



(Declared under Section 3 of the UGC Act 1956)

CURRICULUM AND SYLLABUS FOR



MASTER OF COMPUTER SCIENCE

(M.Sc., CS) (Regular)

Learning Outcome Based Curriculum Framework

(LOCF- 2022)

**(For the Academic Year starting from 2022-2023
onwards)**

OUTCOME-BASED EDUCATION (OBE)
LEARNING OUTCOME-BASED CURRICULUM FRAMEWORK
(LOCF)

OBE is an educational theory that bases each part of an educational system around goals (outcomes). By the end of the educational experience, each student should have achieved the goal. There is no single specified style of teaching or assessment in OBE; instead, classes, opportunities and assessments should all help the students achieve the specific outcomes

Outcome Based Education, as the name suggests depends on Outcomes and not Inputs. The outcomes in OBE are expected to be measurable. In fact each Educational Institute can state its own outcomes. The ultimate goal is to ensure that there is a correlation between education and employability

Outcome –Based Education (OBE): is a student-centric teaching and learning methodology in which the course delivery, assessment are planned to achieve, stated objectives and outcomes. It focuses on measuring student performance i.e. outcomes at different levels.

Some important aspects of the Outcome Based Education

Course: is defined as a theory, practical or theory cum practical subject studied in a semester.

Course Outcomes (COs): are statements that describe significant and essential learning that learners have achieved, and can reliably demonstrate at the end of a course. Generally three or more course outcomes may be specified for each course based on its weightage.

Programme: is defined as the specialization or discipline of a Degree.

Programme Outcomes (POs): Programme outcomes are narrower statements that describe what students are expected to be able to do by the time of graduation. POs are expected to be aligned closely with Graduate Attributes.

Programme Specific Outcomes (PSOs):

PSOs are what the students should be able to do at the time of graduation with reference to a specific discipline.

Programme Educational Objectives (PEOs): The PEOs of a programme are the statements that describe the expected achievement of graduates in their career, and also in particular, what the graduates are expected to perform and achieve during the first few years after Graduation.

Some important terminologies repeatedly used in LOCF.

Core Courses (CC)

A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course. These are the courses which provide basic understanding of their main discipline. In order to maintain a requisite standard certain core courses must be included in an academic program. This helps in providing a universal recognition to the said academic program.

Discipline Specific Elective Courses (DSE)

Elective course may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective (DSE). These courses offer the flexibility of selection of options from a pool of courses. These are considered specialized or advanced to that particular programme and provide extensive exposure in the area chosen; these are also more applied in nature.

DSE: Five courses are offered, one course in each semester and the end semester in two course.

Note: To offer **one DSE**, a minimum of two courses of equal importance / weightage is a must.

Generic Elective Courses

An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

Generic Elective courses are designed for the students of **other disciplines**. Thus, as per the CBCS policy, the students pursuing particular disciplines would have to opt Generic Elective courses offered by other disciplines, as per the basket of courses offered by the college. The scope of the Generic Elective (GE) Courses is positively related to the diversity of disciplines in which programmes are being offered by the college.

The Ability Enhancement Courses (AEC)

One Human Rights Course in Semester-III and one Main discipline related Ability Enhancement Course for each 4 credits is offered for a PG programme by the Department.

Skill Enhancement Courses (SECs)

These courses focus on developing skills or proficiencies in the student, and aim at providing hands-on training. Skill enhancement courses can be opted by the students of any other discipline, but are highly suitable for students pursuing their academic programme.

One SEC is offered in semester I as a compulsory course on Soft Skills, offered by the Department of Human Excellence, common to all the students of PG programme and three courses are given choice in semester II for SEC II.

Comprehensive Examinations: A detailed syllabus consisting of five units to be chosen from the courses offered over the five semesters which are of immense importance and those portions which could not be accommodated in the regular syllabus.

Course Coding:

The following code system (10 alphanumeric characters) is adopted for Post Graduate courses:

Part Category

CC – Core Course Theory

CCP- Core Course Practical

PW- Major Project Work

Discipline Specific Electives Courses

DES – Department Specific Electives

Ability Enhancement Courses

AEC – Ability Enhancement Course

SEC – Skill Enhancement Course

M.Sc., Computer Science

Program Outcomes (POs)

1. Graduates will be able to apply assimilated knowledge to evolve tangible solutions to emerging problems.
2. Graduates will be able to analyse and interpret data to create and design new knowledge.
3. Graduates will be able to engage in innovative and socially relevant research and effectively communicate the findings.
4. Graduates will become ethically committed professionals and entrepreneurs upholding human values.
5. Graduates groomed with ethical values and social concern will be able to understand and appreciate cultural diversity, promote social harmony and ensure sustainable environment.

Programme Specific Outcomes (PSOs)

1. Acquire fundamental knowledge in problem solving, general computing and comprehensive knowledge in Computer Science.
2. Competence to identify, analyze, design, optimize and implement system solutions using contemporary computing techniques which propels towards employability.
3. Gain fundamental knowledge in computational methods and tools for solving real- time problems and implanting the quest for continual learning of novel and in- demand skills.
4. Demonstrate the ability to act as a leader, or as a part of a team to create multi- functional Software Solutions.
5. Ability to showcase discrete practical experiences by implementing various strategies that utilizes a variety of software techniques that are ethical and would be beneficial to the society.

M.Sc. COMPUTER SCIENCE			
PROGRAMME STRUCTURE			
Name	No of Courses	No of Credits	Total
Core Course Theory Credit (CC)	10	4	40
Core Course Practical Credit (CC)	6	3	18
Discipline Specific Elective Credit (DSE)	5	4	20
Ability Enhancement compulsory course Credit (AEC)	2	4	08
Skill Enhancement Course Credit (SEC)	2	3	06
Project Work (PW)	1	8	08
Total Credits			100

M.Sc. COMPUTER SCIENCE						
COURSE WITH CREDITS						
Semester	Compulsory Core Courses (CC) Theory	Compulsory Core Courses (CC) Practical	Discipline Specific Elective (DSE/Generic Electives)	Ability Enhancement Compulsory Courses (AEC)	Skill Enhancement Course (SEC)	Total Credits
Sem I	CC (I,II,III) (3 x 4 credits = 12 credits)	CCP (I,II) (2 x 3 credits = 6 credits)	DSE - I (1 x 4 credits = 4 credits)		SEC - I (1 X 3 = 3 Credits)	25
Sem II	CC (IV,V,VI) (3 x 4 credits = 12 credits)	CCP (III,IV) (2 x 3 credits = 6 credits)	DSE - II (1 x 4 credits = 4 credits)		SEC - II (1 X 3 = 3 Credits)	25
Sem III	CC (VII,VIII,IX) (3 x 4 credits = 12 credits)	CCP (V,VI) (2 x 3 credits = 6 credits)	DSE – III (1 x 4 credits = 4 credits)	AEC – I (1 x 4 credits = 4 credits)	---	26
Sem IV	CC (X) (1 x 4 credits = 4 credits) Major Project work (1 x 8 credits = 8 credits)		DSE – IV, V (2 x 4 credits = 8 credits)	AEC – II (1 x 4 credits = 4 credits)		24
Total	48	18	20	8	6	100

M.Sc. COMPUTER SCIENCE					
PROGRAMME PATTERN					
S.No	Sem	Code	Course Title	Credits	Total
1.	SEM-I	CC-I	Programming with C# using ASP.NET	4	25
2.		CC-II	Advanced Algorithms	4	
3.		CC-III	Mathematical Foundations	4	
4.		CC(P)-I	ASP.NET Practical	3	
5.		CC(P)-II	Advanced Algorithms Practical	3	
6.		DSE-I	Select any one course from DSE Group*	4	
7.		SEC-I	Select any one course from SEC Group*	3	
8.	SEM-II	CC-IV	Advanced Java	4	25
9.		CC-V	Data Science Using Python	4	
10.		CC-VI	Human Computer Interface	4	
11.		CC(P)-III	Advanced Java Practical	3	
12.		CC(P)-IV	Python Practical	3	
13.		DSE-II	Select any one course from DSE Group*	4	
14.		SEC-I	Select any one course from SEC Group*	3	
15.	SEM-III	CC-VII	Web Design using PHP	4	26
16.		CC-VIII	Database Systems	4	
17.		CC-IX	Analytics and Data Science	4	
18.		CC(P)-V	Web Design using PHP Practical	3	
19.		CC(P)-VI	Database Systems Practical	3	
20.		DSE-III	Select any one course from DSE Group*	4	
21.		AEC-I	Select any one course from AEC Group*	4	
22.	SEM-IV	CC-X	Software Engineering for Industry	4	24
23.		DSE-IV	Select any one course from DSE Group*	4	
24.		DSE-V	Select any one course from DSE Group*	4	
25.		AEC-II	Select any one course from AEC Group*	4	
26.		PW	Major Project Work	8	
Total Credits				100	100

Discipline Specific Elective (DSE/Generic Electives)			
Choose any 5 Course (5X4=20 Credits)			
S.No	Group	Course Title	Credits
1.		Digital Image Processing	4
2.		Block Chain Technology	4
3.		Internet of Things	4
4.		Cloud Computing	4
5.		Computer Graphics	4
6.		Artificial Intelligence	4
7.		Digital Marketing	4
8.		Ethical Hacking	4
9.		Compiler Design	4
10.		Computer Networks	4

Skill Enhancement Course (SEC)			
Choose any 2 Course (2X3=6 Credits)			
S.No	Code	Course Title	Credits
		Soft skills	3
		Smart Applications	3
		Cloud Computing	3
		Cyber Security	3

Ability Enhancement Compulsory Courses (AEC)			
S.No	Code	Course Title	Credits
1.	AEC-I	Human Rights	4
2.	AEC-II	Big Data Analytics	4

Course Code	Course Title	Lecture			Semester: I
	CC-I: Programming with C# Using ASP.NET	L	T	P	
Version:	Date of Approval:	4	0	0	
Scheme of Instruction		Scheme of Examination			
No. of Periods	: 60 Hrs.	Maximum Score		:	100
Periods/ Week	: 4	Internal Evaluation		:	30
Credits	: 4	End Semester		:	70
Instruction Mode	: Lecture	Exam Duration		:	3 Hrs.
Course Outcomes:					
By the end of the course, the students will be able to :					
<ol style="list-style-type: none"> 1. Recall the fundamental concepts of .NET Framework. 2. Explain the use of database in Entity Framework. 3. Develop C# programs using Object-Oriented Programming Concepts. 4. Examine Intelligent Applications using Machine Learning and Windows Desktop Applications using Resources and Templates. 5. Interpret the webpages using RAZOR PAGES and MVC. 					
Detailed Contents:					
Unit: 1	Understanding .NET Building console apps using Visual Studio Code. SPEAKING C#: Introducing C# – Understanding C# basics – Working with variables – Working with null values – Exploring console applications further. Controlling Flow and Converting Types: Operating on variables – Understanding selection statements – Understanding iteration statements – Casting and converting between types.				
Unit: 2	Writing, Debugging, and Testing Functions Writing functions – Debugging during development – Logging during development and runtime – Unit testing functions. Building Your Own Types with Object-Oriented Programming: Talking about object-oriented programming – Building class libraries – Building class libraries – Storing data within fields – Writing and calling methods – Controlling access with properties and indexers.				
Unit: 3	Unit-III: Implementing Interfaces and Inheriting Classes Setting up a class library and console application – Simplifying methods – Raising and handling events – Implementing interfaces – Inheriting from classes – Casting within inheritance hierarchies – Inheriting and extending .NET types. WORKING WITH DATABASES USING ENTITY FRAMEWORK CORE: Understanding modern databases – Setting up EF Core – Defining EF Core models – Querying EF Core models – Loading patterns with EF Core – Manipulating data with EF Core.				
Unit: 4	Unit-IV: Building Websites Using Asp.Net Core Razor Pages Understanding web development – Understanding ASP.NET Core – Exploring Razor Pages – Using Entity Framework Core with ASP.NET Core – Using Razor class libraries. Building Websites Using the Model-View-Controller Pattern: Setting up an ASP.NET Core MVC website – Exploring an ASP.NET Core MVC website – Customizing an ASP.NET Core MVC website. Customizing an Asp.Net Core MVC Website: Understanding the benefits of a CMS – Understanding Piranha CMS – Defining components, content types, and templates – Testing the Northwind CMS website.				
Unit: 5	Building Intelligent Apps Using Machine Learning (12-Hours) Understanding machine learning – Understanding ML.NET – Making product recommendations. Building Windows Desktop Apps: Understanding legacy Windows application platforms – Understanding the modern Windows platform – Creating a modern Windows app – Using resources and templates – Using data binding.				
Text Books:					
1	Mark J. Price, C# 8.0 and .NET Core 3.0 – Modern Cross-Platform Development, 4th Edition, Packt Publishing Ltd., Birmingham, UK, 2019. Unit-I – Chapter 1, Chapter 2, Chapter 3 Unit-II – Chapter 4, Chapter 5 Unit-III – Chapter 6, Chapter 11 Unit-IV – Chapter 15, Chapter 16, Unit-V – Chapter 19, Chapter 20				
Reference Books:					
1	Troelsen, Andrew, Japikse, Philip, Pro C# 8 with .NET Core 3 Foundational Principles and Practices in Programming, 9th Edition, Apress., New York City, 2020.				
2	Freeman Adam, Pro ASP.NET Core 3, 8th Edition, Apress., New York City, 2020.				
3	E Balagurusamy, Programming in C#, 4th Edition, McGraw Hill Education Private Limited, Uttar Pradesh, India, 2015.				

Course Code		Course Title		Lecture			Semester: I
		CC-II: Advanced Algorithm		L	T	P	
Version:		Date of Approval:		4	0	0	
Scheme of Instruction				Scheme of Examination			
No. of Periods	:	60 Hrs.		Maximum Score		:	100
Periods/ Week	:	4		Internal Evaluation		:	30
Credits	:	4		End Semester		:	70
Instruction Mode	:	Lecture		Exam Duration		:	3 Hrs.
Course Outcomes:							
By the end of the course, the students will be able to :							
<ol style="list-style-type: none"> 1. Design and analyse programming problem statements. 2. Understand the necessary mathematical abstraction to solve problems. 3. Come up with analysis of efficiency and proofs of correctness. 4. Comprehend and select algorithm design approaches in a problem specific manner. 							
Detailed Contents:							
Unit: 1	Introduction to algorithm, Growth of functions, Master's Theorem, Sorting: Quick Sort, Heap Sort, Shaker Sort, and Counting Sort.						
Unit: 2	Greedy Method: Minimum Spanning Tree-Prim's Algorithm, Tarjan's Algorithm Introduction to Dynamic programming, principal of optimality, Single Source Shortest Path-Bellman-Ford Algorithm, All Pairs Shortest Paths Algorithm-Johnson's Algorithm, Longest Common Sequence (LCS)						
Unit: 3	String Matching: Introduction to String Matching, application of string matching, Naive algorithm, Rabin Karp algorithm, Knuth Morris-Pratt algorithm, Boyer-Moore Algorithm.						
Unit: 4	NP-Hard and NP-Complete problems: Basic Concepts, Non Deterministic Algorithms, NP - Hard and NP-Complete Classes, Cook's theorem. Randomized Algorithms						
Unit: 5	Introduction to parallel algorithm. Parallel Algorithm- Analysis, models, Parallel Random Access Machines (PRAM), Parallel Algorithm Structure, Parallel Algorithms for Sorting, Searching and Merging.						
Text Books:							
1	Algorithms, Coreman, Rivest, Lisserson, PHI, Third Edition.						
2	Design and Analysis of Algorithms, Manas Ranjan Kabat, PHI.						
Reference Books:							
1	Design and Analysis of Algorithms, R. Panneerselvam, PHI.						
2	Parallel Algorithms, Henri Casanova, Arnaud Legrand, Yves Robert, CRC Press.						

Course Code		Course Title			Lecture			Semester: I
		CC-III: Mathematical Foundations			L	T	P	
Version:		Date of Approval:			4	0	0	
Scheme of Instruction				Scheme of Examination				
No. of Periods	:	60 Hrs.		Maximum Score	:	100		
Periods/ Week	:	4		Internal Evaluation	:	30		
Credits	:	4		End Semester	:	70		
Instruction Mode	:	Lecture		Exam Duration	:	3 Hrs.		
Course Outcomes:								
<ol style="list-style-type: none"> 1. Understand the rudimentary knowledge in Mathematical Logics. 2. Demonstrate the use of Operations Research approaches to solve real-time problems in Industry. 3. Gain Fundamental knowledge in recurrence relations, statistical methods to improve decision making and develop critical thinking and objective analysis of decision problems. 4. Examine Transportation and Assignment problems using appropriate method. 5. Evaluate various cryptographic techniques through mathematical knowledge that utilizes a variety of software techniques that would aid the society. 								
Detailed Contents:								
Unit: 1	Mathematical Logic Propositions - Precedence Rules for Operators – Truth tables –Tautologies-Contradiction - Laws of Equivalence -Substitution Rules – Evaluation of Constant Proposition theorem - Well Defined Formula – Duality Law.							
Unit: 2	Recursion and Statistical Analysis The Many Faces of Recursion- Sequences – Recurrence Relation- Some Common Recurrence Relation. Statistical analysis: F-distributions - chi-square Test- T test.							
Unit: 3	Operation Research Introduction - Basics of OR - OR & Decision Making - Linear Programming- Mathematical Formulation- Graphical Solution - Canonical & Standard Forms of LPP.							
Unit: 4	Simplex Method Simplex Method – Big M method – Assignment model Transportation Problem: North West Corner method – Least cost method – VAM method.							
Unit: 5	Coding Theory Introduction– Cryptography- Caesar Cypher Coding- Matrix Encoding- Scrambled Codes- Hamming Metric - Hamming Distance - Error Detecting -Capability of an Encoding.							
Text Books:								
1	David Gries, The Science of Programming, Narosa Pub. House, New Delhi, 1993. Unit-I: Chapters (Sec. 1, 2 ,3.1 to 3.3)							
2	Alan Doerr, Kenneth Levasseur, Applied Discrete Structure for Computer Science, GalgotiaPub., New Delhi, 1995. Unit-II: Chapter 8(Sec 8.1-8.4)							
3	S.C.Gupta & V.K.Kapoor, Fundamentals of Mathematical Statistics, 11th Edition, Sultan Chand and Sons, New Delhi, 2007. Unit- II:Chapter 13,14 (Sec 14.5.1, 14.2, 13.3)							
4	KantiSwarup, Gupta, ManMohan, Operations Research, 7th Edition, Sultan Chand & Sons, New Delhi, 1994. Unit:III:Chapter 1(Sec 1.1,1.9) Chapter 2(Sec 2.1,2.2, 2.3,2.4) Chapter 3 (Sec 3.1,3.2,3.5) Unit-IV: Chapter 4(Sec 4.1,4.4) Chapter 10(Sec 10.1,10.2,10.3) Chapter 11(11.1,11.2,11.3,11.7)							
5	James L. Fisher, Application Oriented Algebra, Dun Donnelly Pub., New York, 1977. Unit-V: Chapter 9(Sec 9.1 - 9.5)							
Reference Books:								
1	Hamdy A. Taha, Operation Research An Introduction, 10th Edition, University of Arkansas, Pearson Education, New Jersey U.S, 2017.							
2	Kenneth Rosen , Discrete Mathematics and Its Applications, 8th Edition, MC Graw Hill Education, India, 2019.							
3	Oscar Levin, Discrete Mathematics an open Introduction, First Edition, University of Northern Colorado, Create Space Publication, U.S, 2018.							

Course Code	Course Title		Lecture			Semester: I
	CC(P)-I: ASP.NET Practical		L	T	P	
Version:	Date of Approval:		0	0	3	
Scheme of Instruction			Scheme of Examination			
No. of Periods	:	36 Hrs.	Maximum Score		:	100
Periods/ Week	:	3	Internal Evaluation		:	
Credits	:	3	End Semester		:	
Instruction Mode	:	Lecture	Exam Duration		:	3 Hrs.
Course Outcomes:						
<ol style="list-style-type: none"> 1. Show console applications. 2. Demonstrate conditional statements and looping. 3. Apply OOPS concepts to programming. 4. Contrast webpages with RAZOR, MVC and CMS. 5. Build a database using EF core. 						
Detailed Contents:						
<ol style="list-style-type: none"> 1. Build a console application using VB.Net 2. Demonstrate the conditional statements and looping VB.Net 3. Write a program using functions using Java .NET 4. Inheritance and interface using Java .NET 5. Create a database using entity framework 6. Build website using Piranha CMS 7. Testing North wind CMS website 8. Build a program with ML.NET 9. Create a windows application 10. Construct a windows application with data binding Using ASP.NET 						

Course Code	Course Title		Lecture			Semester: I
	CC(P)-II: Advanced Algorithm Practical		L	T	P	
Version:	Date of Approval:		0	0	3	
Scheme of Instruction			Scheme of Examination			
No. of Periods	:	36 Hrs.	Maximum Score		:	100
Periods/ Week	:	3	Internal Evaluation		:	
Credits	:	3	End Semester		:	
Instruction Mode	:	Lecture	Exam Duration		:	3 Hrs.
Course Outcomes:						
<ol style="list-style-type: none"> 1. Describe concepts of data structure and algorithms with respect to practical aspect. 2. Write the code for a large program after overcoming the time and space complexity. 3. Write the programs that use arrays, records, linked structures, stacks, queues, trees, and graphs. 4. Compare alternative implementations of data structures with respect to performance. 5. Choose appropriate data structures and algorithms, understand the ADT/libraries, and use it to design Algorithms for a specific problem. 						
Detailed Contents:						
<ol style="list-style-type: none"> i. Sort a given set of n integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of $n > 5000$ and record the time taken to sort. Plot a graph of the time taken versus n on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using C/C++/Java/Python how the divide and-conquer method works along with its time complexity analysis: worst case, average case and best case. ii. Write the Program to implement the Sorting Algorithms Using C++: <ol style="list-style-type: none"> i. Heap Sort iii. Write the program to implement the Minimum Spanning Tree Using Java: <ol style="list-style-type: none"> i. Prim's Algorithm iv. Write a program to implement the Bellman-Ford Algorithm v. Write a program to implement the TSP problem. vi. Write a program to implement the Longest Common Sequence (LCS) problem. Write the Program to implement the following Pattern Matching Algorithms: <ol style="list-style-type: none"> i. Naive algorithm ii. Rabin Karp algorithm 						
Text Books:						
1	The Algorithm Design Manual by Steve S. Skiena, Springer.					
2	https://ds1-iiith.vlabs.ac.in/data-structures-1/ https://ds2-iiith.vlabs.ac.in/data-structures-2/					
Reference Books:						
1	Algorithms: Design and Analysis, Harsh Bhasin, Oxford Publication.					
2	The Design and Analysis of Algorithms, Annay Levitin, Pearson.					

Course Code		Course Title		Lecture			Semester: II
		CC-IV: Advanced Java		L	T	P	
Version:		Date of Approval:		4	0	0	
Scheme of Instruction				Scheme of Examination			
No. of Periods	:	60 Hrs.		Maximum Score		:	100
Periods/ Week	:	4		Internal Evaluation		:	30
Credits	:	4		End Semester		:	70
Instruction Mode	:	Lecture		Exam Duration		:	3 Hrs.
Course Outcomes:							
<ol style="list-style-type: none"> 1. Find solutions for a range of problems using object-oriented programming. 2. Explain the Java Event-Handling model GUI Components. 3. Solve problems using the fundamental syntax and semantics of the Java Programming Language. 4. Examine JDBC programming techniques in Java. 5. Evaluate Remote real-time applications using RMI and Servlet. 							
Detailed Contents:							
Unit: 1	Classes and Objects General Form of a Class - Creation of Objects -Usage of Constructors - 'this' Keyword- Constructor Overloading-Copy Constructors-Static Data Members - Static Methods- Finalize Method. Inheritance and Polymorphism: Inheriting Variables in a Class - Inheriting Methods in a Class - Inheritance and Constructors Abstract Classes - Final Classes.						
Unit: 2	Interfaces and Packages Interfaces-Structure of an Interface - Implementation of an Interface Inheritance. Packages - Placing the Classes in a Package - Package Hierarchy Access Control Modifiers. Applets: The Life Cycle of an Applet -The Applet Class Development and Execution of a Simple Applet - Syntax of Applet Tag- Methods in the Graphic Class.						
Unit: 3	Swings Applet class - Icons - JLabel Control - JOptionPane Class - JTextField Control JButton Control - JCheckBox Control - JRadioButton Control Menus. Exception Handling: Default Exception Handling - Exception and Error Classes - Catch Block Searching Pattern - Custom Exceptions. I/O Streams: Text and Binary Formats of Data Input Stream and Output Stream Classes - Reader and Writer Classes - Data Output Stream and Data Input Stream Classes.						
Unit: 4	Threads Life Cycle of a Thread - Creating and Running Threads - Method in the Thread Class - Setting the Priority of a Thread - Synchronization. Networking: TCP Server Socket Class - TCP Socket Class. Java Database Connectivity: Establishing A Connection - Creation of Data Tables Entering Data into The Tables - Table Updating.						
Unit: 5	Remote Method Invocation Remote Interface-Java.Rmi.Server Package The Naming Class - Creating RMI Client And Server Classes. Servlet: Servlet and Dynamic Webpages Life Cycle of a Servlet a Simple Servlet Javax.Servlet Package Retrieving the Values of Parameters. Cookies: Creating a Cookie and Sending it to the Client – Retrieving the Stored Cookies.						
Text Books:							
1	C. MUTHU, Programming with JAVA, Second Edition, Vijay Nicole Imprints Private Limited, Chennai, 2011. Unit I - Chapter 5, Chapter 6, Unit II - Chapter 7, Chapter 8, Unit III - Chapter 11, Chapter 14, Unit IV - Chapter 13, Chapter 15, Chapter 18, Unit V - Chapter 19, Chapter 20						
Reference Books:							
1	Herbert Schildt, Java 2: Complete Reference, 11th Edition, Tata McGraw Hill, New Delhi, 2018.						
2	E Balagurusamy, Programming with JAVA, 6th Edition, Tata McGraw Hill, New Delhi, 2019.						
3	Mark Lassoff, Java Programming for Beginners, 1st Edition, Packt Publishing, UK, 2017.						

Course Code		Course Title			Lecture			Semester: II
		CC-V: Data Science Using Python			L	T	P	
Version:		Date of Approval:			4	0	0	
Scheme of Instruction				Scheme of Examination				
No. of Periods	:	60 Hrs.			Maximum Score	:	100	
Periods/ Week	:	4			Internal Evaluation	:	30	
Credits	:	4			End Semester	:	70	
Instruction Mode	:	Lecture			Exam Duration	:	3 Hrs.	
Course Outcomes:								
<ol style="list-style-type: none"> 1. Gain the outline knowledge in Data Science through Big Data Analytics. 2. Explain the various programming paradigms in Python. 3. Discover the relationship among the numerical data using Numpy for doing statistical analysis. 4. Interpret the data through Matplotlib for visualization to give possible solutions. 5. Build Data Frames using pandas for Business Solutions that require Data Analytics. 								
Detailed Contents:								
Unit: 1	<p>The Way of the Program Program – Running Python - The First Program – Arithmetic Operators – Values and Types – Formal and Natural language - Debugging. Variables - Expressions and Statements: Assignments Statements – Variable Names – Expressions and Statements – Script mode – Order of Operations- String Operations – Comments. Functions –Function Call – Math Functions – Composition – Adding New Functions – Definitions and Uses – Flow of Execution – Parameters and Arguments – Variable and Parameters – Stack Diagrams</p>							
Unit: 2	<p>Conditionals and Recursion Floor Division and Modulus – Boolean Expression – Logical Operators- Conditional Execution – Alternative Execution – Chained Conditionals – Nested Conditionals – Recursion – infinite Recursion – Keyboard Input. Fruitful Functions: Return values - Incremental Development= Composition- Boolean Functions – More Recursion – Leap of faith. Iteration: reassignment – Updating variables – while – Break – algorithms.</p>							
Unit: 3	<p>Strings Len – Traversal – String Slices – Strings are immutable – searching – Looping and Counting – String methods – The in operator – string Operation. Lists: A List is a sequence – lists are mutable – traversing a List – List Operations – List slices – List methods- Map, filter and Reduce – Deleting Elements – Lists and strings – Objects and values – Aliasing – List arguments. Dictionaries: A Dictionary is a Mapping – Dictionary as a collection of counters – Looping and Dictionaries – Reverse Lookup – Dictionaries and Lists- Memos- Global Variables. Tuples: Tuples Are Immutable - Tuple Assignment - Tuples as Return Values - Tuples as Return Values - Variable-Length Argument Tuples - Lists and Tuples - Dictionaries and Tuples.</p>							
Unit: 4	<p>The Numpy Library Numpy a Little History – nd array - The Heart of the library – Basic Operations – Indexing, Slicing and Iterating – Conditional and Boolean Arrays – Shape Manipulation – Array Manipulation - General Concepts - Structured Arrays – Reading and Writing Array Data on Files. PANDAS LIBRARY – An Introduction: Introduction to Pandas Data Structures - Functionalities on Indexes - Operation between Data Structures – Function Application and mapping – Sorting and Ranking – Correlation and Covariance – Not a Number – Hierarchical indexing and Levelling.</p>							
Unit: 5	<p>Data Visualization with Matplotlib Matplotlib Library – Architecture – pyplot – The Plotting Window – kwargs – Adding Elements to The Chart – Saving Charts – Handling Date Values – Chart Typology – Line Charts – Histograms – Bar Charts – Pie Charts – Advanced Charts – 3D Toolkit – Multi- Panel Plots</p>							
Text Books:								
1	Allen B. Downey, Think Python, 2nd Edition, Published by O’Reilly Media Inc., USA, 2015. Unit – I Chapter 1,2,3 Unit – II Chapter 5,6,7 Unit – III Chapter 8,10,11,12							
2	Fabio Nelli, Python Data Analytics with Pandas, NumPy, and Matplotlib, 2nd Second Edition, Apress, UK, 2018. Unit – IV Chapter 3,4,5 Unit – V Chapter 7							
Reference Books:								
1	Michael Minelli, Michele chambers, Ambiga Dhiraj, <i>Big Data Analytics-Emerging Business Intelligence and Analytic Trends for Today’s Business</i> , Wiley CIO Series, New Jersey, USA, 2014.							
2	Chun, J Wesley, <i>Core Python Programming</i> , 3 rd Edition, Pearson, UK, 2012.							
3	Jake VanderPlas, <i>Python Data Science Handbook</i> , O’Reilly Media Publishers, USA, 2016.							

Course Code	Course Title		Lecture			Semester: II
	CC-VI: Human Computer Interface		L	T	P	
Version:	Date of Approval:		4	0	0	
Scheme of Instruction			Scheme of Examination			
No. of Periods	:	60 Hrs.	Maximum Score		:	100
Periods/ Week	:	4	Internal Evaluation		:	30
Credits	:	4	End Semester		:	70
Instruction Mode	:	Lecture	Exam Duration		:	3 Hrs.
Course Outcomes:						
<ol style="list-style-type: none"> 1. The learning outcomes include students gaining knowledge of Human Computer Network. 2. Another learning outcome is for students to utilize a Human Computer Application for Computer Based Application. 3. Student capability development includes students gaining an understanding the Structure of Various user interface for Mobile Application. 4. Interfaces for Distributed Application an for Various Digital Devices. 5. User Interface for Online Tutorials and Animated Demonstrations. 						
Detailed Contents:						
Unit: 1	Usability Of Interactive Systems : Usability Goals and Measures – Usability Motivations – Universal Usability – Guidelines, Principles, and Theories: Guidelines – Principles – Theories.					
Unit: 2	Managing Design Process: Introduction – Organizational Design to Support Usability – Four Pillars of Design – Development Methodologies – Ethnographic Observation – Participatory Design – Scenario Development – Evaluating Interface Design: Expert Reviews – Usability Testing and Laboratories – Survey Instruments – Acceptance Test – Evaluation During Active Use – Controlled Psychologically Oriented Experiments.					
Unit: 3	Manipulation And Virtual Environments: Introduction-Examples of Direct Manipulation Systems –Discussion of Direct Manipulation-3D Interfaces – Teleoperation – Virtual Augmented Reality – Menu Selection, Form Fill-in, and Dialog Boxes: Task-Related Menu organization – Single Menus – Combinations of Multiple Menus – Form Fill-in, Dialog Boxes, and Alternatives – Command and Natural Languages: Command –Organization Functionality, Strategies, and Structure – Naming and Abbreviations – Natural Language in Computing.					
Unit: 4	Introduction – Keyboards and Keypads – Pointing Devices – Speech and Auditory Interfaces – Small and Large Displays – Collaboration and Social Media Participation: Goals of Collaboration and Participation – Asynchronous Distributed Interfaces – Synchronous Distributed Interfaces – Face to Face Interfaces - Balancing Function and Fashion: Error Messages – Nonanthropomorphic Design – Display Design –Web Page Design – Window Design – Color.					
Unit: 5	Introduction- Online Versus Paper Documentation – Reading from Paper Versus from Displays – Shaping the Content of the Documentation – Accessing the Documentation – Online Tutorials and Animated Demonstrations – Online Communities for User Assistance – The Development Process- Information Search: Searching in Textual Documents and Database Querying – Multimedia Document Searches – Advanced Filtering and Search Interfaces – Information Visualization: Data Type by Task Taxonomy – Challenges for Information Visualization.					
Text Books:						
1	Ben Shneiderman, Plaisant, Cohen, Jacobs, ”Designing The User Interface”,5 th Edition, Addison-Wesley					
Reference Books:						
1	Wilbert O Galitz, “The essential guide to user interface design”, Wiley Dream Tech.					
2	Ben Shneidermann, “Designing the user interface”, 3rd Edition, Pearson Education Asia.					
3	Alan Dix, Janet Finlay, Gregory Abowd& Russell Beale, “Human-Computer Interaction”, 3rd Edition. Prentice Hall, 2004.					

Course Code	Course Title		Lecture			Semester: II
	CC(P) –III: Advanced Java Practical		L	T	P	
Version:	Date of Approval:		0	0	3	
Scheme of Instruction			Scheme of Examination			
No. of Periods	:	36 Hrs.	Maximum Score		:	100
Periods/ Week	:	3	Internal Evaluation		:	
Credits	:	3	End Semester		:	
Instruction Mode	:	Lecture	Exam Duration		:	3 Hrs.
Course Outcomes:						
<ol style="list-style-type: none"> 1. Show the behaviour of Exception handling and Multithreading. 2. Demonstrate the basic concepts of OOPS. 3. Apply the JDBC methods to establish connection with database. 4. Examine the GUI techniques such as Event handling, Applet and Swing. 5. Develop programming aspect with files and networking. 						
List of Exercises:						
<ol style="list-style-type: none"> 1. Exception Handling 2. Multithreading 3. Applet 4. Swing 5. Event Handling Mechanisms 6. Streams and Files 7. Networking 8. JDBC 9. JavaBean 10. Servlets 						

Course Code		Course Title		Lecture			Semester: II
		CC(P) –IV: Python Practical		L	T	P	
Version:	Date of Approval:			0	0	3	
Scheme of Instruction				Scheme of Examination			
No. of Periods	:	36 Hrs.		Maximum Score		:	100
Periods/ Week	:	3		Internal Evaluation		:	
Credits	:	3		End Semester		:	
Instruction Mode	:	Lecture		Exam Duration		:	3 Hrs.
Course Outcomes:							
<ol style="list-style-type: none"> 1. Demonstrate forms using various Python functions. 2. Apply rich controls and conditional statement logic in Python. 3. Analyze the data using various statistical and mathematical functions for Decision Making. 4. Interpret the data through Matplotlib for visualization to give possible solutions. 5. Build applications using Pandas. 							
List of Exercises:							
<ol style="list-style-type: none"> 1. Implement a Python Program to find the largest number from a list of numbers. 2. Implement a Python Program to perform insertion sort. 3. Implement a Python Program to perform selection sort. 4. Implement a Python program to multiply matrices. 5. Implement a Python program to Calculate the most frequent words in a text from a file. 6. Implement function overloading with different function signatures. 7. Implement concept of class, instances and inheritance. 8. Implement internal and external library. 9. Search content using regular expression library in python. 10. Perform Linux administration task using python. 							

Course Code		Course Title		Lecture			Semester: III
		CC-VII: Web Design Using PHP		L	T	P	
Version:		Date of Approval:		4	0	0	
Scheme of Instruction				Scheme of Examination			
No. of Periods	:	60 Hrs.		Maximum Score	:	100	
Periods/ Week	:	4		Internal Evaluation	:	30	
Credits	:	4		End Semester	:	70	
Instruction Mode	:	Lecture		Exam Duration	:	3 Hrs.	
Course Outcomes:							
<ol style="list-style-type: none"> 1. Understand the PHP basic syntax for variable types, structures and controls. 2. Identify the appropriate programming environment for developing dynamic client-side and server-side web applications. 3. Classify the tools to create dynamic website. 4. Distinguish the various existing libraries for developing real-time applications. 5. Build Dynamic web sites using server-side PHP Programming and Database connectivity. 							
Detailed Contents:							
Unit: 1	Introduction to Dynamic Web Content HTTP and HTML: Berners-Lee's Basics -The Request/Response Procedure -The Apache Web Server - What Is a WAMP, MAMP, or LAMP -Installing AMPPS on Windows INTRODUCTION TO PHP: Incorporating PHP Within HTML - The Structure of PHP						
Unit: 2	Expressions and Control Flow in PHP Expression -Operator – Conditionals -Looping -Implicit and Explicit Casting -PHP Dynamic Linking ESSENTIAL PHP: Creating your Development Environment- Mixing HTML and PHP - Command Line. PHP Strings and Arrays: String Function - Modifying Data in an Array -Deleting Array Elements - Array with Loops - PHP Array Functions – Sorting Array - Splitting Array - Merging Array.						
Unit: 3	Creating Function Passing Function - Passing Arrays to Function - Passing by Reference - Using Default Arguments - Passing Variable Numbers of Argument - Returning Data from Function – Nesting Functions. Practical PHP: Date and Time Functions - File Handling - System Calls Reading Data in Web Pages: Setting up Web Pages to communicate with PHP - Text field - Checkbox - Radio Button - Password Controls – List Boxes -Button - Hidden Control - File Upload.						
Unit: 4	PHP Browser Handling Power PHP's Server Variables - HTTP Header - Getting the User's Browser Type - HTTP Header - Data Validation - Client-Side Data Validation. Expressions and Control Flow in Javascript: Expressions - Literals and Variables – Operators -Validating User Input with JavaScript - Regular Expressions- JavaScript Functions - JavaScript Arrays- Validating User Input with JavaScript						
Unit: 5	Working with Database Creating a MYSQL Database – Creating a New Table – Putting Data into the New Database – Accessing the Database –Update data into the Database– Insert data into the Database – Delete data from Database– Handling and Avoiding Errors – Session and Cookies. Manipulating and Creating Images: Upload Images – Converting Image Files Types- Validating User Input						
Text Books:							
1	Robin Nixon, Learning PHP, MYSQL & JavaScript, Fifth Edition, O. REILLY, USA, 2018. Unit-I Chapter 1 (Pages 1-15), Chapter 2 (Pages 35-38), Unit-II Chapter 4 (Pages 63-90), Unit -IIIChapter 7(Pages 139-145), Unit- IV Chapter 14(Pages 329-338), Chapter 16(Pages 371- 380)						
2	Steven Holzner, The Complete Reference PHP, Tata McGraw Hill Pvt.Ltd., Noida, India, 2008. Unit-II Chapter 1 (Pages 1-15), Chapter 1 (Pages 81-120 Unit-III Chapter 4 (Pages 123 -160), Chapter 5(Pages 169-190) Unit-IV Chapter 6 (Pages 203 -237), Unit-V Chapter 10 (Pages 361 -380), Chapter 11(Pages 395 -401)						
Reference Books:							
1	Robin Nixon, <i>Learning PHP, MySQL & JavaScript With jQuery, CSS & HTML5</i> , 5 th Edition, USA, 2018.						
2	Steven Holzner, PHP: The Complete Reference, McGraw-Hill Education, 2017.						
3	Jeremy McPeak, Paul Wilton, Beginning JavaScript ,5th Edition, John Wiley & Sons, Inc, USA, 2015.						

Course Code		Course Title		Lecture			Semester: III
		CC-VIII: Database Systems		L	T	P	
Version:		Date of Approval:		4	0	0	
Scheme of Instruction			Scheme of Examination				
No. of Periods	:	60 Hrs.		Maximum Score		:	100
Periods/ Week	:	4		Internal Evaluation		:	30
Credits	:	4		End Semester		:	70
Instruction Mode	:	Lecture		Exam Duration		:	3 Hrs.
Course Outcomes:							
<ol style="list-style-type: none"> 1. Define the basic commands of the SQL and the constructs of PL/SQL. 2. Discuss the intricacies of the schema & database design aspects and the issues connected with transaction processing. 3. Apply the normalization procedure and solve the problems by constructing queries with SQL commands 4. Compare the SQL commands and demonstrate its use within PL/SQL blocks 5. Design database structures, frame and execute complex queries and implement backend routines. 							
Detailed Contents:							
Unit: 1	Introduction to DBS: Basic Concepts and Definitions - Data Dictionary - Database System - DBA - Database Languages - Database System Architecture: Schemas, Sub-schemas and Instances - Three-level Architecture - Data Independence - Mappings -Data Models - Types Relational Algebra and Calculus: Structure - Relational Algebra - Relational Calculus - ER Model - Specialization and Generalization						
Unit: 2	Relational Query Languages: Introduction - Codd's Rules-Information System Based Language - Structured Query Language (SQL)-Embedded SQL						
Unit: 3	Normalization: Introduction to Database Design - Functional Dependency and Decomposition - Normalization - Normal Forms - BCNF - Multi-valued and Join Dependencies.						
Unit: 4	PL/SQL: A Programming Language: History - Fundamentals -Data types - Operators. Control Structures: Control Structures - Nested Blocks - SQL in PL/SQL - Data Manipulation - Transaction Control statements. PL/SQL Cursors and Exceptions - Named Blocks: Procedures - Functions-Packages -Triggers						
Unit: 5	Transaction Processing and Concurrency Control - Database Recovery System - Database Security - Object Oriented Databases: Introduction - Object Oriented Data Model (OODM) – Concepts of Object Oriented Database (OODB) - Object Oriented DBMS (OODBMS) - Object Data Management Group (OMDG) and Object Oriented Languages - Parallel Database Systems: Introduction to Parallel databases - Architecture - Key Elements of Parallel Database Processing -Distributed Databases - Architecture - Distributed Database design						
Text Book:							
1	S K Singh, "Database Systems Concepts, Design and Applications", Pearson Education, India, 2006.						
Reference Books:							
1	Abraham Silberschatz, "Database Systems", McGraw Hill International, New York, 1997.						
2	CJ Date, "An Introduction to Database Systems", 6th Edition, Addison Wesley Publishing Company, New York, 1995.						
3	Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom, "Database Systems: The Complete Book", Pearson, USA, 2009						

Course Code	Course Title		Lecture			Semester: III
	CC-IX: Analytics and Data Science		L	T	P	
Version:	Date of Approval:		4	0	0	
Scheme of Instruction			Scheme of Examination			
No. of Periods	:	60 Hrs.	Maximum Score		:	100
Periods/ Week	:	4	Internal Evaluation		:	30
Credits	:	4	End Semester		:	70
Instruction Mode	:	Lecture	Exam Duration		:	3 Hrs.
Course Outcomes:						
<ol style="list-style-type: none"> 1. Define data science, its scope and applications. 2. Differentiate data science and data analytics. 3. Illustrate the statistical and visualization techniques in data science. 4. Compare different statistical learning models and classifiers. 5. Compare different machine learning algorithms for data science. 6. Explain single value decomposition techniques in data science and analysis. 7. Implement different data science and analysis problems using R programming language. 						
Detailed Contents:						
Unit: 1	Introduction: Data Science –Basic concepts, definition and architecture, business analytics and visualization techniques, Different industrial application of Data Science technique.					
Unit: 2	Statistics and Probability: Statistical measures, probability– conditional probability, Baye’s theorem, Probability distributions and standard distributions, density functions, Mathematical expectations and moments, covariance and correlation.					
Unit: 3	Statistical learning - Stochastic processes, Markov process, HMM, Forward - Backward procedure, Viterbi algorithm, Baum-Welch algorithm, Applications of HMM.- Statistical classifiers - Linear classifiers, Fisher linear discriminant, Quadratic classifiers, Naive Bayes classifier, Bayesian networks.					
Unit: 4	Dimensionality Reduction, Clustering, Association Rules – Apriori algorithm, Anomaly Detection, Spam Filtering, Network Analysis and Recommender Systems. Singular value decomposition - Handwritten digits and simple algorithm - Classification of handwritten digits using SVD bases - Tangent distance - Text Mining.					
Unit: 5	Familiarization of R-Studio Integrated Development Environment (IDE) – Understanding different data types working with R – Reading/storing data from/in different file types, data manipulation, Loading and saving data, Control flow, Functions, Data analysis using R.					
Text Book:						
1	Cathy O’Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O’Reilly. 2014.					
Reference Books:						
1	Bendat J S, and Piersol A G (2011), Random Data Analysis and Measurement procedures (vol. 729) John Wiley & Sons.					
2	D.A.Simovici, Linear algebra tools for data mining, World Scientific Publishing, 2012.					
3	E. Davis, Linear algebra and probability for computer science applications, CRC Press, 2012.					
4	EldénLars, Matrix methods in datamining and pattern recognition,Society for Industrial and Applied Mathematics, 2007.					

Course Code	Course Title		Lecture			Semester: III
	CC(P) –V: Web Design and PHP Practical		L	T	P	
Version:	Date of Approval:		0	0	3	
Scheme of Instruction			Scheme of Examination			
No. of Periods	:	36 Hrs.	Maximum Score		:	100
Periods/ Week	:	3	Internal Evaluation		:	
Credits	:	3	End Semester		:	
Instruction Mode	:	Lecture	Exam Duration		:	3 Hrs.
Course Outcomes:						
<ol style="list-style-type: none"> 1. Understand the Functionality of PHP Language. 2. Identify the basic Concepts of MySQL. 3. Examine the web applications using PHP with MySQL. 4. Decide suitable features for developing Interactive Websites using JavaScript. 5. Create server side and client side programming, depending on the task to be performed. 						
List of Exercises:						
<ol style="list-style-type: none"> 1. Write a PHP script to display Welcome message. 2. Write PHP Script for addition of two 2x2 matrices 3. Write PHP script to demonstrate Variable function. 4. Write PHP script to demonstrate Date functions. 5. Write PHP script to demonstrate File functions. 6. Create student registration form using text box, check box, radio button, select, submit button. And display user inserted value in new PHP page. 7. Write two different PHP script to demonstrate passing variables through a URL. 8. Write a program to keep track of how many times a visitor has loaded the page. 9. Write a PHP script to connect MySQL server from your website. 10. Write two different PHP script to demonstrate passing variables with sessions. 						

Course Code	Course Title		Lecture			Semester: III
	CC(P)–VI: Database Systems Practical		L	T	P	
Version:	Date of Approval:		0	0	3	
Scheme of Instruction			Scheme of Examination			
No. of Periods	:	36 Hrs.	Maximum Score		:	100
Periods/ Week	:	3	Internal Evaluation		:	
Credits	:	3	End Semester		:	
Instruction Mode	:	Lecture	Exam Duration		:	3 Hrs.
Course Outcomes:						
<ol style="list-style-type: none"> 1. create database tables with all integrity constraints 2. understand and execute SQL queries to interact with the database. 3. apply the SQL commands to frame queries and SQL Plus commands to generate reports. 4. implement processing logic in the form of PL/SQL routines like functions, procedures, packages, triggers and PL/SQL blocks 5. design forms with event handling feature to interact with database. 						
List of Exercises:						
SQL - Simple queries using DDL, DML, and DCL						
<ol style="list-style-type: none"> 1. SQL functions <ul style="list-style-type: none"> ▪ Creation of Tables (along with Primary and Foreign keys), ▪ Altering Tables and Dropping Tables ▪ Practicing DML commands- Insert, Select, Update, Delete 2. SET operations. 3. View and Snapshots 4. Practicing Sub queries (Nested, Correlated) and Joins (Inner, Outer and Equi). 						
PL/SQL						
<ol style="list-style-type: none"> 5. PL/SQL Block 6. Cursors – Declaring, Opening & closing Cursor, Fetching the data 7. Database triggers - creation of trigger, Insertion, Deletion, Updating using trigger. 8. Subprograms and packages. 						
Forms and Reports						
<ol style="list-style-type: none"> 9. Designing forms with menus, buttons and List of values 10. Master-Detail form design. 11. Developing reports (Tabular, Master/detail, Matrix and Mailing label) 						

Course Code	Course Title		Lecture			Semester: VI
	CC-X: Software Engineering for Industry		L	T	P	
Version:	Date of Approval:		4	0	0	
Scheme of Instruction			Scheme of Examination			
No. of Periods	:	60 Hrs.	Maximum Score		:	100
Periods/ Week	:	4	Internal Evaluation		:	30
Credits	:	4	End Semester		:	70
Instruction Mode	:	Lecture	Exam Duration		:	3 Hrs.
Course Outcomes:						
<ol style="list-style-type: none"> 1. Use micro services in software development and its application 2. Identify latest technologies including agile methodology and continuous 3. software development for software development relevant to software 4. engineering industry practice 5. Model an application follows the agile software development process flow 6. Compare Traditional software development life cycle with Agile Software development life cycle 7. Implement a simple application with micro services 8. Use advanced software engineering concepts, principles and best practices applicable to software industry. 9. Improve students' skill in presenting their idea and findings to their peers by studying, and reflecting on software engineering theory and practice. 10. Apply knowledge gained in the course to guide the software requirements engineering, analysis, design, and testing processes. 						
Detailed Contents:						
Unit: 1	Introduction to software engineering- Software Process- Software developmental life cycle- 4P's in software project management-Software Requirements: Functional and Non-Functional requirements-Software requirements Document- Introduction to Legacy Code - Working with Legacy Code- changing software- Legacy code change algorithm					
Unit: 2	Agile Software Development Life Cycle - Agile Software Development vs. Waterfall Software Development - Agile Modeling- Kanban –Scrum- Disciplined Agile Delivery (DAD) - The Agile Process Flow - The Agile Iteration Workflow - Making the Agile Process Work					
Unit: 3	Object Oriented Analysis and Design - UML diagrams - Use case diagram- Class diagram- Activity diagram- Sequence Diagram- Design Patterns. Micro service Architectures for Software Development- Characteristics of Micro services- Challenges- Advantages and Disadvantages- Micro services and SOA- Implementation of a simple micro service program.					
Unit: 4	Continuous Software Development- Continuous Integration- Continuous Integration Best Practices – Continuous Integration in Devops – Continuous Delivery pipeline - Continuous Delivery in Agile model.					
Unit: 5	Continuous Deployment- Fundamental Principles of Continuous Deployment Scaling Key Agile Practices for Continuous Deployment- Summary of Continuous Integration vs. Continuous Delivery vs. Continuous Deployment					
Text Book:						
1	Eberhard Wolff : Microservices: Flexible Software Architecture 1st Edition ,ISBN- 13: 978-0134602417					
Reference Books:						
1	James Shore , Shane Warden ;The Art of Agile Development 1st Edition					
2	Mark S. Merkow, Lakshmikanth Raghavan; Secure and Resilient Software Development , Released June 2010 Auerbach Publications ISBN: 9781498759618					
3	Michael C ;Working effectively with legacy code, Feathers, Prentice Hall PTR					
4	Robert C. Martin : Agile Software Development, Principles, Patterns, and Practices 1st edition by Martin, Robert C. (2002) Paperback.					
5	Rozanski, Nick,Software systems Architecture : working with stakeholders using viewpoints and perspectives.					

Course Code		Course Title		Lecture			Semester: VI
		PW: Major Project Work		L	T	P	
Version:	Date of Approval:			8	0	0	
Scheme of Instruction				Scheme of Examination			
No. of Periods	:	120 Hrs.		Maximum Score	:	100	
Periods/ Week	:	8		Internal Evaluation	:	30	
Credits	:	8		End Semester	:	70	
Instruction Mode	:	Lecture		Exam Duration	:	3 Hrs.	
Course Outcomes:							
<ol style="list-style-type: none"> 1. Comprehend the state-of-the-art requirements of the Industry. 2. Apply critical thinking, reasoning and creative thinking for Software Design in an industry as an individual or as a part of a team. 3. Analyze the problem and provide Solution by Decision Making. 4. Develop Interpersonal, Communication and Presentation skills. 5. Build the modules for a specific problem. 							

DISCIPLINE SPECIFIC ELECTIVE (DSE)							
Course Code	Course Title			Lecture		Semester:	
	I: DIGITAL IMAGE PROCESSING			L	T		P
Version:	Date of Approval:			4	0		0
Scheme of Instruction			Scheme of Examination				
No. Of Periods	:	60Hrs.	Maximum Score		:	100	
Periods/Week	:	4	Internal Evaluation		:	30	
Credits	:	4	End Semester		:	70	
Instruction Mode	:	Lecture	Exam Duration		:	3Hrs.	
Course Outcomes:							
<ol style="list-style-type: none"> 1. Define the elements of image processing. 2. Differentiate color image models in image representation. 3. Discuss about various spatial domain image transformations and filtering. 4. Discuss about various frequency domain image transformations and filtering. 5. Illustrate different morphological operations on an image. 6. Illustrate different boundary representation methods on an image. 7. Discuss about image restoration process. 8. Discuss about image segmentation process. 9. Compare the current technologies and issues specific to Digital Image Processing. 							
Detailed Contents:							
Unit: 1	Digital Image Fundamentals-Elements of Digital Image Processing Systems, color Image fundamentals, RGB, HSI Color Models, Image sampling, quantization.						
Unit: 2	Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering.						
Unit:3	Frequency Domain: Introduction to Fourier Transform – Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters.						
Unit: 4	Morphological operations: Dilation, Erosion, Opening and Closing; Applications: Boundary extraction - Boundary representation – Chain Code – Boundary descriptors - Regional Descriptors– Shape number – Fourier Descriptor.						
Unit: 5	Image Restoration: Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering.						
Text Books:							
1	Anil Jain K. “Fundamentals of Digital Image Processing”, PHI Learning Pvt. Ltd., 2011.						
Reference Books:							
1	D.E. Dudgeon and RM. Mersereau, 'Multidimensional Digital Signal Processing', Prentice Hall Professional Technical Reference, 1990.						
2	Kenneth R. Castleman, Digital Image Processing, Pearson, 2006.						
3	Milan Sonka et al, 'IMAGE PROCESSING, ANALYSIS AND MACHINE VISION', Brookes/Cole, Vikas Publishing House, 2nd edition, 199						
4	Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Fourth Edition, Pearson Education, 2017.						

DISCIPLINE SPECIFIC ELECTIVE (DSE)						Semester:
Course Code	Course Code			Course Code		
	II: Block Chain Technology Block Chain Technology			L	T	
Version:	Date of Approval:			4	0	0
Scheme of Instruction			Scheme of Examination			
No. Of Periods	:	60Hrs.		Maximum Score	:	100
Periods/Week	:	4		Internal Evaluation	:	30
Credits	:	4		End Semester	:	70
Instruction Mode	:	Lecture		Exam Duration	:	3Hrs.
Course Outcomes:						
<ol style="list-style-type: none"> 1. Discuss and describe the history, technology, and applications of Block chain 2. Analyze the significance of crypto currencies in the digital world 3. Identify the functional/operational aspects of crypto currency eco system 4. Explain emerging abstract models for Block chain Technology 5. Illustrate the working of Ethereum Virtual Machine 6. Assess Block chain applications in a structured manner 7. Analyze the process of creating a crypto currency 8. Create an own Crypto token 						
Detailed Contents:						
Unit: 1	Introduction to Block chain: Evolution and Technology –Applications - Core components of Block chain technology- Private Block chain vs Public Block chain - The consensus problem - Asynchronous Byzantine Agreement - AAP protocol and its analysis - Nakamoto Consensus on permission-less, nameless, peer-to-peer network					
Unit: 2	Abstract Models for BLOCK CHAIN - GARAY model - RLA Model - Proof of Work (PoW) as random oracle - formal treatment of consistency, liveness and fairness - Proof of Stake (PoS) based Chains - Hybrid models (PoW + PoS)					
Unit:3	cryptographic basics for cryptocurrency - a short overview of Hashing, signature schemes, encryption schemes and elliptic curve cryptograph					
Unit: 4	Bitcoin - Wallet - Blocks - Merkle Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bitcoin.					
Unit: 5	Ethereum - Ethereum Virtual Machine (EVM) - Wallets for Ethereum - Solidity - Smart Contracts - some attacks on smart contracts					
Text Books:						
1	R.Pass et al, Fruitchain, a fair Block chain, PODC 2017 (eprint.iacr.org/2016/916).					
Reference Books:						
1	J.A.Garay et al, The bitcoin backbone protocol - analysis and applications EUROCRYPT 2015 LNCS VOL 9057, (VOLII), pp 281-310. (Also available at eprint.iacr.org/2016/1048) . (serious beginning of discussions related to formal models for bitcoin protocols).					
2	R.Pass et al, Analysis of Block chain protocol in Asynchronous networks , EUROCRYPT 2017, (eprint.iacr.org/2016/454) . A significant progress and consolidation of several principles).					
3	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.					
4	Block chain by Melanie Swa, O'Reilly					
5	Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy, 2015 (article available for free download) { curtain raiser kind of generic article, written by seasoned experts and pioneers}.					

DISCIPLINE SPECIFIC ELECTIVE (DSE)						Semester:	
Course Code	Course Title			Lecture			
	III: INTERNET OF THINGS			L	T		P
Version:	Date of Approval:			4	0		0
Scheme of Instruction			Scheme of Examination				
No. Of Periods	:	60Hrs.	Maximum Score	:	100		
Periods/Week	:	4	Internal Evaluation	:	30		
Credits	:	4	End Semester	:	70		
Instruction Mode	:	Lecture	Exam Duration	:	3Hrs.		
Course Outcomes:							
<ol style="list-style-type: none"> 1. Explain the significance of IoT technology in the modern digital world. 2. Explain the awareness of technologies behind IoT. 3. Compare IoT and machine to machine technologies. 4. Analyze Smart devices and IoT Systems. 5. Describe operating systems that support IoT. 6. Explain how IoT and bigdata get related. 7. Implement IoT concepts in python 							
Detailed Contents:							
Unit: 1	Introduction, to Internet Technology - Internet of Things and Related Future Internet Technologies - Internet of everything - Internet of Things : Definition, Vision, Characteristics, Physical design, Logical design, Functional blocks - Communication models & APIs.						
Unit: 2	Internet Communication Technologies: Networks and Communication, Processes, Data Management - IoT Related Standardization: Communication protocols, Addressing Schemes - Machine to Machine (M2M): Difference between IoT and M2M, Software define Network2M Service Layer Standardization - OGC Sensor Web for IoT.						
Unit:3	Smart Technology: Introduction, Smart devices, Smart environment, IoT Components, Basic Principles - Embedded technology Vs IoT - Sensors, Wireless sensor networks - Aurdino - Raspberry Pi.						
Unit: 4	Prototyping in IoT: Basics of prototypes, Communication in IoT, Prototyping model, Data handling in IoT, fabryq, Bluetooth Low Energy, µfabryq, Operating Systems for Low-End IoT Devices - Open Source OS: introduction, Contiki, RIOT, FreeRTOS, TinyOS, OpenWSN - Closed Source OS :ThreadX, QNX, VxWorks, Nucleus RTOS.						
Unit: 5	Big Data: BigData versus IoT, BigDatainfluence in IoT, A cyclic model of BigData - Cloud and Internet of Things: Data Storage, Analysis and Communication, Classifications, Characteristics of BigData, Types of BigData - Analysing of Data - Applications, Real time situations, BigData tools - A combined application of Cloud and BigData in IoT.						
Text Books:							
1	Adrian McEwen, Hakim Cassimally, Designing internet of things, John Wiley & Sons, 2013.						
Reference Books:							
1	Anthony Townsend., Smart cities: big data, civic hackers, and the quest for a new utopia, WW Norton & Company, 2013						
2	Anthony Townsend., Smart cities: big data, civic hackers, and the quest for a new utopia, WW Norton & Company, 2013						
3	ArshdeepBahga, Vijay Madiseti, , Internet of things: a hands-on approach, CreateSpace Independent Publishing Platform, 2013						
4	Dieter Uckelmannark Harrisonichahelles Florian (Ed.), Architecting the internet of things, Springer, 2011						
5	Dr. OvidiuVermesan, Dr Peter Friess, Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, River Publishers, 2013						

DISCIPLINE SPECIFIC ELECTIVE (DSE)						Semester:	
Course Code	Course Title			Lecture			
	IV: CLOUD COMPUTING			L	T		P
Version:	Date of Approval:			4	0	0	
Scheme of Instruction			Scheme of Examination				
No. Of Periods	:	60Hrs.			Maximum Score	:	100
Periods/Week	:	4			Internal Evaluation	:	30
Credits	:	4			End Semester	:	70
Instruction Mode	:	Lecture			Exam Duration	:	3Hrs.
Course Outcomes:							
<ol style="list-style-type: none"> 1. Discuss about Cloud Computing, its types and applications 2. Illustrate the application of Cloud Computing on technology, infra structure, and globalize workspace. 3. Discuss the issues and challenges related to cloud computing. 4. Analyze the security and authentication management in cloud. 5. Design a private cloud and integration of different types of cloud 6. Summarize the steps of developing AWS instances,volumes and understanding AWS services 							
Detailed Contents:							
Unit: 1	Cloud computing-Definition, Characteristics, Cloud Architecture, Deployment models, merits and demerits of cloud computing, Application areas.						
Unit: 2	Cloud Services - Infrastructure as a Service (IaaS)- Resource Virtualization (Server, Storage, Network), Platform as a Service (PaaS) - Cloud platform & Management (Computation, Storage), Software as a Service (SaaS) - Web services, Web 2.0, Web OS.						
Unit:3	Cloud Security - Cloud issues and challenges, Cloud provider Lock-in, Infrastructure Security, Data and Storage security.						
Unit: 4	Cloud Management - Authentication Management, Access Control, Trust, Reputation, Cloud contracting Model, Availability and disaster recovery strategies in Cloud.						
Unit: 5	Understanding Services and Applications - Cloud SOA, Basics of developing a private cloud, Moving applications to the cloud, Integration of clouds.						
Text Books:							
1	Barrie Sosinsky ,”Cloud Computing Bible”, 2011, Wiley-India ,ISBN: 978-0-570- 90356.						
Reference Books:							
1	Nick Antonopoulos ,Lee Gillam ,”Cloud Computing: Principles, Systems and Applications” 2012, Springer, ISBN-13: 978-1849962407						
2	RajkumarBuyya, James Broberg, Andrzej M. Goscinski,” Cloud Computing: Principles and Paradigms”, 2011,Wiley,ISBN 978-0-570-88799-8						

DISCIPLINE SPECIFIC ELECTIVE (DSE)							
Course Code	Course Title			Lecture		Semester:	
	V: ARTIFICIAL INTELLIGENCE			L	T		P
Version:	Date of Approval:			4	0		0
Scheme of Instruction			Scheme of Examination				
No. Of Periods	:	60Hrs.	Maximum Score		:	100	
Periods/Week	:	4	Internal Evaluation		:	30	
Credits	:	4	End Semester		:	70	
Instruction Mode	:	Lecture	Exam Duration		:	3Hrs.	
Course Outcomes:							
<ol style="list-style-type: none"> 1. Define the basic principles, models, and algorithms of Artificial Intelligence. 2. Understand knowledge representation, reasoning, and machine learning techniques to real-world problems. 3. Choose appropriate Artificial Intelligence functions and components involved in intelligent systems such as Robotic Perception, Image-Processing Operations to create optimal models. 4. Evaluate Artificial Intelligence with Human Intelligence and Traditional Information Processing. 5. Create logical statements from informal language to propositional logic expressions. 							
Detailed Contents:							
Unit: 1	Artificial Intelligence Introduction - The Turing Test - Goals of AI - Roots of AI - Artificial Consciousness - Techniques Used in AI - Sub-fields of AI - Perception, Understanding, and Action - Physical Symbol System Hypothesis - Considerations for Knowledge Representation - Knowledge Representation Using Natural Language.						
Unit: 2	Logic and Reasoning Patterns Role of Knowledge - Propositional Logic - Reasoning Patterns. First Order Predicate Logic: Introduction - Representation in Predicate Logic - Syntax and Semantics - Conversion to Clausal Form - Substitutions and Unification - Resolution Principle - Complexity of Resolution Proof - Interpretation and Inferences - Most General Unifiers - Unfounded Sets.						
Unit:3	Real-World Knowledge Representation and Reasoning Introduction - Taxonomic Reasoning - Techniques for Common Sense Reasoning – Ontologies - Ontology Structures - Reasoning Using Ontologies - Ontological Engineering - Situation Calculus – Non monotonic Reasoning - Default Reasoning.						
Unit: 4	Robotics Introduction - Robot Hardware - Robotic Perception - Planning to Move - Planning Uncertain Movements – Moving - Robotic Software Architectures - Application Domains. Perception: Image Formation - Early Image-Processing Operations - Reconstructing the 3D World.						
Unit: 5	Philosophical Foundations Weak AI: Can Machines Act Intelligently? - Strong AI: Can Machines Really Think? - The Ethics and Risks of Developing Artificial Intelligence - Summary, Bibliographical and Historical Notes, Exercises. AI: The Present and Future: Agent Components - Agent Architectures.						
Text Books:							
1	K.R.Chowdhary, <i>Fundamentals of Artificial Intelligence</i> , Springer Nature India Private Limited, New Delhi, 2020.						
Reference Books:							
1	S. Russell, P. Norvig, <i>Artificial Intelligence: A Modern Approach</i> , 3 rd Edition, Prentice- Hall, Inc, New Jersey, 2010.						
2	Sridhar Seshadri, <i>A first course in Artificial Intelligence and Agent Technology</i> , 1 st Edition, LAP LAMBERT Academic Publishing, India, 2017.						
3	Wolfgang Ertel, <i>Introduction to Artificial Intelligence</i> , Springer International Publishing G, Germany, 2017.						
4	Kevin Knight, Elaine Rich, Shivashankar B. Nair, <i>Artificial Intelligence</i> , 3 rd , MC Graw Hill Education, India, 2017.						

DISCIPLINE SPECIFIC ELECTIVE (DSE)						Semester:
Course Code	Course Title			Lecture		
	VI: COMPUTER GRAPHICS			L	T	
Version:	Date of Approval:			4	0	0
Scheme of Instruction			Scheme of Examination			
No. Of Periods	:	60Hrs.		Maximum Score	:	100
Periods/Week	:	4		Internal Evaluation	:	30
Credits	:	4		End Semester	:	70
Instruction Mode	:	Lecture		Exam Duration	:	3Hrs.
Course Outcomes:						
<ol style="list-style-type: none"> Understand the basics of computer graphics, different graphics systems and applications of computer graphics. Discuss various algorithms for scan conversion and filling of basic objects and their comparative analysis. Use of geometric transformations on graphics objects and their application in composite form. Extract scene with different clipping methods and its transformation to graphics display device. Explore projections and visible surface detection techniques for display of 3D scene on 2D screen. Render projected objects to naturalize the scene in 2D view and use of illumination models for this. 						
Detailed Contents:						
Unit: 1	<p>Introduction:- Applications of computer graphics; A graphics system; Images: Physical and synthetic; Imaging Systems; The synthetic camera model; The programmer's interface; Graphics architectures; Programmable Pipelines; Performance Characteristics Graphics Programming: The Sierpinski gasket; Programming Two Dimensional Applications. The OpenGL:- The OpenGL API; Primitives and attributes; Color; Viewing; Control functions; The Gasket program; Polygons and recursion; The three- dimensional gasket; Plotting Implicit Functions.</p>					
Unit: 2	<p>Input and Interaction:- Interaction; Input devices; Clients and Servers; Display Lists; Display Lists and Modeling; Programming Event Driven Input; Menus; Picking; A simple CAD program; Building Interactive Models; Animating Interactive Programs; Design of Interactive Programs; Logic Operations Geometric Objects and Transformations-I:- Scalars, Points, and Vectors; Three-dimensional Primitives; Coordinate Systems and Frames; Modeling a Colored Cube; Affine Transformations; Rotation, Translation and Scaling;</p>					
Unit:3	<p>Geometric Objects and Transformations-II:- Geometric Objects and Transformations; Transformation in Homogeneous Coordinates; Concatenation of Transformations; OpenGL Transformation Matrices; Interfaces to threedimensional applications; Quaternion's. Viewing:- Classical and computer viewing; Viewing with a Computer; Positioning of the camera; Simple projections; Projections in OpenGL; Hidden- surface removal; Interactive Mesh Displays; Parallelprojection matrices; Perspective-projection matrices; Projections and Shadows</p>					
Unit: 4	<p>Lighting and Shading Light and Matter; Light Sources; The Phong Lighting model; Computation of vectors; Polygonal Shading; Approximation of a sphere by recursive subdivisions; Light sources in OpenGL; Specification of materials in OpenGL; Shading of the sphere model; Global Illumination.</p>					
Unit: 5	<p>Implementation:- Basic Implementation Strategies; Four major tasks; Clipping; Line-segment clipping; Polygon clipping; Clipping of other primitives; Clipping in three dimensions; Rasterization; Bresenham's algorithm; Polygon Rasterization; Hidden-surface removal; Antialiasing; Display considerations.</p>					
Text Books:						
1	Edward Angel: Interactive Computer Graphics A Top-Down Approach with OpenGL, 5th Edition, Pearson Education, 2008. (Chapters 1 to 7)					
Reference Books:						
1	Donald Hearn and Pauline Baker: Computer Graphics OpenGL Version 3th Edition, Pearson Education, 2004.					
2	F.S. Hill Jr.: Computer Graphics Using OpenGL, 3th Edition, PHI, 2909.					
3	James D Foley, Andries Van Dam, Steven K Feiner, John F Hughes, Computer Graphics, Pearson Education 1997.					

DISCIPLINE SPECIFIC ELECTIVE (DSE)						Semester:	
Course Code	Course Title			Lecture			
	VII: DIGITAL MARKETING			L	T		P
Version:	Date of Approval:			4	0		0
Scheme of Instruction			Scheme of Examination				
No. Of Periods	:	60Hrs.	Maximum Score		:	100	
Periods/Week	:	4	Internal Evaluation		:	30	
Credits	:	4	End Semester		:	70	
Instruction Mode	:	Lecture	Exam Duration		:	3Hrs.	
Course Outcomes:							
<ol style="list-style-type: none"> 1. Show the acquaintance of the concepts of Digital Marketing and Display Advertising. 2. Identify the concepts of Search Engine Advertising. 3. Classify the knowledge of Facebook Marketing and Twitter Marketing. 4. Distinguish various applications of Search Engine Optimization and social media. 5. Elaborate various techniques of Web Analytics. 							
Detailed Contents:							
Unit: 1	Digital Marketing Introduction to Digital Marketing: Internet Users – Digital Marketing Strategies – Skills Required in Digital Marketing – Digital Marketing Plan. Display Advertising: Introduction – Concept of Display Advertising – Types of Display Ads – Buying Models – Display Plan – Targeting – Make a Good Ad.						
Unit: 2	Advanced Display Advertising Programmatic Digital Advertising – Analytics Tools – YouTube Advertising. Search Engine Advertising: Introduction – Pay for Search Advertising – Understanding Ad Placement – Understanding AdRanks. Social Media Marketing: Introduction – To build a Successful Strategy.						
Unit:3	Facebook Marketing Introduction – Facebook for Business- Anatomy of an Ad Campaign – Adverts - Other Marketing Tools - Other Essentials. Twitter Marketing: Introduction – Getting Started with Twitter – Building a Context Strategy – Twitter Usage - Twitter Ads – Twitter Analytics – Twitter Tools and Tips for Marketers. Instagram and Snapchat: Introduction – Instagram- snapchat						
Unit: 4	Search Engine Optimisation Introduction – Search Engine - Concept of Search Engine Optimisation- SEO Phases – On page Optimisation- Off page Optimisation- Social Media Reach – Maintenance.						
Unit: 5	Web Analytics Introduction – Data Collection - Key Metrics - Marketing Web Analytics Actionable – Types of Tracking codes – Mobile Analytics.						
Text Books:							
1	Seema Gupta, Digital Marketing, First Edition, Mc-Graw Hill, New Delhi, 2017.						
Reference Books:							
1	Ian Dodson, The Art of Digital Marketing, Wiley, New Jersey, USA, 2018.						
2	Prof. Nitin C. Kamat, Mr.Chinmay NitinKamat, <i>Digital Social Media Marketing</i> , Himalaya Publishing House Pvt. Ltd., India, 2018.						
3	Ryan Deiss & Russ Henneberry, <i>Digital Marketing for Dummies</i> , 2 nd Edition, John Wiley & Sons, Inc., New Jersey, 2020.						

DISCIPLINE SPECIFIC ELECTIVE (DSE)						Semester:
Course Code	Course Title			Lecture		
	VIII: ETHICAL HACKING			L	T	
Version:	Date of Approval:			4	0	0
Scheme of Instruction			Scheme of Examination			
No. Of Periods	:	60Hrs.		Maximum Score	:	100
Periods/Week	:	4		Internal Evaluation	:	30
Credits	:	4		End Semester	:	70
Instruction Mode	:	Lecture		Exam Duration	:	3Hrs.
Course Outcomes:						
<ol style="list-style-type: none"> 1. Recall the basic knowledge of security and various attacks to protect the user's data effectively in a real time. 2. Explain the various foot printing tools to be aware the problems involved in daily lives and ensure protect environment. 3. Apply the safe ethical techniques in the World Wide Web to be beneficial to the society. 4. Examine various techniques of Key loggers and Spyware for protect the private and public data in a real time. 5. Evaluate the concept of penetration testing and improve testing techniques to solve problems and promote social harmony. 						
Detailed Contents:						
Unit: 1	Introduction to Hacking Importance of Security – Elements of Security – Phases of an Attack – Types of Hacker Attacks – Hactivism – Vulnerability Research.					
Unit: 2	Foot Printing Introduction to Foot printing – Information Gathering Methodology – Foot printing Tools – WHOIS Tools – DNS Information Tools – Locating the Network Range.					
Unit:3	Scanning Objectives – Scanning Methodology – Tools – Introduction to Enumeration – Enumeration Techniques – Enumeration Procedure – Tools.					
Unit: 4	Cracking Passwords Password Cracking Websites – Password Guessing – Password - Cracking Tools – Password Cracking – Counter measures – Escalating Privileges – Executing Applications – Keyloggers and Spyware					
Unit: 5	Penetration Testing Introduction to Penetration Testing, Phases of penetration testing, tools.					
Text Books:						
1	Ec-Council, Ethical Hacking and Countermeasures: Attack Phases, Delmar Cengage Learning, USA, 2009.					
Reference Books:						
1	Gary Hall, Hacking, Computer Hacking, Security Testing, Penetration Testing, and Basic Security, Kindle Edition, Kindle Direct Publishing, USA, 2016.					
2	Alan T. Norman, Computer Hacking Beginners Guide, Kindle Edition, Kindle Direct Publishing, USA, 2016.					
3	Andrew Huang, The Hardware Hacker, 1st Edition No Starch Press, USA, 2017.					

DISCIPLINE SPECIFIC ELECTIVE (DSE)					Semester:
Course Code	Course Title		Lecture		
	IX: COMPILER DESIGN		L	T	
Version:	Date of Approval:		4	0	0
Scheme of Instruction			Scheme of Examination		
No. Of Periods	:	60Hrs.	Maximum Score		: 100
Periods/Week	:	4	Internal Evaluation		: 30
Credits	:	4	End Semester		: 70
Instruction Mode	:	Lecture	Exam Duration		: 3Hrs.
Course Outcomes:					
<ol style="list-style-type: none"> 1. Define the Loop Optimization and DAG for source code. 2. Explain the data structures for Block Structured Languages. 3. Apply various parsing and conversion techniques for the design of a compiler. 4. Analyze the concept of parsing techniques. 5. Evaluate the Code Optimization and code generation techniques. 					
Detailed Contents:					
Unit: 1	Introduction Different Phases of Compiler - Finite State Automation and Lexical analysis - A Simple Approach to the Design of Lexical Analyzers - Regular Expressions - A Language for Specifying Lexical Analyzers.				
Unit: 2	Syntax Specification Context Free Grammars - Parsers – Derivation and Parse trees- Shift Reduce Parsing - Operator Precedence Parsing - Top-Down Parsing – Predictive Parsers.				
Unit:3	Code Generation Intermediate Code Generation - Translation - Implementation of Syntax - Directed Translators - Intermediate Code – Postfix Notation - Parse Trees and Syntax Trees - Three Address Codes, Quadruples and Triples.				
Unit: 4	Symbol Tables Contents of a Symbol Table - Data Structures for Symbol Tables - Implementation of a Simple Stack Allocation Scheme - Implementation of Block Structured Languages - Storage Allocation in Block Structured Languages - Errors - Lexical Phase Error.				
Unit: 5	Code Optimization and Code Generation Elementary Code Optimization technique - Loop Optimization - DAG Representation of Basic Blocks - Value Numbers and Algebraic Laws - Object Programs - Problems in Code Generation - A Machine Model - A Simple Code Generator.				
Text Books:					
1	Alfred V. Aho, Jeffery D.Ullman, Principles of Compiler Design, Narosa, New Delhi, 2002.				
Reference Books:					
1	Torben, Egidius Mogensen, Introduction to Compiler Design, 2nd Edition, Springer International Publishing, Denmark, 2017.				
2	Seth D. Bergmann, Compiler Design: Theory, Tools, and Examples, Rowan University, Open Educational Resources, New Jersey, 2017.				
3	Des Watson, A Practical Approach to Compiler Construction, Springer International Publishing, UK, 2017.				

DISCIPLINE SPECIFIC ELECTIVE (DSE)							
Course Code	Course Title			Lecture		Semester:	
	X: COMPUTER NETWORKS			L	T		P
Version:	Date of Approval:			4	0		0
Scheme of Instruction			Scheme of Examination				
No. Of Periods	:	60Hrs.	Maximum Score	:	100		
Periods/Week	:	4	Internal Evaluation	:	30		
Credits	:	4	End Semester	:	70		
Instruction Mode	:	Lecture	Exam Duration	:	3Hrs.		
Course Outcomes:							
<ol style="list-style-type: none"> 1. Define the services, functions, and inter-relationship of different layers in network models 2. Apply various protocols used in communication. 3. Discover the inter-operability of modules in different layers and their enactment. 4. Understand the various networks and switching concept 5. Estimate the functionality of various Networking Technologies using protocols. 							
Detailed Contents:							
Unit: 1	Introduction Data Communications - Networks - The Internet – Protocols and Standards - Network Models - Layered Tasks - The OSI Model – Layers in the OSI Model - TCP/IP Protocol Suite – Addressing.						
Unit: 2	Physical Layer and Media Analog and Digital - Analog to Digital Conversion - Transmission Modes - Digital to Analog Conversion - Multiplexing - Transmission Media - Guided Media - Unguided Media - Switching – Circuit Switched Networks – Datagram Networks - Virtual Circuit Networks						
Unit:3	Data Link Layer Error Detection and Correction – Block Coding - Cyclic codes - Checksum - Data Link Control- Framing - Flow and error control - Protocols – Noiseless Channels - Noisy Channels -Point to Point Protocol - Channelization - IEEE 802.11 - Bluetooth - Cellular Telephony - Satellite Networks.						
Unit: 4	Network Layer IPV4 Addresses - IPV6 Addresses - Internetworking - IPV4 - IPV6 - Transition from IPv4 to IPv6 - Address mapping - ICMP – IGMP - Delivery - Forwarding - Unicast Routing Protocols - Multicast Routing Protocols.						
Unit: 5	Transport Layer and Application Layer Process to Process Delivery - UDP - TCP - SCTP - Data Traffic - Congestion - Congestion Control - Quality of Service. Application Layer: NameSpace - Domain Name Space – Remote Logging - Email & File Transfer.						
Text Books:							
1	Behrouz A. Forouzan, Data Communications and Networking, 4th Edition, Tata McGraw Hill Publishing Company Limited, New York, 2009.						
Reference Books:							
1	William Stallings, Data and Computer Communication, 9th Edition, Dorling Kindersley Pvt. Ltd., India, 2018.						
2	Andrew S. Tanenbaum, Nickolas Feamster, Computer Networks, 5th Edition, Pearson Education India, United Kingdom, 2019.						
3	James F. Kurose and Keith W. Ross, Computer Networks, 7th Edition, Pearson Education, Inc., New York, 2017						

Skill Enhancement Course (SEC)						Semester:
Course Code	Course Title			Lecture		
	I: SOFT SKILLS			L	T	
Version:	Date of Approval:			3	0	0
Scheme of Instruction			Scheme of Examination			
No. of Periods	:	36 Hrs.		Maximum Score	:	100
Periods/ Week	:	3		Internal Evaluation	:	30
Credits	:	3		End Semester	:	70
Instruction Mode	:	Lecture		Exam Duration	:	3 Hrs.
Course Outcomes:						
<ol style="list-style-type: none"> 1. Be exposed and trained in various nuances of Soft Skills in a Professional manner responding to the requirements of national and international market 2. Be able to synthesize the knowledge and practical skills learnt to be personal effective in any managerial positions 3. Be equipped to construct plans and strategies to work for better human society 4. Be able to illustrate the problems at work and home and design solutions and maintain a balance of work and home 5. Be able to connect on a continuum and maintain growth and sustainability and creativity in employment that increases in productivity, profit for individuals and the society. 						
Detailed Contents:						
Unit: 1	<p>Effective Communication & Professional communication Effective communication: Definition of communication, Process of Communication, Barriers of Communication, Non-verbal Communication. JOHARI Window as a tool of effective communication. Professional Communication: The Art of Listening, The passage, Kinesthetic, Production of Speech, Speech writing , Organization of Speech, Modes of delivery, Conversation Techniques, Good manners and Etiquettes, Different kinds of Etiquettes, Politeness markers.</p>					
Unit: 2	<p>Resume Writing & Interview Skills Resume Writing: Meaning and Purpose. Resume Formats. Types of s Resume. Functional and Mixed Resume, Steps in preparation of Resume, Model resumes for an IT professional Chronological, Types of interviews, Creative resumes using online platforms Interview Skills: Common interview questions, Dos and Don'ts for an interview, Attitude, Emotions, Measurement, Body Language, Facial expressions, Different types of interviews, Telephonic interviews, Behavioural interviews and Mock interviews (Centralized).</p>					
Unit: 3	<p>Group Discussion & Team Building Group Discussion: Group Discussion Basics, GD as the first criterion for selecting software testers, Essentials of GD, Factors that matter in GD, GD parameters for evaluation, Points for GD Topics, GD Topics for Practice, Tips for GD participation. Video shooting of GD presentation & Evaluation (Centralized) Team Building: Characteristics of a team, Guidelines for effective team membership, Pedagogy of team building, Team building skills. Team Vs Group – synergy, Types of synergy, Synergy relates to leadership, Stages of Team Formation, Broken Square-Exercise, Leadership, Leadership styles, Conflict styles, Conflict management strategies & Exercises</p>					
Unit: 4	<p>Personal Effectiveness Personal Effectiveness: Self Discovery: Personality, Characteristics of personality, kinds of self, Personality inventory table, measuring personality, intelligence and Exercises Self Esteem: Types -High & Low self esteem, Ways of proving self esteem, Hypersensitive to criticism, activities. Goal setting: Goal setting process, Decision making process & Exercises. Stress Management: Identifying stress, Symptoms of stress, Responding to Stress, Sources of stress, Coping with stress and Managing stress.</p>					
Unit: 5	<p>Numerical Ability: Average, Percentage, Profit and Loss, Problems of ages, Simple Interest, Compound Interest, Area, Volume and Surface Area, Illustration, Time and Work, Pipes and Cisterns, Time and Distance, Problems on Trains, Illustrations, Boats and Streams, Calendars and Clocks. Test of Reasoning: Verbal Reasoning: Number series, letter series, coding and decoding, logical sequence of words, Assertion and Reasoning, Data Sufficiency, Analogy, Kinds of relationships. Non-Verbal Reasoning: Completion of Series, Classification, analogical, Pattern comparison, Deduction of figures out of series, Mirror Reflection Pattern, Hidden figures, Rotation pattern, Pattern completion and comparison, Sense of direction, Blood relations.</p>					
Reference Books:						
1	Aggarwal, R.S. <i>Quantitative Aptitude</i> , S.Chand & Sons					
2	Aggarwal, R.S. (2010). <i>A Modern Approach to Verbal and Non Verbal Reasoning</i> . S.Chand & Co, Revised Edition.					
3	Khera ,Shiv (2003). <i>You Can Win</i> . Macmillan Books , Revised Edition.					
4	Covey, Stephen. (2004). <i>7 Habits of Highly effective people</i> , Free Press.					
5	Egan, Gerard. (1994). <i>The Skilled Helper</i> (5 th Ed). Pacific Grove, Brooks/Cole.					

Skill Enhancement Course (SEC)						Semester:	
Course Code	Course Title			Lecture			
	II: Smart Applications			L	T		P
Version:	Date of Approval:			3	0	0	
Scheme of Instruction				Scheme of Examination			
No. of Periods	:	36 Hrs.			Maximum Score	:	100
Periods/ Week	:	3			Internal Evaluation	:	30
Credits	:	3			End Semester	:	70
Instruction Mode	:	Lecture			Exam Duration	:	3 Hrs.
Course Outcomes:							
<ol style="list-style-type: none"> 1. Describe methods and technologies for the development of smart connected applications. 2. Explain about smart objects, mobile devices (smart phones, tablets), wearable's (smart watches, fitness trackers) and home automation devices. 3. Discuss about management of smart devices in virtual environments, human user-centered environments and physical environments. 4. Articulate the concepts of Autonomous systems and artificial life. 5. Assess common designs for smart applications. 6. Examine development platforms and cloud services for smart applications. 							
Detailed Contents:							
Unit: 1	Smart devices and services: Service architecture models, service provision life- cycle, virtual machines and operating systems, Application and requirements, device technology and connectivity Smart mobiles, cards and device networks: Smart mobile devices, users, resources and code, operating systems for mobile computers and communicator devices, smart card devices, device networks						
Unit: 2	Management of smart devices - Managing smart devices in virtual environments, managing smart devices in human user-centered environments, managing smart devices in physical environments Smart Expert system - Building Smart systems using different learning techniques, smart system applications, and agent based concurrent engineering						
Unit: 3	Human Computer Interaction: Explicit HCI, Implicit HCI, User Interface and Interaction for four hand-held widely used devices, Hidden UI via basic smart devices, Hidden UI via wearable and implanted devices, Human centred design, user models, iHCI Design. Autonomous systems and artificial life - Basic autonomous intra-acting systems, reflective and self-aware systems, self-management and autonomic computing, complex systems, artificial life.						
Unit: 4	Common designs for smart applications (e.g. fuzzy logic in control systems or cloud analysis of field sensors data streams). Make or buy: selecting appropriate procurement strategies). Development platforms for smart objects (e.g.: Brillo (IoT devices) or Android TV (Smart TVs)), Development platforms for smart architectures (e.g. TensorFlow (server-side RNNs), or the Face Recognition API (mobile)). Cloud services for smart applications (e.g. Google Cloud Machine Learning API, Google Cloud Vision API, Google Cloud Speech API, or Deploying Deep Neural Networks on Microsoft Azure GPU VMs)						
Unit: 5	Deployment and operations (e.g.: cloud hosting vs. device hosting, or harnessing user feedback to drive improvement). Measuring success: methods and metrics (e.g: defining user engagement and satisfaction metrics, or assessing the naturalness of smart interactions)						
Text Book:							
1	Aurélien Geron's - "Hands-On Machine Learning with Scikit-Learn and TensorFlow", O'Reilly Media, Inc.,2017						
Reference Books:							
1	Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle – "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", Elsevier Science Publishing, 2014.						
2	Stefan Poslad-"Ubiquitous Computing, Smart devices, environment and interaction", Wiley, 2011.						

Skill Enhancement Course (SEC)					Semester:
Course Code	Course Title		Lecture		
	III: Cloud Computing		L	T	
Version:	Date of Approval:		3	0	0
Scheme of Instruction			Scheme of Examination		
No. of Periods	:	36 Hrs.	Maximum Score		: 100
Periods/ Week	:	3	Internal Evaluation		: 30
Credits	:	3	End Semester		: 70
Instruction Mode	:	Lecture	Exam Duration		: 3 Hrs.
Course Outcomes:					
<ol style="list-style-type: none"> 1. Discuss about Cloud Computing, its types and applications 2. Illustrate the application of Cloud Computing on technology, infra structure, and globalize workspace. 3. Discuss the issues and challenges related to cloud computing. 4. Analyze the security and authentication management in cloud. 5. Design a private cloud and integration of different types of cloud 6. Summarize the steps of developing AWS instances, volumes and understanding AWS services 					
Detailed Contents:					
Unit: 1	Cloud computing-Definition, Characteristics, Cloud Architecture, Deployment models, Merits and demerits of cloud computing, Application areas. Cloud Services - Infrastructure as a Service (IaaS)- Resource Virtualization(Server, Storage, Network), Platform as a Service (PaaS) - Cloud platform & Management (Computation, Storage), Software as a Service (SaaS) - Web services, Web 2.0, Web OS.				
Unit: 2	Cloud Security - Cloud issues and challenges, Cloud provider Lock-in, Infrastructure Security, Data and Storage security.				
Unit: 3	Cloud Management - Authentication Management, Access Control, Trust, Reputation, Cloud contracting Model, Availability and disaster recovery strategies in Cloud.				
Unit: 4	Understanding Services and Applications - Cloud SOA, Basics of developing a private cloud, Moving applications to the cloud, Integration of clouds.				
Unit: 5	AWS – Introduction to Amazon web services, AWS architecture and terminology, Managing and creating Amazon EC2 instances and EBS volumes, Understanding Simple Storage Service.				
Text Book:					
1	Barrie Sosinsky ,”Cloud Computing Bible”, 2011, Wiley-India ,ISBN: 978-0-570- 90356				
Reference Books:					
1	Nick Antonopoulos ,Lee Gillam ,”Cloud Computing: Principles, Systems and Applications”2012, Springer, ISBN-13: 978-1849962407				
2	Rajkumar Buyya, James Broberg, Andrzej M. Goscinski,” Cloud Computing: Principles and Paradigms”, 2011,Wiley,ISBN 978-0-570-88799-8.				

Skill Enhancement Course (SEC)					Semester:
Course Code	Course Title		Lecture		
	IV: Cyber Security		L	T	
Version:	Date of Approval:		3	0	0
Scheme of Instruction			Scheme of Examination		
No. of Periods	:	36 Hrs.	Maximum Score		: 100
Periods/ Week	:	3	Internal Evaluation		: 30
Credits	:	3	End Semester		: 70
Instruction Mode	:	Lecture	Exam Duration		: 3 Hrs.
Course Outcomes:					
<ol style="list-style-type: none"> 1. Identify the issues and challenges in Networking 2. Explain the concepts of Information security, Threats, Vulnerabilities, Impact and control measures. 3. Analyze the efficiency of algorithms in cryptography. 4. Discuss network security issues. 5. Discuss Virtual Private Networks. 6. Discuss IT Act & its Amendments. 					
Detailed Contents:					
Unit: 1	Information System Threats and attacks, Classification of Threats and Assessing Damages, Security in Mobile and Wireless Computing- Security Challenges in Mobile Devices, authentication Service Security, Security Implication for organizations, Laptops Security, confidentiality, Integrity Availability, Access Control- Biometrics.				
Unit: 2	Model of Cryptographic Systems, Issues in Documents Security, System of Keys, Public Key Cryptography, Digital Signature, Requirement of Digital Signature System, Finger Prints.				
Unit: 3	Firewalls, Design and Implementation Issues, Policies Network Security- Basic Concepts, Dimensions, Perimeter for Network. Network Perimeter Security Fundamentals: Introduction, layers of Network Security, Security by Router.				
Unit: 4	Firewall: Basics, Types - Network Address Translation Issues. - Virtual Private. Networks: VPN Basics, Types of VPN, IPSec Tunneling & Protocols. - VLAN: introduction, Links, Tagging, VLAN Trunk Protocol (VTP).				
Unit: 5	Constitutional & Human Rights Issues in Cyberspace Freedom of Speech and Expression in Cyberspace - Right to Access Cyberspace – Access to Internet- Right to Privacy - Right to Data Protection.				
Text Book:					
1	Forouzan, B.A., Cryptography & Network Security. Tata McGraw-Hill Education, 2010.				
Reference Books:					
1	Godbole, “Information Systems Security”, Willey.				
2	IT Act 2000 Jeffrey M. Bradshaw, Software Agents (Editor). MIT Press.				
3	Kahate, A. Cryptography and Network Security. McGraw-Hill Higher Ed., 2009.				
4	Luger., Artificial Intelligence. 4 ed.- Pearson Education.				
5	Merkov, Breithaupt, “Information Security”, Pearson Education				
6	Schou, Shoemaker, “Information Assurance for the Enterprise”, Tata McGraw Hill, “Cyber Laws Simplified”, Mc GrawHillFurnell, “Computer Insecurity”, Springer.				
7	Yadav, “Foundations of Information Technology”, New Age, Delhi.				

Course Code		Course Title		Lecture			Semester:
		HUMAN RIGHTS		L	T	P	
Version:		Date of Approval:		4	0	0	
Scheme of Instruction				Scheme of Examination			
No. Of Periods	:	60Hrs.		Maximum Score		:	100
Periods/Week	:	4		Internal Evaluation		:	30
Credits	:	4		End Semester		:	70
Instruction Mode	:	Lecture		Exam Duration		:	3Hrs.
Course Outcomes:							
<ol style="list-style-type: none"> 1. Human rights' as an emblem of modernity, good governance, and globalization. 2. Its universal nature with reference to the dignity of every human being brings forward dreams of freedom as well as worries about foreign influence. 3. It refers to actually existing international law and associated legal and political mechanisms as well as processes of far-reaching social and cultural change. 4. This programme offers courses in human rights in both theory and practice from legal, historical, philosophical, political and social science-based perspectives. 							
Detailed Contents:							
Unit: 1	Introduction To Human Rights12 HOURS Human rights: Meaning-origin and growth of human rights in the world- Need and Types of human rights- UNHRC (United Nations Human Rights Commission) – Human Rights in India						
Unit: 2	Classification of human rights 12 HOURS Rights to liberty – Rights to life – Rights to equality-Rights to Dignity- Right against Exploitation- Educational Rights- Cultural rights – Economical Rights –Political Rights- Social Rights.						
Unit:3	Rights of Women and Children12 HOURS Rights of Women- Female feticide and infanticide and selective abortion- Physical assault and sexual harassment-Domestic violence-violence at work place- Remedial measures. Rights of children-Protection right- survival Rights – Participation Rights- Development Rights-Role of UN on convention on Rights of children.						
Unit: 4	Multi – Dimensional aspects of human Rights12 HOURS Labor Rights –Bonded Labour- Child Labour- Contract labour- Migrant Labour- Domestic Women labour-Gender equity –Rights ethic refugees- Problems and Remedies- Role of trade union in protecting the unorganized labour.						
Unit: 5	Grievances and Redressal Mechanism12 HOURS Redressal Mechanisms at national and international levels-structure and function of National and state level human rights commission- Constitutional remedies and directive principles of state policy.						
Reference Books:							
1	Baradot Sergio and Swarojali Ghosh Teaching of human Rights: Dominant Publishers and Distributors New Delhi,2009.						
2	Roy A.N Human Rights Achievement and challenges: vista imitational Publishing house, Delhi, 2005.						
3	Asish Kumar das and PeasantKumar Mohanty: Human Rights in India: Sarup and sons New Delhi, 2007.						
4	Velan, G . Human Rights and Development issues: The associated Publishers Ambalacannt, 2008.						

Course Code		Course Title		Lecture			Semester:
		BIG DATA ANALYTICS		L	T	P	
Version:		Date of Approval:		4	0	0	
Scheme of Instruction				Scheme of Examination			
No. Of Periods	:	60Hrs.		Maximum Score		:	100
Periods/Week	:	4		Internal Evaluation		:	30
Credits	:	4		End Semester		:	70
Instruction Mode	:	Lecture		Exam Duration		:	3Hrs.
Course Outcomes:							
<ol style="list-style-type: none"> 1. Comprehend the overview of an exciting growing field of big data analytics. 2. Perform the fundamentals of various big data analytics techniques. 3. Analyze the HADOOP and Map Reduce technologies associated with Distributed File System 4. Evaluate the Job Execution in Hadoop Environment. 5. Discuss the programming tools in Hadoop Echo System.. 							
Detailed Contents:							
Unit: 1	Overview of Big Data What is big data – Structuring Big data – Elements of Big data – Big data analytics- Careers in Big data. EXPLORING THE USE OF BIG DATA IN BUSINESS: Use of big data in social networking - Preventing Fraudulent Activities – Detecting Fraudulent Activities in Insurance Sector – Retail Industry.						
Unit: 2	Technologies for Handling Big Data Distributed and parallel computing for Big data – Hadoop – Cloud computing and big data – In-Memory computing technology for big data. Understanding Hadoop Ecosystem: Hadoop Ecosystem – Hadoop Distributed File System – MapReduce – Hadoop YARN.						
Unit:3	HBase HBase Architecture – Storing big data with HBase – Interacting with the Hadoop Ecosystem – Combining HBase and HDFS – Hive – Pig and Pig Latin – Sqoop – Zookeeper – Flume – Oozie. Mapreduce and Hbase: MapReduce framework – Techniques to optimize MapReduce Jobs -Uses of MapReduce – Role of HBase in big data processing.						
Unit: 4	Big Data Technology Exploring the big data stack – virtualization and big data. Storing Data in Database and Data Warehouse: RDBMS and Big data – Non- Relational Database – Polyglot Persistence – Interacting big data with Traditional data warehouse.						
Unit: 5	Hadoop Yarn Architecture YARN Architecture – Working of YARN – YARN Schedulers. Exploring Hive: Hive services – Data Types in Hive – Hive DDL- Data manipulation in Hive- Data Retrieval Queries.						
Text Books:							
1	DT Editorial Services, BIG DATA BLACK BOOK, Dreamtech Press, New Delhi, 2017.						
Reference Books:							
1	Michael Minelli, Michaele Chambers, Ambiga Dhiraj, Big Data, Big Analytics, Wiley, UK, 2014.						
2	Dr.Arvind Sathi, Big Data Analytics: Disruptive Technologies for changing the game, published by Elsevier, New York, 2013.						
3	Soumendra Mohanty, Madhu Jagadeesh, and Harsha Srivatsa, Big Data Imperatives: Enterprise Big Data Warehouse, BI Implementations and Analytics, Published by Apress Media, UK, 2013.						