M.Sc. (Computer Science)

Curriculum and Syllabus

for the

AFFILIATED COLLEGES

of

MANONMANIAM SUNDARANAR UNIVERSITY, TIRUNELVELI-12

Learning Outcome based Curriculum Framework (LOCF)
based on TANSCHE COMMON Curriculum Framework

With effect from 2023-2024 onwards

VISION AND MISSION OF THE UNIVERSITY

Vision

"To provide quality education to reach the un-reached"

Mission

- To conduct research, teaching and outreach programmes to improve conditions of human living
- To create an academic environment that honours women and men of all races, caste, creed, cultures and an atmosphere that values intellectual curiosity, pursuit of knowledge, academic freedom and integrity
- To offer a wide variety of off-campus educational and training programs, including the use of information technology, to individuals and groups.
- To develop partnership with industries and government so as to improve the quality of the workplace and to serve as catalyst for economic and cultural development
- To provide quality / inclusive education, especially for the rural and un-reached segments of economically downtrodden students including women, socially oppressed and differently abled

M.Sc. COMPUTER SCIENCE PROGRAMME

Preamble

The M.Sc. Computer Science Programme is introduced to develop Post Graduates in **Computer Science** with a deepknowledge in theoretical Computer Science who can be employed inresearch and development units of industries and academic institutions and could pursue higher studies.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

1. To prepare the students to understand the core concepts in **Computer Science**
2. Enable students to develop problem solving and programming skills in the recent technologies there by developing strong employability
3. Empower students to prepare themselves to engage in active research
4. Enable students to pursue competitive exams at National and state level such as NET/SLET/GATE

Name of the Programme	M.Sc., Computer Science
Programme Code	
Duration	PG - Two Years
Programme Outcomes (POs)	**Programme Outcomes (POs) for M. Sc Computer Science are as follows** At the end of the course, Students will be able to perform the following, **PO1: Computational Knowledge** Understand the basic foundations of Computer Science, Computing Fundamentals with Basic Mathematics. **PO2: Problem Analysis** Analyze and identify the customer requirements in multidisciplinary domains, create high level design and implement robust software applications using latest technological skills. **PO3: Design and Development** Design and develop solutions for complex problems in various domains. Serve as the Programmers or the Software Engineers with the sound knowledge of practical and theoretical concepts for developing software. **PO4: Research Activity** Understand the fundamentals of research and Inculcate the ability to undertake original research at the cutting edge of computer science & its related areas. Produce researchers who can investigate problems in different application domains and creatively develop, and evaluate computational solutions.

	PO5: Software tool usage Adapt and apply modern computing skills and tools to resolve problems with software development tools, software systems, and modern computing platforms. **PO6: Professional ethics** Understand professional ethics and Cyber regulations and develop systems with social commitments. **PO7: Personality development** Understand Management Principles and apply the principles to develop software as a team member and mange projects efficiently for multidisciplinary environments. **PO8: Communication and Presentation Efficacy** Communicate effectively with computing society in both verbal and written form.. **PO9: Social Responsibility** Access Social and Environmental issues for local and global needs and give relevant solutions to them. **PO10: Entrepreneurship** Identify opportunities for entrepreneurship by creating and adding value for the betterment of an individual and society at large.
Programme Specific Outcomes (PSOs)	**PSO1 – Placement** To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, and beliefs and apply diverse frames of reference to decisions and actions. **PSO 2 - Entrepreneur**

	To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations. **PSO3 – Research and Development** Design and implement HR systems and practices grounded in research that complies 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.

REGULATIONS of the PROGRAMME

Duration of the Programme: Two years (4 Semesters)

Eligibility:

Students with three year Bachelor's degree in Computer Science / Computer Applications / Information Technology/Software Engg/AI/Data Science/Cyber Security or any other degree accepted by the Syndicate of Manonmaniam Sundaranar University as equivalent in the 10+2+3 pattern

Credit Distribution for PG Programme based on TANSCHE Common Curriculum Framework

Semester–I	Credit	Hours	Semester-II	Credit	Hours	Semester-III	Credit	Hours	Semester–IV	Credit	Hours
1.1. Core-I Analysis & Design of Algorithms	4	4	**2.1. Core-IV** Data Mining And Warehousing	4	4	3.1. Core-VII	4	4	4.1. Core-X	4	4
1.2 Core-II Object Oriented Analysis and Design & C++	4	4	**2.2 Core-V** Advanced Operating Systems	4	4	3.2 Core-VII	4	4	4.2 Core-XI	4	4
1.3 Core – III Python Programming	4	4	**2.3 Core – VI** Advanced Java Programming	4	4	3.3 Core – IX	4	4	4.3 Core – XII	4	4
1.4 Elective-I Advanced Software Engineering	3	3	**2.4 Elective – III** Artificial Intelligence and Machine Learning	3	3	3.4 Elective (Generic / Discipline Centric) – V	3	4	4.4 Elective (Generic / Discipline Centric) – VI	3	4
1.5 Elective-II Advanced Computer Networks	3	3	**2.5 Elective-IV** Internet of Things	3	3	3.5 Core Industry Module	3	4	4.5 Project with Viva-Voce	3	8
1.6 **Core LAB-I** Algorithms And OOPS Lab	2	3	2.6 **Core LAB-III** Data Mining using R Lab	2	4	3.6 Ability Enhancement Course- Soft Skill -3	2	2	4.6 Ability Enhancement Course- Soft Skill -4	2	2
1.7 **Core LAB-II** Python Programming LAB	2	4	2.7 **Core LAB-IV** Advanced Java Programming Lab	2	4	3.7 Skill Enhancement Course – Term Paper and Seminar Presentation SEC 3	2	6	4.7 Skill Enhancement Course - Professional Competency Skill	2	2
1.8 Ability Enhancement Course **Effective Communication in English**	1	2	2.8 Ability Enhancement **English for Competitive Exams**	1	2	3.8 Internship/ Industrial Activity	2	2	4.8 Extension Activity	1	2
1.9 Skill Enhancement SEC-1 **Basics of Web Design**	1	2	2.9 Skill Enhancement Course SEC 2 (Web development	1	2						

			using PHP)								
	24	30		24	30		24	30		23	30
					Total Credit Points					95	

Component wise Credit Distribution

Credits	Sem I	Sem II	Sem III	Sem IV	Total
Core/Core LAB	16	16	15	12	59
Electives (i)Discipline– Centric	6	6	3	3	18
(ii Skill Enhancement	1	1	2	2	11
(iii)Summer Internship / Industrial Training/ Project			2	3	
Ability Enhancement / Extension	1	1	2	2+1	7
Total Credits	23	23	24	23	95

METHODS OF EVALUATION		
Internal Evaluation	Continuous Internal Assessment Test (15)	**25 Marks**
	Assignments / Snap Test / Quiz (5)	
	Seminars (3)	
	Attendance and Class Participation (2)	
External Evaluation	End Semester Examination	**75 Marks**
Total		**100 Marks**

METHODS OF ASSESSMENT	
Remembering (K1)	• The lowest level of questions require student store call information from the course content • Knowledge questions usually require students to identify information in the text book.
Understanding (K2)	• Understanding of facts and idea s by comprehending organizing, comparing, translating, interpolating and interpreting in their own words. • The questions go beyond simple recall and require students to combine data together
Application (K3)	• Students will be able to solve problems by using/applying a concept learned in the classroom. • Students must use their knowledge to determine a exact response.
Analyze (K4)	• Analyzing the question that asks the students to break down something in to its component parts. • Analyzing requires students to identify reasons causes or motives and reach conclusions or generalizations.
Evaluate (K5)	• Evaluation requires an individual to make judgment on something. • Questions to be asked to judge the value of an idea, a character, a work of art, or a solution to a problem. • Students are engaged in decision-making and problem–solving. • Evaluation questions do not have single right answers.
Create (K6)	• The questions of this category challenge students to get engaged in creative and original thinking. Developing original ideas and problem solving skills

PROGRAMME OUTCOMES (PO) - PROGRAMME SPECIFIC OUTCOMES (PSO) MAPPING

PROGRAMME SPECIFIC OUTCOMES (PSO)					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
PSO1	**3**	**3**	**3**	**3**	**3**
PSO2	**3**	**3**	**3**	**3**	**3**
PSO3	**3**	**3**	**3**	**3**	**3**
PSO4	**3**	**3**	**3**	**3**	**3**
PSO5	**3**	**3**	**3**	**3**	**3**

Level of Correlation between PO's and PSO's
(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value
1 – Low
2 – Medium
3 – High
0 – No Correlation

Semester I

Course Code	Title of the Course	Credits	Hours		Maximum Marks		
			Theory	Practical	CIA	ESE	Total
Core – I	Analysis & Design of Algorithms	4	4		25	75	100
Core – II	Object Oriented Analysis and Design & C++	4	4		25	75	100
Core – III	Python Programming	4	4		25	75	100
Elective – I	Advanced Software Engineering	3	3		25	75	100
Elective – II	Advanced Computer Networks	3	3				
Lab I	Algorithm And OOPS Lab	2		4	40	60	100
Lab II	Python Programming Lab	2		4	40	60	100
Ability Enhancement Course AEC-I	Effective Communication in English	1	2		25	75	100
Skill Enhancement Course– SEC I	Basics of Web Design	1	2		25	75	100
	Total	25	22	8			

I – SEMESTER

Course code		ANALYSIS & DESIGN OF ALGORITHMS	L	T	P	C
Core/Elective/Supportive		Core -I	4			4
Pre-requisite		Basic Data Structures & Algorithms				

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	TRAVERSALANDSEARCHTECHNIQUES	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	DYNAMICPROGRAMMING	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	**BACKTRACKING**	**13hours**
Backtracking:-GeneralMethod–8-QueensProblem–SumOfSubsets–GraphColoring– Hamiltonian Cycles – Branch And Bound: - The Method – Traveling Salesperson.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, on line seminars– webinars		
	Total Lecture hours	**75hours**

Version

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, “Data Structures& Algorithms in Java”,Wiley3rd edition.
2	Skiena,”The Algorithm Design Manual”,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

I – SEMESTER

Course code		OBJECT ORIENTED ANALYSIS AND DESIGN & C++	L	T	P	C
Core/Elective/Supportive		Core -II	4			4
Pre-requisite		Basics of C++ and Object Oriented Concepts				

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	OBJECTMODEL	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	CLASSESANDOBJECTS	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

Introduction to C++-Input and output statements in C++-Declarations-control structures– Functions in C++.

Unit:4	INHERITANCEANDOVERLOADING	13hours

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

Unit:5	**POLYMORPHISM AND FILES**	**15hours**
Memory Management Operators-Polymorphism–Virtual functions–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, SecondEdition,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

I – SEMESTER

Course code		PYTHON PROGRAMMING	L	T	P	C
Core/Elective/Supportive		Core – III	4			4
Pre-requisite		Basics of any OO Programming Language				

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, else if, 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–Inself Defense –Get and Set Attribute Values with Properties –Name Mangling for Privacy – Method Types – Duck Typing – Special Methods –Composition.

Unit:4	DATA TYPESAND WEB	13hours

DataTypes: TextStrings–BinaryData.**StoringandRetrievingData:**FileInput/Output– Structured Text Files – Structured Binary Files - Relational Databases – NoSQL 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 event–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	BillLubanovic,"IntroducingPython",O'Reilly,FirstEdition-SecondRelease,2014.
2	Mark Lutz,"Learning Python", O'Reilly, Fifth Edition, 2013.
Reference Books	
1	David M. Beazley, "Python Essential Reference", Developer's Library, Fourth Edition,2009.
2	Sheetal Taneja, Naveen Kumar, "Python Programming-A Modular Approach", Pearson Publications.
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

I – SEMESTER

Course code		CORE LAB I: ALGORITHM AND OOPS LAB	L	T	P	C
Core/Elective/Supportive		Lab – I			4	2
Pre-requisite		Basic Programming of C++ language				

Course Objectives:

The main objectives of this course are to:

1. This course covers the basic data structures like Stack, Queue, Tree, and List.
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.

Expected Course Outcomes:

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

1	Understand the concepts of object oriented with respect to C++	K1,K2
2	Able to understand and implement OOPS concepts	K3,K4
3	Implementation of data structures like Stack, Queue, Tree, List using C++	K4,K5
4	Application of the data structures for Sorting, Searching using different techniques.	K5,K6

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

LISTOF PROGRAMS	75hours

1) Write a program to solve the tower of Hanoi using recursion.
2) Write a program to traverse through binary search tree using traversals.
3) Write a program to perform various operations on stack using linked list.
4) Write a program to perform various operation in circular queue.
5) Write a program to sort an array of an elements using quick sort.
6) Write a program to solve number of elements in ascending order using heap sort.
7) Write a program to solve the knap sack problem using greedy method
8) Write a program to search for an element in a tree using divide& conquer strategy.
9) Write a program to place the 8 queens on an 8X8 matrix so that no two queens Attack.
10) Write a C++ program to perform Virtual Function
11) Write a C++ program to perform Parameterized constructor
12) Write a C++ program to perform Friend Function
13) Write a C++ program to perform Function Overloading
14) Write a C++ program to perform Single Inheritance
15) Write a C++ program to perform Employee Details using files.

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
Reference Books	
1	Anany Levith, ”Introduction to the Design and Analysis of algorithm”, Pearson Education Asia, 2003.
2	Robert Sedgewick, Phillipe Flajolet, ”An Introduction to the Analysis of Algorithms”, Addison-Wesley Publishing Company,1996.
Related Online Contents [MOOC, SWAYAM, NPTEL, Web sites 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	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

I – SEMESTER

Course code		**CORE LAB II: PYTHON PROGRAMMING LAB**	**L**	**T**	**P**	**C**
Core/Elective/Supportive		**Lab – II**			4	2
Pre-requisite		Basics of any OO Programming Language				

Course Objectives:

The main objectives of this course are to:

1. This course presents an overview of elementary data items, lists, dictionaries, sets and tuples
2. To understand and write simple Python programs
3. To Understand the OOPS concepts of Python
4. To develop web applications using Python

Expected Course Outcomes:

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

1	Able to write programs in Python using OOPS concepts	K1,K2
2	To understand the concepts of File operations and Modules in Python	K2,K3
3	Implementation of lists, dictionaries, sets and tuples as programs	K3,K4
4	To develop web applications using Python	K5,K6

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

LIST OF PROGRAMS	**75hours**

Implement the following in Python:

1. Programs using elementary data items, lists, dictionaries and tuples
2. Programs using conditional branches,
3. Programs using loops.
4. Programs using functions
5. Programs using exception handling
6. Programs using inheritance
7. Programs using polymorphism
8. Programs to implement file operations.
9. Programs using modules.
10. Programs for creating dynamic and interactive Web Pages using forms.

Total Lecture hours	**75hours**

Text Books

1	Bill Lubanovic, “Introducing Python”,O’Reilly,FirstEdition-SecondRelease,2014.
2	Mark Lutz, “Learning Python”, O’Reilly, Fifth Edition, 2013.

Reference Books

1	David M. Beazley, "Python Essential Reference", Developer's Library, Fourth Edition,2009.
2	Sheetal Taneja, Naveen Kumar, "Python Programming-A Modular Approach" ,Pearson Publications.
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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	S
CO2	S	S	S	S	S	S	S	M	S	M
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

AEC-I : Ability Enhancement Course 1

L	T	P	C
2			1

EFFECTIVE COMMUNICATION IN ENGLISH

Course code:

Course Objectives:

• To help the students develop communication skills and self confidence
• To motivate the students to acquire employability skills
• To introduce various interview techniques to the students
• To motivate the students to becomes good public speakers
• To develop leadership qualities in the students
• To guide the students how to tackle interviews
• To help the students to enhance their writing skills
• To teach the students how to write a good CV
• To introduce various articles in writing to the students

Course Contents

Public Speaking
The power of Public Speaking, • Developing confidence, • Planning • Preparation • Successful and effective delivery of speech

Group Discussion
What is group discussion? • Why are group discussions held? • Preparation for a group discussion • Skills for effective participation • Traits tested in a group discussion • Initiating a group discussion • Non-verbal communication in group discussion • Types of group discussions

Interviews
Interviewing in the 21st century • Developing an Interview Strategy • Taking Care of the Details • Practicing for the Interview • During the Interview • Stress Interviews • Traditional Interviews

Writing Skills • Basics of writing • Writing paragraphs • Writing research articles • Report writing • Writing a CV

L	T	P	C
2			1

Skill Enhancement Course (SEC 2)

Basics of Web Design

UNIT I
Introduction to Web Design Introduction of Internet, WWW, Website, Working of Websites, Webpages, Front End, Back End, Client and Server Scripting Languages, Responsive Web Designing, Types of Websites (Static and Dynamic Websites).

UNIT II
HTML Basics HTML: Introduction, Basic Structure of HTML, Head Section and Elements of Head Section, HTML 5 Introduction, HTML5 New Elements: Section, Nav, Article, Aside, Audio Tag, Video Tag, HTML5 Form Validations: Require Attribute. Autofocus Attribute, email, number type, date type , Range type, HTML embed multimedia, HTML Layout, HTML Iframe

Unit III
CSS Introduction to CSS, Types of CSS, CSS Selectors: Universal Selector, ID selector, Tag Selector, Class Selector, Sub Selector, Attribute Selector, Group Selector, CSS Properties: Back Ground properties, Block Properties, Box properties, List properties, Border Properties, Positioning Properties, CSS Lists CSS Tables, CSS Menu Design CSS Image Gallery

Unit IV
JavaScript and Angular JS Introduction to Client Side Scripting Language, Variables in Java Script, Operators in JS, Conditions Statements, JS Popup Boxes.

Unit V
JS Events, Basic Form Validations in JavaScript. Introduction to Angular JS: Expressions, Modules and Directives.

Books for Reference:

1. HTML5, Black Book, Kagent Learning Solution Inc, 2014
2. Mastering HTML, CSS &JavaScript Web Publishing by Lemay Laura, BPB publications
3. HTML & CSS: The Complete Reference by Thomas Powell

SECOND SEMESTER							
Type of the Course	Course Name	Credits	Hours Theory	PRACTICAL	INT	EXT	TOT
Core – IV	Data Mining And Warehousing	4	4		25	75	100
Core – V	Advanced Operating Systems	4	4		25	75	100
Core – VI	Advanced Java Programming	4	4		25	75	100
Elective – III	Artificial Intelligence and Machine Learning	3	3		25	75	100
Elective –IV	Internet of Things	3	3		25	75	100
Lab– III	Data Mining using R - Lab	2		4	40	60	100
Lab – IV	Advanced Java Programming Lab	2		4	40	60	100
Ability Enhancement Course AEC-II	English for Competitive Exams	1	2		25	75	100
Skill Enhancement Course – SEC II	Web Development using PHP	1	2		25	75	100
	Total	25	22	8			

II – SEMESTER

Course code		**DATA MINING AND WAREHOUSING**	**L**	**T**	**P**	**C**
Core/Elective/Supportive		**Core – IV**	4			4
Pre-requisite		Basics of RDBMS & Algorithms				

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-based algorithms-neural network–based algorithms–rule-based algorithms–combining techniques.

Unit:3	**CLUSTERING AND ASSOCIATION**	**12hours**

Clustering:Introduction–SimilarityandDistanceMeasures–Outliers–HierarchicalAlgorithms -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 data mart. Online analytical processing :introduction -OLTP & OLAP systems Data modeling –star schema for multidimensional view –data modeling – multi fact 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	MargaretH.Dunham,"DataMining:IntroductoryandAdvancedTopics",Pearson education,2003.
2	C.S.R. Prabhu, "Data Warehousing Concepts, Techniques, Products and Applications", PHI, Second Edition.
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	Jiawei Han & Micheline Kamber, "Data Mining Concepts & Techniques", 2001, Academicpress.
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

II – SEMESTER

Course code		**ADVANCED OPERATING SYSTEMS**	**L**	**T**	**P**	**C**
Core/Elective/Supportive		**Core – V**	4			4
Pre-requisite		Basics of OS& its functioning				

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	**BASICSOFOPERATINGSYSTEMS**	**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	**DISTRIBUTEDOPERATINGSYSTEMS**	**12hours**

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

Unit:3	**REALTIMEOPERATINGSYSTEM**	**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	**HANDHELDSYSTEM**	**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: Theory and Practice ",Pearson Education India,2006.
2	Pramod Chandra P. Bhatt, An introduction to operating systems, concept and practice, PHI, Third edition, 2010.
3	Daniel.P.Bovet&MarcoCesati,"UnderstandingtheLinuxkernel",3rd edition,O"Reilly,2005
4	Neil Smyth, "iPhone iOS 4Development Essentials–Xcode", Fourth Edition, 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

II – SEMESTER

Course code		**ADVANCED JAVA PROGRAMMING**	**L**	**T**	**P**	**C**
Core/Elective/Supportive		**Core – VI**	4			4
Pre-requisite		Basics of Java & its Usage				

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	**BASICSOFJAVA**	**12hours**

Java Basics Review: Components and event handling–Threading concepts–Networking features – Media techniques

Unit:2	**REMOTEMETHOD 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**

Java in Databases-JDBC principles–database access-Interacting-database search–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	**ADVANCEDTECHNIQUES**	**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	**60 hours**

Text Books	
1	Jamie Jaworski, "Java Unleashed", SAMS Tech media Publications,1999.
2	Campione, Walrath and Huml, "The Java Tutorial", Addison Wesley,1999.
Reference Books	
1	JimKeogh,"TheCompleteReferenceJ2EE",TataMcGrawHillPublishingCompanyLtd,2010.
2	DavidSawyerMcFarland,"JavaScriptAndJQuery-TheMissingManual",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

Course code		PRACTICAL III:DATA MINING USING R	L	T	P	C
Core/Elective/Supportive		Lab - III			4	2
Pre-requisite		Basics of DM Algorithms & R Programming				

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 understand & write programs using the DM algorithms
3. To apply statistical interpretations for the solutions
4. Able to use visualizations techniques for interpretations

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	K1,K2
2	To implement data mining techniques like classification, prediction	K2,K3
3	Able to use different visualization techniques using R	K4,K5
4	To apply different data mining algorithm s to solve real world applications	K5,K6

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

LISTOF PROGRAMS	**75hours**

- Implement Apriori algorithm to extract association rule of data mining.
- Implement k-means clustering technique.
- Implement anyone Hierarchal Clustering.
- Implement Classification algorithm.
- Implement Decision Tree.
- Linear Regression.
- Data Visualization.

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

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.

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	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

de		PRACTICAL IV:ADVANCED JAVA LAB	L	T	P	C
Core/Elective/Supportive		Lab - IV			4	2
Pre-requisite		Basics in Java Programming				

Course Objectives:

The main objectives of this course are to:

1. To enable the students to implement the simple programs using JSP, JAR
2. To provide knowledge on using Servlets, Applets
3. To introduce JDBC and navigation of records
4. To understand RMI & its implementation
5. To introduce to Socket programming

Expected Course Outcomes:

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

1	Understand to the implement concepts of Java using HTML forms ,JSP & JAR	K1,K2
2	Must be capable of implementing JDBC and RMI concepts	K3,K4
3	Able to write Applets with Event handling mechanism	K4,K5
4	To Create interactive web based applications using servlets and jsp	K5,K6

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

LISTOF PROGRAMS	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 pay slip using JSP.
6. Write a program using JDBC for creating a table, Inserting, Deleting records and list out the records.
7. Write a program using Java servlet to handle form data.
8. Write a simple Servlet program to create a table of all the 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 apple 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).

Expert lectures, online seminars –webinars

Total Lecture hours	75hours

Text Books	
1	JamieJaworski,"JavaUnleashed",SAMSTechmediaPublications,1999.
2	Campione, Walrath and Huml,"TheJavaTutorial",AddisonWesley,1999.
Reference Books	
1	JimKeogh,"TheCompleteReferenceJ2EE",Tata Mc Graw Hill Publishing Company Ltd,2010.
2	DavidSawyerMcFarland,"JavaScriptAndJQuery-TheMissingManual",Oreilly Publications, 3rd Edition,2011.
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	M	S	S	S	M	M	S	M
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S

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

Ability Enhancement Course: AEC 2

L	T	P	C
2			1

ENGLISH FOR COMPETITIVE EXAMS

Objectives:

- To help the students prepare for competitive exams
- To enable the students to learn the techniques to ace the tests
- To enable the students to learn English grammar
- To enhance the students' reading skills
- To teach the students how to answer comprehension questions
- To focus on vocabulary and its importance
- To guide the students about IELT exams
- To discuss various components of vocabulary
- To introduce a variety of reading passages to the students

Course Contents

Reading Comprehension
- Introduction to a variety of reading passages - Key to comprehension - Tackling questions - Techniques for answering comprehension questions

Reading Skills
- Skimming - Scanning - Intensive reading - Extensive reading

Vocabulary
Synonyms - Antonyms - Analogy - Sentence completion

Grammar
Basics of grammar (Parts of speech, tense form, articles, etc.) - Identifying errors

Writing
- Importance of writing - Responding to the task - Coherence and cohesion - Lexical resource - Grammatical range and accuracy - Planning and preparation - Using examples - Writing general essays - Descriptive writing.

Skill Enhancement Course (SEC 2)

L	T	P	C
2			1

Web Development using PHP

UNIT I

Introduction to PHP as a programming Language: - Advantages of PHP, the server side architecture Decomposed, overview of PHP, history, object oriented support, benefits in running PHP as a server side script.

UNIT II

The basics of PHP: - data types, variables, constants, operators, Arrays, Conditional statements (if statement, Executing Multiple Statements, else if clause and switch statement), Iterations (for loop, while loop, controlling an array using a while loop, do while statement.

UNIT III

Functions, user defined functions, functions with arguments, built in functions (print(), includer(), header(), phpinfo()), Working with Strings.

UNIT IV

Working with forms, form elements (Text Box, Text Area, Password, Radio Button, Checkbox, The Combo Box, Hidden Field and image), adding elements to a form

UNIT V

Data base connectivity using PHP (MySQL, ODBC, ORACLE, SQL) Performing, executing Commands, different types of Data Base Operations like Insertion, deletion, update and query on dat

Books for Reference:

1. Mastering PHP, WebTech Solutions, Khanna Publishing House
2. Learning PHP, Ramesh Bangia, Khanna Publishing House

LIST OF ELECTIVES

Course code		ADVANCED SOFTWARE ENGINEERING	L	T	P	C
Core/Elective/Supportive		Elective	3			3
Pre-requisite		Basics of Software Engineering & SPM				

Course Objectives:

The main objectives of this course are to:

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

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	**75 hours**

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,3rdEdition.

Reference Books

1	Software Engineering– K.K. Aggarwal and Yogesh Singh, New Age International Publishers, 3 rd 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

MappingwithProgrammingOutcomes

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

Course code		ADVANCED COMPUTER NETWORKS	L	T	P	C
Core/Elective/Supportive		Elective	3			3
Pre-requisite		Basic Knowledge on mathematics and networking				

Course Objectives:

The main objectives of this course are to:

1. Have a detailed knowledge on the concept of networks
2. Know the idea on protocols, OSI layers and its functions.
3. Get knowledge on protocols used in different layers.
4. Know about the function of Internet

Expected Course Outcomes:

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

1	Understand fundamental underlying principles of computer networking	K1,K2
2	Understand details and functionality of layered network architecture.	K2,K3
3	Apply mathematical foundations to solve computational problems in computer networking	K3,K4
4	Analyze and evaluate performance of various communication protocols.	K4,K5,K6
5	Compare and create new routing algorithms.	K6

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

Unit:1	INTRODUCTION	12hours

Introduction- data communications – networks – The internet – Protocols and standards – OSI model – layers in OSI model – TCP/IP protocol suite – addressing – guided media – Unguided media

Unit:2	DATA LINK LAYER	12hours

Switching – Circuit switched networks – datagram networks – virtual circuit networks – Framing – Flow and error control Multiple access – random access – wired Lan – wireless Lan – Cellular telephony – satellite networks

Unit:3	NETWORK LAYER	12hours

Network layer – IP V4 addressing – IPV6 addressing – ICMP – IGMP –Network layer delivery – forwarding – unicast and multicast routing protocols

Unit:4	TRANSPORT LAYER	12hours

Transport layer – Process to process delivery – UDP -TCP -Congestion – congestion control – QOS – Techniques to improve QOS

Unit:5	APPLICATION LAYER	12hours

Domain name system – name space – domain name space – distribution of name space – DNS in the internet – remote logging - email – file transfer -Network management system – SNMP Protocol

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

Text Books	
1	Data communications and networking – Behrouz A Forouzan McGraw Hill 4th Edition 2015 Reprint
Reference Books	
1	Computer Networks – Tenenbaum -Pearson -2022
2	Computer networking –Kurose James F, Ross Keith W -Pearson – 2017
3	Data and computer communications – William Stallings – Pearson 2017
4	Computer networks and Internet – Douglas E Comer – Pearson - 2018
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/106105080
2	https://www.tutorialspoint.com/computer-networks/index.asp
3	https://www.javatpoint.com/computer-network-tutorial

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

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

Course code		ARTIFICIAL INTELLIGENCE & MACHINE LEARNING	L	T	P	C
Core/Elective/Supportive		Elective	3			3
Pre-requisite		Basics of AI & An Introduction about ML				

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 are all 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	SEARCHTECHNIQUES	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	PREDICATELOGIC	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	MACHINELEARNING	12hours

Understanding Machine Learning: What Is Machine Learning? - Defining Big Data - Big Data in Context with Machine Learning - The Importance of the Hybrid Cloud - Leveraging the Power of Machine Learning - The Roles of Statistics and Data Mining with Machine Learning-Putting Machine Learning in Context-Approaches to Machine Learning.		
Unit:5	**APPLICATIONSOFMACHINE LEARNING**	**10 hours**
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", 4thEdition, 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

Course code		INTERNET OF THINGS	L	T	P	C
Core/Elective/Supportive		Elective	3			3
Pre-requisite		Basics of Sensors & its Applications				

Course Objectives:

The main objectives of this course are to:

- To get familiar with the evolution of IOT with its design principles.
- To outline the functionalities and protocols of internet communication.
- To analyze the hardware and software components needed to construct IOT applications.
- To identify the appropriate protocol for API construction and writing embedded code.
- To realize various business models and ethics in Internet of Things.

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	Comprehend the IoT evolution with its architecture and sensors	K2,K3
3	Assess the embedded technologies and develop prototypes for the IoT products	K4
4	Evaluate the use of Application Programming Interface and design an API for IoT in real-time	K5,K6
5	Design IoT in real time applications using today's internet & wireless Technologies	K6

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

Unit:1	INTRODUCTION	12hours

Internet of Things: An Overview : IoT Conceptual Framework - IoT Architectural View - Technology Behind IoT - Sources of IoT - M2M Communication - Examples of IoT - Design Principles for Connected Devices : IoT/M2M Systems Layers and Designs Standardization - Communication Technologies - Data Enrichment, Data Consolidation and Device Management at Gateway

Unit:2	**Design Principles for Web Connectivity** :	12hours

Communication Protocols for Connected Devices – Message Communication Protocols for Connected Devices – Web Connectivity for Connected Devices – Network Using Gateway , SOAP, REST, HTTP, RESTful and WebSockets - Internet Connectivity Principles : Internet Connectivity - Internet Based Communication – IP Addressing in the IoT – Media Access Control – Application Layer Protocols: HTTP, HTTPS, FTP, Telnet and Others

Unit:3	**Data Acquiring, Organizing, Processing and Analytics** :	12hours

Data Acquiring and Storage – Organising the Data – Transactions, Business Processes, Integration and Enterprise Systems – Analytics – Knowledge Acquiring, Managing and Storing Processes - Data Collection, Storage and Computing Using a Cloud Platform: Cloud Computing Paradigm for Data Collection, Storage and Computing – Everything as a Service and Cloud Service Models.		
Unit:4	**SENSORS AND ACTUATORS**	**10hours**
Sensors, Participatory Sensing, RFIDs, and Wireless Sensor Networks : Sensor Technology – Wireless Sensor Networks Technology - Prototyping the Embedded Devices for loT and M2M : Embedded Computing Basics – Embedded Platforms for Prototyping.		
Unit:5	**Prototyping and Designing the Software for IoT Applications**	**12hours**
Prototyping Embedded Device Software - Devices, Gateways, Internet and Web/Cloud Services Software Development – Prototyping online Component APIs and Web APIs – Security for IoT : Vulnerabilities, Security Requirements and Threat Analysis – IoT Security Tomography and Layered Attacker Model – Security Models, Profiles and Protocols for IoT – IoT Application Case Study : Design Layers, Design Complexity and Designing using Cloud PaaS – IoT / IIoT Applications in the premises, Supply – Chain and Customer Monitoring – Connected Car and its Applications and Services.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars –webinars		
	Total Lecture hours	**60 hours**

Text Book	
1	Raj Kamal , " Internet of Things Architecture and Design Principles", McGraw Hill, 2017
Reference Books	
1	Ovidiu Vermesan and Peter Friess, "Internet of Things – From Research and Innovation to Mark Deployement" , River Publishers, 2014.
2	Peter Waher, "Learning Internet of Things" ,Packt Publishing, 2015.
3	Donald Norris, "The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and Beagle Bone Black", Mc Graw Hill, 2015
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

Course code		**MULTIMEDIA AND ITS APPLICATIONS**	**L**	**T**	**P**	**C**
Core/Elective/Supportive		**Elective**	3			3
Pre-requisite		Basics of Multimedia				

Course Objectives:

The main objectives of this course are to:

1. To introduce the students 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	Analyz e 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	**MULTIMEDIATOOLS**	**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 World Wide Web–Designing for the World Wide Web.		
Unit:5	MULTIMEDIASYSTEMS	**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 Jef floate, "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

Course code		EMBEDDED SYSTEMS	L	T	P	C
Core/Elective/Supportive		Elective	3			3
Pre-requisite		Basics of Micro Controller				

Course Objectives:

The main objectives of this course are to:

1. Present theintroductionto8051 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 the malfunctioning system using various debugging techniques	K5,K6

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

Unit:1	8051 MICROCONTROLLER	12Hours

8051 Microcontroller: Introduction-8051Architecture-Input/Output Pins, Ports and Circuits-External Memory - Counters / Timers - Serial Data Input / Output –Interrupts

Unit:2	PROGRAMMINGBASICS	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	CONCEPTSONRTOS	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, Mail boxes and pipes- Timer Functions-Events - Memory Management-Interrupt Routines in an RTOS Environment.

Unit:4	DESIGNUSING 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: Embedded software Development Tools: Hosts and Target Machines-

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,"The8051 Microcontroller and Architecture programming and application", Second Edition, Penram International.
Reference Books	
1	RajKamal, "Embedded Systems –Architecture, programming and design", TataMcGraw–Hill, 2003.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
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

Course code		CRITICAL THINKING, DESIGN THINKING AND PROBLEM SOLVING	L	T	P	C
Core/Elective/Supportive		Elective	3			3
Pre-requisite		Basics of Logical & Reasoning Skills				

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 to critical thinking and problem solving skills	K2,K3
3	Apply design thinking in problems	K3,K4
4	Decide 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	CRITICALTHINKING	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, data processing, solution methods, solving problems by searching, recognizing patterns, 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. LeBlanc, Strategies for Creative Problem Solving, 2nd edition, Pearson, Upper Saddle River, NJ, 2008.
Reference Books	
1	A. Whimbey and J. Lochhead, Problem Solving & Comprehension, 6th edition, Lawrence Erlbaum, Mahwah, NJ, 1999.
2	M. Levine, Effective Problem Solving, 2nd edition, Prentice Hall, Upper Saddle River, NJ, 1994.
3	Michael Baker, The Basic of Critical Thinking, The Critical Thinking Co. press, 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

Course code		MOBILE COMPUTING	L	T	P	C
Core/Elective/Supportive		Elective	3			3
Pre-requisite		Basics of Mobile Communication				

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, student 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	MOBILECOMMUNICATION	12hours

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

Unit:3	MOBILECOMPUTING	12hours

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

Unit:4	MOBILECOMMUNICATIONSYSTEM	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	COMMUNICATIONTECHNOLOGY	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. Palani velu, R. Nakkeeran, "Wireless and Mobile Communication", PHI Limited, 2009.
2	Jochen Schiller, "Mobile Communications," Second Edition, Pearson Education, 2007.
Reference Books	
1	Asoke K Talukder, Hasan Ahmed, Roopa Yavagal, "Mobile Computing", TMH,2010.
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

Course code		BLOCKCHAIN TECHNOLOGY	L	T	P	C
Core/Elective/Supportive		Elective	3			3
Pre-requisite		Basics of Block Chain & Crypto Currency				

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 Block Chain.

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 healthcare 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	CRYPTOCURRENCYREGULATION	11hours

Crypto currency Regulation-Stake holders, Roots of Bitcoin, Legal views-exchange of crypto currency-Black Market- Global Economy. Cyrpto economics–assets, supply and

Demand, inflation and deflation – Regulation.		
Unit:5	**CHALLENGESINBLOCKCHAIN**	**11hours**
Opportunities and challenges in Block Chain – Application of block chain: Industry 4.0 – machine to machine communication –Data management in industry4.0–future prospects .Block chain in Health 4.0 - Blockchain properties - Healthcare Costs - Healthcare Quality - Healthcare Value - Challenges for using block chain for health care data		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60 hours**

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,"MasteringBitcoin:UnlockingDigitalCryptocurrencies"
Reference Books	
1	Satoshi Nakamoto,"Bitcoin: APeer-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

Course code		WEB SERVICES	L	T	P	C
Core/Elective/Supportive		Elective	3			3
Pre-requisite		Basics of Distributed Computing				

Course Objectives:

The main objectives of this course are to:

1. Present the Web Services , Building real world Enterprise applications using Web Services with Technologies XML, SOAP , WSDL , UDDI
2. Get overview of Distributed Computing, XML, and its technologies
3. Update with QoS and its features
4. Develop Standards and future of Web Services

Expected Course Outcomes:

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

1	Understand web services and its related technologies	K1,K2
2	Understand XML concepts	K2,K3
3	Analyze on SOAP and UDDI model	K4,K5
4	Demonstrate the road map for the standards and future of web services	K5
5	Analyze QoS enabled applications in web services	K5,K6

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

Unit:1	INTRODUCTION	12hours

Introduction to web services – Overview of Distributed Computing- Evolution and importance of web services-Industry standards, Technologies and concepts underlying web services-Web services and enterprises-web services standards organization-web services platforms.

Unit:2	XMLFUNDAMENTALS	12hours

XMLFundamentals–XMLdocuments-XMLNamespaces-XMLSchema–ProcessingXML.

Unit:3	SOAP MODEL	12hours

SOAP: The SOAP model- SOAP messages-SOAP encoding- WSDL: WSDL structure- interface definitions-bindings-services-Using SOAP and WSDL-UDDI: About UDDI- UDDI registry Specification- Core data structures-Accessing UDDI

Unit:4	TECHNOLOGIESANDSTANDARDS	12hours

Advanced web services technologies and standards: Conversations overview-web services conversation language-WSCL interface components. Workflow: business process management-workflows and workflow management systems Security: Basics-data handling and forwarding-data storage-errors-Web services security issues.

Unit:5	QUALITYOFSERVICE	10 hours
Quality of Service: Importance of QoS for web services-QoS metrics-holes-design patterns-QoS enabled web services-QoS enabled applications. Web services management-web services standards and future trends.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars –webinars		
	Total Lecture hours	**60 hours**

Text Books

1	Sandeep Chatterjee, James Webber, "Developing Enterprise Web Services: An Architects Guide", Prentice Hall, Nov 2003.
2	Keith Ballinger, "NET Web services: Architecture and Implementation with .Net", Pearson Education, First Edition, Feb 2003.

Reference Books

1	RameshNagappan,"DevelopingJavaWebServices:Architectinganddevelopingsecure Web Services Using Java", John Wiley and Sons, first Edition Feb 2003.
2	Eric A Marks and Mark J Werrell ," Executive Guide to Webservices" ,John Wiley and sons, March 2003.
3	Anne Thomas Manes, "Web Services :A managers Guide", AddisonWesley,June2003.

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

1	https://www.tutorialspoint.com/webservices/index.htm
2	https://www.javatpoint.com/web-services-tutorial
3	https://www.btechguru.com/training--programming--xml--web-services--web-services-part-1-video-lecture--11801--24--147.html

Mapping with Programming Outcomes

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

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

Course code		ROBOTIC PROCESS AUTOMATION FOR BUSINESS	L	T	P	C
Core/Elective/Supportive		Elective	3			3
Pre-requisite		Basics of Robots & its Applications				

Course Objectives:

The main objectives of this course are to:

1. Learn the concepts of RPA, its benefits, types and models.
2. Gain the knowledge in application of RPA in Business Scenarios.
3. Identify measures and skills required for RPA

Expected Course Outcomes:

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

1	Demonstrate the benefits and ethics of RPA	K1,K2
2	Understand the Automation cycle and its techniques	K2
3	Draw inferences and information processing of RPA	K3,K4
4	Implement & Apply RPA in Business Scenarios	K5
5	Analyze on Robots & leveraging automation	K5,K6

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

Unit:1	INTRODUCTION	12hours

Introduction to RPA -Overview of RPA -Benefits of RPA in a business environment -Industries & domains fit for RPA - Identification of process for automation - Types of Robots - Ethics of RPA & Best Practices - Automation and RPA Concepts - Different business models for implementing RPA -Centre of Excellence –Types and their applications -Building an RPA team -Approach for implementing RPA initiatives.

Unit:2	AUTOMATION	12hours

Role of a Business Manager in Automation initiatives - Skills required by a Business Manager for successful automation - The importance of a Business Manager in automation - Analyzing different business processes - Process Mapping frameworks - Role of a Business Manager in successful implementation – Part 1 - Understanding the Automation cycle – First 3 automation stages and activities performed by different people.

Unit:3	AUTOMATION IMPLEMENTATION	12hours

Evaluating the Automation Implementation Detailed description of last 3 stages and activities performed by different people - Role of a Business Manager in successful completion – Part 2 - Activities to be performed post-implementation - Guidelines for tracking the implementation success - Metrics/Parameters to be considered for gauging success - Choosing the right licensing option - Sending emails - Publishing and Running Workflows.

Unit:4	ROBOT	12hours

Ability to process information through scopes/systems - Understand the skill of information processing and its use in business - Leveraging automation - Creating a Robot - New Processes. Establish causality by variable behavior - Understand the skill of drawing inference or establishing causality by tracking the behavior of a variable as it varies across time/referenced variable - Leveraging automation for this skill - Robot & new process creation.		
Unit:5	**ROBOTSKILL**	**10hours**
Inference from snapshots of curated terms – Omni-source data curation - Multisource trend tracking - Understand the skill of drawing inference from the behavior of curated terms by taking snapshots across systems in reference to time/variable(s) - Leveraging automation for this skill – Robot creation and new process creation for this skill.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert, online seminars – webinars		
	Total Lecture hours	**60hours**

Text Books

1	Alok Mani Tripathi" Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool" Packt Publishing Limited March 2018.
2	Tom Taulli "The Robotic Process Automation Handbook" Apress, February2020.

Reference Books

1	Steve Kaelble "Robotic Process Automation" John Wiley & Sons, Ltd., 2018

Related Online Contents [MOOC, SWAYAM, NPTEL, Websitesetc.]

1	https://www.tutorialspoint.com/uipath/uipath_robotic_process_automation_introduction.htm
2	https://www.javatpoint.com/rpa
3	https://onlinecourses.nptel.ac.in/noc19_me74/preview

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	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