

**D.K.M. COLLEGE FOR WOMEN(AUTONOMOUS)
VELLORE-1
(REACCREDITED BY NAAC WITH 'A' GRADE)**

**DEPARTMENT OF COMPUTER SCIENCE AND
APPLICATIONS**

PG-M.Sc COMPUTER SCIENCE DEGREE



TEMPLATE AND SYLLABUS

2024-2025

M.SC. COMPUTER SCIENCE

Programme Educational Objectives (PEOs)

PEO1: Attain Academic and Professional Excellence

Build a strong academic foundation and skill set that will enable success in higher education, competitive examinations, teaching, research, industry, and entrepreneurial ventures.

PEO2: Emerge as Empowered Individuals

Develop into confident, self-reliant, and economically independent women capable of applying scientific knowledge to enhance personal growth, family welfare, and community development.

PEO3: Advance Research and Innovation

Demonstrate the ability to investigate real-world challenges and contribute contextually relevant, research-driven, and innovative solutions across scientific disciplines.

PEO4: Uphold Ethical and Cultural Values

Adhere to high ethical standards, respect cultural diversity, and engage responsibly in scientific practices that contribute to a just and inclusive society.

PEO5: Respond to Societal and National Needs

Utilize scientific understanding to support public health, environmental conservation, and technological advancement, fostering inclusive regional and national progress.

PEO6: Exhibit Leadership and Social Responsibility

Lead scientific and community initiatives with integrity, inspire collaborative action, and actively contribute to positive social transformation at local and global levels.

PEO7: Engage in Lifelong and Global Learning

Pursue continuous personal and professional development while staying abreast of global trends, innovations, and interdisciplinary scientific advancements.

Programme Outcomes (POs)

PO1: Comprehend and Apply Scientific Knowledge

Acquire and apply core knowledge from scientific disciplines to understand natural phenomena, solve complex problems, and support innovation across various domains of life and industry.

PO2: Demonstrate Analytical and Critical Thinking

Develop the ability to think critically and analytically by formulating hypotheses, interpreting experimental results, evaluating scientific literature, and drawing evidence-based conclusions.

PO3: Exhibit Technical and Laboratory Competency

Gain proficiency in laboratory techniques, handling of scientific instruments, and use of software tools, while adhering to safety protocols, accuracy, and reproducibility in experimental work.

PO4: Communicate Effectively

Present scientific concepts and findings clearly and coherently through oral presentations, technical writing, and the use of digital tools, adapting to both academic and professional contexts.

PO5: Uphold Ethical Values and Environmental Consciousness

Integrate ethical principles and environmental awareness into scientific practices, promoting sustainable solutions and a sense of accountability towards society and nature.

PO6: Engage in Lifelong Learning

Cultivate an inquisitive mindset and adaptability to emerging scientific advancements, technologies, and interdisciplinary approaches, thereby remaining relevant and competent throughout life.

PO7: Collaborate and Lead in Scientific and Social Contexts

Participate effectively in collaborative scientific projects and community-based activities, demonstrating leadership, decision-making, and commitment to women's empowerment and societal progress.

📖 Programme Specific Outcomes – M.Sc. Computer Science

PSO1: Master Advanced Computing Concepts

Apply deep theoretical knowledge in algorithms, distributed systems, compiler design, AI, and cyber security to research and enterprise problems.

PSO2: Design Enterprise-Scale Software Systems

Engineer scalable, secure, and modular software for modern computing environments including cloud, mobile, and multi-platform applications.

PSO3: Engage in Research and Innovation

Conduct high-quality research, publish findings, and develop prototypes addressing real-world technological challenges.

PSO4: Contribute to Industry, Government, and Community Needs

Develop solutions for e-governance, rural automation, digital finance, healthcare informatics, and education systems.

PSO5: Practice Ethical Tech Leadership

Lead teams and projects while ensuring ethical handling of data, intellectual property, and inclusive technology use.

PSO6: Prepare for Doctoral Research and Academic Roles

Be equipped to pursue Ph.D., NET, SET, or work as lecturers, research associates, or technology consultants.

PSO7: Empower Women Through High-Impact Tech Solutions

Champion the role of women in STEM by mentoring, leading innovation hubs, and building inclusive, tech-enabled communities.

Choice Based Credit System (CBCS), Learning Outcomes Based Curriculum Framework (LOCF) Guideline Based Credit and Hours Distribution System

M.Sc. Computer Science Curriculum Design

Course Code	Title of the Course	Credits	Hours		Maximum Marks		
			Theory	Practical	CIA	ESE	Total
FIRST SEMESTER							
Core-I	Analysis and Design of Algorithms	5	7	-	25	75	100
Core-II	Object Oriented Analysis and Design & C++	5	7	-	25	75	100
Core-III	Python Programming	4	6	-	25	75	100
Elective-I	1. Advanced Software Engineering 2. Principles of Compiler Design	3	5	-	25	75	100
Elective-II	1. Algorithm and OOPS Lab 2. Python Programming Lab	3	-	5	25	75	100
Total		20	25	5			500
SECOND SEMESTER							
Core-IV	Data Mining and Warehousing	5	5	-	25	75	100
Core-V	Advanced Operating Systems	5	5	-	25	75	100
Core-VI	Advanced Java Programming	4	6	-	25	75	100
Elective-III	1. Artificial Intelligence and Machine Learning 2. Web Services	3	4	-	25	75	100
Elective-IV	1. Advanced Java Programming Lab 2. Web Application Development and Hosting Lab	3	-	4	25	75	100
SEC-I	Data Mining using R Lab	2	-	4	25	75	100
	Fundamentals of Human Rights	2	2	-	25	75	100
	MOOC Course/Self Study paper	2	-	-	-	-	-
Total		26	22	8			700

THIRD SEMESTER							
Core-VII	Digital Image Processing	5	6	-	25	75	100
Core-VIII	Paper X: Cloud Computing	5	5	-	25	75	100
Core-IX	Network Security and Cryptography	5	5	-	25	75	100
Core-X	Data Science and Analytics	4	6	-	25	75	100
Elective-V	1. Digital Image Processing Lab using MATLAB 2. Network Security and Cryptography Lab	3	-	4	25	75	100
SEC-II	Cloud Computing Lab	2	-	4	25	75	100
Internship	Internship Industrial Activity	2	-	-	-	-	-
Total		26	22	8			600
FOURTH SEMESTER							
Core-XI	Internet of Things	5	6	-	25	75	100
Core-XII	Block Chain Technology	5	6	-	25	75	100
Core - XIII	Project Work and Viva- Voce	7	-	10	25	75	100
Elective-VI	1. Industry Entrepreneurship : Internet of Things Lab 2. Block Chain Technologies Lab	3	-	4	25	75	100
SEC-III	Skill Enhancement Course: Soft Skill Development Lab /Professional Competency Skill : Data Visualisation Lab	2	-	4	25	75	100
	Extension Activity	1	-	-	-	-	-
Total		23	12	18			500
Grand Total		95					2300

TOTAL CREDITS

M.Sc (COMPUTER SCIENCE)

PART	SUBJECT	PAPERS	CREDIT	TOTAL CREDITS	MARKS	TOTAL MARKS
Part I	Core Theory	12	9 * 5= 45 3 * 4= 12	57	100	1200
	Discipline centric/Generic centric Elective	2	3	6	100	200
	Elective practical	4	3	12	100	400
	Project with viva-voce	1	7	7	100	100
Part II	Skill Enhancement	3	2	6	100	300
	Human rights	1	2	2	100	100
	MOOC course	1	2	2	-	-
	Summer Internship	1	2	2	-	-
Part III	Extension activity	1	1	1	-	-
	TOTAL	26	-	95	-	2300

I-SEMESTER

Course code	ANALYSIS AND DESIGN OF ALGORITHMS			L	T	P	C
Core/Elective/Supportive	Core			7			5
Pre-requisite	Basic Data Structures & Algorithms						
Course Objectives:							
The main objectives of this course are to:							
<ol style="list-style-type: none"> 1. Enable the students to learn Elementary Data Structures and algorithms. 2. Presents an introduction to the algorithms, their analysis and design. 3. Discuss various methods like Basic Traversal and Search Techniques, Divide and Conquer method, Dynamic programming, backtracking. 4. Understood the various design and analysis of the algorithms. 							
Expected Course Outcomes:							
On the successful completion of the course, student will be able to:							
1	Get knowledge about algorithms and determine their time complexity. Demonstrate specific search and sort algorithms using divide and conquer technique.					K1,K2	
2	Gain good understanding of Greedy method and its algorithm.					K2,K3	
3	Able to describe about graphs using dynamic programming technique.					K3,K4	
4	Demonstrate the concept of backtracking & branch and bound technique.					K5,K6	
5	Explore the traversal and searching technique and apply it for trees and graphs.					K6	
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create							
Unit:1	INTRODUCTION					20Hours	
Introduction: - Algorithm Definition and Specification – Space complexity-Time Complexity-Asymptotic Notations - Elementary Data Structure: Stacks and Queues – Binary Tree - Binary Search Tree - Heap – Heapsort- Graph.							
Unit:2	TRAVERSAL AND SEARCH TECHNIQUES					20Hours	
Basic Traversal and Search Techniques: Techniques for Binary Trees-Techniques for Graphs-Divide and Conquer: - General Method – Binary Search – Merge Sort – Quick Sort.							
Unit:3	GREEDY METHOD					20Hours	
The Greedy Method: - General Method–Knapsack Problem–Minimum Cost Spanning Tree–Single Source Shortest Path.							

Unit:4	DYNAMIC PROGRAMMING	20Hours
Dynamic Programming-General Method–Multistage Graphs–All Pair Shortest Path–Optimal Binary Search Trees–0/1Knapsacks–Traveling Salesman Problem–Flow Shop Scheduling.		
Unit:5	BACKTRACKING	20Hours
Backtracking: - General Method–8-Queens Problem–Sum Of Subsets– Graph Coloring– Hamiltonian Cycles – Branch And Bound: - The Method – Traveling Salesperson.		
Unit:6	Contemporary Issues	5Hours
Expert lectures, online seminars– webinars		
Total Lecture Hours		105hours
Text Books		
1	Ellis Horowitz, “Computer Algorithms”, Galgotia Publications.	
2	Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms".	
Reference Books		
1	Goodrich, “Data Structures & Algorithms in Java”, Wiley 3 rd edition.	
2	Skiena, “The Algorithm Design Manual”, Second Edition, Springer,2008	
3	Anany Levith, “Introduction to the Design and Analysis of algorithm”, Pearson Education Asia, 2003.	
4	Robert Sedgewick, Phillipe Flajolet, “An Introduction to the Analysis of Algorithms”, Addison-WesleyPublishingCompany,1996.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/courses/106/106/106106131/	
2	https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm	
3	https://www.javatpoint.com/daa-tutorial	

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

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

I-SEMESTER

Course code	OBJECT ORIENTED ANALYSIS AND DESIGN & C++			L	T	P	C
Core/Elective/Supportive	Core			7			5
Pre-requisite	Basics of C++ and Object-Oriented Concepts						
Course Objectives:							
The main objectives of this course are to:							
<ol style="list-style-type: none"> 1. Present the object model, classes and objects, object orientation, machine view and model management view. 2. Enables the students to learn the basic functions, principles and concepts of object- oriented analysis and design. 3. Enable the students to understand C++ language with respect to OOAD. 							
Expected Course Outcomes:							
On the successful completion of the course, student will be able to:							
1	Understand the concept of Object-Oriented development and modeling techniques					K1, K2	
2	Gain knowledge about the various steps performed during object design					K2, K3	
3	Abstract object-based views for generics of Software systems					K3	
4	Link OOAD with C++ language					K4, K5	
5	Apply the basic concept of OOPs and familiarize to write C++ program					K5, K6	
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create							
Unit:1	OBJECT MODEL					20Hours	
The Object Model: The Evolution of the Object Model–Elements of the Object Model–Applying the Object Model. Classes and Objects: The Nature of an Object – Relationship among Objects.							
Unit:2	CLASSESANDOBJECTS					20Hours	
Classes and Object: Nature of Class – Relationship Among classes – The Interplay of classes and Objects. Classification: The importance of Proper Classification–identifying classes and objects–Key Abstractions and Mechanism.							
Unit:3	C++INTRODUCTION					20Hours	
Introduction to C++-Input and output statements in C++ - Declarations-control structures– Functions in C++.							

Unit:4	INHERITANCE AND OVERLOADING	20Hours
Classes and Objects–Constructors and Destructors–operators overloading–Type Conversion- Inheritance – Pointers and Arrays.		
Unit:5	POLYMORPHISMANDFILES	20Hours
Memory Management Operators-Polymorphism–Virtual functions–Files–Exception Handling– String Handling-Templates.		
Unit:6	Contemporary Issues	5Hours
Expert lectures, online seminars– webinars		
Total Lecture Hours		105Hours
Text Books		
1	“Object Oriented Analysis and Design with Applications”, Grady Booch, Second Edition, Pearson Education.	
2	“Object-Oriented Programming with ANSI & Turbo C++”, Ashok N. Kamthane, First Indian Print -2003, Pearson Education.	
Reference Books		
1	Balagurusamy, “Object Oriented Programming with C++”, TMH, Second Edition,2003.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://onlinecourses.nptel.ac.in/noc19_cs48/preview	
2	https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs19/	
3	https://www.tutorialspoint.com/object_oriented_analysis_design/ood_object_oriented_analysis.htm	

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

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

I-SEMESTER

Course code	PYTHON PROGRAMMING			L	T	P	C
Core/Elective/Supportive	Core			4			6
Pre-requisite	Basics of any OOProgramming Language						
Course Objectives:							
The main objectives of this course are to:							
<ol style="list-style-type: none"> 1. Presents an introduction to Python, creation of web applications, network applications and working in the clouds. 2. Use functions for structuring Python programs. 3. Understand different Data Structures of Python. 4. Represent compound data using Python lists, tuples and dictionaries. 							
Expected Course Outcomes:							
On the successful completion of the course, student will be able to:							
1	Understand the basic concepts of Python Programming					K1, K2	
2	Understand File operations, Classes, and Objects					K2, K3	
3	Acquire Object Oriented Skills in Python					K3, K4	
4	Develop web applications using Python					K5	
5	Develop Client Server Networking applications					K5, K6	
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create							
Unit:1	INTRODUCTION					17Hours	
Python: Introduction–Numbers–Strings–Variables–Lists–Tuples–Dictionaries–Sets–Comparison.							
Unit:2	CODE STRUCTURES					17Hours	
Code Structures: if, elseif, and else – Repeat with while – Iterate with for – Comprehensions – Functions–Generators–Decorators–Namespaces and Scope–Handle Errors with try and except – User Exceptions.							
Unit:3	MODULES, PACKAGES AND CLASSES					17Hours	
Modules, Packages, and Programs: Standalone Programs – Command-Line Arguments – Modules and the import Statement –The Python Standard Library. Objects and Classes: Define a Class with class–Inheritance–Override a Method–Add a Method–Get Help from Parent with super–Inself Defense –Get and Set Attribute Values with Properties–Name Mangling for Privacy – Method Types – Duck Typing – Special Methods –Composition.							

Unit:4	DATA TYPES AND WEB	17Hours
Data Types: Text Strings–Binary Data, Storing and Retrieving Data: File Input/Output–Structured Text Files–Structured Binary Files–Relational Databases–NoSQL Data Stores. Web: Web Clients–Web Servers–Web Services and Automation		
Unit:5	SYSTEMSANDNETWORKS	17Hours
Systems: Files–Directories–Programs and Processes–Calendars and Clocks. Concurrency: Queues–Processes–Threads–Green Threads and gevent–twisted–Redis. Networks: Patterns – The Publish-Subscribe Model – TCP/IP – Sockets – Zero MQ –Internet Services–Web Services and APIs–Remote Processing–Big Fat Data and Map Reduce–Working in the Clouds.		
Unit:6	Contemporary Issues	5Hours
Expert lectures, online, seminars– webinars		
Total Lecture Hours		90Hours
Text Books		
1	Bill Lubanovic, “Introducing Python”, O’ Reilly, First Edition-Second Release, 2014.	
2	Mark Lutz, “Learning Python”, O’Reilly, Fifth Edition, 2013.	
Reference Books		
1	David M. Beazley, “Python Reference”, Developer’s Library, Essential Fourth Edition, 2009.	
2	Sheetal Taneja, Naveen Kumar, Programming- A Modular Approach”, Pearson Publications.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.programiz.com/python-programming/	
2	https://www.tutorialspoint.com/python/index.htm	
3	https://onlinecourses.swayam2.ac.in/aic20_sp33/preview	

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

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

I-SEMESTER

Course code	ADVANCED SOFTWARE ENGINEERING			L	T	P	C
Core/Elective/Supportive	Elective			5			3
Pre-requisite	Basics of Software Engineering & SPM						
Course Objectives:							
The main objectives of this course are to:							
<ol style="list-style-type: none"> 1. Introduction to Software Engineering, Design, Testing and Maintenance. 2. Enable the students to learn the concepts of Software Engineering. 3. Learn about Software Project Management, Software Design & Testing. 							
Expected Course Outcomes:							
On the successful completion of the course, student will be able to:							
1	Understand about Software Engineering process					K1, K2	
2	Understand about Software project management skills, design and quality management					K2, K3	
3	Analyze on Software Requirements and Specification					K3, K4	
4	Analyze on Software Testing, Maintenance and Software, Re-Engineering					K4, K5	
5	Design and conduct various types and levels of software quality for a software project					K5, K6	
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create							
Unit:1	INTRODUCTION					14Hours	
Introduction: The Problem Domain – Software Engineering Challenges - Software Engineering Approach – Software Processes: Software Process – Characteristics of a Software Process – Software Development Process Models – Other software processes.							
Unit:2	SOFTWARE REQUIREMENTS					14Hours	
Software Requirements Analysis and Specification: Requirement engineering – Type of Requirements – Feasibility Studies – Requirements Elicitation – Requirement Analysis – Requirement Documentation – Requirement Validation – Requirement Management – SRS - Formal System Specification – Axiomatic Specification – Algebraic Specification - Case study: Student Result management system. Software Quality Management –Software Quality, Software Quality Management System, ISO 9000, SEI CMM.							
Unit:3	PROJECT MANAGEMENT					14Hours	
Software Project Management: Responsibilities of a software project manager – Project planning – Metrics for Project size estimation – Project Estimation Techniques – Empirical Estimation Techniques – COCOMO – Halstead’s software science – Staffing level estimation– Scheduling– Organization and Team Structures – Staffing – Risk management – Software Configuration Management – Miscellaneous Plan.							

Unit:4	SOFTWAREDESIGN	14Hours
Software Design: Outcome of a Design process–Characteristics of a good software design– Cohesion and coupling-Strategy of Design–Function Oriented Design–Object Oriented Design -Detailed Design-IEEE Recommended Practice for Software Design Descriptions.		
Unit:5	SOFTWARE TESTING	14Hours
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.		
Unit:6	Contemporary Issues	5Hours
Expert lectures, online seminars – webinars		
Total Lecture Hours		75Hours
Text Books		
1	An Integrated Approach to Software Engineering–Pankaj Jalote, Narosa Publishing House, Delhi, 3rd Edition.	
2	Fundamentals of Software Engineering–Rajib Mall, PHI Publication, 3 rd Edition.	
Reference Books		
1	Software Engineering– K.K. Aggarwal and Yogesh Singh, New Age International Publishers, 3rd edition.	
2	A Practitioners Approach– Software Engineering, R.S. Pressman, McGraw Hill.	
3	Fundamentals of Software Engineering - Carlo Ghezzi, M. Jarayeri, D. Manodrioli, PHI Publication.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.javatpoint.com/software-engineering-tutorial	
2	https://onlinecourses.swayam2.ac.in/cec20_cs07/preview	
3	https://onlinecourses.nptel.ac.in/noc19_cs69/preview	

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

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

I-SEMESTER

Course code	PRINCIPLES OF COMPILER DESIGN			L	T	P	C
Core/Elective/Supportive	Elective			5			3
Pre-requisite	Basics of Formal Languages and Automata Theory						
Course Objectives:							
The main objectives of this course are to:							
<ol style="list-style-type: none"> 1. Introducing Grammar, Finite Automata, Parser, Syntax Tree and Code Generation. 2. Enable the students to learn about different phases of Compiler. 3. Learn about Conversion of Source Code to Object Code. 							
Expected Course Outcomes:							
On the successful completion of the course, student will be able to:							
1	Understand the phases and tools available in Compiler					K2	
2	Design and implement a Lexical Analyzer					K3	
3	Compare and analyze different types of Compilers					K4	
4	Specify appropriate translations to generate Intermediate Code					K3	
5	Identify sources for Code Optimization					K4	
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create							
Unit:1							
INTRODUCTION TO COMPILERS				14Hours			
Introduction to Compiling –Compilers–Analysis of the Source Program–Phases of a Compiler. Grouping of Phases – Compiler Construction Tools.							
Unit:2							
LEXICALANALYSIS				14Hours			
Lexical Analysis – Role of the Lexical Analyzer – Specification and Recognition of Tokens – Language for specifying Lexical Analyzer – Finite Automata – Regular Expressions to NFA – Design of Lexical Analyzer Generator – Optimization of DFA based pattern matchers.							
Unit:3							
SYNTAXANALYSIS				14Hours			
Syntax Analysis – Role of Parser– Context Free Grammars – Top-Down Parsing– Bottom-Up Parsing – Operator Precedence Parsing – LR Parsers.							
Unit:4							
SYNTAXDIRECTEDTRANSLATION				14Hours			
Syntax Directed Translation: Syntax Directed Definitions–Construction of Syntax Trees–Bottom Up evaluation of attributed definition – Bottom Up evaluation of inherited attributes – Recursive evaluators.							

Unit:5	INTERMEDIATE CODE GENERATION AND OPTIMIZATION	14Hours
Intermediate Code Generation: Intermediate Languages – Declaration – Assignment Statements. Procedure Calls–Runtime Storage Management. Code Generation and Optimization: Basic Blocks and Flow Graphs – DAG Representation.		
Unit:6	Contemporary Issues	5Hours
Expert lectures, online seminars– webinars		
Total Lecture Hours		75Hours
Text Books		
1	Compilers–Principles, Techniques and Tools–Alfred Aho, Ravi Sethi, Jeffrey D. Ullman, Pearson: 1986	
2	Modern Compiler Design–Dick Grune, Bal, Langendoen, Jacobs, Wiley:2012	
3	Compiler Design–K. Muneeswaran, Oxford University Press:2013	
Reference Books		
1	Modern Compiler Design–David Galles, Pearson Education Asia: 2001	
2	Advanced Compiler Design and Implementation–Steven S. Muchnick, Morgan Kaufmann Publishers: 2000	
3	Crafting a Compiler with C –C.N. Fisher, R. J. LeBlane, Pearson Education: 2000	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.,]		
1	https://www.geeksforgeeks.org/compiler-lexical-analysis	
2	https://ieeexplore.ieee.org/document/7779385/	
3	https://www.tutorialspoint.com/compiler_design/compiler_design_tutorial.pdf	

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

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

I-SEMESTER

Course code	PRACTICAL: ALGORITHM AND OOPS LAB	L	T	P	C
Core/Elective/Supportive	Elective			5	3
Pre-requisite	Basic Programming of C++ language				
Course Objectives:					
The main objectives of this course are to:					
<ol style="list-style-type: none"> 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 enables the students to understand C++ language with respect to OOAD concepts. 4. Application of OOPS concepts. 					
Expected Course Outcomes:					
On the successful completion of the course, student will be able to:					
1	Understand the concepts of object oriented with respect to C++				K1, K2
2	Able to understand and implement OOPS concepts				K3, K4
3	Implementation of data structures like Stack, Queue, Tree, List using C++				K4, K5
4	Application of the data structures for Sorting, Searching using different techniques.				K5, K6
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create					
LIST OF PROGRAMS					75Hours
<ol style="list-style-type: none"> 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 operations in a circular queue. 5) Write a program to sort an array of elements using quicksort. 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 a 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 8 X 8 matrix so that no two queens Attack. 10) Write a C++ program to perform Virtual Function. 11) Write a C++ program to perform Parameterized constructor. 12) Write a C++ program to perform Friend Function. 13) Write a C++ program to perform Function Overloading. 14) Write a C++ program to perform Single Inheritance. 15) Write a C++ program to perform Employee Details using files. 					
Total Hours					75Hours

Text Books	
1	Goodrich, “Data Structures & Algorithms in Java”, Wiley 3rd edition.
2	Skiena, “The Algorithm Design Manual”, Second Edition, Springer, 2008
Reference Books	
1	Anany Levith, “Introduction to the Design and Analysis of Algorithm”, Pearson Education Asia, 2003.
2	Robert Sedgewick, Phillipe Flajolet, “An Introduction to the Analysis of Algorithms”, Addison-Wesley Publishing Company,1996.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://onlinecourses.nptel.ac.in/noc19_cs48/preview
2	https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs19/
3	https://www.tutorialspoint.com/object_oriented_analysis_design/ooad_object_oriented_analysis.htm

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

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

I –SEMESTER

Course code		PRACTICAL: PYTHON PROGRAMMING LAB	L	T	P	C
Core/Elective/Supportive		Elective			5	3
Pre-requisite	Basics of any OOProgramming Language					
Course Objectives:						
The main objectives of this course are to:						
<ol style="list-style-type: none"> 1. This course presents an overview of elementary data items, lists, dictionaries, sets and tuples. 2. To understand and write simple Python programs. 3. To Understand the OOPS concepts of Python. 4. To develop web applications using Python. 						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Able to write programs in Python using OOPS concepts				K1, K2	
2	To understand the concepts of File operations and Modules in Python				K2, K3	
3	Implementation of lists, dictionaries, sets and tuples as programs				K3, K4	
4	To develop web applications using Python				K5, K6	
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
LIST OF PROGRAMS					75hours	
<p>Implement the following in Python:</p> <ol style="list-style-type: none"> 1. Programs using elementary data items, lists, dictionaries, and tuples. 2. Programs using conditional branches, 3. Programs using loops. 4. Programs using functions. 5. Programs using exception handling. 6. Programs using inheritance. 7. Programs using polymorphism. 8. Programs to implement file operations. 9. Programs using modules. 10. Programs for creating dynamic and interactive webpages using forms. 						
Total Hours					75hours	

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

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

II –SEMESTER

Course code	DATA MINING AND WARE HOUSING			L	T	P	C
Core/Elective/Supportive	Core			5			5
Pre-requisite	Basics of RDBMS & Algorithms						
Course Objectives:							
The main objectives of this course are to:							
<ol style="list-style-type: none"> 1. Enable the students to learn the concepts of Mining tasks, classification, clustering, and Data Warehousing. 2. Develop skills of using recent data mining software for solving practical problems. 3. Develop and apply critical thinking, problem-solving, and decision-making skills. 							
Expected Course Outcomes:							
On the successful completion of the course, student will be able to:							
1	Understand the basic data mining techniques and algorithms					K1, K2	
2	Understand the Association rules, Clustering techniques and Data warehousing contents					K2, K3	
3	Compare and evaluate different data mining techniques like classification, prediction, Clustering, and association rule mining					K4, K5	
4	Design data warehouse with dimensional modeling and apply OLAP operations					K5, K6	
5	Identify appropriate datamining algorithms to solve real world problems					K6	
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create							
Unit:1							
BASICS AND TECHNIQUES						14Hours	
Basic datamining tasks–datamining versus knowledge discovery in databases–datamining issues –datamining metrics–social implications of datamining–datamining from a database perspective. Datamining techniques: Introduction–a statistical perspective on datamining–similarity measures – decision trees – neural networks – genetic algorithms.							
Unit:2							
ALGORITHMS						14Hours	
Classification: Introduction–Statistical–based algorithms–distance–based algorithms–decision tree–based algorithms–neural network–based algorithms–rule–based algorithms–combining techniques.							
Unit:3							
CLUSTERING AND ASSOCIATION						14Hours	
Clustering: Introduction–Similarity and Distance Measures–Outliers–Hierarchical Algorithms –Partitional Algorithms. Association rules: Introduction - large item sets - basic algorithms – parallel & distributed algorithms – comparing approaches- incremental rules – advanced association rules techniques – measuring the quality of rules.							

Unit:4	DATA WAREHOUSING AND MODELING	14Hours
Data warehousing: Introduction-characteristics of a data warehouse–data marts–other aspects Of data mart. Online analytical processing: introduction -OLTP & OLAP systems Data modeling–stars chema formulti dimensional view–data modeling– multi facts schemaor snowflake schema – OLAP TOOLS – State of the market – OLAP TOOLS and the internet.		
Unit:5	APPLICATIONSOFDATAWAREHOUSE	14Hours
Developing a data WAREHOUSE: why and how to build a data warehouse – data warehouse architectural strategies and organization issues - design consideration – data content – metadata distribution of data – tools for data warehousing – performance considerations – crucial decisions in designing a data warehouse. Applications of data warehousing and data mining in government: Introduction - national data warehouses – other areas for data warehousing and data mining.		
Unit:6	Contemporary Issues	5Hours
Expert lectures, online seminars– webinars		
Total Lecture Hours		75Hours
Text Books		
1	Margaret H. Dunham, “Data Mining: Introductory and Advanced Topics”, Pearson education,2003.	
2	C.S.R. Prabhu, “Data Warehousing Concepts, Techniques, Products and Applications”, PHI, Second Edition.	
Reference Books		
1	Arun K. Pujari, “Data Mining Techniques”, Universities Press (India) Pvt. Ltd., 2003.	
2	Alex Berson, Stephen J. Smith, “Data Warehousing, Data Mining and OLAP”, TMCH, 2001.	
3	Jiawei Han & Micheline Kamber, “Data Mining Concepts & Techniques”, 2001, Academic press.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.javatpoint.com/data-warehouse	
2	https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs12/	
3	https://www.btechguru.com/training--it--database-management-systems--file-structures--introduction-to-data-warehousing-and-olap-2-video-lecture--12054--26--151.html	

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

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

II-SEMESTER

Course code	ADVANCED OPERATING SYSTEMS			L	T	P	C
Core/Elective/Supportive	Core			5			5
Pre-requisite	Basics of OS & its functioning						
Course Objectives:							
The main objectives of this course are to:							
<ol style="list-style-type: none"> 1. Enable the students to learn the different types of operating systems and their functioning. 2. Gain knowledge on Distributed Operating Systems 3. Gain insight into the components and management aspects of realtime and mobile operating systems. 4. Learn case studies in Linux Operating Systems 							
Expected Course Outcomes:							
On the successful completion of the course, student will be able to:							
1	Understand the design issues associated with operating systems.					K1, K2	
2	Master various process management concepts including scheduling, deadlocks, and distributed file systems					K3, K4	
3	Prepare Real Time Task Scheduling					K4, K5	
4	Analyze Operating Systems for Hand held Systems					K5	
5	Analyze Operating Systems like LINUX and iOS					K5, K6	
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create							
Unit:1	BASICS OF OPERATING SYSTEMS					14Hours	
Basics of Operating Systems: What is an Operating System? – Main frame Systems – Desktop Systems – Multiprocessor Systems – Distributed Systems – Clustered Systems – Real-Time Systems – Handheld Systems – Feature Migration – Computing Environments - Process Scheduling – Cooperating Processes – Inter Process Communication - Deadlocks – Prevention – Avoidance – Detection – Recovery.							
Unit:2	DISTRIBUTED OPERATING SYSTEMS					14Hours	
Distributed Operating Systems: Issues– Communication Primitives–Lampert’s Logical Clocks– Deadlock handling strategies–Issues in deadlock detection and resolution-distributed file systems –design issues – Case studies – The Sun Network File System-Coda.							
Unit:3	REAL TIME OPERATING SYSTEM					14Hours	
Realtime Operating Systems: Introduction–Applications of Real Time Systems–Basic Model of Real Time System – Characteristics – Safety and Reliability - Real Time Task Scheduling							

Unit:4	HANDHELD SYSTEM	14Hours
Operating Systems for Handheld Systems: Requirements–Technology Overview–Handheld Operating Systems–Palm OS-Symbian Operating System-Android–Architecture of android–		
Securing handheld systems		
Unit:5	CASE STUDIES	14Hours
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 - CoreOS Layer - File System.		
Unit:6	Contemporary Issues	5Hours
Expert lectures, online seminars– webinars		
Total Lecture Hours		75Hours
Text Books		
1	Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, “Operating System Concepts”, Seventh Edition, JohnWiley&Sons, 2004.	
2	Mukesh Singhal and Niranjana G. Shivaratri, “Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems”, Tata McGraw-Hill, 2001.	
Reference Books		
1	RajibMall, “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 rd edition, O’Reilly, 2005	
4	Neil Smyth, “iPhone iOS 4 Development Essentials–Xcode”, Fourth Edition, Payload media, 2011.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites, etc.]		
1	https://onlinecourses.nptel.ac.in/noc20_cs04/preview	
2	https://www.udacity.com/course/advanced-operating-systems--ud189	
3	https://minnie.tuhs.org/CompArch/Resources/os-notes.pdf	

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

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

II-SEMESTER

Course code	ADVANCED JAVA PROGRAMMING			L	T	P	C
Core/Elective/Supportive	Core			6			4
Pre-requisite	Basics of Java & its Usage						
Course Objectives:							
The main objectives of this course are to:							
<ol style="list-style-type: none"> 1. Enable the students to learn the basic functions, principles and concepts of advanced java programming. 2. Provide knowledge on concepts needed for distributed Application Architecture. 3. Learn JDBC, Servlet packages, JQuery, Java Server Pages and JAR file format. 							
Expected Course Outcomes:							
On the successful completion of the course, student will be able to:							
1	Understand the advanced concepts of Java Programming					K1, K2	
2	Understand JDBC and RMI concepts					K2, K3	
3	Apply and analyze Javain Database					K3, K4	
4	Handle different event in java using the delegation event model, event listener and class					K5	
5	Design interactive applications using Java Servlet, JSP and JDBC					K5, K6	
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create							
Unit:1							
			BASICS OF JAVA			17Hours	
Java Basics Review: Components and event handling–Threading concepts–Networking features–Media techniques							
Unit:2							
			REMOTE METHOD INVOCATION			17Hours	
Remote Method Invocation-Distributed Application Architecture-Creating stubs and skeletons-Defining Remote objects- Remote Object Activation-Object Serialization-Java Spaces							
Unit:3							
			DATABASE			17Hours	
Javain Databases-JDBC principles–database access-Interacting-database search–Creating multimedia databases–Database support in web applications							
Unit:4							
			SERVLETS			17Hours	
Java Servlets: Java Servlet and CGI programming- A simple java Servlet-Anatomy of a java Servlet-Readingdatafromaclient-Readinghttprequestheader-sendingdatatoaclientandwriting the http response header-working with cookies. Java Server Pages: JSP Overview-Installation-JSP tags-Components of a JSP page-Expressions-Scriptlets-Directives-Declarations-A complete example							

Unit:5	ADVANCED TECHNIQUES	17Hours
JAR file format creation–Internationalization–Swing Programming–Advanced java techniques		
Unit:6	Contemporary Issues	5Hours
Expert lectures, online seminars– webinars		
	Total Lecture Hours	90Hours
Text Books		
1	Jamie Jaworski, “Java Unleashed”, SAMS Techmedia Publications, 1999.	
2	Campione, Walrathand Huml, “The Java Tutorial”, Addison Wesley, 1999.	
Reference Books		
1	JimKeogh, “The Complete Reference J2EE”, Tata McGraw Hill Publishing Company Ltd, 2010.	
2	David Sawyer McFarland, “Java Script and JQuery – The Missing Manual”, Oreilly Publications, 3rd Edition, 2011.	
3	Deitel and Deitel, “Java How to Program”, Third Edition, PHI/Pearson Education Asia.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.javatpoint.com/servlet-tutorial	
2	https://www.tutorialspoint.com/java/index.htm	
3	https://onlinecourses.nptel.ac.in/noc19_cs84/preview	

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

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

II-SEMESTER

Course code	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING		L	T	P	C
Core/Elective/Supportive	Elective		4			3
Pre-requisite	Basics of AI & an Introduction about ML					
Course Objectives:						
The main objectives of this course are to:						
<ol style="list-style-type: none"> 1. Enable the students to learn the basic functions of AI, Heuristic Search Techniques. 2. Provide knowledge on concepts of Representations and Mappings and Predicate Logic. 3. Introducing Machine Learning with respect to Data Mining, BigData and Cloud. 4. Study about Applications & Impact of ML. 						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Demonstrate AI problems and techniques				K1, K2	
2	Understand machine learning concepts				K2, K3	
3	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning				K3, K4	
4	Analyze the impact of machine learning on applications				K4, K5	
5	Analyze and design of AI world problem for implementation and understand the dynamic behavior of a system				K5, K6	
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
Unit:1	INTRODUCTION				11Hours	
Introduction: AI Problems - AI techniques - Criteria for success. Problems, Problem Spaces, Search: State space search - Production Systems - Problem Characteristics - Issues in design of Search.						
Unit:2	SEARCH TECHNIQUES				11Hours	
Heuristic Search techniques: Generate and Test - Hill Climbing- Best-First, Problem Reduction, Constraint Satisfaction, Means-end analysis. Knowledge representation issues: Representations and mappings -Approaches to Knowledge representations -Issues in Knowledge representations - Frame Problem.						

Unit:3	PREDICATE LOGIC	11Hours
Using Predicate logic: Representing simple facts in logic - Representing Instance and Isa relationships-Computable functions and predicates-Resolution-Natural deduction. Representing knowledge using rules: Procedural Vs Declarative knowledge- Logic programming -Forward Vs Backward reasoning - Matching-Control knowledge.		
Unit:4	MACHINE LEARNING	11Hours
Understanding Machine Learning: What Is Machine Learning? – Defining Big Data-Big Data in Context with Machine Learning-The Importance of the Hybrid Cloud-Leveraging the Power of Machine Learning-The Roles of Statistics and Data Mining with Machine Learning-Putting Machine Learning in Context-Approaches to Machine Learning.		
Unit:5	APPLICATIONS OF MACHINE LEARNING	11Hours
Looking Inside Machine Learning: The Impact of Machine Learning on Applications - Data Preparation-The Machine Learning Cycle.		
Unit:6	Contemporary Issues	5Hours
Expert lectures, online seminars– webinars		
Total Lecture Hours		60Hours
Text Books		
1	Elaine Richand Kevin Knight, "Artificial Intelligence", Tata McGraw Hill Publishers company Pvt Ltd, Second Edition, 1991.	
2	George F Luger, "Artificial Intelligence", 4 th Edition, Pearson Education Publ, 2002.	
Reference Books		
1	Machine Learning for Dummies®, IBM Limited Edition by Judith Hurwitz, Daniel Kirsch.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.ibm.com/downloads/cas/GB8ZMQZ3	
2	https://www.javatpoint.com/artificial-intelligence-tutorial	
3	https://nptel.ac.in/courses/106/105/106105077/	

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

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

II-SEMESTER

Course code	WEB SERVICES			L	T	P	C
Core/Elective/Supportive	Elective			4			3
Pre-requisite	Basics of Distributed Computing						
Course Objectives:							
The main objectives of this course are to:							
<ol style="list-style-type: none"> 1. Present the Web Services, building real world Enterprise applications using Web Services with Technologies XML, SOAP, WSDL, UDDI. 2. Get an overview of Distributed Computing, XML, and its technologies. 3. Update with QoS and its features. 4. Develop Standards and future of Web Services. 							
Expected Course Outcomes:							
On the successful completion of the course, student will be able to:							
1	Understand web services and its related technologies					K1, K2	
2	Understand XML concepts					K2, K3	
3	Analyze on SOAP and UDDI model					K4, K5	
4	Demonstrate the roadmap for the standards and future of webservices					K5	
5	Analyze QoS enabled applications in webservices					K5, K6	
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create							
Unit:1	INTRODUCTION					11Hours	
Introduction to webservices – Overview of Distributed Computing- Evolution and importance of web services-Industry standards, Technologies and concepts underlying web services-Web services and enterprises-web services standards organization-web services platforms.							
Unit:2	XML FUNDAMENTALS					11Hours	
XML Fundamentals–XML documents-XML Namespaces-XML Schema–Processing XML.							
Unit:3	SOAP MODEL					11Hours	
SOAP: The SOAP model- SOAP messages-SOAP encoding- WSDL: WSDL structure- interface definitions-bindings-services-Using SOAP and WSDL-UDDI: About UDDI- UDDI registry Specification- Core data structures-Accessing UDDI							

Unit:4	TECHNOLOGIES AND STANDARDS	11Hours
Advanced web services technologies and standards: Conversations overview-web services conversation language-WSCL interface components. Workflow: business process management-workflows and workflow management systems Security: Basics-data handling and forwarding-data storage-errors-Web services security issues.		
Unit:5	QUALITY OF SERVICE	11Hours
Quality of Service: Importance of QoS for web services-QoS metrics-holes-design patterns-QoS enabled webservices-QoS enabled applications. Webservices management-web services standards and future trends.		
Unit:6	Contemporary Issues	5Hours
Expert lectures, online seminars– webinars		
	Total Lecture Hours	60Hours
Text Books		
1	Sandeep Chatterjee, James Webber, “Developing Enterprise Web Services: An Architects Guide”, Prentice Hall, Nov 2003.	
2	Keith Ballinger, “NET Webservices: Architecture and Implementation with .Net”, Pearson Education, First Edition, Feb 2003.	
Reference Books		
1	Ramesh Nagappan, “Developing Java Web Services: Architecting and developing secure Web Services Using Java”, John Wiley and Sons, first Edition, Feb2003.	
2	Eric A Marks and Mark J Werrell, “Executive Guide to Webservices”, John Wiley and sons, March 2003.	
3	Anne Thomas Manes, “Web Services: A managers Guide”, Addison Wesley, June 2003.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.tutorialspoint.com/webservices/index.htm	
2	https://www.javatpoint.com/web-services-tutorial	
3	https://www.btechguru.com/training--programming--xml--web-services--web-services-part-1-video-lecture--11801--24--147.html	

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

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

II-SEMESTER

Course code	PRACTICAL: ADVANCED JAVA PROGRAMMING LAB	L	T	P	C
Core/Elective/Supportive	Elective			4	3
Pre-requisite	Basics in Java Programming				
Course Objectives:					
The main objectives of this course are to:					
<ol style="list-style-type: none"> 1. To enable the students to implement the simple programs using JSP, JAR 2. To provide knowledge on using Servlets, Applets 3. To introduce JDBC and navigation of records 4. To understand RMI & its implementation 5. To introduce to Socket programming 					
Expected Course Outcomes:					
On the successful completion of the course, student will be able to:					
1	Understand to the implement concepts of Java using HTML forms, JSP & JAR				K1, K2
2	Must be capable of implementing JDBC and RMI concepts				K3, K4
3	Able to write Applets with Event handling mechanism				K4, K5
4	To Create interactive web-based applications using servlets and jsp.				K5, K6
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create					
LISTOFPROGRAMS				60Hours	
<ol style="list-style-type: none"> 1. Display welcome message using Servlet. 2. Design a Purchase Order form using Html form and Servlet. 3. Develop a program for calculating the percentage of marks of a student using JSP. 4. Design a Purchase Order form using Html form and JSP. 5. Prepare a Employee pay slip using JSP. 6. Write a program using JDBC for creating a table, Inserting, deleting records and list out the records. 7. Write a program using Java servlet to handle form data. 8. Write a simple Servlet program to create a table of all the header sit receives along with their associated values. 9. Write a program in JSP by using session object. 10. Write a program to build a simple Client Server application using RMI. 11. Create an applet for a calculator application. 12. Program to send a Text message to another system and receive the text message from the system (use socket programming). 					
TotalHours				60Hours	

TextBooks	
1	Jamie Jaworski, “Java Unleashed”, SAMS Techmedia Publications, 1999.
2	Campione, Walrathand Huml, “The Java Tutorial”, Addison Wesley, 1999.
Reference Books	
1	Jim Keogh, “The Complete Reference J2EE”, Tata McGraw Hill Publishing Company Ltd, 2010.
2	David Sawyer Mc Farland, “Java Script and JQuery– The Missing Manual”, Oreilly Publications,3rdEdition,2011.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.javatpoint.com/servlet-tutorial
2	https://www.tutorialspoint.com/java/index.htm
3	https://onlinecourses.nptel.ac.in/noc19_cs84/preview

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

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

II-SEMESTER

Course code	PRACTICAL: WEB APPLICATION DEVELOPMENT AND HOSTING	L	T	P	C
Core/Elective/Supportive	Core			4	3
Pre-requisite	Basic Programming using HTML tags				
Course Objectives:					
The main objectives of this course are to:					
1. Able to design a webpage using HTML tags.					
2. To enable the students to use Frame sets, hyperlinks, and different formatting features of HTML tags.					
3. Enable the students to use Forms & other controls on a webpage.					
4. To create interactive applications using PHP.					
Expected Course Outcomes:					
On the successful completion of the course, student will be able to:					
1	Understand & implement the basic HTML tags to create static webpages				K1, K2
2	Capable of using hyperlinks, frames, images, tables,... in a webpage				K2, K3
3	Able to write dynamic web applications using HTML forms				K4, K5
4	Must be able to write dynamic web applications in PHP & HTML tags using XAMPP.				K5, K6
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create					
LISTOFPROGRAMS				60Hours	
1. Develop a website for your college using advanced tags of HTML.					
2. Write names of several countries in a paragraph and store it as an HTML document, world.html. Each country's name must be a hot text. When you click India (for example), it must open india.html and it should provide a brief introduction about India.					
3. Develop a HTML document to i) display Text with Bullets/Numbers - Using Lists ii) to display the Table Format Data					
4. Develop a Complete Web Page using FramesandFramesetswhichgivestheInformation about a Hospital using HTML.					
5. WriteanHTMLdocumenttoprintyourBiodatainaneatformusingseveralcomponents.					
6. DevelopanHTMLdocumenttodisplayaRegistrationFormforaninter-collegiate function.					
7. Using HTML form accept Customer details like Name, City, Pincode, 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.).	
8. Write a program to accept two numbers n1 and n2 using HTML form and display the Prime Numbers between n and n2 using PHP.	
Total Hours	30Hours
Text Books	
1	Ivan Bayross, “Web Enabled Commercial Applications Development Using HTML, JavaScript, DHTML and PHP”, BPB Publications, 4 th Revised Edition, 2010.
Reference Books	
2	A. K. Saini and Sumint Tuli, “Mastering XML”, First Edition, New Delhi, 2002.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.tutorialspoint.com/xml/index.htm
2	https://www.tutorialspoint.com/internet_technologies/websites_development.htm
3	https://www.youtube.com/watch?v=PlxWf493en4

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

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

II-SEMESTER

Course code	PRACTICAL:DATA MINING USING R LAB	L	T	P	C
Core/Elective/Supportive	Core			4	2
Pre-requisite	Basics of DM Algorithms & R Programming				
Course Objectives:					
The main objectives of this course are to:					
<ol style="list-style-type: none"> 1. To enable the students to learn the concepts of Data Mining algorithms namely classification, clustering, regression. 2. To understand & write programs using the DM algorithms. 3. To apply statistical interpretations for the solutions. 4. Able to use visualizations techniques for interpretations. 					
Expected Course Outcomes:					
On the successful completion of the course, student will be able to:					
1	Able to write programs using R for Association rules, Clustering techniques	K1, K2			
2	To implement datamining techniques like classification, prediction	K2, K3			
3	Able to use different visualizations techniques using R	K4, K5			
4	To apply different datamining algorithms to solve real world applications	K5, K6			
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create					
LIST OF PROGRAMS					60Hours
<ol style="list-style-type: none"> 1. Implement A priori algorithm to extract association rule of datamining. 2. Implement k-means clustering Technique. 3. Implement anyone Hierarchal Clustering. 4. Implement Classification algorithm. 5. Implement Decision Tree. 6. Linear Regression. 7. Data Visualization. 					
Total Hours					60Hours
Text Books					
1	Margaret H. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson education,2003.				
2	C.S.R. Prabhu, "Data Warehousing Concepts, Techniques, Products and Applications", PHI, Second Edition				
Reference Books					
1	Arun K. Pujari, "Data Mining Techniques", Universities Press (India) Pvt. Ltd., 2003.				
2	Alex Berson, Stephen J. Smith, "Data Warehousing, Data Mining and OLAP", TMCH,2001.				

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

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

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

II –SEMESTER

Course code	GUIDELINES FOR MOOC COURSE	L	T	P	C
Core/Elective/Supportive	Supportive				2
<ol style="list-style-type: none"> 1. All the candidates who have enrolled for Post Graduate course in the affiliated colleges of Thiruvalluvar University must undergo one MOOC (Massive Open Online Course) course during the Second Semester of study, with a minimum of 2 credits, compulsorily. 2. The department shall assign a Faculty Member exclusively for handling MOOC Course, as the Advisor, for the Candidates during the Second Semester of the course. 3. The Advisor of the MOOC course is responsible for keeping track and / or monitoring of the various activities of the candidates pertaining to the MOOC Course from Registration of the Course till the credits earned by them are transferred to the University. 4. The Advisor shall inform the candidates, in advance, about the Notification of the Courses, that are FREE OF COST to the candidates by visiting the portals of MOOC Courses. 5. The department shall suggest one or more notified courses (before the Second Semester) that are relevant to the Programme that suits with a minimum of 2 Credits, for the Candidates to proceed during the Second Semester. 6. The candidates then select a course from the list of courses suggested by the Department. 7. The Advisor is responsible for assisting the Candidates for Registration, Information about the Schedule of the Course, Information about the Periodical Assessments, Making Candidates to Respond to the Assessments and assists the Candidates for Registering for the Certification, Directing to Pay required Fee for the Certification, Preparing the Candidates for the Certification Examination, etc., 8. The Department shall take necessary efforts to convey the Results / Certification of the Successful Candidate's to the University through the Institution along with a copy of the Certificate issued to the Candidates and ensure that the Candidate's Credits earned through the MOOC Course are transferred to the University. 9. In case of the Unsuccessful Candidates in the Certification, the Advisor helps them to re-register for the same. 10. Visit https://swayam.gov.in for the complete details of MOOC Courses. 					

III SEMESTER

Course code	DIGITAL IMAGE PROCESSING			L	T	P	C
Core/Elective/Supportive	Core			6			5
Pre-requisite	Basics of Image Processing						
Course Objectives:							
The main objectives of this course are to:							
<ol style="list-style-type: none"> 1. Learn basic image processing techniques for solving real problems. 2. Gain knowledge in image transformation and Image enhancement techniques. 3. Learn Image compression and Segmentation procedures. 							
Expected Course Outcomes:							
On the successful completion of the course, student will be able to:							
1	Understand the fundamentals of Digital Image Processing.					K1,K2	
2	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	
K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate;K6-Create							
Unit: 1	INTRODUCTION					17 Hours	
Introduction: What is Digital image processing – the origin of DIP – Examples of fields that use DIP – Fundamentals steps in DIP – Components of an image processing system. Digital Image Fundamentals: Elements of Visual perception – Light and the electromagnetic spectrum – Image sensing and acquisition – Image sampling and Quantization – Some Basic relationship between Pixels – Linear & Nonlinear operations.							
Unit: 2	IMAGE ENHANCEMENT					17 Hours	
Image Enhancement in the spatial domain:-Background–some basic Gray level Transformations – Histogram Processing – Enhancement using Arithmetic / Logic operations – Basics of spatial filtering – Smoothing spatial filters – Sharpening spatial filters – Combining spatial enhancement methods.							

Unit: 3	IMAGE RESTORATION	17 Hours
Image Restoration: A model of the Image Degradation / Restoration Process – Noise models – Restoration is the process of noise only–Spatial Filtering–Periodic Noise reduction by frequency domain filtering –Linear, Portion–Invariant Degradations–Estimating the degradation function – Inverse filtering – Minimum mean square Error Filtering – Constrained least squares filtering – Geometric mean filter – Geometric Transformations.		
Unit:4	IMAGE COMPRESSION	17 Hours
Image Compression :Fundamentals–Image compression models–Elements of Information Theory–Error Free compression–Lossy compression– Image compression standards.		
Unit:5	IMAGE SEGMENTATION	17 Hours
Image Segmentation: Detection and Discontinuities – Edge Linking and Boundary deduction – Thresholding – Region-Based segmentation – Segmentation by Morphological watersheds – The use of motion in segmentation.		
Unit:6	Contemporary Issues	5 hours
Expert lectures, online seminars– webinars		
Total Lecture Hours		90 Hours
Text Books		
1	Rafael C. Gonzalez, Richard E. Woods, “Digital Image Processing”, Second Edition, PHI/Pearson Education.	
2	B. Chanda, D. Dutta Majumder, “Digital Image Processing and Analysis”, PHI, 2003.	
Reference Books		
1	Nick Efford, “Digital Image Processing a practical introducing using Java”, Pearson Education, 2004.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/courses/117/105/117105135/	
2	https://www.tutorialspoint.com/dip/index.htm	
3	https://www.javatpoint.com/digital-image-processing-tutorial	

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

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

III SEMESTER

Course code	CLOUD COMPUTING			L	T	P	C
Core/Elective/Supportive	Core			5			5
Pre-requisite	Basics of Cloud & its Applications						
Course Objectives:							
The main objectives of this course are to:							
<ol style="list-style-type: none"> 1. Gain knowledge on cloud computing, cloud services, architectures, and applications. 2. Enable the students to learn the basics of cloud computing with real time usage. 3. How to store and share, in and from cloud. 							
Expected Course Outcomes:							
On the successful completion of the course, student will be able to:							
1	Understand the concepts of Cloud and its services					K1,K2	
2	Collaborate Cloud for Event & Project Management					K3,K4	
3	Analyze on cloud in-Word Processing, Spread Sheets, Mail, Calendar, Database					K4,K5	
4	Analyze cloud in social networks					K5,K6	
5	Explore cloud storage and sharing					K6	
K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate;K6-Create							
Unit:1	INTRODUCTION					14 Hours	
INTRODUCTION Cloud Computing Introduction, From, Collaboration to cloud, Working of cloud computing, pros and cons, benefits, developing cloud computing services, Cloud service development, discovering cloud services.							
Unit:2	CLOUD COMPUTING					14 Hours	
CLOUD COMPUTING FOR EVERYONE Centralizing email communications, cloud computing for community, collaborating on schedules, collaborating on group projects and events, cloud computing for corporation, mapping, schedules, managing projects, presenting on road.							
Unit:3	CLOUD SERVICES					14 Hours	
USING CLOUD SERVICES Collaborating on calendars, Schedules, and task management, exploring online scheduling and planning, collaborating on event management, collaborating on contact management, collaborating on project management, collaborating on word processing, spreadsheets, and databases.							

Unit:4	OUTSIDE THE CLOUD	14 Hours
OUTSIDE THE CLOUD Evaluating web mail services, Evaluating instant messaging, Evaluating web conference tools, creating groups on social networks, Evaluating online groupware, Collaborating via blogs and wikis.		
Unit:5	STORING AND SHARING	14 Hours
STORING AND SHARING Understanding cloud storage, evaluating online file storage, exploring on line book marking services, exploring on line photo editing applications, exploring photo sharing communities, controlling it with web based desktops.		
Unit:6	Contemporary Issues	5 Hours
Expert lectures, online seminars– webinars		
Total Lecture Hours		75 Hours
Text Books		
1	Michael Miller, “Cloud Computing”, Pearson Education, New Delhi 2009.	
Reference Books		
1	Anthony T. Velte, “Cloud Computing: A Practical Approach”, 1stEdition, Tata McGraw Hill Education Private Limited, 2009.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/courses/106/105/106105167/	
2	https://www.tutorialspoint.com/cloud_computing/index.htm	
3	https://www.javatpoint.com/cloud-computing-tutorial	

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

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

III-SEMESTER

Course code	NETWORK SECURITY AND CRYPTOGRAPHY			L	T	P	C
Core/Elective/Supportive	Core			5			5
Pre-requisite	Basics of Networks & its Security						
Course Objectives:							
The main objectives of this course are to:							
<ol style="list-style-type: none"> 1. Enable students to learn Introduction to Cryptography, Web Security and Case studies in Cryptography. 2. To gain knowledge on classical encryption techniques and concepts of modular arithmetic and number theory. 3. To explore the working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes and message digests, and public key algorithms. 4. To explore the design issues and working principles of various authentication Applications and various secure communication standards including Kerberos, IPsec, and SSL/TLS and email. 							
Expected Course Outcomes:							
On the successful completion of the course, student will be able to:							
1	Understand the process of the cryptographic algorithms						K1,K2
2	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	Explore suitable cryptographic algorithms						K4,K5
5	Analyze different digital signature algorithms to achieve authentication and design secure applications						K5,K6
K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate;K6-Create							
Unit:1	INTRODUCTION					14 Hours	
Introduction to Cryptography – Security Attacks – Security Services –Security Algorithm- Stream cipher and Block cipher - Symmetric and Asymmetric-key Cryptosystem Symmetric Key Algorithms: Introduction – DES – Triple DES – AES – IDEA – Blowfish – RC5.							
Unit:2	CRYPTOSYSTEM					14 Hours	
Public-key Cryptosystem: Introduction to Number Theory-RSA Algorithm–Key Management -Diffie-Hellman Key exchange–Elliptic Curve Cryptography Message Authentication and Hash functions – Hash and Mac Algorithm – Digital Signatures and Authentication Protocol.							

Unit:3	NETWORK SECURITY	14 Hours
Network Security Practice: Authentication Applications–Kerberos–X.509 Authentication services and Encryption Techniques. E-mail Security – PGP – S / MIME – IP Security.		
Unit:4	WEB SECURITY	14 Hours
Web Security-Secure Socket Layer–Secure Electronic Transaction, System Security-Intruders and Viruses – Firewalls– Password Security.		
Unit:5	CASE STUDY	14 Hours
Case Study: Implementation of Cryptographic Algorithms–RSA–DSA–ECC(C/JAVA Programming).		
Network Forensic –Security Audit-Other Security Mechanism: Introduction to: Stenography– Quantum Cryptography–Water Marking-DNA Cryptography		
Unit:6	Contemporary Issues	5 hours
Expert lectures, online seminars– webinars		
Total Lecture Hours		75 hours
Text Books		
1	William Stallings, “Cryptography and Network Security”, PHI/Pearson Education.	
2	Bruce Schneir, “Applied Cryptography”, CRC Press.	
Reference Books		
1	A. Menezes, P Van Oorschot and S. Vanstone, “Hand book of Applied Cryptography”, CRC Press,1997	
2	Ankit Fadia,”Network Security”, Mac Millan.	
Related Online Contents[MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/courses/106/105/106105031/	
2	http://www.nptelvideos.in/2012/11/cryptography-and-network-security.html	
3	https://www.tutorialspoint.com/cryptography/index.htm	

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

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

III-SEMESTER

Course code	DATA SCIENCE AND ANALYTICS			L	T	P	C
Core/Elective/Supportive	Core			6			4
Pre-requisite	Basics of Data Science & its Applications						
Course Objectives:							
The main objectives of this course are to:							
<ol style="list-style-type: none"> 1. Introduce the students to data science, big data & its ecosystem. 2. Learn data analytics & its lifecycle. 3. To explore the programming language R, with respect to the data mining algorithms. 4. Relate the relationship between artificial intelligence, machine learning and data science. 							
Expected Course Outcomes:							
On the successful completion of the course, student will be able to:							
1	Understand the concept of data science and its techniques					K1,K2	
2	Review data analytics					K2,K3	
3	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	
K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate;K6-Create							
Unit:1	INTRODUCTION					17 Hours	
Introduction of Data Science: data science and big data–facets of data-data science process- Ecosystem- The Data Science process – six steps- Machine Learning.							
Unit:2	BASICS OF DATA ANALYTICS					17 Hours	
Data Analytics lifecycle-review of data analytics-Advanced data Analytics-technology and tools.							
Unit:3	DATA ANALYTICS USING R					17 Hours	
Basic Data Analytics using R : R Graphical User Interfaces – Data Import and Export – Attribute and Data Types –Descriptive Statistics – Exploratory Data Analysis – Visualization Before Analysis – Dirty Data – Visualizing a Single Variable – Examining Multiple Variables – Data Exploration Versus Presentation.							

Unit:4	CLUSTERING	17 Hours
Overview of Clustering : K-means – Use Cases – Overview of the Method – Performa K-means Analysis using R–Classification–Decision Trees–Overview of a Decision Tree –Decision Tree Algorithms – Evaluating a Decision Tree – Decision Tree in R – Bayes’ Theorem– Naïve Bayes Classifier – Smoothing – Naïve Bayes in R.		
Unit:5	ARTIFICIAL INTELLIGENCE	17 Hours
Artificial intelligence: Machine Learning and deep learning in data science-Clustering, association rules. Linear regression-logistic regression-Additional regression methods.		
Unit:6	Contemporary Issues	5 hours
Expert lectures, online seminars– webinars		
	Total Lecture Hours	90 Hours
Text Books		
1	Introducing-Data-Science-Big-Data-Machine-Learning-and-more-using-Python-tools-2016. pdf	
2	Data science in big data analytics-Wiley2015. John Wiley & Sons	
Reference Books		
1	A simple introduction to Data Science-Lars Nielson 2015.	
2	Introducing Data Science Davy Cielen, Arno D.B. Meysman, Mohamed Ali,2016 Manning Publication	
3	R Programming for Data Science-RogerD.Peng2015Lean Publication	
4	Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.tutorialspoint.com/python_data_science/index.htm	
2	https://www.javatpoint.com/data-science	
3	https://nptel.ac.in/courses/106/106/106106179/	

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

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

III-SEMESTER

Course code		PRACTICAL: DIGITAL IMAGE PROCESSING USING MATLAB	L	T	P	C
Core/Elective/Supportive		Elective			4	3
Pre-requisite	Basic Programming of Image Processing & An introduction to MATLAB					
Course Objectives:						
The main objectives of this course are to:						
<ol style="list-style-type: none"> 1. To understand the basics of Digital Image Processing fundamentals, image enhancement and image restoration techniques. 2. To enable the students to learn the fundamentals of image compression and segmentation. 3. To understand Image Restoration & Filtering Techniques. 4. Implementation of the above using MATLAB. 						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	To write programs in MATLAB for image processing using the techniques.				K1,K2	
2	To able to implement Image Enhancements & Restoration techniques.				K2,K3	
3	Capable of using Compression techniques in an Image.				K3,K4	
4	Must be able to manipulate the image and Segment it.				K5,K6	
K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate;K6-Create						
LIST OF PROGRAMS					60 Hours	
<ol style="list-style-type: none"> 1. Implement Image Enhancing Technique. 2. Histogram Equalization. 3. Image Restoration. 4. Implement Image Filtering. 5. Edge detection using Operators (Roberts, Prewitts and Sobels operators). 6. Implement image compression. 7. Image Subtraction. 8. Boundary Extraction using morphology. 9. Image Segmentation. 						
Total Hours					60 Hours	

Text Books	
1	Rafael C. Gonzalez, Richard E. Woods, “Digital Image Processing”, Second Edition, PHI/Pearson Education.
2	B. Chanda, D. Dutta Majumder, “Digital Image Processing and Analysis”, PHI, 2003.
Reference Books	
1	Nick Efford, “Digital Image Processing A Practical Introducing Using Java”, Pearson Education, 2004.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/117/105/117105135/
2	https://www.tutorialspoint.com/dip/index.htm
3	https://www.javatpoint.com/digital-image-processing-tutorial

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

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

III-SEMESTER

Course code	PRACTICAL: NETWORK SECURITY AND CRYPTOGRAPHY LAB	L	T	P	C
Core/Elective/Supportive	Elective			4	3
Pre-requisite	Basic Knowledge about Network Security				
Course Objectives:					
<ul style="list-style-type: none"> ● To develop in classical encryption techniques and advanced encryption standards. ● To acquire programming skills in Implement various cryptographic algorithms including secret key cryptography. ● To develop hashes, message digests and public key algorithms. ● Implement different encryption and decryption techniques. ● To comprehend related to confidentiality and authentication techniques. 					
Expected Course Outcomes:					
On the successful completion of the course, student will be able to:					
1	Comprehend the programming skills in classical encryption techniques and to develop advanced encryption standards				K1-K6
2	Understand and implement the various cryptographic algorithms including secret key cryptography, hashes, and message digests				K1-K6
3	Evaluate the use of different encryption and decryption techniques				K1-K6
4	Design to Solve related confidentiality and authentication problems				K1-K6
5	Create public key algorithms				K1-K6
K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate;K6-Create					
LIST OF PROGRAMS				60 Hours	
<ol style="list-style-type: none"> 1. Write a program that contains a string (char pointer) with a value 'Hello world'. The program should XOR each character in the string with 0 and display the result. 2. Write a program to perform encryption and decryption using the Ceaser Cipher. 3. Write a program to perform encryption and decryption using the Hill Cipher. 4. Write a program to perform encryption and decryption using the Substitution Cipher. 5. Write a program to perform encryption and decryption using the DES algorithm. 6. Connect to switch with a computer and enable the port security. 7. Defeating malware using Building Trojans and Rootkit hunter. 8. Implement signature scheme –Digital Signature Standard. 9. Identify and capture the username and password in a same network using wireshark. 					

10. Implement Man-in-the-middle attack and Session hijacking.	
Total Hours	60 Hours
Text Books	
1	William Stallings, “Cryptography and Network Security”, PHI/ Pearson Education.
2	Bruce Schneir, “Applied Cryptography”, CRC Press.
Reference Books	
1	A. Menezes, P Van Oorschot and S.Vanstone, “Handbook of Applied Cryptography”, CRC Press,1997
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/106/105/106105031/
2	http://www.nptelvideos.in/2012/11/cryptography-and-network-security.html
3	https://www.tutorialspoint.com/cryptography/index.htm

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

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

III-SEMESTER

Course code	PRACTICAL: CLOUD COMPUTING LAB	L	T	P	C
Core/Elective/Supportive	Core			4	2
Pre-requisite	Basic Programming using Cloud				
Course Objectives:					
The main objectives of this course are to:					
<ol style="list-style-type: none"> 1. Deploy applications over commercial cloud computing infrastructures. 2. Experiment the Cloud and Virtualization Experience. 3. Understand the Cloud Storage and Security. 4. Implement the Cloud Environments with the available resources. 					
Expected Course Outcomes:					
On the successful completion of the course, student will be able to:					
1	Articulate the main concepts, key technologies, strengths, and limitations of Cloud Computing and deploy applications over commercial cloud computing infrastructures.				K1,K2
2	Gain knowledge about cloud and virtualization along with it, how one can migrate over it.				K3,K4
3	Develop the ability to manage the cloud environment and understand the concepts of cloud storage, security.				K4,K5
4	Choose the appropriate technologies, algorithms, and approaches for implementation of cloud environment using Open stack / AWS / Microsoft Azure/Google App Engine, etc.,				K5,K6
K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate;K6-Create					
LIST OF PROGRAMS				60 Hours	
<ol style="list-style-type: none"> 1. Working with Google Drive to make spread sheets and notes. 2. Launch a Linux Virtual Machine. 3. To host static website 4. Exploring Google cloud for the following <ol style="list-style-type: none"> a).Storage b)Sharing of data c) Manage your calendar, to-do lists, d). document editing tool. 5. Working and installation of Google App Engine. 6. Working and installation of Microsoft Azure. 7. To Connect Amazon Red shift with S3 bucket. 8. To Create and Query a NoSQL Table. 					
Total Hours				60 Hours	

Text Books	
1	Michael Miller, “Cloud Computing”, Pearson Education, NewDelhi,2009.
Reference Books	
1	AnthonyT.Velte,“Cloud Computing: A Practical Approach”, 1stEdition,TataMcGraw Hill Education Private Limited, 2009.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/106/105/106105167/
2	https://www.tutorialspoint.com/cloud_computing/index.htm
3	https://www.javatpoint.com/cloud-computing-tutorial

Mapping with Programming Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	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

III –SEMESTER

Course code	INTERNSHIP			L	T	P	C
Core/Elective/Supportive	Core						2
Pre-requisite	Knowledge of Industrial Work Culture and Etiquette						
Course Objectives:							
<p>The main objectives of this course are to :</p> <ol style="list-style-type: none"> 4. Introduce the Working Ambience, Attitude, Adaptability, Problem Solving Ability, Ability to work with Supervisor, Ability to take Directions, etc., 5. Expose on the different phases of Developing a Computer Solution with Team Spirit. 6. Learn about Problem Solving Skills, Soft Skills and other related Skills required for the Industry. 							
Expected Course Outcomes:							
On the successful completion of the course, student will be able to:							
1	Find the specific areas of interest, refine their skills and abilities						K1
2	Show a greater sense of self-awareness and appreciation for others						K2
3	Develop work habits and attitudes that are essential to succeed in the workplace						K3
4	Discover the importance of communication, interpersonal and other critical skills						K4
5	Choose and prioritize employment contacts leading directly to a full-time job immediately after the graduation from the college.						K5&K6
K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate;K6-Create							
REGULATIONS							
<ol style="list-style-type: none"> 1. The Candidates have to undergo a Minimum of 40 Hours of Internship Programme in the Industry during the holidays of the Second Semester of the Course of Study. 2. The Candidates need to get a Project, Analyze, learn the various stages of Developing a solution, Test, Validate and carryout the other related requirements. 3. During the course of Third Semester, the Candidates need to refine the work carried out during the Internship at the Industry, progress towards developing a better Solution as per the standards of the Industry and by carrying out the constructive comments received from the Industry and / or Institution during the Reviews. 4. Then the Candidates have to prepare and submit the manuscript of the Internship experience as a Report as per the requirements of the Institution / Department for Evaluation. 5. The submission of the Internship Report will be done at the end of the Third Semester for Presentation and Viva-Voce during the Practical Examinations of the Semester. 							

6. The Passing Minimum for Internship is 50%.
7. If the Candidate fails to score 50% in the Internship, the Candidate has to improve it during the next attempt.
8. A Faculty Member from the Department will act as a Guide to Supervise and Monitor the progress of the Candidates during the course of Internship.
9. The Faculty Member will act as the Internal Examiner during the course of Internship as well as at the time of conducting the Viva-Voce Examination.
10. The Internal Marks for the Internship will be awarded by the concerned Guide/Internal Examiner.
11. The Internal and External Examiners shall both evaluate the Internship Report, Presentation and conduct the Viva-Voce Examination.

INTERNAL MARKS AWARDED FOR THE INTERNSHIP–40 Marks

1. Learning the Work Culture leading towards Performance, Organizations Skills and Relationship with Team Members – **10 Marks**
2. Internship Review 1 (During the beginning of the Semester)– **10 Marks**
3. Internship Review 2 (During the end of the Semester)– **10 Marks**
4. Progress of the Internship by the Candidate’s active Participation– **10 Marks**

EXTERNAL MARKS AWARDED FOR THE INTERNSHIP–60 Marks

1. Evaluation of the Internship Report-**20 Marks**
2. Presentation– **20 Marks**
3. Viva-Voce Examination–**20 Marks**

Total –100 Marks

IV –SEMESTER

Course code	INTERNET OF THINGS			L	T	P	C
Core/Elective/Supportive	Core			6			5
Pre-requisite	Basics of Sensors & its Applications						
Course Objectives:							
The main objectives of this course are to :							
<ol style="list-style-type: none"> 1. About Internet of Things where various communicating entities are controlled and managed for decision making in the application domain. 2. Enable students to learn the Architecture of IoT and IoT Technologies. 3. Developing IoT applications and Security in IoT, Basic Electronics for IoT, Arduino IDE, Sensors and Actuators Programming NODEMCU using Arduino IDE. 							
Expected Course Outcomes:							
On the successful completion of the course, student will be able to:							
1	Understand about IoT, its Architecture and its Applications.						K1,K2
2	Understand basic electronics used in IoT & its role.						K2,K3
3	Develop applications with Cusing 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
K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate;K6-Create							
Unit:1	INTRODUCTION					17 Hours	
Introduction to IoT: Evolution of IoT – Definition & Characteristics of IoT – Architecture of IoT– Technologies for IoT – Developing IoT Applications – Applications of IoT – Industrial IoT – Security in IoT.							
Unit:2	BASIC ELECTRONICS FOR IoT					17 Hours	
Basic Electronics for IoT: Electric Charge, Resistance, Current and Voltage –Binary Calculations –Logic Chips– Microcontrollers–Multipurpose Computers–Electronic Signals– A/D and D/A Conversion – Pulse Width Modulation.							
Unit:3	PROGRAMMING USING ARDUINO					17 Hours	
Programming Fundamentals with Cusing Arduino IDE: Installing and Setting up the Arduino IDE – Basic Syntax–Data Types/Variables/Constant–Operators–Conditional Statements and Loops – Using Arduino C Library Functions for Serial, delay and other invoking Functions–Strings and Mathematics Library Functions.							

Unit:4	SENSORS AND ACTUATORS	17 Hours
Sensors and Actuators: Analog and Digital Sensors–Interfacing temperature sensor, ultrasound Sensor and infrared (IR) sensor with Arduino – Interfacing LED and Buzzer with Arduino.		
Unit:5	SENSOR DATA IN INTERNET	17 Hours
Sending Sensor Data Over Internet: Introduction to ESP8266 NODEMCU Wi-Fi Module – Programming NODEMCU using Arduino IDE – Using Wi-Fi and NODEMCU to transmit data from temperature sensor to Open Source IoT cloud platform (Thing Speak).		
Unit:6	Contemporary Issues	5 hours
Expert lectures, online seminars– webinars		
	Total Lecture Hours	90 Hours
Text Books		
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.	
Reference Books		
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.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://onlinecourses.nptel.ac.in/noc20_cs66/preview	
2	https://www.javatpoint.com/iot-internet-of-things	
3	https://www.tutorialspoint.com/internet_of_things/index.htm	

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

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

IV–SEMESTER

Course code	BLOCK CHAIN TECHNOLOGY			L	T	P	C
Core/Elective/Supportive	Core			6			5
Pre-requisite	Basics of Block Chain & Crypto Currency						
Course Objectives:							
The main objectives of this course are to :							
<ol style="list-style-type: none"> 1. Understand the fundamentals of block chain and crypto currency. 2. Understand the influence and role of Block Chain in various other fields. 3. Learn security features and its significance. 4. Identify problems & challenges posed by Block Chain. 							
Expected Course Outcomes:							
On the successful completion of the course, student will be able to:							
1	Demonstrate block chain technology and crypto currency.					K1,K2	
2	Understand the mining mechanism in block chain.					K2	
3	Apply and identify security measures, and various types of services that allow People to trade and transact with bitcoins.					K3,K4	
4	Apply and analyze Block chain in health care industry					K4,K5	
5	Analyze security, privacy, and efficiency of a given Block chain system					K5,K6	
K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate;K6-Create							
Unit:1	INTRODUCTION					17 Hours	
Introduction to Blockchain - The big picture of the industry – size, growth, structure, players. Bitcoin versus Cryptocurrencies versus Blockchain - Distributed Ledger Technology (DLT). Strategic analysis of the space– Blockchain platforms, regulators, application providers. The major application: currency, identity, chain of custody.							
Unit:2	NETWORK AND SECURITY					17 Hours	
Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Blockchain 1.0, 2.0 and 3.0 – transition, advancements and features. Privacy, Security issues in Blockchain.							
Unit:3	CRYPTOCURRENCY					17 Hours	
Cryptocurrency - History, Distributed Ledger, Bitcoin protocols -Symmetric-key cryptography - Public-key cryptography-Digital Signatures-High and Low trust societies-Types of Trust model: Peer-to-Peer, Leviathan, and Intermediary. Application of Cryptography to Blockchain							

Unit:4	CRYPTOCURRENCY REGULATION	17 Hours
Cryptocurrency Regulation-Stakeholders, Roots of Bitcoin, Legal views-exchange of cryptocurrency - Black Market - Global Economy. Crypto economics-assets, supply and demand, inflation, and deflation-Regulation.		
Unit:5	CHALLENGES IN BLOCKCHAIN	17 Hours
Opportunities and challenges in BlockChain – Application of blockchain: Industry 4.0-machine to machine communication – Data management in industry4.0 – future prospects. Block chain in Health 4.0 - Blockchain properties - Healthcare Costs - Healthcare Quality - Healthcare Value - Challenges for using blockchain for healthcare data		
Unit:6	Contemporary Issues	5 hours
Expert lectures, online seminars- webinars		
	Total Lecture Hours	90 Hours
Text Books		
1	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction”, Princeton University Press (July 19, 2016).	
2	Antonopoulos, “MasteringBitcoin:UnlockingDigitalCryptocurrencies”	
Reference Books		
1	Satoshi Nakamoto, “Bitcoin: A Peer-to-Peer Electronic Cash System”	
2	Rodrigoda Rosa Righi, Antonio Marcos Alberti, Madhusudan Singh, “Blockchain Technology for Industry 4.0” Springer 2020.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.javatpoint.com/blockchain-tutorial	
2	https://www.tutorialspoint.com/blockchain/index.htm	
3	https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs01/	

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

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

IV–SEMESTER

Course code		PROJECT WORK AND VIVA-VOCE	L	T	P	C
Core/Elective/Supportive		Core			10	7
Pre-requisite	Knowledge of Software Development Phases					
Course Objectives:						
The main objectives of this course are to :						
<ol style="list-style-type: none"> 1. Expose to the various phases of Software Development Life Cycle. 2. Learn to apply the Skills and Knowledge in Design, Coding and Testing with appropriate Technological Tools and Procedures. 3. Learn to Develop Applications with Personal, Societal and Professional Ethical Standards. 						
Expected Course Outcomes:						
On the successful completion of the course, students will be able to:						
1	Show Leadership Skills and Learn Time Management					K1
2	Identify various Tools to be applied to a specific Problem					K2
3	Evaluate the Reports					K3
4	Involve in the Team and Manage it to deliver the excellent Outcomes					K4
5	Assess and Develop the Individual Skills to Present and Organize the Projects					K5&K6
K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate;K6-Create						
REGULATIONS						
<ol style="list-style-type: none"> 1. The Candidates have to undergo a Minimum of 150 Hours of Project Work during the Course of Study either in an IT Industry/Public or Private Sector Organization /Research Institutes/Institution itself. 2. The Candidates need to identify and analyze real world problems on the selected project domain. 3. During the course of study, the Candidates need to Develop, Design, Test, etc., the Applications as per the directions by the Guide. 4. Then the Candidates have to prepare and submit the manuscript of the Project Work as a Report as per the requirements of the Institution / Department for Evaluation. 5. The submission of the Project Report will be done at the end of the Semester for Presentation and Viva-Voce during the Practical Examinations of the Semester. 						

6. The Passing Minimum for Project Work is 50%.
7. If the Candidate fails to score 50% in the Project Work, the Candidate has to improve it during the next attempt.
8. A Faculty Member from the Department will act as a Guide to Supervise and Monitor the progress of the Candidates during the course of Project Work.
9. The Faculty Member will act as the Internal Examiner during the course of Project Work as well as at the time of conducting the Viva-Voce Examination.
10. The Internal Marks for the Project Work will be awarded by the concerned Guide /Internal Examiner.
11. The Internal and External Examiners shall both evaluate the Project Report, Presentation and conduct the Viva-Voce Examination.

INTERNAL MARKS AWARDED FOR THE PROJECT WORK–80 Marks

1. Plan of the Project–**15 Marks**
2. Execution of the Plan –**15 Marks**
3. Individual Initiative–**10 Marks**
4. Review 1–**20 Marks**
5. Review 2–**20 Marks**

EXTERNAL MARKS AWARDED FOR THE PROJECT WORK–120 Marks

1. Evaluation of the Project Report-**50 Marks**
2. Presentation– **30 Marks**
3. Viva-Voce Examination–**40 Marks**

Total–200 Marks

IV–SEMESTER

Course code		PRACTICAL: INTERNET OF THINGS LAB	L	T	P	C
Core/Elective/Supportive		Elective			4	3
Pre-requisite		Basics of Sensors & its Applications				
Course Objectives:						
<ol style="list-style-type: none"> 1. To create IoT program to turn ON/OFF LED. 2. To implement IoT program for object detection. 3. To develop IoT programs for agricultural purposes. 4. To create webserver program for local hosting. 5. To design IoT application for health monitoring. 						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Implement IoT programs to turn ON/OFF LED.					K1– K6
2	Develop IoT programs for object detection.					K1– K6
3	Create IoT programs for agricultural purpose.					K1– K6
4	Implement webserver program for local hosting.					K1– K6
5	Design various IoT applications.					K1– K6
K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate;K6-Create						
LIST OF PROGRAMS					60 Hours	
<ol style="list-style-type: none"> 1. To develop an IoT program to turn ON/OFF LED light(3.3V) 2. To develop an IoT program using IR sensor (Smart Garbage Monitoring, Detecting Parking Availability, etc.) 3. To develop an IoT program using Humidity and Temperature Monitoring(Forest fire Detection, Weather Monitoring) 4. To develop an IoT web server program for local hosting 5. To develop an IoT program using Soil Moisture Sensor 6. To develop an IoT program using Ultrasonic Sensor(Distance Measurement, etc.) 7. To develop a real-time IoT program using Relay Module(Smart Home Automation with 230V) 8. To develop an IoT program for Fire Detection (Home, Industry, etc.) 9. To develop an IoT program for Gas Leakage detection (Home, Industry,etc.) 						

10.To develop an IoT program using Heart beat Sensor										
									Total Hours	60 Hours
Text Books										
1	Adrian Mc Ewen and Hakim Cassimally, “Designing the Internet of Things”, Wiley, 2014.									
2	Donald Norris,“The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry PiandBeagleBoneBlack”, McGrawHill, 2015.									
ReferenceBooks										
1	Ovidiu Vermesan and Peter Friess,“Internet of Things–From Research and Innovation to Market Deployment”,River Publishers,2014.									
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]										
1	https://www.techtarget.com/iotagenda/definition/Internet-of-Things-IoT									
2	https://www.shiksha.com/online-courses/industrial-internet-of-things-iiot-course-cour1405									
3	https://ibm.com/topics/internet-of-things									
Mapping with Programming Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	M	S	S	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	M	S	S	S	S	M	S	S	M
CO4	S	S	S	S	S	S	S	S	S	L
CO5	S	S	S	S	M	S	L	S	S	M

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

IV–SEMESTER

Course code	PRACTICAL: BLOCKCHAIN TECHNOLOGIES LAB	L	T	P	C
Core/Elective/Supportive	Elective			4	3
Pre-requisite	Basics of Block Chain & Crypto Currency				
Course Objectives:					
<ol style="list-style-type: none"> 1. To learn the basics of Blockchain and apply cryptographic algorithms. 2. To design, build, and deploy smart contracts and distributed applications. 3. To deploy Private Blockchain and smart contracts on Ethereum. 4. To understand and deploy cryptocurrencies and their functions in applications. 5. To implement Blockchain for various use cases. 					
Expected Course Outcomes:					
On the successful completion of the course, student will be able to:					
1	Enable to set up your own private Blockchain and deploy smart contracts on Ethereum.				K1– K6
2	Gains familiarity and implement with cryptography and Consensus algorithms.				K1– K6
3	Create and deploy projects using Web3j.				K1– K6
4	Recall and deploy the structure & mechanism of Bitcoin, Ethereum, Hyper ledger				K1– K6
5	Implement Blockchain for various use cases				K1– K6
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create					
LIST OF PROGRAMS					60 Hours
<ol style="list-style-type: none"> 1. Create a Public Ledger and Private Ledger with various attributes like Access, Network Actors, Native token, Security, Speed and examples. 2. Building and Deploying Multi chain private Blockchain. 3. Write HelloWorld smart contract in a higher programming language (Solidity). 4. Construct the Naïve blockchain. 5. Construct and deploy your contract (Use deploy method). 6. Setup a Regtest environment. 7. Build a payment request URI. 8. Hash Cash implementation. 9. Develop a toy application using Blockchain. 10. Create simple wallet transaction from one account to another account using MetaMask. 					
Total Hours					60 Hours

Text Books										
1	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Gold feder. Bitcoin and Cryptocurrency Technologies. Princeton University Press, 2016. ISBN978-0691171692.									
Reference Books										
1	Andreas Antonopoulos. Mastering Bitcoin: Programming the open block chain. OreillyPublishers,2017. ISBN978-9352135745									
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]										
1	https://www.techtarget.com/searchcio/feature/Todays-blockchain-use-cases-and-industry-applications									
2	https://www.shiksha.com/online-courses/basics-of-blockchain-course-grlel877									
Mapping with Programming Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	L	M	S	M	S	S	S
CO2	S	M	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	M	S	S	M
CO4	S	M	L	S	M	S	S	S	S	L
CO5	M	S	M	L	S	S	L	S	S	M

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

IV–SEMESTER

Course code	PRACTICAL: SOFT SKILL DEVELOPMENT LAB	L	T	P	C
Core/Elective/Supportive	Supportive			4	2
Pre-requisite	Basics of Soft Skills				
Course Objectives:					
<ol style="list-style-type: none"> 1. To enable students to gain basic communication skills in professional and social contexts effectively. 2. To acquire useful words and apply them in situational context. 3. To develop listening and reading skills through comprehension passages. 4. To enrich leadership qualities and inter personal communication. 5. To enhance essential characteristics in writing. 					
Expected Course Outcomes:					
On the successful completion of the course, student will be able to:					
1	Gain basic communication skills in professional and social contexts effectively.	K1– K6			
2	Acquire useful words and apply them institutional context.	K1– K6			
3	Develop listening and reading skills through comprehension passages.	K1– K6			
4	Enrich leadership qualities and inter personal communication.	K1– K6			
5	Enhance essential characteristics in writing.	K1– K6			
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create					
LIST OF EXERCISES					60 Hours
<ol style="list-style-type: none"> 1. Characteristics of Technical Writing. 2. Development of Employability Skills. 3. Vocabulary Development. 4. Sentence Completion. 5. Error Spotting. 6. Interpretation of Verbal Analogy. 7. Interpretation of Reading (Comprehension -Conception). 8. Interpretation of Reading (Comprehension-Reasoning). 9. Practice for writing E-mails/Technical Blogs /Forums. 10. PPT Preparation/ Demonstration of Technical Presentation. 11. Preparation of Resume. 12. Preparation for Job Interviews /Mock Interview Section. 13. Group Discussion Skills. 					

14. Developing Listening Skill (Comprehension).	
15. Practice for Short Speeches/Situational Conversation.	
16. English through Mass Media.	
17. Essential Grammar.	
18. Communicating and collaborating with peer members.	
19. Team Empowerment.	
20. Persuasive Communication.	
Total Hours	
60 Hours	
Text Books	
1	Uma Narula, "Development Communication : Theory and Practice", Revised Edition, Har- Aanad Publication, 2019.
2	Annette Capeland Wendy Sharp, "Cambridge English: Objective First", Fourth Edition, Cambridge University Press, s2013.
3	Emma Sue-Prince, "The Advantage: The 7 Soft Skills You Need to Stay One Step A head", First Edition, FTPress, 2013.
4	Guy Brook-Hart, "Cambridge English: Business Benchmark", Second Edition, Cambridge University Press, 2014.
5	Norman Lewis, "How to Read Better & Faster", Binny Publishing House, New Delhi, 1978.
Reference Books	
1	Michael McCarthy and Felicity O'Dell, "English Vocabulary in Use: 100 Units of Vocabulary Reference and Practice", Cambridge University Press, 1996.
2	Murphy, Raymond, "Intermediate English Grammar", Second Edition, Cambridge University Press, 1999.

IV–SEMESTER

Course code	PRACTICAL: DATA VISUALIZATION LAB	L	T	P	C
Core/Elective/Supportive	Supportive			4	2
Pre-requisite	Basics Of Visualization Tools				
Course Objectives:					
<ol style="list-style-type: none"> 1. To learn the basic functions and operations of Excel and tableau. 2. To explore to design, build, and deploy various charts for applications. 3. To comprehend, design and deploy the label and heat map. 4. To understand and deploy dashboard. 5. To understand the functions of tableau for data process. 					
Expected Course Outcomes:					
On the successful completion of the course, student will be able to:					
1	Enable to create and apply Spread sheet and Tableau for various data processing	K1– K6			
2	Gains knowledge to create and design various visualization tools in Excel and Tableau.	K1– K6			
3	Comprehend, create, and deploy labels and heat map.	K1– K6			
4	Enable to create and apply dashboard for various data processing	K1– K6			
5	Illustrate and apply data visualization tool for any dataset	K1– K6			
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create					
LIST OF PROGRAMS				60 Hours	
Note: Use the following Dataset					
http://www.tableau.com/sites/default/files/training/global_superstore.zip					
IMPLEMENT THE FOLLOWING USING EXCEL					
<ol style="list-style-type: none"> 1. Create Pie chart for Sales and Sales % by Country (sorted in descending order). 2. Create Bar chart for Sales by Country by Year (rounded to nearest thousand and sorted by Grand Total). 3. Create Line char for Sales by Ship Mode (First Class, Same Day, Second Class and Standard Class). 4. Create Scatter chart for Sales by Ship Mode by Country (rounded to the nearest dollar and sorted by First Class). 5. Create heat map for Sales by Category by Sub-Category (in thousands and sorted by sales value in descending order). 6. Design and create the label for vendor list. 7. Design and create the dashboard. 					
IMPLEMENT THE FOLLOWING USING TABLEAU					
<ol style="list-style-type: none"> 1. Sales by Ship Mode (First Class, Same Day, Second Class, and Standard Class). 2. Sales by Ship Mode by Country (rounded to the nearest dollar and sorted by First Class). 3. Sales by Category by Sub-Category (in thousands and sorted by sales value in descending order). 					

	Total Hours 60 Hours
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Course code	GUIDELINES FOR EXTENSION ACTIVITY	L	T	P	C
Core/Elective/Supportive	Supportive				1
<ol style="list-style-type: none"> 1. All the candidates who have enrolled for Post Graduate course in the affiliated colleges of Thiruvalluvar University must become a Member of any one the Extension Activities that is offered in the Institution/ College, namely, National Service Scheme (NSS), Youth Red Cross (YRC), Red Ribbon Club (RRC), Eco Club, Rovers and Rangers,etc.,that serves the people of the neighborhood through its various activities. 2. The department must facilitate the Candidates to register any one of the Extension Activity Club/Forum that are functioning in the Institution/ College. 3. The Candidates are then expected to actively participate in the various activities organized by the above Clubs / Forum and complete the same within the Stipulated time. 4. The Club / Forum shall declare the Candidates successful at the end of the Semester / Year if they complete the activities and earn 1 credit or certificate from the Club / Forum. 5. The Department shall take necessary efforts to convey the Credit / Certification received from the Successful Candidates of the Club / Forum to the University through the Institution along with a copy of the Certificate issued to the Candidates and ensure that the Candidate's Credit is transferred to the University. 6. In case of the Unsuccessful Candidates in the Certification, the Candidates themselves have to re-register for the same. 					