireless Networks – Wireless Local Area Networks (WLANs)
1.5 Wireless Technology Divisions – Cellular-WLAN Integration
1.6 All-IP Networks: Vision for 4G</td></tr>
<tr><td></td><td colspan="8">UNIT II (12 hours) (K1, K2, K3, K4, K5 & K6)
2.1 Multiple Access Techniques in Wireless Communications: FDMA (K1)
2.2 TDMA (K2, K3)
2.3 SDMA (K2)</td></tr>
</table>

	2.4 CDMA (K2) 2.5 GSM: Architecture and Protocols: GSM Network Architecture(K1, K5) 2.6 GSM Authentication and Security (K4, K6)
	UNIT III (12 hours) (K1, K2, K3, K4& K5) 3.1 2.5G GPRS: Revisited– GPRS Networks Architecture 3.2 Overview of CDMA - CDMA Evolution 3.3 CDMA IS-95 Systems – Handoff Process in a CDMA System 3.4 3G- UMTS: UMTS Network Architecture – UMTS Interfaces 3.5 UMTS FDD and TDD – UMTS Channels 3.6 UMTS Network Protocol
	UNIT IV (11 hours) (K1, K2, K3, K4& K5) 4.1 Overview of Internet Protocol and Mobile Internet Protocol: – TCP – UDP – DNS 4.2 Network Address Resolution Protocol 4.3 IP Routing Protocols – Basic Mobile IP 4.4 Problems and Limitations of MIP 4.5 Cellular and WLAN integration 4.6 Internetworking Network Integration
	UNIT V (11 hours) (K1, K2, K3, K4& K5) 5.1 Fundamentals of Wireless Local Area Networks: IEEE 802.11 – WLAN Transmission Technology – Spread Spectrum Technology (K1, K2) 5.2 WLAN System Architecture – IEEE 802.11 Logical Architecture (K3) 5.3 Collision Sense Multiple Access with Collision Detection: CSMA/CD (K4) 5.4 Collision Sense Multiple Access with Collision Avoidance: CSMA/CA – MAC Frame Format and Fragmentation (K4, K5) 5.5 IEEE 802.11 PCF – IEEE 802.11 PHY Layer – 802.11 Systems Performance – Security Issues: Some Basic 802.11 Services (K3, K6) 5.6 Roaming Handover and Mobility Management for WLAN – WLAN Applications – Overview of WiMAX Technologies: – IEEE 802.16 Standard Architecture(K2, K6)

Text Books	1. ITI SahaMisra (2013). Wireless Communications and Networks. McGraw Hill Education.
Reference Books	1. Jochen Schiller (2011). Mobile Communications. PHI/Pearson Education. 2nd Edition. 2. Dharma Prakash Agrawal- Qing-An Zeng (2006). Introduction to Wireless and Mobile Systems Cencage Learning. 3. William Stallings (2002). Wireless Communications and Networks. PHI/ Pearson Education.Second Edition. 4. KavehPahlavan-PrasanthKrishnamoorthy (2003). Principles of Wireless Networks. PHI/ Pearson Education
Web resources	1.https://www.tutorialspoint.com/wireless_communication/wireless_communication_overview.htm 2. https://www.youtube.com/watch?v=f2wlHL1Sok8&list=PLuv3GM6-gsE3ypUYh43pPuZsXxJVG1e7F

CO	Course Outcomes
On completion of this course, students will be able to;	
CO1	1. To design the various wireless networks.
CO2	2. Understand the principles behind the networking operation.
CO3	3. Examine the services provided in various layers of networks.
CO4	4. Classify different technologies followed in various generation of cellular networks.
CO5	5. Analyze different types of networks in wireless technology.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	M	M	L	M	L
CO2	L	H	H	L	M	L
CO3	M	L	M	M	L	M
CO4	H	L	L	M	M	M
CO5	L	L	L	M	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	L	M	L	M	M	L
CO2	M	L	M	L	M	L
CO3	L	M	L	M	H	L
CO4	L	H	L	M	L	L
CO5	M	L	L	M	L	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ROBOTICS PROCESS AUTOMATION</td></tr>
<tr><td>Paper No.</td><td colspan="7">Professional Competency Skill Enhancement Course</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">PPCS24</td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>3</td><td>-</td><td colspan="3">-</td><td colspan="2">3</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• Learn the concepts of RPA, its benefits, types and models.
• Gain the knowledge in application of RPA in Business Scenarios.
• Identify measures and skills required for RPA</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (12 hours) (K1, K2, K3, K4& K5)
1.1 Introduction to RPA –Overview of RPA
1.2 Benefits of RPA in a business environment
1.3 Industries & domains fit for RPA - Identification of process for automation
1.4 Types of Robots - Ethics of RPA & Best Practices - Automation and RPA Concepts
1.5 Different business models for implementing RPA –Centre of Excellence
1.6 Types and their applications –Building an RPA team-Approach for implementing RPA initiatives.</td></tr>
<tr><td></td><td colspan="7">UNIT II (12 hours) (K1, K2, K3, K4, K5 & K6)
2.1 Role of a Business Manager in Automation initiatives
2.2 Skills required by a Business Manager for successful automation
2.3 The importance of a Business Manager in automation
2.4 Analyzing different business processes - Process Mapping frameworks –
2.5 Role of a Business Manager in successful implementation</td></tr>
</table>

	2.6 Part 1 - Understanding the Automation cycle – First 3 automation stages and activities performed by different people.
	UNIT III (12 hours) (K1, K2, K3, K4& K5) 3.1 Evaluating the Automation Implementation Detailed description of last 3 stages and activities performed by different people 3.2 Role of a Business Manager in successful completion 3.3 Part 2 - Activities to be performed post-implementation 3.4 Guidelines for tracking the implementation success – 3.5 Metrics/Parameters to be considered for gauging success 3.6 Choosing the right licensing option - Sending emails - Publishing and Running Workflows.
	UNIT IV (11 hours) (K1, K2, K3, K4 , K5 & K6) 4.1 Ability to process information through scopes/systems 4.2 Understand the skill of information processing and its use in business 4.3 Leveraging automation - Creating a Robot - New Processes 4.4 Establish causality by variable behavior 4.5 Understand the skill of drawing inference or establishing causality by tracking the behavior of a variable as it varies across time/referenced variable \ 4.6 Leveraging automation for this skill - Robot & new process creation.
	UNIT V (11hours) (K1, K2, K3, K4& K5) 5.1 Inference from snapshots of curated terms 5.2 Omni-source data curation 5.3 Multisource trend tracking 5.4 Understand the skill of drawing inference from the behavior of curated terms by taking snapshots across systems in reference to time/variable(s)

	5.5 Leveraging automation for this skill 5.6 Robot creation and new process creation for this skill.
Text Books	1. Alok Mani Tripathi" Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool" Packt Publishing Limited March 2018. 2. Tom Taulli"The Robotic Process Automation Handbook"A presses, February 2020.
Reference Books	1. Steve Kaelble" Robotic Process Automation "John Wiley & Sons, Ltd., 2018
Web resources	1. https://www.tutorialspoint.com/uipath/uipath_robotic_process_automation_introduction.html 2. https://www.javatpoint.com/rpa 3. https://onlinecourses.nptel.ac.in/noc19_me74/preview

CO	Course Outcomes
On completion of this course, students will be able to;	
CO1	Demonstrate the benefits and ethics of RPA
CO2	Understand the Automation cycle and its techniques
CO3	Draw inferences and information processing of RPA
CO4	Implement & Apply RPA in Business Scenarios
CO5	Analyze on Robots & leveraging automation

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	L	H	L	M	L
CO2	L	M	L	H	L	L
CO3	M	L	M	M	L	M
CO4	L	L	M	M	L	M
CO5	M	L	L	M	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	M	L	L	M	L
CO2	M	L	M	L	M	M
CO3	L	M	H	M	L	L
CO4	L	H	L	M	L	L
CO5	M	L	L	M	M	H