Manonmaniam Sundaranar University

Tirunelveli
Choice Based Credit System
Course Structure for M.Sc Computer Science – Affiliated Colleges
(With effect from the Academic Year 2023-2024 onwards)

M.Sc Computer Science - Semester - I

Course Code	Title of the Course	Credits	Hours Per Week (L/T/P)
Core – I	Analysis & Design of Algorithms	4	4
Core - II	Object Oriented Analysis and Design & C++	4	4
Core - IV	Python Programming	4	4
Elective - I	Advanced Software Engineering	3	3
Elective - II	Advanced Computer Networks	3	3
Lab - I	Algorithm And OOPS Lab	2	4
Lab - II	Python Programming Lab	2	4
Ability Enhancement Course [AEC-I]	Effective Communication in English	1	2
Skill Enhancement Course [SEC I]	Basics of Web Design	1	2
		24	30

M.Sc Computer Science - Semester - II

Course Code	Title of the Course	Credits	Hours Per Week (L/T/P)
Core – VI	Data Mining And Warehousing	4	4
Core - V	Advanced Operating Systems	4	4
Core - VI	Advanced Java Programming	4	4
Elective - III	Artificial Intelligence and Machine Learning	3	3
Elective - VI	Internet of Things	3	3
Lab - III	Data Mining using R - Lab	2	4
Lab - IV	Advanced Java Programming Lab	2	4
Ability Enhancement Course [AEC - II]	English for Competitive Exams	1	2
Skill Enhancement Course [SEC - II]	Web Development using PHP	1	2
		24	30

M.Sc Computer Science - Semester - III

Course Code	Title of the Course	Credits	Hours Per Week (L/T/P)
Core – 14	Digital Image Processing	4	4
Core - 15	Soft Computing	4	4
Core - 16	Advanced Computer Networks	4	4
Core - 17	Research Methodology	4	4
Elective – II (Select any one)	1. Cloud Computing 2. Mobile Computing 3. Optimization Technique	4	3
Core – 18 Practical - 5	Digital Image Processing using Scilab	4	2
Lab - IV	Mini Project	6+ 2*	6
	Sub Total	30	27
Semester IV			
Core - 20	Major Project	30+2*	16
Sub Total		30	16
Cumulative total		120	90

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 de sign and analysis of the algorithms.

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
	Versio	
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**

	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

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

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

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. Re present compound data using P thon lists, tuples and dictionaries

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

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.
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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

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

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.
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

AEC-I :   Ability Enhancement Course 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

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			

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.

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	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.
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

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 Operati ng Systems

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 – 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	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	HAND HELD 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: 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",3rdedition,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

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

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

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.

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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

		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

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

Ability Enhancement Course: AEC 2

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)

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.

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	

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

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

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. Stud y 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/

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.

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 a
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

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

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/

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.

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

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

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, 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/

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 conce pt of mobile computing.

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/

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.

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 An	tonopoulos,"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/

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

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	XML FUNDAMENTALS	12hours

XML Fundamentals–XML documents-XMLNamespaces-XMLSchema–Processing XML.

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	TECHNOLOGIES AND STANDARDS	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	QUALITY OF SERVICE	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

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:

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

SEMESTER III					
Semester (1)	Course No (2)	Course Type (3)	Course Name (4)	Contact Hrs./ Week (5)	Credits (6)
III	15	Core14	Digital Image Processing	4	4
	16	Core15	Soft Computing	4	4
	17	Core16	Advanced Computer Networks	4	4
	18	Core17	Research Methodology	4	4
	19	Elective 2 (Select any one)	1. Cloud Computing 2. Mobile Computing 3. Optimization Technique	4	3
	20	Core 18 Practical 5	Digital Image Processing using Sci Lab	4	2
	21	Core –19	Mini Project	6+2*	6
			Subtotal	30	27

Core 14 DIGITAL IMAGE PROCESSING   [C L T P 4 3 1 0]

Course Objectives:

> ➢ To provide complete knowledge on Digital Image Processing methods, such
> as image processing methods in Spatial domain and Frequency domain,
> Edge detection, Compression, Segmentation, and Morphological concepts,
> which enable the students to understand the concepts and implement them
> empirically.

Course Outline: ***(Total 60 Hours)***

UNIT1 Introduction and Digital Image Fundamentals   *(12 Hours)*

Introduction: What is Digital Image Processing examples of fields that uses DIP
Fundamental Steps in Digital Image Processing Components of an Image
Processing Digital Image Fundamentals: Elements of Visual Perception Light and
the Electromagnetic Spectrum Image Sensing and Acquisition Image Sampling
and Quantization Some Basic Relationships Between Pixels Introduction to the
Basic Mathematical Tools Used in Digital Image Processing.

UNIT – II Image Enhancement and Frequency Domain Filtering   *(12 Hours)*

Image Enhancement: Background Some Basic Intensity Transformation Functions -
Histogram Processing Fundamentals of Spatial Filtering Smoothing Spatial Filters
Sharpening Spatial Filters Combining Spatial Enhancement Methods Using Fuzzy
Techniques for Intensity Transformations and Spatial Filtering. Filtering in the
Frequency Domain: Background Preliminary Concepts Sampling and the Fourier
Transform of Sampled Functions The Discrete Fourier Transform of One Variable
Extensions to Functions of Two Variables Some Properties of the 2D DFT and IDF
The Basics of Filtering in the Frequency Domain Image Smoothing Using Low pass
Frequency Domain Filters   Image Sharpening Using High pass Filters   Selective
Filtering The Fast Fourier Transform.

UNIT – III Image Restoration and Image Transforms   *(12 Hours)*

Image Restoration: Model of the Image Degradation/Restoration process – Noise Models Noise Only—Spatial Filtering Periodic Noise Reduction Using FDF Inverse Filtering Minimum Mean Square Error Filtering Constrained Least Squares Filtering Geometric Mean Filter Image Reconstruction from Projections. Wavelet and Other Image Transforms Preliminaries Matrix based Transforms Correlation Basis Functions in the TimeFrequency Plane Basis Images FourierRelated Transforms WalshHadamard Transforms   Slant Transform Haar Transform   Wavelet Transforms.

UNIT – IV   Color Image Processing and Image Compression   *(12 Hours)*

Color Image Processing: Color Fundamentals Color Models Pseudo color Image Processing   Basics of FullColor Image Processing Color Transformations Color Image Smoothing and Sharpening Using Color in Image Segmentation Noise in Color Images Color Image Compression. Image Compression and Watermarking Fundamentals Huffman Coding Arithmetic Coding – LZW Coding Runlength Coding Symbolbased Coding Bitplane Coding Block Transform Coding Predictive Coding Digital Image Watermarking.

UNIT – V   Morphological Processing & Image Segmentation   *(12 Hours)*

Morphological Image Processing Preliminaries Erosion and Dilation Some Basic Morphological Algorithms – Morphological Reconstruction Image Segmentation Fundamentals
 Point, Line, and Edge Detection Thresholding segmentation by Region Growing and by Region Splitting and Merging The Use of Motion in Segmentation.

Text and Reference books

1. Digital Image Processing, Fourth Edition, Rafel C. Gonzalez and Richard
   E. Woods, Pearson Education, 2018.
2. Fundamentals of Digital Image Processing, Chris Solomon & Toby Breckon,
   Wiley
   Blackwell publications, 2011.
3. Digital Image Processing and Analysis, B. Chandra and D.
   DuttaMajumder, PHI,New Delhi, 2006.
4. Fundamentals of Digital Image Processing, Anil K. Jain, Prentice Hall of
   India,1989.

Course Objectives: **Core 15 SOFT COMPUTING   [C L T P 4 3 1 0]**

- ➢ Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory.

- ➢ Introduce students to artificial neural networks and fuzzy theory from an engineering perspective.

Course Outline: **(Total 60 hours)**

UNIT1 INTRODUCTION   *(12 Hours)*

Introduction: Soft Computing Constituents – Soft Computing Vs Hard Computing – Characteristics - Applications - Artificial Neural Network (ANN): Fundamental Concept – Application Scope - Basic Terminologies – Neural Network Architecture – Learning Process – Basic Models of ANN: McCulloch - Pitts Model – Hebb Network – Linear Separability.

UNIT – II SUPERVISED LEARNING NETWORKS   *(12 Hours)*
Supervised Learning Networks: Perceptron Networks – Adaline and Madaline Networks – Back Propagation Network – Radial Basis Function Network. Associative Memory Networks – BAM – Hopfield Network - Boltzmann Machine.
Unsupervised Learning Networks: Kohonen Self Organizing Network – Counter Propagation Network – ART Network.

UNIT – III FUZZY SETS   *(12 Hours)*

Fuzzy Sets: Basic Concept – Crisp Set Vs Fuzzy Set - Operations on Fuzzy Set – Properties of Fuzzy Sets – Fuzzy Relations: Concept – Fuzzy Composition – Fuzzy Equivalence and Tolerance Relation
- Membership Functions: Features – Fuzzification – Methods of Membership value assignments – Defuzzification – Methods.

UNIT – IV   FUZZY CONCEPTS   *(12 Hours)*

Fuzzy Arithmetic – Extension Principle – Fuzzy Measures – Fuzzy Rules and Fuzzy Reasoning: Fuzzy Propositions – Formation of Rules – Decomposition of Rules – Aggregation of Rules – Approximate Reasoning – Fuzzy Inference and Expert Systems – Fuzzy Decision Making – Fuzzy Logic Control Systems.

UNIT – V   GENETIC ALGORITHM   *(12 Hours)*

Genetic Algorithm: Fundamental Concept – Basic Terminologies – Traditional Vs Genetic Algorithm Elements of GA Encoding Fitness Function – Genetic Operators: Selection – Cross Over Inversion and Deletion Mutation – Simple and General GA – The Schema Theorem Classification of Genetic Algorithm – Genetic Programming – Applications of GA.

Text and Reference books
1. S.N. Sivanandam, S.N. Deepa, "Principles of Soft Computing", Wiley India, 2007.
2. S. Rajasekaran, G.A.V. Pai, "Neural Networks, Fuzzy Logic, Genetic Algorithms",
   Prentice Hall India, 2004.

Core 16 ADVANCED COMPUTER NETWORKS   [C L T P 4 3 1 0]

Course Objectives:

➢ To study communication network protocols, different communication layer structure
➢ To learn security mechanism for data communication
➢ To learn network simulator.

Course Outline: **(Total 60 hours)**
UNIT - 1   *(12 Hours)*

   INTRODUCTION TO NETWORKS & COMMUNICATION MEDIA: Uses – Network Hardware - Network software – Reference Models. Example Networks: Internet – X.25 ATM Transmission media – Wireless Transmission – Telephone system – ISDN, ATM communication – satellite communication.

UNIT – II   *(12 Hours)*
DATA TRANSFER & ACCESS PROTOCOLS: Error detection and correction methods – Elementary protocols – Sliding window protocols IEEE 802.2 Logical Link Control – Bluetooth: architecture – protocol stack – radio layer – baseband layer – L2CAP layer – frame structure.

UNIT – III   *(12 Hours)*

 NETWORK LAYER PROTOCOLS: Routing algorithms – Congestion control: Principles – policies – Congestion control in VC subnets – congestion control in datagram subnets Network layer in Internet: Architecture – IP protocol IP Address – IPv6

UNIT – IV   *(12 Hours)*
TRANSPORT PROTOCOLS: Transport service – Transport protocols – Transport protocols in Internet: TCP and UDP
UNIT – V   *(12 Hours)*
APPLICATION LAYER ISSUES: Domain Name System – Electronic mail Network security Cryptography. Network Simulator: Basics of Computer Network Simulation – Introduction to Network Simulator 2 (NS2) – Basic Architecture – Installation – Directories and Convention – Running NS2 Simulation – Simulation Examples.

Text and Reference books

1. Andrew S.Tanenbaum, "Computer Networks", PHI, 5 th Edition, 2013
2. Behrouz A. Forouzan, "Data communication and Networking", Tata McGrawHill, 4th Edition, 2006
3. William Stallings, "Data and Computer Communication", 7th Edition, Pearson Education, 2007
4. TeerawatUssaruyakul, EkramHossain, Introduction to Network Simulator NS2, Springer, 2009

Core 17 RESEARCH METHODOLOGY   [C L T P 4 3 1 0]

Course Objectives:

- ➢ To understand the importance of Research Methodology
- ➢ To perform exploratory data analysis
- ➢ To apply the statistical testing to prove the hypothesis
- ➢ To provide the inference using quantitative data analysis
- ➢ To make use of computer aids to analyze the data, prepare reports and presentations Able to evaluate methodology of teaching

Course Outline: **(Total 60 hours)**
UNIT1   *(12 Hours)*
INTRODUCTION OF RESEARCH AND FORMULATION Motivation and Objectives – Research methods vs Methodology. Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical. Defining and formulating the research problem Selecting the problem Necessity of defining the problem Importance of literature review in defining a problem – Literature review – Primary and secondary sources – Reviews, treatise, monographs, patents –Critical literature review . RESEARCH DESIGN AND METHODS Research design – Basic Principles Need of research design –– Features of good design – Important concepts relating to research design.

UNIT – II   *(12 Hours)*
Observation and Facts, Laws and Theories, Prediction and explanation, Induction, Deduction, Development of Models Developing a research plan Exploration, Description, Diagnosis, Experimentation Determining experimental and sample designs. DATA COLLECTION Execution of the research Observation and Collection of data Methods of data collection.

UNIT – III   *(12 Hours)*
DATA ANALYSIS Quantitative Methods: Online Quantitative Design and Survey – Descriptive Measures – Probability – Random Variables and Distribution Functions – Discrete Probability Distributions – Continuous Probability Distribution – Sampling Distributions – Theory of Estimation – Hypothesis Testing – Correlation – Regression – Principles of Sample Survey – Types of Sampling – Design of Experiments – CRD-RBDLSDFactor Analysis – Cluster Analysis – Discriminant Analysis – Multiple Regression and Correlation – Canonical Correlation – Application of Statistical Software Packages. REPORTING AND THESIS WRITING Reporting and

thesis writing – Structure and components of scientific reports Types of report – Technical reports and thesis – Significance – Different steps in the preparation – Layout, structure and Language of typical reports – Illustrations and tables Bibliography, referencing and footnotes – Use of Oral presentation – Software Packages for thesis Preparation– Planning – Preparation – Practice – Making presentation – Use of visual aids Importance of effective communication.

UNIT – IV   *(12 Hours)*
APPLICATION OF RESULTS AND ETHICS Application of results and ethics Environmental impacts

 Ethical issues ethical committees Commercialization – Copy right – royalty – Intellectual property rights and patent law – Trade Related aspects of Intellectual Property Rights – Reproduction of published material – Plagiarism – Application of Plagiarism detection tools Citation and acknowledgment Reproducibility and accountability.

UNIT – V   *(12 Hours)*
METHODOLOGY OF TEACHING: Teaching – Objectives of Teaching, Phases of Teaching – Teaching Methods: Lecture Method, Discussion Method, Discovery Learning, Inquiry, Problem Solving Method, Project method, Seminar – Integrating ICT in Teaching: Individualized Instruction, Ways for Effective Presentation with PowerPoint – Documentation – Evaluation: Formative, Summative & Continuous and Comprehensive Evaluation – Later Adolescent Psychology: Meaning, Physical, Cognitive, Emotional, Social and Moral Development – Teaching Later Adolescents.

Text and Reference books

1. C R Kothari, Paperback "Research Methodology: Methods and Techniques", 2014
2. Modern Language Association Handbook, Eight Edition, 2016
3. R. Paneerselvam, "Research Methodology" 2nd Edition, PHI, 2014
4. John W Creswel, Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, 3rd Edition, 2014
5. S.C. Gupta & V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi, 2014 Edition.

6. S.C. Gupta & V.K. Kapoor, Fundamentals of Applied Statistics, Sultan Chand & Sons. 2014 Edition.
7. Sampath.K, Panneerselvam.A&Santhanam.S (1984), Introduction to Educational Technology (2nd Revised Ed.) New Delhi: Sterling Publishers.
8. Sharma.S.R(2003).Effective Classroom teaching modern methods, tools & techniques, Jaipur: Mangal Deep.
9. Vedanayagam.E.G (1989). Teaching Technology for College Teachers, Newyark: Sterling Publishers.

Elective 2 (a) CLOUD COMPUTING   [C L T P 3 3 1 0]

Course Objectives:

- ➢ To understand the concept of cloud computing.
- ➢ To appreciate the evolution of cloud from the existing technologies.
- ➢ To have knowledge on the various issues in cloud computing.
- ➢ To be familiar with the lead players in cloud.
- ➢ To appreciate the emergence of cloud as the next generation computing paradigm.

Course Outline: **(Total 45 hours)**

UNIT1 INTRODUCTION   *(9 hours)*

Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – Ondemand Provisioning.

UNIT – II CLOUD ENABLING TECHNOLOGIES   *(9 hours)*

Service Oriented Architecture – REST and Systems of Systems – Web Services – Publish Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices –Virtualization Support and Disaster Recovery.

UNIT – III CLOUD ARCHITECTURE, SERVICES AND STORAGE   *(9 hours)*

Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds – laaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – StorageasaService – Advantages of Cloud Storage – Cloud Storage Providers – S3.

UNIT – IV RESOURCE MANAGEMENT AND SECURITY IN CLOUD   *(9 hours)*

Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods
– Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges –

SoftwareasaService Security – Security Governance – Virtual Machine Security – IAM –

Security Standards.

UNIT – V CLOUD TECHNOLOGIES AND ADVANCEMENTS   *(9 hours)*

Hadoop – MapReduce – Virtual Box — Google App Engine – Programming Environment for Google App Engine –– Open Stack – Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation.

Text and Reference books

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From
   Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Rittinghouse, John W., and James F. Ransome, —Cloud Computing: Implementation,
   Management and Security, CRC Press, 2017.
3. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, —Mastering Cloud Computing, Tata
   Mcgraw Hill, 2013.
4. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing – A Practical
   Approach, Tata Mcgraw Hill, 2009.
5. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in
   the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), O'Reilly, 2009.

Elective 2 (b) MOBILE COMPUTING   [C L T P 4 3 1 0]

Course Objectives:

> ➢ To learn the fundamental technologies that help in the networking of wireless devices.
> ➢ To learn about different wireless technologies
> ➢ To learn about the evolution of cellular systems
> ➢ To understand the various wireless standards

Course Outline   ***(Total 45 hours)***

UNIT1   *(9 hours)*

Introduction: Mobility of bits and bytes–Mobile Device ProfilesWireless the beginning–Mobile Computing–Dialogue control–Networks–Middle ware and gateways–Applications and services– Developing mobile computing applications. Mobile Computing Architecture: Architecture of Mobile Computing – Three Tire Architecture –Design Consideration for mobile computing – Making existing applications to mobile enabled. Mobile Computing Through Telephony: Multiple Access procedure – Satellite Communication System Mobile Computing Through Telephone– Developing an IVR Application –Voice XML– Telephony Application Program InterfaceMulti Channel and Multimode user InterfaceDeveloping Mobile GUI's – VUI's

UNIT – II   *(9 hours)*

Emerging Technologies: Introduction – Bluetooth – Radio Frequency Identification(RFID) – Wireless Broadband(WIMAX)– Mobile IP –Internet Protocol version6(IPV6). Global System for Mobile Communication: Introduction – GSM Architecture and Services– GSM Entities –Call Routing in GSM – PLMN interface – GSM addresses and identifiers – Network Aspects in GSM – Mobility Management – GSM frequency allocation – Personal Communication service – Authentication and Security. Short Message Service: Mobile Computing over SMS Short Message Service (SMS) – SMS ArchitectureValue added Services through SMS– Accessing the SMS bearer.

UNIT – III   *(9 hours)*

General Packet Radio Service (GPRS): Introduction – GPRS and Packet data Networking –GPRS Network Architecture GPRS Network Operations – Data Services in GPRS – Applications for GPRS–Limitations of GPRS– Billing and Charging in GPRS– Enhanced Data rate for GSM Evaluation (EDGE).Wireless Application Protocol: Introduction–WAP–MMS –GPRS Applications. CDMA and 3G: Introduction – Spread Spectrum Technology – IS95 – Wireless Data – Third Generation Networks– Applications of 3G.

UNIT – IV   *(9 hours)*

Wireless Networks: Wireless Network and TopologyCellular TelephonyWireless Transmission and Wireless LAN Wireless LAN Advantages–IEEE802.11Standards– Wireless LAN Architecture – Mobility in Wireless LAN – Deploying Wireless LAN – Mobile Adhoc Networks and Sensor Networks – MAC ProtocolRouting Protocol-Transport Layer Protocol – QOS Dynamic Linking and ServicesCommunication via WebWireless LAN security – Wireless Access in Vehicular Environment –Wireless Local Loop– Hiper LAN–WIFI versus 3G. Intelligent Networks and Interworking: Fundamentals of Call Processing – Intelligence in the Networks – SS#7 Signaling – IN Conceptual Model (INCM) – Soft switch – Programmable Networks– Technologies and Interfaces for IN .Client Programming: Mobile Phones–Features of Mobile phones–PDA–Design constraints in Applications for Handheld devices– Recent Developments in Client Technology.

UNIT – V   *(9 hours)*

Programming for the PALM OS: History of PALM OS–PALM OS architecture– Application Development– Communication in PALM OS– Multimedia. Wireless Devices with Symbian OS: Introduction to Symbian OS Symbian OS Architecture – Security on Symbian OS. Security Issues in Mobile Computing: Information Security– Web SecuritySecurity Techniques and Algorithms – Security Protocols– Public Key Infrastructure.

Text and Reference books

1. AsokeKTalukder, Hasan Ahmed and RoopaRyavagal, "Mobile Computing:Technology, Applications and Service Creation", Second Edition , TMH,2010
2. Jochen Schiller, "Mobile Communications",Second Edition, Pearson Education,
   2012
3. T.G. Palanivelu, R. Nakkeeran, Wireless and Mobile Communication, PHI Learning Private Limited, 2009
4. Raj Kamal, "Mobile Computing" ,Second Edition, Oxford University Press, 2012
5. William Stallings, "Wireless Communication and Networks", Pearson Education
   Asia,2002
6. C.Siva Ram Murthy, B.S. Manoj, "Ad Hoc Wireless Networks –Architectures and
   Protocols", 2nd Edition, Pearson Education.2004
7. Ashok K Talukder, Roopa R Yavagal, "Mobile Computing", Tata McGrawHill, 2005.
8. JochenBurkhardt, Dr. HorstHenn, Klaus Rintdoff, Thomas Schack, "Pervasive Computing", Pearson, 2009.

Elective 2 (c) OPTIMIZATION TECHNIQUES [C L T P 3 3 1 0]

Course Objectives:

- ➢ To get the basic knowledge of Optimization Techniques.
- ➢ To study the measurement and scaling techniques.
- ➢ To learn about Assignment Problems.

Course Outline: (Total 45 hours)

UNIT1 INTRODUCTION *(9 hours)*

Statement of an optimization problems – classification of optimization problem – classical optimization techniques; Single variable optimizations, Multi variable optimization, equality constrains, inequality constraints, No constraints.

UNIT – II LINEAR PROGRAMMING *(9 hours)*

Graphical method for two dimensional problems – central problems of Linear Programming – Definitions – Simples – Algorithm – Phase I and II of simplex Method – Revised Simplex Method. Simplex Multipliers – Dual and Primal – Dual Simplex Method – Sensitivity Analysis – Transportation problem and its solution – Assignment problem and its solution – Assignment problem and its solution by Hungarian method – Karmakar's method – statement, Conversion of the Linear Programming problem into the required form, Algorithm.

UNIT – III NON LINEAR PROGRAMMING *(9 hours)*

NON LINEAR PROGRAMMING (ONE DIMENSIONAL MINIMIZATION: Introduction – Unrestricted search – Exhaustive search – interval halving method – Fibonacci method. NON LINEAR PROGRAMMING: (UNCONSTRAINED OPRIMIZATION): Introduction– Random search method – Univariate method – Pattern search methods – Hooke and Jeeves method, simplex method Gradient of a function – steepest descent method – Conjugate gradient method.

UNIT – IV   DYNAMIC PROGRAMMING   *(9 hours)*

Introduction – multistage decision processes – Principles of optimality – Computation procedures.

UNIT – V   DECISION MAKING   *(9 hours)*

Decisions under uncertainty, under certainty and under risk – Decision trees – Expected value of perfect information and imperfect information.

Text and Reference books
1. Kalynamoy Deb, "Optimization for   Engineering Design, Algorithms   and Examples", Prentice Hall, 2004.
2. Hamdy A Taha, "Operations Research – An introduction", Pearson Education, 2002.
3. An Introduction to optimization Techniques by Vikrant Sharma, Vinod Kumar Jain, Atul Kumar April 20,2021 by Chapman and Hall/CRC
4. H.A. Taha, "Operation Research" Prentice Hall of India,2012

Core 18 (Practical)

DIGITAL IMAGE PROCESSING LAB USING SCILAB [C L T P 2 0 0 4]

Course Objectives:

➢ To provide complete knowledge on Digital Image Processing methods, such as image processing methods in Spatial domain and Frequency domain, Edge detection, Compression, Segmentation, and Morphological concepts, which enable the students to understand the concepts and implement them empirically.

LIST OF lab EXERCISES RECOMMENDED:

1. Write a program in Scilab to convert Gray Scale image to Binary Image.
2. Write a program in Scilab for finding Negative of an Image.
3. Write a program in Scilab for Histogram Equalization.
4. Write a program in Scilab for Arithmetic Operators using Image.
5. Write a program in Scilab for Gaussian Low pass Filter.
6. Write a program in Scilab for Gaussian High pass Filter.
7. Write a program in Scilab for Homomorphic Filtering.
8. Write a program in Scilab for Edge Detection.
9. Write a program in Scilab for Erosion of an Image.
10. Write a program in Scilab for Dilation of an Image.
11. Write a program in Scilab for conversion between color spaces.
12. Write a program in Scilab for Segmentation using watershed transform

Core – 19: Mini Project work

GUIDELINES FOR MINI PROJECT WORK

Objective
The Mini project is aimed to enable the third semester student to study of Project development and permit them to design and develop a small scale solution to some real world problem in any one of the core area of study. Student may undertake the project in her/his own area of interest under the supervision of one of the faculty member, complete within the third semester and the whole mini project work is to be evaluated continuously by the internal examiner (Guide) and by the External examiner during the end semester examination. The mini project enables the student to get a prior exposure to carry out the Major project at Fourth Semester

Mode of Mini Project :   Individual Project

Nature of Mini Project: Every student shall undertake a unique project title (Novel Concept/ idea/system or a small research problem, which shall be designed and   implemented   using   available software   development   tool
/programming language) approved by her/his guide.

Guide: Each Student shall be allotted under the Guidance of one Department   faculty   member   by   the   Programme coordinator/Head

Duration :   One semester (6 hours per week)
Student carryout the Mini Project work in her/his College itself. In case of Company project, students are permitted to do the Mini project work in reputed IT companies without affecting the minimum attendance and other classes of the third semester

Continuous Assessment: Based on periodic reviews (Three reviews during the Semester. Tentative review dates are decided by the department and to be intimated to the students at the beginning of the third Semester)

Evaluation criteria:
Each student is evaluated by the Internal Examiner (Guide) continuously during the respective semester. External Examination will be conducted at the end of the respective semester.

Maximum Marks :	Internal	External
100	50	50

Passing Criteria: Student shall secure a minimum of **50 % marks in the external** evaluation and shall secure a **minimum of 50 % marks in combined Internal and External evaluation**. (There is no passing minimum for the internal evaluation)

Internal (CIA) (50 Marks) (All the three reviews are mandatory)		External (50 Marks)	
Review I (Problem identification, Title & Abstract submission, Novelty of the idea, proposed outcomes, issues in existing methods, tools to be used)	15 Marks	Both Internal and External Examiner Shall evaluate the student based on the following criteria at the end of the semester: (Guide or any other department faculty decided by the HOD shall be internal examiner. External Examiner will be appointed by the COE	
Review II System Design / Database Design or Research Methodology / Algorithms and Techniques/ detailed Implementation plan	15 Marks	**Internal Examiner** Project Report	20 Marks
Review III System Implementation status, Testing, demo of working system and completion of report writing	20 Marks	**External Examiner shall evaluate under the following criteria** • Presentation of the Mini Project • Demonstration of the Mini project working • Viva voce	10 Marks 10 Marks 10 Marks
Total	**50 Marks**		**50 Marks**

Semester IV				
Cours e NO	Course Type	Course Name	No of Hours per Week	Credits
22	Core – 20	Major Project	30+2*	16
		Subtotal	**30**	**16**

Core 20 Major Project work

GUIDELINES FOR MAJOR PROJECT WORK

Objective

The Major project is aimed to enable the Fourth semester student to design and develop a standard solution to one of the significant real world problem in any one of the core area of study. Student may undertake the major project in her/his own area of interest under the supervision of one of the faculty member, They may also be permitted to undertake the Major project in a reputed IT firm also with prior permission from the Department Head. The Major project shall be completed within the fourth semester and the whole Major project work shall be evaluated continuously by the internal examiner (Guide) and by the External examiner during the end semester examination. The Major project enables the student to get a prior exposure to project development that enhances their employability skills.

Maximum Marks :	Internal	External
100	50	50

Mode of Major Project: Individual Project

Nature of Major Project: Every student shall undertake a unique project title (Novel Concept/ idea/system or a small research problem, which shall be designed and implemented using available software development tool /programming language) approved by her/his guide.

Guide: Each Student shall be allotted under the Guidance of one Department faculty member by the Programme coordinator/Head

Duration : One semester (30 hours per week) Major project students may also opt for company projects with prior permission from the Head of the Department/Principal

Continuous Assessment: Based on periodic reviews (Three reviews during the Semester. Tentative review dates are decided by the department and to be intimated to the students at the beginning of the fourth Semester)

Evaluation criteria

Each student is evaluated by the Internal Examiner (Guide) continuously during the respective semester. External Examination will be conducted at the end of the respective semester.

Passing Criteria: Student shall secure a minimum of **50 % marks in the external** evaluation and shall secure a **minimum of 50 % marks in combined Internal and External evaluation**. (There is no passing minimum for the internal evaluation)

Internal (50 Marks) (All the three reviews are mandatory)		External (50 Marks)	
Review I (Problem identification, Title & Abstract submission, Novelty of the idea, proposed outcomes, issues in existing methods, tools to be used)	15 Marks	Both Internal and External Examiner Shall evaluate the student based on the following criteria at the end of the semester: (Guide or any other department faculty decided by the HOD shall be internal examiner. External Examiner will be appointed by the COE	
Review II System Design / Database Design / Methodology / Algorithms and Techniques/ detailed Implementation plan	15 Marks	**Internal Examiner** Project Report	20 Marks
Review III System Implementation status, Testing, outcomes and	20 Marks	**External Examiner shall evaluate under the following criteria** • Presentation of the Project	

report writing		• Demonstration of the working project • Viva voce	10 Marks 10 Marks 10 Marks
Total	**50 Marks**		**50 Marks**