

# M. Sc. COMPUTER SCIENCE

## Syllabus

### AFFILIATED COLLEGES

Program Code: 32K

2021 – 2022 onwards



## BHARATHIAR UNIVERSITY

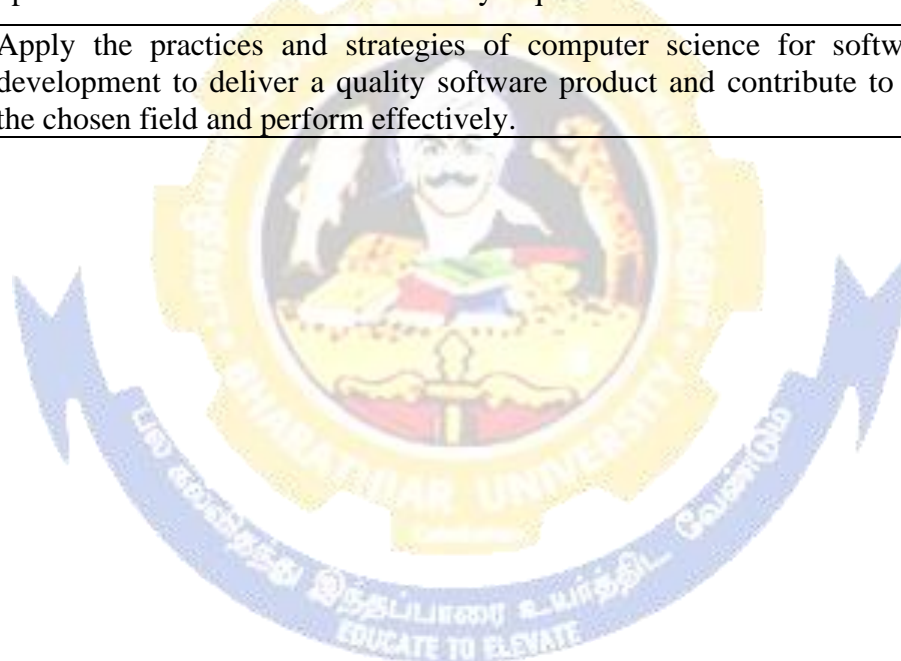
(A State University, Accredited with “A” Grade by NAAC,  
Ranked 13<sup>th</sup> among Indian Universities by MHRD-NIRF,  
World Ranking : Times - 801-1000, Shanghai - 901-1000, URAP - 982)

Coimbatore - 641 046, Tamil Nadu, India

<b>Program Educational Objectives (PEOs)</b>	
The <b>M.Sc. CS</b> program describe accomplishments that graduates are expected to attain within five to seven years after graduation	
PEO1	To enrich the students with the clear picture of the course objectives and to map their requirements.
PEO2	To enable the students, to understand the core concepts, visualize and to apply them in the real time scenarios.
PEO3	To impart the need for consistent learning, importance of research & development for the welfare of the society and to the nation at large.



<b>Program Specific Outcomes (PSOs)</b>	
After the successful completion of <b>M.Sc. CS</b> program, the students are expected to	
PSO1	Able to analyze, design and develop problem solving skills in the discipline of computer science.
PSO2	Acquire evaluation of potential benefits of alternative solution in designing software and/or hardware systems in broad range of open source programming languages to withstand technological changes.
PSO3	Able to pursue careers in IT industry/ consultancy/ research and development, teaching and allied areas related to computer science.
PSO4	Adapt to the continuous technological change in computational science and update themselves to meet the industry requirements and standards.
PSO5	Apply the practices and strategies of computer science for software project development to deliver a quality software product and contribute to research in the chosen field and perform effectively.



<b>Program Outcomes (POs)</b>	
On successful completion of the <b>M.Sc. CS</b> program	
PO1	Develop creativity and problem solving skills with the knowledge of computing and mathematics.
PO2	Ability to develop and carry out experiments, interpret and infer data.
PO3	Design algorithms and develop software to aid solutions to industry and governments.
PO4	Review the latest technology and tool handling mechanism.
PO5	Analyze the outcome to solve global environment related issues.
PO6	Apply the knowledge in lifelong learning journey to equip themselves.
PO7	Identify the perspective of business practices, risks and limitations.
PO8	Work with professional and ethical values.
PO9	Formulate the responsibilities of human rights and entrepreneurial spirit.
PO10	Understand the methods to communicate effectively and work collectively.



**BHARATHIAR UNIVERSITY :: COIMBATORE 641 046**

**M. Sc. Computer Science (Affiliated Colleges)**

(Effective For the candidates admitted during the academic year -2021 – 2022 & onwards)

**REVISED SCHEME OF EXAMINATIONS – CBCS PATTERN**

Course Code	Title of the Course	Credits	Hours		Maximum Marks		
			Theory	Practical	CIA	ESE	Total
<b>FIRST SEMESTER</b>							
	Paper I : Analysis & Design of Algorithms	4	5		50	50	100
	Paper II : Object Oriented Analysis and Design & C++	4	5		50	50	100
	Paper III : Python Programming	4	5		50	50	100
	Paper IV : Advanced Software Engineering	4	5		50	50	100
	Practical I : Algorithm and OOPS Lab	4		5	50	50	100
	Practical II : Python Programming Lab	4		5	50	50	100
	<b>Total</b>	24	20	10			
<b>SECOND SEMESTER</b>							
	Paper V : Data Mining and Warehousing	4	4		50	50	100
	Paper VI Advanced Operating Systems	4	4		50	50	100
	Paper VII Advanced Java Programming	4	4		50	50	100
	Paper VIII : Artificial Intelligence & Machine Learning	4	4		50	50	100
	Elective – I	4	4		50	50	100
	Practical III: Data Mining Lab using R	4		5	50	50	100
	Practical IV: Advanced Java Programming Lab	4		5	50	50	100
	<b>Total</b>	28	20	10			

<b>THIRD SEMESTER</b>							
	Paper IX : Digital Image Processing	4	4		50	50	100
	Paper X: Cloud Computing	4	4		50	50	100
	Paper XI: Network Security and Cryptography	4	4		50	50	100
	Paper XII : Data Science & Analytics	4	4		50	50	100
	Elective – II	4	4		50	50	100
	Practical V: Digital Image Processing Lab using MATLAB	4		4	50	50	100
	Practical VI : Cloud Computing Lab	4		4	50	50	100
	Practical VII : Web Application development & hosting	2		2	25	25	50
	<b>Total</b>	30	20	10			
<b>FOURTH SEMESTER</b>							
	Project work and Viva-voce (200 marks)	8					200*
	<b>Total</b>	8					200
	<b>Grand Total</b>	90					2250
<b>ONLINE COURSES</b>							
1.	<b>#SWAYAM / MOOC</b>	2					
2.	<b>#Job oriented Certificate course</b>	2					

\* Project Report – 100 marks & Viva Voce – 100 marks

# During II or III Semester (Optional)



**First  
Semester**

Course code	ANALYSIS & DESIGN OF ALGORITHMS		L	T	P	C
Core/Elective/Supportive	Core		4			4
Pre-requisite	Basic Data Structures & Algorithms		Syllabus Version		2021-22	
<b>Course Objectives:</b>						
The main objectives of this course are to:						
<ol style="list-style-type: none"> <li>1. Enable the students to learn the Elementary Data Structures and algorithms.</li> <li>2. Presents an introduction to the algorithms, their analysis and design</li> <li>3. Discuss various methods like Basic Traversal And Search Techniques, divide and conquer method, Dynamic programming, backtracking</li> <li>4. Understood the various design and analysis of the algorithms.</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
1	Get knowledge about algorithms and determines their time complexity. Demonstrate specific search and sort algorithms using divide and conquer technique.				K1,K2	
2	Gain good understanding of Greedy method and its algorithm.				K2,K3	
3	Able to describe about graphs using dynamic programming technique.				K3,K4	
4	Demonstrate the concept of backtracking & branch and bound technique.				K5,K6	
5	Explore the traversal and searching technique and apply it for trees and graphs.				K6	
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>						
<b>Unit:1</b>	<b>INTRODUCTION</b>				<b>15 hours</b>	
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.						
<b>Unit:2</b>	<b>TRAVERSAL AND SEARCH TECHNIQUES</b>				<b>15 hours</b>	
Basic Traversal And Search Techniques: Techniques for Binary Trees-Techniques for Graphs - Divide and Conquer: - General Method – Binary Search – Merge Sort – Quick Sort.						
<b>Unit:3</b>	<b>GREEDY METHOD</b>				<b>15 hours</b>	
The Greedy Method: - General Method – Knapsack Problem – Minimum Cost Spanning Tree – Single Source Shortest Path.						
<b>Unit:4</b>	<b>DYNAMIC PROGRAMMING</b>				<b>15 hours</b>	
Dynamic Programming - General Method – Multistage Graphs – All Pair Shortest Path – Optimal Binary Search Trees – 0/1 Knapsacks – Traveling Salesman Problem – Flow Shop Scheduling.						

<b>Unit:5</b>	<b>BACKTRACKING</b>	<b>13 hours</b>
Backtracking: - General Method – 8-Queens Problem – Sum Of Subsets – Graph Coloring – Hamiltonian Cycles – Branch And Bound: - The Method – Traveling Salesperson.		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars – webinars		
<b>Total Lecture hours</b>		<b>75 hours</b>
<b>Text Books</b>		
1	Ellis Horowitz,“Computer Algorithms”, Galgotia Publications.	
2	Alfred V.Aho,John E.Hopcroft,Jeffrey D.Ullman, "Data Structures and Algorithms".	
<b>Reference Books</b>		
1	Goodrich, “Data Structures & Algorithms in Java”, Wiley 3rd edition.	
2	Skiena, ”The Algorithm Design Manual”, Second Edition, Springer , 2008	
3	AnanyLevith, ”Introduction to the Design and Analysis of algorithm”, Pearson Education Asia, 2003.	
4	Robert Sedgewick,Phillipe Flajolet, ”An Introduction to the Analysis of Algorithms”, Addison-Wesley Publishing Company,1996.	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	<a href="https://nptel.ac.in/courses/106/106/106106131/">https://nptel.ac.in/courses/106/106/106106131/</a>	
2	<a href="https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm">https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm</a>	
3	<a href="https://www.javatpoint.com/daa-tutorial">https://www.javatpoint.com/daa-tutorial</a>	
Course Designed By:		

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

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



<b>Course code</b>		<b>OBJECT ORIENTED ANALYSIS AND DESIGN &amp; C++</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Core/Elective/Supportive</b>		<b>Core</b>	4			4
<b>Pre-requisite</b>	Basics of C++ and Object Oriented Concepts		<b>Syllabus Version</b>		<b>2021-22</b>	
<b>Course Objectives:</b>						
The main objectives of this course are to:						
<ol style="list-style-type: none"> <li>1. Present the object model, classes and objects, object orientation, machine view and model management view.</li> <li>2. Enables the students to learn the basic functions, principles and concepts of object oriented analysis and design.</li> <li>3. Enable the students to understand C++ language with respect to OOAD</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
1	Understand the concept of Object-Oriented development and modeling techniques					K1,K2
2	Gain knowledge about the various steps performed during object design					K2,K3
3	Abstract object-based views for generic software systems					K3
4	Link OOAD with C++ language					K4,K5
5	Apply the basic concept of OOPs and familiarize to write C++ program					K5,K6
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>						
<b>Unit:1</b>	<b>OBJECT MODEL</b>					<b>15 hours</b>
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.						
<b>Unit:2</b>	<b>CLASSES AND OBJECTS</b>					<b>15 hours</b>
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.						
<b>Unit:3</b>	<b>C++ INTRODUCTION</b>					<b>15 hours</b>
Introduction to C++ - Input and output statements in C++ - Declarations -control structures – Functions in C++.						
<b>Unit:4</b>	<b>INHERITANCE AND OVERLOADING</b>					<b>13 hours</b>
Classes and Objects –Constructors and Destructors –operators overloading –Type Conversion-Inheritance – Pointers and Arrays.						

<b>Unit:5</b>	<b>POLYMORPHISM AND FILES</b>	<b>15 hours</b>
Memory Management Operators- Polymorphism – Virtual functions – Files – Exception Handling – String Handling -Templates.		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars – webinars		
<b>Total Lecture hours</b>		<b>75 hours</b>
<b>Text Books</b>		
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.	
<b>Reference Books</b>		
1	Balagurusamy “Object Oriented Programming with C++”, TMH, Second Edition, 2003.	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	<a href="https://onlinecourses.nptel.ac.in/noc19_cs48/preview">https://onlinecourses.nptel.ac.in/noc19_cs48/preview</a>	
2	<a href="https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs19/">https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs19/</a>	
3	<a href="https://www.tutorialspoint.com/object_oriented_analysis_design/ooad_object_oriented_analysis.htm">https://www.tutorialspoint.com/object_oriented_analysis_design/ooad_object_oriented_analysis.htm</a>	
Course Designed By:		

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

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

Course code	PYTHON PROGRAMMING			L	T	P	C
Core/Elective/Supportive	Core			4			4
Pre-requisite	Basics of any OO Programming Language			Syllabus		2021-22	
<b>Course Objectives:</b>							
The main objectives of this course are to:							
<ol style="list-style-type: none"> <li>1. Presents an introduction to Python, creation of web applications, network applications and working in the clouds</li> <li>2. Use functions for structuring Python programs</li> <li>3. Understand different Data Structures of Python</li> <li>4. Represent compound data using Python lists, tuples and dictionaries</li> </ol>							
<b>Expected Course Outcomes:</b>							
On the successful completion of the course, student will be able to:							
1	Understand the basic concepts of Python Programming					K1,K2	
2	Understand File operations, Classes and Objects					K2,K3	
3	Acquire Object Oriented Skills in Python					K3,K4	
4	Develop web applications using Python					K5	
5	Develop Client Server Networking applications					K5,K6	
<b>K1</b> - Remember; <b>K2</b> - Understand; <b>K3</b> - Apply; <b>K4</b> - Analyze; <b>K5</b> - Evaluate; <b>K6</b> - Create							
<b>Unit:1</b>	<b>INTRODUCTION</b>					<b>15 hours</b>	
<b>Python:</b> Introduction – Numbers – Strings – Variables – Lists – Tuples – Dictionaries – Sets– Comparison.							
<b>Unit:2</b>	<b>CODE STRUCTURES</b>					<b>15 hours</b>	
<b>Code Structures:</b> if, elseif, and else – Repeat with while – Iterate with for – Comprehensions – Functions – Generators – Decorators – Namespaces and Scope – Handle Errors with try and except – User Exceptions.							
<b>Unit:3</b>	<b>MODULES, PACKAGES AND CLASSES</b>					<b>15 hours</b>	
<b>Modules, Packages, and Programs:</b> Standalone Programs – Command-Line Arguments – Modules and the import Statement – The Python Standard Library. <b>Objects and Classes:</b> Define a Class with class – Inheritance – Override a Method – Add a Method – Get Help from Parent with super – In self Defense – Get and Set Attribute Values with Properties – Name Mangling for Privacy – Method Types – Duck Typing – Special Methods –Composition.							
<b>Unit:4</b>	<b>DATA TYPES AND WEB</b>					<b>13 hours</b>	
<b>Data Types:</b> Text Strings – Binary Data. <b>Storing and Retrieving Data:</b> File Input/Output – Structured Text Files – Structured Binary Files - Relational Databases – NoSQL Data Stores.							
<b>Web:</b> Web Clients – Web Servers – Web Services and Automation							



<b>Unit:5</b>	<b>SYSTEMS AND NETWORKS</b>	<b>15 hours</b>
<p><b>Systems:</b> Files –Directories – Programs and Processes – Calendars and Clocks.  <b>Concurrency:</b> Queues – Processes – Threads – Green Threads and event – twisted – Redis.  <b>Networks:</b> 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.</p>		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars – webinars		
<b>Total Lecture hours</b>		<b>75 hours</b>
<b>Text Books</b>		
1	Bill Lubanovic, “Introducing Python”, O’Reilly, First Edition-Second Release, 2014.	
2	Mark Lutz, “Learning Python”, O’Reilly, Fifth Edition, 2013.	
<b>Reference Books</b>		
1	David M. Beazley, “Python Essential Reference”, Developer’s Library, Fourth Edition, 2009.	
2	SheetalTaneja, Naveen Kumar, “Python Programming-A Modular Approach”, Pearson Publications.	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	<a href="https://www.programiz.com/python-programming/">https://www.programiz.com/python-programming/</a>	
2	<a href="https://www.tutorialspoint.com/python/index.htm">https://www.tutorialspoint.com/python/index.htm</a>	
3	<a href="https://onlinecourses.swayam2.ac.in/aic20_sp33/preview">https://onlinecourses.swayam2.ac.in/aic20_sp33/preview</a>	
Course Designed By:		

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

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

Course code	ADVANCED SOFTWARE ENGINEERING			L	T	P	C
Core/Elective/Supportive	Core			4			4
Pre-requisite	Basics of Software Engineering & SPM			Syllabus		2021-22	
<b>Course Objectives:</b>							
The main objectives of this course are to:							
<ol style="list-style-type: none"> <li>1. Introduce to Software Engineering, Design, Testing and Maintenance.</li> <li>2. Enable the students to learn the concepts of Software Engineering.</li> <li>3. Learn about Software Project Management, Software Design &amp; Testing.</li> </ol>							
<b>Expected Course Outcomes:</b>							
On the successful completion of the course, student will be able to:							
1	Understand about Software Engineering process					K1,K2	
2	Understand about Software project management skills, design and quality management					K2,K3	
3	Analyze on Software Requirements and Specification					K3,K4	
4	Analyze on Software Testing, Maintenance and Software Re-Engineering					K4,K5	
5	Design and conduct various types and levels of software quality for a software project					K5,K6	
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>							
<b>Unit:1</b>	<b>INTRODUCTION</b>					<b>15 hours</b>	
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.							
<b>Unit:2</b>	<b>SOFTWARE REQUIREMENTS</b>					<b>15 hours</b>	
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.							
<b>Unit:3</b>	<b>PROJECT MANAGEMENT</b>					<b>15 hours</b>	
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.							
<b>Unit:4</b>	<b>SOFTWARE DESIGN</b>					<b>15 hours</b>	

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.		
<b>Unit:5</b>	<b>SOFTWARE TESTING</b>	<b>13 hours</b>
Software Testing: A Strategic approach to software testing – Terminologies – Functional testing – Structural testing – Levels of testing – Validation testing - Regression testing – Art of Debugging – Testing tools - Metrics-Reliability Estimation. Software Maintenance - Maintenance Process - Reverse Engineering – Software Re-engineering - Configuration Management Activities.		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars – webinars		
	<b>Total Lecture hours</b>	<b>75 hours</b>
<b>Text Books</b>		
1	An Integrated Approach to Software Engineering – Pankaj Jalote, Narosa Publishing House, Delhi, 3rd Edition.	
2	Fundamentals of Software Engineering – Rajib Mall, PHI Publication, 3rd Edition.	
<b>Reference Books</b>		
1	Software Engineering – K.K. Aggarwal and Yogesh Singh, New Age International Publishers, 3rd edition.	
2	A Practitioners Approach- Software Engineering, - R. S. Pressman, McGraw Hill.	
3	Fundamentals of Software Engineering - Carlo Ghezzi, M. Jarayeri, D. Manodrioli,PHIPublication.	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	<a href="https://www.javatpoint.com/software-engineering-tutorial">https://www.javatpoint.com/software-engineering-tutorial</a>	
2	<a href="https://onlinecourses.swayam2.ac.in/cec20_cs07/preview">https://onlinecourses.swayam2.ac.in/cec20_cs07/preview</a>	
3	<a href="https://onlinecourses.nptel.ac.in/noc19_cs69/preview">https://onlinecourses.nptel.ac.in/noc19_cs69/preview</a>	
Course Designed By:		

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

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

<b>Course code</b>		<b>PRACTICAL I : ALGORITHM AND OOPS LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Core/Elective/Supportive</b>		<b>Core</b>			4	4
<b>Pre-requisite</b>		Basic Programming of C++ language	<b>Syllabus</b>		<b>2021-22</b>	
<b>Course Objectives:</b>						
The main objectives of this course are to:						
1.This course covers the basic data structures like Stack, Queue, Tree , 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.						
<b>Expected Course Outcomes:</b>						
On the successful 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	
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>						
<b>LIST OF PROGRAMS</b>						<b>75 hours</b>
1) Write a program to solve the tower of Hanoi using recursion. 2) Write a program to traverse through binary search tree using traversals. 3) Write a program to perform various operations on stack using linked list. 4) Write a program to perform various operation in circular queue. 5) Write a program to sort an array of an elements using quick sort. 6) Write a program to solve number of elements in ascending order using heap sort. 7) Write a program to solve the knapsack problem using greedy method 8) Write a program to search for an element in a tree using divide & conquer strategy. 9) Write a program to place the 8 queens on an 8X8 matrix so that no two queens Attack. 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						

<b>Total Lecture hours</b>		<b>75 hours</b>
<b>Text Books</b>		
1	Goodrich, "Data Structures & Algorithms in Java", Wiley 3rd edition.	
2	Skiena,"The Algorithm Design Manual",SecondEdition,Springer , 2008	
<b>Reference Books</b>		
1	AnanyLevith,"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.	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	<a href="https://onlinecourses.nptel.ac.in/noc19_cs48/preview">https://onlinecourses.nptel.ac.in/noc19_cs48/preview</a>	
2	<a href="https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs19/">https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs19/</a>	
3	<a href="https://www.tutorialspoint.com/object_oriented_analysis_design/ooad_object_oriented_analysis.htm">https://www.tutorialspoint.com/object_oriented_analysis_design/ooad_object_oriented_analysis.htm</a>	
Course Designed By:		

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

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

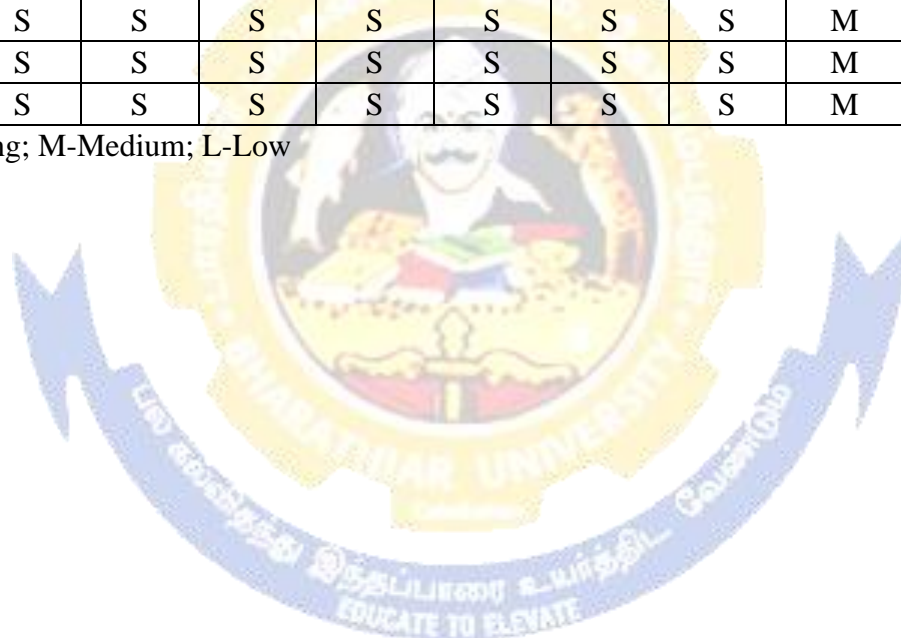


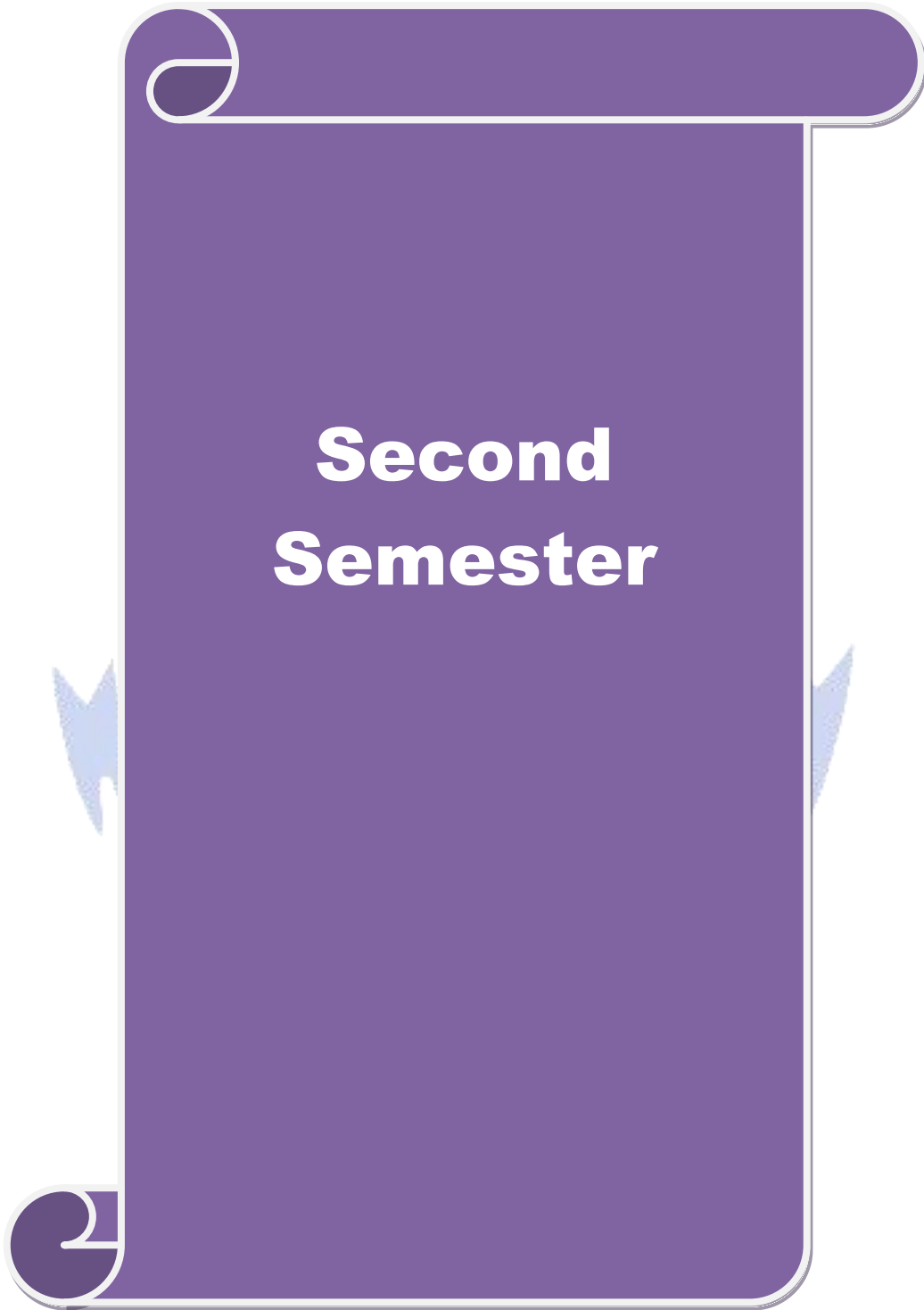
Course code	PRACTICAL II : PYTHON PROGRAMMING LAB		L	T	P	C
Core/Elective/Supportive	Core				4	4
Pre-requisite	Basics of any OO Programming Language		Syllabus		2021-22	
<b>Course Objectives:</b>						
The main objectives of this course are to:						
<ol style="list-style-type: none"> <li>1. This course presents an overview of elementary data items, lists, dictionaries, sets and tuples</li> <li>2. To understand and write simple Python programs</li> <li>3. To Understand the OOPS concepts of Python</li> <li>4. To develop web applications using Python</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
1	Able to write programs in Python using OOPS concepts				K1,K2	
2	To understand the concepts of File operations and Modules in Python				K2,K3	
3	Implementation of lists, dictionaries, sets and tuples as programs				K3,K4	
4	To develop web applications using Python				K5,K6	
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>						
<b>LIST OF PROGRAMS</b>					<b>75 hours</b>	
Implement the following in Python:						
<ol style="list-style-type: none"> <li>1. Programs using elementary data items, lists, dictionaries and tuples</li> <li>2. Programs using conditional branches,</li> <li>3. Programs using loops.</li> <li>4. Programs using functions</li> <li>5. Programs using exception handling</li> <li>6. Programs using inheritance</li> <li>7. Programs using polymorphism</li> <li>8. Programs to implement file operations.</li> <li>9. Programs using modules.</li> <li>10. Programs for creating dynamic and interactive web pages using forms.</li> </ol>						
<b>Total Lecture hours</b>					<b>75 hours</b>	
<b>Text Books</b>						
1	Bill Lubanovic, “Introducing Python”, O’Reilly, First Edition-Second Release, 2014.					
2	Mark Lutz, “Learning Python”, O’Reilly, Fifth Edition, 2013.					
<b>Reference Books</b>						

1	David M. Beazley, "Python Essential Reference", Developer's Library, Fourth Edition, 2009.
2	SheetalTaneja, Naveen Kumar, "Python Programming-A Modular Approach", Pearson Publications.
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>	
1	<a href="https://www.programiz.com/python-programming/">https://www.programiz.com/python-programming/</a>
2	<a href="https://www.tutorialspoint.com/python/index.htm">https://www.tutorialspoint.com/python/index.htm</a>
3	<a href="https://onlinecourses.swyam2.ac.in/aic20_sp33/preview">https://onlinecourses.swyam2.ac.in/aic20_sp33/preview</a>
Course Designed By:	

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

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







Course code	DATA MINING AND WAREHOUSING		L	T	P	C
Core/Elective/Supportive	Core		4			4
Pre-requisite	Basics of RDBMS & Algorithms		Syllabus		2021-22	
<b>Course Objectives:</b>						
The main objectives of this course are to:						
<ol style="list-style-type: none"> <li>1. Enable the students to learn the concepts of Mining tasks, classification, clustering and Data Warehousing.</li> <li>2. Develop skills of using recent data mining software for solving practical problems.</li> <li>3. Develop and apply critical thinking, problem-solving, and decision-making skills.</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
1	Understand the basic data mining techniques and algorithms				K1,K2	
2	Understand the Association rules, Clustering techniques and Data warehousing contents				K2,K3	
3	Compare and evaluate different data mining techniques like classification, prediction, Clustering and association rule mining				K4,K5	
4	Design data warehouse with dimensional modeling and apply OLAP operations				K5,K6	
5	Identify appropriate data mining algorithms to solve real world problems				K6	
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>						
<b>Unit:1</b>	<b>BASICS AND TECHNIQUES</b>				<b>12 hours</b>	
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.						
<b>Unit:2</b>	<b>ALGORITHMS</b>				<b>12 hours</b>	
Classification: Introduction – Statistical – based algorithms - distance – based algorithms- decision tree - based algorithms - neural network – based algorithms –rule - based algorithms – combining techniques.						
<b>Unit:3</b>	<b>CLUSTERING AND ASSOCIATION</b>				<b>12 hours</b>	
Clustering: Introduction – Similarity and Distance Measures – Outliers – Hierarchical Algorithms - Partitional Algorithms.						
Association rules: Introduction - large item sets - basic algorithms – parallel & distributed algorithms – comparing approaches- incremental rules – advanced association rules techniques – measuring the quality of rules.						
<b>Unit:4</b>	<b>DATA WAREHOUSING AND MODELING</b>				<b>11 hours</b>	
Data warehousing: introduction - characteristics of a data warehouse – data marts – other aspects						

of data mart. Online analytical processing: introduction - OLTP & OLAP systems		
Datamodeling –star schema for multidimensional view –data modeling – multifactstar schema or snow flake schema – OLAP TOOLS – State of the market – OLAP TOOLS and the internet.		
<b>Unit:5</b>	<b>APPLICATIONS OF DATA WAREHOUSE</b>	<b>11 hours</b>
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.		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars – webinars		
<b>Total Lecture hours</b>		<b>60 hours</b>
<b>Text Books</b>		
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.	
<b>Reference Books</b>		
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.	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	<a href="https://www.javatpoint.com/data-warehouse">https://www.javatpoint.com/data-warehouse</a>	
2	<a href="https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs12/">https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs12/</a>	
3	<a href="https://www.btechguru.com/training--it--database-management-systems--file-structures--introduction-to-data-warehousing-and-olap-2-video-lecture--12054--26--151.html">https://www.btechguru.com/training--it--database-management-systems--file-structures--introduction-to-data-warehousing-and-olap-2-video-lecture--12054--26--151.html</a>	
Course Designed By:		

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

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

Course code	ADVANCED OPERATING SYSTEMS		L	T	P	C
Core/Elective/Supportive	Core		4			4
Pre-requisite	Basics of OS & its functioning		Syllabus		2021-22	
<b>Course Objectives:</b>						
The main objectives of this course are to:						
<ol style="list-style-type: none"> <li>1. Enable the students to learn the different types of operating systems and their functioning.</li> <li>2. Gain knowledge on Distributed Operating Systems</li> <li>3. Gain insight into the components and management aspects of real time and mobile operating systems.</li> <li>4. Learn case studies in Linux Operating Systems</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
1	Understand the design issues associated with operating systems				K1,K2	
2	Master various process management concepts including scheduling, deadlocks and distributed file systems				K3,K4	
3	Prepare Real Time Task Scheduling				K4,K5	
4	Analyze Operating Systems for Handheld Systems				K5	
5	Analyze Operating Systems like LINUX and iOS				K5,K6	
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>						
<b>Unit:1</b>	<b>BASICS OF OPERATING SYSTEMS</b>				<b>12 hours</b>	
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.						
<b>Unit:2</b>	<b>DISTRIBUTED OPERATING SYSTEMS</b>				<b>12 hours</b>	
Distributed Operating Systems: Issues – Communication Primitives – Lamport’s Logical Clocks – Deadlock handling strategies – Issues in deadlock detection and resolution-distributed file systems –design issues – Case studies – The Sun Network File System-Coda.						
<b>Unit:3</b>	<b>REAL TIME OPERATING SYSTEM</b>				<b>10 hours</b>	
Realtime Operating Systems : Introduction – Applications of Real Time Systems – Basic Model of Real Time System – Characteristics – Safety and Reliability - Real Time Task Scheduling						
<b>Unit:4</b>	<b>HANDHELD SYSTEM</b>				<b>12 hours</b>	
Operating Systems for Handheld Systems: Requirements – Technology Overview –Handheld Operating Systems – PalmOS-Symbian Operating System- Android –Architecture of android –						

Securing handheld systems		
<b>Unit:5</b>	<b>CASE STUDIES</b>	<b>12 hours</b>
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.		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars – webinars		
<b>Total Lecture hours</b>		<b>60 hours</b>
<b>Text Books</b>		
1	Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, “Operating System Concepts”, Seventh Edition, John Wiley & Sons, 2004.	
2	MukeshSinghal and Niranjana G. Shivaratri, “Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems”, Tata McGraw-Hill, 2001.	
<b>Reference Books</b>		
1	Rajib Mall, “Real-Time Systems: Theory and Practice”, Pearson Education India, 2006.	
2	Pramod Chandra P.Bhatt, An introduction to operating systems, concept and practice, PHI, Third edition, 2010.	
3	Daniel.P.Bovet& Marco Cesati,“Understanding the Linux kernel”,3 <sup>rd</sup> edition,O’Reilly, 2005	
4	Neil Smyth, “iPhone iOS 4 Development Essentials – Xcode”, Fourth Edition, Payload media, 2011.	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	<a href="https://onlinecourses.nptel.ac.in/noc20_cs04/preview">https://onlinecourses.nptel.ac.in/noc20_cs04/preview</a>	
2	<a href="https://www.udacity.com/course/advanced-operating-systems--ud189">https://www.udacity.com/course/advanced-operating-systems--ud189</a>	
3	<a href="https://minnie.tuhs.org/CompArch/Resources/os-notes.pdf">https://minnie.tuhs.org/CompArch/Resources/os-notes.pdf</a>	
Course Designed By:		

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

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



<b>Course code</b>		<b>ADVANCED JAVA PROGRAMMING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Core/Elective/Supportive</b>		<b>Core</b>	4			4
<b>Pre-requisite</b>		Basics of Java & its Usage	<b>Syllabus</b>		<b>2021-22</b>	
<b>Course Objectives:</b>						
The main objectives of this course are to:						
<ol style="list-style-type: none"> <li>1. Enable the students to learn the basic functions, principles and concepts of advanced java programming.</li> <li>2. Provide knowledge on concepts needed for distributed Application Architecture.</li> <li>3. Learn JDBC, Servlet packages, JQuery, Java Server Pages and JAR file format</li> </ol>						
<b>Expected Course Outcomes:</b>						
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
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>						
<b>Unit:1</b>	<b>BASICS OF JAVA</b>					<b>12 hours</b>
Java Basics Review: Components and event handling – Threading concepts – Networking features – Media techniques						
<b>Unit:2</b>	<b>REMOTE METHOD INVOCATION</b>					<b>12 hours</b>
Remote Method Invocation-Distributed Application Architecture- Creating stubs and skeletons-Defining Remote objects- Remote Object Activation-Object Serialization-Java Spaces						
<b>Unit:3</b>	<b>DATABASE</b>					<b>10 hours</b>
Java in Databases- JDBC principles – database access- Interacting- database search – Creating multimedia databases – Database support in web applications						
<b>Unit:4</b>	<b>SERVLETS</b>					<b>12 hours</b>
Java Servlets: Java Servlet and CGI programming- A simple java Servlet-Anatomy of a java Servlet-Readingdata 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						
<b>Unit:5</b>	<b>ADVANCED TECHNIQUES</b>					<b>12 hours</b>
JAR file format creation – Internationalization – Swing Programming – Advanced java						

techniques		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars – webinars		
<b>Total Lecture hours</b>		<b>60 hours</b>
<b>Text Books</b>		
1	Jamie Jaworski, “Java Unleashed”, SAMS Techmedia Publications,1999.	
2	Campione, Walrath and Huml, “The Java Tutorial”, AddisonWesley,1999.	
<b>Reference Books</b>		
1	Jim Keogh,” The Complete Reference J2EE”, Tata McGrawHill Publishing Company Ltd,2010.	
2	David Sawyer McFarland, “JavaScript And JQuery- The Missing Manual”, Oreilly Publications, 3rd Edition,2011.	
3	Deitel and Deitel, “Java How to Program”, Third Edition, PHI/Pearson Education Asia.	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	<a href="https://www.javatpoint.com/servlet-tutorial">https://www.javatpoint.com/servlet-tutorial</a>	
2	<a href="https://www.tutorialspoint.com/java/index.htm">https://www.tutorialspoint.com/java/index.htm</a>	
3	<a href="https://onlinecourses.nptel.ac.in/noc19_cs84/preview">https://onlinecourses.nptel.ac.in/noc19_cs84/preview</a>	
Course Designed By:		

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

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

Course code	ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		L	T	P	C
Core/Elective/Supportive	Core		4			4
Pre-requisite	Basics of AI & an Introduction about ML		Syllabus		2021-22	
<b>Course Objectives:</b>						
The main objectives of this course are to:						
<ol style="list-style-type: none"> <li>1. Enable the students to learn the basic functions of AI, Heuristic Search Techniques.</li> <li>2. Provide knowledge on concepts of Representations and Mappings and Predicate Logic.</li> <li>3. Introduce Machine Learning with respect Data Mining, Big Data and Cloud.</li> <li>4. Study about Applications &amp; Impact of ML.</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
1	Demonstrate AI problems and techniques				K1,K2	
2	Understand machine learning concepts				K2,K3	
3	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning				K3,K4	
4	Analyze the impact of machine learning on applications				K4,K5	
5	Analyze and design a real world problem for implementation and understand the dynamic behavior of a system				K5,K6	
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>						
<b>Unit:1</b>	<b>INTRODUCTION</b>				<b>12 hours</b>	
Introduction: AI Problems - AI techniques - Criteria for success. Problems, Problem Spaces, Search: State space search - Production Systems - Problem Characteristics - Issues in design of Search.						
<b>Unit:2</b>	<b>SEARCH TECHNIQUES</b>				<b>12 hours</b>	
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.						
<b>Unit:3</b>	<b>PREDICATE LOGIC</b>				<b>12 hours</b>	
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.						
<b>Unit:4</b>	<b>MACHINE LEARNING</b>				<b>12 hours</b>	

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.		
<b>Unit:5</b>	<b>APPLICATIONS OF MACHINE LEARNING</b>	<b>10 hours</b>
Looking Inside Machine Learning:The Impact of Machine Learning on Applications - Data Preparation-The Machine Learning Cycle.		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars – webinars		
	<b>Total Lecture hours</b>	<b>60 hours</b>
<b>Text Books</b>		
1	Elaine Rich and Kevin Knight," Artificial Intelligence", Tata McGraw Hill Publishers company Pvt Ltd, Second Edition, 1991.	
2	George F Luger, "Artificial Intelligence",4th Edition, Pearson Education Publ,2002.	
<b>Reference Books</b>		
1	Machine Learning For Dummies®, IBM Limited Edition by Judith Hurwitz, Daniel Kirsch.	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	<a href="https://www.ibm.com/downloads/cas/GB8ZMQZ3">https://www.ibm.com/downloads/cas/GB8ZMQZ3</a>	
2	<a href="https://www.javatpoint.com/artificial-intelligence-tutorial">https://www.javatpoint.com/artificial-intelligence-tutorial</a>	
3	<a href="https://nptel.ac.in/courses/106/105/106105077/">https://nptel.ac.in/courses/106/105/106105077/</a>	
Course Designed By:		

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

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



Course code		<b>PRACTICAL III : DATA MINING USING R</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
Core/Elective/Supportive		<b>Core</b>			4	4
Pre-requisite	Basics of DM Algorithms & R Programming		<b>Syllabus Version</b>		2021-22	
<b>Course Objectives:</b>						
The main objectives of this course are to:						
<ol style="list-style-type: none"> <li>To enable the students to learn the concepts of Data Mining algorithms namely classification, clustering, regression....</li> <li>To understand &amp; write programs using the DM algorithms</li> <li>To apply statistical interpretations for the solutions</li> <li>Able to use visualizations techniques for interpretations</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
1	Able to write programs using R for Association rules, Clustering techniques				K1,K2	
2	To implement data mining techniques like classification, prediction				K2,K3	
3	Able to use different visualizations techniques using R				K4,K5	
4	To apply different data mining algorithms to solve real world applications				K5,K6	
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>						
<b>LIST OF PROGRAMS</b>						<b>75 hours</b>
<ol style="list-style-type: none"> <li>Implement Apriori algorithm to extract association rule of datamining.</li> <li>Implement k-means clustering technique.</li> <li>Implement any one Hierarchal Clustering.</li> <li>Implement Classification algorithm.</li> <li>Implement Decision Tree.</li> <li>Linear Regression.</li> <li>Data Visualization.</li> </ol>						
<b>Total Lecture hours</b>						<b>75 hours</b>
<b>Text Books</b>						
1	Margaret H. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson education,2003.					
2	C.S.R. Prabhu, "Data Warehousing Concepts,Techniques, Productsand Applications", PHI, Second Edition					
<b>Reference Books</b>						
1	ArunK.Pujari, "Data Mining Techniques", Universities Press (India) Pvt. Ltd.,2003.					
2	Alex Berson, Stephen J. Smith, "Data Warehousing, Data Mining and OLAP", TMCH, 2001.					
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>						

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

Course Designed By:

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

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



Course code		<b>PRACTICAL IV : ADVANCED JAVA LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
Core/Elective/Supportive		<b>Core</b>			4	4
Pre-requisite		Basics in Java Programming	<b>Syllabus</b>		<b>2021-22</b>	
<b>Course Objectives:</b>						
The main objectives of this course are to:						
<ol style="list-style-type: none"> <li>1.To enable the students to implement the simple programs using JSP, JAR</li> <li>2.To provide knowledge on using Servlets, Applets</li> <li>3.To introduce JDBC and navigation of records</li> <li>4.To understand RMI &amp; its implementation</li> <li>5.To introduce to Socket programming</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
1	Understand to the implement concepts of Java using HTML forms, JSP & JAR				K1,K2	
2	Must be capable of implementing JDBC and RMI concepts				K3,K4	
3	Able to write Applets with Event handling mechanism				K4,K5	
4	To Create interactive web based applications using servlets and jsp				K5,K6	
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>						
<b>LIST OF PROGRAMS</b>					<b>75 hours</b>	
<ol style="list-style-type: none"> <li>1. Display a welcome message usingServlet.</li> <li>2. Design a Purchase Order form using Html form andServlet.</li> <li>3. Develop a program for calculating the percentage of marks of a student usingJSP.</li> <li>4. Design a Purchase Order form using Html form andJSP.</li> <li>5. Prepare a Employee pay slip usingJSP.</li> <li>6. Write a program using JDBC for creating a table, Inserting, Deleting records and listout therecords.</li> <li>7. Write a program using Java servlet to handle formdata.</li> <li>8. Write a simple Servlet program to create a table of all the headers it receives along withtheir associatedvalues.</li> <li>9. Write a program in JSP by using sessionobject.</li> <li>10. Write a program to build a simple Client Server application usingRMI.</li> <li>11. Create an applet for a calculator application.</li> <li>12. Program to send a text message to another system and receive the text message from the system (use socket programming).</li> </ol>						
Expert lectures, online seminars – webinars						
<b>Total Lecture hours</b>					<b>75 hours</b>	

<b>Text Books</b>	
1	Jamie Jaworski, “Java Unleashed”, SAMS Techmedia Publications,1999.
2	Campione, Walrath and Huml, “The Java Tutorial”, AddisonWesley,1999.
<b>Reference Books</b>	
1	Jim Keogh,” The Complete Reference J2EE”, Tata McGrawHill Publishing Company Ltd,2010.
2	David Sawyer McFarland, “JavaScript And JQuery- The Missing Manual”, Oreilly Publications, 3rd Edition,2011.
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>	
1	<a href="https://www.javatpoint.com/servlet-tutorial">https://www.javatpoint.com/servlet-tutorial</a>
2	<a href="https://www.tutorialspoint.com/java/index.htm">https://www.tutorialspoint.com/java/index.htm</a>
3	<a href="https://onlinecourses.nptel.ac.in/noc19_cs84/preview">https://onlinecourses.nptel.ac.in/noc19_cs84/preview</a>
Course Designed By:	

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

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



**Third  
Semester**

Course code	DIGITAL IMAGE PROCESSING			L	T	P	C
Core/Elective/Supportive	Core			4			4
Pre-requisite	Basics of Image Processing			Syllabus		2021-22	
<b>Course Objectives:</b>							
The main objectives of this course are to:							
<ol style="list-style-type: none"> <li>1. Learn basic image processing techniques for solving real problems.</li> <li>2. Gain knowledge in image transformation and Image enhancement techniques.</li> <li>3. Learn Image compression and Segmentation procedures.</li> </ol>							
<b>Expected Course Outcomes:</b>							
On the successful completion of the course, student will be able to:							
1	Understand the fundamentals of Digital Image Processing					K1,K2	
2	Understand the mathematical foundations for digital image representation, image acquisition, image transformation, and image enhancement					K2,K3	
3	Apply, Design and Implement and get solutions for digital image processing problems					K3,K4	
4	Apply the concepts of filtering and segmentation for digital image retrieval					K4,K5	
5	Explore the concepts of Multi-resolution process and recognize the objects in an efficient manner					K5,K6	
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>							
<b>Unit:1</b>	<b>INTRODUCTION</b>					<b>12 hours</b>	
Introduction: What is Digital image processing – the origin of DIP – Examples of fields that use DIP – Fundamentals steps in DIP – Components of an image processing system. Digital Image Fundamentals: Elements of Visual perception – Light and the electromagnetic spectrum – Image sensing and acquisition – Image sampling and Quantization – Some Basic relationship between Pixels – Linear & Nonlinear operations.							
<b>Unit:2</b>	<b>IMAGE ENHANCEMENT</b>					<b>12 hours</b>	
Image Enhancement in the spatial domain:- Background – some basic Gray level Transformations – Histogram Processing – Enhancement using Arithmetic / Logic operations – Basics of spatial filtering – Smoothing spatial filters – Sharpening spatial filters – Combining spatial enhancement methods.							
<b>Unit:3</b>	<b>IMAGE RESTORATION</b>					<b>12 hours</b>	
Image Restoration: A model of the Image Degradation / Restoration Process – Noise models – Restoration is the process of noise only – Spatial Filtering – Periodic Noise reduction by frequency domain filtering – Linear, Portion – Invariant Degradations – Estimating the degradation function – Inverse filtering – Minimum mean square Error Filtering – Constrained least squares filtering – Geometric mean filter – Geometric Transformations.							



<b>Unit:4</b>	<b>IMAGE COMPRESSION</b>	<b>11 hours</b>
Image Compression: Fundamentals – Image compression models – Elements of Information Theory – Error Free compression – Lossy compression – Image compression standards.		
<b>Unit:5</b>	<b>IMAGE SEGMENTATION</b>	<b>11 hours</b>
Image Segmentation: Detection and Discontinuities – Edge Linking and Boundary deduction – Thresholding – Region-Based segmentation – Segmentation by Morphological watersheds – The use of motion in segmentation.		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars – webinars		
	<b>Total Lecture hours</b>	<b>60 hours</b>
<b>Text Books</b>		
1	Rafael C. Gonzalez, Richard E. Woods, “Digital Image Processing”, Second Edition, PHI/Pearson Education.	
2	B. Chanda, D. Dutta Majumder, “Digital Image Processing and Analysis”, PHI, 2003.	
<b>Reference Books</b>		
1	Nick Efford, “Digital Image Processing a practical introducing using Java”, Pearson Education, 2004.	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	<a href="https://nptel.ac.in/courses/117/105/117105135/">https://nptel.ac.in/courses/117/105/117105135/</a>	
2	<a href="https://www.tutorialspoint.com/dip/index.htm">https://www.tutorialspoint.com/dip/index.htm</a>	
3	<a href="https://www.javatpoint.com/digital-image-processing-tutorial">https://www.javatpoint.com/digital-image-processing-tutorial</a>	
Course Designed By:		

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

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

<b>Course code</b>		<b>CLOUD COMPUTING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Core/Elective/Supportive</b>		<b>Core</b>	4			4
<b>Pre-requisite</b>	Basics of Cloud & its Applications		<b>Syllabus</b>		<b>2021-22</b>	
<b>Course Objectives:</b>						
The main objectives of this course are to:						
<ol style="list-style-type: none"> <li>1. Gain knowledge on cloud computing, cloud services, architectures and applications.</li> <li>2. Enable the students to learn the basics of cloud computing with real time usage</li> <li>3. How to store and share, in and from cloud?</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
1	Understand the concepts of Cloud and its services					K1,K2
2	Collaborate Cloud for Event & Project Management					K3,K4
3	Analyze on cloud in – Word Processing, Spread Sheets, Mail, Calendar, Database					K4,K5
4	Analyze cloud in social networks					K5,K6
5	Explore cloud storage and sharing					K6
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>						
<b>Unit:1</b>	<b>INTRODUCTION</b>					<b>12 hours</b>
INTRODUCTION Cloud Computing Introduction, From, Collaboration to cloud, Working of cloud computing, pros and cons, benefits, developing cloud computing services, Cloud service development, discovering cloud services.						
<b>Unit:2</b>	<b>CLOUD COMPUTING</b>					<b>12 hours</b>
CLOUD COMPUTING FOR EVERYONE Centralizing email communications, cloud computing for community, collaborating on schedules, collaborating on group projects and events, cloud computing for corporation, mapping, schedules, managing projects, presenting on road.						
<b>Unit:3</b>	<b>CLOUD SERVICES</b>					<b>12 hours</b>
USING CLOUD SERVICES Collaborating on calendars, Schedules and task management, exploring on line scheduling and planning, collaborating on event management, collaborating on contact management, collaborating on project management, collaborating on word processing, spreadsheets, and databases.						
<b>Unit:4</b>	<b>OUTSIDE THE CLOUD</b>					<b>12 hours</b>
OUTSIDE THE CLOUD Evaluating web mail services, Evaluating instant messaging, Evaluating web conference tools, creating groups on social networks, Evaluating on line						



groupware, collaborating via blogs and wikis.		
<b>Unit:5</b>	<b>STORING AND SHARING</b>	<b>10 hours</b>
STORING AND SHARING Understanding cloud storage, evaluating on line file storage, exploring on line book marking services, exploring on line photo editing applications, exploring photo sharing communities, controlling it with web based desktops.		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars – webinars		
<b>Total Lecture hours</b>		<b>60 hours</b>
<b>Text Books</b>		
1	Michael Miller, “Cloud Computing”, Pearson Education, New Delhi, 2009.	
<b>Reference Books</b>		
1	Anthony T. Velte, “Cloud Computing: A Practical Approach”, 1st Edition, Tata McGraw Hill Education Private Limited, 2009.	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	<a href="https://nptel.ac.in/courses/106/105/106105167/">https://nptel.ac.in/courses/106/105/106105167/</a>	
2	<a href="https://www.tutorialspoint.com/cloud_computing/index.htm">https://www.tutorialspoint.com/cloud_computing/index.htm</a>	
3	<a href="https://www.javatpoint.com/cloud-computing-tutorial">https://www.javatpoint.com/cloud-computing-tutorial</a>	
Course Designed By:		

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

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

Course code	NETWORK SECURITY AND CRYPTOGRAPHY		L	T	P	C
Core/Elective/Supportive	Core		4			4
Pre-requisite	Basics of Networks & its Security		Syllabus		2021-22	
<b>Course Objectives:</b>						
The main objectives of this course are to:						
<ol style="list-style-type: none"> <li>1. Enable students to learn the Introduction to Cryptography, Web Security and Case studies in Cryptography.</li> <li>2. To gain knowledge on classical encryption techniques and concepts of modular arithmetic and number theory.</li> <li>3. To explore the working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes and message digests, and public key algorithms.</li> <li>4. To explore the design issues and working principles of various authentication Applications and various secure communication standards including Kerberos, IPsec, and SSL/TLS and email.</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
1	Understand the process of the cryptographic algorithms				K1,K2	
2	Compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication				K2,K3	
3	Apply and analyze appropriate security techniques to solve network security problem				K3,K4	
4	Exploresuitable cryptographic algorithms				K4,K5	
5	Analyze different digital signature algorithms to achieve authentication and design secure applications				K5,K6	
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>						
<b>Unit:1</b>	<b>INTRODUCTION</b>				<b>12 hours</b>	
Introduction to Cryptography – Security Attacks – Security Services –Security Algorithm- Stream cipher and Block cipher - Symmetric and Asymmetric-key Cryptosystem Symmetric Key Algorithms: Introduction – DES – Triple DES – AES – IDEA – Blowfish – RC5.						
<b>Unit:2</b>	<b>CRYPTO SYSTEM</b>				<b>12 hours</b>	
Public-key Cryptosystem: Introduction to Number Theory - RSA Algorithm – Key Management - Diffie-Hell man Key exchange – Elliptic Curve Cryptography Message Authentication and Hash functions – Hash and Mac Algorithm – Digital Signatures and Authentication Protocol.						
<b>Unit:3</b>	<b>NETWORK SECURITY</b>				<b>12 hours</b>	
Network Security Practice: Authentication Applications – Kerberos – X.509 Authentication services and Encryption Techniques. E-mail Security – PGP – S / MIME – IP Security.						

<b>Unit:4</b>	<b>WEB SECURITY</b>	<b>10 hours</b>
Web Security - Secure Socket Layer – Secure Electronic Transaction. System Security - Intruders and Viruses – Firewalls– Password Security.		
<b>Unit:5</b>	<b>CASE STUDY</b>	<b>12 hours</b>
Case Study: Implementation of Cryptographic Algorithms – RSA – DSA – ECC (C / JAVA Programming).		
Network Forensic – Security Audit - Other Security Mechanism: Introduction to: Stenography – Quantum Cryptography – Water Marking - DNA Cryptography		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars – webinars		
<b>Total Lecture hours</b>		<b>60 hours</b>
<b>Text Books</b>		
1	William Stallings, “Cryptography and Network Security”, PHI/Pearson Education.	
2	Bruce Schneir, “Applied Cryptography”, CRC Press.	
<b>Reference Books</b>		
1	A.Menezes, P Van Oorschot and S.Vanstone, “Hand Book of Applied Cryptography”, CRC Press, 1997	
2	AnkitFadia, ”Network Security”, MacMillan.	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	<a href="https://nptel.ac.in/courses/106/105/106105031/">https://nptel.ac.in/courses/106/105/106105031/</a>	
2	<a href="http://www.nptelvideos.in/2012/11/cryptography-and-network-security.html">http://www.nptelvideos.in/2012/11/cryptography-and-network-security.html</a>	
3	<a href="https://www.tutorialspoint.com/cryptography/index.htm">https://www.tutorialspoint.com/cryptography/index.htm</a>	
Course Designed By:		

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

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

Course code	DATA SCIENCE & ANALYTICS			L	T	P	C
Core/Elective/Supportive	Core			4			4
Pre-requisite	Basics of Data Science & its Applications			Syllabus		2021-22	
<b>Course Objectives:</b>							
The main objectives of this course are to:							
<ol style="list-style-type: none"> <li>1. Introduce the students to data science, big data &amp; its eco system.</li> <li>2. Learn data analytics &amp; its life cycle.</li> <li>3. To explore the programming language R, with respect to the data mining algorithms.</li> <li>4. Relate the relationship between artificial intelligence, machine learning and data science.</li> </ol>							
<b>Expected Course Outcomes:</b>							
On the successful completion of the course, student will be able to:							
1	Understand the concept of data science and its techniques					K1,K2	
2	Review data analytics					K2,K3	
3	Apply and determine appropriate Data Mining techniques using R to real time applications					K3,K4	
4	Analyze on clustering algorithms					K4,K5	
5	Analyze on regression methods in AI					K6	
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>							
<b>Unit:1</b>	<b>INTRODUCTION</b>					<b>12 hours</b>	
Introduction of Data Science: data science and big data – facets of data-data science process- Ecosystem- The Data Science process – six steps- Machine Learning.							
<b>Unit:2</b>	<b>BASICS OF DATA ANALYTICS</b>					<b>12 hours</b>	
Data Analytics life cycle - review of data analytics - Advanced data Analytics-technology and tools.							
<b>Unit:3</b>	<b>DATA ANALYTICS USING R</b>					<b>12 hours</b>	
Basic Data Analytics using R : R Graphical User Interfaces – Data Import and Export – Attribute and Data Types –Descriptive Statistics – Exploratory Data Analysis –Visualization Before Analysis – Dirty Data – Visualizing a Single Variable – Examining Multiple Variables – Data Exploration Versus Presentation.							
<b>Unit:4</b>	<b>CLUSTERING</b>					<b>12 hours</b>	
Overview of Clustering : K-means – Use Cases – Overview of the Method – Perform a K-means Analysis using R –Classification – Decision Trees – Overview of a Decision Tree – Decision Tree Algorithms – Evaluating a Decision Tree – Decision Tree in R – Bayes’ Theorem – Naïve Bayes Classifier – Smoothing – Naïve Bayes in R.							

<b>Unit:5</b>	<b>ARTIFICIAL INTELLIGENCE</b>	<b>10 hours</b>
Artificial intelligence: Machine Learning and deep learning in data science - Clustering, association rules. Linear regression-logistic regression-Additional regression methods.		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars – webinars		
<b>Total Lecture hours</b>		<b>60 hours</b>
<b>Text Books</b>		
1	Introducing-Data-Science-Big-Data-Machine-Learning-and-more-using-Python-tools-2016. Pdf	
2	Data science in big data analytics-Wiley 2015 John Wiley & Sons	
<b>Reference Books</b>		
1	A simple introduction to Data Science - Lars Nielson 2015	
2	Introducing Data Science Davy Cielen, Arno D.B.Meysman, Mohamed Ali 2016 Manning Publication	
3	R Programming for Data Science - Roger D.Peng 2015 Lean Publication	
4	Data Science & Big Data Analytics: Discovering, Analyzing , Visualizing and Presenting Data	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	<a href="https://www.tutorialspoint.com/python_data_science/index.htm">https://www.tutorialspoint.com/python_data_science/index.htm</a>	
2	<a href="https://www.javatpoint.com/data-science">https://www.javatpoint.com/data-science</a>	
3	<a href="https://nptel.ac.in/courses/106/106/106106179/">https://nptel.ac.in/courses/106/106/106106179/</a>	
Course Designed By:		

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

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



<b>Course code</b>		<b>PRACTICAL V : DIGITAL IMAGE PROCESSING Using MATLAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Core/Elective/Supportive</b>		<b>Core</b>			4	4
<b>Pre-requisite</b>		Basic Programming of Image Processing & an intro to MATLAB	<b>Syllabus Version</b>		2021-22	
<b>Course Objectives:</b>						
The main objectives of this course are to:						
1.To understand the basics of Digital Image Processing fundamentals, image enhancement and image restoration techniques						
2. To enable the students to learn the fundamentals of image compression and segmentation						
3. To understand Image Restoration & Filtering Techniques						
4. Implementation of the above using MATLAB						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
1	To write programs in MATLAB for image processing using the techniques				K1,K2	
2	To able to implement Image Enhancements & Restoration techniques				K2,K3	
3	Capable of using Compression techniques in an Image				K3,K4	
4	Must be able to manipulate the image and Segment it				K5,K6	
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>						
<b>LIST OF PROGRAMS</b>					<b>60 hours</b>	
1. Implement Image enhancementTechnique.						
2. Histogram Equalization						
3. ImageRestoration.						
4. Implement ImageFiltering.						
5. Edge detection using Operators (Roberts, Prewitts and Sobeloperators)						
6. Implement image compression.						
7. Image Subtraction						
8. Boundary Extraction using morphology.						
9. Image Segmentation						
<b>Total Lecture hours</b>					<b>60 hours</b>	
<b>Text Books</b>						
1	Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Second Edition,					

	PHI/Pearson Education.
2	B. Chanda, D. Dutta Majumder, “Digital Image Processing and Analysis”, PHI, 2003.
<b>Reference Books</b>	
1	Nick Efford, “Digital Image Processing a practical introducing using Java”, Pearson Education, 2004.
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>	
1	<a href="https://nptel.ac.in/courses/117/105/117105135/">https://nptel.ac.in/courses/117/105/117105135/</a>
2	<a href="https://www.tutorialspoint.com/dip/index.htm">https://www.tutorialspoint.com/dip/index.htm</a>
3	<a href="https://www.javatpoint.com/digital-image-processing-tutorial">https://www.javatpoint.com/digital-image-processing-tutorial</a>
Course Designed By:	

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

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



Course code	<b>PRACTICAL VI : CLOUD COMPUTING LAB</b>		L	T	P	C
Core/Elective/Supportive	Core				4	4
Pre-requisite	Basic Programming using Cloud		Syllabus		2021-22	
<b>Course Objectives:</b>						
The main objectives of this course are to:						
1.This course covers the basic data structures like Stack, Queue, Tree , 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						
<b>Expected Course Outcomes:</b>						
On the successful 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	
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>						
<b>LIST OF PROGRAMS</b>					<b>60 hours</b>	
1. Working with Google Drive to make spreadsheet and notes.						
2. Launch a Linux Virtual Machine.						
3. To host a static website						
4. Exploring Google cloud for the following a) Storage b) Sharing of data c) manage your calendar, to-do lists, d) a document editing tool						
5. Working and installation of Google App Engine						
6. Working and installation of Microsoft Azure						
7. To Connect Amazon Redshift with S3 bucket						
8. To Create and Query a NoSQL Table						
Expert lectures, online seminars – webinars						
<b>Total Lecture hours</b>					<b>60 hours</b>	
<b>Text Books</b>						
1	Michael Miller, “Cloud Computing”, Pearson Education, New Delhi, 2009.					
<b>Reference Books</b>						

1	Anthony T. Velte, "Cloud Computing: A Practical Approach", 1st Edition, Tata McGraw Hill Education Private Limited, 2009.
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>	
1	<a href="https://nptel.ac.in/courses/106/105/106105167/">https://nptel.ac.in/courses/106/105/106105167/</a>
2	<a href="https://www.tutorialspoint.com/cloud_computing/index.htm">https://www.tutorialspoint.com/cloud_computing/index.htm</a>
3	<a href="https://www.javatpoint.com/cloud-computing-tutorial">https://www.javatpoint.com/cloud-computing-tutorial</a>
Course Designed By:	

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

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



<b>Course code</b>	<b>PRACTICAL VII : WEB APPLICATION DEVELOPMENT AND HOSTING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Core/Elective/Supportive</b>	<b>Core</b>			2	2
<b>Pre-requisite</b>	Basic Programming using HTML tags	<b>Syllabus</b>		<b>2021-22</b>	
<b>Course Objectives:</b>					
The main objectives of this course are to:					
1.Able to design a web page using HTML tags					
2.To enable the students to use Framesets, hyper links and different formatting features of HTML tags					
3.Enable the students to use Forms & other controls in a web page					
4.To create interactive applications using PHP					
<b>Expected Course Outcomes:</b>					
On the successful completion of the course, student will be able to:					
1	Understand & implement the basic HTML tags to create static web pages				K1,K2
2	Capable of using hyperlinks, frames , images, tables, ...in a web page				K2,K3
3	Able to write dynamic web applications using HTML forms				K4,K5
4	Must be able to write dynamic web applications in PHP & HTML tags using XAMPP.				K5,K6
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>					
<b>LIST OF PROGRAMS</b>					<b>30 hours</b>
<p>1. Develop a website for your college using advanced tags of HTML.</p> <p>2. Write names of several countries in a paragraph and store it as an HTML document, world.html. Each country name must be a hot text. When you click India (for example), it must open india.html and it should provide a brief introduction about India.</p> <p>3. Develop a HTML document to i)display Text with Bullets / Numbers - Using Lists ii) to display the Table Format Data</p> <p>4. Develop a Complete Web Page using Frames and Framesets which gives the Information about a Hospital using HTML.</p> <p>5. Write a HTML document to print your Bio-Data in a neat format using several components.</p> <p>6. Develop a HTML document to display a Registration Form for an inter-collegiate function.</p> <p>7. Using HTML form accept Customer details like Name, City, Pin code, Phone number and Email address and validate the data and display appropriate messages for violations using PHP (Eg. Name is Mandatory field; Pin code must be 6 digits, etc.).</p> <p>8. Write a program to accept two numbers n1 and n2 using HTML form and display the Prime</p>					



numbers between n1 and n2 using PHP.	
<b>Total Lecture hours</b>	<b>30 hours</b>
<b>Text Books</b>	
1	Ivan Bayross, “Web Enabled Commercial Applications Development Using HTML, JavaScript, DHTML and PHP”, BPB Publications, 4th Revised Edition, 2010.
<b>Reference Books</b>	
2	A.K.Saini and SumintTuli, “Mastering XML”, First Edition, New Delhi, 2002.
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>	
1	<a href="https://www.tutorialspoint.com/xml/index.htm">https://www.tutorialspoint.com/xml/index.htm</a>
2	<a href="https://www.tutorialspoint.com/internet_technologies/websites_development.htm">https://www.tutorialspoint.com/internet_technologies/websites_development.htm</a>
3	<a href="https://www.youtube.com/watch?v=PlxWf493en4">https://www.youtube.com/watch?v=PlxWf493en4</a>
Course Designed By:	

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

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



# **Elective Courses**

Course code	MULTIMEDIA AND ITS APPLICATIONS		L	T	P	C
Core/Elective/Supportive	Elective		4			4
Pre-requisite	Basics of Multimedia		Syllabus		2021-22	
<b>Course Objectives:</b>						
The main objectives of this course are to:						
<ol style="list-style-type: none"> <li>To introduce the students the concepts of Multimedia, Images &amp; Animation.</li> <li>To introduce Multimedia authoring tools</li> <li>To understand the role of Multimedia in Internet</li> <li>To know about High Definition Television and Desktop Computing – Knowledge based Multimedia systems</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
1	Understand the basic concepts of Multimedia				K1,K2	
2	Demonstrate Multimedia authoring tools				K2,K3	
3	Analyze the concepts of Sound, Images, Video & Animation				K4	
4	Apply and Analyze the role of Multimedia in Internet and real time applications				K4,K5	
5	Analyze multimedia applications using HDTV				K5,K6	
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>						
<b>Unit:1</b>	<b>INTRODUCTION</b>				<b>12 hours</b>	
What is Multimedia? – Introduction to making Multimedia – Macintosh and Windows Production platforms – Basic Software tools.						
<b>Unit:2</b>	<b>MULTIMEDIA TOOLS</b>				<b>12 hours</b>	
Making Instant Multimedia – Multimedia authoring tools – Multimedia building blocks – Text – Sound.						
<b>Unit:3</b>	<b>ANIMATION</b>				<b>10 hours</b>	
Images – Animation – Video.						
<b>Unit:4</b>	<b>INTERNET</b>				<b>12 hours</b>	
Multimedia and the Internet – The Internet and how it works – Tools for World Wide Web – Designing for the World Wide Web.						
<b>Unit:5</b>	<b>MULTIMEDIA SYSTEMS</b>				<b>12 hours</b>	
High Definition Television and Desktop Computing – Knowledge based Multimedia systems.						

<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars - webinars		
<b>Total Lecture hours</b>		<b>60 hours</b>
<b>Text Books</b>		
1	Tay Vaughan, “Multimedia making it work”, Fifth Edition, Tata McGrawHill.	
2	John F. Koegel Bufford, “Multimedia Systems”, Pearson Education.	
<b>Reference Books</b>		
1	Judith Jeffloat, “Multimedia in Practice (Technology and Applications)”, PHI,2003.	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	<a href="https://www.tutorialspoint.com/multimedia/index.htm">https://www.tutorialspoint.com/multimedia/index.htm</a>	
2	<a href="https://www.tutorialspoint.com/basics_of_computer_science/basics_of_computer_science_multimedia.htm">https://www.tutorialspoint.com/basics_of_computer_science/basics_of_computer_science_multimedia.htm</a>	
3	<a href="https://nptel.ac.in/courses/117/105/117105083/">https://nptel.ac.in/courses/117/105/117105083/</a>	
Course Designed By:		

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

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

Course code	EMBEDDED SYSTEMS		L	T	P	C
Core/Elective/Supportive	Elective		4			4
Pre-requisite	Basics of Micro Controller		Syllabus		2021-22	
<b>Course Objectives:</b>						
The main objectives of this course are to:						
<ol style="list-style-type: none"> <li>1. Present the introduction to 8051 Microcontroller Instruction Set, concepts on RTOS &amp; Software tools.</li> <li>2. Gain the knowledge about the embedded software development.</li> <li>3. Learn about Microcontroller and software tools in the embedded systems.</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
1	Understand the concept of 8051 microcontroller				K1,K2	
2	Understand the Instruction Set and Programming				K2,K3	
3	Analyze the concepts of RTOS				K3,K4	
4	Analyze and design various real time embedded systems using RTOS				K5	
5	Debug the malfunctioning system using various debugging techniques				K5,K6	
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6- Create</b>						
<b>Unit:1</b>	<b>8051 MICROCONTROLLER</b>				<b>12Hours</b>	
8051 Microcontroller: Introduction - 8051 Architecture-Input/Output Pins, Ports and Circuits - External Memory - Counters / Timers - Serial Data Input / Output –Interrupts						
<b>Unit:2</b>	<b>PROGRAMMING BASICS</b>				<b>12Hours</b>	
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.						
<b>Unit:3</b>	<b>CONCEPTS ON RTOS</b>				<b>12Hours</b>	
CONCEPTS ON RTOS: Introduction to RTOS-Selecting an RTOS-Task and Task states - Tasks and data- Semaphores and shared data. MORE operating systems services: Interrupt Process communication - Message Queues, Mailboxes and pipes- Timer Functions-Events - Memory Management-Interrupt Routines in an RTOS Environment.						
<b>Unit:4</b>	<b>DESIGN USING RTOS</b>				<b>10Hours</b>	
Basic Design using a RTOS: Principles - Encapsulating semaphores and Queues-Hard real time scheduling considerations-Saving memory space and power- introductions to RTL & QNX.						
<b>Unit:5</b>	<b>SOFTWARE TOOLS</b>				<b>12Hours</b>	
SOFTWARE TOOLS: 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.		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars – webinars		
<b>Total Lecture hours</b>		<b>60Hours</b>
<b>Text Books</b>		
1	David E. Simon, “An Embedded Software primer” Pearson Education Asia, 2003.	
2	Kenneth J Ayala, “The 8051 Microcontroller and Architecture programming and application”, Second Edition, Penram International.	
<b>Reference Books</b>		
1	Raj Kamal, “Embedded Systems – Architecture, programming and design”, Tata McGraw – Hill, 2003.	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	<a href="https://onlinecourses.nptel.ac.in/noc20_cs14/preview">https://onlinecourses.nptel.ac.in/noc20_cs14/preview</a>	
2	<a href="https://www.javatpoint.com/embedded-system-tutorial">https://www.javatpoint.com/embedded-system-tutorial</a>	
3	<a href="https://www.tutorialspoint.com/embedded_systems/index.htm">https://www.tutorialspoint.com/embedded_systems/index.htm</a>	
Course Designed By:		

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

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

Course code	INTERNET OF THINGS			L	T	P	C
Core/Elective/Supportive	Elective			4			4
Pre-requisite	Basics of Sensors & its Applications			Syllabus		2021-22	
<b>Course Objectives:</b>							
The main objectives of this course are to:							
<ol style="list-style-type: none"> <li>About Internet of Things where various communicating entities are controlled and managed for decision making in the application domain.</li> <li>Enable students to learn the Architecture of IoT and IoT Technologies</li> <li>Developing IoT applications and Security in IoT, Basic Electronics for IoT, Arduino IDE, Sensors and Actuators Programming NODEMCU using Arduino IDE.</li> </ol>							
<b>Expected Course Outcomes:</b>							
On the successful completion of the course, student will be able to:							
1	Understand about IoT, its Architecture and its Applications					K1,K2	
2	Understand basic electronics used in IoT & its role					K2,K3	
3	Develop applications with C using Arduino IDE					K4	
4	Analyze about sensors and actuators					K5,K6	
5	Design IoT in real time applications using today's internet & wireless technologies					K6	
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>							
<b>Unit:1</b>	<b>INTRODUCTION</b>					<b>12 hours</b>	
Introduction to IoT: Evolution of IoT – Definition & Characteristics of IoT - Architecture of IoT – Technologies for IoT – Developing IoT Applications – Applications of IoT – Industrial IoT – Security in IoT							
<b>Unit:2</b>	<b>BASIC ELECTRONICS FOR IoT</b>					<b>12 hours</b>	
Basic Electronics for IoT: Electric Charge, Resistance, Current and Voltage – Binary Calculations – Logic Chips – Microcontrollers – Multipurpose Computers – Electronic Signals – A/D and D/A Conversion – Pulse Width Modulation.							
<b>Unit:3</b>	<b>PROGRAMMING USING ARDUINO</b>					<b>12 hours</b>	
Programming Fundamentals with C using Arduino IDE: Installing and Setting up the Arduino IDE – Basic Syntax – Data Types/ Variables/ Constant – Operators – Conditional Statements and Loops – Using Arduino C Library Functions for Serial, delay and other invoking Functions – Strings and Mathematics Library Functions.							
<b>Unit:4</b>	<b>SENSORS AND ACTUATORS</b>					<b>10 hours</b>	
Sensors and Actuators: Analog and Digital Sensors – Interfacing temperature sensor, ultrasound							

sensor and infrared (IR) sensor with Arduino – Interfacing LED and Buzzer with Arduino.		
<b>Unit:5</b>	<b>SENSOR DATA IN INTERNET</b>	<b>12 hours</b>
Sending Sensor Data Over Internet: Introduction to ESP8266 NODEMCU WiFi Module – Programming NODEMCU using Arduino IDE – Using WiFi and NODEMCU to transmit data from temperature sensor to Open Source IoT cloud platform (ThingSpeak).		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars – webinars		
	<b>Total Lecture hours</b>	<b>hours</b>
<b>Text Books</b>		
1	Arshdeep Bahga, Vijay Madiseti, “Internet of Things: A Hands-On Approach”, 2014. ISBN: 978-0996025515	
2	Boris Adryan, Dominik Obermaier, Paul Fremantle, “The Technical Foundations of IoT”, Artech Houser Publishers, 2017.	
<b>Reference Books</b>		
1	Michael Margolis, “Arduino Cookbook”, O’Reilly, 2011	
2	Marco Schwartz, “Internet of Things with ESP8266”, Packt Publishing, 2016.	
3	Dhivya Bala, “ESP8266: Step by Step Tutorial for ESP8266 IoT, Arduino NODEMCU Dev. Kit”, 2018.	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	<a href="https://onlinecourses.nptel.ac.in/noc20_cs66/preview">https://onlinecourses.nptel.ac.in/noc20_cs66/preview</a>	
2	<a href="https://www.javatpoint.com/iot-internet-of-things">https://www.javatpoint.com/iot-internet-of-things</a>	
3	<a href="https://www.tutorialspoint.com/internet_of_things/index.htm">https://www.tutorialspoint.com/internet_of_things/index.htm</a>	
Course Designed By:		

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

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

Course code	CRITICAL THINKING, DESIGN THINKING AND PROBLEM SOLVING		L	T	P	C
Core/Elective/Supportive	Elective		4			4
Pre-requisite	Basics of Logical & Reasoning Skills		Syllabus		2021-22	
<b>Course Objectives:</b>						
The main objectives of this course are to:						
<ol style="list-style-type: none"> <li>1. Learn critical thinking and its related concepts</li> <li>2. Learn design thinking and its related concepts</li> <li>3. Develop Thinking patterns, Problem solving &amp; Reasoning</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
1	Understand the concepts of Critical thinking and its related technology				K1,K2	
2	Focus on the explicit development of critical thinking and problem solving skills				K2,K3	
3	Apply design thinking in problems				K3,K4	
4	Make a decision and take actions based on analysis				K4,K5	
5	Analyze the concepts of Thinking patterns, Problem solving & Reasoning in real time applications				K5,K6	
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>						
<b>Unit:1</b>	<b>CRITICAL THINKING</b>				<b>12 hours</b>	
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.						
<b>Unit:2</b>	<b>DESIGN THINKING</b>				<b>12 hours</b>	
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.						
<b>Unit:3</b>	<b>CASE STUDY</b>				<b>12 hours</b>	
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.						
<b>Unit:4</b>	<b>PROBLEM SOLVING</b>				<b>10 hours</b>	
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.		
<b>Unit:5</b>	<b>REASONING</b>	<b>12 hours</b>
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		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars – webinars		
<b>Total Lecture hours</b>		<b>60 hours</b>
<b>Text Books</b>		
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.	
<b>Reference Books</b>		
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.	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	<a href="https://www.tutorialspoint.com/critical_thinking/index.htm">https://www.tutorialspoint.com/critical_thinking/index.htm</a>	
2	<a href="https://www.tutorialspoint.com/design_thinking/design_thinking_quick_guide.htm">https://www.tutorialspoint.com/design_thinking/design_thinking_quick_guide.htm</a>	
3	<a href="https://nptel.ac.in/courses/109/104/109104109/">https://nptel.ac.in/courses/109/104/109104109/</a>	
Course Designed By:		

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

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



Course code	MOBILE COMPUTING			L	T	P	C
Core/Elective/Supportive	Elective			4			4
Pre-requisite	Basics of Mobile Communication			Syllabus		2021-22	
<b>Course Objectives:</b>							
The main objectives of this course are to:							
<ol style="list-style-type: none"> <li>1. Present the overview of Mobile computing, Applications and Architectures.</li> <li>2. Describe the futuristic computing challenges.</li> <li>3. Enable the students to learn the concept of mobile computing.</li> </ol>							
<b>Expected Course Outcomes:</b>							
On the successful completion of the course, student will be able to:							
1	Understand the need and requirements of mobile communication					K1,K2	
2	Focus on mobile computing applications and techniques					K2,K3	
3	Demonstrate satellite communication in mobile computing					K4	
4	Analyze about wireless local loop architecture					K5,K6	
5	Analyze various mobile communication technologies					K6	
<b>K1</b> - Remember; <b>K2</b> - Understand; <b>K3</b> - Apply; <b>K4</b> - Analyze; <b>K5</b> - Evaluate; <b>K6</b> - Create							
<b>Unit:1</b>	<b>INTRODUCTION</b>					<b>12 hours</b>	
Introduction: Advantages of Digital Information - Introduction to Telephone Systems –Mobile communication: Need for Mobile Communication – Requirements of Mobile Communication – History of Mobile Communication.							
<b>Unit:2</b>	<b>MOBILE COMMUNICATION</b>					<b>12 hours</b>	
Introduction to Cellular Mobile Communication – Mobile Communication Standards –Mobility Management – Frequency Management – Cordless Mobile Communication Systems.							
<b>Unit:3</b>	<b>MOBILE COMPUTING</b>					<b>12 hours</b>	
Mobile Computing: History of data networks – Classification of Mobile data networks - CDPD System – Satellites in Mobile Communication: Satellite classification – Global Satellite Communication – Changeover from one satellite to other – Global Mobile Communication – Interferences in Cellular Mobile Communication.							
<b>Unit:4</b>	<b>MOBILE COMMUNICATION SYSTEM</b>					<b>11 hours</b>	
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.							
<b>Unit:5</b>	<b>COMMUNICATION TECHNOLOGY</b>					<b>11 hours</b>	

WCDMA Technology and Fiber Optic Microcellular Mobile Communication – Ad hoc Network and Bluetooth technology – Intelligent Mobile Communication system – Fourth Generation Mobile Communication systems.		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars – webinars		
<b>Total Lecture hours</b>		<b>60 hours</b>
<b>Text Books</b>		
1	T.G. Palanivelu, R. Nakkeeran, “Wireless and Mobile Communication”, PHI Limited, 2009.	
2	Jochen Schiller, “Mobile Communications”, Second Edition, Pearson Education, 2007.	
<b>Reference Books</b>		
1	Asoke K Talukder, Hasan Ahmed, Roopa Yavagal, “Mobile Computing”, TMH, 2010.	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	<a href="https://www.tutorialspoint.com/mobile_computing/index.htm">https://www.tutorialspoint.com/mobile_computing/index.htm</a>	
2	<a href="https://www.javatpoint.com/mobile-computing">https://www.javatpoint.com/mobile-computing</a>	
3	<a href="https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs13/">https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs13/</a>	
Course Designed By:		

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

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

Course code	BLOCK CHAIN TECHNOLOGY			L	T	P	C
Core/Elective/Supportive	Elective			4			4
Pre-requisite	Basics of Block Chain & Crypto Currency			Syllabus		2021-22	
<b>Course Objectives:</b>							
The main objectives of this course are to:							
<ol style="list-style-type: none"> <li>1. Understand the fundamentals of block chain and cryptocurrency.</li> <li>2. Understand the influence and role of block chain in various other fields.</li> <li>3. Learn security features and its significance.</li> <li>4. Identify problems &amp; challenges posed by Block Chain.</li> </ol>							
<b>Expected Course Outcomes:</b>							
On the successful completion of the course, student will be able to:							
1	Demonstrate blockchain technology and crypto currency					K1,K2	
2	Understand the mining mechanism in blockchain					K2	
3	Apply and identify security measures, and various types of services that allow people to trade and transact with bitcoins					K3,K4	
4	Apply and analyze Blockchain in health care industry					K4,K5	
5	Analyze security, privacy, and efficiency of a given Blockchain system					K5,K6	
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>							
<b>Unit:1</b>	<b>INTRODUCTION</b>					<b>12 hours</b>	
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.							
<b>Unit:2</b>	<b>NETWORK AND SECURITY</b>					<b>12 hours</b>	
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.							
<b>Unit:3</b>	<b>CRYPTOCURRENCY</b>					<b>12 hours</b>	
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							
<b>Unit:4</b>	<b>CRYPTOCURRENCY REGULATION</b>					<b>11 hours</b>	
Cryptocurrency Regulation - Stakeholders, Roots of Bit coin, Legal views - exchange of cryptocurrency - Black Market - Global Economy. Cyprtoeconomics – assets, supply and							

demand, inflation and deflation – Regulation.		
<b>Unit:5</b>	<b>CHALLENGES IN BLOCK CHAIN</b>	<b>11 hours</b>
Opportunities and challenges in Block Chain – Application of block chain: Industry 4.0 – machine to machine communication – Data management in industry 4.0 – future prospects. Block chain in Health 4.0 - Blockchain properties - Healthcare Costs - Healthcare Quality - Healthcare Value - Challenges for using blockchain for healthcare data		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars – webinars		
<b>Total Lecture hours</b>		<b>60 hours</b>
<b>Text Books</b>		
1	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction”, Princeton University Press (July 19, 2016).	
2	Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”	
<b>Reference Books</b>		
1	Satoshi Nakamoto, “Bitcoin: A Peer-to-Peer Electronic Cash System”	
2	Rodrigo da Rosa Righi, Antonio Marcos Alberti, Madhusudan Singh, “Blockchain Technology for Industry 4.0” Springer 2020.	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	<a href="https://www.javatpoint.com/blockchain-tutorial">https://www.javatpoint.com/blockchain-tutorial</a>	
2	<a href="https://www.tutorialspoint.com/blockchain/index.htm">https://www.tutorialspoint.com/blockchain/index.htm</a>	
3	<a href="https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs01/">https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs01/</a>	
Course Designed By:		

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

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



Course code	WEB SERVICES			L	T	P	C
Core/Elective/Supportive	Elective			4			4
Pre-requisite	Basics of Distributed Computing			Syllabus Version		2021-22	
<b>Course Objectives:</b>							
The main objectives of this course are to:							
<ol style="list-style-type: none"> <li>1. Present the Web Services , Building real world Enterprise applications using Web Services with Technologies XML, SOAP , WSDL , UDDI</li> <li>2. Get overview of Distributed Computing, XML, and its technologies</li> <li>3. Update with QoS and its features</li> <li>4. Develop Standards and future of Web Services</li> </ol>							
<b>Expected Course Outcomes:</b>							
On the successful completion of the course, student will be able to:							
1	Understand web services and its related technologies					K1,K2	
2	Understand XML concepts					K2,K3	
3	Analyze on SOAP and UDDI model					K4,K5	
4	Demonstrate the road map for the standards and future of web services					K5	
5	Analyze QoS enabled applications in web services					K5,K6	
<b>K1</b> - Remember; <b>K2</b> - Understand; <b>K3</b> - Apply; <b>K4</b> - Analyze; <b>K5</b> - Evaluate; <b>K6</b> - Create							
<b>Unit:1</b>	<b>INTRODUCTION</b>					<b>12 hours</b>	
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.							
<b>Unit:2</b>	<b>XML FUNDAMENTALS</b>					<b>12 hours</b>	
XML Fundamentals – XML documents - XML Namespaces- XML Schema –Processing XML.							
<b>Unit:3</b>	<b>SOAP MODEL</b>					<b>12 hours</b>	
SOAP: The SOAP model- SOAP messages-SOAP encoding- WSDL: WSDL structure-interfacedefinitions-bindings-services-Using SOAP and WSDL-UDDI: About UDDI- UDDI registrySpecification- Core data structures-Accessing UDDI							
<b>Unit:4</b>	<b>TECHNOLOGIES AND STANDARDS</b>					<b>12 hours</b>	
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.							



<b>Unit:5</b>	<b>QUALITY OF SERVICE</b>	<b>10 hours</b>
Quality of Service: Importance of QoS for web services-QoS metrics-roles-design patterns-QoS enabled web services-QoS enabled applications. Web services management-web services standards and future trends.		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars – webinars		
<b>Total Lecture hours</b>		<b>60 hours</b>
<b>Text Books</b>		
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.	
<b>Reference Books</b>		
1	Ramesh Nagappan, “Developing Java Web Services: Architecting and developing secure Web Services Using Java”, John Wiley and Sons, first Edition Feb 2003.	
2	Eric A Marks and Mark J Werrell, “Executive Guide to Web services”, John Wiley and sons, March 2003.	
3	Anne Thomas Manes, “Web Services: A managers Guide”, Addison Wesley, June 2003.	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	<a href="https://www.tutorialspoint.com/webservices/index.htm">https://www.tutorialspoint.com/webservices/index.htm</a>	
2	<a href="https://www.javatpoint.com/web-services-tutorial">https://www.javatpoint.com/web-services-tutorial</a>	
3	<a href="https://www.btechguru.com/training--programming--xml--web-services--web-services-part-1-video-lecture--11801--24--147.html">https://www.btechguru.com/training--programming--xml--web-services--web-services-part-1-video-lecture--11801--24--147.html</a>	
Course Designed By:		

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

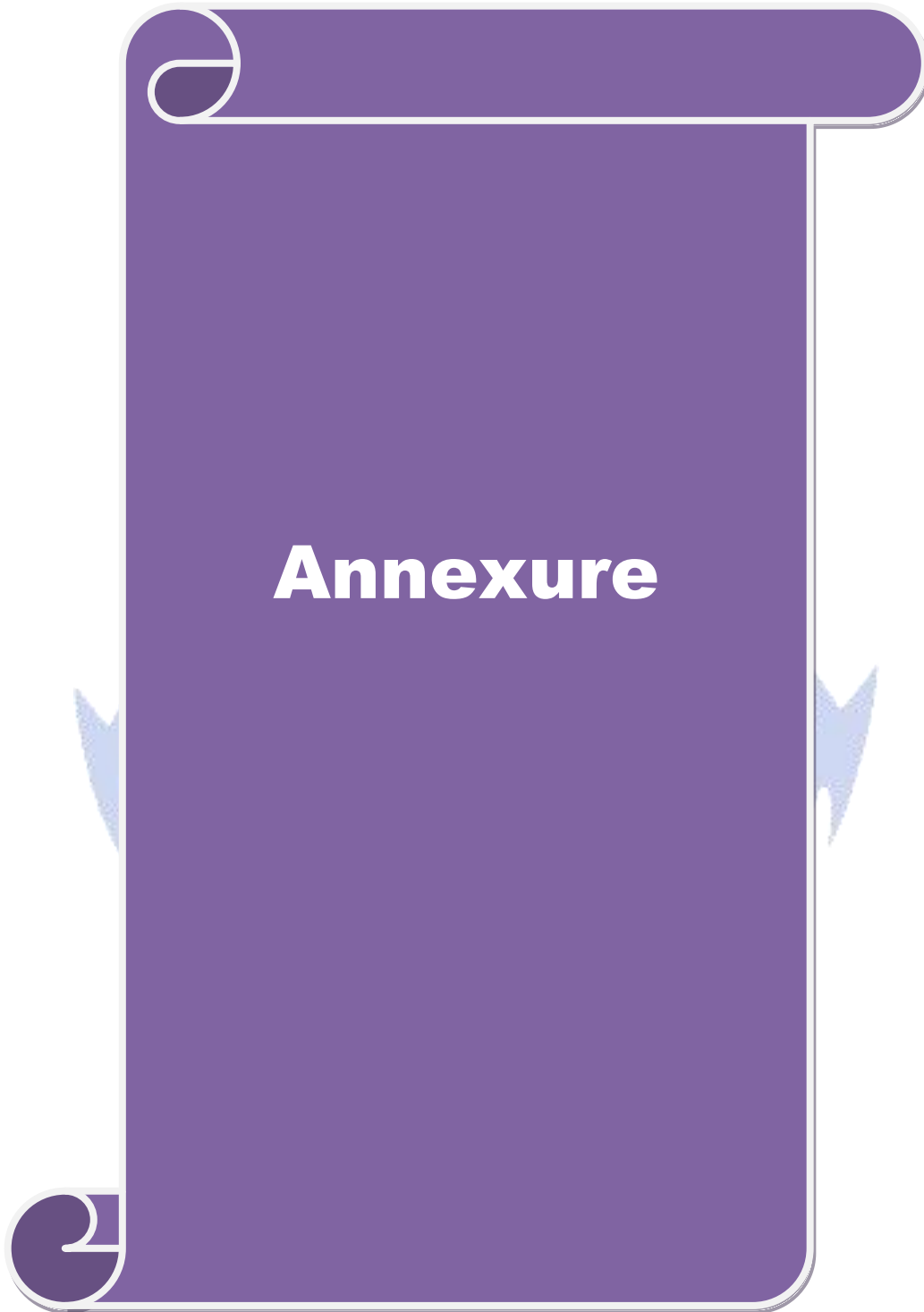
\*S-Strong; M-Medium; L-Low

Course code	ROBOTIC PROCESS AUTOMATION FOR BUSINESS			L	T	P	C
Core/Elective/Supportive	Elective			4			4
Pre-requisite	Basics of Robots & its Applications			Syllabus		2021-22	
<b>Course Objectives:</b>							
The main objectives of this course are to:							
<ol style="list-style-type: none"> <li>1. Learn the concepts of RPA, its benefits, types and models.</li> <li>2. Gain the knowledge in application of RPA in Business Scenarios.</li> <li>3. Identify measures and skills required for RPA</li> </ol>							
<b>Expected Course Outcomes:</b>							
On the successful completion of the course, student will be able to:							
1	Demonstrate the benefits and ethics of RPA					K1,K2	
2	Understand the Automation cycle and its techniques					K2	
3	Draw inferences and information processing of RPA					K3,K4	
4	Implement & Apply RPA in Business Scenarios					K5	
5	Analyze on Robots & leveraging automation					K5,K6	
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>							
<b>Unit:1</b>	<b>INTRODUCTION</b>					<b>12 hours</b>	
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.							
<b>Unit:2</b>	<b>AUTOMATION</b>					<b>12 hours</b>	
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.							
<b>Unit:3</b>	<b>AUTOMATION IMPLEMENTATION</b>					<b>12 hours</b>	
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.							
<b>Unit:4</b>	<b>ROBOT</b>					<b>12 hours</b>	

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.		
<b>Unit:5</b>	<b>ROBOT SKILL</b>	<b>10 hours</b>
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.		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars – webinars		
<b>Total Lecture hours</b>		<b>60 hours</b>
<b>Text Books</b>		
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 , February 2020.	
<b>Reference Books</b>		
1	Steve Kaelble” Robotic Process Automation” John Wiley & Sons, Ltd., 2018	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	<a href="https://www.tutorialspoint.com/uiopath/uiopath_robotic_process_automation_introduction.htm">https://www.tutorialspoint.com/uiopath/uiopath_robotic_process_automation_introduction.htm</a>	
2	<a href="https://www.javatpoint.com/rpa">https://www.javatpoint.com/rpa</a>	
3	<a href="https://onlinecourses.nptel.ac.in/noc19_me74/preview">https://onlinecourses.nptel.ac.in/noc19_me74/preview</a>	
Course Designed By:		

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

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



## M.Sc. COMPUTER SCIENCE

### Syllabus

(With effect from 2021 -2022 & Onwards)



**Program Code:**

**DEPARTMENT OF COMPUTER SCIENCE**

**Bharathiar University**

(A State University, Accredited with "A" Grade by NAAC and  
13<sup>th</sup> Rank among Indian Universities by MHRD-NIRF)

**Coimbatore 641 046, INDIA**



**BHARATHIAR UNIVERSITY : : COIMBATORE 641046**  
**DEPARTMENT OF COMPUTER SCIENCE**

**MISSION**

1. To keep pace with emerging technologies and concepts, students are thrown open to the ever changing arena, meeting the industry requirements and standards, with the necessary knowledge and skill sets.
2. Are trained to explore more, at their own pace, knowing the demands of the IT world.
3. Apart from all the technical stuff, to inculcate the students about the Human Values and Professional ethics and to play a vital role in the society. Imparting them not only as world class Professionals, but also as tech savvy human beings to serve mankind.
4. **ELECTIVE – I**
5. 1.1. Multimedia and its Applications
6. 1.2. Embedded Systems
7. 1.3. Internet of Things
8. 1.4. Critical Thinking, Design Thinking and Problem Solving
- 9.
- 10.
11. **ELECTIVE – II**
12. 2.1. Mobile Computing
13. 2.2. Block Chain Technology
14. 2.3. Web Services
- 15.2.4. Robotic Process Automation for Business