ANNAMALAI UNIVERSITY
(Affiliated Colleges)

412 - M. Sc. COMPUTER SCIENCE

Programme Structure and Scheme of Examination (under CBCS)
(Applicable to the candidates admitted from the academic year 2023 -2024 onwards)

Part	Course Code	Study Components & Course Title	Credit	Hours/ Week	CIA	ESE	Total
		SEMESTER – I					
A	23PCSCC11	**Core – I:** Analysis & Design of Algorithms	5	7	25	75	100
	23PCSCC12	**Core – II:** Python Programming	5	7	25	75	100
	23PCSCP13	**Core – III:** Algorithm and Python Lab	4	6	25	75	100
	23PCSCE14-1/ 23PCSCE14-2/ 23PCSCE14-3	**Elective – I:** Advance Software Engineering (or) Multimedia and its Applications (or) Object Oriented Analysis and Design	3	5	25	75	100
	23PCSCE15-1/ 23PCSCE15-2	**Elective – II:** Embedded Systems (or) Internet of Things	3	5	25	75	100
		Total	**20**	**30**			**500**
		SEMESTER – II					
A	23PCSCC21	**Core – IV:** Data Mining and Warehousing	5	6	25	75	100
	23PCSCP22	**Core – V:** Data Mining and Advanced Java Programming Lab	5	6	25	75	100
	23PCSCC23	**Core – VI:** Advanced Java Programming	4	6	25	75	100
	23PCSCE24-1/ 23PCSCE24-2/ 23PCSCE24-3	**Elective – III:** Artificial Intelligence & Machine Learning (or) Critical Thinking, Design Thinking and Problem Solving (or) Advanced Operating System	3	4	25	75	100
	23PCSCE25-1/ 23PCSCE25-2	**Elective – IV:** Mobile Computing/ (or) Blockchain Technology	3	4	25	75	100
B (i)	23PCSCS26	**Skill Enhancement Course [SEC] – I:** Object Oriented Programming through Java, HTML Basics	2	4	25	75	100
			22	**30**			**600**

SEMESTER – III							
A	23PCSCC31	**Core – IX:** Digital Image Processing	5	6	25	75	100
	23PCSCC32	**Core – X:** Cloud Computing	5	6	25	75	100
	23PCSCC33	**Core – XI:** Network Security and Cryptography	5	6	25	75	100
	23PCSCC34	**Core – X:** Data Science & Analytics	4	6	25	75	100
	23PCSCE35	**Elective – V:** Digital Image Processing Lab using MATLAB (Practical)	3	3	25	75	100
B (i)	23PCSCS36	**Skill Enhancement Course [SEC] – II:** Cloud Computing Lab (Practical)	2	3	25	75	100
B (ii)	23PCSCI37	Summer Internship*	2	--	25	75	100
			26	**30**			**700**
SEMESTER – IV							
A	23PCSCP41	**Core – XI:** Data Analytics Lab	5	6	25	75	100
	23PCSCP42	**Core – XII:** Web Application Development & Hosting (Practical)	5	6	25	75	100
	23PCSCD43	Project work and Viva-voce	7	10	25	75	100
	23PCSCE44-1 23PCSCE44-2	Elective VI: Introduction to Robotics (or) Virtual and Augmented Reality	3	4	25	75	100
B (i)	23PCSCS45	Skill Enhancement Course - Professional Competency Skill: Soft Skills	2	4	25	75	100
C	23PCSCX46	Extension Activity	1	--	100		100
			23	**30**			**600**
			91				**2400**

* Students should complete two weeks of internship before the commencement of III semester.

Credit Distribution

Study Components	Papers	Total Credits	Marks/Sub	Total Marks
Core Theory	8	38	100	800
Core Practical	4	19		400
Core Electives	6	18	100	600
Skill Enhancement Courses SEC1, SEC2, SEC3	3	6	100	300
Internship/Industrial Activity (Carried out in Summer Vacation at the end of I Year – Two Weeks Period)	1	2	100	100
Project	1	7	100	100
Extension Activity	1	1	100	100
	24	**91**		**2400**

Credit Distribution for PG Science Programme

Part	Course Details	No. of courses	Credit per course	Total Credit
A	Core Theory	8	4/5	**38**
	Core Practical	4	4/5	**19**
	Elective Course	6	3	**18**
	Project Work with VIVA-VOCE	1	7	**7**
B(i)	Skill Enhancement Course	3	2	**6**
B(ii)	Summer Internship	1	2	**2**
C	Extension Activity	1	1	**1**
				91

Component-wise Credit Distribution

Part	Courses	Sem I	Sem II	Sem III	Sem IV	Total
A	Core (including Practical and Project)	14	14	19	17	**64**
	Elective	6	6	3	3	**18**
B(i)	Skill Enhancement Course	-	2	2	2	**6**
B(ii)	Summer Internship	-	-	2	-	**2**
C	Extension Activity	-	-	-	1	**1**
						91

Part A and B(i) component will be taken into account for CGPA calculation for the post graduate programme and the other components Part B(ii) and C have to be completed during the duration of the programme as per the norms, to be eligible for obtaining PG degree.

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.

SEMESTER: I PART: A CORE COURSE – I	23PCSCC11: ANALYSIS & DESIGN OF ALGORITHMS	CREDIT:5 HOURS:7

Course Objectives:
The main objectives of this course are to: 1. Enable the students to learn the Elementary Data Structures and algorithms. 2. Presents an introduction to the algorithms, their analysis and design 3. Discuss various methods like Basic Traversal And Search Techniques, divide and conquer method, Dynamic programming, backtracking 4. Understood the various design and analysis of the algorithms.

Expected Course Outcomes:		
On the successful completion of the course, student will be able to:		
1	Get knowledge about algorithms and determines their time complexity. Demonstrate specific search and sort algorithms using divide and conquer technique.	K1,K2
2	Gain good understanding of Greedy method and its algorithm.	K2,K3
3	Able to describe about graphs using dynamic programming technique.	K3,K4
4	Demonstrate the concept of backtracking & branch and bound technique.	K5,K6
5	Explore the traversal and searching technique and apply it for trees and graphs.	K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	INTRODUCTION	15hours

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.

Unit:2	TRAVERSAL AND SEARCH TECHNIQUES	15hours

Basic Traversal And Search Techniques: Techniques for Binary Trees-Techniques for Graphs -Divide and Conquer: - General Method – Binary Search – Merge Sort – Quick Sort.

Unit:3	GREEDY METHOD	15hours

The Greedy Method:- General Method–Knapsack Problem–Minimum Cost Spanning Tree– Single Source Shortest Path.

Unit:4	DYNAMIC PROGRAMMING	15hours

Dynamic Programming-General Method–Multistage Graphs–All Pair Shortest Path–Optimal Binary Search Trees – 0/1 Knapsacks – Traveling Salesman Problem – Flow Shop Scheduling.

Unit:5	BACK TRACKING	13hours

Backtracking:-General Method–8-Queens Problem–Sum Of Subsets–Graph Coloring– Hamiltonian Cycles – Branch And Bound: - The Method – Traveling Salesperson.

Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars– webinars		
	Total Lecture hours	75hours

	Text Books
1	Ellis Horowitz, "Computer Algorithms", Galgotia Publications.
2	Alfred V.Aho ,John E.Hopcroft,Jeffrey D.Ullman, "Data Structures and Algorithms".
	Reference Books
1	Goodrich,"DataStructures&AlgorithmsinJava",Wiley3rd edition.
2	Skiena,"TheAlgorithmDesignManual",SecondEdition,Springer,2008
3	Anany Levith,"Introduction to the Design and Analysis of algorithm", Pearson Education Asia, 2003.
4	Robert Sedgewick, Phillipe Flajolet, "An Introduction to the Analysis of Algorithms", Addison-Wesley Publishing Company,1996.
	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1	https://nptel.ac.in/courses/106/106/106106131/
2	https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm
3	https://www.javatpoint.com/daa-tutorial

Mapping with Programming Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	M	S	L	M	L	S	M
CO2	S	S	S	S	S	M	S	M	S	M
CO3	S	S	S	S	S	M	S	M	S	M
CO4	S	S	S	S	S	M	S	M	S	M
CO5	S	S	S	S	S	M	S	M	S	M

*S-Strong; M-Medium; L-Low

SEMESTER: I PART: A CORE COURSE – II	23PCSCC12: PYTHON PROGRAMMING	CREDIT:5 HOURS:7

Course Objectives:

The main objectives of this course are to:

1. Presents an introduction to Python, creation of web applications, network applications and working in the clouds
2. Use functions for structuring Python programs
3. Understand different Data Structures of Python
4. Represent compound data using Python lists, tuples and dictionaries

Expected Course Outcomes:

On the successful completion of the course ,student will be able to:

1	Understand the basic concepts of Python Programming	K1,K2
2	Understand File operations, Classes and Objects	K2,K3
3	Acquire Object Oriented Skills in Python	K3,K4
4	Develop web applications using Python	K5
5	Develop Client Server Networking applications	K5,K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	INTRODUCTION	15hours

Python: Introduction–Numbers–Strings–Variables–Lists–Tuples–Dictionaries–Sets– Comparison.

Unit:2	CODE STRUCTURES	15hours

Code Structures: if, elseif, and else – Repeat with while – Iterate with for – Comprehensions – Functions – Generators – Decorators – Namespaces and Scope – Handle Errors with try and except – User Exceptions.

Unit:3	MODULES, PACKAGES AND CLASSES	15hours

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–In self Defense –Get and Set Attribute Values with Properties –Name Mangling for Privacy – Method Types – Duck Typing – Special Methods –Composition.

Unit:4	DATA TYPES AND WEB	13hours

Data Types: Text Strings–Binary Data. **Storing and Retrieving Data:** File Input/Output– Structured Text Files – Structured Binary Files - Relational Databases – No SQL Data Stores. **Web:** Web Clients – Web Servers–Web Services and Automation

Unit:5	SYSTEMS AND NETWORKS	15hours

Systems: Files–Directories–Programs and Processes–Calendars and Clocks.

Concurrency: Queues– Processes–Threads–Green Threads and gevent–twisted–Redis.

Networks: Patterns – The Publish-Subscribe Model – TCP/IP – Sockets – ZeroMQ –Internet Services – Web Services and APIs – Remote Processing – Big Fat Data and MapReduce – Working in the Clouds.

Unit:6	Contemporary Issues	2 hours
	Expert lectures, online seminars –webinars	
	Total Lecture hours	**75hours**

	Text Books
1	Bill Lubanovic, "Introducing Python", O'Reilly, First Edition-Second Release, 2014.
2	Mark Lutz, "Learning Python", O' Reilly, Fifth Edition, 2013.
	Reference Books
1	David M. Beazley,"Python Essential Edition,2009. Reference", Developer's Library Fourth
2	Sheetal Taneja, Naveen Kumar, Approach", Pearson Publications. "Python Programming-A Modular.
	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1	https://www.programiz.com/python-programming/
2	https://www.tutorialspoint.com/python/index.htm
3	https://onlinecourses.swayam2.ac.in/aic20_sp33/preview

Mapping with Programming Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	M	M	S	M
CO2	S	S	S	S	S	S	S	M	S	M
CO3	S	S	S	S	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	S	M
CO5	S	S	S	S	S	S	S	M	S	M

*S-Strong; M-Medium; L-Low

SEMESTER: I PART: A PRACTICAL - I	23PCSCP13: ALGORITHM AND PYTHON LAB	CREDIT: 4 HOURS: 6

Course Objectives:

The main objectives of this course are to:

1. This course covers the basic data structures like Stack, Queue, Tree, List and Elementary data items, lists, dictionaries, sets and tuples in Python.
2. This course enables the students to learn the applications of the data structures using various techniques
3. It also enable the students to understand C++language with respect to OOAD concepts
4. Application of OOPS concepts in Python.
5. To develop web applications using Python

Expected Course Outcomes:	

On the successful completion of the course, student will be able to:

1	Understand the concepts of object oriented with respect to C++ and able to write programs in Python using OOPS concepts.	K1,K2
2	Able to understand and implement OOPS concepts and to understand the concepts of File operations and Modules in Python.	K3,K4
3	Implementation of data structures like Stack, Queue, Tree, List using C++ and Implementation of lists, dictionaries, sets and tuples as programs.	K4,K5
4	Application of the data structures for Sorting, Searching using different techniques and to develop web applications using Python.	K5,K6

K1-Remember; **K2**-Understand; **K3**-Apply; **K4**-Analyze; **K5**-Evaluate; **K6**-Create

LIST OF PROGRAMS	75 hours

Algorithm Lab:

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 knapsack problem using greedy method

8) Write a program to search for an element in a tree using divide& conquer strategy.

9) Write a program to place the 8 queens on an 8X8 matrix so that no two queens Attack.

Python Lab:

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 webpages using forms.

Expert lectures, online seminars –webinars		
	Total Lecture hours	**75hours**

Text Books	
1	Goodrich, "Data Structures & Algorithms in Java", Wiley 3rd edition.
2	Skiena, "The Algorithm Design Manual", Second Edition, Springer, 2008.
3	Bill Lubanovic, "Introducing Python", O'Reilly, First Edition-Second Release, 2014.
4	Mark Lutz," Learning Python", O'Reilly, Fifth Edition, 2013.

Reference Books	
1	Anany Levith,"Introduction to the Design and Analysis of algorithm", Pearson Education Asia, 2003.
2	Robert Sedge wick, Phillipe Flajolet, "An Introduction to the Analysis of Algorithms", Addison-Wesley Publishing Company,1996.
3	David M. Beazley, " Python Essential Reference", Developer's Library, Fourth Edition, 2009.
4	Sheetal Taneja, Naveen Kumar, "Python Programming-A Modular Approach" ,Pearson Publications.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://onlinecourses.nptel.ac.in/noc19_cs48/preview
2	https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs19/
3	https://www.tutorialspoint.com/object_oriented_analysis_design/ooad_object_oriented_analysis.htm
4	https://www.programiz.com/python-programming/
5	https://www.tutorialspoint.com/python/index.htm
6	https://onlinecourses.swayam2.ac.in/aic20_sp33/preview

Mapping with Programming Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	S	S	M	M	S	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low

SEMESTER: I PART: A ELECTIVE : I	23PCSCE14-1: ADVANCE SOFTWARE ENGINEERING	CREDIT: 3 HOURS: 5

Course Objectives:

The main objectives of this course are to:

1. Introduce Software Engineering, Design, Testing and Maintenance.
2. Enable the students to learn the concepts of Software Engineering.
3. Learn about Software Project Management, Software Design &Testing.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand about Software Engineering process	K1,K2
2	Understand about Software project management skills, design and quality management	K2,K3
3	Analyze on Software Requirements and Specification	K3,K4
4	Analyze on Software Testing, Maintenance and Software Re-Engineering	K4,K5
5	Design and conduct various types and levels of software quality for a software project	K5,K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	INTRODUCTION	15hours

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.

Unit:2	SOFTWARE REQUIREMENTS	15hours

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.

Unit:3	PROJECT MANAGEMENT	15hours

Software Project Management: Responsibilities of a software project manager – Project planning – Metrics for Project size estimation – Project 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.

Unit:4	SOFTWARE DESIGN	15hours

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.

Unit:5	SOFTWARE TESTING	13hours

Software Testing: A Strategic approach to software testing – Terminologies – Functional testing– Structural testing – Levels of testing – Validation testing - Regression testing – Art of Debugging– Testingtools-Metrics-ReliabilityEstimation.SoftwareMaintenance -Maintenance Process - Reverse Engineering – Software Re-engineering - Configuration Management Activities.

Unit:6	Contemporary Issues	2 hours

Expert lectures, online seminars –webinars

		Total Lecture hours	75hours

Text Books

1	An Integrated Approach to Software Engineering–Pankaj Jalote, Narosa Publishing House, Delhi, 3rd Edition.
2	Fundamentals of Software Engineering –Rajib Mall, PHI Publication,3rd Edition.

Reference Books

1	Software Engineering–K.K.Aggarwal and Yogesh Singh, New Age International Publishers, 3rd edition.
2	A Practitioners Approach-Software Engineering,-R.S.Pressman, McGraw Hill.
3	Fundamentals of Software Engineering - Carlo Ghezzi, M. Jarayeri, D. Manodrioli, PHI Publication.

Related Online Contents[MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://www.javatpoint.com/software-engineering-tutorial
2	https://onlinecourses.swayam2.ac.in/cec20_cs07/preview
3	https://onlinecourses.nptel.ac.in/noc19_cs69/preview

Mapping with Programming Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	M	M	M	M
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low

SEMESTER: I PART: A ELECTIVE : I	23PCSCE14-2: MULTIMEDIA AND ITS APPLICATIONS	CREDIT: 3 HOURS: 5

Course Objectives:

The main objectives of this course are to:

1. To introduce the students about the concepts of Multimedia, Images & Animation.
2. To introduce Multimedia authoring tools
3. To understand the role of Multimedia in Internet
4. To know about High Definition Television and Desktop Computing– Knowledge based Multimedia systems

Expected Course Outcomes:	

On the successful completion of the course, student will be able to:

1	Understand the basic concepts of Multimedia	K1,K2
2	Demonstrate Multimedia authoring tools	K2,K3
3	Analyze the concepts of Sound, Images, Video & Animation	K4
4	Apply and Analyze the role of Multimedia in Internet and realtime applications	K4,K5
5	Analyze multimedia applications using HDTV	K5,K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	INTRODUCTION	12hours

What is Multimedia?–Introduction to making Multimedia–Macintosh and Windows Production platforms – Basic Software tools.

Unit:2	MULTIMEDIA TOOLS	12hours

Making Instant Multimedia–Multimedia authoring tools–Multimedia building blocks–Text– Sound.

Unit:3	ANIMATION	10hours

Images–Animation–Video.

Unit:4	INTERNET	12hours

Multimedia and the Internet–The Internet and how it works–Tools for WorldWideWeb– Designing for the World Wide Web.

Unit:5	MULTIMEDIA SYSTEMS	12hours

High Definition Television and Desktop Computing –Knowledge based Multimedia systems.

Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars - webinars		
	Total Lecture hours	60hours

Text Books

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 Jeffloate, "Multimedia in Practice (Technology and Applications)", PHI,2003.

	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1	https://www.tutorialspoint.com/multimedia/index.htm
2	https://www.tutorialspoint.com/basics_of_computer_science/basics_of_computer_science_multimedia.htm
3	https://nptel.ac.in/courses/117/105/117105083/

Mapping with Programming Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	S	M	M	M	S
CO2	S	S	S	S	M	S	M	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

SEMESTER: I PART: A ELECTIVE - I	23PCSCE14-3: OBJECT ORIENTED ANALYSIS AND DESIGN	CREDIT:3 HOURS:5

Course Objectives:
The main objectives of this course are to:

1. Present the object model, classes and objects, object orientation, machine view and model management view.
2. Enables the students to learn the basic functions, principles and concepts of object oriented analysis and design.
3. Enable the students to understand C++ language with respect to OOAD

Expected Course Outcomes:		
On the successful completion of the course, student will be able to:		
1	Understand the concept of Object-Oriented development and modeling techniques	K1,K2
2	Gain knowledge about the various steps performed during object design	K2,K3
3	Abstract object-based views for generic software systems	K3
4	Link OOAD with C++ language	K4,K5
5	Apply the basic concept of OOPs and familiarize to write C++ program	K5,K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	OBJECT MODEL	15hours

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**.**

Unit:2	CLASSES AND OBJECTS	15hours

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.

Unit:3	C++ INTRODUCTION	15hours

IntroductiontoC++-Inputandoutputstatementsin C++-Declarations-controlstructures– Functions in C++.

Unit:4	INHERITANCE AND OVERLOADING	13hours

Classes and Objects–Constructors and Destructors–operators overloading –Type Conversion-Inheritance – Pointers and Arrays.

Unit:5	POLYMORPHISM AND FILES	15hours

MemoryManagementOperators-Polymorphism–Virtualfunctions–Files–Exception Handling – String Handling -Templates.

Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars –webinars		
	Total Lecture hours	75hours

	Text Books
1	"Object Oriented Analysis and Design with Applications", Grady Booch, Second Edition, Pearson Education.
2	"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.
	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1	https://onlinecourses.nptel.ac.in/noc19_cs48/preview
2	https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs19/
3	https://www.tutorialspoint.com/object_oriented_analysis_design/ooad_object_oriented_analysis.htm

Mapping with Programming Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	M	S	M	S	S
CO2	S	S	S	M	S	M	S	M	S	S
CO3	S	S	S	M	S	M	S	M	S	S
CO4	S	S	S	M	S	M	S	M	S	S
CO5	S	S	S	M	S	M	S	M	S	S

 *S-Strong; M-Medium; L-Low

SEMESTER: I PART: A ELECTIVE : II	23PCSCE15-1: EMBEDDED SYSTEMS	CREDIT: 3 HOURS: 5

Course Objectives:

The main objectives of this course are to:

1. Present the introduction to 8051 Microcontroller Instruction Set, concepts on RTOS & Software tools.
2. Gain the knowledge about the embedded software development.
3. Learn about Micro controller and software tools in the embedded systems.

Expected Course Outcomes:	

On the successful completion of the course, student will be able to:

1	Understand the concept of 8051 microcontroller	K1,K2
2	Understand the Instruction Set and Programming	K2,K3
3	Analyze the concepts of RTOS	K3,K4
4	Analyze and design various real time embedded systems using RTOS	K5
5	Debug them all functioning system using various debugging techniques	K5,K6

K1-Remember;**K2**-Understand;**K3**-Apply; **K4**-Analyze;**K5**-Evaluate; **K6**– Create

Unit:1	8051 MICRO CONTROLLER	12Hours

8051Microcontroller:Introduction-8051Architecture-Input/OutputPins,PortsandCircuits- External Memory - Counters / Timers - Serial Data Input / Output –Interrupts

Unit:2	PROGRAMMING BASICS	12Hours

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.

Unit:3	CONCEPTS ON RTOS	12Hours

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, Mailboxes and pipes- Timer Functions-Events - Memory Management-Interrupt Routines in an RTOS Environment.

Unit:4	DESIGN USING RTOS	10Hours

Basic Design using a RTOS: Principles - Encapsulating semaphores and Queues-Hard real time scheduling considerations-Saving memory space and power- introductions to RTL &QNX.

Unit:5	SOFTWARE TOOLS	12Hours

SOFTWARETOOLS:EmbeddedsoftwareDevelopmentTools:HostsandTargetMachines-

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.

Unit:6	Contemporary Issues	2 hours

Expert lectures, online seminars –webinars		
	Total Lecture hours	**60Hours**

	Text Books
1	David E.Simon, "An Embedded Software primer" Pearson Education Asia, 2003.
2	Kenneth J Ayala, "The 8051Microcontroller and Architecture programming and application", Second Edition, Penram International.
	Reference Books
1	Raj Kamal, " Embedded Systems –Architecture, programming and design", Tata McGraw– Hill, 2003.
	Related Online Contents [MOOC, SWAYAM, NPTEL, Website setc.]
1	https://onlinecourses.nptel.ac.in/noc20_cs14/preview
2	https://www.javatpoint.com/embedded-system-tutorial
3	https://www.tutorialspoint.com/embedded_systems/index.htm

Mapping with Programming Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	L	S	M	S	S	M	M	S
CO2	M	M	S	S	M	S	M	S	S	S
CO3	M	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

SEMESTER: I PART: A ELECTIVE : II	23PCSCE15-2: INTERNET OF THINGS	CREDIT: 3 HOURS: 5

Course Objectives:

The main objectives of this course are to:

1. About Internet of Things where various communicating entities are controlled and managed for decision making in the application domain.
2. Enable students to learn the Architecture of IoT and IoT Technologies
3. Developing IoT applications and Security in IoT, Basic Electronics for IoT, ArduinoIDE, Sensors and Actuators Programming NODEMCU using Arduino IDE.

Expected Course Outcomes:		
On the successful completion of the course, student will be able to:		
1	Understand about IoT, its Architecture and its Applications	K1,K2
2	Understand basic electronics used in IoT & its role	K2,K3
3	Develop applications with C using Arduino IDE	K4
4	Analyze about sensors and actuators	K5,K6
5	Design IoT in rea ltime applications using today's internet &wireless technologies	K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	INTRODUCTION	12hours

Introduction to IoT: Evolution of IoT – Definition & Characteristics of IoT - Architecture of IoT– Technologies for IoT – Developing IoT Applications – Applications of IoT – Industrial IoT – Security in IoT

Unit:2	BASIC ELECTRONICS FOR IoT	12hours

Basic Electronics for IoT: Electric Charge, Resistance, Current and Voltage – Binary Calculations – Logic Chips – Microcontrollers – Multipurpose Computers – Electronic Signals – A/D and D/A Conversion – Pulse Width Modulation.

Unit:3	PROGRAMMING USING ARDUINO	12hours

Programming Fundamentals with C using Arduino IDE: Installing and Setting up the Arduino IDE – Basic Syntax – Data Types/ Variables/ Constant – Operators – Conditional Statements and Loops – Using Arduino C Library Functions for Serial, delay and other invoking Functions – Strings and Mathematics Library Functions.

Unit:4	SENSORS AND ACTUATORS	10hours

Sensors and Actuators: Analog and Digital Sensors–Interfacing temperature sensor, ultrasound Sensor and infrared(IR) sensor with Arduino– Interfacing LED and Buzzer with Arduino.

Unit:5	SENSOR DATA IN INTERNET	12hours

Sending Sensor Data Over Internet: Introduction to ESP8266 NODEMCU WiFi Module – Programming NODEMCU using Arduino IDE – Using WiFi and NODEMCU to transmit data from temperature sensor to Open Source IoT cloud platform (ThingSpeak).

Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars –webinars		
	Total Lecture hours	hours

Text Books	
1	Arshdeep Bahga,Vijay Madisetti,"InternetofThings:AHands-OnApproach",2014. ISBN: 978-0996025515
2	Boris Adryan, Dominik Obermaier, Paul Fremantle, "The Technical Foundations of IoT", Artech Houser Publishers, 2017.

Reference Books	
1	Michael Margolis, "Arduino Cookbook", O"Reilly,2011
2	Marco Schwartz, "Internet of Things withESP8266",Packt Publishing, 2016.
3	DhivyaBala, "ESP8266: Step by Step Tutorial for ESP8266 IoT, Arduino NODEMCU Dev. Kit", 2018.

Related Online Contents[MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://onlinecourses.nptel.ac.in/noc20_cs66/preview
2	https://www.javatpoint.com/iot-internet-of-things
3	https://www.tutorialspoint.com/internet_of_things/index.htm

Mapping with Programming Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	M	S	M	M	S	M
CO2	M	S	M	S	M	S	M	S	S	S
CO3	S	S	S	S	M	S	M	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

SEMESTER: II PART: A CORE COURSE – IV	23PCSCC21: DATA MINING AND WAREHOUSING	CREDIT:5 HOURS:6

Course Objectives:

The main objectives of this course are to:

1. Enable the students to learn the concepts of Mining tasks, classification, clustering and Data Warehousing.
2. Develop skills of using recent data mining software for solving practical problems.
3. Develop and apply critical thinking, problem-solving, and decision-making skills.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the basic data mining techniques and algorithms	K1,K2
2	Understand the Association rules, Clustering techniques and Data warehousing contents	K2,K3
3	Compare and evaluate different data mining techniques like classification, prediction, Clustering and association rule mining	K4,K5
4	Design data warehouse with dimensional modeling and apply OLAP operations	K5,K6
5	Identify appropriate data mining algorithms to solve real world problems	K6

K1-Remember;**K2**-Understand;**K3**-Apply; **K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	BASICS AND TECHNIQUES	12hours

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.

Unit:2	ALGORITHMS	12hours

Classification: Introduction –Statistical –based algorithms -distance–based algorithms-decision tree-basedalgorithms-neuralnetwork–basedalgorithms–rule-basedalgorithms–combining techniques.

Unit:3	CLUSTERING AND ASSOCIATION	12hours

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.

Unit:4	DATA WAREHOUSING AND MODELING	11hours

Data warehousing: introduction- characteristics of a data warehouse–data marts–other aspects of datamart.
Online analytical processing: introduction –OLTP & OLAP systems
Data modeling –star schema for multidimensional view –data modeling – multifact star schema or snow flake schema – OLAP TOOLS – State of the market – OLAP TOOLS and the internet.

Unit:5	APPLICATIONS OF DATA WAREHOUSE	11 hours

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.

Unit:6	Contemporary Issues	2 hours
	Expert lectures, online seminars –webinars	
	Total Lecture hours	**60hours**

Text Books

1	Margaret H. Dunham,"Data Mining: Introductory and Advanced Topics", Pearson education,2003.
2	C.S.R. Prabhu, "Data Warehousing Concepts, Techniques, Products and Applications", PHI, Second Edition.

Reference Books

1	ArunK.Pujari,"Data Mining Techniques", Universities Press(India)Pvt. Ltd.,2003.
2	Alex Berson, Stephen J.Smith," Data Warehousing, Data Mining and OLAP",TMCH, 2001.
3	Jiawei Han& Micheline Kamber, "Data Mining Concepts &Techniques", 2001, Academic press.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

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

Mapping with Programming Outcomes									
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	S	S	S	M	M	M	M
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low

SEMESTER: II PART: A PRACTICAL -II	23PCSCP22: DATA MINING AND ADVANCE JAVA PROGRAMMING LAB	CREDIT: 6 HOURS: 5

Course Objectives:

The main objectives of this course are to:

1. To enable the students to learn the concepts of Data Mining algorithms namely classification, clustering, regression.
2. To apply statistical interpretations for the solutions and use visualizations techniques for interpretations.
3. To enable the students to implement the simple programs using JSP, JAR and provide knowledge on using Servlets, Applets.
4. To introduce JDBC and navigation of records and to understand RMI& its implementation.
5. To introduce Socket programming in Java.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Able to write programs using R for Association rules, Clustering techniques and simple Java programmes.	K1,K2
2	To implement data mining techniques like classification, prediction and must be capable of implementing JDBC and RMI concepts.	K2,K3
3	Able to use different visualizations techniques using R and able to write Applets with Event handling mechanism.	K4,K5
4	To apply different data mining algorithms to solve real world applications and To create interactive web based applications using servlets and JSP.	K5,K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

LIST OF PROGRAMS IN DATA MINING	75hours

1. Implement Apriori algorithm to extract association rule of data mining.

2. Implement k-means clustering technique.

3. Implement any one Hierarchal Clustering.

4. Implement Classification algorithm.

5. Implement Decision Tree.

6. Linear Regression.

7. Data Visualization.

LIST OF PROGRAMS IN ADVANCE JAVA	75hours

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 a Employee payslip using JSP.
6. Write a program using JDBC for creating a table, Inserting, Deleting records and list out the records.
7. Write a program using Java servlet to handle form data.

8. Write a simple Servlet program to create a table of all the headers it receives along with their associated values.

9. Write a program in JSP by using session object.
10. Write a program to build a simple Client Server application using RMI.
11. Create an applet for a calculator application.
12. Program to send a text message to another system and receive the text message from the system (use socket programming).

	Total Lecture hours	**75hours**

Text Books	
1	Margaret H. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson education,2003.
2	C.S.R. Prabhu, "Data Warehousing Concepts, Techniques, Products and Applications", PHI, Second Edition.
3	Jamie Jaworski,"Java Unleashed" ,SAMS Techmedia Publications,1999.
4	Campione, Walrath and Huml,"TheJavaTutorial",AddisonWesley,1999.

Reference Books	
1	Arun K.Pujari," Data Mining Techniques", Universities Press(India)Pvt. Ltd.,2003.
2	Alex Berson, Stephen J.Smith, "Data Warehousing, Data Mining and OLAP",TMCH, 2001.
3	Jim Keogh,"The Complete Reference J2EE",Tata McGraw Hill Publishing Company Ltd,2010.
4	David Sawyer McFarland, "Java Script And JQuery-The Missing Manual",Oreilly Publications, 3rd Edition,2011.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.javatpoint.com/data-warehouse
2	https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs12/
3	https://www.btechguru.com/training--it--database-management-systems--file-structures--introduction-to-data-warehousing-and-olap-2-video-lecture--12054--26--151.html
4	https://www.javatpoint.com/servlet-tutorial
5	https://www.tutorialspoint.com/java/index.htm
6	https://onlinecourses.nptel.ac.in/noc19_cs84/preview

Mapping with Programming Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	S	S	M	M	S	S
CO2	S	S	S	S	S	S	S	M	S	M
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low

SEMESTER: II PART: A CORE COURSE – VI	23PCSCC23: ADVANCED JAVA PROGRAMMING	CREDIT:4 HOURS:6

Course Objectives:

The main objectives of this course are to:

1. Enable the students to learn the basic functions, principles and concepts of advanced java programming.
2. Provide knowledge on concepts needed for distributed Application Architecture.
3. Learn JDBC, Servlet packages, JQuery, Java Server Pages and JAR file format

Expected Course Outcomes:		
On the successful completion of the course, student will be able to:		
1	Understand the advanced concepts of Java Programming	K1,K2
2	Understand JDBC and RMI concepts	K2,K3
3	Apply and analyze Java in Database	K3,K4
4	Handle different event in java using the delegation event model, event listener and class	K5
5	Design interactive applications using Java Servlet, JSP and JDBC	K5,K6
K1-Remember;**K2**-Understand;**K3**-Apply; **K4**-Analyze;**K5**-Evaluate; **K6**-Create		
Unit:1	**BASICS OF JAVA**	**12hours**
Java Basics Review: Components and event handling–Threading concepts–Networking features – Media techniques		
Unit:2	**REMOTE METHOD INVOCATION**	**12hours**
Remote Method Invocation-Distributed Application Architecture- Creating stubs and skeletons- Defining Remote objects- Remote Object Activation-Object Serialization-Java Spaces		
Unit:3	**DATABASE**	**10hours**
JavainDatabases-JDBCprinciples–databaseaccess-Interacting-databasesearch–Creating multimedia databases – Database support in web applications		
Unit:4	**SERVLETS**	**12hours**
Java Servlets: Java Servlet and CGI programming- A simple java Servlet-Anatomy of a java 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:5	**ADVANCED TECHNIQUES**	**12hours**
JAR file format creation–Internationalization–Swing Programming–Advanced java techniques		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars –webinars		
	Total Lecture hours	**60hours**

Text Books	
1	Jamie Jaworski, "Java Unleashed", SAMS Tech media Publications,1999.

2	Campione, Walrath and Huml,"The Java Tutorial",AddisonWesley,1999.
Reference Books	
1	JimKeogh,"The Complete Reference J2EE",Tata McGraw Hill Publishing Company Ltd, 2010.
2	David Sawyer McFarland, "Java Script And JQuery-The Missing Manual", Oreilly Publications, 3rd Edition, 2011.
3	Deitel and Deitel, "Java How to Program", Third Edition, PHI/Pearson Education Asia.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.javatpoint.com/servlet-tutorial
2	https://www.tutorialspoint.com/java/index.htm
3	https://onlinecourses.nptel.ac.in/noc19_cs84/preview

Mapping with Programming Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	M	M	M	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low

SEMESTER: II PART: A ELECTIVE : III	23PCSCE24-1: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING	CREDIT:3 HOURS:4

Course Objectives:

The main objectives of this course are to:

1. Enable the students to learn the basic functions of AI, Heuristic Search Techniques.
2. Provide knowledge on concepts of Representations and Mappings and Predicate Logic.
3. Introduce Machine Learning with respect Data Mining, Big Data and Cloud.
4. Study about Applications & Impact of ML.

Expected Course Outcomes:		
On the successful completion of the course, student will be able to:		
1	Demonstrate AI problems and techniques	K1,K2
2	Understand machine learning concepts	K2,K3
3	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning	K3,K4
4	Analyze the impact of machine learning on applications	K4,K5
5	Analyze and design a real world problem for implementation and understand the dynamic behavior of a system	K5,K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	INTRODUCTION	12hours

Introduction: AI Problems - Al techniques - Criteria for success. Problems, Problem Spaces, Search: State space search - Production Systems - Problem Characteristics - Issues in design of Search.

Unit:2	SEARCH TECHNIQUES	12hours

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.

Unit:3	PREDICATE LOGIC	12hours

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 Backward reasoning -Matching-Control knowledge.

Unit:4	MACHINE LEARNING	12hours

Understanding Machine Learning: What Is Machine Learning?-Defining Big Data-Big Data in ContextwithMachineLearning-TheImportanceoftheHybridCloud-LeveragingthePowerof   Machine Learning-The Roles of Statistics and Data Mining with Machine Learning-Putting Machine Learning in Context-Approaches to Machine Learning.

Unit:5	APPLICATIONS OF MACHINE LEARNING	10hours

Looking Inside Machine Learning: The Impact of Machine Learning on Applications-Data Preparation-The Machine Learning Cycle.

Unit:6	Contemporary Issues	2 hours

Expert lectures, online seminars –webinars

	Total Lecture hours	60hours

Text Books

1	Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill Publishers company Pvt Ltd, Second Edition, 1991.
2	George F Luger," Artificial Intelligence",4th Edition, Pearson Education Publ,2002.

Reference Books

1	Machine Learning For Dummies ®,IBM Limited Edition by Judith Hurwitz, Daniel Kirsch.

Related Online Contents[MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://www.ibm.com/downloads/cas/GB8ZMQZ3
2	https://www.javatpoint.com/artificial-intelligence-tutorial
3	https://nptel.ac.in/courses/106/105/106105077/

Mapping with Programming Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	M	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low

SEMESTER: II PART: A ELECTIVE : III	23PCSCE24-2: CRITICAL THINKING, DESIGN THINKING AND PROBLEM SOLVING	CREDIT:3 HOURS:4

Course Objectives:

The main objectives of this course are to:

1. Learn critical thinking and its related concepts
2. Learn design thinking and its related concepts
3. Develop Thinking patterns, Problem solving & Reasoning

Expected Course Outcomes:		
On the successful completion of the course ,student will be able to:		
1	Understand the concepts of Critical thinking and its related technology	K1,K2
2	Focus on the explicit development of critical thinking and problem solving skills	K2,K3
3	Apply design thinking in problems	K3,K4
4	Make a decision and take actions based on analysis	K4,K5
5	Analyze the concepts of Thinking patterns, Problem solving & Reasoning in real time applications	K5,K6

K1-Remember;**K2**-Understand;**K3**-Apply; **K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	CRITICAL THINKING	12hours

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.

Unit:2	DESIGN THINKING	12hours

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, Stake holder assessment, design thinking for manufacturers, smart Idea to implementation.

Unit:3	CASE STUDY	12hours

Thinking to confidence, fear management, duty Vs passion, Team management, Tools for Thinking, prototype design, Relevance of Design and Design Thinking in engineering, human centered design, case study: apply design thinking in problem.

Unit:4	PROBLEM SOLVING	10hours

Problem solving: problem definition, problem solving methods, selecting and using information, dataprocessing,solutionmethods,solvingproblemsbysearching,recognizingpatterns,spatial

reasoning, necessity and sufficiency, choosing and using models, making choices and decisions.

Unit:5	REASONING	12hours

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

Unit:6	Contemporary Issues	2 hours

Expert lectures, online seminars –webinars

	Total Lecture hours	60hours

Text Books

1	John Butterworth and Geoff Thwaites, Thinking skills: Critical Thinking and Problem Solving, Cambridge University Press, 2013.
2	H.S.Fogler and S .E.Le Blanc, Strategies for Creative Problem Solving, 2nd edition, Pearson, Upper Saddle River, NJ, 2008.

Reference Books

1	A. Whimbey and J. Lochhead, Problem Solving & Comprehension, 6th edition, Lawrence Erlbaum, Mahwah, NJ, 1999.
2	M. Levine, Effective Problem Solving, 2nd edition, Prentice Hall, Upper Saddle River, NJ, 1994.
3	Michael Baker, The Basic of Critical Thinking, The Critical Thinking Copress, 2015.
4	David Kelley and Tom Kelley, Creative Confidence,2013.

Related Online Contents[MOOC, SWAYAM, NPTEL, Websites etc.]

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

Mapping with Programming Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	M	S	S	S
CO2	S	S	M	S	S	S	M	S	S	S
CO3	S	S	M	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

SEMESTER: II PART: A ELECTIVE - III	23PCSCE24-3: ADVANCED OPERATING SYSTEMS	CREDIT:3 HOURS:4

Course Objectives:

The main objectives of this course are to:

1. Enable the students to learn the different types of operating systems and their functioning.
2. Gain knowledge on Distributed Operating Systems
3. Gain insight into the components and management aspects of real time and mobile operating systems.
4. Learn case studies in Linux Operating Systems

Expected Course Outcomes:		
On the successful completion of the course, student will be able to:		
1	Understand the design issues associated with operating systems	K1,K2
2	Master various process management concepts including scheduling, deadlocks and distributed file systems	K3,K4
3	Prepare Real Time Task Scheduling	K4,K5
4	Analyze Operating Systems for Handheld Systems	K5
5	Analyze Operating Systems like LINUX and iOS	K5,K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	BASICS OF OPERATING SYSTEMS	12hours

Basics of Operating Systems: What is an Operating System? – Main frame 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.

Unit:2	DISTRIBUTED OPERATING SYSTEMS	12hours

Distributed Operating Systems: Issues – Communication Primitives – Lamport"s Logical Clocks – Deadlock handling strategies – Issues in deadlock detection and resolution-distributed file systems –design issues – Case studies – The Sun Network File System-Coda.

Unit:3	REAL TIME OPERATING SYSTEM	10hours

Realtime Operating Systems : Introduction – Applications of Real Time Systems – Basic Model of Real Time System – Characteristics – Safety and Reliability - Real Time Task Scheduling

Unit:4	HANDHELD SYSTEM	12hours

Operating Systems for Handheld Systems: Requirements–Technology Overview– Handheld Operating Systems–Palm OS-Symbian Operating System-Android–Architecture of android– Securing handheld systems

Unit:5	CASE STUDIES	12hours

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.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars–webinars		
	Total Lecture hours	**60hours**

Text Books

1	Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, "Operating System Concepts", Seventh Edition, John Wiley & Sons, 2004.
2	Mukesh Singhal and Niranjan G. Shivaratri, "Advanced Concepts in Operating Systems –Distributed, Database, and Multiprocessor Operating Systems", Tata McGraw-Hill, 2001.

Reference Books

1	Rajib Mall,"Real-Time Systems:TheoryandPractice",PearsonEducationIndia,2006.
2	Pramod Chandra P.Bhatt, An introduction to operating systems, concept and practice, PHI, Third edition, 2010.
3	Daniel.P.Bovet&MarcoCesati,"UnderstandingtheLinuxkernel",3rdedition,O"Reilly,2005
4	NeilSmyth,"iPhoneiOS4DevelopmentEssentials–Xcode",FourthEdition,Payload media, 2011.

Related Online Contents[MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://onlinecourses.nptel.ac.in/noc20_cs04/preview
2	https://www.udacity.com/course/advanced-operating-systems--ud189
3	https://minnie.tuhs.org/CompArch/Resources/os-notes.pdf

Mapping with Programming Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	S	S	S	M	M	M	M
CO2	S	M	S	S	S	S	S	M	S	M
CO3	S	M	S	S	S	S	S	M	S	M
CO4	S	M	S	S	S	S	S	M	S	M
CO5	S	M	S	S	S	S	S	M	S	M

*S-Strong; M-Medium; L-Low

SEMESTER: II PART: A ELECTIVE : IV	23PCSCE25-1: MOBILE COMPUTING	CREDIT:3 HOURS:4

Course Objectives:

The main objectives of this course are to:

1. Present the overview of Mobile computing, Applications and Architectures.
2. Describe the futuristic computing challenges.
3. Enable the students to learn the concept of mobile computing.

Expected Course Outcomes:	

On the successful completion of the course, students will be able to:

1	Understand the need and requirements of mobile communication	K1,K2
2	Focus on mobile computing applications and techniques	K2,K3
3	Demonstrate satellite communication in mobile computing	K4
4	Analyze about wireless local loop architecture	K5,K6
5	Analyze various mobile communication technologies	K6

K1-Remember;**K2**-Understand;**K3**-Apply; **K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	INTRODUCTION	12hours

Introduction: Advantages of Digital Information - Introduction to Telephone Systems –Mobile communication: Need for Mobile Communication – Requirements of Mobile Communication – History of Mobile Communication.

Unit:2	MOBILE COMMUNICATION	12hours

Introduction to Cellular Mobile Communication – Mobile Communication Standards –Mobility Management – Frequency Management – Cordless Mobile Communication Systems.

Unit:3	MOBILE COMPUTING	12hours

Mobile Computing: History of data networks – Classification of Mobile data networks - CDPD System – Satellites in Mobile Communication: Satellite classification – Global Satellite Communication – Changeover from one satellite to other – Global Mobile Communication – Interferences in Cellular Mobile Communication.

Unit:4	MOBILE COMMUNICATION SYSTEM	11hours

Important Parameters of Mobile Communication System – Mobile Internet: 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:5	COMMUNICATION TECHNOLOGY	11hours

WCDMA Technology and Fiber Optic Microcellular Mobile Communication – Ad hoc Network and Bluetooth technology – Intelligent Mobile Communication system – Fourth Generation Mobile Communication systems.

Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars–webinars		

		Total Lecture hours	60hours

	Text Books
1	T.G.Palanivelu,R.Nakkeeran,"Wireless and Mobile Communication", PHI Limited, 2009.
2	Jochen S chiller," Mobile Communications",Second Edition, Pearson Education, 2007.

	Reference Books
1	Asoke K Talukder, Hasan Ahmed,Roopa Yavagal,"Mobile Computing",TMH,2010.

	Related Online Contents[MOOC, SWAYAM, NPTEL, Websites etc.]
1	https://www.tutorialspoint.com/mobile_computing/index.htm
2	https://www.javatpoint.com/mobile-computing
3	https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs13/

Mapping with Programming Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	M	L	L	M	S	M	M	M	M
CO2	S	S	S	M	M	S	M	S	S	S
CO3	S	S	S	S	M	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

SEMESTER: II PART: A ELECTIVE : IV	23PCSCE25-2: BLOCKCHAIN TECHNOLOGY	CREDIT:3 HOURS:4

Course Objectives:

The main objectives of this course are to:

1. Understand the fundamentals of block chain and cryptocurrency.
2. Understand the influence and role of block chain in various other fields.
3. Learn security features and its significance.
4. Identify problems & challenges posed by BlockChain.

Expected Course Outcomes:		
On the successful completion of the course, student will be able to:		
1	Demonstrate blockchain technology and crypto currency	K1,K2
2	Understand the mining mechanism in blockchain	K2
3	Apply and identify security measures, and various types of services that allow people to trade and transact with bitcoins	K3,K4
4	Apply and analyze Block chain in health care industry	K4,K5
5	Analyze security, privacy, and efficiency of a given Block chain system	K5,K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	**INTRODUCTION**	**12hours**

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 application: currency, identity, chain of custody.

Unit:2	**NETWORKAND SECURITY**	**12hours**

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.

Unit:3	**CRYPTOCURRENCY**	**12hours**

Cryptocurrency - History, Distributed Ledger, Bitcoin protocols -Symmetric-key cryptography - Public-key cryptography - Digital Signatures -High and Low trust societies - Types of Trust model: Peer-to-Peer, Leviathan, and Intermediary. Application of Cryptography to Blockchain

Unit:4	**CRYPTOCURRENCY REGULATION**	**11hours**

Cryptocurrency Regulation-Stakeholders, Roots of Bitcoin, Legal views-exchange of cryptocurrency- Black Market-Global Economy. Cyrpto economics– assets, supply and demand, in flat ion and deflation – Regulation.

Unit:5	CHALLENGES IN BLOCKCHAIN	11hours

Opportunities and challenges in Block Chain – Application of block chain: Industry 4.0 – machine to machine communication –Data management in industry 4.0–future prospects. Block chain in Health 4.0 - Blockchain properties - Healthcare Costs - Healthcare Quality - Healthcare Value - Challenges for using blockchain for healthcare data

Unit : 6	Contemporary Issues	2 hours

Expert lectures, online seminars –webinars

		Total Lecture hours	60hours

Text Books

1	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press (July 19, 2016).
2	Antonopoulos, "Mastering Bit coin: Unlocking Digital Cryptocurrencies"

Reference Books

1	Satoshi Nakamoto, "Bitcoin: A Peer-to-Peer Electronic Cash System"
2	Rodrigoda Rosa Righi, Antonio Marcos Alberti, Madhusudan Singh, "Blockchain Technology for Industry 4.0" Springer 2020.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://www.javatpoint.com/blockchain-tutorial
2	https://www.tutorialspoint.com/blockchain/index.htm
3	https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs01/

Mapping with Programming Outcomes									
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

SEMESTER: II PART: A SEC: 1	23PCSCS26: OBJECT ORIENTED PROGRAMMING THROUGH JAVA, HTML BASICS	CREDIT:2 HOURS:4

Course Objectives:

The main objectives of this course are to:
1. To implement the static web pages using HTML and do client side validation using JavaScript.
2. To introduce Node JS implementation for server side programming.
3. To experiment with single page application development using React.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Develop a proper understanding of Web Development Architecture.	K1, K2
2	Create application using React components.	K2, K3
3	Perform Navigation using Routes.	K3, K4
4	Build Web Applications using React with Redux.	K5, K6
5	Perform ReactJS animations	K6

K1-Remember; **K2**-Understand; **K3**-Apply; **K4**-Analyze; **K5**-Evaluate; **K6**-Create

Unit:1		15hours

ReactJS introduction, why to learn ReactJS, React Environment Setup- pre-requisite for ReactJS, ways to install ReactJS, ReactJS - Architecture, ReactJS - creating a React Application, React create-react-app, Features of ReactJS, ReactJS vs Native React, ReactJS vs AngularJS.

Unit:2		15hours

ReactJS - JSX, ReactJS - components: creating a React component, creating a class component, creating a function component, ReactJS - styling, ReactJs - properties (props), React Props Validation.

Unit:3		15hours

ReactJS state management, ReactJS event Management, React Constructor, React component API, React component Life-cycle, React Forms and user input, controlled Component, Un-Controlled Component, Form link.

Unit:4		15hours

ReactJS - Http client Programming, React Lists, The map() function, React Keys, React Refs, React Fragments, React Router, ReactCSS, React Animation, React Date picker, DoM in React.

Unit:5		13hours

React AJAX call - HTTP GET request, HTTP GET Request and Looping through data, React Bootstrap, React Table, React Hooks, React building and deployment.

Unit:6	Contemporary Issues	2 hours

Expert lectures, online seminars– webinars

	Total Lecture hours	75hours

	Text Books
1	Learning React: Functional web Development with React and Redux 1st Edition by Alex Banks.
2	The Road to React: your journey to master plain yet pragmatic React.js by Robin Wieruch
	Reference Books
1	React.js Essentials: A fast-paced guide to designing and building scalable and maintainable web apps with React.js Artemij Fedosejev.
2	Full-Stack React projects: Learn MERN stack development by building modem web apps using MongoDB, Express, React, and Node.js, 2nd Edition paperback by shama Hoque
3	React.js Book: Learning React Javascript Library From Scratch by Greg Sidelnikov
	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1	https://www.mygreatlearning.com/academy/learn-for-free/courses/react-js-tutorial
2	https://www.classcentral.com/course/edx-introduction-to-reactjs-8770

Mapping with Programming Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	S	L	M	L	S	M
CO2	S	S	S	S	S	M	S	M	S	M
CO3	S	S	S	S	S	M	S	M	S	M
CO4	S	S	S	S	S	M	S	M	S	M
CO5	S	S	S	S	S	M	S	M	S	M

*S-Strong; M-Medium; L-Low

SEMESTER: III PART: A CORE: VII	23PCSCC31: DIGITAL IMAGE PROCESSING	CREDIT:5 HOURS:6

Pre-requisite	Basics of Image Processing		

Course Objectives:

The main objectives of this course are to:

1. Learn basic image processing techniques for solving real problems.
2. Gain knowledge in image transformation and Image enhancement techniques.
3. Learn Image compression and Segmentation procedures.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the fundamentals of Digital Image Processing	K1,K2
2	Understandthemathematicalfoundationsfordigitalimagerepresentation, image acquisition, image transformation, and image enhancement	K2,K3
3	Apply, Design and Implement and get solutions for digital image processing problems	K3,K4
4	Applytheconceptsoffilteringandsegmentationfordigitalimageretrieval	K4,K5
5	Explore the concepts of 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

Unit:1	INTRODUCTION	12hours

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.

Unit:2	IMAGEENHANCEMENT	12hours

Image Enhancement in the spatial domain:- Background – some basic Gray level Transformations – Histogram Processing – Enhancement using Arithmetic / Logic operations – Basics of spatial filtering – Smoothing spatial filters – Sharpening spatial filters – Combining spatial enhancement methods.

Unit:3	IMAGERESTORATION	12hours

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 – Invariant Degradations – Estimating the degradation function – Inverse filtering – Minimum mean square Error Filtering – Constrained least squares filtering – Geometric mean filter – Geometric Transformations.

Unit:4	IMAGECOMPRESSION	11hours

Image Compression: Fundamentals–Image compression models– Elements of Information Theory – Error Free compression – Lossy compression – Image compression standards.

Unit:5	IMAGESEGMENTATION	11hours

Image Segmentation: Detection and Discontinuities – Edge Linking and Boundary deduction – Thresholding – Region-Based segmentation – Segmentation by Morphological watersheds – The use of motion in segmentation.

Unit:6	Contemporary Issues	2 hours

Expert lectures, online seminars –webinars

	Total Lecture hours	60hours

Text Books

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, Websites etc.]

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
CO1	S	M	S	S	S	M	S	M	M	S
CO2	S	S	S	S	S	M	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low

SEMESTER: III PART: A CORE: VIII	23PCSCC32: CLOUD COMPUTING	CREDIT:5 HOURS:6

Pre-requisite	Basics of Cloud & Its Applications		

Course Objectives:

The main objectives of this course are to:

1. Gain knowledge on cloud computing, cloud services, architectures and applications.
2. Enable the students to learn the basics of cloud computing with real time usage
3. How to store and share, in and from cloud?

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the concepts of Cloud and its services	K1,K2
2	Collaborate Cloud for Event & Project Management	K3,K4
3	Analyze on cloud in – Word Processing, Spread Sheets, Mail, Calendar, Database	K4,K5
4	Analyze cloud in social networks	K5,K6
5	Explore cloud storage and sharing	K6

K1-Remember; **K2**-Understand; **K3**-Apply; **K4**-Analyze; **K5**-Evaluate; **K6**-Create

Unit:1	INTRODUCTION	12hours

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.

Unit:2	CLOUDCOMPUTING	12hours

CLOUD COMPUTING FOR EVERYONE Centralizing email communications, cloud computing for community, collaborating on schedules, collaborating on group projects and events, cloud computing for corporation, mapping, schedules, managing projects, presenting on road.

Unit:3	CLOUDSERVICES	12hours

USING CLOUD SERVICES Collaborating on calendars, Schedules and task management, exploring on line scheduling and planning, collaborating on event management, collaborating on contact management, collaborating on project management, collaborating on word processing, spreadsheets, and databases.

Unit:4	OUTSIDETHECLOUD	12hours

OUTSIDE THE CLOUDE valuating webmail services, Evaluating instant messaging, Evaluating web conference tools, creating groups on social networks, Evaluating online groupware, collaborating via blogs and wikis.

Unit:5	STORINGAND SHARING	10hours

STORING AND SHARING Understanding cloud storage, evaluating on line file storage, exploring on line book marking services, exploring on line photo editing applications, exploring photo sharing communities, controlling it with web based desktops.

Unit:6	Contemporary Issues	2 hours
	Expert lectures, online seminars –webinars	

		Total Lecture hours	60hours

Text Books

1	Michael Miller, "Cloud Computing", Pearson Education, New Delhi, 2009.

Reference Books

1	Anthony T. Velte, "Cloud Computing: A Practical Approach", 1st Edition, Tata McGraw Hill Education Private Limited, 2009.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://nptel.ac.in/courses/106/105/106105167/
2	https://www.tutorialspoint.com/cloud_computing/index.htm
3	https://www.javatpoint.com/cloud-computing-tutorial

Mapping with Programming Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	S	M	S	M	S	M	M	M	S
CO2	M	S	M	S	S	S	M	M	M	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	M	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

SEMESTER: III PART: A CORE: IX	23PCSCC33: NETWORKSECURITYAND CRYPTOGRAPHY	CREDIT:5 HOURS:6

Pre-requisite	Basics of Networks & its Security		

Course Objectives:

The main objectives of this course are to:

1. Enable students to learn the Introduction to Cryptography, Web Security and Case studies in Cryptography.
2. To gain knowledge on classical encryption techniques and concepts of modular arithmetic and number theory.
3. To explore the working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes and message digests, and public key algorithms.
4. To explore the design issues and working principles of various authentication Applications and various secure communication standards including Kerberos, IPsec, and SSL/TLS and email.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the process of the cryptographic algorithms	K1,K2
2	Compareandapplydifferentencryptionanddecryptiontechniquestosolveproblems related to confidentiality and authentication	K2,K3
3	Applyandanalyzeappropriatesecuritytechniquestosolvenetworksecurity problem	K3,K4
4	Explore suitable cryptographic algorithms	K4,K5
5	Analyze different digital signature algorithms to achieve authentication and design secure applications	K5,K6

K1-Remember; **K2**-Understand; **K3**-Apply; **K4**-Analyze; **K5**-Evaluate; **K6**-Create

Unit:1	**INTRODUCTION**	**12hours**

Introduction to Cryptography – Security Attacks – Security Services –Security Algorithm- Stream cipher and Block cipher - Symmetric and Asymmetric-key Cryptosystem Symmetric Key Algorithms: Introduction – DES – Triple DES – AES – IDEA – Blowfish – RC5.

Unit:2	**CRYPTOSYSTEM**	**12hours**

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.

Unit:3	**NETWORK SECURITY**	**12hours**

Network Security Practice: Authentication Applications – Kerberos – X.509 Authentication services and Encryption Techniques. E-mail Security – PGP – S / MIME – IP Security.

Unit:4	WEB SECURITY	10hours

Web Security – Secure Socket Layer–Secure Electronic Transaction. System Security - Intruders and Viruses – Firewalls– Password Security.

Unit:5	CASE STUDY	12hours

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

Unit:6	Contemporary Issues	2 hours
	Expert lectures, online seminars–webinars	

	Total Lecture hours	60hours

Text Books

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", MacMillan.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

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.htm

Mapping with Programming Outcomes									
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	M	L	S	M	S	M	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

SEMESTER: III PART: A CORE: X	23PCSCC34: DATA SCIENCE & ANALYTICS	CREDIT:4 HOURS:6

Pre-requisite	Basics of Data Science & its Applications		

Course Objectives:

The main objectives of this course are to:

1. Introduce the students to data science, big data & its ecosystem.
2. Learn data analytics &its life cycle.
3. To explore the programming language R, with respect to the datamining algorithms.
4. Relate the relationship between artificial intelligence, machine learning and data science.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the concept of data science and its techniques	K1,K2
2	Review data analytics	K2,K3
3	ApplyanddetermineappropriateDataMiningtechniquesusingRtorealtime applications	K3,K4
4	Analyze on clustering algorithms	K4,K5
5	Analyze on regression methods in AI	K6

K1-Remember; **K2**-Understand; **K3**-Apply; **K4**-Analyze; **K5** -Evaluate; **K6**-Create

Unit:1	INTRODUCTION	12 hours

Introduction of Data Science: data science and big data–facets of data-data science process- Ecosystem-The Data Science process – six steps- Machine Learning.

Unit:2	BASICS OF DATA ANALYTICS	12 hours

Data Analytics lifecycle – review of data analytics – Advanced data Analytics-technology and tools.

Unit:3	DATA ANALYTICS USING R	12 hours

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.

Unit:4	CLUSTERING	12 hours

Overview of Clustering : K-means – Use Cases – Overview of the Method – Perform a K-means Analysis using R –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.

Unit:5	ARTIFICIAL INTELLIGENCE	10 hours

Artificial intelligence: Machine Learning and deep learning in data science-Clustering, association rules. Linear regression-logistic regression-Additional regression methods.

Unit:6	Contemporary Issues	2 hours

Expert lectures, online seminars –webinars

		Total Lecture hours	60 hours

Text Books

1	Introducing-Data-Science-Big-Data-Machine-Learning-and-more-using-Python-tools-2016. Pdf
2	Data science in big data analytics-Wiley 2015 John Wiley & Sons.

Reference Books

1	A simple introduction to Data Science – Lars Nielson 2015
2	Introducing Data Science Davy Cielen, Arno D.B. Meysman, Mohamed Ali 2016 Manning Publication
3	R Programming for Data Science-Roger D. Peng 2015 Lean Publication
4	Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://www.tutorialspoint.com/python_data_science/index.htm
2	https://www.javatpoint.com/data-science
3	https://nptel.ac.in/courses/106/106/106106179/

Mapping with Programming Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	M	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low

SEMESTER: III PART: A ELECTIVE V	23PCSCE35: PRACTICAL V: DIGITAL IMAGE PROCESSING USING MATLAB	CREDIT:3 HOURS:3

Pre-requisite	Basic Programming of Image Processing& an intro to MATLAB

Course Objectives:

The main objectives of this course are to:

1. To understand the basics of Digital Image Processing fundamentals, image enhancement and image restoration techniques.

2. To enable the students to learn the fundamentals of image compression and segmentation.

3. To understand Image Restoration & Filtering Techniques.

4. Implementation of the above using MATLAB.

Expected Course Out comes:

On the successful completion of the course, student will be able to:

1	To write programs in MATLAB for image processing using the techniques	K1,K2
2	To able to implement Image Enhancements & Restoration techniques	K2,K3
3	Capable of using Compression techniques in an Image	K3,K4
4	Must be able to manipulate the image and Segment it	K5,K6

K1-Remember; **K2**-Understand; **K3**-Apply; **K4**-Analyze; **K5**-Evaluate; **K6**-Create

LISTOF PROGRAMS	**60hours**

1. Implement Image enhancement Technique.

2. Histogram Equalization

3. Image Restoration.

4. Implement Image Filtering.

5. Edge detection using Operators (Roberts, Prewitt s and Sobels operators)

6. Implement image compression.

7. Image Subtraction

8. Boundary Extraction using morphology.

9. Image Segmentation

Total Lecture hours	**60hours**

Text Books

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, Websites etc.]	
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**
CO1	S	S	M	S	S	S	M	M	S	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low

SEMESTER: III PART: B (i) SEC – II	23PCSCS36: PRACTICAL VI: CLOUD COMPUTING LAB	CREDIT: 2 HOURS: 3

Pre-requisite	Basic Programming using Cloud		

Course Objectives:

The main objectives of this course are to:
1. Understand the different concepts of cloud computing and its services
2. Securely store and retrieve data from the cloud using its Tools.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:	
1	Understand the concepts of Working with Google Drive and also learning about principles of Linux Virtual Machine in Cloud Environment.	K1,K2
2	To Exploring the Google cloud applications using its Tools.	K3,K4
3	To Learn the working and Installation Process of Google App Engine and Microsoft Azure	K4,K5
4	To implement the concept of Amazon and Querya NoSQL Table	K5,K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

LISTOF PROGRAMS	**60hours**

1. Working with Google Drive to make spread sheet and notes.

2. Launch a Linux Virtual Machine.

3. To host a static website

4. Exploring Google cloud for the following a) Storage, b) Sharing of data, c) manage your calendar, to-do lists, d) a document editing tool

5. Working and installation of Google App Engine

6. Working and installation of Microsoft Azure

7. To Connect Amazon RedshiftwithS3bucket

8. To Create and Querya NoSQL Table

Expert lectures, online seminars–webinars	

Total Lecture hours	**60hours**

Text Books

1	Michael Miller, "Cloud Computing", Pearson Education, NewDelhi, 2009.

Reference Books

1	Anthony T. Velte, "Cloud Computing: A Practical Approach", 1st Edition, Tata McGrawHill Education Private Limited, 2009.

Related Online Contents[MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/106/105/106105167/
2	https://www.tutorialspoint.com/cloud_computing/index.htm
3	https://www.javatpoint.com/cloud-computing-tutorial

Mapping with Programming Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	M	M	S	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low

SEMESTER: III PART-B(ii)	23PCSCI37: SUMMER INTERNSHIP	Credit:2 Hours:-

-Refer to the Regulations-

SEMESTER: III PART: A CORE: XII	23PCSCP41 : Data Analytics Lab (Practical)	CREDIT: 5 HOURS: 6

Course Objectives:
The main objectives of this course are to:

1. Know Basic Data Analytics using R and Graphical User Interfaces
2. Use functions for structuring R programs and different statistics techniques
3. Understand different Data Structures and Pandas of R
4. Have an idea on Exploratory Data Analysis and clustering algorithms
5. Work on different clustering and classification algorithms

List of Exercises

1. Write an R Script to perform the data Import and export operations.
2. Write an R Script to perform the Data Pre-processing techniques.
3. Write an R Script to perform the descriptive statistics concepts.
4. Visualizing the data in different graphics using R Scripts.
5. Write an R Script to implement the Normal and binomial distribution.
6. Write an R Script to convert numerical data to categorical variables.
7. Write an R Script to Bayes' Theorem.
8. Write an R Script to implement the Time series data analysis and forecasting.
9. Hypothesis Testing in R Programming.
10. Predictive Analysis using R Programming.
11. Write an R Script to implement the Cross-Validation.
12. Write an R Script to implement the Ordinary Least Squares (OLS).
13. Write an R Script to implement the Linear regression algorithm.
14. Write an R Script to implement the K-Means clustering algorithm.
15. Write an R Script to implement the Naïve Bayes.

Expected Course Outcomes:	
On the successful completion of the course ,student will be able to:	
1	Understand the basic concepts of Data Analytics	K1,K2
2	Understand R functions	K2,K3
3	Perform various data preprocessing techniques	K3,K4
4	Acquire knowledge about Exploratory Data Analysis	K5
5	Develop classification and clustering algorithms using R	K5,K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Text Books
1	Introducing-Data-Science-Big-Data-Machine-Learning-and-more-using-Python-tools-2016. Pdf
2	Data science in big data analytics-Wiley 2015 John Wiley & Sons.

Reference Books
1	A simple introduction to Data Science – Lars Nielson 2015

2	Introducing Data Science Davy Cielen, Arno D.B. Meysman, Mohamed Ali 2016 Manning Publication
3	R Programming for Data Science-Roger D. Peng 2015 Lean Publication
4	Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data

| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** |
1	https://www.tutorialspoint.com/python_data_science/index.htm
2	https://www.javatpoint.com/data-science
3	https://nptel.ac.in/courses/106/106/106106179/

Mapping with Programming Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	M	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low

****

SEMESTER: III PART: A CORE: XII	23PCSCP42: PRACTICAL VII: WEB APPLICATION DEVELOPMENT AND HOSTING	CREDIT: 5 HOURS: 6

Pre-requisite	Basic Programming using HTML tags		

Course Objectives:

The main objectives of this course are to:

1. Able to design a webpage using HTML tags

2. To enable the students to use Framesets, hyperlinks and different formatting features of HTML tags

3. Enable the students to use Forms &other controls in a webpage

4. To create inter active applications using PHP

Expected Course Outcomes:

On the successful completion of the course, student willable to:

1	Understand & implement the basic HTML tags to create static webpages	K1,K2
2	Capable of using hyper links,frames,images, tables, ... in a webpage	K2,K3
3	Able to write dynamic web applications using HTML forms	K4,K5
4	Must be able to write dynamic web applications in PHP & HTML tags using XAMPP.	K5,K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

LISTOF PROGRAMS	30hours

1. Develop website for your college using advanced tags of HTML.

2. Write names of several countries in a paragraph and store it as an HTML document, world.html. Each country name must be a hot text. When you click India (for example), it must open india.html and it should provide a brief introduction about India.

3. Develop a HTML document to i)display Text with Bullets / Numbers - Using Lists ii) to display the Table Format Data

4. Develop a Complete Web Page using Frames and Framesets which gives the Information about a Hospital using HTML.

5. WriteaHTMLdocumenttoprintyourBio-Datainaneatformatusingseveralcomponents.

6. DevelopaHTMLdocumenttodisplayaRegistrationFormforaninter-collegiatefunction.

7. Using HTML form accept Customer details like Name, City, Pin code, Phone number and Email address and validate the data and display appropriate messages for violations using PHP

(Eg. Name is Mandatory field; Pin code must be6digits, etc.).

8. Writeaprogramtoaccepttwonumbersn1andn2usingHTMLformanddisplaythePrime   numbersbetweenn1 andn2using PHP.

		Total Lecture hours	30hours

	Text Books
1	IvanBayross,"WebEnabledCommercialApplicationsDevelopmentUsingHTML, JavaScript, DHTML and PHP", BPB Publications, 4th Revised Edition, 2010.
	Reference Books
2	A.K.SainiandSumintTuli,"MasteringXML",FirstEdition,NewDelhi, 2002.
	Related Online Contents[MOOC, SWAYAM, NPTEL, Websites etc.]
1	https://www.tutorialspoint.com/xml/index.htm
2	https://www.tutorialspoint.com/internet_technologies/websites_development.htm
3	https://www.youtube.com/watch?v=PlxWf493en4

Mapping with Programming Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	M	M	S	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S

SEMESTER: IV PART: A PROJECT	23PCSCD43: PROJECT WITH VIVA VOCE	CREDIT: 7 HOURS: 10

-Refer to the Regulations-

SEMESTER: III PART: A ELECTIVE: VI	23PCSCE44-1: INTRODUCTION TO ROBOTICS	CREDIT: 3 HOURS: 4

Pre-requisite	Understanding of basic physics
Objectives of the Course	To introduce students to fundamental components, functionality of Robotic systems and to provide knowledge in the design and development challenges in the field of robotics.
Course Outline	
	UNIT-I : **Introduction**-Definition of Automation-Mechanization Vs Automation-Advantages-Goals-Social Issues-Types-Current Emphasis in Automation-Issues in automation in Factory Operations-Strategies of Automation
	UNIT-II : **Introduction** -History of Robots- Definition- Laws of Robotics-Characteristics-Components-Comparison of the Human and the Robot Manipulator-Robot Wrist and End of Arm Tools-Robot Terminology-Robotic Joints-Classification-Selection-Workcell-Robotics and Machine Vision-Applications
	UNIT-III : **Robot Components**: **Sensors**: Exteroceptors Sensors -Tactile Sensors -Proximity Sensors-Range Sensors-Machine Vision Sensors-Velocity Sensors-Proprioceptors-Robots with sensors- - **End Effectors**: Grippers-selection of grippers-Gripping mechanism-tools-Types of Grippers- **Drives**: Pneumatic, Hydraulic, Electric Actuators
	UNIT-IV : **Transformations**: Introduction to Manipulator Kinematics -Homogeneous Transformations-Robot Kinematics-Manipulator Path Control-Robot Dynamics- **Robot Programming Techniques**: Online programming- Lead-through Programming-Offline Programming-Task Level Programming-Motion Programming-Robot Programming Languages-Robot languages and its types

	UNIT-V: **Applications of Robots**: Robot Capabilities-Application of Robots-Manufacturing Applications-Material handling applications **Robotics and Artificial Intelligence:** Vision-Voice communication-Planning-Modelling-Adaptive control-Error monitoring and recovery-Autonomy and intelligence in robots-Expert systems in robotics
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Gupta.A.K, Arora. S. K., Industrial Automation and Robotics, Mercury Learning and Information, 2017(Unit I,II ,III,IV,V) 2. Mikell P Groover, "Industrial Robotics", Mc GrawHill, 2012.(Unit III: Drives :Fundamentals of Robot technology -Robot Drive systems, Unit IV: Transformations) 3. D.J.Todd, "Fundamentals of Robot Technology", An Introduction to Industrial Robots, Teleoperators and Robot Vehicles, Wiley,1986.(Unit V: Robotics and Artificial Intelligence)
Reference Books	1. Thomas. K. Rufuss, "Robotics and Automation Handbook", CRC Press, 2018 2. Ghoyal.K., Deepak Bhandari, "Automation and Robotics", S.K.Kataria& Sons Publishers, 2012. 3. John.J. Craig, "Introduction to Robotics: Mechanics and Control", Pearson, 2018. 4. Gonzalez, Fu Lee, Robotics: Control, Sensing, Vision and Intelligence, Wiley, 1998
Website and **e-Learning Source**	1. https://builtin.com/robotics 2. https://www.elprocus.com/robot-sensor/ 3. https://sp-automation.co.uk/the-top-seven-types-of-robots/ 4. https://robots.ieee.org/learn/types-of-robots/ 5. https://www.intel.in/content/www/in/en/robotics/types-and-applications

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Outline the anatomy, specifications and applicability of Robotic system
CLO2	Demonstrate the role of kinematics and dynamic behavior of robots with programming techniques
CLO3	Identify the characteristics and functionality of robots in various sectors.
CLO4	Analyze the various functionality of robotic systems with respect to software and hardware components
CLO5	Assess the scientific background of robotic systems through various real time examples

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	1	1	2	2	2
CLO2	3	3	3	3	3	2
CLO3	3	2	3	3	3	3
CLO4	3	2	2	3	3	2
CLO5	3	2	3	3	3	3
Weightage of course contribute to each PSO	15	10	10	14	14	12

SEMESTER: IV PART: A ELECTIVE-VI	23PCSCE44-2 : VIRTUAL AND AUGMENTED REALITY	CREDIT:3 HOURS:4
Pre-requisite	Basic knowledge of computer graphics	
Objectives of the Course	To provide knowledge on basic principles of virtual & augmented reality and have the ability to use its technology as a platform for real-world applications.	
Course Outline		
	UNIT-I : **Virtual Reality**: The Three I's of VR – History – Early commercial VR Technology – Components of a VR System –**Input Devices:** Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces	
	UNIT-II : **Output Devices:** Graphics Displays – Sound Displays – Haptic Feedback - **Computer Architecture for VR:** The Rendering Pipeline- PC Graphics Architecture - **VR Programming:** Toolkits and Scene Graphs – Traditional and Emerging Applications of VR	
	UNIT-III : **Augmented Reality**: Introduction – **Augmented Reality Concepts:** Working Principle of AR –Concepts related to AR- Ingredients of an Augmented Reality Experience	
	UNIT-IV : Augmented Reality Hardware– Augmented Reality Software– Software to create content for AR Application – Tools and Technologies	
	UNIT-V: **Augmented Reality Content:** Introduction- Creating Content for Visual, Audio, and other senses – Interaction in AR - **Mobile Augmented Reality:** Introduction – Augmented Reality Applications Areas- Collaborative Augmented Reality	
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	

Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Grigore C. Burdea and Philippe Coiffet, "Virtual Reality Technology", Wiley Student Edition , Second Edition (Unit I: Chapter 1,2 & Unit II: Chapter 3,4,6,8 & 9) 2. Alan B. Craig(2013), "Understanding Augmented Reality: Concepts and Applications"(Unit III: Chapter 1, 2, Unit IV : Chapter 3, 4 & Unit V: Chapter 5,6,8) 3. Jon Peddie (2017), "Augmented Reality: Where We Will All Live", Springer, Ist Edition (Unit IV: Chapter 7 (Tools & Technologies)
Reference Books	1. Alan Craig & William R. Sherman & Jeffrey D. Will, Morgan Kaufmann(2009), "Developing Virtual Reality Applications: Foundations of Effective Design", Elsevier(Morgan Kaufmann Publishers) 2. Paul Mealy (2018), "Virtual and Augmented Reality", Wiley 3. Bruno Arnaldi & Pascal Guitton & Guillaume Moreau(2018), "Virtual Reality and Augmented Reality: Myths and Realities", Wiley
Website and **e-Learning Source**	1. Manivannan, M., (2018), "Virtual Reality Engineering," IIT Madras, https://nptel.ac.in/courses/121106013 2. Dube, A., (2020), "Augmented Reality - Fundamentals and Development," NPTEL Special Lecture Series, https://www.youtube.com/watch?v=MGuSTAqlZ9Q 3. http://msl.cs.uiuc.edu/vr/ 4. http://www.britannica.com/technology/virtual reality/Living-in - virtual-worlds 5. https://mobidev.biz/blog/augmented-reality-development-guide

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Outline the basic terminologies, techniques and applications of VR and AR
CLO2	Describe different architectures and principles of VR and AR systems
CLO3	Use suitable hardware and software technologies for different varieties of virtual and augmented reality applications
CLO4	Analyze and explain the behavior of VR and AR technology relates to human perception and cognition
CLO5	Assess the importance of VR/AR content and interactions to implement for the real-world problem

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	1	1	2	2	2
CLO2	3	2	2	2	2	2
CLO3	3	2	2	3	3	3
CLO4	3	2	2	3	3	2
CLO5	3	2	3	3	3	3
Weightage of course contribute to each PSO	15	9	10	13	13	12

YEAR – II	SOFT SKILLS	23PCSCS45
SEMESTER– IV	(Skill Enhancement Course/Professional	HRS-4
Part – B (i)	Competency Skill)	CREDIT – 2

Objectives:

1. To help the students to enhance the knowledge in research areas
2. To enable the students to learn the teaching techniques in higher education.
3. Students to enrich their communication skills and learn about ICT tools.
4. Quantitative Aptitude measures the ability of an individual to solve numerical and mathematical problems related to competitive exams
5. To provide knowledge to the students about Higher Education and Environmental awareness.

COURSE OUTCOMES:

CO1: Students to increase their expertise in research topics.

CO2: The students will acquire teaching approaches in higher education.

CO3: Students improve their skills to prepare for competitive exams and better career opportunities.

CO4 Quantitative Aptitude assesses an individual's ability to solve numerical and mathematical issues linked to competitive tests.

CO5: To educate pupils about higher education and environmental consciousness.

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER IV	COURSE CODE: 23PCSCS45					TITLE OF THE PAPER: Professional Competency Skill					HOURS: 4	CREDITS: 2
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)					MEAN SCORE OF CO'S	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO1	2	3	3	4	4	4	4	4	4	3	3.5	
CO2	3	4	3	4	3	4	4	3	3	4	3.5	
CO3	3	4	3	3	4	4	4	3	4	4	3.6	
CO4	3	4	3	3	3	4	4	3	4	4	3.5	
CO5	4	4	3	3	3	4	4	3	4	4	3.6	
Mean Overall Score											3.5	

Result: The Score of this Course is 3.5(High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome

Unit-I Teaching Methodology and Research Skills   **12 Hrs**

      Teaching: Concept, Objectives, Levels of teaching - Characteristics of adolescent and adult learners - Factors affecting teaching related to Teacher, Learner - Methods of teaching in Institutions of higher learning, Swayam - Teaching Support System- Evaluation Systems-CBCS System. **Research:** Meaning, Types, and Characteristics, - Methods of Research - Steps of Research - Application of ICT in research.

Unit-II Communication Skills   **12 Hrs**

      Communication - Meaning, types and characteristics of communication - Effective communication - Barriers to effective communication - Mass-Media and Society. **Information and Communication Technology (ICT) ICT:** Basics of Internet, Intranet, E-mail, Audio and Video-conferencing - Digital initiatives in higher education.

Unit-III Mathematical Reasoning and Aptitude skills   **12 Hrs**

      Number series, Letter series, Codes and Relationships - Mathematical Aptitude- Logical Reasoning - Understanding the structure of arguments: argument forms, structure of categorical propositions, Mood and Figure, Formal and Informal fallacies - Evaluating and distinguishing deductive and inductive reasoning.

Unit IV Analytical and Ethical Learning skills   **12 Hrs**

      Analogies - Venn diagram - Data Interpretation - Graphical representation (Bar-chart, Histograms, Pie-chart, Table-chart and Line-chart) and mapping of Data - Comprehension – Practice Problems only.

Unit-V: Higher Education and Environmental awareness   **12 Hrs**

      People, Development and Environment: Development and environment - Human and environment interaction- Environmental issues - Impacts of pollutants on human health- Natural and energy resources - Natural hazards and disasters- **Higher Education System** - Evolution of higher learning and research in Post-Independence India - Oriental, Conventional and Non-conventional learning programmes in India - Professional, Technical and Skill Based education - Policies, Governance, and Administration.

Text Books:

1. Trueman, M. (2020). *UGC NET/JRF/SET Teaching & Research Aptitude: General Paper 1* (5th ed.). Trueman Publishers.

2. Singh, K. (2021). *UGC NET/JRF/SET Teaching & Research Aptitude: General Paper 1* (3rd ed.). Arihant Publications.

Reference Books:

1. Kothari, C. R. (2016). *Research Methodology: Methods and Techniques* (3rd ed.). New Age International.
2. Sharma, R. A. (2018). *Teaching Aptitude for UGC NET/SLET* (1st ed.). Ramesh Publishing House.
3. Singh, S. (2017). *Communication Skills for UGC NET* (2nd ed.). McGraw-Hill Education.

4. Chopra, R. (2020). *Logical and Analytical Reasoning for UGC NET* (4th ed.). Pearson Education India.
5. Roy, S. K. (2019). *Data Interpretation and Analysis for UGC NET* (1st ed.). Disha Publications.

SEMESTER: IV PART- C	23PCSCX46: EXTENSION ACTIVITY	Credit:1 Hours:-

-Refer to the Regulations-

****