B.Sc. INFORMATION TECHNOLOGY CURRICULUM

FIRST YEAR: SEMESTER-I

Part	List of Courses	Credit	Hours per week (L/T/P)	Internal Mark	External Mark
Part-I	Language – Tamil	3	6	25	75
Part-II	English	3	6	25	75
Part-III	CC1 – Programming in C	5	5	25	75
	CC2 – C programming Practical	5	5	25	75
	EC1 : Elective Course (Generic / Discipline Specific) ***Discrete Mathematics-I*** ***(Annexure I)***	3	4	25	75
Part-IV	***SEC-1 : Skill Enhancement Course (Non Major Elective)*** ***Problem Solving Techniques*** ***(Annexure I)***	2	2	25	75
	Foundation Course FC FC1 : Fundamentals of Computers (Annexure II)	2	2	25	75
TOTAL		**23**	**30**		

SEMESTER -II

Part	List of Courses	Credit	Hours per week (L/T/P)	Internal Mark	External Mark
Part-I	Language – Tamil	3	6	25	75
PartII	English	3	6	25	75

Part-III	CC3: Java Programming and Data Structures	5	5	25	75
	CC4 : Java Programming and Data Structures Practical	5	5	25	75
	EC2 : Elective Course (Generic / Discipline Specific) ***Statistical Method and Its Application-I*** ***(Annexure I)***	3	4	25	75
	Skill Enhancement Course -SEC-2 (Non Major Elective) ***Multimedia Systems(Annexure I)***	2	2	25	75
	Skill Enhancement Course -SEC-3 (Discipline Specific / Generic) ***Advanced Excel(Annexure II)***	2	2	25	75
TOTAL		**23**	**30**		

SECOND YEAR: SEMESTER-III

Part	List of Courses	Credit	Hours per week (L/T/P)	Internal Mark	External Mark
Part-I	Language – Tamil	3	6	25	75
Part-II	English	3	6	25	75
Part-III	CC5 : Relational Database Management System	5	5	25	75
	CC6 : Relational Database Management System Practical	5	5	25	75
	EC3 : Elective Course (Generic / Discipline	3	4	25	75

	Specific) ***Digital Logic Fundamentals (Annexure I)***				
Part-IV	***SEC-4 :Skill Enhancement Course - (Entrepreneurial Based)*** ***Web Designing(Annexure I)***	1	1	25	75
	SEC-5 :Skill Enhancement Course (Discipline Specific/ Generic) ***Biometrics(Annexure II)***	2	2	25	75
	Environmental Studies(EVS)	-	1	-	-
TOTAL		**22**	**30**		

SEMESTER-IV

Part	**List of Courses**	**Credit**	**Hours per week (L/T/P)**	**Internal Mark**	**External Mark**
Part-I	Language – Tamil	3	6	25	75
Part-II	English	3	6	25	75
Part-III	CC7 : .NET Programming	5	5	25	75
	CC8 : .NET Programming Lab	5	5	25	75
	EC4 : Elective Course (Generic / Discipline Specific)IoT and Its Application ***(Annexure I)***	3	4	25	75
Part-IV	***SEC6 : Skill Enhancement Course*** ***Cyber Forensics(Annexure II)***	2	2	25	75
	SEC-7 : Skill Enhancement Course - (Discipline Specific / Generic) ***Software Testing(Annexure II)***	2	2	25	75
	Environmental Studies EVS	2	2	25	75

	TOTAL	**25**	**30**		

THIRD YEAR :

SEMESTER-V

Part	**List of Courses**	**Credit**	**Hours per week (L/T/P)**	**Internal Mark**	**External Mark**
Part-III	CC9 : Python Programming	4	5	25	75
	CC10 : Python Programming Lab	4	5	25	75
	CC11 : Operating Systems	4	5	25	75
	EC5 : Elective Courses (Generic / Discipline Specific) Bigdata Analytics ***(Annexure I)***	3	4	25	75
	EC6 : Elective Courses (Generic / Discipline Specific) cryptography ***(Annexure I)***	3	4	25	75
	Core /Project with Viva voce CC12	4	5	25	75
Part-IV	Value Education	2	2	25	75
	Internship / Industrial Training (Carried out in II Year Summer vacation) (30 hours)	2	-	-	-
TOTAL		**26**	**30**		

SEMESTER-VI

Part	**List of Courses**	**Credit**	**Hours per week (L/T/P)**	**Internal Mark**	**External Mark**
Part-	CC13 : Data Mining	4	6	25	75

III	CC14 : Data Mining Lab	4	6	25	75
	CC15 : Data Communication and Networking	4	6	25	75
	EC7 : Elective Courses (Generic / Discipline Specific) Artificial Intelligence ***(Annexure I)***	3	5	25	75
	EC8 : Elective Courses (Generic / Discipline Specific) Computational Intelligence(Annexure I)	3	5	25	75
Part IV	***Professional Competency Skill Enhancement Course SE8*** ***Quantitative Aptitude(Annexure II)***	2	2	25	75
Part-V	Extension Activity (Outside college hours)	1	-	-	-
TOTAL		**21**	**30**		

Total Credits: 140

Remarks: English Soft Skill Two Hours Will be handled by English Teachers (4+2 = 6 hours for English).

ANNEXURE I

SUGGESTED TOPICS IN CORE COMPONENT.

1. Object Oriented Programming Using C++
2. C++ Programming Lab
3. Data Structures
4. PHP Scripting
5. Software Project Management
6. Software Engineering
7. Software Engineering Lab
8. Software Metrics
9. Machine Learning
10. Network Security
11. Mobile Application Development and more..

SUGGESTED TOPICS IN ELECTIVE COURSE

GENERIC SPECIFIC

1. Discrete Mathematics – I
2. Discrete Mathematics-II
3. Statistical Methods and its Application-I
4. Statistical Methods and its Application-II
5. Optimization Techniques
6. Nano Technology
7. Introduction to Linear Algebra
8. Graph Theory and its Application
9. Financial Accounting
10. Cost and Management Accounting
11. Digital Logic Fundamentals
12. Numerical Methods

ELECTIVE COURSE – (1- 8)-DISCIPLINE SPECIFIC

1. Natural Language Processing
2. Analytics for Service Industry
3. Cryptography
4. Big Data Analytics
5. IOT and its Applications
6. Human Computer Interaction
7. Fuzzy Logic
8. Artificial Intelligence
9. Robotics and its Applications
10. Computational Intelligence
11. Grid Computing
12. Trends in Computing
13. Artificial Neural Network
14. Agile Project Management and more..

SUGGESTED TOPICS IN SKILL ENHANCEMENT (SEC1-SEC8) COURSE

ANNEXURE II

SKILL ENHANCEMENT COURSE

1. Office Automation
2. Basics of Internet
3. Problem Solving Techniques
4. Multimedia Lab
5. Fundamentals of Information Technology
6. Introduction to HTML
7. Web Designing
8. Software Testing
9. Quantitative Aptitude
10. Multimedia Systems
11. Advanced Excel
12. Biometrics
13. Cyber Forensics
14. Pattern Recognition
15. Enterprise Resource Planning
16. Robotics and Its Applications
17. Simulation and Modelling
18. Organization Behaviour and more..

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
EC-GS	Discrete Mathematics – I	**Elective**	4	-	-		3	25	75	100
Learning Objectives										
LO1	To understand the mathematical concepts like set theory, logics, number theory, combinatory and relations.									
LO2	To Understand Graphs and Graphs Model									

UNIT	Contents	No. Of. Hours
I	The Foundations: Logic and Proofs: Propositional logic – Applications of Propositional logic – Propositional equivalences – (Exclude Propositional satisfiability, Applications of satisfiability, Solving satisfiability problems, and its related problems) – Predicates and Quantifiers – Rules of inference.	**12**
II	Relations: Relations and their properties – Representing relations – Closures of relations – Partial orderings (Theorems statement only; Exclude lexicographic ordering - Exclude Lattices)	**12**
III	Counting: The basic of counting - The pigeonhole principle – Permutation and Combinations – Applications of recurrence relations – Solving recurrence relations – Divide and Conquer algorithms and recurrence relations. (All theorems and Results statement only)	**12**
IV	Graphs: Graphs and Graphs models, (Excluding Biological networks; Tournaments; all its related examples and problems) – Graph terminology and special types of graphs – Representing graphs and Graph isomorphism – Connectivity (paths – connectedness in undirected graphs – paths and isomorphism – counting paths between vertices) – shortest path problems.	**12**
V	Matrices: Introduction – operations – inverse – Rank of a matrix, solution	**12**

	of simultaneous linear equations – Eigen values and Eigen Vectors.	
Total hours		**60**
Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	To understand the mathematical concepts like set theory, logics, number theory, combinatory and relations.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	To understand different mathematical logics and functions	PO1, PO2, PO3, PO4, PO5, PO6
CO3	To Understanding the different form of number theory	PO1, PO2, PO3, PO4, PO5, PO6
CO4	To gain knowledge on set theory	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Able to understand Relations and its applications	PO1, PO2, PO3, PO4, PO5, PO6
Textbooks		
1	Discrete Mathematics and its applications, Seventh Edition, Kenneth.H.Rosen, McGrawHill Publishing Company, 2012.	
2	Discrete Mathematics, M.Venkataraman, N.Sridharan and N.Chandrasekaran, The National Publishing Company, 2009. Unit I : Textbook 1 Chapter 1: Sections: 1.1, 1.2, 1.3, 1.4, 1.6 Unit II : Textbook 1 Chapter 9: Sections: 9.1, 9.3, 9.4, 9.5, 9.6 Unit III : Textbook 1 Chapter 6: Sections: 6.1, 6.2, 6.3 Chapter 8: Sections: 8.1, 8.2, 8.3 (Pages: 527 -529 only) (Exclude algorithms and relations, on page 507 and its related problems) Unit IV : Textbook 1 Chapter 10: Sections: 10.1, 10.2, 10.3, 10.4, 10.6) Unit V : Textbook 2 Chapter 6 :Sections :6.1 to 6.5, and 6.7)	
Reference Books		
1.	Modern Algebra - S.Arumugam and A. Thangapandi Isaac, Scitech publications 2005.	

2.	Invitation to Graph Theory-S.Arumugam and S.Ramachandran, Scitech Publications,2005, Chennai.
3.	Discrete Mathematical Structures with applications to Computer Science - Tremblay and Manohar, McGraw Hill,1997.
Web Resources	
1.	Web resources from NDL Library, E-content from open-source libraries

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
SEC	**PROBLEM SOLVING TECHNIQUES**	Specific Elective	Y	-	-	-	2	2	25	75	100

Course Objective	
C1	Understand the systematic approach to problem solving.
C2	Know the approach and algorithms to solve specific fundamental problems.
C3	Understand the efficient approach to solve specific factoring-related problems.
C4	Understand the efficient array-related techniques to solve specific problems.
C5	Understand the efficient methods to solve specific problems related to text processing. Understand how recursion works.

UNIT	**Details**	**No. of Hours**
I	**Introduction:** Notion of algorithms and programs – Requirements for solving problems by computer – The problem-solving aspect: Problem definition phase, Getting started on a problem, The use of specific examples, Similarities among problems, Working backwards from the solution – General problem-solving strategies - Problem solving using top-down design – Implementation of algorithms – The concept of Recursion.	6
II	**Fundamental Algorithms**: Exchanging the values of two variables – Counting - Summation of a set of numbers - Factorial computation - Sine function computation - Fibonacci Series generation - Reversing the digits	6

	of an integer – Base Conversion.	
III	**Factoring Methods**: Finding the square root of a number – The smallest divisor of an integer – Greatest common divisor of two integers - Generating prime numbers – Computing the prime factors of an integer – Generation of pseudo-random numbers - Raising a number to a large power – Computing the *n*th Fibonacci number.	6
IV	**Array Techniques**: Array order reversal – Array counting or histograming – Finding the maximum number in a set - Removal of duplicates from an ordered array - Partitioning an array – Finding the k^{th} smallest element – Longest monotone subsequence.	6
V	**Text Processing and Pattern Searching**: Text line length adjustment – Left and right justification of text – Keyword searching in text – Text line editing – Linear pattern search. **Recursive algorithms**: Towers of Hanoi – Permutation generation.	6
	Total	**30**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Understand the logic of problem and analyses implementation of algorithm and TopDown approach and concept of Recursion	PO1,PO6
2	Able to understand the Sequence of Numbers and Series Fibonacci, Reversing ,Base Conversion.	PO2
3	Able to do Algebraic operations	PO2,PO4
4	Coverage of Arrays and its Logics	PO6,PO8
5	Text Processing and Pattern Searching Approach	PO7

Text Book

1	R. G. Dromey, *How to Solve it by Computer*, Pearson India, 2007

Reference Books

1.	George Polya, Jeremy Kilpatrick, *The Stanford Mathematics Problem Book: With Hints and Solutions*, Dover Publications, 2009 (Kindle Edition 2013).
2.	Greg W. Scragg, *Problem Solving with Computers*, Jones & Bartlett 1st edition, 1996.

Web Resources

1.	https://www.studytonight.com/

2.	https://www.w3schools.com/

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	M					S		
CO 2		M						
CO 3		S		L				
CO 4						S		M
CO 5							M	

S-Strong M-Medium L-Low

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Marks**		
								CIA	**External**	**Total**
EC-GS	Statistical Methods and its Application-I	**Elect**	4	-	-		3	25	75	100

Learning Objectives		
LO1	Organizing and summarizing the data. Analyzing the data and drawing conclusions from it. Assessing the strengths of the conclusions and evaluating their uncertainty	
LO2	Define the principal concepts about probability.	
LO3	Explain the concept of a random variable and the probability distributions.	
UNIT	**Contents**	**No. Of. Hours**
I	Nature and Scope of Statistical Methods and Their Limitations — Classifications, Tabulation and Diagrammatic Representation of	**12**

	various types of statistical data — Frequency Curves and Ogives — Graphical determination of percentiles quartiles and their properties — Merits and Demerits.	
II	Measures of Location — Arithmetic Mean, Median, Mode, Geometric Mean, Harmonic Mean and their properties — Merits and Demerits	**12**
III	Measures of Dispersion — Range, Mean Deviation, Quartile Deviation, Standard Deviation, Coefficient of Variation, Skewness and Kurtosis and their properties	**12**
IV	Probability of an event — Finitely additive probability sopace addition and multiplication theorems — Independence of events — Conditional Probability	**12**
V	Concepts of Random Variable — Mathematical expectation — Moments of random variable (raw and central moments) — Moment generating function — Chebychev's inequality — Simple Problems.	**12**
Total hours		**60**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Understand basic probability axioms and rules and the moments of discrete and continuous random variables as well as be familiar with common named discrete and continuous random variables	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Derive the probability density function of transformations of random variables and use these techniques to generate data from various distributions	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Derive the marginal and conditional distributions of random variables, translate realworld problems into probability models	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Analyse the different Statistical measures of data	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Test hypothesis of different types	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks

1	Statistical Methods, S.P.Gupta, Sultan Chand and sons Publications,4th Edition 2011
Reference Books	
1.	Statistics, Dr. S.Arumugam and A.ThangapandiIssac, New Gamma Publication house, 2002.
2.	KishorS. Trivedi - Probability and statistics with reliability queuing and Computer Science Applications - Prentice Hall of India (P) Ltd., New Delhi -1997
3.	Discrete Mathematics - Seymour Lipschutz, Marc Lars Lipson Schaum's Outlines- by, 3rd Edition., Tata McGraw Hill, Education Pvt. Ltd., New Delhi. 5th Reprint, 2012
Web Resources	
1.	Web resources from NDL Library, E-content from open-source libraries

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
SEC	**Multimedia Systems**	Specific Elective	Y	-	-	-	2	2	25	75	100
Course Objective											
C1	Understand the basics of Multimedia										
C2	To study about the Image File Formats,SoundsAudio File Formats										
C3	Understand the concepts of Animation and DigitalVideoContainers										
C4	To study about the Stage of Multimedia Project										
C5	Understand the concept of OwnershipofContentCreatedforProjectAcquiringTalent										
UNIT	**Details**							**No. of Hours**	**Course Objective**		
I	Multimedia Definition-Use Of Multimedia-Delivering Multimedia- Text:About Fonts and Faces - Using Text in Multimedia -Computers and Text Font Editing and DesignTools-							12	C1		

	HypermediaandHypertext.		
II	Images: Plan Approach - Organize Tools - Configure Computer Workspace -Making Still Images - Color - Image File Formats. Sound: The Power of Sound -DigitalAudio-MidiAudio-Midivs.DigitalAudio-MultimediaSystemSoundsAudio File Formats - Vaughan's Law of Multimedia Minimums - Adding SoundtoMultimediaProject	12	C2
III	Animation:The Power of Motion-Principles of Animation-Animation by Computer - Making Animations that Work. Video: Using Video - Working with Video and Displays-DigitalVideoContainers-ObtainingVideo Clips -ShootingandEditingVideo	12	C3
IV	Making Multimedia: The Stage of Multimedia Project - The Intangible Needs -The Hardware Needs - The Software Needs - An Authoring Systems Needs-MultimediaProductionTeam.	12	C4
V	PlanningandCosting:TheProcessofMakingMultimedia-Scheduling-Estimating - RFPs and Bid Proposals. Designing and Producing - Content andTalent:AcquiringContent-OwnershipofContentCreatedforProject-AcquiringTalent	12	C5
	Total	**60**	

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	understand the concepts, importance, application and the process of developing multimedia	PO1
2	to have basic knowledge and understanding about image related processings	PO1, PO2
3	To understand the framework of frames and bit images to animations	PO4, PO6
4	Speaks about the multimedia projects and stages of requirement in phases of project.	PO4, PO5, PO6
5	Understanding the concept of cost involved in multimedia planning, designing, and producing	PO3, PO8

Text Book	
1	TayVaughan,"Multimedia:MakingItWork",8thEdition,Osborne/McGraw-Hill,2001.
Reference Books	
1.	RalfSteinmetz&KlaraNahrstedt"MultimediaComputing,Communication& Applications",PearsonEducation,2012.
Web Resources	
1.	https://www.geeksforgeeks.org/multimedia-systems-with-features-or-characteristics/

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO 1	S							
CO 2	M	S						
CO 3				S		S		
CO 4				S	S	M		
CO 5			S					S

S-Strong M-Medium L-Low

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
SEC	**Advanced Excel**	Specific Elective	Y	-	-	-	2	2	25	75	100
Course Objective											
C1	Handle large amounts of data										
C2	Aggregate numeric data and summarize into categories and subcategories										
C3	Filtering, sorting, and grouping data or subsets of data										
C4	Create pivot tables to consolidate data from multiple files										
C5	Presenting data in the form of charts and graphs										

UNIT	Details	No. of Hours	Course Objective
I	Basics of Excel- Customizing common options- Absolute and relative cells- Protecting and un-protecting worksheets and cells- Working with Functions - Writing conditional expressions - logical functions - lookup and reference functions- VlookUP with Exact Match, Approximate Match- Nested VlookUP with Exact Match- VlookUP with Tables, Dynamic Ranges- Nested VlookUP with Exact Match- Using VLookUP to consolidate Data from Multiple Sheets	6	C1
II	Data Validations - Specifying a valid range of values - Specifying a list of valid values- Specifying custom validations based on formula - Working with Templates Designing the structure of a template- templates for standardization of worksheets - Sorting and Filtering Data -Sorting tables- multiple-level sorting- custom sorting- Filtering data for selected view - advanced filter options- Working with Reports Creating subtotals- Multiple-level subtotal.	6	C2
III	Creating Pivot tables Formatting and customizing Pivot tables- advanced options of Pivot tables- Pivot charts- Consolidating data from multiple sheets and files using Pivot tables- external data sources- data consolidation feature to consolidate data- Show Value As % of Row, % of Column, Running Total, Compare with Specific Field- Viewing Subtotal under Pivot- Creating Slicers.	6	C3
IV	More Functions Date and time functions- Text functions- Database functions- Power Functions - Formatting Using auto formatting option for worksheets- Using conditional formatting option for rows, columns and cells- WhatIf Analysis - Goal Seek- Data Tables- Scenario Manager.	6	C4
V	Charts - Formatting Charts- 3D Graphs- Bar and Line Chart together- Secondary Axis in Graphs- Sharing	6	C5

	Charts with PowerPoint / MS Word, Dynamically-New Features Of Excel Sparklines, Inline Charts, data Charts- Overview of all the new features.		
	Total	**30**	

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Work with big data tools and its analysis techniques.	PO1
2	Analyze data by utilizing clustering and classification algorithms.	PO1, PO2
3	Learn and apply different mining algorithms and recommendation systems for large volumes of data.	PO4, PO6
4	Perform analytics on data streams.	PO4, PO5, PO6
5	Learn NoSQL databases and management.	PO3, PO8

Text Book	
1	**Excel 2019 All**
2	**Microsoft Excel 2019 Pivot Table Data Crunching**
Web Resources	
1.	https://www.simplilearn.com
2	https://www.javatpoint.com
3	https://www.w3schools.com

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO 1	S							
CO 2	M	S						
CO 3				S		S		
CO 4				S	S	M		
CO 5			S					S

S-Strong M-Medium L-Low

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
EC-GS	Digital Logic Fundamentals	Elect	4	-	-		3	25	75	100

Learning Objectives	
LO1	ItaimstotrainthestudenttothebasicconceptsofDigitalComputerFundamentals
LO2	Toimpart the in-depth knowledge of logic gates, Boolean algebra,combinationalcircuitsandsequentialcircuits.

UNIT	Contents	No. Of. Hours
I	NumberSystemsandCodes:NumberSystem–BaseConversion – BinaryCodes – Code Conversion. Digital Logic: Logic Gates – Truth Tables – UniversalGates.	12
II	Boolean Algebra: Laws and Theorems – SOP, POS Methods – Simplification ofBooleanFunctions– UsingTheorems,K-Map,Prime–ImplicantMethod–Binary Arithmetic: Binary Addition – Subtraction – Various Representations ofBinaryNumbers– ArithmeticBuildingBlocks–Adder–Subtractor.	12
III	Combinational Logic: Multiplexers – Demultiplexers – Decoders – Encoders –CodeConverters– ParityGeneratorsandCheckers.	12
IV	SequentialLogic:RS,JK,D,andTFlip-Flops–Master-Slave Flip-Flops.Registers:ShiftRegisters–TypesofShiftRegisters.	12
V	Counters: Asynchronous and Synchronous Counters - Ripple, Mod, Up-DownCounters– Ring Counters. Memory: Basic Terms and Ideas –Types of ROMs –TypesofRAMs.	12
Total hours		60

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Identify the logic gates and their functionality.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Perform number conversions from one system to another system	PO1, PO2, PO3, PO4, PO5, PO6

CO3	Understand the functions of combinational circuits	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Perform number conversions	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Perform Counter design and learn its operations	PO1, PO2, PO3, PO4, PO5, PO6
Textbooks		
1	V.RajaramanandT.Radhakrishnan,*Digital Computer Design*, Prentice HallofIndia,2001	
2	D.P.LeachandA.P.Malvino,*DigitalPrinciplesandApplications*–TMH–FifthEdition–2002	
3	M.MorisMano,*DigitalLogicandComputerDesign*,PHI,2001	
4	T.C.Bartee,*DigitalComputerFundamentals*,6th Edition,TataMcGrawHill,1991	
Web Resources		
1.	Web resources from NDL Library, E-content from open-source libraries	

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Marks**		
								CIA	**External**	**Total**
EC-GS	Numerical Methods	**Elect**	4	-	-		3	25	75	100

Learning Objectives		
LO1	To introduce the various topics in Numerical methods.	
LO2	To make understand the fundamentals of algebraic equations.	
LO3	To apply interpolation and approximation on examples.	
LO4	To solve problems using numerical differentiation and integration	
LO5	To solve linear systems, numerical solution of ordinary differential equations.	
UNIT	**Contents**	**No. Of. Hours**
I	FUNDAMENTALS OF ALGEBRAIC EQUATION: Solution of algebraic and transcendental equations-Bisection method – Fixed point iteration method – Newton Raphson method –linear system of	**12**

	equations – Gauss elimination method – Gauss Jordan method .	
II	ITERATIVE, INTERPOLATION AND APPROXIMATION: Iterative methods - Gauss Jacobi and Gauss Seidel – Eigen values of a matrix by Power method and Jacobi's method for symmetric matrices. Interpolation with unequal intervals – Lagrange's interpolation – Newton's divided difference interpolation	**12**
III	INTERPOLATION WITH EQUAL INTERVAL: Difference operators and relations. -Interpolation with equal intervals – Newton's forward and backward difference formulae.	**12**
IV	NUMERICAL DIFFERENTIATION AND INTEGRATION: Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal, Simpson's 1/3 rule	**12**
V	INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS: Single step methods – Taylor's series method – Euler's method – Modified Euler's method - RungeKutta method for solving(first, second , Third and 4th) order equations – Multi step methods	**12**
Total hours		**60**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Know how to solve various problems on numerical methods	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Use approximation to solve problems	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Differentiation and integration concept are applied	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Apply , direct methods for solving linear systems	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Numerical solution of ordinary differential equations	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks	
1	Numerical Methods, Second Edition, S.Arumugam, A.ThangapandiIssac, A.Somasundaram, SCITECH publications, 2009.
Reference Books	
1.	Mathews J.H. Numerical Method for Maths, Science and Engineering; PHI, New Delhi, 2001
2.	Iqbal H. Khan & Q. Hassan Numerical Methods for Engineers and Scientist - Galgotia Publications (P) Ltd., New Delhi – 1997
3.	M.K. Jain, S.R.K. Iyengar&R.K.Jain - Numerical Methods for Scientific and Engineering Computation - New Age International(P) Ltd., New Delhi – 1996.
Web Resources	
1.	Web resources from NDL Library, E-content from open-source libraries

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst.	Marks		
									CIA	External	Total
SEC	**WEB DESIGNING**	Specific Elective	Y	-	-	-	2	2	25	75	100

Course Objective	
C1	Understand the basics of HTML and its components
C2	To study about the Graphics in HTML
C3	Understand and apply the concepts of XML and DHTML
C4	Understand the concept of JavaScript
C5	To identify and understand the goals and objectives of the Ajax

UNIT	Details	No. of Hours	Course Objective
I	HTML: HTML-Introduction-tag basics- page structure-adding comments working with texts, paragraphs and line break. Emphasizing test- heading and horizontal rules-list-font size,		

	face and color-alignment links-tables-frames.	6	C1
II	Forms & Images Using Html: Graphics: Introduction-How to work efficiently with images in web pages, image maps, GIF animation, adding multimedia, data collection with html forms textbox, password, list box, combo box, text area, tools for building web page front page.	6	C2
III	XML & DHTML: Cascading style sheet (CSS)-what is CSS-Why we use CSS-adding CSS to your web pages-Grouping styles-extensible markup language (XML).	6	C3
IV	Dynamic HTML: Document object model (DCOM)-Accessing HTML & CSS through DCOM Dynamic content styles & positioning-Event bubbling-data binding. JavaScript: Client-side scripting, What is JavaScript, How to develop JavaScript, simple JavaScript, variables, functions, conditions, loops and repetition,	6	C4
V	Advance script, JavaScript and objects, JavaScript own objects, the DOM and web browser environments, forms and validations.	6	C5
	Total	**60**	

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Develop working knowledge of HTML	PO1, PO3, PO6, PO8
2	Ability to Develop and publish Web pages using Hypertext Markup Language (HTML).	PO1,PO2,PO3,PO6
3	Ability to optimize page styles and layout with Cascading Style Sheets (CSS).	PO3, PO5
4	Ability to develop a java script	PO1, PO2, PO3, PO7
5	An ability to develop web application using Ajax.	P02, PO6, PO7

Text Book	
1	Pankaj Sharma, “Web Technology”, SkKataria& Sons Bangalore 2011.
2	Mike Mcgrath, “Java Script”, Dream Tech Press 2006, 1st Edition.
3	Achyut S Godbole&AtulKahate, “Web Technologies”, 2002, 2nd Edition.

Reference Books	
1.	Laura Lemay, RafeColburn , Jennifer Kyrnin, “Mastering HTML, CSS &Javascript Web Publishing”, 2016.
2.	DT Editorial Services (Author), “HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)”, Paperback 2016, 2nd Edition.

Web Resources

1.	NPTEL & MOOC courses titled Web Design and Development.
2.	https://www.geeksforgeeks.org

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO 1	S		M			L		M
CO 2	S	M	L			M		
CO 3			S		M			
CO 4	S	M	M				L	
CO 5		M				L	M	

S-Strong M-Medium L-Low

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
SEC	**Biometrics**	Specific Elective	Y	-	-	-	2	2	25	75	100

Course Objectives	
CO1	Identify the various biometric technologies.
CO2	Design of biometric recognition.
CO3	Develop simple applications for privacy
CO4	Understand the need of biometric in the society
CO5	Understand the scope of biometric techniques

UNIT	**Details**	**No. of Hours**	**Course Objectives**
I	**Introduction**: What is Biometrics, History,Types of biometric Traits, General architecture of biometric	6	CO1

	systems, Basic working of biometric matching, Biometric system error and performance measures, Design of biometric system, Applications of biometrics, Biometrics versus traditional authentication methods. **Face Biometrics:** Introduction, Background of Face Recognition, Design of Face Recognition System, Neural Network for Face Recognition, Face Detection in Video Sequences, Challenges in Face Biometrics, .7 Face Recognition Methods, Advantages and Disadvantages.		
II	**Retina and Iris Biometrics:** Introduction, Performance of Biometrics, Design of Retina Biometrics, Design of Iris Recognition System, Iris Segmentation Method , Determination of Iris Region, Determination of Iris Region, Applications of Iris Biometrics, Advantages and Disadvantages **Vein and Fingerprint Biometrics:** Introduction, Biometrics Using Vein Pattern of Palm, Fingerprint Biometrics, Fingerprint Recognition System, Minutiae Extraction, Fingerprint Indexing, Experimental Results, Advantages and Disadvantages.	6	CO2
III	**Privacy Enhancement Using Biometrics:** Introduction, Privacy Concerns Associated with Biometric Deployments, Identity and Privacy, Privacy Concerns, Biometrics with Privacy Enhancement, Comparison of Various Biometrics in Terms of Privacy, Soft Biometrics. **Multimodal Biometrics:** Introduction to Multimodal Biometrics , Basic Architecture of Multimodal Biometrics, Multimodal Biometrics Using Face and Ear, Characteristics and Advantages of Multimodal Biometrics, Characteristics and Advantages of Multimodal Biometrics.	6	CO3
IV	**WatermarkingTechniques:** Introduction, Data Hiding Methods, Basic Framework of Watermarking, Classification of Watermarking, Applications of Watermarking, Attacks on Watermarks, Performance Evaluation, Characteristics of Watermarks, General	6	CO4

	Watermarking Process, Image Watermarking Techniques, Watermarking Algorithm, Experimental Results, Effect of Attacks on Watermarking Techniques, Attacks on Spatial Domain Watermarking.		
V	**Scope and Future:** Scope and Future Market of Biometrics, Biometric Technologies, Applications of Biometrics, Biometrics and Information Technology Infrastructure, Role of Biometrics in Enterprise Security, Role of Biometrics in Border Security, Smart Card Technology and Biometrics, Radio Frequency Identification (RFID) Biometrics, DNA Biometrics, Comparative Study of Various Biometric Techniques. **Biometric Standards:** Introduction, Standard Development Organizations, Application Programming Interface (API), Information Security and Biometric Standards, Biometric Template Interoperability.	6	CO5
	Total	**30**	

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	To understand the basic concepts and the functionality of the Biometrics, Face Biometrics, Types, Architecture and Applications.	PO1, PO3, PO6, PO8
CO2	To know the concepts Retina and Iris Biometrics and Vein and Fingerprint Biometrics.	PO1,PO2,PO3,PO6
CO3	To analyse the Privacy Enhancement and Multimodal Biometrics.	PO3, PO5
CO4	To get analytical idea on Water marking Techniques	PO1, PO2, PO3, PO7
CO5	To Gain knowledge on Future scope of Biometrics,and Study of various Biometric Techniques.	PO2, PO6, PO7

Recommended Text	
1.	Biometrics: Concepts and Applications by G.R Sinha and SandeepB.Patil , Wiley, 2013

References Books	
1.	Guide to Biometrics by Ruud M. Bolle , SharathPankanti, Nalinik.Ratha, Andrew W.Senior, Jonathan H. Connell , Springer 2009
2.	Introduction to Biometrics by Anil k. Jain, Arun A. Ross, KarthikNandakumar
3.	Hand book of Biometrics by Anil K. Jain, Patrick Flynn, ArunA.Ross.
Web Resources	
1.	https://www.tutorialspoint.com/biometrics/index.htm
2.	https://www.javatpoint.com/biometrics-tutorial
3.	https://www.thalesgroup.com/en/markets/digital-identity-and-security/government/inspired/biometrics

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	S		M			L		M
CO 2	S	M	L			M		
CO 3			S		M			
CO 4	S	M	M				L	
CO 5		M				L	M	

S-Strong M-Medium L-Low

INTERNET OF THINGS AND ITS APPLICATIONS

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
EC-DS	**Internet of Things and Its Application**	Elect	4	-	-	-	3	4	25	75	100

Course Objective	
C1	Use of Devices, Gateways and Data Management in IoT.
C2	Design IoT applications in different domain and be able to analyze their performance
C3	Implement basic IoT applications on embedded platform
C4	To gain knowledge on Industry Internet of Things
C5	To Learn about the privacy and Security issues in IoT

UNIT	Details	No. of Hours	Course

			Objective
I	IoT& Web Technology, The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.	12	C1
II	M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.	12	C2
III	**:** IoT Architecture -State of the Art – Introduction, State of the art, Architecture. Reference Model-Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture-Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views	12	C3

IV	IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and GasIndustry, Opinions on IoT Application and Value for Industry, Home Management	12	C4
V	Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security	12	C5
	Total	**60**	

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Work with big data tools and its analysis techniques.	PO1
2	Analyze data by utilizing clustering and classification algorithms.	PO1, PO2
3	Learn and apply different mining algorithms and recommendation systems for large volumes of data.	PO4, PO6
4	Perform analytics on data streams.	PO4, PO5, PO6
5	Learn NoSQL databases and management.	PO3, PO8

Text Book

1. Vijay Madisetti and ArshdeepBahga, "Internet of Things: (A Hands-on Approach)", Universities Press (INDIA) Private Limited 2014, 1st Edition.

Reference Books

1. Michael Miller, "The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World", kindle version.
2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to

	Connecting Everything", Apress Publications 2013, 1st Edition,.
3	WaltenegusDargie, ChristianPoellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice" 4..CunoPfister, "Getting Started with the Internet of Things", O"Reilly Media 2011
Web Resources	
1.	https://www.simplilearn.com
2.	https://www.javatpoint.com
3.	https://www.w3schools.com

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO 1	S							
CO 2	M	S						
CO 3				S		S		
CO 4				S	S	M		
CO 5			S					S

S-Strong M-Medium L-Low

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
SEC	**Cyber Forensics**	Specific Elective	Y	-	-	-	2	2	25	75	100
Course Objective											
C1	Understand the definition of computer forensics fundamentals.										
C2	To study about the Types of Computer Forensics Evidence										

C3	Understand and apply the concepts of Duplication and Preservation of Digital Evidence		
C4	Understand the concepts of Electronic Evidence and Identification of Data		
C5	To study about the Digital Detective, Network Forensics Scenario, Damaging Computer Evidence.		
UNIT	**Details**	**No. of Hours**	**Course Objective**
I	**Overview of Computer Forensics Technology:** Computer Forensics Fundamentals: What is Computer Forensics? Use of ComputerForensics in Law Enforcement, Computer Forensics Assistance to HumanResources/Employment Proceedings, Computer Forensics Services, Benefits of professionalForensics Methodology, Steps taken by Computer Forensics Specialists. Types of Computer.Forensics Technology: Types of Business Computer Forensic, Technology–Types ofMilitary Computer Forensic Technology–Types of Law Enforcement–Computer Forensic. Technology–Types of Business Computer Forensic Technology.	6	C1
II	**Computer Forensics Evidence and capture:** Data Recovery: Data Recovery Defined, Data Back–up and Recovery, The Role of Back –up in Data Recovery, The Data –Recovery Solution. Evidence Collection and Data Seizure: Collection Options, Obstacles, Types of Evidence, The Rules of Evidence, Volatile Evidence, General Procedure, Collection and Archiving, Methods of Collections, Artefacts, Collection Steps, Controlling Contamination: The chain of custody.	6	C2
IV	**Computer Forensics Analysis:** Discovery of Electronic Evidence: ElectronicDocument Discovery: A Powerful New Litigation Tool. Identification of		C4

	Data: Time Travel, Forensic Identification and Analysis of Technical Surveillance Devices.	6	
V	**Reconstructing Past Events:** How to Become a Digital Detective, Useable File Formats,Unusable File Formats, Converting Files.Networks: Network Forensics Scenario, a technical approach, Destruction Of E–Mail, Damaging Computer Evidence, DocumentingThe Intrusion on Destruction of Data, System Testing.	6	C5
	Total	**30**	
Course Outcomes		**Programme Outcomes**	
CO	On completion of this course, students will		
1	Understand the definition of computer forensics fundamentals.	PO1	
2	Evaluate the different types of computer forensics technology.	PO1, PO2	
3	Analyze various computer forensics systems.	PO4, PO6	
4	Apply the methods for data recovery, evidence collection and data seizure.	PO4, PO5, PO6	
5	Gain your knowledge of duplication and preservation of digital evidence.	PO3, PO8	
Text Book			
1	John R. Vacca, "Computer Forensics: Computer Crime Investigation", 3/E ,Firewall Media, New Delhi, 2002.		
Reference Books			
1.	Nelson, Phillips Enfinger, Steuart,"Computer Forensics and Investigations" Enfinger, Steuart, CENGAGE Learning, 2004.		
2.	Anthony Sammes and Brian Jenkinson,"Forensic Computing: A Practitioner's Guide", Second Edition, Springer–Verlag London Limited, 2007.		
3.	.Robert M.Slade," Software Forensics Collecting Evidence from the Scene of a Digital		

	Crime", TMH 2005.
Web Resources	
1.	https://www.vskills.in
2.	https://www.hackingarticles.in/best-of-computer-forensics-tutorials/

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO 1	S							
CO 2	M	S						
CO 3				S		S		
CO 4				S	S	M		
CO 5			S					S

S-Strong M-Medium L-Low

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
SEC	**SoftwareTesting**	Specific Elective	Y	-	-	-	2	2	25	75	100

Course Objective	
C1	To study fundamental concepts in software testing
C2	To discuss various software testing issues and solutions in software unit test, integration and system testing.
C3	To study the basic concept of Data flow testing and Domain testing.
C4	To Acquire knowledge on path products and path expressions.
C5	To learn about Logic based testing and decision tables

UNIT	**Details**	**No. of Hours**	**Course**

			Objective
I	Introduction: Purpose–Productivity and Quality in Software–TestingVsDebugging–Model for Testing–Bugs–Types of Bugs – Testing and Design Style.	6	C1
II	Flow / Graphs and Path Testing – Achievable paths – Path instrumentation Application Transaction FlowTesting Techniques.	6	C2
III	Data Flow Testing Strategies - Domain Testing:Domains and Paths – Domains and Interface Testing.	6	C3
IV	Linguistic –Metrics – Structural Metric – Path Products and Path Expressions.SyntaxTesting–Formats–Test Cases	6	C4
V	Logic Based Testing–Decision Tables–Transition Testing–States, State Graph, StateTesting.	6	C5
	Total	**30**	

Course Outcomes		**Program Outcomes**
CO	On completion of this course, students will	
1	Students learn to apply software testing knowledge and engineering methods	PO1
2	Have an ability to identify the needs of software test automation, and define and develop a test tool to support test automation.	PO1, PO2
3	Have an ability understand and identify various software testing problems, and solve these problems by designing and selecting software test models, criteria, strategies, and methods.	PO4, PO6
4	Have basic understanding and knowledge of contemporary issues in software testing, such as component-based software testing problems	PO4, PO5, PO6
5	Have an ability to use software testing methods and modern software testing tools for their testing projects.	PO3, PO8

Text Book

1	B.Beizer,“SoftwareTestingTechniques”,IIEdn.,DreamTechIndia,NewDelhi, 2003.
2	K.V.K.Prasad,“SoftwareTestingTools”,DreamTech.India,NewDelhi,2005

Reference Books	
1.	I.Burnstein,2003,"PracticalSoftwareTesting",SpringerInternationalEdn.
2.	E. Kit, 1995, "Software Testing in the Real World: Improving the Process", PearsonEducation,Delhi.
3.	R. Rajani,andP.P.Oak,2004,"SoftwareTesting",TataMcgrawHill,New Delhi.
Web Resources	
1.	https://www.javatpoint.com/software-testing-tutorial
2.	https://www.guru99.com/software-testing.html

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO 1	S							
CO 2	M	S						
CO 3				S		S		
CO 4				S	S	M		
CO 5			S					S

S-Strong M-Medium L-Low

BIG DATA ANALYTICS

Subject Code	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
								CIA	**External**	**Total**
EC-DS	Elective	4	-	-	-	3	5	25	75	100

Course Objective	
C1	Understand the Big Data Platform and its Use cases, Map Reduce Jobs
C2	To identify and understand the basics of cluster and decision tree
C3	To study about the Association Rules,Recommendation System
C4	To learn about the concept of stream
C5	Understand the concepts of NoSQL Databases

UNIT	Details	No. of Hours
I	**Data Explosion and Big Data Analytics**: An Overview: Introduction, Evolution of Database Technology and Big Data, Elements of Big Data, Big Data System Components, Big Data Analytics – Data Analytics. Types of Big Data Analytics, Applications of Big Data Technology, Challenges and Skills required with Big Data Technology.	12
II	**Analytical Theory:** Introduction about Classification Algorithms, Regression Techniques, Domain Specific Analytic Techniques: In Database Analytics, Text Analytics. **Real – Time Analysis:** Introduction: Real-time System, Types of Real-time System, Characteristics of Real-time Systems, Real-time Processing Systems for Big Data: Introduction, Data Integration and Analytics, Big Data Engine-Hadoop, Real-time System Architecture, Real-time Data Analytics.	12
III	**Big Data: Hardware, Technology Foundations**: Introduction, Big Data Stack, Virtualization and Big Data. **Understanding NoSQL and Hadoop Ecosystem**: Introduction, NoSQL: CouchDB, MongoDB, Hadoop Ecosystem – HDFS, HBase, Yarn.	12
IV	**High Dimensional Data: A Big Data Perspective:** Introduction – What is Dimensionality? Dimensionality Reduction: Approaches for Dimensionality Reduction, Dimensionality Reduction Techniques. **User Interface and Visualization:** Desirable Properties, Visualization Techniques. **R Programming Basics:** Introduction, Data Types, Data Structures and Operators – Basic Data Types in R, R Operators, Vectors, List, Factor, Arrays and Matrix, Data Frame, R Programming Structure – Control Statements of R: if, if-else, if-else ladder, Switch-Case, Return, Loops and	12

	Loop Control Statements.	
V	R Programming: Input / Output: Import and Export Data, Handling Missing Values, Statistical Functions and Models of R, R Graphics and Data Visualization. Case Study: K Means Clustering Algorithm Implementations, Decision Tree Algorithm Implementations, Association Rule Mining Algorithm Implementations, Naïve Bayes Classification Algorithm Implementation, Build the Regression models, Constructing Directed Graph using Adjacency matrix.	12
	Total	**60**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Work with big data tools and its analysis techniques.	PO1
2	Analyze data by utilizing clustering and classification algorithms.	PO1, PO2
3	Learn and apply different mining algorithms and recommendation systems for large volumes of data.	PO4, PO6
4	Perform analytics on data streams.	PO4, PO5, PO6
5	Learn NoSQL databases and management.	PO3, PO8

Text Book

Big Data Analytics – Concepts, Techniques, Tools and Technologies – First Edition, Thangaraj, S. Suguna, G. Sudha, PHI Learning Private Limited, Delhi,2022.

Unit I : Chapter 1

Unit II : Chapter 2.2.2, 2.2.4, 2.3.2, 2.3.2

Chapter 3 (3.1.1, 3.1.2, 3.2, 3.3.1 – 3.3.4, 3.4)

Unit III : Chapter 4 (4.1 – 4.3)

	Chapter 5 (5.1, 5.2, 5.3.1 - 5.3.3) **Unit IV: Chapter 6.1, 6.3** **Chapter 7.3** **Chapter 8 (8.1 – 8.3)** **Unit V : Chapter 8 (8.4 – 8.7)**
Reference Books	
	1. Data Mining Concepts and Techniques – Jiawei Han, MichelineKamber& Jain Pei, Morgan Kaufmann Publishers, Third edition 2012. 2. DT Editorial Services, *Big Data Black Book: Covers Hadoop 2, MapReduce, Hive, Yarn, Pig, R and Data Visualization*, Publisher: Dreamtech Press India Pvt. Ltd, January 2016. 3. Krishna Rungta (R-tutorial), *Learn R Programming in 1 Day (Complete Guide for Beginners)*, 1st Edition, 2019. 4. Insight into Data mining Theory and Practice, K.P. Soman, ShyamDiwakar and V. Ajay, Easter Economy Edition, Prentice Hall of India, 2006. 5. Introduction to Data Mining with Case Studies, G. K. Gupta, Easter Economy Edition, Prentice Hall of India, 2006
Web Resources	
1.	https://www.simplilearn.com
2.	https://www.sas.com/en_us/insights/analytics/big-data-analytics.html

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO 1	S							
CO 2	M	S						
CO 3				S		S		
CO 4				S	S	M		

CO 5			S					S

S-Strong M-Medium L-Low

CRYPTOGRAPHY

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
EC-DS	**Cryptography**	**Elect**	4	-	-	-	3	25	75	100

Learning Objectives	
LO1	To understand the fundamentals of Cryptography
LO2	To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
LO3	To understand the various key distribution and management schemes.
LO4	To understand how to deploy encryption techniques to secure data in transit across data networks
LO5	To design security applications in the field of Information technology

UNIT	**Contents**	**No. Of. Hours**
I	**Introduction:** The OSI security Architecture – Security Attacks – Security Mechanisms – Security Services – A model for network Security.	**12**
II	**Classical Encryption Techniques:** Symmetric cipher model – **Substitution Techniques:** Caesar Cipher – Monoalphabetic cipher – Play fair cipher – Poly Alphabetic Cipher – Transposition techniques – Stenography	**12**
III	**Block Cipher and DES:** Block Cipher Principles – DES – The Strength of DES –**RSA:** The RSA algorithm.	**12**
IV	**Network Security Practices**: IP Security overview - IP Security architecture – Authentication Header. **Web Security**: SecureSocketLayerand Transport Layer Security – Secure Electronic Transaction.	**12**
V	Intruders – Malicious software – Firewalls.	**12**
	TOTAL HOURS	**60**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Analyze the vulnerabilities in any computing system and hence be able to design a security solution.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Apply the different cryptographic operations of symmetric cryptographic algorithms	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Apply the different cryptographic operations of public key cryptography	PO1, PO2, PO3, PO4, PO5, PO6

CO4	Apply the various Authentication schemes to simulate different applications.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Understand various Security practices and System security standards	PO1, PO2, PO3, PO4, PO5, PO6
Textbooks		
1	**William Stallings,** "Cryptography and Network Security Principles andPractices".	
Reference Books		
1.	**Behrouz A. Foruzan,** "Cryptography and Network Security", Tata McGraw-Hill, 2007.	
2	**AtulKahate**, "*Cryptography and Network Security*", Second Edition, 2003,TMH.	
3	**M.V. Arun Kumar**, "*NetworkSecurity*", 2011, First Edition,USP.	
	Web Resources	
1	https://www.tutorialspoint.com/cryptography/	
2	https://gpgtools.tenderapp.com/kb/how-to/introduction-to-cryptography	

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	2	3	2
CO 2	3	2	3	2	3	3
CO 3	3	3	3	2	3	3
CO 4	2	3	3	3	2	3
CO 5	3	2	3	3	3	3
Weightage of course contributed to each PSO	14	13	15	12	14	14

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
EC-DS	**Artificial Intelligence**	Elective	-	Y	-	-	3	4	25	75	100

Course Objective		
C1	To learn various concepts of AI Techniques.	
C2	To learn various Search Algorithm in AI.	
C3	To learn probabilistic reasoning and models in AI.	
C4	To learn about Markov Decision Process.	
C5	To learn various type of Reinforcement learning.	
UNIT	**Details**	**No. of Hours**
I	Introduction: Concept of AI, history, current status, scope, agents, environments, Problem Formulations, Review of tree and graph structures, State space representation, Search graph and Search tree	12
II	Search Algorithms : Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, Best first search, A* algorithm, Game Search	12
III	Probabilistic Reasoning : Probability, conditional probability, Bayes Rule, Bayesian Networks- representation, construction and inference, temporal model, hidden Markov model.	12
IV	Markov Decision process : MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs.	12
V	Reinforcement Learning : Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning- Q learning	12
	Total	**60**

Course Outcomes		Programme Outcome
CO	On completion of this course, students will	
1	Understand the various concepts of AI Techniques.	PO1
2	Understand various Search Algorithm in AI.	PO1, PO2
3	Understand probabilistic reasoning and models in AI.	PO4, PO6
4	Understand Markov Decision Process.	PO4, PO5, PO6
5	Understand various type of Reinforcement learning	PO3, PO8

	Techniques.	
Text Book		
1	Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach" , 3rd Edition, Prentice Hall.	
	Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill	
Reference Books		
1.	Trivedi, M.C., "A Classical Approach to Artifical Intelligence", Khanna Publishing House, Delhi.	
2.	SarojKaushik, "Artificial Intelligence", Cengage Learning India, 2011	
3.	David Poole and Alan Mackworth, "Artificial Intelligence: Foundations for Computational Agents", Cambridge University Press 2010	
Web Resources		
1.	NPTEL&MOOCcoursestitledArtificialIntelligenceandExpertSystems	
2.	https://nptel.ac.in/courses/106106140/	
3.	**https://nptel.ac.in/courses/106106126/**	

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO 1	**S**							
CO 2	**S**	**S**						
CO 3				**S**		**S**		
CO 4				**S**	**S**	**S**		
CO 5			**S**					**S**

S-Strong M-Medium L-Low

Subject	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**C**	**I**	**Marks**

Code									CIA	External	Total
EC-DS	**Computational Intelligence**	Elective	Y	-	-	-	3	4	25	75	100

Course Objective	
C1	To identify and understand the basics of AI and its search.
C2	To study about the Fuzzy logic systems.
C3	Understand and apply the concepts of Neural Network and its functions.
C4	Understand the concepts of Artifical Neural Network
C5	To study about the Genetic Algorithm.

UNIT	Details	No. of Hours	Course Objective
I	**Introduction to AI**: Problem formulation – AI Applications – Problems – State Space and Search – Production Systems – Breadth First and Depth First – Travelling Salesman Problem – Heuristic search techniques: Generate and Test – Types of Hill Climbing.	12	C1
II	**Fuzzy Logic Systems:** Notion of fuzziness – Operations on fuzzy sets – T-norms and other aggregation operators – Basics of Approximate Reasoning – Compositional Rule of Inference – Fuzzy Rule Based Systems – Schemes of Fuzzification – Inferencing – Defuzzification – Fuzzy Clustering – fuzzy rule-based classifier.	12	C2
III	**Neural Networks:** What is Neural Network, Learning rules and various activation functions, Single layer Perceptions, Back Propagation networks, Architecture of Backpropagation (BP) Networks, Back propagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications	12	C3
IV	**Artificial Neural Networks:** Fundamental Concepts – Basic Models of Artificial Neural Networks –	12	C4

	Important Terminologies of ANNs – McCulloch-Pitts Neuron – Linear Separability – Hebb Network.		
V	**Genetic Algorithm:** Introduction – Biological Background – Genetic Algorithm Vs Traditional Algorithm – Basic Terminologies in Genetic Algorithm – Simple GA – General Genetic Algorithm – Operators in Genetic Algorithm	12	C5
	Total	**60**	

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Describe the fundamentals of artificial intelligence concepts and searching techniques.	PO1
2	Develop the fuzzy logic sets and membership function and defuzzification techniques.	PO1, PO2
3	Understand the concepts of Neural Network and analyze and apply the learning techniques	PO4, PO6
4	Understand the artificial neural networks and its applications.	PO4, PO5, PO6
5	Understand the concept of Genetic Algorithm and Analyze the optimization problems using GAs.	PO3, PO8

Text Book	
1	S.N. Sivanandam and S.N. Deepa, “Principles of Soft Computing”, 2nd Edition, Wiley India Pvt. Ltd.
2	Stuart Russell and Peter Norvig, “Artificial Intelligence - A Modern Approach”, 2nd Edition, Pearson Education in Asia.
3	S. Rajasekaran, G. A. Vijayalakshmi, “Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications”, PHI.
Reference Books	
1.	F. Martin, Mcneill, and Ellen Thro, “Fuzzy Logic: A Practical approach”, AP Professional, 2000. Chin Teng Lin, C. S. George Lee,” Neuro-Fuzzy Systems”, PHI
2.	Chin Teng Lin, C. S. George Lee,” Neuro-Fuzzy Systems”, PHI.
Web Resources	
1.	https://www.javatpoint.com/artificial-intelligence-tutorial
2.	https://www.w3schools.com/ai/

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**

CO 1	S							
CO 2	M	S						
CO 3				S		S		
CO 4				S	S	M		
CO 5			S					S

S-Strong M-Medium L-Low

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
SEC	**Quantitative Aptitude**	Specific Elective	Y	-	-	-	2	2	25	75	100

Course Objective	
C1	To understand the basic concepts of numbers
C2	Understand and apply the concept of percentage, profit & loss
C3	To study the basic concepts of time and work, interests
C4	To learn the concepts of permutation, probability, discounts
C5	To study about the concepts of data representation, graphs

UNIT	**Details**	**No. of Hours**	**Course Objective**
I	Numbers-HCF and LCM of numbers-Decimal fractions-Simplification-Squareroot and cuberoots - Average-problems on Numbers.	6	CO1
II	Problems on Ages - Surds and Indices - percentage - profits and loss - ratio and proportion-partnership-Chainrule.	6	CO2
III	Time and work - pipes and cisterns - Time and Distance - problems on trains -Boats and streams - simple interest - compound interest - Logarithms - Area-Volume and surfacearea -races and	6	CO3

	Gamesofskill.		
IV	Permutation and combination-probability-True Discount-Bankers Discount – Height and Distances-Oddmanout& Series.	6	CO4
V	Calendar - Clocks - stocks and shares - Data representation - Tabulation –BarGraphs-Piecharts-Linegraphs.	6	CO5
	Total	**60**	
Course Outcomes		**Programme Outcome**	
CO	On completion of this course, students will		
1	understand the concepts, application and the problems of numbers	PO1	
2	To have basic knowledge and understanding about percentage, profit & loss related processings	PO1, PO2	
3	To understand the concepts of time and work	PO4, PO6	
4	Speaks about the concepts of probability, discount	PO4, PO5, PO6	
5	Understanding the concept of problem solving involved in stocks & shares, graphs	PO3, PO8	
Text Book			
1	“QuantitativeAptitude”,R.S.AGGARWAL.,S.Chand&CompanyLtd.,		
Reference Books			
1.			
Web Resources			
1.	https://www.javatpoint.com/aptitude/quantitative		
2.	https://www.toppr.com/guides/quantitative-aptitude/		

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO 1	S							
CO 2	M	S						

CO 3				S		S		
CO 4				S	S	M		
CO 5			S					S

S-Strong M-Medium L-Low