

JP COLLEGE OF ARTS & SCIENCE (AUTONOMOUS)

(Run by DMI Sisters)

(Affiliated to Manonmaniam Sundaranar University – Tirunelveli)

Accredited by NAAC with “B++” Grade

2(f) status of UGC Act, 1956 | ISO 9001:2015 Certified Institution

Ayikudy, Tenkasi District - 627852.

SYLLABUS



Master of Computer Science

Choice Based Credit System (CBCS)

(w.e.f. June 2026-2027)



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SYLLABUS

PROGRAMME OUTCOMES (PO) FOR UG PROGRAMME

The successful completion of the M.Sc Computer Science programme shall enable the students 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.
PO7	Entrepreneurial Skill Equip with skills and competencies to become an entrepreneur.
PO8	Contribution to Society Succeed in career endeavors and contribute significantly to society.
PO9	Multicultural competence Possess knowledge of the values and beliefs of multiple cultures and a global perspective.
PO10	Moral and ethical awareness/reasoning Capability to lead themselves and the team to achieve organizational goals.



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Regulations 2026–2027 for Postgraduate Programme

**Learning Outcomes Based Curriculum Framework–(LOCF)
model with Choice Based Credit System (CBCS)**

Programme: Master of Computer Science

(Applicable for the Students admitted during the Academic Year 2026-27 onwards)

M.Sc. Computer Science

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

Computer Science is the study of quantity, structure, space and change, focusing on problem solving, application development with wider scope of application in science, engineering, technology, social sciences etc. throughout the world in last couple of decades and it has carved out a space for itself like any other disciplines of basic science and engineering. Computer science is a discipline that spans theory and practice and it requires thinking both in abstract terms and in concrete terms. Nowadays, practically everyone is a computer user, and many people are even computer programmers. Computer Science can be seen on a higher level, as a science of problem solving and problem solving requires precision, creativity, and careful reasoning. The ever-evolving discipline of computer science also has strong connections to other disciplines. Many problems in science, engineering, health care, business, and other areas

can be solved effectively with computers, but finding a solution requires both computer science expertise and knowledge of the particular application domain. Computer science has a wide range of specialties. These include Computer Architecture, Software Systems, Graphics, Artificial Intelligence, Computational Science, and Software Engineering. Drawing from a common core of computer science knowledge, each specialty area focuses on specific challenges. Computer Science is practiced by mathematicians, scientists and engineers. Mathematics, the origins of Computer Science, provides reason and logic. Science provides the methodology for learning and refinement. Engineering provides the techniques for building hardware and software.

Vision

- We aim to nurture academic excellence, promote collaborative teamwork, develop critical thinking and logical reasoning, and build leadership qualities in students for thriving in a globalized world

Mission

- To prepare students for global careers in Computer Science with skills in software development, research, and strong ethical values.
- To develop students into skilled software developers and researchers who uphold ethical standards and are ready for global challenges.
- To provide students with the knowledge and skills in Computer Science, focusing on software development, research, and ethics

TANSICHE REGULATIONS ON LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK FOR POSTGRADUATE EDUCATION	
Programme	M.Sc., Computer Science
Duration	PG - Two Years
Programme Outcomes (Pos)	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. PO7: Entrepreneurial Skill Equip with skills and competencies to become an entrepreneur. PO8: Contribution to Society Succeed in career endeavors and contribute significantly to society. PO 9 Multicultural competence Possess knowledge of the values and beliefs of multiple cultures and a global perspective. PO 10: Moral and ethical awareness/reasoning Ability to embrace moral/ethical values in conducting one's life.

Programme Specific Outcomes (PSOs)	PSO1 – Placement To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, 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 research 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.
	PSO 5 – Contribution to the Society To contribute to the development of the society by collaborating with stakeholders for mutual benefit.

Component wise Credit Distribution

Credits	Sem I	Sem II	Sem III	Sem IV	Total
Core/Core LAB/Mini Project/ Major Project	16	12	17	18	63
Electives					
(i)Discipline– Centric/Generic Skill	8	8	4		20
(ii)Soft Skill		2	2		4
(iii)Summer Internship/Industrial Training			2		2
Ability Enhancement / Extension				1	1
Total	24	22	25	19	90

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

Curriculum

M.Sc., Computer Science

FIRST SEMESTER								
Course Code	Course Category	Title of the Course	Credits	Hours		Maximum Marks		
				Theory	Practical	CIA	ESE	Total
26PCCS11	Core-I	Design and Analysis of Algorithms	4	5		25	75	100
26PCCS12	Core-II	Object Oriented Analysis and Design & C++	4	5		25	75	100
26PCCS13	Core-III	Python Programming	4	4		25	75	100
26PECS11/ 26PECS12/ 26PECS13	Elective- I	Advanced Software Engineering/Web Services /Multimedia and its Applications	4	4		25	75	100
26PECS14/ 26PECS15/ 26PECS16	Elective- II	Advanced Operating System/Mobile Computing /Advanced Computer Network	4	4		25	75	100
26PCCSP1	Core Practical1	Algorithm Lab	2		4	50	50	100
26PCCSP2	Core Practical 2	Python Lab	2		4	50	50	100
Total			24	22	8			
SECOND SEMESTER								
26PCCS21	Core-IV	Data Mining and Warehousing	4	5		25	75	100
26PCCS22	Core- V	Advanced Java Programming	4	5		25	75	100
26PECS21/ 26PECS22/ 26PECS23	Elective- III	Artificial Intelligence &Machine Learning/ Robotics Process Automation for Business/Cloud Computing	4	4		25	75	100
26PECS24/ 26PECS25/ 26PECS26	Elective- IV	IoT/Embedded System/Block Chain Technology	4	4		25	75	100

26PCCSP3	Core Practical 3	Data Mining Lab using R	2		4	50	50	100
26PCCSP4	Core Practical 4	Advanced Java Lab	2		4	50	50	100
26PSECS21	SEC 1	Statistical Tools	2	4		25	75	100
	Total		22	22	8			

THIRD SEMESTER								
Course Code	Course Category	Title of the Course	Credits	Hours		Maximum Marks		
				Theory	Practical	CIA	ESE	Total
26PCCS31	Core-VI	Digital Image Processing	4	5		25	75	100
26PCCS32	Core- VII	Network Security and Cryptography	4	4		25	75	100
26PCCS33	Core- VIII	Data Science & Analytics	4	4		25	75	100
26PECS31/ 26PECS32/ 26PECS33	Elective- V	Deep Learning / Big Data Analytics /Critical thinking, Design Thinking & Problem Solving	4	4		25	75	100
26PCCSP5	Core Practical5	Digital Image Processing Using MatLab	2		4	50	50	100
26PCCS3P	Mini Project	Web Application Development & Hosting	3		6	50	50	100
26PSECS31	SEC 2	Cloud Computing Tools	2	3		25	75	100
26PCCS3I	Internship/ Industrial Activity/ Research Updation Activity		2	-				
	Total		25	20	10			

	FOURTH SEMESTER							
Course Code	Course Category	Title of the Course	Credits	Hours		Maximum Marks		
				Theory	Practical	CIA	ESE	Total
26PCCS4P	Core Project	Project work and Viva- voce	18		30	50	50	100
		Extension Activity	1	-				
	Total		19		30			

Semester I

	FIRST SEMESTER							
Course Code	Course Category	Title of the Course	Credits	Hours		Maximum Marks		
				Theory	Practical	CIA	ESE	Total
26PCCS11	Core-I	Design and Analysis of Algorithms	4	5		50	50	100
26PCCS12	Core-II	Object Oriented Analysis and Design & C++	4	5		50	50	100
26PCCS13	Core-III	Python Programming	4	4		50	50	100
26PECS11/ 26PECS12/ 26PECS13	Elective- I	Advanced Software Engineering/Web Services /Multimedia and its Applications	4	4		50	50	100
26PECS14/ 26PECS15/ 26PECS16	Elective- II	Advanced Operating System/Mobile Computing /Advanced Computer Network	4	4		50	50	100
26PCCSP1	Core Practical1	Algorithm Lab	2		4	50	50	100
26PCCSP2	Core Practical 2	Python Lab	2		4	50	50	100
	Total		24	22	8			

FIRST YEAR – SEMESTER – I

CORE – I: DESIGN & ANALYSIS OF ALGORITHMS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26PCCS11	5	0	0	I	4	5	50	50	100
Learning Objectives									
LO1	Enable the students to learn the Elementary Data Structures and algorithms.								
LO2	Presents an introduction to the algorithms, their analysis and design								
LO3	Discuss various methods like Basic Traversal and Search Techniques, divide and conquer method, Dynamic programming, backtracking								
LO4	Understood the various design and analysis of the algorithms.								
LO5	Apply appropriate algorithmic techniques to solve real-world computational problems efficiently.								
Prerequisites:									
Unit	Contents								No. of Hours
I	INTRODUCTION: Introduction: - Algorithm Definition and Specification – Space Complexity- Time Complexity- Asymptotic Notations - Elementary Data Structure: Stacks and Queues – Binary Tree – Binary Search Tree - Heap – Heapsort- Graph.								15
II	TRAVERSALANDSEARCHTECHNIQUES: Basic Traversal and Search Techniques: Techniques for Binary Trees-Techniques for Graphs - Divide and Conquer: - General Method – Binary Search – Merge Sort – Quick Sort.								15
III	GREEDY METHOD: The Greedy Method: -General Method– Knapsack Problem–Minimum Cost Spanning Tree– Single Source Shortest Path.								15
IV	DYNAMIC PROGRAMMING: Dynamic Programming-General Method–Multistage Graphs–All Pair Shortest Path–Optimal Binary								15

	Search Trees – 0/1 Knapsacks – Traveling Salesman Problem – Flow Shop Scheduling.	
V	BACKTRACKING: Backtracking: -General Method–8-QueensProblem–Sum Of Subsets–Graph Coloring– Hamiltonian Cycles – Branch and Bound: - The Method – Traveling Salesperson.	13
VI	Contemporary Issues: Expert lectures, online seminars– webinars	02
TOTAL		75
CO	Course Outcomes	
CO1	Understand the concept of Object-Oriented development and modelling 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 students with writing C++ program	
Textbooks		
➤	Ellis Horowitz, “Computer Algorithms”, Galgotia Publications	
➤	Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms".	
Reference Books		
1.	Goodrich, “Data Structures& Algorithms in Java”, Wiley3rd edition.	
2.	Skiena,” The Algorithm Design Manual”, second edition, Springer,2008	
3.	Anany Levith,” Introduction to the Design and Analysis of Algorithm”, Pearson EducationAsia, 2003.	
4.	Robert Sedgewick, Phillipe Flajolet,” An Introduction to the Analysis of Algorithms”, Addison-Wesley Publishing Company,1996.	

Mapping with Programming Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	S	S	S	M	S	M	S	M	S	S
CO 2	S	S	S	M	S	M	S	M	S	S
CO 3	S	S	S	M	S	M	S	M	S	S
CO 4	S	S	S	M	S	M	S	M	S	S
CO 5	S	S	S	M	S	M	S	M	S	S

CORE PRACTICAL– I: ALGORITHM LAB

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26PCCSP1	0	0	4	I	2	4	50	50	100
Learning Objectives									
LO1	This course covers the basic data structures like Stack, Queue, Tree, and List.								
LO2	This course enables the students to learn the applications of the data structures using various techniques								
LO3	It also enables the students to understand C ++ language concerning OOAD concepts								
LO4	Application of OOPS concepts.								
LO5	Evaluate and compare different algorithms based on performance and scalability.								
Prerequisites:									
Contents									
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 operation 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 knap sack 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 no two 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. |
| Total Hours: 60 |

Total Hours: 60

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

Mapping with Programming Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	S	S	M	S	S	S	M	M	S	S
CO 2	S	S	S	S	S	S	S	M	S	S
CO 3	S	S	S	S	S	S	S	M	S	S
CO 4	S	S	S	S	S	S	S	M	S	S

CORE II – OBJECT-ORIENTED ANALYSIS AND DESIGN & C++

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26PCCS12	5	0	0	I	4	5	50	50	100
Learning Objectives									
LO1	Present the object model, classes and objects, object orientation, machine view and model management view.								
LO2	Enables the students to learn the basic functions, principles and concepts of object-oriented analysis and design.								
LO3	Enable the students to understand C++ language concerning OOAD								
LO4	Analyze and solve problems using object-oriented design methodologies for efficient and maintainable software development.								
LO5	Develop modular, reusable, and scalable applications using C++ programming concepts.								
Prerequisites:									
Unit	Contents								No. of Hours
I	OBJECT MODEL:The Object Model: The Evolution of the Object Model – Elements of the Object Model – Applying the Object Model. Classes and Objects: The Nature of an Object – Relationship among Objects.								15
II	CLASSES AND Classes and Object: Nature of Class – Relationship Among classes – The Interplay of classes and Objects. Classification: The importance of Proper Classification – identifying classes and objects – Key Abstractions and Mechanism.								15
III	C++ INTRODUCTION: The Greedy Method: -General Method– Knapsack Problem–Minimum Cost Spanning Tree– Single Source Shortest Path.								15
IV	INHERITANCE AND OVERLOADING: Classes and Objects– Constructors and Destructors–operators overloading–Type Conversion- Inheritance – Pointers and Arrays.								15

V	POLYMORPHISM AND FILES: Memory Management Operators-Polymorphism–Virtual Functions–Files–Exception Handling – String Handling -Templates.	13
UNIT VI	Contemporary Issues: Expert lectures, online seminars– webinars	02
TOTAL		75

CO	Course Outcomes
CO1	Recall fundamental concepts to develop a clear understanding of mathematical principles.
CO2	Explain and interpret practical problems using mathematical reasoning.
CO3	Construct matrices based on concepts of discrete mathematics.
CO4	Analyze mathematical techniques used for graph construction.
CO5	Design and represent graphs using appropriate mathematical representations.
Textbooks	
➤	“Object Oriented Analysis and Design with Applications”, Grady Booch, Second Edition, Pearson Education.
➤	“Object-Oriented Programming with ANSI & Turbo C++”, Ashok N.Kamthane, First Indian Print -2003, Pearson Education.
Reference Books	
1.	Balagurusamy “Object Oriented Programming with C++”, TMH, Second Edition, 2003.

Mapping with Programming Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	S	S	S	M	S	M	S	M	S	S
CO 2	S	S	S	M	S	M	S	M	S	S
CO 3	S	S	S	M	S	M	S	M	S	S
CO 4	S	S	S	M	S	M	S	M	S	S
CO 5	S	S	S	M	S	M	S	M	S	S

CORE III – PYTHON PROGRAMMING

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26PCCS13	4	0	0	I	4	4	50	50	100
Learning Objectives									
LO1	Presents an introduction to Python, creation of web applications, network applications and working in the clouds								
LO2	Use functions for structuring Python programs								
LO3	Understand different Data Structures of Python								
LO4	Represent compound data using Python lists, tuples and dictionaries								
LO5	Handle files, exceptions, and basic input/output operations in real-world applications.								
Prerequisites:									
Unit	Contents								No. of Hours
I	INTRODUCTION:Python: Introduction–Numbers–Strings–Variables–Lists–Tuples–Dictionaries–Sets– Comparison.								12
II	CODE STRUCTURES: Nature of Class – Relationship Among classes – The Interplay of classes and Objects. Classification: The importance of Proper Classification –identifying classes and objects – Key Abstractions and Mechanism.								12
III	MODULES, PACKAGES AND CLASSES: Modules, Packages, and Programs: Standalone Programs – Command-Line Arguments – Modules and the import Statement – The Python Standard Library. Objects and Classes: Define a Class with class – 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 – Method Types – Duck Typing – Special Methods –Composition.								12
IV	DATA TYPES AND WEB: Datatypes: Text Strings–Binary Data, Storing and Retrieving Data: File Input/Output– Structured								12

	Text Files – Structured Binary Files - Relational Databases – NoSQL Data Stores. Web: Web Clients –Web Servers–Web Services and Automation	
V	SYSTEMS AND NETWORKS: Systems: Files–Directories–Programs and Processes–Calendars and Clocks. Concurrency: Queues– Processes–Threads–Green Threads and event–twisted–Redis. Networks: Patterns – The Publish-Subscribe Model – TCP/IP – Sockets – Zero MQ –Internet Services – Web Services and APIs – Remote Processing – Big Fat Data and MapReduce – Working in the Clouds.	10
VI	Contemporary Issues: Expert lectures, online seminars–webinars	02
TOTAL		60
CO	Course Outcomes	
CO1	Obtain numerical solutions of algebraic and transcendental equations	
CO2	Solve system of linear equations numerically using direct and iterative methods	
CO3	Solve ordinary differential equations	
CO4	Compute integration using Simpson’s & Trapezoidal Rule	
CO5	Apply numerical methods in real life	
Textbooks		
➤	BillLubanovic, “Introducing Python”, O’Reilly, FirstEdition-SecondRelease,2014.	
➤	Mark Lutz, “Learning Python”, O’Reilly, Fifth Edition, 2013.	
Reference Books		
➤	David M. Beazley, “Python Essential Edition,2009. Reference”, Developer’s Library, Fourth Edition 2009	
➤	Sheetal Taneja, Naveen Kumar, Approach”, Pearson Publications. “Python Programming-A Modular	

Mapping with Programming Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	S	S	M	S	S	M	M	M	S	M
CO 2	S	S	M	S	S	M	S	M	S	M
CO 3	S	S	M	S	S	M	S	M	S	M
CO 4	S	S	M	S	S	M	S	M	S	M
CO 5	S	S	M	S	S	M	S	M	S	M

CORE II – PYTHON LAB

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26PCCSP2	0	0	4	I	2	4	50	50	100
Learning Objectives									
LO1	This course presents an overview of elementary data items, lists, dictionaries, sets and tuples								
LO2	To understand and write simple Python programs								
LO3	To Understand the OOPS concepts of Python								
LO4	To develop web applications using Python								
LO5	Utilize Python libraries for tasks such as data processing, visualization, and basic automation.								
Prerequisites:									
Contents									
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.									
Total Hours :								60	

Elective 1-1 ADVANCED SOFTWARE ENGINEERING

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26PECS11	4	0	0	I	4	4	50	50	100
Learning Objectives									
LO1	Introduce Software Engineering, Design, Testing and Maintenance.								
LO2	Enable the students to learn the concepts of Software Engineering.								
LO3	Learn about Software Project Management, Software Design & Testing.								
LO4	Design and evaluate software architectures using patterns, frameworks, and architectural styles.								
LO5	Perform software requirements analysis, risk management, and project planning for complex systems.								
Unit	Contents							No. of Hours	
I	INTRODUCTION: Introduction: The Problem Domain – Software Engineering Challenges - Software Engineering Approach – Software Processes: Software Process – Characteristics of a Software Process – Software Development Process Models – Other software processes.							12	
II	SOFTWARE REQUIREMENTS: Software Requirements Analysis and Specification: Requirement engineering – Type of Requirements – Feasibility Studies – Requirements Elicitation – Requirement Analysis – Requirement Documentation – Requirement Validation – Requirement Management – SRS - Formal System Specification – Axiomatic Specification – Algebraic Specification - Case study: Student Result management system. Software Quality Management –Software Quality, Software Quality Management System, ISO 9000, SEI CMM.							11	
III	PROJECT MANAGEMENT: Software Project Management: Responsibilities of a software project manager – Project planning – Metrics for Project size estimation – Project							12	

	Estimation Techniques – Empirical Estimation Techniques – COCOMO – Halstead’s software science – Staffing level estimation – Scheduling– Organization and Team Structures – Staffing – Risk management – Software Configuration Management – Miscellaneous Plan.	
IV	Software Design: Outcome of a Design process – Characteristics of a good software design – Cohesion and coupling - Strategy of Design – Function Oriented Design – Object Oriented Design - Detailed Design - IEEE Recommended Practice for Software Design Descriptions.	11
V	SOFTWARE TESTING: Software Testing: A Strategic approach to software testing – Terminologies – Functional testing– Structural testing – Levels of testing – Validation testing - Regression testing – Art of Debugging– Testing Tools- Metrics-Reliability Estimation. Software Maintenance - Maintenance Process - Reverse Engineering – Software Re-engineering - Configuration Management Activities.	12
VI	Contemporary Issues: Expert lectures, online seminars– webinars	02
TOTAL		60
CO	Course Outcomes	
CO1	Understand about Software Engineering process	
CO2	Understand about Software project management skills, design and quality management	
CO3	Analyze Software Requirements and Specification	
CO4	Analyze Software Testing, Maintenance and Software Re-Engineering	
CO5	Design and conduct various types and levels of software quality for software project	
Textbooks		

ELECTIVE 1.2 - WEB SERVICES

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26PECS12	4	0	0	I	4	4	50	50	100
Learning Objectives									
LO1	Present the Web Services , Building real world Enterprise applications using Web Services with Technologies XML, SOAP , WSDL , UDDI								
LO2	Get overview of Distributed Computing, XML, and its technologies								
LO3	Update with QoS and its features								
LO4	Develop Standards and future of Web Services								
LO5	Integrate web services with applications and evaluate their effectiveness in distributed systems.								
Unit	Contents								No. of Hours
I	INTRODUCTION: Introduction to web services – Overview of Distributed Computing- Evolution and importance of web services- Industry standards, Technologies and concepts underlying web services- Web services and enterprises-web services standards organization-web services platforms.								12
II	XMLFUNDAMENTALS: XMLFundamentals–XMLdocuments-XMLNamespaces-XMLSchema–ProcessingXML.								11
III	SOAP MODEL: SOAP: The SOAP model- SOAP messages-SOAP encoding- WSDL: WSDL structure- interface definitions-bindings-services-Using SOAP and WSDL-UDDI: About UDDI- UDDI registry Specification- Core data structures-Accessing UDDI								12
IV	TECHNOLOGIESANDSTANDARDS: Advanced web services technologies and standards: Conversations overview-web services conversation language-WSCL interface components. Workflow: business process management- workflows and workflow management systems								11

	Security: Basics-data handling and forwarding- data storage-errors-Web services security issues.	
V	QUALITYOFSERVICE: Quality of Service: Importance of QoS for web services-QoS metrics-holes-design patterns-QoS enabled web services-QoS enabled applications. Web services management-web services standards and future trends.	12
VI	Contemporary Issues: Expert lectures, online seminars– webinars	02
TOTAL		60
CO	Course Outcomes	
CO1	Understand web services and its related technologies	
CO2	Understand XML concepts	
CO3	Analyze on SOAP and UDDI model	
CO4	Demonstrate the road map for the standards and future of web services	
CO5	Analyze QoS enabled applications in web services	
Textbooks		
1	Sandeep Chatterjee, James Webber, “Developing Enterprise Web Services: An Architects Guide”, Prentice Hall, Nov 2003.	
2	Keith Ballinger, “NET Web services: Architecture and Implementation with .Net”, Pearson Education, First Edition, Feb 2003.	
Reference Books		
1	RameshNagappan,“DevelopingJavaWebServices:Architectinganddevelopingsecure Web Services Using Java”, John Wiley and Sons, first Edition Feb 2003.	
2	Eric A Marks and Mark J Werrell ,“ Executive Guide to Webservices” ,John Wiley and sons, March 2003.	
3	Anne Thomas Manes, “Web Services :A managers Guide”, AddisonWesley,June2003.	

Mapping with Programming Outcomes

[illegible]

ECTIVE 1.3 - MULTIMEDIA AND ITS APPLICATIONS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26PECS13	4	0	0	I	4	4	50	50	100
Learning Objectives									
LO1	To introduce the students the concepts of Multimedia, Images & Animation.								
LO2	To introduce Multimedia authoring tools								
LO3	To understand the role of Multimedia in Internet								
LO4	To know about High-Definition Television and Desktop Computing – Knowledge based Multimedia systems								
LO5	Evaluate the role of multimedia in web, mobile, and emerging applications such as virtual reality and e-learning.								
Unit	Contents								No. of Hours
I	INTRODUCTION: What is Multimedia?–Introduction to making Multimedia–Macintosh and Windows Production platforms – Basic Software tools.								12
II	MULTIMEDIATOOLS: Making Instant Multimedia–Multimedia authoring tools–Multimedia building blocks–Text– Sound.								10
III	ANIMATION:Images–Animation–Video.								12
IV	INTERNET: Multimedia and the Internet–The Internet and how it works–Tools for World Wide Web– Designing for the World Wide Web.								12
V	MULTIMEDIASYSTEMS: High Definition Television and Desktop Computing –Knowledge based Multimedia systems.								12
VI	Contemporary Issues: Expert lectures, online seminars– webinars								02
TOTAL								60	
CO	Course Outcomes								

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 realtime applications
CO5	Analyze multimedia applications using HDTV
Textbooks	
1	Tay Vaughan, “Multimedia making it work”, Fifth Edition, Tata McGraw Hill.
2	John F. Koegel Bufford, “Multimedia Systems”, Pearson Education.
Reference Books	
1	Judith Jef floate, “Multimedia in Practice (Technology and Applications)”, PHI,2003.

Mapping with Programming Outcomes

[illegible]

Elective 2-1: ADVANCED OPERATING SYSTEMS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26PECS14	4	0	0	I	4	4	50	50	100
Learning Objectives									
LO1	Enable the students to learn the concepts of Mining tasks, classification, clustering and Data Warehousing.								
LO2	Develop skills in using recent data mining software for solving practical problems.								
LO3	Develop and apply critical thinking, problem-solving, and decision-making skills.								
LO4	Design and implement algorithms for process scheduling, deadlock handling, and resource allocation.								
LO5	Apply concepts of security, protection, and fault tolerance in modern operating systems.								
Prerequisites:									
Unit	Contents								No. of Hours
I	BASICS OF OPERATING SYSTEMS: Basics of Operating Systems: What is an Operating System? – Mainframe Systems – Desktop Systems – Multiprocessor Systems – Distributed Systems – Clustered Systems –Real-Time Systems – Handheld Systems – Feature Migration – Computing Environments -Process Scheduling – Cooperating Processes – Inter-Process Communication-Deadlocks –Prevention – Avoidance – Detection – Recovery.								12
II	DISTRIBUTED OPERATING SYSTEMS: Distributed Operating Systems: Issues – Communication Primitives – Lamports Logical Clocks – Deadlock handling strategies – Issues in deadlock detection and resolution-distributed file systems –design issues – Case studies – The Sun Network File System-Co								12

III	Realtime Operating Systems: Introduction – Applications of Real-Time Systems – Basic Model of Real-Time System – Characteristics – Safety and Reliability - Real-Time Task Scheduling Realtime Operating Systems: Introduction – Applications of Real-Time Systems – Basic Model of Real-Time System – Characteristics – Safety and Reliability - Real-Time Task Scheduling	10
IV	HANDHELD SYSTEM: Operating Systems for Handheld Systems: Requirements–Technology Overview–Handheld Operating Systems–Palm OS–Symbian Operating System–Android–Architecture of android–Securing handheld systems	12
V	CASE STUDIES: Case Studies: Linux System: Introduction – Memory Management – Process Scheduling – Scheduling Policy - Managing I/O devices – Accessing Files- iOS: Architecture and SDK Framework - Media Layer - Services Layer - Core OS Layer - File System.	12
VI	Contemporary Issues: Expert lectures, online seminars– webinars	02
TOTAL		60
CO	Course Outcomes	
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	Analyze Operating Systems for Handheld Systems	
CO5	Analyze Operating Systems like LINUX and IOS	
Textbooks		
1.	Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, “Operating System Concepts”, Seventh Edition, John Wiley & Sons, 2004.	

2.	Mukesh Singhal and Niranjana 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: Theory 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 & Marco Cesati, “Understanding the Linux kernel”, 3rd edition, O’Reilly, 2005
4	Neil Smyth, “iPhone iOS 4 Development Essentials–Xcode”, Fourth Edition, Payload media, 2011.

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	S	M	S	S	S	S	M	M	M	M
CO 2	S	M	S	S	S	S	S	M	S	M
CO 3	S	M	S	S	S	S	S	M	S	M
CO 4	S	M	S	S	S	S	S	M	S	M
CO 5	S	M	S	S	S	S	S	M	S	M

Elective 2-2: MOBILE COMPUTING

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26PECS15	4	0	0	I	4	4	50	50	100
Learning Objectives									
LO1	Have a detailed knowledge of the concept of networks								
LO2	Know the idea of protocols, OSI layers and their functions.								
LO3	Get knowledge of protocols used in different layers.								
LO4	Know about the function of the Internet								
LO5	Analyze and ensure security, reliability, and performance of web services.								
Unit	Contents								No. of Hours
I	INTRODUCTION: Introduction- data communications – networks – The internet – Protocols and standards – OSI model – layers in OSI model – TCP/IP protocol suite – addressing – guided media								12
II	DATA LINK LAYER: Switching – Circuit switched networks – datagram networks – virtual circuit networks – Framing – Flow and error control Multiple access – random access – wired Lan – wireless Lan – Cellular telephony – satellite networks								12
III	NETWORK LAYER: Network layer – IP V4 addressing – IPV6 addressing – ICMP – IGMP –Network layer delivery – forwarding – unicast and multicast routing protocols								11
IV	TRANSPORT LAYER: Transport layer – Process to process delivery – UDP -TCP -Congestion – congestion control – QOS								11
V	APPLICATION LAYER: Domain name system – name space – domain name space – distribution of name space – DNS in the internet – remote logging - email – file transfer -Network management system – SNMP Protocol								12

VI	Contemporary Issues: Expert lectures, online seminars–webinars	02
TOTAL		60
CO	Course Outcomes	
CO1	Understand the fundamentals of data communication, networking concepts, OSI model, TCP/IP protocol suite, and transmission media.	
CO2	Analyze data link layer concepts including switching techniques, framing, error control, and wired/wireless LAN technologies.	
CO3	Apply network layer concepts such as IPv4/IPv6 addressing, routing, forwarding, and related protocols like ICMP and IGMP.	
CO4	Explain transport layer mechanisms including process-to-process communication, UDP, TCP, congestion control, and Quality of Service (QoS).	
CO5	Understand application layer protocols such as DNS, email, file transfer, remote login, and network management using SNMP.	
Textbooks		
1	Data communications and networking – Behrouz A Forouzan McGraw Hill 4th Edition 2015 Reprint	
Reference Books		
1	Computer Networks – Tenenbaum -Pearson -2022	
2	Computer networking –Kurose James F, Ross Keith W -Pearson – 2017	
3	Data and computer communications – William Stallings – Pearson 2017	
4	Computer networks and Internet – Douglas E Comer – Pearson - 2018	

Mapping with Programming Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	S	M	M	M	M	M	S	L	M	L
CO 2	S	M	M	S	M	M	S	L	S	L
CO 3	S	S	M	S	S	M	S	M	S	M
CO 4	S	S	S	S	S	M	S	M	S	M
CO 5	S	S	S	S	S	S	S	M	S	M

Elective 2-3 : ADVANCED COMPUTER NETWORKS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26PECS16	4	0	0	I	4	4	50	50	100
Learning Objectives									
LO1	Present the overview of Mobile Computing, Applications and Architecture.								
LO2	Describe the futuristic computing challenges.								
LO3	Enable the students to learn the concept of mobile computing.								
LO4	Apply concepts of wireless, mobile, and sensor networks in real-world scenarios.								
LO5	Implement network security mechanisms including encryption, authentication, and intrusion detection.								
Unit	Contents							No. of Hours	
UNIT I	INTRODUCTION: Introduction: Advantages of Digital Information - Introduction to Telephone Systems –Mobile Communication: Need for Mobile Communication – Requirements of Mobile Communication – History of Mobile Communication.							12	
UNIT II	MOBILE COMMUNICATION: Introduction to Cellular Mobile Communication – Mobile Communication Standards –Mobility Management – Frequency Management – Cordless Mobile Communication Systems.							12	
UNIT III	MOBILE COMPUTING: Mobile Computing: History of data networks – Classification of Mobile data networks - CDPD System – Satellites in Mobile Communication: Satellite classification – Global Satellite Communication – Change over from one satellite to another – Global Mobile Communication – Interferences in Cellular Mobile Communication.							12	
UNIT IV	MOBILE COMMUNICATION SYSTEM: Important Parameters of Mobile Communication System – Mobile Internet:							11	

	Working of Mobile IP – Wireless Network Security – Wireless Local Loop Architecture: Components in WLL – Problems in WLL – Modern Wireless Local Loop – Local Multipoint Distribution Service – Wireless Application Protocol.	
UNIT V	COMMUNICATION TECHNOLOGY: WCDMA Technology and Fiber Optic Microcellular Mobile Communication – Ad hoc Network and Bluetooth technology – Intelligent Mobile Communication system – Fourth Generation Mobile Communication systems.	11
UNIT VI	Contemporary Issues: Expert lectures, online seminars–webinars	02
TOTAL		60
CO	Course Outcomes	
CO1	Understand the fundamentals and evolution of digital and mobile communication systems, including telephone systems and the need for mobile communication.	
CO2	Analyze cellular mobile communication concepts such as standards, mobility management, and frequency management.	
CO3	Apply mobile computing concepts including mobile data networks, satellite communication, and global mobile communication systems.	
CO4	Evaluate mobile communication system parameters, mobile internet technologies, wireless security, and wireless local loop architectures.	
CO5	Understand advanced communication technologies such as WCDMA, Bluetooth, ad hoc networks, fiber optics, and next-generation mobile communication systems.	
Textbooks		
1	T.G. Palani velu, R. Nakkeeran, “Wireless and Mobile Communication”, PHI Limited, 2009.	
2	Jochen Schiller, “Mobile Communications,” Second Edition, Pearson Education, 2007.	
Reference Books		
1	Asoke K Talukder, Hasan Ahmed, Roopa Yavagal, “Mobile Computing”, TMH,2010.	

Mapping with Programming Outcomes

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Semester II

	SECOND SEMESTER							
Course Code	Course Category	Title of the Course	Credits	Hours		Maximum Marks		
				Theory	Practical	CIA	ESE	Total
26PCCS21	Core-IV	Data Mining and Warehousing	4	5		50	50	100
26PCCS22	Core– V	Advanced Java Programming	4	5		50	50	100
26PECS21/ 26PECS22/ 26PECS23	Elective– III	Artificial Intelligence & Machine Learning/ Robotics Process Automation for Business/Cloud Computing	4	4		50	50	100
26PECS24/ 26PECS25/ 26PECS26	Elective– IV	IoT/Embedded System/Block Chain Technology	4	4		50	50	100
26PCCSP3	Core Practical 3	Data Mining Lab using R	2		4	50	50	100
26PCCSP4	Core Practical 4	Advanced Java Lab	2		4	50	50	100
26PSECS21	SEC 1	Statistical Tools	2	4		50	50	100
	Total	22	22	22	8			

FIRST YEAR - SEMESTER – II

Core/Elective/Supportive –IV: DATA MINING AND WAREHOUSING

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26PCCS21	5	0	0	II	4	5	50	50	100
Learning Objectives									
LO1	Enable the students to learn the concepts of Mining tasks, classification, clustering and Data Warehousing.								
LO2	Develop skills in using recent data mining software for solving practical problems.								
LO3	Develop and apply critical thinking, problem-solving, and decision-making skills.								
LO4	Evaluate patterns and trends from large datasets to support business intelligence and strategic decisions.								
LO5	Explore real-world applications of data mining in domains such as finance, healthcare, and marketing.								
Prerequisites:									
Unit	Contents								No. of Hours
I	BASICS AND TECHNIQUES : Basic data mining tasks – data mining versus knowledge discovery in databases – data mining issues – data mining metrics – social implications of data mining – data mining from a database perspective. Data mining techniques: Introduction – a statistical perspective on data mining – similarity measures – decision trees – neural networks – genetic algorithms.								15
II	ALGORITHMS: Classification: Introduction –Statistical–based algorithms -distance–based algorithms-decision tree-based algorithms-neural network-based algorithms–rule-based algorithms–combining techniques.								15

III	CLUSTERING AND ASSOCIATION: Clustering: Introduction– Similarity and Distance Measures– Outliers– Hierarchical Algorithms – Partitional Algorithms. Association rules: Introduction - large item sets - basic algorithms – parallel & distributed algorithms – comparing approaches- incremental rules – advanced association rules techniques – measuring the quality of rules.	15
IV	DATA WAREHOUSING AND MODELING: Data warehousing: introduction-characteristics of a data warehouse–data marts–other aspects 25 Of data mart. Online analytical processing: introduction -OLTP & OLAP systems.Data modelling – star schema for the multidimensional view –data modelling – multi-fact star schema or snowflake schema – OLAP TOOLS – State of the market – OLAP TOOLS and the internet.	15
V	APPLICATIONS OF DATA WAREHOUSE : Developing a data WAREHOUSE: why and how to build a data warehouse –data warehouse architectural strategies and organization issues - design consideration – data content – metadata distribution of data – tools for data warehousing – performance considerations – crucial decisions in designing a data warehouse. Applications of data warehousing and data mining in government: Introduction - national data warehouses – other areas for data warehousing and data mining.	13
	Contemporary Issues: Expert lectures, online seminars– webinars	02
TOTAL		75
CO	Course Outcomes	
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	

Core– V : ADVANCED JAVA PROGRAMMING

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26PCCS22	5	0	0	II	4	5	50	50	100
Learning Objectives									
LO1	Enable the students to learn the basic functions, principles and concepts of advanced Java programming.								
LO2	Provide knowledge on concepts needed for distributed Application Architecture.								
LO3	Learn JDBC, Servlet packages, jQuery, Java Server Pages and JAR file format.								
LO4	Apply object-oriented principles and design patterns in Java application development.								
LO5	Analyze and optimize Java applications for performance, security, and scalability.								
Unit	Contents							No of Hours	
UNIT I	BASICS OF JAVA: Java Basics Review: Components and event handling–Threading concepts–Networking features – Media techniques							15	
UNIT II	REMOTE METHOD INVOCATION: Remote Method Invocation-Distributed Application Architecture- Creating stubs and skeletons- Defining Remote objects- Remote Object Activation-Object Serialization-Java Spaces							14	
UNIT III	DATABASE: Java in Databases-JDBC principles–database access-Interacting-database search–Creating multimedia databases – Database support in web applications							14	
UNIT IV	SERVLETS: Java Servlets: Java Servlet and CGI programming- A simple Java Servlet-Anatomy of a Java							15	

	Servlet-Reading data from a client-Reading HTTP request header-sending data to a client and writing the HTTP response header-working with cookies Java Server Pages: JSP Overview-Installation-JSP tags-Components of a JSP page-Expressions- Scriptlets-Directives-Declarations-A complete example	
UNIT V	ADVANCED TECHNIQUES: JAR file format creation–Internationalization–Swing Programming–Advanced java Techniques	15
UNIT VI	Contemporary Issues: Expert lectures, online seminars–webinars	02
TOTAL		75
CO	Course Outcomes	
CO1	Understand the advanced concepts of Java Programming	
CO2	Understand JDBC and RMI concepts	
CO3	Apply and analyze Java in Database	
CO4	Handle different events in Java using the delegation event model, event listener and class	
CO5	Design interactive applications using Java Servlet, JSP and JDBC	

Mapping with Programming Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	S	S	S	S	S	S	M	M	M	M
CO 2	S	S	S	S	S	S	S	M	S	S
CO 3	S	S	S	S	S	S	S	M	S	S
CO 4	S	S	S	S	S	S	S	M	S	S
CO 5	S	S	S	S	S	S	S	M	S	S

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26PCCSP3	0	0	4	II	2	4	50	50	100
Learning Objectives									
L01	To familiarize the student with basic principles and fundamentals in digital logics and design.								
L02	To develop basic skills using tools and theory used in design process.								
L03	To understand the creative process, develop techniques and methods of creative problem solving								
L04	Develop and evaluate predictive models using R for real-world applications.								
L05	Analyze datasets using statistical methods and interpret results for decision-making.								
1. Implement the Apriori algorithm to extract the association rule of data mining. 2. Implement k-means clustering technique. 3. Implement any Hierarchal Clustering. 4. Implement Classification algorithm. 5. Implement Decision Tree. 6. Linear Regression. 7. Data Visualization.									
TOTAL								60	
CO	Course Outcomes								
CO1	Implement association rule mining techniques such as the Apriori algorithm.								
CO2	Apply clustering techniques including K-means and hierarchical clustering.								
CO3	Develop classification models using various classification algorithms and decision trees.								
CO4	Apply regression techniques such as linear regression for predictive analysis.								
CO5	Perform data visualization to represent and interpret data effectively.								
Textbooks									

CORE LAB IV: ADVANCED JAVA LAB

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26PCCSP4	0	0	4	II	2	4	50	50	100
Learning Objectives									
LO1	To enable the students to implement the simple programs using JSP, JAR								
LO2	To provide knowledge on using Servlets, Applets								
LO3	To introduce JDBC and navigation of records								
LO 4	To understand RMI & its implementation								
LO 5	To introduce to Socket programming								
LIST OF PROGRAMS									
Implement the following in Python:									
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 listing 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 headers it receives along with their associated values. 9. Write a program in JSP by using a 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).									
TOTAL									60
CO	Course Outcomes								

CO1	Develop web applications using Servlets to display messages and handle client requests and form data.
CO2	Design and implement dynamic web pages using JSP for applications such as student result processing and employee pay slips.
CO3	Build database-driven applications using JDBC for creating tables and performing insert, delete, and retrieval operations.
CO4	Implement session management techniques and handle HTTP request/response data in web applications.
CO5	Develop distributed applications using RMI and socket programming, including simple client-server communication and application development like a calculator.
Textbooks	
➤	1. JamieJaworski,“JavaUnleashed”,SAMSTechmediaPublications,1999.
➤	2. Campione, Walrath and Huml,“TheJavaTutorial”,AddisonWesley,1999.
Reference Books	
1.	JimKeogh,”TheCompleteReferenceJ2EE”,Tata Mc Graw Hill Publishing Company Ltd,2010.
2.	DavidSawyerMcFarland,“JavaScriptAndjQuery-TheMissingManual”,Oreilly Publications, 3rd Edition,2011.

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Skill Enhancement Course 1: STATISTICAL TOOLS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26PSECS21	4	0	0	II	2	4	25	75	100
Learning Objectives									
LO1	Understand the difference between descriptive & inferential statistics.								
LO2	Understand the importance of sample size calculations and the required input parameters.								
LO3	Analyze data more quickly and more accurately.								
LO4	Interpret statistical results and draw meaningful conclusions from datasets.								
LO5	Apply statistical techniques in various domains such as business, research, and social sciences.								
Unit	Contents							No of Hours	
UNIT I	Introduction- Descriptive and Inferential Statistics- Variables and types of data Data Collection and sampling technique-Uses and Misuses of Statistics							12	
UNIT II	Organizing data-Histogram, Frequency Polygon and Ogives-other types of graph Measures of Central Tendency							12	
UNIT III	Classical Test statistics: Z-test, T-test, F-tests and Goodness of fit test							12	
UNIT IV	Correlation and Regression- Scatter Plots-Analysis of Variance: one-way analysis of variance-Two-way analysis of variance							12	
UNIT V	Statistics Packages : SPSS,MS-EXCEL,SAS,R- Programming, MiniTab							12	
TOTAL							60		

CO	Course Outcomes
CO1	Understand basic concepts of descriptive and inferential statistics, variables, and data collection methods.
CO2	Organize and present data using tables, graphs, and measures of central tendency.
CO3	Apply statistical tests such as Z-test, t-test, F-test, and goodness-of-fit test.
CO4	Analyze relationships using correlation, regression, and ANOVA techniques
CO5	Use statistical software tools like SPSS, Excel, SAS, R, and MiniTab for data analysis.
Textbooks	
➤	Allan G. Bluman, Elementary Statistics, 1992.
➤	Dr. M.J de Smith, Statistical Analysis Handbook, 2014.
➤	ARice, John. Mathematical Statistics and Data Analysis. Duxbury Press, 2006.
➤	Statistics in a NutShell-Sarab Boslaugh & Paul Andrew Watters

Mapping with Programming Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	S	S	S	S	S	S	M	M	M	M
CO 2	S	S	S	S	S	S	S	M	S	S
CO 3	S	S	S	S	S	S	S	M	S	S
CO 4	S	S	S	S	S	S	S	M	S	S
CO 5	S	S	S	S	S	S	S	M	S	S

Elective 3- 1 : ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26PECS21	4	0	0	II	4	4	50	50	100
Learning Objectives									
LO1	Enable the students to learn the basic functions of AI and Heuristic Search Techniques.								
LO2	Provide knowledge on concepts of Representations and Mappings and Predicate Logic.								
LO3	Introduce Machine Learning to Data Mining, Big Data and Cloud.								
LO4	Study about Applications & Impact of ML.								
LO5	Evaluate model performance using appropriate metrics and validation techniques.								
Prerequisites:									
Unit	Contents								No. of Hours
UNIT I	INTRODUCTION: Introduction: AI Problems - AI techniques - Criteria for success. Problems, Problem Spaces, Search State space search - Production Systems - Problem Characteristics - Issues in the design of Search..								12
UNIT II	SEARCH TECHNIQUES: Heuristic Search Techniques: Generate and Test - Hill Climbing- Best-First, Problem Reduction, Constraint Satisfaction, Means-end analysis. Knowledge representation issues: Representations and mappings -Approaches to Knowledge representations -Issues in Knowledge representations - Frame Problem.								12

UNIT III	PREDICATE LOGIC: Using Predicate logic: Representing simple facts in logic - Representing Instance and Isa relationships - Computable functions and predicates - Resolution - Natural deduction. Representing knowledge using rules: Procedural Vs Declarative knowledge- Logic programming -Forward vs. backwards reasoning -Matching-Control knowledge.	12
UNIT IV	MACHINE LEARNING: Understanding Machine Learning: What Is Machine Learning? - Defining Big Data - Big Data in Context with Machine Learning - The Importance of the Hybrid Cloud - Leveraging the Power of Machine Learning - The Roles of Statistics and Data Mining with Machine Learning- Putting Machine Learning in Context-Approaches to Machine Learning.	11
UNIT V	APPLICATIONS OF MACHINE LEARNING: Looking Inside Machine Learning: The Impact of Machine Learning on Applications - Data Preparation -The Machine Learning Cycle.	11
UNIT VI	Contemporary Issues: Expert lectures, online seminars–webinars	02
TOTAL		60
CO	Course Outcomes	
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 designing are all world problems for implementation and understanding the dynamic behaviour of a system	
Textbooks		
➤	Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill Publishers Company Pvt Ltd, Second Edition, 1991.	
➤	George F Luger, "Artificial Intelligence", 4th edition, Pearson Education Publ,2002.	

Reference Books	
5.	Machine Learning For Dummies ®, IBM Limited Edition by Judith Hurwitz, Daniel Kirsch.

Mapping with Programming Outcomes

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Elective 3-2 : ROBOTIC PROCESS AUTOMATION FOR BUSINESS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26PECS22	4	0	0	II	4	4	50	50	100
Learning Objectives									
LO1	Learn the concepts of RPA, its benefits, types and models.								
LO2	Gain the knowledge in application of RPA in Business Scenarios.								
LO3	Identify measures and skills required for RPA								
LO4	Implement automation for tasks such as data entry, report generation, and system integration.								
LO5	Evaluate the performance, scalability in business environments								
Prerequisites:									
Unit	Contents								No. of Hours
UNIT I	INTRODUCTION: Introduction to RPA -Overview of RPA -Benefits of RPA in a business environment -Industries & domains fit for RPA - Identification of process for automation - Types of Robots - Ethics of RPA & Best Practices - Automation and RPA Concepts - Different business models for implementing RPA -Centre of Excellence –Types and their applications -Building an RPA team -Approach for implementing RPA initiatives.								12
UNIT II	AUTOMATION: Role of a Business Manager in Automation initiatives - Skills required by a Business Manager for successful automation - The importance of a Business Manager in automation - Analyzing different business processes - Process Mapping frameworks - Role of a Business Manager in successful implementation – Part 1 - Understanding the Automation cycle – First 3 automation stages and activities performed by different people.								12

UNIT III	AUTOMATION IMPLEMENTATION: Evaluating the Automation Implementation Detailed description of last 3 stages and activities performed by different people - Role of a Business Manager in successful completion – Part 2 - Activities to be performed post-implementation - Guidelines for tracking the implementation success - Metrics/Parameters to be considered for gauging success - Choosing the right licensing option - Sending emails - Publishing and Running Workflows.	12
UNIT IV	ROBOT: Ability to process information through scopes/systems - Understand the skill of information processing and its use in business - Leveraging automation - Creating a Robot - New Processes. Establish causality by variable behavior - Understand the skill of drawing inference or establishing causality by tracking the behavior of a variable as it varies across time/referenced variable - Leveraging automation for this skill - Robot & new process creation.	11
UNIT V	ROBOTSKILL: - Understand the skill of drawing inference from the behavior of curated terms by taking snapshots across systems in reference to time/variable(s) - Leveraging automation for this skill – Robot creation and new process creation for this skill.	11
UNIT VI	Contemporary Issues: Expert lectures, online seminars–webinars	02
TOTAL		60
CO	Course Outcomes	
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
Textbooks	
➤	Alok Mani Tripathi” Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool” Packt Publishing Limited March 2018.
➤	Tom Taulli “The Robotic Process Automation Handbook” Apress, February2020.
Reference Books	
1	Machine Learning For Dummies ®, IBM Limited Edition by Judith Hurwitz, Daniel Kirsch.

Mapping with Programming Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	L	M	L	L	M	S	M	M	M	M
CO 2	S	S	S	M	M	S	M	M	S	S
CO 3	S	S	S	S	M	S	S	M	S	S
CO 4	S	S	S	S	S	S	S	M	S	S
CO 5	S	S	S	S	S	S	S	M	S	S

Elective 3-3 : CLOUD COMPUTING

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26PECS23	4	0	0	II	4	4	50	50	100
Learning Objectives									
LO1	Gain knowledge on cloud computing, cloud services, architectures and applications.								
LO2	Enable the students to learn the basics of cloud computing with real-time usage								
LO3	How to store and share in and from the cloud?								
LO4	Evaluate cloud security, privacy, and compliance issues in distributed environments.								
LO5	Optimize cloud resources for cost, performance, and scalability in real-world applications.								
Prerequisites:									
Unit	Contents								No. of Hours
UNIT I	INTRODUCTION: INTRODUCTION Cloud Computing Introduction, From, Collaboration to cloud, Working of cloud computing, pros and cons, benefits, developing cloud computing services, Cloud service development, discovering cloud services.								12
UNIT II	CLOUD COMPUTING: CLOUD COMPUTING FOR EVERYONE Centralizing email communications, cloud computing for the community, collaborating on schedules, collaborating on group projects and events, cloud computing for corporations, mapping, schedules, managing projects, and presenting on the road.								12
UNIT III	CLOUD SERVICES:USING CLOUD SERVICES Collaborating on calendars, Schedules and task management,								12

	exploring online scheduling and planning, collaborating on event management, collaborating on contact management, collaborating on project management, collaborating on word processing, spreadsheets, and databases.	
UNIT IV	OUTSIDE THE CLOUD: Evaluating webmail services, evaluating instant messaging, Evaluating web conference tools, creating groups on social networks, Evaluating online groupware, collaborating via blogs and wikis.	12
UNIT V	STORING AND SHARING : STORING AND SHARING Understanding cloud storage, evaluating online file storage, exploring online bookmarking services, exploring online photo editing applications, exploring photo sharing communities, and controlling it with web-based desktops.	10
UNIT VI	Contemporary Issues: Expert lectures, online seminars–webinars	02
TOTAL		60
CO	Course Outcomes	
CO1	Understand the concepts of the 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	
Textbooks		
➤	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, 2009.	

Mapping with Programming Outcomes

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Elective 4-1 : INTERNET OF THINGS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26PECS24	4	0	0	I	4	4	50	50	100
Learning Objectives									
LO1	To get familiar with the evolution of IOT with its design principles.								
LO2	To outline the functionalities and protocols of Internet communication.								
LO3	To analyze the hardware and software components needed to construct IOT applications.								
LO4	To identify the appropriate protocol for API construction and writing embedded code.								
LO5	To realize various business models and ethics in the Internet of Things.								
Prerequisites:									
Unit	Contents								No. of Hours
UNIT I	INTRODUCTION: Internet of Things: An Overview: IoT Conceptual Framework - IoT Architectural View - Technology Behind IoT - Sources of IoT - M2M Communication - Examples of IoT - Design Principles for Connected Devices: IoT/M2M Systems Layers and Designs Standardization - Communication Technologies - Data Enrichment, Data Consolidation and Device Management at Gateway								12
UNIT II	Design Principles for Web Connectivity: Communication Protocols for Connected Devices – Message Communication Protocols for Connected Devices – Web Connectivity for Connected Devices – Network Using Gateway, SOAP, REST, HTTP, RESTful and Web Sockets - Internet Connectivity Principles: Internet Connectivity - Internet Based Communication – IP Addressing in the IoT – Media Access								12

	Control – Application Layer Protocols: HTTP, HTTPS, FTP, Telnet and Others	
UNIT III	Data Acquiring, Organizing, Processing and Analytics: Data Acquiring and Storage – Organizing the Data – Transactions, Business Processes, Integration and Enterprise Systems – Analytics – Knowledge Acquiring, Managing and Storing Processes - Data Collection, Storage and Computing Using a Cloud Platform: Cloud Computing Paradigm for Data Collection, Storage and Computing – Everything as a Service and Cloud Service Models.	12
UNIT IV	SENSORS AND ACTUATORS: Sensors, Participatory Sensing, RFIDs, and Wireless Sensor Networks: Sensor Technology – Wireless Sensor Networks Technology - Prototyping the Embedded Devices for IoT and M2M : Embedded Computing Basics – Embedded Platforms for Prototyping.	10
UNIT V	Prototyping and Designing the Software for IoT Applications: Prototyping Embedded Device Software - Devices, Gateways, Internet and Web/Cloud Services Software Development – Prototyping online Component APIs and Web APIs – Security for IoT: Vulnerabilities, Security Requirements and Threat Analysis – IoT Security Tomography and Layered Attacker Model – Security Models, Profiles and Protocols for IoT – IoT Application Case Study: Design Layers, Design Complexity and Designing using Cloud PaaS – IoT / IoT Applications in the premises, Supply – Chain and Customer Monitoring – Connected Car and its Applications and Services.	12
UNIT VI	Contemporary Issues: Expert lectures, online seminars–webinars	02
TOTAL		60
CO	Course Outcomes	

CO1	Understand about IoT, its Architecture and its Applications
CO2	Comprehend the IoT evolution with its architecture and sensors
CO3	Assess the embedded technologies and develop prototypes for the IoT products
CO4	Evaluate the use of Application Programming Interface and design an API for IoT in real-time
CO5	Design IoT in real-time applications using today's internet & wireless Technologies
Textbooks	
➤	Raj Kamal, “ Internet of Things Architecture and Design Principles”, McGraw Hill, 2017
Reference Books	
6.	Ovidiu Vermesan and Peter Friess, “Internet of Things – From Research and Innovation to Mark Deployment”, River Publishers, 2014.
7.	Peter Waher, “Learning Internet of Things” , Packt Publishing, 2015.
8.	Donald Norris, “The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and Beagle Bone Black”, Mc Graw Hill, 2015

Mapping with Programming Outcomes

[illegible]

Elective 4-2 : EMBEDDED SYSTEMS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26PECS25	4	0	0	II	4	4	50	50	100
Learning Objectives									
LO1	Present the introduction to 8051 the Microcontroller Instruction Set and concepts on RTOS & Software tools.								
LO2	Gain knowledge about embedded software development.								
LO3	Learn about microcontrollers and software tools in embedded systems.								
LO4	Apply interfacing of sensors, actuators, and communication modules in embedded system design.								
LO5	Evaluate performance, reliability, and power efficiency of embedded systems in real-world applications.								
Prerequisites:									
Unit	Contents								No. of Hours
UNIT I	8051 MICROCONTROLLERS: 8051 Microcontroller: Introduction-8051 Architecture-Input/Output Pins, Ports and Circuits- External Memory – Counters / Timers – Serial Data Input / Output –Interrupts								12
UNIT II	PROGRAMMING BASICS: Instruction Set and Programming Moving Data-Addressing Modes-Logical Operations- Arithmetic Operation-Jump and Call Instructions-Simple Program. Applications: Keyboard Interface- Display Interface-Pulse Measurements-DIA and AID Conversions-Multiple Interrupts.								12
UNIT III	CONCEPTS ON RTOS: CONCEPTS ON RTOS: Introduction to RTOS-Selecting an RTOS-Task and Task states – Tasks and data- Semaphores and shared data. MORE operating systems services: Interrupt Process communication – Message Queues,								12

	Mailboxes and pipes- Timer Functions – Memory management routines in an RTOS Environment.	
UNIT IV	DESIGN USING RTOS: Basic Design using an RTOS: Principles – Encapsulating semaphores and Queues-Hard real-time scheduling considerations-Saving memory space and power- introductions to RTL &QNX.	10
UNIT V	SOFTWARE TOOLS: SOFTWARE TOOLS: Embedded Software Development Tools: Hosts and Target Machines- 69 Linker/Locators for Embedded software-getting Embedded software into the Target systems. Debugging Techniques: Testing on your Host machine – Instruction set simulators- The assert macro using laboratory tools.	12
UNIT VI	Contemporary Issues: Expert lectures, online seminars–webinars	02
TOTAL		60
CO	Course Outcomes	
CO1	Understand the concept of the 8051 microcontrollers	
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	
Textbooks		
➤	David E. Simon, “An Embedded Software Primer” Pearson Education Asia, 2003.	
➤	Kenneth J Ayala, “The8051 Microcontroller and Architecture programming and application”, Second Edition, Penram International.	
Reference Books		
➤	RajKamal, “Embedded Systems –Architecture, programming and design”, Tata McGraw– Hill, 2003.	

Mapping with Programming Outcomes

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Elective 4-3 : BLOCKCHAIN TECHNOLOGY

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26PECS26	4	0	0	II	4	4	50	50	100
Learning Objectives									
LO1	Understand the fundamentals of blockchain and cryptocurrency.								
LO2	Understand the influence and role of blockchain in various other fields..								
LO3	Learn security features and their significance								
LO 4	Identify problems & challenges posed by blockchain.								
LO5	Evaluate security, privacy, and scalability issues in blockchain systems.								
Prerequisites:									
Unit	Contents								No. of Hours
UNIT I	INTRODUCTIO :Introduction to Blockchain - The big picture of the industry – size, growth, structure, players. Bitcoin versus Cryptocurrencies versus Blockchain - Distributed Ledger Technology (DLT). Strategic analysis of the space – Blockchain platforms, regulators, application providers. The major applications are Currency, identity, and chain of custody.								12
UNIT II	NETWORK AND SECURITY: Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Blockchain 1.0, 2.0 and 3.0 – transition, advancements and features. Privacy, Security issues in Blockchain.								12
UNIT III	CRYPTOCURRENCY: Cryptocurrency - History, Distributed Ledger, Bitcoin protocols -Symmetric-key cryptography - Public-key cryptography - Digital Signatures -High and Low								12

	trust societies - Types of Trust model: Peer-to-Peer, Leviathan, and Intermediary. Application of Cryptography to Blockchain	
UNIT IV	CRYPTOCURRENCY REGULATION: Cryptocurrency Regulation-Stake holders, Roots of Bitcoin, Legal views-exchange of crypto currency-Black Market- Global Economy. Crypto economics–assets, supply and Demand, inflation and deflation – Regulation.	10
UNIT V	CHALLENGES IN BLOCKCHAIN: Opportunities and challenges in blockchain – Application of blockchain: Industry 4.0 – machine to machine communication –Data management in industry4.0–prospects. Blockchain in Health 4.0 - Blockchain properties - Healthcare Costs - Healthcare Quality - Healthcare Value - Challenges for Using Blockchain for Healthcare Data	12
UNIT VI	Contemporary Issues: Expert lectures, online seminars–webinars	02
TOTAL		60
CO	Course Outcomes	
CO1	Demonstrate blockchain technology and cryptocurrency	
CO2	Understand the mining mechanism in blockchain	
CO3	Apply and identify security measures and various types of services that allow people to trade and transact with bitcoins	
CO4	Apply and analyze Blockchain in the healthcare industry	
CO5	Analyze the security, privacy, and efficiency of a given Blockchain system	
Textbooks		
➤	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction”, Princeton University Press (July 19, 2016).	
➤	Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”	
Reference Books		

➤	Satoshi Nakamoto, “Bitcoin: A peer-to-peer Electronic Cash System” Rodrigo da Rosa Righi, Antonio Marcos Alberti, Madhusudan Singh, “Blockchain Technology for Industry 4.0” Springer 2020.
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Mapping with Programming Outcomes

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Semester III

THIRD SEMESTER								
Course Code	Course Category	Title of the Course	Credits	Hours		Maximum Marks		
				Theory	Practical	CIA	ESE	Total
26PCCS31	Core-VI	Digital Image Processing	4	5		25	75	100
26PCCS32	Core- VII	Network Security and Cryptography	4	4		25	75	100
26PCCS33	Core- VIII	Data Science & Analytics	4	4		25	75	100
26PECS31/ 26PECS32/ 26PECS33	Elective- V	Deep Learning / Big Data Analytics /Critical thinking, Design Thinking & Problem Solving	4	4		25	75	100
26PCCSP5	Core Practical5	Digital Image Processing Using MatLab	2		4	50	50	100
26PCCS3P	Mini Project	Web Application Development & Hosting	3		6	50	50	100
26PSECS31	SEC 2	Cloud Computing Tools	2	3		25	75	100
26PCCS3I	Internship/ Industrial Activity/ Research Updation Activity		2	-				
	Total		25	20	10			

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26PCCS31	5	0	0	III	4	5	25	75	100
Learning Objectives									
LO1	Learn basic image processing techniques for solving real problems.								
LO2	Gain knowledge in information and image enhancement techniques.								
LO3	Learn Image compression and Segmentation procedures.								
LO4	Evaluate image compression techniques for efficient storage and transmission.								
LO5	Develop applications using image processing techniques in areas such as medical imaging, remote sensing, and computer vision.								
Prerequisites:									
Unit	Contents								No. of Hours
I	INTRODUCTION: What is Digital image processing – the origin of DIP – Examples of fields that use DIP – Fundamentals steps in DIP – Components of an image processing system. Digital Image Fundamentals: Elements of Visual perception – Light and the electromagnetic spectrum – Image sensing and acquisition – Image sampling and Quantization – Some Basic relationship between Pixels – Linear & Nonlinear operations.								15
II	IMAGE ENHANCEMENT: Image Enhancement in the spatial domain: - Background – some basic grey level Transformations – Histogram Processing – Enhancement using Arithmetic / Logic operations – Basics of spatial filtering – Smoothing spatial filters – Sharpening spatial filters – Combining spatial enhancement methods.								15
III	IMAGE RESTORATION: Image Restoration: A model of the Image Degradation / Restoration Process – Noise models – Restoration is the process of noise only – Spatial Filtering – Periodic Noise reduction by frequency domain filtering – Linear, Portion –								15

	Invariant Degradations – Estimating the degradation function – Inverse filtering – Minimum mean square Error Filtering – Constrained least squares filtering – Geometric mean filter – Geometric Transformations.	
IV	IMAGE COMPRESSION: Fundamentals–Image compression models–Elements of Information Theory – Error Free compression – Lossy compression – Image compression standards.	14
V	IMAGE SEGMENTATION: Detection and Discontinuities – Edge Linking and Boundary Deduction – Thresholding – Region-Based Segmentation – Segmentation by Morphological watersheds – The use of motion in segmentation.	14
VI	Contemporary Issues: Expert lectures, online seminars– webinars	2
TOTAL		75
Expected Course Outcomes:		
On the successful completion of the course, students will be able to:		
CO	Course Outcomes	
CO1	Understand the fundamentals of Digital Image Processing K1, K2	
CO2	Understand the mathematical foundations for digital image representation, image acquisition, image transformation, and image enhancement K2, K3	
CO3	Apply, Design and Implement and get solutions for digital image processing problems K3, K4	
CO4	Apply the concepts of filtering and segmentation for digital image retrieval K4, K5	
CO5	Explore the concepts of the Multi-resolution process and recognize the objects in an efficient manner K5, K6	
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create		
Textbooks		
1	Rafael C.Gonzalez, Richard.Woods, “Digital Image Processing”, Second Edition, PHI / Pearson Education.	
2	B.Chanda, D.DuttaMajumder, “Digital Image Processing and Analysis”, PHI, 2003.	

Semester III
Core– VIII: NETWORK SECURITY AND CRYPTOGRAPHY

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26PCCS32	4	0	0	III	4	4	50	50	100
Learning Objectives									
LO1	Enable students to learn the Introduction to Cryptography, Web Security and Case Studies in Cryptography								
LO2	To gain knowledge of classical encryption techniques and concepts of modular arithmetic and number theory.								
LO3	To explore the working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes and message digests, and public key algorithms.								
LO4	To explore the design issues and working principles of various authentication Applications and various secure communication standards including Kerberos, IPsec, SSL/TLS and email.								
LO5	Design secure systems by addressing confidentiality, integrity, availability, and risk management principles.								
Prerequisites:									
Unit	Contents								No. of Hours
I	INTRODUCTION: Introduction to Cryptography – Security Attacks – Security Services –Security Algorithm- Stream cypher and Block cypher - Symmetric and Asymmetric-key Cryptosystem Symmetric Key Algorithms: Introduction – DES – Triple DES – AES – IDEA – Blowfish – RC5.								12
II	CRYPTOSYSTEM: Public-key cryptosystem: Introduction to Number Theory-RSA algorithm–Key Management - Diffie-Hellman Key exchange–Elliptic Curve Cryptography Message Authentication and Hash functions – Hash and Mac Algorithm – Digital Signatures and Authentication Protocol.								12

III	NETWORK SECURITY: Network Security Practice: Authentication Applications–Kerberos–X.509Authentication services and Encryption Techniques. E-mail Security – PGP – S / MIME – IP Security.	12
IV	WEB SECURITY : Web Security – Secure Socket Layer–Secure Electronic Transaction.System Security- Intruders and Viruses – Firewalls– Password Security.	11
V	Case Study: Implementation of Cryptographic Algorithms–RSA–DSA–ECC(C/JAVA Programming). Network Forensic – Security Audit - Other Security Mechanism: Introduction to Stenography – Quantum Cryptography – Water Marking - DNA Cryptography	11
VI	Contemporary Issues: Expert lectures, online seminars– webinars	2
TOTAL		60
Expected Course Outcomes:		
On the successful completion of the course, students will be able to:		
CO	Course Outcomes	
CO1	Understand the process of the cryptographic algorithms	
CO2	Compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication	
CO3	Apply and analyse appropriate security techniques to solve network security problem	
CO4	Explore suitable cryptographic algorithms	
CO5	Analyze different digital signature algorithms to achieve authentication and design secure applications	
K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate; K6-Create		
Textbooks		
1	William Stallings, “Cryptography and Network Security”, PHI/ Pearson Education.	
2	Bruce Schneir, “Applied Cryptography”, CRC Press.	
Reference Books		

1	A.Menezes, P Van Oorschot and S.Vanstone, “Hand Book of Applied Cryptography”, CRC Press, 1997
2	Ankit Fadia,”Network Security”,Mac Millan.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websitesetc.]	
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

Mapping with Programming Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	S	M	S	S	S	M	M	M	M	S
CO 2	S	S	S	S	S	M	S	M	S	S
CO 3	S	S	S	S	S	S	S	M	S	S
CO 4	S	S	S	S	S	S	S	M	S	S
CO 5	S	S	S	S	S	S	S	M	S	S

Semester III
Core/Elective/Supportive – IX: DATA SCIENCE & ANALYTICS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26PCCS32	4	0		III	4	4	50	50	100
Learning Objectives									
LO1	Introduce the students to data science, big data & its ecosystem.								
LO2	Learn data analytics & its life cycle.								
LO3	To explore the programming language, concerning the data mining algorithms.								
LO4	Relate the relationship between artificial intelligence, machine learning and data science.								
LO5	Visualize data effectively using tools and libraries to communicate insights.								
Prerequisites:									
Unit	Contents								No. of Hours
I	INTRODUCTION: Introduction of Data Science: data science and big data – facets of data-data science process- Ecosystem- The Data Science process – six steps- Machine Learning.								12
II	BASICS OF DATA ANALYTICS: Data Analytics lifecycle- review of data analytics- Advanced data Analytics- technology and tools.								12
III	DATA ANALYTICS USING R: Basic Data Analytics using R: R Graphical User Interfaces – Data Import and Export – Attribute and Data Types – Descriptive Statistics – Exploratory Data Analysis – Visualization Before Analysis – Dirty Data – Visualizing a Single Variable – Examining Multiple Variables – Data Exploration Versus Presentation..								12
IV	CLUSTERING: Overview of Clustering: K-means – Use Cases – Overview of the Method – Perform a K-means Analysis using R –								11

	Classification – Decision Trees – Overview of a Decision Tree – Decision Tree Algorithms – Evaluating a Decision Tree – Decision Tree in R – Bayes’ Theorem – Naïve Bayes Classifier – Smoothing – Naïve Bayes in R.	
V	ARTIFICIAL INTELLIGENCE: Machine Learning and Deep Learning in data science-clustering, association rules. Linear regression-logistic regression-Additional regression methods.	11
VI	Contemporary Issues: Expert lectures, online seminars– webinars	2
TOTAL		60
Expected Course Outcomes:		
On the successful completion of the course, students will be able to:		
CO	Course Outcomes	
CO1	Understand the concept of 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 clustering algorithms	
CO5	Analyze regression methods in AI	
K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate; K6-Create		
Textbooks		
1	Introducing Data Science big data, machine learning, and more, using python tools davy cielen arno d. B. Meysman mohamed ali	
2	Data Science & Big Data Analytics Discovering, Analyzing, Visualizing and Presenting Data EMC Education Services, WILEY	
3	Introducing Data Science Big Data Machine Learning and more using Python-tools-2016. Pdf	
4	Data science in big data analytics-Wiley2015JohnWiley&Sons	
Reference Books		
1	A simple introduction to Data Science – Lars Nielson 2015	

CORE LAB V: DIGITAL IMAGE PROCESSING Using MATLAB

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26PCCSP5	0	0	4	III	2	4	50	50	100
Learning Objectives									
LO1	To understand the basics of Digital Image Processing fundamentals, image enhancement and image restoration techniques								
LO2	To enable the students to learn the fundamentals of image compression and segmentation								
LO3	To understand Image Restoration & Filtering Techniques								
LO4	Implementation of the above using MATLAB								
LO5	Evaluate model performance and interpret results for real-world business applications.								
Prerequisites:									
Contents									
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									
Total Hours								60 Hours	
Expected Course Outcomes:									
On the successful completion of the course, students will be able to:									
CO	Course Outcomes								
CO1	To write programs in MATLAB for image processing using the techniques K1,K2								

CO2	To able to implement Image Enhancements & Restoration techniques K2,K3
CO3	Capable of using Compression techniques in an Image K3,K4
CO4	Able to manipulate the image and Segment it K5,K6
K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate; K6-Create	
Textbooks	
1	Rafael C.Gonzalez, Richard E.Woods, “Digital Image Processing”, Second Edition, PHI/Pearson Education.
2	B.Chanda, D.Dutta Majumder, “Digital Image Processing and Analysis”, PHI, 2003
Reference Books	
1	Nick Efford,“Digital Image Processing a practical introducing using Java”,Pearson Education, 2004.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websitesetc.]	
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

Mapping with Programming Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	S	S	M	S	S	S	M	M	S	M
CO 2	S	S	S	S	S	S	S	M	S	S
CO 3	S	S	S	S	S	S	S	M	S	S
CO 4	S	S	S	S	S	S	S	M	S	S

Elective 5- 1 : DEEP LEARNING

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26PECS31	4	0	0	III	4	4	50	50	100
Learning Objectives									
LO1	To introduce the fundamental techniques and principles of Neural Networks								
LO2	To familiarize fundamental concepts in Deep Learning								
LO2	Implement deep learning models using frameworks such as TensorFlow or PyTorch.								
LO4	Evaluate model performance using appropriate metrics and techniques to prevent overfitting.								
LO5	Explore applications of deep learning in areas such as computer vision, natural language processing, and speech recognition.								
Prerequisites:									
Unit	Contents								No. of Hours
I	INTRODUCTION: Introduction to Neural Networks – Introduction – Basic Architecture of Neural Networks – Training and Neural Network with Backpropagation – Practical Issues in Neural Network Training – The Secrets to the Power of Function Composition – Common Neural Architectures – Advanced Topics.								12
II	Machine Learning with Shallow Neural Networks: Introduction – Neural Architectures for Binary Classification Models – Neural Architectures for Multiclass models – Back propagated saliency for Feature Selection – Matrix Factorization with Auto encoders – Simple Neural Architectures for Graph Embedding.								12
III	Training Deep Neural Networks: Introduction – Backpropagation – Setup and Initialization issues – The vanishing and exploding gradient problems – Gradient Descent Strategies’ –Batch Normalization–Teaching Deep Learners to Generalize: Introduction –The Bias-Variance trade-off – Generalization issues in model								12

	tuning and evaluation – Penalty based regularization – Ensemble methods – Early Stopping – Unsupervised pre-training – Continuation and Curriculum learning – Parameter sharing – Regularization in Unsupervised Applications.	
IV	Recurrent Neural Networks: Introduction – Architecture of Recurrent Neural Networks –The challenges of training recurrent Networks–Echo-State Networks– Long Short-Term Memory – Gated Recurrent Units – Applications of 73 Recurrent Neural Networks. Convolutional Neural Networks: Introduction – The Basic Structure of a Convolutional Network – Training a Convolutional Network – Case studies of Convolutional Architectures – Visualization and Unsupervised Learning – Applications of Convolutional Networks.	10
V	Deep Reinforcement Learning: Introduction – Stateless Algorithms – The basic framework of Reinforcement Learning – Bootstrapping for value function learning– Policy Gradient Methods – Monte Carlo Tree Search – Case Studies – Practical Challenges associated with safety. Advanced Topics associated with Deep Learning: Generative adversarial networks (GAN) – Competitive Learning – Limitations of Neural Networks	12
VI	Contemporary Issues: Expert lectures, online seminars– webinars	2
TOTAL		60
Expected Course Outcomes:		
On the successful completion of the course, students will be able to:		
CO	Course Outcomes	
CO1	Become familiar with the fundamental concepts in Deep Learning	
CO2	Explore the use of Deep Learning Technology in computer vision, speech analysis, healthcare, agriculture, and understanding climate change.	
CO3	Apply Deep Learning technology in computer vision, speech analysis, Health care, agriculture, and understanding climate change	

CO4	Analyze Deep Reinforcement Learning
CO5	Evaluate the Practical Challenges in Deep Learning
K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate; K6-Create	
Textbooks	
1	1. Charu C. Aggarwal, Neural Networks and Deep Learning, Springer 2018
Reference Books	
1	Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, The MIT Press, 2016
2	Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, The MIT Press, 2016
3	Josh Patterson, Adam Gibson, Deep Learning: A Practitioner's Approach 1st Edition, O'Reilly' 2017

Mapping with Programming Outcomes

[illegible]

Elective 5-2 : BIG DATA ANALYTICS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26PECS32	4	0	0	III	4	4	50	50	100
Learning Objectives									
LO1	To understand the fundamental concepts of big data and analytics.								
LO2	To explore tools and practices for working with big data								
LO3	To know about the research with the integration of large amounts of data.								
LO4	Implement analytical methods including data mining, machine learning, and real-time processing.								
LO5	Utilize big data tools and technologies for storage, processing, and visualization.								
Prerequisites:									
Unit	Contents								No. of Hours
I	INTRODUCTION:Introduction to Big Data Analytics: Big Data Overview–Data Structures–Analyst Perspective on Data Repositories - State of the Practice in Analytics – BI Versus Data Science - Current Analytical Architecture – Drivers of Big Data – Big Data Ecosystem – Key Role for the New Big Data Ecosystem.								12
II	BIG DATA TECHNOLOGIES & TOOLS: Advanced Analytics-Technology and Tools: MapReduce and Hadoop: Analytics for Unstructured Data. - Use Cases - MapReduce - Apache Hadoop – The Hadoop Ecosystem – pig – Hive – Hbase – Mahout – NoSQL - Tools in Database Analytics: SQL Essentials – Joins – Set operations – Grouping Extensions – In Database Text Analysis - Advanced SQL – Windows Functions – User Defined Functions and Aggregates – ordered aggregates- MADLib.								12
III	CLUSTERING AND CLASSIFICATION: iew of the Method - Determining the Number of Clusters - Diagnostics - Reasons to Choose and Cautions .- Classification: Decision Trees - Overview								12

	of a Decision Tree - The General Algorithm - Decision Tree Algorithms - Evaluating a Decision Tree - Decision Trees in R - Naïve Bayes - Bayes_ Theorem - Naïve Bayes	
IV	Time Series Analysis: Overview –Box–Jenkins Methodology–ARIMA Model Autocorrelation Function – Autoregressive Models – Moving Average Models – ARMA and ARIMA Models–Building and Evaluating and ARIMA Model-Text Analysis: Text Analysis Steps – Example – Collecting – Representing Term Frequency – Categorizing – Determining Sentiments – Gaining Insights	10
V	Machine Learning with BIG DATA & Applications: MACHINE LEARNING BASICS- Classifying with Nearest Neighbors -SVM REGRESSION: Logistic-Tree based Regression-A-Priori Algorithm-Principal Component Analysis-Neural Network-spam filtering-Ranking-Multidimensional Scaling-Social Graphing Application Evolution, Big Data Analysis Fields - Structured Data Analysis, Text Data Analysis,Web Data Analysis, Multimedia Data Analysis, Network Data Analysis, Mobile Traffic Analysis, Key Applications - Application of Big Data in Enterprises, Application of IoT Based Big Data, Application of Online Social Network-Oriented Big Data, Applications of Healthcare and Medical Big Data, Collective Intelligence, Smart Grid.	12
VI	Contemporary Issues: Expert lectures, online seminars– webinars	2
TOTAL		60
Expected Course Outcomes:		
On the successful completion of the course, students will be able to:		
CO	Course Outcomes	
CO1	Acquire knowledge of the basics of Big Data	
CO2	Work with big data tools	
CO3	Design efficient algorithms for mining data from large volumes	

CO4	Explore the cutting-edge tools and technologies to analyse Big Data
CO5	Appreciate Big Data Processing concepts and Data visualization techniques
K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate; K6-Create	
Textbooks	
1	Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, EMC Education Services Published by John Wiley & Sons
2	Noreen Burlingame, “The Little Book on Big Data”, NewStreetpublishers,2012
3	Anil Maheshwari, “Data Analytics”, McGrawHillEducation,2017.
4	Kim S.Priesand Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers " CRC Press, 2015.
5	Min Chen, Shiwen Mao, Yin Zhang,Victor C.M. Leung, “Big Data: Related Technologies, challenges and Future Prospects”, Springer; 2014 edition
Reference Books	
1	David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013.
2	Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.
3	DietmarJannachandMarkusZanker, "Recommended Systems: An Introduction", Cambridge University Press, 2010.
4	Tom White, “Hadoop- The Definitive Guide”, O’reilly, 2nd Edition.
5	Vignesh Prajapati,”Big Data Analytics with R and Hadoop”, PACKT Publishing,November 2013.

Mapping with Programming Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	L	M	L	L	M	S	M	M	M	M
CO 2	S	S	S	M	M	S	M	M	S	S
CO 3	S	S	S	S	M	S	S	M	S	S
CO 4	S	S	S	S	S	S	S	M	S	S
CO 5	S	S	S	S	S	S	S	M	S	S

Elective 5-3 : CRITICAL THINKING, DESIGN THINKING AND PROBLEM-SOLVING

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26PECS33	4	0	0	III	4	4	50	50	100
Learning Objectives									
LO1	Learn critical thinking and its related concepts.								
LO2	Learn design thinking and its related concepts								
LO3	Develop Thinking patterns, Problem solving & Reasoning								
LO4	Develop creative and user-centered solutions for real-world challenges.								
LO5	Communicate ideas effectively through collaboration, visualization, and presentation techniques.								
Prerequisites:									
Unit	Contents								No. of Hours
I	CRITICAL THINKING: Critical Thinking: Definition, Conclusions and Decisions, Beliefs and Claims, Evidence-finding, evaluation, Inferences, Facts – opinion, probable truth, probably false, Venn diagram. Applied critical thinking: Inference, Explanation, Evidence, Credibility, Two Case Studies, critical thinking and science, critical evaluation, self-assessment.								12
II	DESIGN THINKING: Design Thinking: Introduction, Need of Design Thinking, problem to question - design thinking process, Traditional Problem Solving versus Design Thinking, phases of Design Thinking, problem exploration, Stakeholder assessment, design thinking for manufacturers, smart idea to implementation.								12
III	CASE STUDY: Thinking to confidence, fear management, duty Vs passion, Team management, Tools for Thinking, prototype design, Relevance of Design and Design Thinking in engineering, human-centred design, case study: apply design thinking in problem.								12

IV	PROBLEM-SOLVING: Problem-solving: problem definition, problem-solving methods, selecting and using information, data processing, solution methods, solving problems by searching, recognizing patterns, spatial 59 reasoning, necessity and sufficiency, choosing and using models, and making choices and decisions.	12
V	Reasoning: Deductive and hypothetical reasoning, computational problem solving; generating, implementing, and evaluating solutions, interpersonal problem solving. Advanced problem solving: Combining skills – using imagination, developing models, Carrying out investigations, Data analysis and inference. Graphical methods of solution, Probability, tree diagrams and decision trees	10
VI	Contemporary Issues: Expert lectures, online seminars– webinars	2
TOTAL		60
Expected Course Outcomes:		
On the successful completion of the course, students will be able to:		
CO	Course Outcomes	
CO1	https://nptel.ac.in/courses/109/104/109104109/	
CO2	Focus on the explicit development of critical thinking and problem-solving skills	
CO3	Apply design thinking to problems	
CO4	Decide and take action based on the analysis	
CO5	Analyze the concepts of Thinking patterns, Problem-solving & Reasoning in real-time applications	
K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate; K6-Create		
Textbooks		
1	John Butterworth and Geoff Thwaites, Thinking skills: Critical Thinking and Problem Solving, Cambridge University Press, 2013.	
2	H.S. Fogler and S.E. LeBlanc, Strategies for Creative Problem Solving, 2nd edition, Pearson, Upper Saddle River, NJ, 2008.	

Core: Mini Project

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26PCCS3P	0	0	6	III	3	6	50	50	100
Learning Objectives									
LO1	To enable the third-semester students to study Project development								
LO2	To undertake a unique project title								
LO3	To get a novel idea for the project								
LO4	To define the problem								
LO5	To design and implement using a n available software development tool Programming								
LO6	Prepare a report								
Mini Project Guidelines									
Mode of Mini Project: Individual Project									
Nature of Mini Project: Every student shall undertake a unique project title (Novel Concept/ idea/system or a small research problem, which shall be designed and implemented using Web Application Development and hosting using open-source software like Python, PHP, HTML,.NET etc., approved by her/his guide.									
Total Hours : 90									
Guide: Each Student shall be allotted under the Guidance of one Department faculty member by the Programme coordinator/Head									
Expected Course Outcomes:									
On the successful completion of the course, students will be able to:									
CO	Course Outcomes								
CO1	To define the problem								
CO2	Design the Project using Software tools								
CO3	Capable of implementing the problem with techniques								
CO4	Report Formation								
CO5	Present the project outcomes through reports, documentation, and oral presentations.								
K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate; K6-Create									

Mapping with Programming Outcomes

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Skill Enhancement Course 1: CLOUD COMPUTING TOOLS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26PECS3B	3	0	0	III	2	3	50	50	100
Learning Objectives									
LO1	Analyze the components of cloud computing showing how business agility in an organization can be created								
LO2	Evaluate the deployment of web services from cloud architecture								
LO3	Critique the consistency of services deployed from an architecture								
LO4	Compare and contrast the economic benefits delivered by various cloud models based on application requirements, economic constraints and business requirements.								
LO5	Integrate and automate workflows using cloud tools for scalable and efficient application development.								
Prerequisites:									
Unit	Contents								No. of Hours
I	Introduction : Basic Concepts and Terminology-Goals and Benefits-Risk and Challenges								09
II	Fundamental Concepts and Models : Roles and Boundaries-Cloud Characteristics-Cloud Delivery Model: IaaS, PaaS, SaaS, Comparing Cloud Delivery Model, Combining Cloud Delivery Model-Cloud Deployment Model.								09
III	Cloud Enabling Technology : Broadband Networks and Internet Architecture-Data Center Technology-Virtualization Technology Web Technology-Multitenant Technology-Service Technology.								09
IV	Developing for Cloud : Cloud Application Design: Introduction-Design Considerations for Cloud Applications-Cloud Application Design Methodologies-Data Storage Approach								09

V	Service Development : Development environments for service development; Amazon, Azure, Google App.	09
TOTAL		45
Expected Course Outcomes:		
On the successful completion of the course, students will be able to:		
CO	Course Outcomes	
CO1	https://nptel.ac.in/courses/109/104/109104109/	
CO2	Focus on the explicit development of critical thinking and problem-solving skills	
CO3	Apply design thinking to problems	
CO4	Decide and take action based on the analysis	
CO5	Analyze the concepts of Thinking patterns, Problem-solving & Reasoning in real-time applications	
K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate; K6-Create		
Textbooks		
1	Cloud Computing Concepts, Technology & Architecture by Thomas Erl, Zaigham Mahmood, and Ricardo Puttini	
2	"Cloud Computing: A Hands-On Approach" by Arshdeep Bahga and Vijay Madisetti,2014	
Reference Books		
1	The Basics of Cloud Computing: Understanding the Fundamentals of Cloud Computing in Theory and Practice by Derrick Rountree and Ileana Castrillo 2013	
2	"Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)" by Michael J. Kavis	

Semester IV

	FOURTH SEMESTER							
Course Code	Course Category	Title of the Course	Credits	Hours		Maximum Marks		
				Theory	Practical	CIA	ESE	Total
26PCCS4P	Core Project	Project work and Viva- voce	18		30	50	50	100
		Extension Activity	1	-				
	Total		19		30			

Core: Major Project

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26PCCS4P	0	0	30	IV	18	-	50	50	100
Learning Objectives									
LO1	To enable the third-semester students to study Project development								
LO2	To undertake a unique project title								
LO3	To get a novel idea for the project								
LO4	To define the problem								
LO5	To design and implement using a n available software development tool / Programming								
LO6	Prepare a report								
Major Project Guidelines									
Nature of Major Project: Every student must choose a unique project title (novel concept, idea, system, or a small research problem) approved by their guide and then design and implement it using available software development tools or programming languages.									
Guide: Each Student shall be allotted under the Guidance of one Department faculty member by the Programme coordinator/Head									
Duration : One semester - (30 hours per week) Major project students may also opt for company projects with prior permission from the Head of the Department/Principal									
Continuous Assessment: Based on periodic reviews (Three reviews during the Semester. Tentative review dates are decided by the department and to be intimated to the students at the beginning of the fourth Semester)									
Expected Course Outcomes:									
On the successful completion of the course, students will be able to:									
CO	Course Outcomes								
CO1	To define the problem								
CO2	Design the Project using Software tools K2,K3								
CO3	Capable of implementing the problem with techniques K3,K4								

CO4	Report Formation K5,K6
CO5	Present the project outcomes through reports, documentation, and oral presentations.
K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate; K6-Create	

Mapping with Programming Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	S	S	M	S	M	S	M	M	S	S
CO 2	S	S	S	S	S	S	S	M	S	S
CO 3	S	S	S	S	S	S	S	M	S	S
CO 4	S	S	S	S	S	S	S	M	S	S
CO 5	S	S	S	S	S	S	S	M	S	S

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26PCCS4P	0	0	0	IV	2	-	50	50	100
Learning Objectives									
LO1	To build the necessary skills								
LO2	To gain industry working Experience								
LO3	To a high capacity for analysis to solve problems								
LO4	To achieve a goal								
LO5	To adapting easily to changes								
Expected Course Outcomes:									
On the successful completion of the course, students will be able to:									
CO	Course Outcomes								
CO1	to build the necessary skills								
CO2	to gain industry working Experience								
CO3	a high capacity for analysis to solve problems								
CO4	Report Formation								
CO5	Prepare and present reports reflecting learning experiences, outcomes, and future scope.								
K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate; K6-Create									
Rules and Regulations									
1	Each Student has to undergo 25 days institutional/industry-based training during the fourth semester summer vacation								
2	Internships could be undertaken in different media organizations, industries and educational institutions which should be approved by the department								
3	Students should keep a detailed record of activities performed and hours spent in training and report the same to the Faculty Coordinator/Mentor/Guide regularly about the progress of internship on weekly basis								
4	At the end of the internship, the student must submit a full-fledged detailed internship report (not exceeding 20 pages) along with attendance certificate.								