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*,6thEdition,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**	**Cat**	**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

APPENDIX – BG

MADURAI KAMARAJ UNIVERSITY

(University with Potential for Excellence)

B.Sc. INFORMATION TECHNOLOGY
(Semester Pattern)

CHOICE BASED CREDIT SYSTEMREVISED SYLLABUS
(With effect from 2023-24)

SCHEME OF EXAMINATIONS, REGULATIONS AND SYLLABUS

1. **CourseObjectives:**

   - To prepare the students to manage the software components in a computer independently and to be a Programmer.
   - To motivate the students to take up higher studies in Computer Science and other streams.

2. **EligibilityforAdmission:**

   A candidate should have studied +2 level Mathematics as one of the subjects in the 10 +2 stream.

3. **Durationof theCourse:**

   The students shall undergo the prescribed course of study for a period of notlessthan three academic year(Six semesters).

4. **MediumofInstruction:**English

5. **EligibilityfortheDegree:**
   - A Candidate shall be eligible for the award of the degree on completion of theprescribed course of study and passing all the prescribed externalexaminations.
   - Attendance progress, internal examinations, conduct certificate from the Head of theInstitutionshallberequiredfortakingtheexternalexamination.
   - The passing minimum and the ranking are as per the existing rule of the ChoiceBasedCreditSystemfortheaffiliatedcollegeoftheUniversity.

1. Introduction

B.Sc. Information Technology

Education is the key to development of any society. Role of higher education is crucial for securing right kind of employment and also to pursue further studies in best available world class institutes elsewhere within and outside India. Quality education in general and higher education in particular deserves high priority to enable the young and future generation of students to acquire skill, training and knowledge in order to enhance their thinking, creativity, comprehension and application abilities and prepare them to compete, succeed and excel globally. Learning Outcomes-based Curriculum Framework (LOCF) which makes it student-centric, interactive and outcome-oriented with well-defined aims, objectives and goals to achieve. LOCF also aims at ensuring uniform education standard and content delivery across the state which will help the students to ensure similar quality of education irrespective of the institute and location.

Information Technology is the study of quantity, structure, space and change, focusing on problem solving, application development with wider scope of application in science, engineering, technology, social sciences etc. throughout the world in last couple of decades and it has carved out a space for itself like any other disciplines of basic science and engineering. Computer science is a discipline that spans theory and practice and it requires thinking both in abstract terms and in concrete terms. Nowadays, practically everyone is a computer user, and many people are even computer programmers. Computer Science can be seen on a higher level, as a science of problem solving and problem solving requires precision, creativity, and careful reasoning. The ever-evolving discipline of computer science also has strong connections to other disciplines. Many problems in science, engineering, health care, business, and other areas can be solved effectively with computers, but finding a solution requires both computer science expertise and knowledge of the particular application domain. Computer science has a wide range of specialties. These include Computer Architecture, Software Systems, Graphics, Artificial Intelligence, Computational Science, and Software Engineering. Drawing from a common core of computer science knowledge, each specialty area focuses on specific challenges. Computer Science is practiced by mathematicians, scientists and engineers. Mathematics, the origins of Computer Science, provides reason and logic. Science provides the methodology for learning and refinement. Engineering provides the techniques for building hardware and software.

The Students completing this programme will be able to present Software application clearly and precisely, make abstract ideas precise by formulating them in the Computer languages. Completion of this programme will also enable the learners to join teaching profession, enhance their employability for government jobs, jobs in software industry, banking, insurance and investment sectors, data analyst jobs and jobs in various other public and private enterprises.

LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK GUIDELINES BASED REGULATIONS FOR UNDER GRADUATE PROGRAMME	
Programme:	**B.Sc., Information Technology**
Programme Code:	
Duration:	**3 years [UG]**
Programme Outcomes:	**PO1: Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study **PO2: Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups. **PO3: Critical thinking:** Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. **PO4: Problem solving: Capacity** to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations. **PO5: Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others;

	analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints. **PO6: Research-related skills**: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation **PO7: Cooperation/Team work:** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team **PO8: Scientific reasoning**: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective. **PO9: Reflective thinking**: Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society. **PO10 Information/digital literacy:** Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data. **PO 11 Self-directed learning**: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion. **PO 12 Multicultural competence:** Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups. **PO 13: Moral and ethical awareness/reasoning**: Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument

	about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demon starting the ability to identify ethical issues related to one‟s work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work. **PO 14: Leadership readiness/qualities:** Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way. **PO 15: Lifelong learning:** Ability to acquire knowledge and skills, including „learning how to learn‟, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.
Programme Specific Outcomes:	**PSO1**: To enable students to apply basic microeconomic, macroeconomic and monetary concepts and theories in real life and decision making. **PSO 2**: To sensitize students to various economic issues related to Development, Growth, International Economics, Sustainable Development and Environment. **PSO 3**: To familiarize students to the concepts and theories related to Finance, Investments and Modern Marketing. **PSO 4**: Evaluate various social and economic problems in the society and develop answer to the problems as global citizens. **PSO 5:** Enhance skills of analytical and critical thinking to analyze effectiveness of economic policies.

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
PSO 1	Y	Y	Y	Y	Y	Y	Y	Y
PSO 2	Y	Y	Y	Y	Y	Y	Y	Y
PSO3	Y	Y	Y	Y	Y	Y	Y	Y
PSO 4	Y	Y	Y	Y	Y	Y	Y	Y
PSO 5	Y	Y	Y	Y	Y	Y	Y	Y

3 – Strong, 2- Medium, 1- Low

Highlights of the Revamped Curriculum:

- Student-centric, meeting the demands of industry & society, incorporating industrial components, hands-on training, skill enhancement modules, industrial project, project with viva-voce, exposure to entrepreneurial skills, training for competitive examinations, sustaining the quality of the core components and incorporating application oriented content wherever required.
- The Core subjects include latest developments in the education and scientific front, advanced programming packages allied with the discipline topics, practical training, devising mathematical models and algorithms for providing solutions to industry / real life situations. The curriculum also facilitates peer learning with advanced mathematical topics in the final semester, catering to the needs of stakeholders with research aptitude.
- The General Studies and Mathematics based problem solving skills are included as mandatory components in the 'Training for Competitive Examinations' course at the final semester, a first of its kind.
- The curriculum is designed so as to strengthen the Industry-Academia interface and provide more job opportunities for the students.
- The Industrial Statistics course is newly introduced in the fourth semester, to expose the students to real life problems and train the students on designing a mathematical model to provide solutions to the industrial problems.
- The Internship during the second year vacation will help the students gain valuable work experience, that connects classroom knowledge to real world experience and to narrow down and focus on the career path.
- Project with viva-voce component in the fifth semester enables the student, application of conceptual knowledge to practical situations. The state of art technologies in conducting a Explain in a scientific and systematic way and arriving at a precise solution is ensured. Such innovative provisions of the industrial training,

project and internships will give students an edge over the counterparts in the job market.

- State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature are incorporated as Elective courses, covering conventional topics to the latest - Artificial Intelligence.

ValueadditionsintheRevampedCurriculum:

Semester	**NewlyintroducedComponents**	**Outcome/ Benefits**
I	**FoundationCourse** To ease the transition of learningfrom higher secondary to highereducation,providinganoverviewofthepedagogyoflearningLiteratureandanalysingtheworldthroughtheliterarylens givesrisetoanewperspective.	➢ Instill confidenceamongstudents ➢ Createinterestforthesubject
I,II,III,IV	**SkillEnhancementpapers**(Discipline centric /Generic/Entrepreneurial)	➢ Industry readygraduates ➢ Skilledhumanresource ➢ Studentsareequippedwithessentialskillsto makethememployable
		➢ Trainingonlanguageand communicationskillsenablethestudents gain knowledge and exposureinthecompetitiveworld.
		➢ Discipline centric skillwillimprovetheTechnical knowhow ofsolvingreallife problems.

III,IV,V& VI	Electivepapers	➢ Strengthening thedomainknowledge ➢ Introducing thestakeholdersto theState-of Arttechniquesfrom the streamsofmulti-disciplinary,crossdisciplinaryandinterdisciplinarynature ➢ Emerging topics inhigher education/industry/communicationnetwork/healthsectoretc.areintroducedwith Hands –on-training.
IV	ElectivePapers	➢ Exposuretoindustrymodulesstudentsintosolutionproviders ➢ GeneratesIndustryready graduates ➢ Employmentopportunitiesenhanced
VSemester	Electivepapers	➢ Self-learning isenhanced ➢ Applicationoftheconcepttorealsituationisconceivedresulting intangibleoutcome
VISemester	Electivepapers	➢ Enriches the studybeyondthe course. ➢ Developingaresearchframework and presenting their independent and intellectual ideas effectively.
ExtraCredits: ForAdvancedLearners/Honorsdegree		➢ Tocatertotheneedsofpeerlearners/research Aspirants
SkillsacquiredfromtheCourses	Knowledge, Problem Solving, Analytical ability,ProfessionalCompetency,ProfessionalCommunicationandTransferrable Skill	

Credit Distribution for UG Programmes

Sem I	Credit	Sem II	Credit	Sem III	Credit	Sem IV	Credit	Sem V	Credit	Sem VI	Credit
1.1. Language - Tamil	3	2.1. Language - Tamil	3	3.1. Language - Tamil	3	4.1. Language - Tamil	3	5.1 Core Course – \CC IX	4	6.1 Core Course – CC XIII	4
1.2 English	3	2.2 English	3	3.2 English	3	4.2 English	3	5.2 Core Course – CC X	4	6.2 Core Course – CC XIV	4
1.3 Core Course – CC I	5	2.3 Core Course – CC III	5	3.3 Core Course – CC V	5	4.3 Core Course – CC VII Core Industry Module	5	5. 3.Core Course CC -XI	4	6.3 Core Course – CC XV	4
1.4 Core Course – CC II	5	2.4 Core Course – CC IV	5	3.4 Core Course – CC VI	5	4.4 Core Course – CC VIII	5	5. 3.Core Course –/ Project with viva-voce CC -XII	4	6.4 Elective -VII Generic/ Discipline Specific	3
1.5 Elective I Generic/ Discipline Specific	3	2.5 Elective II Generic/ Discipline Specific	3	3.5 Elective III Generic/ Discipline Specific	3	4.5 Elective IV Generic/ Discipline Specific	3	5.4 Elective V Generic/ Discipline Specific	3	6.5 Elective VIII Generic/ Discipline Specific	3
1.6 Skill Enhancement Course SEC-1 (NME)	2	2.6 Skill Enhancement Course SEC-2 (NME)	2	3.6 Skill Enhancement Course SEC-4, (Entrepreneurial Skill)	1	4.6 Skill Enhancement Course SEC-6	2	5.5 Elective VI Generic/ Discipline Specific	3	6.6 Extension Activity	1
1.7 Skill Enhancement - (Foundation Course)	2	2.7 Skill Enhancement Course –SEC-3	2	3.7 Skill Enhancement Course SEC-5	2	4.7 Skill Enhancement Course SEC-7	2	5.6 Value Education	2	6.7 Professional Competency Skill	2
								5.5 Summer Internship /Industrial Training	2		
				3.8 E.V.S	-	4.8 E.V.S	2				
	23		**23**		**22**		**25**		**26**		**21**
	Total Credit Points										**140**

CREDIT DISTRIBUTION FOR B.ScInformation Technology

3 – Year UG Programme Credits Distribution			
		No. of Papers	**Credits**
Part I	Tamil(3 Credits)	4	12
Part II	English(3 Credits)	4	12
Part III	Core Courses	15	68
	Elective Courses :Generic / Discipline Specific (3 Credits)	8	24
		Total	**116**
Part IV	NME (2 Credits)	2	4
	Foundation Course	1	2
	Skill Enhancement Courses (6 courses) Entrepreneurial Skill -1 Professional Competency Skill Enhancement Course	6 1	11 2
	EVS (2 Credits)	1	2
	Value Education (2 Credits)	1	2
		Part IV Credits	**23**
Part V	Extension Activity (NSS / NCC / Physical Education)		1
		Total Credits for the UG Programme	**140**

Consolidated Semester wise and Component wise Credit distribution

Parts	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total Credits
Part I	3	3	3	3	-	-	12
Part II	3	3	3	3	-	-	12
Part III	13	13	13	13	22	18	92
Part IV	4	4	3	6	4	2	23
Part V	-	-	-	-	-	1	1
Total	23	23	22	25	26	21	**140**

***Part I. II, and Part III components will be separately taken into account for CGPA calculation and classification for the under graduate programme and the other components. IV, V has to be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree.**

MethodsofEvaluation		
Internal Evaluation	ContinuousInternalAssessmentTest	25 Marks
	Assignments	
	Seminars	
	AttendanceandClassParticipation	
External Evaluation	EndSemesterExamination	75 Marks
	Total	100 Marks
MethodsofAssessment		
Recall(K1)	Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions	
Understand/Comprehend(K2)	MCQ,True/False,Shortessays,Conceptexplanations,Shortsummaryor Overview	
Application (K3)	Suggestidea/conceptwithexamples,Suggestformulae, Solveproblems, Observe,Explain	
Analyze(K4)	Problem-solvingquestions,Finishaprocedureinmanysteps,Differentiate	
	betweenvariousideas,Mapknowledge	
Evaluate(K5)	Longer essay/Evaluationessay,Critiqueorjustifywithprosandcons	
Create(K6)	Checkknowledgeinspecificoroffbeatsituations,Discussion,Debatingor Presentations	

B.Sc INFORMATION TECHNOLOGYCURRICULUM

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-	English	3	6	25	75

II					
Part-III	CC1 – Programming in C	5	5	25	75
	CC2 – C programming Practical	5	5	25	75
	EC1 : Elective Course (Generic / Discipline Specific)	3	4	25	75
Part-IV	SEC-1 : Skill Enhancement Course (Non Major Elective)	2	2	25	75
	Foundation Course FC FC1 : Fundamentals of Computers	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)	3	4	25	75
Part-IV	Skill Enhancement Course -SEC-2 (Non Major Elective)	2	2	25	75
	Skill Enhancement Course -SEC-3 (Discipline Specific / Generic)	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 Specific)	3	4	25	75
Part-IV	SEC-4 :Skill Enhancement Course - (Entrepreneurial Based)	1	1	25	75
	SEC-5 :Skill Enhancement Course (Discipline Specific/ Generic)	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-	English	3	6	25	75

II					
Part-III	CC7 : .NET Programming	5	5	25	75
	CC8 : .NET Programming Lab	5	5	25	75
	EC4 : Elective Course (Generic / Discipline Specific)	3	4	25	75
Part-IV	SEC6 : Skill Enhancement Course	2	2	25	75
	SEC-7 : Skill Enhancement Course - (Discipline Specific / Generic)	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)	3	4	25	75
	EC6 : Elective Courses (Generic / Discipline Specific)	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-III	CC13 : Data Mining	4	6	25	75
	CC14 : Data Mining Lab	4	6	25	75
	CC15 : Data Communication and Networking	4	6	25	75
	EC7 : Elective Courses (Generic / Discipline Specific)	3	5	25	75
	EC8 : Elective Courses (Generic / Discipline Specific)	3	5	25	75
Part IV	Professional Competency Skill Enhancement Course SE8	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..

FIRST YEAR – SEMESTER – I

CORE – I: PROGRAMMING IN C

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC1	**5**	0	0	I	**5**	**5**	**25**	**75**	**100**
Learning Objectives									
LO1	To familiarize the students with the understanding of code organization								
LO2	To improve the programming skills								
LO3	Learning the basic programming constructs.								
Prerequisites: Basic Knowledge About Programming Concepts.									
Unit	**Contents**								**No. of Hours**
I	**Studying Concepts of Programming Languages**- Language Evaluation Criteria - Language design - Language Categories - Implementation Methods – Programming Environments - Overview of								**15**

	C: History of C- Importance of C- Basic Structure of C Programs- Executing a C Program- Constants, Variables and Data types - Operators and Expressions - Managing Input and Output Operations	
II	**Decision Making and Branching**: Decision Making and Looping - Arrays - Character Arrays and Strings	**15**
III	**User Defined Functions:** Elements of User Defined Functions- Definition of Functions- Return Values and their Types- Function Call- Function Declaration- Categories of Functions- Nesting of Functions- Recursion	**15**
IV	**Structures and Unions:** Introduction- Defining a Structure- Declaring Structure Variables Accessing Structure Members- Structure Initialization- Arrays of Structures- Arrays within Structures- Unions- Size of Structures.	**15**
V	**Pointers:** Understanding Pointers- Accessing the Address of a Variable- Declaring Pointer Variables- Initializing of Pointer Variables- Accessing a Variable through its Pointer- Chain of Pointers- Pointer Expressions- Pointer and Scale Factor- Pointer and Arrays- Pointers and Character Strings- Array of Pointers- Pointer as Function Arguments- Functions Returning Pointers- Pointers to Functions- **File Management in C**	**15**
TOTAL		**75**

CO	**Course Outcomes**
CO1	Outline the fundamental concepts of C programming languages, andits features
CO2	Demonstrate the programming methodology.
CO3	Identify suitable programming constructs for problem solving.
CO4	Select the appropriate data representation, control structures, functions and concepts based on the problem requirement.
CO5	Evaluate the program performance by fixing the errors.

Textbooks

➢	Robert W. Sebesta, (2012), ―Concepts of Programming Languages‖, Fourth Edition, Addison Wesley (Unit I : Chapter – 1)
➢	E. Balaguruswamy, (2010), ―Programming in ANSI C‖, Fifth Edition, Tata McGraw Hill Publications

Reference Books

1.	Ashok Kamthane, (2009), ―Programming with ANSI & Turbo C‖, Pearson Education
2.	Byron Gottfried, (2010), ―Programming with C‖, Schaums Outline Series, Tata

	McGraw Hill Publications
NOTE: Latest Edition of Textbooks May be Used	
Web Resources	
1.	http://www.tutorialspoint.com/cprogramming/
2.	http://www.cprogramming.com/
3.	http://www.programmingsimplified.com/c-program-examples
4.	http://www.programiz.com/c-programming
5.	http://www.cs.cf.ac.uk/Dave/C/CE.html
6.	http://fresh2refresh.com/c-programming/c-function/

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	3	2	2
CO2	3	3	2	3	2	2
CO3	3	3	3	3	2	2
CO4	3	3	2	3	2	2
CO5	3	3	2	3	2	2
Weightage ofcoursecontributedtoeachPSO	15	14	11	15	10	10

CORE – II: C Programming Practical

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC2	0	0	5	I	5	5	25	75	100

Learning Objectives	
LO1	The Course aims to provide exposure to problem-solving through C programming
LO2	It aims to train the student to the basic concepts of the C -Programming language
LO3	Apply different concepts of C language to solve the problem
Prerequisites: Basic knowledge about programming concepts	
Contents	**No of Hours**

1. Programs using Input/ Output functions 2. Programs on conditional structures 3. Command Line Arguments 4. Programs using Arrays 5. String Manipulations 6. Programs using Functions 7. Recursive Functions 8. Programs using Pointers 9. Files 10. Programs using Structures & Unions	**75**

CO	**Course Outcomes**
CO1	Demonstrate the understanding of syntax and semantics of C programs.
CO2	Identify the problem and solve using C programming techniques.
CO3	Identify suitable programming constructs for problem solving.
CO4	Analyze various concepts of C language to solve the problem in an efficient way.
CO5	Develop a C program for a given problem and test for its correctness.

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**2**	**2**	**3**	**2**	**2**
CO2	**3**	**3**	**2**	**3**	**2**	**2**
CO3	**3**	**3**	**3**	**3**	**2**	**2**
CO4	**3**	**3**	**2**	**3**	**2**	**2**
CO5	**3**	**3**	**2**	**3**	**3**	**2**
Weightage ofcoursecontributedtoeachPSO	**15**	**14**	**11**	**15**	**11**	**10**

Foundation Course -I FUNDAMENTALS OF COMPUTERS

Subject Code	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
							CIA	**External**	**Total**
FC1	**2**	0	0	II	**2**	**2**	**25**	**75**	**100**
Learning Objectives									
LO1	To analyze a problem with appropriate problem solving techniques								
LO2	To understand the main principles of imperative, functional and logic oriented								

	programming languages and	
LO3	Toincrease the ability to learn new programming languages.	
Prerequisites: Basic knowledge about programming concepts		
Unit	**Contents**	**No. of Hours**
I	**Introduction:** Characteristics of Computers - Evolution of Computers **Basic Computer Organization:** I/O Unit - Storage Unit - Arithmetic Logic Unit - Control Unit - Central Processing Unit	**6**
II	**Computer Software:** Types of Software - System Architecture **Computer Languages:** Machine Language - Assembly Language - High Level Language - Object Oriented Languages	**6**
III	**Problem Solving Concepts:** Problem Solving in Everyday life - Types of Problems - Problem solving with computers - Difficulties with Problem Solving	**6**
IV	**Problem Solving concepts for the computer:** Constant Variables - Data Types - Functions -Operators - Expressions and Equations - **Organizing the Solution:** Analyzing the problem - Algorithm - Flowchart - Pseudo code	**6**
V	**Programming Structure:** Structuring a solution - Modules and their function - Local and Global variables - Parameters - Return values - Sequential Logic Structure - Problem solving with Decision - Problem Solving with Loops	**6**
TOTAL		**30**
CO	**Course Outcomes**	
CO1	Outline the Computer fundamentals and various problem solving concepts in Computers	
CO2	Describe the basic computer organization, software, computer languages, software development life cycle and the need of structured programming in solving a computer problem	
CO3	Identify the types of computer languages, software, computer problems and examine how to set up expressions and equations to solve the problem.	
CO4	Choose most appropriate programming languages, constructs and features to solve the problems in diversified domains.	
CO5	Analyze the design of modules and functions in structuring the solution and various Organizing tools in problem solving.	
Textbooks		
➢	PradeepK.Sinha and PritiSinha, (2004) ―Computer Fundamentals‖, Sixth Edition, BPB Publications. (Unit I : Chapter 1 & 2, Unit II : Chapter 10 & 12)	

➢	Maureen Sprankle and Jim Hubbard, (2009) ―Problem Solving and Programming Concept, Ninth Edition, Prentice Hall. (Unit III: Chapter 1,2 &3) Unit IV : Chapter 3, Unit V : Chapter 4,5 ,6,7 & 8)
Reference Books	
1.	R.G. Dromey, (2007), ―How to Solve it by Computer‖, Prentice Hall International Series in Computer Science.
2.	C. S. V. Murthy, (2009), ―Fundamentals of Computers‖, Third Edition, Himalaya Publishing House.
NOTE: Latest Edition of Textbooks May be Used	
Web Resources	
1.	http://www.tutorialspoint.com/computer_fundamentals/
2.	http://www.comptechdoc.org/basic/basictut/
3.	http://www.homeandlearn.co.uk/
4.	http://www.top-windows-tutorials.com/computer-basics/
5.	https://www.programiz.com/article/flowchart-programming (Algorithm and flow chart)

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	2	2	3
CO2	3	2	2	2	3	2
CO3	3	3	3	3	2	2
CO4	3	2	2	2	2	3
CO5	3	3	2	2	3	2
Weightage ofcoursecontributedtoeachPSO	15	12	11	11	12	12

FIRST YEAR – SEMESTER – II

CORE – III: JAVAPROGRAMMING & DATA STRUCTURES

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC3	5	0	0	II	5	5	25	75	100
Learning Objectives									
L	Toprovideknowledgeonfundamentalsofobject-orientedprogramming								

O 1		
L O 2	Tohavetheability to use theSDKenvironment tocreate, debugandrun servlet programs	
Prerequisites: Basic knowledge about programming concepts.		
Unit	**Contents**	**No. of Hours**
I	**INTRODUCTION TO DATA STRUCTURES:** Data Structures: Definition- Time & Space Complexity, Arrays, Linear list: Singly linked list implementation, STACKS and QUEUES Operations, array and linked representations of stack, stack applications,Queues: operations on queues, array and linked representations. Circular Queue: operations, Trees: Definitions and Concepts- Representation of binary tree, Binary tree traversals. FundamentalsofObject-OrientedProgramming:Introduction– ObjectOrientedParadigm–ConceptsofObject–OrientedProgramming– BenefitsofOOP–Evolution:JavaHistory-JavaFeatures-DiffersfromCandC++- OverviewofJavaLanguage:JavaProgram-Structure–Tokens–JavaStatements– JavaVirtualMachine–CommandLineArguments	**15**
II	Constants,VariablesandDataTypes–OperatorsandExpressions– Decisionmaking andBranching–Looping– Arrays - Strings – Collection Interfaces and classes	**15**
III	Classes objects and methods: Introduction – Defining a class – Method Declaration –Constructors - Method Overloading – Static Members – Nesting of methods – Inheritance –Overriding– Final variables andmethods– Abstract methodsand classes	**15**
IV	MultipleInheritance:DefiningInterfaces–ExtendingInterfaces– ImplementingInterfaces – Packages: Creating Packages – Accessing Packages – Using a Package – ManagingErrorsandExceptions- MultithreadedProgramming. Layout Managers -JDBC – Java Servlet: - Servlet Environment Role – Servlet API –ServletLifeCycle	**15**
V	Layout Managers -JDBC – Java Servlet: - Servlet Environment Role – Servlet API –ServletLifeCycle –ServletContext–HTTPSupport– HTMLtoServlet Communication.	**15**

TOTAL	**75**
CO	**Course Outcomes**
CO1	Understand the concepts of Data Structures and simple linear data structure , Outline the basic terminologies of OOP, programming language techniques,JDBCandInternetprogrammingconcepts
CO2	Solve problems using basic constructs, mechanisms, techniquesandtechnologies ofJava
CO3	AnalyseandexplainthebehaviorofsimpleprogramsinvolvingdifferenttechniquessuchasInheritance,Packages,Interfaces,ExceptionHandlingandThreadandtechnologiessuchasJDBCandServlets
CO4	Assessvariousproblem-solvingstrategiesinvolvedinJavatodevelopa high-level application.
CO5	DesignGUIbasedJDBCapplicationsandabletodevelopServletsusingsuitableOOP concepts and techniques
Textbooks	
	Ellis Horowitz ,SartajSahni, Second Edition , "Fundamentals of Data Structures", Universities Press. E Balagurusamy(2010), "ProgrammingwithJava", TataMcGrawHill EditionIndia PrivateLtd, 4th Edition
	C Xavier,"JavaProgramming – A Practical Approach", Tata McGrawHill Edition Private Ltd
Reference Books	
	P.Naughton andH.Schildt(1999), "Java2 TheComplete Reference", TMH, 3rdEdition
	JaisonHunder&WilliamCrawford(2002),"JavaServlet Programming",O'Reilly
	Jim Keogh (2002), "J2EE: TheComplete Reference", Tata McGraw HillEdition.
NOTE: Latest Edition of Textbooks May be Used	
Web Resources	
	http://javabeginnerstutorial.com/core-java/
	http://www.tutorialspoint.com/java/
	http://beginnersbook.com/java-tutorial-for-beginners-with-examples/
	http://www.homeandlearn.co.uk/java/java.html

	http://www.journaldev.com/1877/servlet-tutorial-java(UnitV:ServletAPI)

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	2	2	2
CO2	2	3	2	2	2	2
CO3	2	3	3	3	2	2
CO4	2	3	2	2	2	2
CO5	3	3	2	2	2	2
Weightage ofcoursecontributedtoeachPSO	12	14	11	11	10	10

CORE – IV: JAVA PROGRAMMING & DATA STRUCTURES PRACTICAL

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC4	0	0	5	II	5	5	25	75	100

Learning Objectives	
LO1	To design anddevelop applications using different Java programming language techniques, JDBC &Servlets
LO2	To organize and manipulate the data with the help of fundamental data structures

Prerequisites: Basic knowledge about java Programming.

Contents	No of Hours
1. Basic Programs 2. Arrays 3. Strings 4. ArrayList, HashSet and Vector collection classes 5. ClassesandObjects 6. Interfaces 7. Inheritance 8. Packages 9. ExceptionHandling 10. Threads 11. LinkedList 12. Stacks 13. Queue 14. Sorting 15. Binary Tree Representation	75

16. Working with Database using JDBC 17. Web application using Servlet	

CO	Course Outcomes
CO1	Identifyandexplain the wayofsolvingthe simple problems
CO2	Use appropriate software development environment to write, compile and execute object-oriented Javaprograms
CO3	Analyze and identify necessary mechanisms ofJavaneeded tosolve real-world problem
CO4	Test fordefectsand validateaJavaprogramwith differentinputs
CO5	Design, develop and compile Core Java , GUI , JDBC and servlet applicationsthat utilizeOOP and data structure concepts

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**3**	**3**	**2**	**2**
CO2	**3**	**3**	**3**	**3**	**2**	**2**
CO3	**3**	**3**	**3**	**2**	**2**	**3**
CO4	**3**	**3**	**3**	**3**	**3**	**2**
CO5	**3**	**3**	**2**	**3**	**2**	**2**
Weightage ofcoursecontributedtoeachPSO	**15**	**14**	**14**	**14**	**11**	**11**

SECOND YEAR – SEMESTER – III

CORE – V: RELATIONAL DATABASE MANAGEMENT SYSTEM

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC5	5	0	0	III	**5**	5	**25**	**75**	**100**
Learning Objectives									
LO1	To understand the basic DBMS models and architecture								

LO2	To learn how to query and normalize the database.	
LO3	To study the data base design, transaction Processing and Management and Security Issues.	
Prerequisites: Basic knowledge about data and information		
Unit	**Contents**	**No. of Hours**
I	Introduction to Databases: Introduction – Characteristics of the Database Approach – Actors on the Scene – Workers behind the scene – Advantages of using DBMS Approach. Overview of database and Architectures: Data Models, Schemas, and Instances – Three-schema Architecture and Data Independence – Database languages & Interfaces – Database System Environment– Centralized & Client Server Architecture for DBMS - Classification of DBMS.	**15**
II	Basic Relational Model: Relational Model Concepts – Relational Model Constraints and Relational Database Schemas – Update Operations, Tractions, Dealing with Constraint Violations – Formal Relational Languages: Unary Relational Operations: SELECT and PROJECT – Relational Algebra Operations from Set Theory – Binary Relational Operations: JOIN and DIVISION – Examples of Queries in Relational Algebra.	**15**
III	Conceptual Data Modeling using the ER Model: Using High-Level Conceptual Data Models for Database Design – An example DB application – Entity Types, Entity Sets, Attributes, and Keys – Relationship Types, Relationship sets, Roles, and Structural Constraints – Weak entity types – Example- Mapping a Conceptual Design into Logical Design: Relational Database Design using ER- Relational Mapping – Mapping EER Model Constructs to Relations	**15**
IV	Functional Dependencies and Normalization for Relational Database: Functional Dependencies – Definition of Functional Dependency – Normal Forms based on Primary Keys – Normalization of Relations – First Normal Form – Second Normal Form – Third Normal Form – BCNF- Fourth Normal Form- Fifth Normal Form.	**15**
V	SQL: The Relational Database Standard: Data definition, Constraints, and schema changes in SQL – Basic Queries in SQL – More complex SQL Queries – Insert, delete and update statements in SQL – Views in SQL.	**15**

	PL/SQL: Introduction to PL/SQL – More on PL/SQL – Error Handling in PL/SQL – Oracle's Named Exception Handlers – Stored Procedures and Functions – Execution of Procedures and Functions – Advantages – Procedures Vs. Functions – Syntax for Creating Procedures and Functions – Deleting a Stored Procedure or Function – Oracle Packages – Database Triggers – Types Of Triggers – Deleting a Trigger – Raise-Application Error Procedure	
TOTAL		**75**

THEORY 100%

CO	**Course Outcomes**
CO1	Outline the fundamental RDBMS concepts and PL/SQL
CO2	Apply database operations, mapping, normalization, SQL and PL/SQL
CO3	Analyze the requirements to implement relational database concepts
CO4	Evaluate the database based on various models and normalization.
CO5	Design and construct normalized tables and manipulate it effectively using SQL and PL/SQL database objects

Textbooks

➢	RamezElmasri, Shamkant B. Navathe (2014), ―Database Systems‖, Sixth edition, Pearson Education, New Delhi.
➢	Ivan Bayross (2003 Reprint), SQL, PL/SQL-The Programming Language of Oracle, Second Revised Edition, BPB Publications, New Delhi.

Reference Books

1.	Abraham Silberschatz, Henry F.Korth, S.Sudarshan, Database System Concepts, Tata McGraw Hill Publication, 4th Edition.

NOTE: Latest Edition of Textbooks May be Used

Web Resources

1.	http://srikanthtechnologies.com/books/orabook/ch1.pdf
2.	Http://www.tmv.edu.in/pdf/Distance_education/BCA%20Books/BCA%20IV%20SEM/BC A-428%20Oracle.pdf

3.	http://www.tutorialspoint.com/sql/sql-rdbms-concepts.htm
4.	http://ecomputernotes.com/database-system/rdbms
5.	http://www.mithunashok.com/2011/04/basics-of-rdbms.html

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**2**	**3**	**3**	**3**
CO2	**3**	**3**	**2**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**	**2**
CO4	**3**	**3**	**2**	**3**	**3**	**3**
CO5	**3**	**3**	**2**	**3**	**3**	**2**
Weightage ofcoursecontributedtoeachPSO	**15**	**14**	**11**	**15**	**15**	**13**

CORE – VI: RELATIONAL DATABASE MANAGEMENT SYSTEMPRACTICAL

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC6	0	0	**5**	III	5	**5**	**25**	**75**	**100**

Learning Objectives

LO1	The primary Objective of this paper is to learn and implement SQL& PL/SQL.

Prerequisites: Basic Knowledge About Database Management

Contents	No of Hours
SQL: 1. DDL Commands 2. DML Commands 3. DCL Commands 4. SQL Built-in functions 5. Using Sub Queries **PL/SQL:** 6. Simple programs using PL/SQL 7. Procedures 8. User-defined functions 9. Exception Handling 10. Triggers	**75**

CO	Course Outcomes
CO1	Choose appropriate SQL queries and PL/SQL blocks for the database.
CO2	Implement SQL and PL/SQL blocks for the given problem effectively.
CO3	Analyse the problem and Exceptions using queries and PL/SQL blocks.
CO4	Validate the database for normalization using SQL and PL/SQL blocks.
CO5	Design Database tables, create Procedures, user-defined functions and Triggers.

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	2	2	2	3	3	2
CO2	3	3	2	3	2	3
CO3	2	3	3	3	2	3
CO4	2	3	2	3	3	3
CO5	2	2	2	3	3	2
Weightage ofcoursecontributedtoeachPSO	11	13	11	15	13	13

SECOND YEAR –SEMESTER- IV

CORE – VIII:.NET PROGRAMMING

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC7	5	0	0	IV	5	4	25	75	100

Learning Objectives	
LO1	To provide sufficient knowledge in developing web applications using C# and ASP.NET
LO2	To manipulate data from SQL Server using Microsoft ADO.NET.

Prerequisites: Basic knowledge about Programming.

Unit	Contents	No. of Hours
I	**The Creation of C#**: C# Relates to the .Net Framework - Common Language Runtime - Managed vs unmanaged code - **An Overview of C#:** Object-Oriented Programming - First Simple Program-Handling Syntax errors - Using code blocks-semicolon, positioning and Indentation-The C# Keywords-Identifiers-The .Net Framework Class Library-Data Types, Literals and Variables- Operators.	12

II	**Program Control Statements**: If Statement- switch Statement-For Loop- While loop do-while loop- foreach loop-using break to exit a loop-using continue- goto- **Introducing Classes and objects**: Class Fundamentals- objects creation-Methods-constructors-Garbage Collection and Destructors-Exception Handling.	**12**
III	**Arrays and Strings**: Arrays-Multidimensional Arrays-Jagged Arrays-for each loop Strings- Methods and classes: Method overloading- Main Method-Recursion-static Classes Delegates,Events and Lambda Expressions: Delegates -Lambda Expressions-LINQ	**12**
IV	Developing ASP.NET Applications**:** Visual Studio: Creating Websites-The Anatomy of a Web Form – Web Form Fundamentals: Converting HTML Page to an ASP.Net Page – Page Class – Web Controls. State Management**:** View State - Transferring Information between Pages – Cookies – Session State – Application State.	**12**
V	Validation Controls – AdRotator Control. Working with Data**:** ADO.NET Fundamentals:– Direct Data Access – Disconnected Data Access - Data Binding: Data Binding with ADO.NET –Data Source Controls - The Data Controls: The GridView – Formatting the GridView – Selecting GridView Row – Editing, Sorting and Paging the GridView-Generating Crystal Reports.	**12**
TOTAL		**60**
THEORY 80% & PROGRAM 20%		
CO	**Course Outcomes**	
CO1	Outline the features of C# programming language and ASP.NET applications	
CO2	Demonstrate the salient properties of C# and ASP.NET applications	
CO3	Identify the various stages in developing a web forms	
CO4	Select the appropriate controls to create a web form.	
CO5	Recommend a data driven web application by connecting to the data sources	
Textbooks		
➢	Herbert Schildt (2010), C# 4.0 The Complete Reference, Tata McGraw-Hill Pvt Ltd	
➢	Mathew MacDonald, (2010), Beginning ASP.NET 4 in C# 2010, Second Edition, Apress.	
Reference Books		
1.	Greg Buczek (2002), ―ASP.NET – Developer‘s guide‖, Tata MaGraw Hill Publication	
2.	Jesse Liberty, (2002), ―Programming C#, 3.0‖, O‘Reilly Press	

3.	J.Sharp (2009), ―Microsoft Visual C# 2008 Step by Step‖, PHI Learning Private Ltd.
4.	Christian Nagel et al. , ―Professional C# 2005 with .NET 3.0‖, Wiley India, 2007
NOTE: Latest Edition of Textbooks May be Used	
Web Resources	
1.	http://ssw.jku.at/Teaching/Lectures/CSharp/Tutorial/
2.	http://www.csharpkey.com/csharp/
3.	http://www.w3schools.com/aspnet/default.asp

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	3	3	3
CO2	3	3	2	3	3	3
CO3	3	3	3	3	3	3
CO4	3	3	2	3	3	3
CO5	3	3	2	3	3	3
Weightage ofcoursecontributedtoeachPSO	15	14	11	15	15	15

CORE –VII: .NET PROGRAMMING LAB

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC8	0	0	5	IV	5	4	25	75	100

Learning Objectives	
LO1	To provide sufficient knowledge in developing web applications and to manipulate data from SQL Server using Microsoft ADO.NET.

Prerequisites: Basic knowledge about Programming Concepts.

Contents	No of Hours
Exercises 1. C# Basics 2. Looping Constructs 3. Arrays & Jagged Array 4. Strings 5. Classes and Objects 6. Method overloading 7. Delegates 8. LINQ	**60**

9. Lambda Expressions	

CO	Course Outcomes
CO1	Demonstrate MS Visual Studio.NET IDE to Create applications.
CO2	Apply C# and ASP.NET concepts to design applications.
CO3	Simplify the functionality of the web application in accordance to the user requirement.
CO4	Evaluate the web application to fix the errors.
CO5	Build a web application using C# and ASP.NET concepts to solve the problem

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**2**	**3**	**3**	**3**
CO2	**3**	**3**	**2**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**2**	**3**	**3**	**3**
CO5	**3**	**3**	**2**	**3**	**3**	**3**
Weightage ofcoursecontributedtoeachPSO	**15**	**14**	**11**	**15**	**15**	**15**

THIRD YEAR –SEMESTER- V

CORE – IX: PYTHON PROGRAMMING

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC9	**5**	**0**	**0**	**V**	**4**	**5**	**25**	**75**	**100**

Learning Objectives	
LO1	Understand the concepts of Python programming.
LO2	To apply the OOPs concept in PYTHON programming.
LO3	To impart knowledge on demand and supply concepts
LO4	Learn to solve basic programming problems.

Unit	Contents	No. of Hours
I	**Basics of Python Programming:** History of Python-Features of Python-Literal-Constants-Variables - Identifiers–Keywords-Built-in Data Types-Output Statements – Input Statements-Comments – Indentation- Operators-Expressions-Type conversions. **Python Arrays:** Defining and Processing Arrays – Array methods.	**15**

II	**Control Statements:** Selection/Conditional Branching statements: if, if-else, nested if and if-elif-else statements. Iterative Statements: while loop, for loop, else suite in loop and nested loops. **Jump Statements:** break, continue and pass statements**.**	**15**
III	**Functions:** Function Definition – Function Call – Variable Scope and its Lifetime-Return Statement. **Function Arguments**: Required Arguments, Keyword Arguments, Default Arguments and Variable Length Arguments- Recursion. **Python Strings:** String operations- Immutable Strings - Built-in String Methods and Functions - String Comparison. **Modules**: import statement-The Python module – dir() function – Modules and Namespace – Defining our own modules.	**15**
IV	**Lists:** Creating a list -Access values in List-Updating values in Lists-Nested lists -Basic list operations-List Methods. Tuples: Creating, Accessing, Updating and Deleting Elements in a tuple – Nested tuples– Difference between lists and tuples. **Dictionaries:** Creating, Accessing, Updating and Deleting Elements in a Dictionary – Dictionary Functions and Methods - Difference between Lists and Dictionaries.	**15**
V	**Python File Handling:** Types of files in Python - Opening and Closing files-Reading and Writing files: write() and writelines() methods- append() method – read() and readlines() methods – with keyword – Splitting words – File methods - File Positions-Renaming and deleting files.	**15**
TOTAL		**75**

CO	**Course Outcomes**
CO1	Outline the basic concepts in python language.
CO2	Interpret different looping and conditional statements in python language
CO3	Apply the various data types and identify the usage of control statements, loops, functions and Modules in python for processing the data
CO4	Analyze and solve problems using basic constructs and techniques of python.
CO5	Assess the approaches used in the development of interactive application.

Textbooks

- ReemaThareja, "Python Programming using problem solving approach", First Edition, 2017, Oxford University Press.
- Dr. R. NageswaraRao, "Core Python Programming", First Edition, 2017, Dream tech Publishers

Reference Books

1. VamsiKurama, "Python Programming: A Modern Approach", Pearson Education.
2. Mark Lutz, "Learning Python", Orielly.

NOTE: Latest Edition of Textbooks May be Used	
Web Resources	
1.	https://www.programiz.com/python-programming
2.	https://www.guru99.com/python-tutorials.html

MAPPING TABLE						
CO/PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	**3**	**2**	**2**	**3**	**2**	**2**
CO2	**2**	**3**	**2**	**3**	**2**	**2**
CO3	**2**	**3**	**2**	**2**	**3**	**1**
CO4	**1**	**2**	**2**	**1**	**3**	**2**
CO5	**2**	**2**	**2**	**1**	**3**	**3**
Weightageof coursecontributedto each PSO	**10**	**12**	**10**	**10**	**13**	**10**

CORE 10: PYTHON PROGRAMMING LAB

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC10	**0**	**0**	**5**	**V**	**4**	**5**	**25**	**75**	**100**

Learning Objectives	
LO1	Understand the fundamentals of programming using Python, such as variables, data types, control structures, and functions.
LO2	Learn how to use Python libraries and modules to solve problems.
LO3	Practice writing Python code to solve real-world problems and build basic applications.
LO4	Gain experience with common programming paradigms, such as object-oriented programming and functional programming.
LO5	Understand best practices for debugging and testing code.

List of Exercises	No of Hours

1. Program using variables, constants, I/O statements in Python. 2. Program using Operators in Python. 3. Program using Conditional Statements. 4. Program using Loops. 5. Program using Jump Statements. 6. Program using Functions. 7. Program using Recursion. 8. Program using Arrays. 9. Program using Strings. 10. Program using Modules. 11. Program using Lists. 12. Program using Tuples. 13. Program using Dictionaries. 14. Program for File Handling.	**75**
TOTAL	**75**

CO	**Course Outcomes**
CO1	Understand the significance of control statements, loops and functions in creating Simple programs.
CO2	Interpret the core data structures available in python to store, process and sort the data.
CO3	Develop the real time applications using python programming language.
CO4	Analyze the real time problem using suitable python concepts.
CO5	Assess the complex problems using appropriate concepts in python.

MAPPING TABLE

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**2**	**3**	**2**	**3**	**3**
CO2	**3**	**3**	**2**	**2**	**3**	**3**
CO3	**3**	**2**	**2**	**3**	**3**	**2**
CO4	**3**	**2**	**3**	**3**	**2**	**2**
CO5	**3**	**3**	**3**	**3**	**3**	**2**
Weightageof coursecontributedtoeach PSO	**15**	**12**	**13**	**13**	**14**	**12**

CORE – XI: OPERATING SYSTEMS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC11	5	0	0	V	**4**	5	**25**	**75**	**100**

		Learning Objectives
LO1		The objective of this course is to provide an introduction to the internal operation of modern operating systems
LO2		To focus on the core concepts such as processes and threads, mutual exclusion, CPU scheduling, deadlock, memory management, and file systems.

Prerequisites: Basic Knowledge about operating systems.

Unit		Contents	No. of Hours
I		Introduction: Definition of Operating System - OS Structures: OS Services - System Calls - Virtual Machines - Process Management: Process Concept - Process Scheduling - Operation on Processes - Co-operating Processes - Inter-process Communication	**15**
II		CPU Scheduling: Basic Concepts - Scheduling Criteria - Scheduling Algorithms - Process Synchronization: The Critical Section Problem - Semaphores - Classical Problems of Synchronization - Critical Regions	**15**
III		Deadlocks: System Model - Deadlock characterization – Methods for Handling Deadlocks Deadlock Prevention - Deadlock avoidance- Deadlock Detection - Recovery from Deadlock.	**15**
IV		Storage management: Memory management - Swapping – Contiguous Memory allocation. Paging – Segmentation – Segmentation with Paging –Virtual memory: Demand paging - Page replacement – Thrashing. Mass-Storage Structure: Disk Structure- Disk scheduling.	**15**
V		File-System Interface: File Concept-File Attributes-File Operations – Access Methods: Sequential Access – Direct Access –Directory Structure: Single-Level Directory- Two –Level Directory-Tree-Structured Directories- Introducing Shell Programming – Linux General Purpose Commands-Process Oriented Commands – Communication Oriented Commands	**15**
		TOTAL	**75**

CO		Course Outcomes
CO1		Outline the fundamental concepts of an OS and their respective functionality
CO2		Illustrate the importance of open source operating system commands
CO3		Identify and stimulate management activities of operating system
CO4		Analyze the various services provided by the operating system.
CO5		Interpret different problems related to Process, Scheduling, Deadlock, memory and Files
		Textbooks
➢		Abraham Silberschatz, Peter Baer Galvin, Greg Gagne (2012), ―Operating System Concepts‖, 9th edition, Wiley Student Edition.
➢		B.Mohamed Ibrahim, (2005), ―Linux Practical Approach‖,Firewall Media
		Reference Books
1.		Milan Milenkovic (2003), ―Operating System Concepts and Design‖, McGraw Hill.
2.		Andrew S. Tanenbaum, (2001), ―Modern Operating Systems‖, 2nd Edition, Prentice Hall of India.
3.		Deital and Deital (1990), ―Introduction to Operating System‖, Pearson Education.
4.		William Stallings (1997), ―Operating Systems‖, Prentice Hall of India.
		NOTE: Latest Edition of Textbooks May be Used
		Web Resources
1.		http://www.tutorialspoint.com/operating_system/
2.		http://www.reallylinux.com/docs/files.shtml
3.		http://www.tutorialspoint.com/operating_system/os_linux.htm

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	3	3	3
CO2	3	3	2	3	3	3
CO3	3	3	3	3	3	3
CO4	3	3	2	3	3	3
CO5	3	3	2	3	3	3
Weightage ofcoursecontributedtoeachPSO	15	14	11	15	15	15

THIRD YEAR – SEMESTER – VI

CORE – XIII: DATA MINING

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC13	**6**	0	0	VI	4	**6**	**25**	**75**	**100**

Learning Objectives	
LO1	To identify the underlying concepts and the fundamental data mining methodologies with the ability to formulate and solve problems

Prerequisites: Basic knowledge about data mining.

Unit	Contents	No. of Hours
I	**Introduction:** Data Mining – Kinds of Data and Patterns to be Mined – Technologies used –Kinds of Applications are Targeted - Major Issues – Data objects and Attribute types – Basic statistical Descriptions of Data- **Data Preprocessing** : Data Cleaning – Data Integration - Data Reduction - Data Transformation.	**15**
II	**Association Rules Mining**: Introduction – Frequent Itemset Mining Methods: Apriori Algorithm-Generating Association Rules from Frequent Itemsets-Improving the efficiency of Apriori-A Pattern –Growth Approach for mining Frequent Itemsets-Pattern Evaluation Methods.	**15**
III	**Classification:** Introduction –Basic concepts – Logistic regression - Decision tree induction–Bayesian classification, Rule–based classification-Model Evaluation and selection.	**15**
IV	**Cluster Analysis:** Introduction-Requirements for Cluster Analysis - **Partitioning Methods**: The K-Means method - **Hierarchical Method**: Agglomerative method - **Density based methods:** DBSCAN-**Evaluation of Clustering**: Determining the Number of Clusters – Measuring Clustering Quality.	**15**
V	**Outlier Detection:** Outliers and Outlier Analysis – Outlier Detection Methods **- Data Visualization:** Pixel-oriented visualization **–** Geometric Projectionvisualization technique- Icon-based-Hierarchical visualization-Visualizing complex data and relations.	**15**
TOTAL		**75**

CO	Course Outcomes
CO1	Outline the fundamentals and the principles of Data Mining

CO2	Apply suitable different preprocessing for data mining
CO3	Classify data-mining techniques based on the different applications
CO4	Analyze the various data mining algorithms with respect to functionality
CO5	Recommend appropriate data models for data mining techniques to solve real world problems
Textbooks	
➢	Jiawei Han, MichelineKamber, Jian Pei, "Data Mining concepts and techniques", 3rd Edition, Elsevier publication, 2012.
Reference Books	
1.	Ian H. Witten and Eibe Frank, (2005), "Data Mining: Practical Machine Learning Tools and Techniques (Second Edition)", Morgan Kaufmann.
2.	Arun K Pujari, "Data Mining Techniques", 10 impression, University Press, 2008.
3.	Daniel T. Larose , Chantal D. Larose, "Data mining and Predictive analytics," Second Ed., Wiley Publication, 2015.
4.	G.K. Gupta, "Introduction to Data mining with case studies", 2nd Edition, PHI Private limited, New Delhi, 2011.
NOTE: Latest Edition of Textbooks May be Used	
Web Resources	
1.	http://csed.sggs.ac.in/csed/sites/default/files/WEKA%20Explorer%20Tutorial.pdf
2.	https://www.cs.auckland.ac.nz/courses/compsci367s1c/tutorials/IntroductionToWeka.pdf

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**2**	**2**	**2**	**2**	**3**	**3**
CO2	**3**	**3**	**2**	**3**	**3**	**2**
CO3	**2**	**3**	**3**	**2**	**3**	**3**
CO4	**3**	**3**	**2**	**2**	**3**	**3**
CO5	**3**	**3**	**2**	**2**	**3**	**3**
Weightage ofcoursecontributedtoeachPSO	**13**	**14**	**11**	**11**	**15**	**14**

CORE – XIV: DATA MINING LAB

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC14	0	0	**6**	**VI**	4	**6**	**25**	**75**	**100**

Learning Objectives

LO1	Understand the data sets, data preprocessing and demonstrate the working of algorithms for data mining tasks such as association rule mining, classification, clustering and regression.

Prerequisites: Basic Knowledge about Data Mining

Contents	No of Hours
1. Understanding the data 2. Visualization Techniques 3. Data Preprocessing 4. Handling Missing Values 5. Data Reduction-Principal Component Analysis 6. Data Normalization-Min-Max, Z-score, Decimal Scaling 7. Association Rule Mining-Apriori Algorithm 8. Classification 9. Logistic Regression 10. Decision Tree 11. Naive Bayesian 12. Clustering 13. K-Means Clustering 14. DBSCAN 15. Agglomerative 16. Case Study	**75**

CO	Course Outcomes
CO1	Understand the real time datasets for analysis
CO2	Apply suitable preprocessing for data mining task
CO3	Demonstrate data-mining techniques based on the different applications
CO4	Analyze the performance evaluation of various data mining algorithms
CO5	Prescribe appropriate data models for data mining techniques to solve real world problems

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**2**	**2**	**2**	**2**	**3**	**3**
CO2	**3**	**3**	**2**	**3**	**3**	**2**
CO3	**2**	**3**	**3**	**2**	**3**	**3**
CO4	**3**	**3**	**2**	**2**	**3**	**3**
CO5	**3**	**3**	**2**	**2**	**3**	**3**
Weightage ofcoursecontributedtoea	**13**	**14**	**11**	**11**	**15**	**14**

chPSO						

CORE – XV: DATA COMMUNICATION AND NETWORKING

Subject Code	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
							CIA	**External**	**Total**
CC15	**6**	0	0	VI	4	**6**	**25**	**75**	**100**

Learning Objectives	
LO1	This course is to provide students with an overview of the concepts and fundamentals of data communication and computer networks
LO2	To familiarize the student with the basic taxonomy and terminology of the computer.

Prerequisites: Basic knowledge about Data Communication and Networking**.**

Unit	**Contents**	**No. of Hours**
I	Introduction: Data Communication-Networks: Distributed Processing-Network Criteria Physical Structures –Network Models-Categories of Network-Internetwork - The Internet Protocols and Standards – Network Models: Layers in the OSI Model - TCP/IP Protocol Suite.	**15**
II	Data and Signals: Analog and Digital Data - Analog and Digital Signals – Performance - Digital Transmission: Transmission Modes – Multiplexing: FDM – WDM - Synchronous TDM -Statistical TDM - Transmission Media: Guided media - Unguided Media.	**15**
III	Switching: Circuit Switched Networks - Datagram Networks-Virtual Circuit Network - Error Detection and Correction: Introduction - Block Coding - Linear Block Codes - Cyclic Codes: Cyclic Redundancy Check - Checksum. Data Link Control: Framing - Flow Control and Error Control - Noiseless Channel: Stop-and-wait Protocol.	**15**
IV	Wired LANs: Standard Ethernet-GIGABIT Ethernet-Wireless LAN: Bluetooth Connecting LANs: Connecting Devices**:** Passive Hubs-Repeaters-Active Hubs-Bridges-Two Layer Switches-Routers-Three layer Switches-Gateway-Network Layer: Internet Protocol: IPv4 – Ipv6-Transition from IPv4 to IPv6.	**15**
V	Network Layer: Delivery, Forwarding and Routing- Unicast Routing Protocols: Distance Vector Routing-Link state routing- Future & Current Trends in Computer Networks: 5G Network: Salient Features-Technology-Applications-Advanced Features-Advantages & Disadvantages-Internet of Things: key Features -Advantages & Disadvantages-IOT Hardware- IOT Technology and Protocols-IOT	**15**

	Common Uses-Applications-WiFi-WiMaxLifi- LifivsWifi.	
TOTAL		**75**
THEORY 20% & PROBLEM 80%		
CO	**Course Outcomes**	
CO1	Understand the fundamental concepts of computer networks and its application areas	
CO2	Identify and use various networking techniques and components to establish networking connection and transmission	
CO3	Analyze the services performed by different network layers and recent advancements in networking	
CO4	Compare various networking models, layers, protocols and technologies.	
CO5	Select the appropriate networking mechanisms to build a reliable network	
Textbooks		
➢	Behrouz and Forouzan,(2006), Data Communication and Networking‖, 4th Edition, TMH.	
➢	Ajit Pal,(2014), Data Communication and Computer Networks, PHI.	
Reference Books		
1.	Jean Walrand (1998), ―Communication Networks,Second Edition‖, TataMcGraw Hill.	
NOTE: Latest Edition of Textbooks May be Used		
Web Resources		
1.	http://www.tutorialspoint.com/data_communication_computer_network/	
2.	http://www.slideshare.net/zafar_ayub/data-communication-and-network-11903853	
3.	http://www.freetechbooks.com/data-communication-and-networks-f31.html	

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**2**	**3**	**3**	**2**
CO2	**3**	**3**	**2**	**3**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**3**	**2**
CO4	**3**	**3**	**2**	**3**	**3**	**2**
CO5	**3**	**3**	**2**	**3**	**3**	**2**
Weightage ofcoursecontributedtoea	**15**	**14**	**11**	**15**	**15**	**10**

chPSO						

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 CORE COMPONENT

OBJECT ORIENTED PROGRAMMING USING C++

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC	**5**	**0**	**0**	**-**	**4**	**5**	**25**	**75**	**100**
Learning Objectives									
LO1	To inculcate knowledge on Object-oriented concepts and programming using C++.								
LO2	Demonstrate the use of various OOPs concepts with the help of programs								
Unit	**Contents**								**No. of Hours**
I	OOP Paradigm – Concepts of OOP – Benefits of OOP - Object Oriented Languages – Applications of OOP – OOP Design: Using UML as a Design Tool Beginning with C++								**15**
II	Tokens, Expressions and Control Structures - Functions in C++ : Function Prototyping – Call by Reference - Return by Reference – Inline Function – Default Arguments – Const Arguments – Recursion – Function Overloading – Classes and Objects								**15**
III	Constructors and Destructors: Constructors – Parameterized Constructors – Multiple Constructors – Constructor with default Arguments – Copy Constructors – Dynamic Constructor – Destructors – Operator Overloading and Type Conversions: Operator Overloading – Overloading Unary Operators – Overloading Binary operators – Rules for Operator Overloading – Type Conversions								**15**

IV	Inheritance: Introduction – Types of Inheritance – Virtual Base Classes – Abstract Classes – Pointers - Virtual Function - Polymorphism	15
V	Templates: Class Templates – Function Templates – Overloading of template Function – Exception Handling	15
TOTAL		75

CO	**Course Outcomes**
CO1	Outline the C++ programming fundamentals and the concepts of object-oriented programming like object and class, Encapsulation, inheritance and polymorphism.
CO2	Classify the control structures, types of constructors, inheritance and different type conversion mechanisms.
CO3	Analyze the importance of object oriented programming features like polymorphism, reusability, generic programming, data abstraction and the usage of exception handling.
CO4	Determine the use of object oriented features such as classes, inheritance and templates to develop C++ programs for complex problems.
CO5	Create a program in C++ by implementing the concepts of object-oriented programming.

Textbooks	
➢	E. Balaguruswamy, (2013), "Object Oriented Programming using C++", 6th Edition, Tata McGraw Hill.
Reference Books	
1	BjarneStroustrup, "The C++ Programming Language", Fourth Edition, Pearson Education.
2	Hilbert Schildt, (2009), "C++ - The Complete Reference", 4th Edition, Tata McGrawHill
NOTE: Latest Edition of Textbooks May be Used	
Web Resources	
1.	http:/fahad.cprogramming.blogspot.com/p/c-simple-examples.html
2.	http://www.sitesbay.com/cpp/cpp-polymorphism

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**2**	**2**	**3**	**3**	**2**
CO2	**3**	**3**	**2**	**3**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**3**	**2**
CO4	**3**	**3**	**2**	**3**	**3**	**2**

CO5	**3**	**3**	**2**	**3**	**3**	**2**
Weightage ofcoursecontributedtoeachPSO	**15**	**14**	**11**	**15**	**15**	**10**

C++ Programming Lab

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC	**0**	**0**	**5**	**-**	**4**	**5**	**25**	**75**	**100**

Learning Objectives

LO1	To inculcate knowledge on Object-oriented concepts and programming using C++.
LO2	Demonstrate the use of various OOPs concepts with the help of programs

List of Excercises

Exercises:

1. Working with Classes and Objects
2. Using Constructors and Destructors
3. Using Function Overloading
4. Using Operator Overloading
5. Using Type Conversions
6. Using Inheritance
7. Using Polymorphism
8. Using Console I/O
9. Using Templates
10. Using Exceptions

TOTAL 75

CO	Course Outcomes
CO1	Understand the fundamentals of C++ programming structure
CO2	Identify the basic features of OOPS such as classes, objects, polymorphism, inheritance
CO3	Analyze the concept of inheritance with the understanding of early and late binding, usage of exception handling, constructors, destructors, generic programming and type conversions
CO4	Determine the use of various data structures such as stacks, queues and lists to solve va computing problems in C++ by incorporating OOPS concepts.
CO5	Develop a program in C++ with the concepts of object oriented programming to solve r problems.

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6

CO1	**3**	**2**	**2**	**3**	**3**	**2**
CO2	**3**	**3**	**2**	**3**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**3**	**2**
CO4	**3**	**3**	**2**	**3**	**3**	**2**
CO5	**3**	**3**	**2**	**3**	**3**	**2**
Weightage ofcoursecontributedtoeachPSO	**15**	**14**	**11**	**15**	**15**	**10**

DATA STRUCTURES

Subject Code	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
							CIA	**External**	**Total**
CC	4	0	0	II	4	4	**25**	**75**	**100**

Learning Objectives

LO1	To become familiar with the various data structures and their applications
LO2	to increase the understanding of basic concepts of the design and use of algorithms

Prerequisites:

Unit	**Contents**	**No. of Hours**
I	Introduction and overview: Basic Terminology – Data Structures – Operations - Algorithms: Complexity – Time Space – Algorithmic Notation – Control Structures – Complexity of Algorithms – Notations Arrays: Representation – Operations - Linear Search – Binary Search	**12**
II	Stack: Representation – Arithmetic expressions: Polish Notation – Recursion: Towers of Hanoi - Queue –Priority Queue - Linked Lists: Introduction – Representation of Linked Lists – Traversing a Linked Lists – Searching a Linked List	**12**
III	Insertion into a Linked List – Deletion into Linked List – Header Linked Lists – Two-way Lists –Doubly Linked List - Trees : Binary Trees – Representation – Traversal using Recursion – Binary Search Trees	**12**
IV	Sorting : Bubble Sort Insertion Sort, Selection Sort, Merge Sort, Quick Sort, Heap Sort	**12**
V	Graph – Graph Theory Terminology –Sequential Representation – Warshalls Algorithm – Shortest Path – Linked Representation - Traversals – Dynamic Programming – All Pairs Shortest Path - Greedy – Knapsack – Back Tracking – 8 Queens	**12**
TOTAL		**60**

THEORY 100%

CO	**Course Outcomes**

CO1	Outline the different fundamental concepts of data structures
CO2	Make use of different memory representation for data storage and apply various operations
CO3	Construct an algorithm for different data structure operations.
CO4	Analyse the data structures applications.
CO5	Discover suitable techniques to provide solution for solving the problems.
Textbooks	
➢	Seymour Lipschutz (1986), ―Theory and Problems of Data Structures‖, Tata McGraw-Hill Edition
Reference Books	
1.	E.Horowitz, S.Sahni, S.Rajasekaran (1998), ―Computer Algorithms‖, Galgotia Publications.
2.	Robert Kruse, C.L.Tondo, Bruce Leung, ―Data Structures and Program Design in C‖, Second Edition, Prientice Hall Publications
NOTE: Latest Edition of Textbooks May be Used	
Web Resources	
1.	http://www.cs.sunysb.edu/~skiena/214/lectures/
2.	http://datastructures.itgo.com/graphs/dfsbfs.htm
3.	http://oopweb.com/Algorithms/Documents/PLDS210/VolumeFrames.html
4.	http://discuss.codechef.com/questions/48877/data-structures-and-algorithms
5.	http://code.tutsplus.com/tutorials/algorithms-and-data-structures--cms-20437
6.	ttps://www.tutorialspoint.com/data_structures_algorithms/insertion_sort_algorithm.htm (Unit IV : Insertion Sorting)

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**2**	**3**	**3**	**3**
CO2	**3**	**3**	**2**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**	**2**
CO4	**3**	**3**	**2**	**3**	**3**	**3**
CO5	**3**	**3**	**2**	**3**	**3**	**2**
Weightage ofcoursecontributedtoeachPSO	**15**	**14**	**11**	**15**	**15**	**13**

PHP SCRIPTING – PRACTICAL

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC	0	0	5	V	4	5	25	75	100

Learning Objectives	
LO1	Toenablethestudentstounderstand,analyzeandbuilddynamicwebpagesusingPHP and jQuerywith MySql database

Prerequisites:

Unit	Contents	No. of Hours
I	IntroductiontoPHP:LanguageBasics:LexicalStructure – Data Types – Variables - Expressions and Operators – Flow – Control statements – EmbeddingPHP in Web Pages Exercises: 1. ControlStructures 2. Workingwith Forms.	**15**
II	Functions : Defining a function – Variable Scope- Function Parameters – Strings :Encoding and Escaping – Comparing Strings – ManipulatingandSearchingStrings– Arrays:SingleandMultidimensionalArrays– TraversingArrays–Sorting Exercises: 3. StringManipulations 4. Arrays 5. Functions 6. Sorting	**15**
III	Classes and Objects – Introspection – Serialization – WebTechniques: Processing Forms – Setting Response Headers – Maintaining State : Cookies andSession-Graphics Exercises: 7. Classes andObjects 8. CookiesandSessions 9. Graphics	**15**
IV	Working with MySQL Database: Select data from a single table – Select data from multiple tables- Performing DML operations Exercises: 10. Working with single table 11. Working with multiple tables	**15**
V	jQuery Fundamentals: Requirements of jQuery- JavaScript Premier – jQuery Core – DOM Selection and Manipulation – Event Handling –	**15**

	HTMLForms andData –jQuerywith PHP Exercises: 12. EventHandling 13. Handling HTMLForms with jQuery	
TOTAL		**75**
CO	**Course Outcomes**	
CO1	Demonstratesimple programsusingPHPand jQuery	
CO2	Applythe interfacesetup,styles&themesforthegiven application	
CO3	Analyzetheproblemandaddnecessaryuserinterfacecomponents, multimedia componentsand webdatasourceintothe application	
CO4	Evaluatethe resultsbyimplementingthe correcttechniques onthe webform	
CO5	Constructwebapplicationswith thefacilitatedcomponentsin PHPandjQuery	
Textbooks		
➢	Kevin Tatroe, Peter MacIntyre, RasmusLerdorf, " Programming PHP",O'Reilly Publications,Third Edition	
➢	Joel Murach, Ray Harris (2010), "PHP and MySQL", Shroff Publishers & Distributors	
➢	CesarOtero, RobLorsen (2012), "Professional jQuery", John WileySons &Inc	
Reference Books		
1.	W.Jason Gilmore(2010), "BeginningPHP&MySql",Apress	
2.	LarryUllman (2008), "PHP6 and MySQL5", Pearson Education	
3.	John Coggeshall(2006), "PHP5",Pearson Education	
4.	MichaleC.Glass(2004),"BeginningPHP,Apache, MySQLWebDevelopment",Wiley DreamTechPress	
5.	Robin Nixon (2013),"LearningPHP,MySQL, JavaScript &CSS", O'Reilly, 2nd Edition	
6.	Jack Franlin (2013),"BeginningjQuery", Apress,Springer Science	
NOTE: Latest Edition of Textbooks May be Used		
Web Resources		
1.	http://www.w3schools.com/jquery/	
2.	http://www.ccc.commnet.edu/faculty/sfreeman/cst%20250/jQueryNotes.pdf	
3.	http://www.w3schools.com/php/	

4.	http://www.tutorialspoint.com/php/
5.	http://www.tutorialspoint.com/mysql/

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	3	3	2
CO2	3	3	2	2	2	3
CO3	3	2	3	2	2	3
CO4	3	2	2	2	2	3
CO5	3	2	2	3	2	2
Weightage ofcoursecontributedtoeachPSO	15	11	11	12	11	13

SOFTWARE PROJECT MANAGEMENT

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC	4	0	0	-	4	4	25	75	100

Learning Objectives	
LO1	To define and highlight importance of software project management.
LO2	To formulate and define the software management metrics & strategy in managing projects
LO3	Understand to apply software testing techniques in commercial environment

Unit	Contents	No. of Hours
I	Introduction to Competencies - Product Development Techniques - Management Skills - Product Development Life Cycle - Software Development Process and models - The SEI CMM - International Organization for Standardization.	12
II	Managing Domain Processes - Project Selection Models - Project Portfolio Management - Financial Processes - Selecting a Project Team - Goal and Scope of the Software Project -Project Planning - Creating the Work Breakdown Structure - Approaches to Building a WBS - Project Milestones - Work Packages - Building a WBS for Software.	12
III	Tasks and Activities - Software Size and Reuse Estimating - The SEI CMM - Problems and Risks - Cost Estimation - Effort	12

	Measures - COCOMO: A Regression Model - COCOMO II - SLIM: A Mathematical Model - Organizational Planning - Project Roles and Skills Needed.	
IV	Project Management Resource Activities - Organizational Form and Structure - Software Development Dependencies - Brainstorming - Scheduling Fundamentals - PERT and CPM - Leveling Resource Assignments - Map the Schedule to a Real Calendar - Critical Chain Scheduling.	**12**
V	Quality: Requirements – The SEI CMM - Guidelines - Challenges - Quality Function Deployment - Building the Software Quality Assurance - Plan - Software Configuration Management: Principles - Requirements - Planning and Organizing - Tools - Benefits - Legal Issues in Software - Case Study	**12**
TOTAL		**60**

CO	**Course Outcomes**
CO1	Understand the principles and concepts of project management
CO2	Knowledge gained to train software project managers
CO3	Apply software project management methodologies.
CO4	Able to create comprehensive project plans
CO5	Evaluate and mitigate risks associated with software development process

Textbooks

➢	Robert T. Futrell, Donald F. Shafer, Linda I. Safer, "Quality Software Project Management", Pearson Education Asia 2002.

Reference Books

1.	PankajJalote, "Software Project Management in Practice", Addison Wesley 2002.
2.	Hughes, "Software Project Management", Tata McGraw Hill 2004, 3rd Edition.

NOTE: Latest Edition of Textbooks May be Used

Web Resources

1.	NPTEL & MOOC courses titled Software Project Management
2.	www.smartworld.com/notes/software-project-management

MAPPING TABLE

CO/PSO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	2	2
CO2	3	1	3	2	2	2
CO3	2	3	2	3	3	3
CO4	3	3	2	3	3	2
CO5	2	2	2	3	3	3
Weightageof coursecontributed toeachPSO	13	11	10	13	13	12

SOFTWARE ENGINEERING

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC	5	0	0	V	3	5	25	75	100

Learning Objectives	
LO1	This paper familiarizes the students about the processes, forms, tasks, techniques and tools involved in Software Engineering
LO2	To use the necessary for software engineering practice.

Prerequisites: Basic knowledge about software engineering.

Unit	Contents	No. of Hours
I	Introduction to Software Engineering: Definition - The changing nature of software - Software Myths - Terminologies - Role of Management in Software Development - Software Life Cycle Models: The Waterfall Model - Increment Process Model - Evolutionary Process Model - The Unified Process.	15
II	Software Requirements Analysis and Specifications: Requirements Engineering - Type of Requirements - Feasibility Studies - Requireents Elicitation - Requirements Analysis - Requirements Documentation - Requirements Validation.	15
III	Software Project Planning: Size Estimation - Cost Estimation - The Constructive Cost Model (COCOMO) - COCOMO II - The Putnam Resource Allocation Model - Software Risk Management - Software Design: Definition - Modularity - Strategy of Design - Function Oriented Design.	15

IV	Software Testing: A Strategic Approach to Software Testing - Terminologies - Functional Testing - Structural Testing - Levels of Testing - Validation Testing - Testing Tools.	**15**
V	Software Reliability: Basic Concepts - Software Quality - McCall Software Quality Model - Boehm Software Quality Model - Capability Maturity Model - Software Maintenance: Definition - Process - Models - Configuration Management -Documentation.	**15**
TOTAL		**75**

THEORY & PROBLEM

CO	**Course Outcomes**
CO1	Define the basic terminologies involved in the entire software developmental life cycle
CO2	Identify suitable models, techniques and tools for the development of a software product
CO3	Apply software engineering perspective through requirements analysis, software design and construction, verification, and validation to develop solutions to modern problems
CO4	Compare and contrast different process, cost, quality models and testing techniques
CO5	Estimate the project cost using suitable cost estimation models, rate the software risks and evaluate management strategies for effective software development

Textbooks

➢	K.K Agarwal, Yogesh Singh (2009), ―Software Engineering‖, 3 rd Edition, New Age International Publishers

Reference Books

1.	Roger S. Pressman, ―Software Engineering – A Practioners Approach‖, 5 th Edition, Tata McGraw Hill Publication.
2.	PanajJalote (2005), ―An Integrated Approach to Software Engineering‖, 3 rd Edition, Narosa Publication.
3.	Thomas T. Baker, ―Writing Software Documentation – A task oriented approach‖, Second Edition, Pearson Education, 2004.
4.	Rajib Mall, ―Fundamentals of Software Engineering‖, Second Edition, Prentice Hall.

NOTE: Latest Edition of Textbooks May be Used

Web Resources

1.	http://www/tutorialspoint.com/software_engineering
2.	http://www.nada.kth.se/lectures/
3.	http://www2.latech.edu/

MAPPING TABLE						
CO/PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	**3**	**2**	**3**	**2**	**2**	**2**
CO2	**2**	**3**	**3**	**3**	**3**	**2**
CO3	**2**	**2**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**2**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**	**3**
Weightageofcourse contributedtoeach PSO	**13**	**12**	**14**	**14**	**14**	**13**

SOFTWARE ENGINEERING LAB

Subject Code	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
							CIA	**External**	**Total**
CC	**0**	**0**	**5**	**V**	**4**	**5**	**25**	**75**	**100**

Learning Objectives

LO1	To Impart Practical Training in Software Engineering
LO2	To understand about different Software Testing
LO3	Learn to write test cases using different testing techniques.

List of Exercises

Do the following 8 exercises for any project projects (Eg. Student Portal, Online exam registration)

1) Development of problem statement.
2) Preparation of Software Requirement Specification Document.
3)Preparation of Software Configuration Management and Risk Management related documents.
4) Draw the entity relationship diagram
5) Draw the data flow diagrams at level 0 and level 1
6) Draw use case diagram
7) Draw activity diagram of all use cases.
8) Performing the Design by using any Design phase CASE tools.
9) Develop test cases for unit testing and integration testing
10) Develop test cases for various white box and black box testing techniques

TOTAL		75
CO	**Course Outcomes**	
CO1	An ability to use the methodology and tools necessary for engineering practice.	
CO2	Ability to elicit, analyze and specify software requirements.	
CO3	Analyze and translate specifications into a design.	
CO4	Ability to derive test cases for different testing.	
CO5	Apply software engineering perspective through requirements analysis, software design and construction, verification, and validation to develop solutions to modern problems	

MAPPING TABLE						
CO/PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	**3**	**2**	**3**	**2**	**2**	**2**
CO2	**2**	**3**	**3**	**3**	**3**	**2**
CO3	**2**	**2**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**2**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**	**3**
Weightageofcourse contributedtoeach PSO	**13**	**12**	**14**	**14**	**14**	**13**

SOFTWARE METRICS

Subject Code	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
							CIA	**External**	**Total**
CC	**5**	**0**	**0**	**-**	**4**	**5**	**25**	**75**	**100**

Learning Objectives	
LO1	Gain a solid understanding of what software metrics are and their significance
LO2	Learn how to identify and select appropriate software metrics based on project goals
LO3	Acquire knowledge and skills in collecting and measuring software metrics
LO4	Learn how to analyze and interpret software metrics data to extract valuable insights
LO5	Gain the ability to evaluate software quality using appropriate metrics

Unit	Contents	No. of Hours
I	Fundamentals of Measurement: Need for Measurement: Measurement in Software Engineering, Scope of Software Metrics, The Basics of measurement: The representational theory of measurement, Measurement and models, Measurement scales and scale types, meaningfulness in measurement	**15**
II	A Goal-Based Framework For Software Measurement: Classifying software measures, Determining what to Measure, Applying the framework, Software measurement validation, Performing SoftwareMeasurementValidation Empirical investigation: Principles of Empirical Studies, Planning Experiments, Planning case studies as quasi-experiments, Relevant and Meaningful Studies	**15**
III	Software Metrics Data Collection: Defining good data, Data collection for incident reports, How to collect data, Reliability of data collection Procedures Analyzing software measurement data: Statistical distributions and hypothesis testing, Classical data analysis techniques, Examples of simple analysis techniques	**15**
IV	Measuring internal product attributes: Size Properties of Software Size, Code size, Design size, Requirements analysis and Specification size, Functional size measures and estimators, Applications of size measures Measuring internal product attributes: Structure: Aspects of Structural Measures, Control flow structure of program units, Design-levelAttributes, Object-oriented Structural attributes and measures	**15**
V	Measuring External Product Attributes: Modelling software quality, Measuring aspects of quality, Usability Measures, Maintainability measures,SecurityMeasures Software Reliability: Measurement and Prediction: Basics of reliability theory, The software reliability problem, Parametric reliability growth models, Predictive accuracy	**15**
TOTAL		**75**

CO	Course Outcomes
CO1	Understand various fundamentals of measurement and software metrics
CO2	Identify frame work and analysis techniques for software measurement
CO3	Apply internal and external attributes of software product for effort estimation
CO4	Use appropriate analytical techniques to interpret software metrics data and derive

	meaningful insights
CO5	Recommend reliability models for predicting software quality
Textbooks	
➢	Software Metrics A Rigorous and Practical Approach, Norman Fenton, James Bieman , Third Edition, 2014
Reference Books	
1	Software metrics, Norman E, Fenton and Shari Lawrence Pfleeger, International Thomson Computer Press, 1997
2	Metric and models in software quality engineering, Stephen H.Kan, Second edition, 2002, Addison Wesley Professional
3	Practical Software Metrics for Project Management and Process Improvement, Robert B.Grady, 1992, Prentice Hall.
NOTE: Latest Edition of Textbooks May be Used	
Web Resources	
1.	https://lansa.com/blog/general/what-are-software-metrics-how-can-i-measure-these-metrics/
2.	https://stackify.com/track-software-metrics/

MAPPING TABLE						
CO/PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	**3**	**2**	**2**	**2**	**2**	**2**
CO2	**2**	**3**	**3**	**3**	**3**	**2**
CO3	**2**	**2**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**2**	**3**	**2**	**3**
CO5	**3**	**3**	**3**	**2**	**3**	**3**
Weightageofcourse contributedtoeach PSO	**13**	**12**	**13**	**13**	**13**	**13**

MACHINE LEARNING

Subject	**L**	**T**	**P**	**S**	**Credits**	**Inst.**	**Marks**

Code						Hours	CIA	External	Total
CC	5	0	0	-	4	5	25	75	100

Learning Objectives		
LO1	To comprehend the raw data and to design the same with the appropriate machine learning algorithms for a meaningful representation of data..	
Unit	**Contents**	**No. of Hours**
I	**Introduction:** Machine Learning – Examples of Machine Learning Applications. **Supervised Learning:** Learning a Class from Examples – Vapnik-Chervonenkis (VC) Dimension – Probably Approximately Correct (PAC) Learning – Noise – Learning Multiple Classes – Regression – Model Selection and Generalization – Dimensions of a Supervised Machine Learning Algorithm. **Bayesian Decision Theory:** Introduction – Classification – Losses and Risks – Discriminant Functions – Association Rules.	**15**
II	**Parametric Methods:** Maximum Likelihood Estimation – Evaluating an Estimator: Bias and Variance – The Bayes' Estimator – Parametric Classification – Regression – Tuning Model Complexity: Bias/Variance Dilemma – Model Selection Procedures. **Nonparametric Methods:** Nonparametric Density Estimation – Generalization to Multivariate Data – Nonparametric Classification – Condensed Nearest Neighbor – Distance-Based Classification – Outlier Detection – Nonparametric Regression: Smoothing Models	**15**
III	**Linear Discrimination** – Generalizing the Linear Model – Geometry of the Linear Discriminant – Pairwise Separation – Gradient Descent – Logistic Discrimination – Discrimination by Regression – Learning to Rank. **Multilayer Perceptrons:** The Perceptron – Training a Perceptron – Learning Boolean Functions – Multilayer Perceptrons – MLP as a Universal Approximator – Backpropagation Algorithm	**15**
IV	**Combining Multiple Learners:** Generating Diverse Learners – Model Combination Schemes – Voting – Bagging – Boosting – Stacked Generalization – Fine-Tuning an Ensemble – Cascading Reinforcement Learning: Elements of Reinforcement Learning – Model-Based Learning – Temporal Difference Learning – Generalization – Partially Observable States	**15**
V	**Machine Learning with Python**: Data Pre-processing, Analysis & Visualization - Training Data and Test Data – Techniques – Algorithms: List of Common Machine Learning Algorithms- Decision Tree Algorithm- Naïve Bayes Algorithm - K-Means-Random Forest- Dimensionality Reduction Algorithm- Boosting Algorithms –	**15**

	Applications: Social Media-Refinement of Search Engine Results-Product Recommendations-Detection of Online frauds.	
TOTAL		**75**

CO	**Course Outcomes**
CO1	Outline the importance of machine learning in terms of designing intelligent machines
CO2	Identify suitable machine learning techniques for the real time applications
CO3	Analyze the theoretical concepts and how they relate to the practical aspects of machine learning.
CO4	Assess the significance of principles, algorithms and applications of machine learning through a hands-on approach
CO5	Compare the machine learning techniques with respective functionality

Textbooks	
➢	EthemAlpaydın, "Introduction to Machine Learning" Third Edition, MIT, 2014. (Unit I – Unit IV) https://www.tutorialspoint.com/machine_learning_with_python/machine_learning_with_python_tutorial.pdf (**Unit V:** Machine learning with python tutorial)

Reference Books	
	1. Bertt Lantz, "Machine Learning with R," Packt Publishing, 2013
	2. Jason Bell, "Machine Learning: Hands-On for Developers and Technical Professionals," Wiley Publication, 2015.

NOTE: Latest Edition of Textbooks May be Used

Web Resources	
	1. https://www.expertsystem.com/machine-learning-definition/
.	2. https://searchenterpriseai.techtarget.com/definition/machine-learning-ML

MAPPING TABLE

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**2**	**2**	**2**	**2**	**2**
CO2	**2**	**3**	**3**	**3**	**3**	**2**
CO3	**2**	**2**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**2**	**3**	**2**	**3**
CO5	**3**	**3**	**3**	**2**	**3**	**3**

WeightageofcoursecontributedtoeachPSO	**13**	**12**	**13**	**13**	**13**	**13**

NETWORK SECURITY

Subject Code	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
							CIA	**External**	**Total**
CC	-	5	-	-	4	5	25	75	100

Learning Objectives		
LO1	To familiarize on the model of network security, Encryption techniques	
LO2	To understand the design concept of cryptography and authentication	
LO3	To develop experiments on algorithm used for security	
LO4	To understand about virus and threats, firewalls, and implementation of Cryptography	
UNIT	**Details**	**No. of Hours**
I	Model of network security – Security attacks, services and attacks – OSI security architecture – Classical encryption techniques – SDES – Block cipher PrinciplesDES – Strength of DES – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – RC4 - Differential and linear cryptanalysis – Placement of encryption function – traffic confidentiality.	15
II	Number Theory – Prime number – Modular arithmetic – Euclid's algorithm - Fermet's and Euler's theorem – Primality – Chinese remainder theorem – Discrete logarithm – Public key cryptography and RSA – Key distribution – Key management – Diffie Hellman key exchange – Elliptic curve cryptography	15
III	Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA - HMAC – CMAC - Digital signature and authentication protocols – DSS.	15
IV	Authentication applications – Kerberos – X.509 Authentication services - E- mail security – IP security - Web security	15
V	Intruder – Intrusion detection system – Virus and related threats – Countermeasures – Firewalls design principles – Trusted systems – Practical implementation of cryptography and security	15
	Total	**75**
Course Outcomes		

Course Outcomes	On completion of this course, students will;
CO1	Understand public-key cryptography, RSA and other public-key cryptosystems such as Diffie-Hellman Key Exchange, ElGamal Cryptosystem.
CO2	Understand the security issues.
CO3	Apply key management and distribution schemes design. User Authentication
CO4	Analyze and design hash and MAC algorithms, and digital signatures. Analyze and design classical encryption techniques and block ciphers.
CO5	Assess Intruders and Intruder Detection mechanisms, Types of Malicious software,

Reference Text :	
1.	William Stallings, "Cryptography & Network Security", Pearson Education, Fourth Edition 2010.
References :	
1.	CharlieKaufman,RadiaPerlman,MikeSpeciner,"NetworkSecurity,Privatecommunicationinpublicworld",PHISecondEdition,2002
2.	Bruce Schneier, Neils Ferguson, "Practical Cryptography", Wiley Dreamtech India Pvt Ltd, First Edition, 2003.
3.	DouglasRSimson"Cryptography–Theoryandpractice",CRCPress,FirstEdition,1995
Web Resources	
1.	https://www.javatpoint.com/computer-network-security
2.	https://www.tutorialspoint.com/information_security_cyber_law/network_security.htm
3.	https://www.geeksforgeeks.org/network-security/

MAPPING TABLE						
CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**2**	**2**	**2**	**2**	**2**
CO2	**2**	**3**	**3**	**3**	**3**	**2**
CO3	**2**	**2**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**2**	**3**	**2**	**3**
CO5	**3**	**3**	**3**	**2**	**3**	**3**
WeightageofcoursecontributedtoeachPSO	**13**	**12**	**13**	**13**	**13**	**13**

MOBILE APPLICATION DEVELOPMENT

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC	5	0	0	-	4	5	25	75	100

Learning Objectives		
LO1	To provide the students with the basics of Android Software Development tools and development of software on mobile platform.	
Unit	**Contents**	**No. of Hours**
I	IntroductiontoAndroidOperatingSystem– ConfigurationofAndroidEnvironment-CreatetheFirstAndroid Application. Layout: Vertical, Vertical Scroll, horizontal, horizontal Scroll, Table Layout arrangement. **Designing User Interface:** Label Text - TextView – Password Text Box - Button –ImageButton– CheckBox– Image - RadioButton – Slider – Autocomplete text View.	**15**
II	User Interface: Spinner – Switch – Side Bar- ListView - List Picker - Image Picker - Notifier - Time and Date Picker - Web Viewer	**15**
III	**Media: Camcorder - Camera – Player – Speech Recognizer – Text to Speech – Video Player - Canvas**	**15**
IV	Maps: Maps - Sensor: Location Sensor – Barcode Scanner Social components: Contact Picker – Email Picker – Phone Number Picker – Phone Call - Social: Texting	**15**
V	Storage: Cloud DB – Tiny DB – Experimental – Fire DB	**15**
TOTAL		**75**

CO	Course Outcomes
CO1	Charttherequirementsneeded fordevelopingandroidapplication
CO2	Identify the results by executing the application in emulator or in android device

CO3	Apply proper interface setup, styles & themes, storing and management
CO4	Analyze the problem and add necessary user interface components, graphics and multimedia components into the application.
CO5	Evaluate the results by implementing the concept behind the problem with proper code.
Textbooks	
➢	Karen Lang and Selim Tezel, (2022), Become an App Inventor The official guide from MIT App Inventor, Miteen Press, Walker Books Limited.
Reference Books	
1	Wei – Meng Lee, (2012), Beginning Android 4 Application Development, Wiley India Edition.
2	Deital, Android for Programmers-An App-Driven Approach,Second Edition.
NOTE: Latest Edition of Textbooks May be Used	
Web Resources	
	http://ai2.appinventor.mit.edu/reference/
.	http://appinventor.mit.edu/explore/paint-pot-extended-camera

ANNEXURE I

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

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 of simultaneous linear equations – Eigen values and Eigen Vectors.									**12**
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	Marks		
								CIA	External	Total
EC-GS	Discrete Mathematics-II	**Elective**	4	-	-		3	25	75	100

Learning Objectives	
LO1	To Understand set and sequences
LO2	To understand Relational Structures on Sets
LO3	Analyze sets with operations, and identify their structure. Reason and Conclude properties about the structure based on the observations.

UNIT	Contents	No. Of. Hours
I	**Sets and Sequences : Data Models** Finite Sets, Power Set, Cardinality of finite sets, Cartesian Product, Properties of Sets, Vector Implementations of Sets.	**12**
II	**Describing Sets : Logic & Proofs** Introduction to Logic. Propositional Logic, Truth tables, Deduction, Resolution, Predicates and Quantifiers, Mathematical Proofs. Infinite sets, well-ordering. Countable and Uncountable sets, Cantor's diagonalization. Mathematical Induction - weak and strong induction.	**12**

III	**Relational Structures on Sets : Relations & Graphs** Relations, Equivalence Relations. Functions, Bijections. Binary relations and Graphs. Trees (Basics). Posets and Lattices, Hasse Diagrams. Boolean Algebra.	**12**
IV	**Sizes of Sets : Counting &Combinatorics :** Counting, Sum and product rule, Principle of Inclusion Exclusion. Pigeon Hole Principle, Counting by Bijections. Double Counting. Linear Recurrence relations - methods of solutions. Generating Functions. Permutations and counting.	**12**
V	**Structured Sets : Algebraic Structures –** Structured sets with respect to binary operations. Groups, Semigroups, Monoids. Rings, and Fields. Vector Spaces, Basis.	**12**

Total hours		**60**
Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Understanding the concept of set and sequences	PO1, PO2, PO3, PO4, PO5, PO6
CO2	To know the concept of Logics and proofs	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Understanding the Relation and graphs	PO1, PO2, PO3, PO4, PO5, PO6
Textbooks		
1	Discrete Mathematics and its Applications - Kenneth H. Rosen 7th Edition -Tata McGraw Hill Publishers - 2007	
Reference Books		
1.	Elements of Discrete Mathematics, C. L Liu, McGraw-Hill Inc, 1985. Applied Combinatorics, Alan Tucker, 2007.	

2.	Concrete Mathematics, Ronald Graham, Donald Knuth, and Oren Patashnik, 2nd Edition - Pearson Education Publishers - 1996.
3.	Combinatorics: Topics, Techniques, Algorithms by Peter J. Cameron, Cambridge University Press, 1994 (reprinted 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**	**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 various types of statistical data — Frequency Curves and Ogives — Graphical determination of percentiles quartiles and their properties — Merits and Demerits.	**12**
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**	**Marks**		
								CIA	**External**	**Total**
EC-GS	Statistical Methods and its Application-II	**Elect**	4	-	-		3	25	75	100

Learning Objectives		
LO1	To introduce the concept of Statistics	
LO2	To know the concept of Bowley‘s coefficient of Skewness , Coefficient of skewness based upon moments.	
LO3	To Explain the concept of Simple Correlation	
UNIT	**Contents**	**No. Of. Hours**
I	Introduction to statistics – primary and secondary data – classification, tabulation and Diagrammatic Representation of statistical data – Bar-charts, Piediagrams‘ – Graphical Representation of data – Histograms, Frequency polygon, Ogives.	**12**
II	Measures of dispersion – characteristics – coefficient of dispersion - Coefficient of variation-Moments – skewness and kurtosis – Pearson‘s coefficient of skewness - Bowley‘s coefficient of Skewness – Coefficient of skewness based upon moments.	**12**
III	Simple correlation – Karl Pearson‘s coefficient of correlation –	**12**

	correlation coefficient for A bivariate frequency distribution – Rank correlation – Regression lines of regression – Properties of regression coefficient	
IV	Events and sets – sample space – concept of probability – addition and multiplications Theorem on probability – conditional probability and independence of evens – Baye‘s Theorem – concept of random variable – Mathematical Expectation.	**12**
V	Concept of sampling distributions – standard error- Tests of significance based on t, Chi- square and F distributions with respect to mean, variance.	**12**
Total hours		**60**
Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Analyzing the concept of Bowley‘s coefficient of Skewness , Coefficient of skewness based upon moments.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Analyse different concept regarding correlation,regression.	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	Marks		
								CIA	External	Total
EC-GS	Optimization Techniques	**Elect**	4	-	-		3	25	75	100

Learning Objectives		
LO1	To develop mathematical models for the decision making problems of the industry and solve them algorithmically by using the available resources moreeffectively.	
LO2	To understand Scheduling Techniques	
UNIT	**Contents**	**No. Of. Hours**
I	Linear Programming :Linear Programming Problem –Assumptions of LinearProgramming Problem – Three Stages of Linear Programming Problem – Limitations of LinearProgramming – Formulating a Problem as Linear Programming Model – Illustrative examples of LP Model Formulation -General Linear Programming Problem - Canonical and Standard forms ofLPP- Terminology for the solution of LPP- Solving Linear Programming Problems: Graphical Solution method.	**12**
II	Insights into the Simplex method – The computational procedure – Simplex Algorithm – Use ofArtificial variables – Two-Phase Method – Big-M method – Degeneracy and Unboundedness in Linear Programming.	**12**
III	Transportation Problem: General Structure of a Transportation Problem –Existence of solutionand degeneracy in Transportation Problem - Standard transportation table -Solution of aTransportation Problem – Methods for finding Initial Basic feasible solution -Optimality Test- Stepping Stone method - MODI method - Unbalanced Transportation Problem.	**12**

IV	Assignment Problem: Model formulation of an Assignment Problem – Assumptions inAssignment Problem - Methods of solving an Assignment Problem – The Hungarian Assignmentalgorithm – Special cases in Assignment Problems - Maximization cases in Assignment Problems– Prohibited Assignments.	**12**
V	Scheduling Techniques: Why networks? - Basic components of Network – Logical Sequencing- Rules of Network Construction –Network Scheduling - Critical Path Analysis-Critical PathCalculations – Procedure for determining Critical Path.	**12**
Total hours		**60**
Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	summarize various algorithms and rules used in solving OR problems.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	solve all problems of Linear Programming, Transportation, Assignment and Networkscheduling.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	analyze various problems for infeasibility, degeneracy, unboundedness and alternatesolutions.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	find the best suitable method for obtaining optimal solution to Linear Programming,Transportation, Assignment problems.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	formulate the real world decision making problems into mathematical models.	PO1, PO2, PO3, PO4, PO5, PO6
Textbooks		
1	KantiSwarup, P.K.Gupta and Manmohan(2022) , “Operations Research”, Sultan Chand &Sons, Twentieth Revised Edition.	
Reference Books		
1.	J..K.Sharma(2017), “Operations Research Theory and Applications”, LakshmiPublications, Sixth Edition.	
2.	G.Srinivasan (2017), “Operations Research”, PHI Learning Private Limited, ThirdEdition.	

Web Resources	
1.	Web resources from NDL Library, E-content from open-source libraries

Subject Code	Subject Name	Category	L	T	P	S	C	Marks		
								CIA	External	Total
EC-GS	Nano Technology	Elect	4	-	-		3	25	75	100

Learning Objectives	
LO1	To introduce the concept of nano science and nano technology
LO2	To understand the definition of nanosystem
LO3	To explain the concept of nano structured materials

UNIT	Contents	No. Of. Hours
I	Background to nanoscience and nanotechnology - scientific revolutions - nanosizedeffectssurface to volume ratio- – atomic structure – molecules & phases – energy at the nanoscale molecular and atomic size -quantum effects- types of nanotechnology and nano machines	12
II	Definition of a nano system - classification of nanocrystals - dimensionality and size dependent phenomena; Quantum dots, Nanowires and Nanotubes, 2D films;	12
III	Nano &mesopores – top down and bottom up- Misnomers and misconception of Nanotechnologyimportance of the nanoscale materials and their devices -size dependent variation in mechanical, physical and chemical, magnetic, electronic transport, reactivity etc.,	12

IV	Nanostructured materials-metal-semiconductor-ceramics and composites- size dependent properties - uniqueness in these properties compared to bulk and microscopic solids– nanomaterials and nanostructures in nature- superhydrophobicity, self-cleaning - antifogging.	**12**
V	Recent special nanomaterials - Carbon based nanomaterials – CNT-graphene- core-shell structures- Micro and Mesopores Materials-Organic-Inorganic Hybrids- ZnO- Silicon -- DNA- RNA- Nanoproducts	**12**
Total hours		**60**
Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Study and Understand the Rationale, Fundamentals and Applications of Nanotechnology.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Design processing conditions to functional nanomaterials	PO1, PO2, PO3, PO4, PO5, PO6
Textbooks		
1	Introduction to Nanoscience and Nanotechnology, Gabor .L et al,	
Reference Books		
1.	1. "Nanostructures &Nanomaterials: Synthesis, Properties &Applications" G. Cao, Imperial College Press, 2004. 2. Nanomaterials, Nanotechnologies and Design: An introduction for engineers and Architects, Micheal F. Ashby, P.J. Ferreria, D.L. Schodek, 3. Fundamentals of Nanotechnology, Hornyak, G. Louis, Tibbals, H. F., Dutta, Joydeep, CRC Press, 2009 5. Nanomaterials: An introduction to synthesis, properties and application, Dieter Vollath, WILE-VCH, 2008	
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	Introduction to Linear Algebra	Elect	4	-	-		3	25	75	100

Learning Objectives		
LO1	Introduce the theory of systems of linear equations and mathematical proofs.	
LO2	To get the Knowledge about Matrices	
LO3	To understand the topics of linear equations	
UNIT	**Contents**	**No. Of. Hours**
I	Vector spaces: Definitions and Examples – Subspaces – Linear Transformations - Span of a set.	**12**
II	Linear independence – Basis and dimensions – Rank and Nullity – Matrix of a linear transformation.	**12**
III	Inner product Spaces: Definition and examples – Orthogonality – Orthogonal Complement.	**12**
IV	Matrices – Elementary transformations – Rank of a matrix – Simultaneous linear equations – Characteristic equations and Cayley Hamilton theorem – Eigen values and eigen vectors.	**12**
V	Bilinear forms – Quadratic forms.	**12**
Total hours		**60**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	The concept of linear algebra and crucial for understanding the theory behind machine learning and deep learning.	PO1, PO2, PO3, PO4, PO5, PO6

CO2	Prove statements of an algebraic nature concerning linear transformations	PO1, PO2, PO3, PO4, PO5, PO6
Textbooks		
1	Dr. S. Arumugam and Prof. A. Thangapandi Isaac, Modern Algebra, SciTech Publication, India Private Ltd., January 2018. Unit I: Chapter 5 – Sections 1, 2, 3 and 4 Unit II: Chapter 5 – Sections 5, 6, 7 and 8 Unit III: Chapter 6 – Sections 1, 2 and 3 Unit IV: Chapter 7 – Sections 4, 5, 6, 7 and 8 Unit V: Chapter 8 – Sections 1 and 2.	
Reference Books		
1.	I. N. Herstein, Topics in Algebra, Wiley Eastern Ltd, 2006.	
2.	A. R. Vasishtha, Modern Algebra, Krishna Publication, January 2015	
Web Resources		
1.	Web resources from NDL Library, E-content from open-source libraries	

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Cre**	**Marks**		
								CIA	**External**	**Total**
EC-GS	Graph Theory and its Application	**Elect**	4	-	-		3	25	75	100
Learning Objectives										
LO1	Definition of Graph, sub graph their representations, degree and algebraic operations.									
LO2	Connected graphs, weighted graphs and shortest paths									
LO3	Trees: Characterizations, spanning tree, minimum spanning trees									

LO4	Eulerian and Hamiltonian graphs: Characterization, Necessary and sufficient conditions	
LO5	Special classes of graphs: Bipartite graphs, line graphs, chordal graphs	
UNIT	**Contents**	**No. Of. Hours**
I	**INTRODUCTION**: Graph-mathematical definition- Introduction – sub graphs –Walks, paths, Circuits connectedness- Components- Euler Graphs- Hamiltonian paths and circuits-Trees- properties of Trees- Distance and centers in Tree- Rooted and Binary Trees	**12**
II	**CONNECTIVITY AND PLANARITY:** Introduction to circuits - cut set- properties of cut set- All cut sets –connectivity and separability – Network Flows - 1-Isomorphism - 2-Isomorphism- Combinatorial and Geometric graphs- Planar Graphs – Different representation of planar graph.	**12**
III	**COLORING AND DIRECTED GRAPH:** Basics of Colouring&Chromatic number – Chromatic partitioning – Graph Colouring – four colour Problem Chromatic polynomial - Matching – Covering - Directed graphs - Types of Directed Graphs – Diagraphs and binary relations – Directed paths- Euler Graph.	**12**
IV	**MATRIX REPRESENTATION IN GRAPH:** Matrix representation of graphs, Sub graphs& Quotient Graphs, Transitive Closure digraph, Euler's Path & Circuit (only definitions and examples), spanning Trees of Connected Relations, Prim's Algorithm to construct Spanning Trees, Weighted Graphs, Minimal, Spanning Trees by Prim's Algorithm &Kruskal's Algorithm.	**12**
V	**APPLICATIONS OF GRAPH:** Traveling Sales Person Problem with Directed and Un directed Graph, - Graph with n vertices and k colours- Shortest path from one to many Cities with directed graph- Shortest Paths with Un directed Graphs-Connected Components.	**12**
Total hours		**60**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	To Introduce the fundamental concepts in graph theory Graphs, subgraphs, walks, Euler graphs, Hamiltonian Paths Tree Properties , Hamiltonian paths and circuits	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Understanding the concepts of Circuits, Cut set and its Properties, Network Flows, Isomorphism and Combinatorial and Planar Graphs.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Applying the concept of Colouring with Chromatic Number, Directed Graphs, Matching , Covering Pattern and Euler Graphs	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Analysing the Various Concepts of Representation of Graphs, Euler Paths Circuit, Kruskals and Prims Algorithms, Connected Components.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Implementation of an application using All Types of Graphs and evaluate the Applications with travelling sales person Problem, K colour Problem with n vertices in a Graph and Shortest Path finding Problem using Directed and Undirected Graphs	PO1, PO2, PO3, PO4, PO5, PO6
Textbooks		
1	NarsinghDeo , " Graph Theory with Application to Engineering and Computer Science" Prentice Hall of India 2010(Reprint)	
2	Rosen H "Discrete Mathematics and Its Application " McGraw Hill , 2007	
Reference Books		
1.	Discrete Maths for Computer Scientists & Mathematicians by Mott, Kandel, Baker	
2.	Clark J and Holton DA " First look at Graph Theory" Allied Publishers 1995	
3.	Discrete Maths for Computer Scientists & Mathematicians by Mott, Kandel, Baker	
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	Financial Accounting	**Elective**	4	-	-		3	25	75	100

Learning Objectives	
LO1	Describe cost classifications.
LO2	Describe cost estimation and analysis methods.
LO3	Apply the cost-volume-profit analysis for business decisions.

UNIT	Contents	No. Of. Hours
I	Accounting Principles – Concepts – Conventions – Rules of Double Entry System – Transactions - Journals – Ledgers – Subsidiary Books – Trial Balance.	**12**
II	Errors – Types – Errors disclosed and not disclosed by trial balance – Suspense account – Rectification of errors – Bank Reconciliation Statement	**12**
III	Final accounts of sole trading concerns with adjustments.	**12**
IV	Bills of Exchange – Trade and Accommodation bills – Renewals – Dishonour due to insolvency – Retiring the bill.	**12**
V	Single entry or Accounts from incomplete records – Methods of ascertainment of profit : Net worth method – Conversion method	**12**
Total hours		**60**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	

CO1	Exemplify to prepare and analyse the financial statements.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Acquire the basic concept of accounting terms.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Journalize the ability to rectify the errors in bank reconciliation statement.	PO1, PO2, PO3, PO4, PO5, PO6
Textbooks		
1	BOOKS FOR STUDY: 1. Advanced Accountancy - R.L.Gupta and Radhaswamy 2. Advanced accounting - S.P. Jain and K.L. Narang 3. Advanced Accountancy - M.A.Arulanandam and K.S. Raman 4. Advanced Accountancy - S.N. Maheswari and S.K. Maheshwari 5. Advanced Accountancy - T.S.Reddy and A.Murthy 6. Principles of Accountancy - DalstonL.Cecil and JenitraL.Merwin	
Reference Books		
1.	1. Advanced Accounts - M.C.Shukla and T.S.Grewal 2. Advanced Accountancy - P.C.Tulsian 3. Introduction to accountancy - T.S. Grewal	
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	Cost and Management Accounting	**Elective**	4	-	-		3	25	75	100
Learning Objectives										

LO1	To acquaint the students with basic concepts used in the cost accounting, various methods involved in cost ascertainment and cost accounting book keeping system.	
LO2	To impart knowledge of profit planning, decision making and give information about budgeting.	
UNIT	**Contents**	**No. Of. Hours**
I	**Introduction :** Definition of Cost – Costing, Cost Accounting and Cost Accountancy – Scope and Objectives – Advantages and Limitations – Cost Accounting VS Financial Accounting and Cost Accounting VS Management Accounting – Classification of Cost – Elements of Cost – Preparation of Cost sheet.	**12**
II	**Material :** Material Control – Purchase Procedure – Different Levels of Stock of Materials – EOQ – Perpetual Inventory System – ABC Analysis – Inventory Turnover Ratio – Bin Card – Stores Ledger – Pricing of Material Issues (FIFO, LIFO and Average Methods). **Methods of Costing :** Operating costing – Process Costing – Normal Loss, Abnormal Loss and Abnormal effectives – Process Accounts (Excluding Inter – Process Profit and Equivalent Production)	**12**
III	**Management Accounting :** Meaning – Definition – Characteristics – Scope – Objectives and Functions – Advantages – Limitations – Management Accounting Vs Financial Accounting – Management Accounting Vs. Cost Accounting – Tools and Techniques of Management Accounting.	**12**
IV	**Financial Statement Analysis:** Meaning – Importance and Limitations of Financial Statements – Techniques of Financial Statement Analysis – Comparative Statements – Common size statement – Trend Analysis (Theory Only)	**12**
V	Meaning – Advantages – Limitations – Classifications and Computation of Ratios (Simple Problems) UNIT – III Cash Flow Statement – Meaning – Importance – Advantages – Limitations – Preparation of Cash Flow Statements (As per Revised Accounting Standards) Simple Problems – Preparation of Cash Budget – Cash Flow Statement Vs.Cash Budget.	**12**
Total hours		**60**

Course Outcomes		Programme Outcomes
CO		
CO1	critically analyse and provide recommendations to improve the operations of organisations through the application of management accounting techniques;	PO1, PO2, PO3, PO4, PO5, PO6
CO2	demonstrate mastery of costing systems, cost management systems, budgeting systems and performance measurement systems.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	demonstrate mastery of costing systems, cost management systems, budgeting systems and performance measurement systems.	PO1, PO2, PO3, PO4, PO5, PO6
Textbooks		
	Cost Accouting : 1 .Cost Accounting - R.S.N.Pillai and Bhagavathi 2. Cost Accounting - T.S. Reddy and Y.Hair Prasad Reddy 3. Advanced Cost Accounting - S.P.Jain&K.L.Narang 4. Cost Accounting - S.P. Iyengar. Management Accounting : 1. Management Accounting & Financial Control :S.N.Maheswari 2. Management Accounting :T.S.Reddy and Y. Hari Prasad Reddy 3. Management Accounting :Manmohan&Goyal 4. Management Accounting :M.Y.Khan&P.K.Jain. 5. Management Accounting :GordenP.Jeyaram, N.Sundaram,R.Jeyachandran	
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	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*,6thEdition,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

ANNEXURE I

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..

Elective course – (EC1-EC8)-Discipline Specific Syllabus

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

Learning Objectives	
LO1	To understand approaches to syntax and semantics in NLP.
LO2	To learn natural language processing and to learn how to apply basic algorithms in this field.
LO3	To understand approaches to discourse, generation, dialogue and summarization within NLP.
LO4	Toget acquainted with the algorithmic description of the main language levels: morphology, syntax, semantics, pragmatics etc.
LO5	To understand current methods for statistical approaches to machine translation.

UNIT	Contents	No. Of. Hours
I	**Introduction :** Natural Language Processing tasks in syntax, semantics, and pragmatics – Issue- Applications – The role of machine learning – Probability Basics –Information theory – Collocations -N-gram Language Models – Estimating parameters and smoothing – Evaluating language models.	**12**
II	**Word level and Syntactic Analysis:**Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging.Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing.	**12**
III	**Semantic analysis and Discourse Processing:** Semantic Analysis: Meaning Representation-Lexical Semantics- Ambiguity-Word Sense Disambiguation. Discourse Processing: cohesion-Reference Resolution- Discourse Coherence and Structure.	**12**
IV	**Natural Language Generation:** Architecture of NLG Systems- Generation Tasks and Representations- Application of NLG. Machine Translation: Problems in Machine Translation. Characteristics of Indian Languages-Machine Translation Approaches-Translation involving Indian Languages.	**12**
V	**Information retrieval and lexical resources:** Information Retrieval: Design features of Information Retrieval Systems-Classical, Non-classical, Alternative Models of Information Retrieval – valuation Lexical Resources: WorldNet-Frame NetStemmers- POS Tagger- Research Corpora SSAS.	**12**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Describe the fundamental concepts and techniques of natural language processing. Explain the advantages and disadvantages of different NLP technologies and their applicability in different business situations.	
CO2	Distinguish among the various techniques, taking into account the assumptions, strengths, and weaknesses of each Use NLP technologies to explore and gain a broad understanding of text data.	
CO3	Use appropriate descriptions, visualizations, and statistics to communicate the problems and their solutions. Use NLP methods to analyse sentiment of a text document.	
CO4	Analyze large volume text data generated from a range of real-world applications. Use NLP methods to perform topic modelling.	
CO5	Develop robotic process automation to manage business processes and to increase and monitor their efficiency and effectiveness. Determine the framework in which artificial intelligence and the Internet of things may function, including interactions with people, enterprise functions, and environments.	
Textbooks		
1	Daniel Jurafsky, James H. Martin, "Speech & language processing", Pearson publications.	
2	Allen, James. Natural language understanding. Pearson, 1995.	
Reference Books		
1.	Pierre M. Nugues, "An Introduction to Language Processing with Perl and Prolog",Springer	
Web Resources		
1.	https://en.wikipedia.org/wiki/Natural_language_processing	
2.	https://www.techtarget.com/searchenterpriseai/definition/natural-language-processing-NLP	

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	2	3	3	3	2	3

CO 3	3	3	3	3	3	3
CO 4	3	2	3	3	2	3
CO 5	3	3	3	3	3	3
WeightageofcoursecontributedtoeachPSO	14	14	15	15	13	15

ANALYTICS FOR SERVICE INDUSTRY

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Marks**		
								CIA	**External**	**Total**
	ANALYTICS FOR SERVICE INDUSTRY	**Elect**	4	-	-	-	3	25	75	100

	Learning Objectives
LO1	Recognize challenges in dealing with data sets in service industry.
LO2	Identify and apply appropriate algorithms for analyzing the healthcare, Human resource, hospitality and tourism data.
LO3	Make choices for a model for new machine learning tasks.
LO4	To identify employees with high attrition risk.
LO5	To Prioritizing various talent management initiatives for your organization.

UNIT	**Contents**	**No. Of. Hours**
I	**Healthcare Analytics :** Introduction to Healthcare Data Analytics- Electronic Health Records– Components of EHR- Coding Systems- Benefits of EHR- Barrier to Adopting HER Challenges-Phenotyping Algorithms. Biomedical Image Analysis and Signal Analysis- Genomic Data Analysis for Personalized Medicine. Review of Clinical Prediction Models.	**12**
II	**Healthcare Analytics Applications :** Applications and Practical Systems for Healthcare– Data Analytics for Pervasive Health- Fraud Detection in Healthcare- Data Analytics for Pharmaceutical Discoveries- Clinical Decision Support Systems- Computer-	**12**

	Assisted Medical Image Analysis Systems- Mobile Imaging and Analytics for Biomedical Data.	
III	**HR Analytics:** Evolution of HR Analytics, HR information systems and data sources, HR Metric and HR Analytics, Evolution of HR Analytics; HR Metrics and HR Analytics; Intuition versus analytical thinking; HRMS/HRIS and data sources; Analytics frameworks like LAMP, HCM:21(r) Model.	**12**
IV	**Performance Analysis:** Predicting employee performance, Training requirements, evaluating training and development, Optimizing selection and promotion decisions.	**12**
V	**Tourism and Hospitality Analytics:** Guest Analytics – Loyalty Analytics – Customer Satisfaction – Dynamic Pricing – optimized disruption management – Fraud detection in payments.	**12**
	TOTAL HOURS	**60**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Understand and critically apply the concepts and methods of business analytics	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Identify, model and solve decision problems in different settings.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Interpret results/solutions and identify appropriate courses of action for a given managerial situation whether a problem or an opportunity.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Create viable solutions to decision making problems.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Instill a sense of ethical decision-making and a commitment to the long-run welfare of both organizations and the communities they serve.	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks

1	Chandan K. Reddy and Charu C Aggarwal, "Healthcare data analytics", Taylor & Francis, 2015.
2	Edwards Martin R, Edwards Kirsten (2016),"Predictive HR Analytics: Mastering the HR Metric", Kogan Page Publishers, ISBN-0749473924
3	Fitz-enzJac (2010), "The new HR analytics: predicting the economic value of your company's human capital investments", AMACOM, ISBN-13: 978-0-8144-1643-3

4	RajendraSahu, Manoj Dash and Anil Kumar. Applying Predictive Analytics Within the Service Sector.
Reference Books	
1.	Hui Yang and Eva K. Lee, "Healthcare Analytics: From Data to Knowledge to Healthcare Improvement, Wiley, 2016
2.	Fitz-enzJac, Mattox II John (2014), "Predictive Analytics for Human Resources", Wiley, ISBN- 1118940709.
Web Resources	
1.	https://www.ukessays.com/essays/marketing/contemporary-issues-in-marketing-marketing-essay.php
2.	https://yourbusiness.azcentral.com/examples-contemporary-issues-marketing-field-26524.html

Mapping with Programme Outcomes:

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO 1	3	3	3	3	3	3
CO 2	2	3	3	3	3	3
CO 3	3	3	2	3	3	2
CO 4	3	3	3	3	3	3
CO 5	3	3	3	3	3	3
Weightageof coursecontributedtoeachPSO	14	15	14	15	15	14

S-Strong-3 M-Medium-2 L-Low-1

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**: SecureSocketLayer and 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

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	12

	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.	
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 Loop Control Statements.	12
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

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**
EC-DS	**Human Computer Interaction**	Elective	-	Y	-	V	3	4	25	75	100
Course Objective											
C1	To learn about the foundations of Human Computer Interaction.										
C2	To learn the design and software process technologies.										

C3	To learn HCI models and theories.	
C4	To learn Mobile Ecosystem.	
C5	To learn the various types of Web Interface Design.	
UNIT	**Details**	**No. of Hours**
I	**FOUNDATIONS OF HCI :** • The Human: I/O channels – Memory • Reasoning and problem solving; The Computer: Devices – Memory – processing and networks; • Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms. - Case Studies	12
II	**DESIGN & SOFTWARE PROCESS:** • Interactive Design: • Basics – process – scenarios • Navigation: screen design Iteration and prototyping. • HCI in software process: • Software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules: principles, standards, guidelines, rules. Evaluation Techniques – Universal Design	12
III	**MODELS AND THEORIES:** • HCI Models : Cognitive models:- Socio-Organizational issues and stakeholder requirements Communication and collaboration models-Hypertext, Multimedia and WWW.	12
IV	**Mobile HCI:** • Mobile Ecosystem: Platforms, Application frameworks • Types of Mobile Applications: Widgets, Applications, Games • Mobile Information Architecture, Mobile 2.0, • Mobile Design: Elements of Mobile Design, Tools. - Case Studies	12
V	**WEB INTERFACE DESIGN:** Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow - Case Studies	12
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Understand thefundementals of HCI.	PO1
2	Understand the design and software process technologies.	PO1, PO2

3	Understand HCI models and theories.	PO4, PO6
4	Understand Mobile Ecosystem, types of Mobile Applications, mobile Architecture and design.	PO4, PO5, PO6
5	Understand the various types of Web Interface Design.	PO3, PO8
Text Book		
1	Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human -Computer Interaction‖", III Edition, Pearson Education, 2004 (UNIT I, II & III)	
2	Brian Fling, ―"Mobile Design and Development", I Edition, O'Reilly Media Inc., 2009(UNIT–IV)	
3	Bill Scott and Theresa Neil, ―Designing Web Interfaces‖, First Edition, O'Reilly, 2009. (UNIT-V)	
Reference Books		
1.	Shneiderman, "Designing the User Interface: Strategies for Effective Human-Computer Interaction", V Edition, Pearson Education.	
Web Resources		
1.	https://www.interaction-design.org/literature/topics/human-computer-interaction	
2.	https://link.springer.com/10.1007/978-0-387-39940-9_192	
3.	https://en.wikipedia.org/wiki/Human%E2%80%93computer_interaction	

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 Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
EC-DS	**Fuzzy Logic**	Elective	Y	-	-	V	3	4	25	75	100
Course Objective											
CO1	To understand the basic concept of Fuzzy logic										

CO2	To learn the various operations on relation properties		
CO3	To study about the membership functions		
CO4	To learn about the Defuzzification and Fuzzy Rule-Based System		
CO5	To learn the concepts of Applications of Fuzzy Logic		
UNIT	**Details**	**No. of Hours**	**Course Objective**
I	Introduction to Fuzzy Logic- Fuzzy Sets- Fuzzy Set Operations, Properties of Fuzzy Sets, Classical and Fuzzy Relations: Introduction-Cartesian Product of Relation-Classical Relations-Cardinality of Crisp Relation.	12	C1
II	Operations on Crisp Relation-Properties of Crisp Relations-Composition Fuzzy Relations, Cardinality of Fuzzy Relations-Operations on Fuzzy Relations-Properties of Fuzzy Relations-Fuzzy Cartesian Product and Composition-Tolerance and Equivalence Relations ,Crisp Relation.	12	C2
III	Membership Functions: Introduction, Features of Membership Function, Classification of Fuzzy Sets, Fuzzification, Membership Value Assignments, Intuition, Inference, Rank Ordering.	12	C3
IV	Defuzzification: Introduction, Lambda Cuts for Fuzzy Sets, Lambda Cuts for Fuzzy Relations, Defuzzification Methods, Fuzzy Rule-Based System: Introduction, Formation of Rules, Decomposition of Rules, Aggregation of Fuzzy Rules, Properties of Set of Rules.	12	C4
V	Applications of Fuzzy Logic: Fuzzy Logic in		

	Automotive Applications, Fuzzy Antilock Brake System-Antilock-Braking System and Vehicle Speed-Estimation Using Fuzzy Logic.	12	C5
	Total		

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Understand the basics of Fuzzy sets, operation and properties.	PO1
2	Apply Cartesian product and composition on Fuzzy relations and usethe tolerance and Equivalence relations.	PO1, PO2
3	Analyze various fuzzification methods and features of membership Functions.	PO4, PO6
4	Evaluate defuzzification methods for real time applications.	PO4, PO5, PO6
5	Design an application using Fuzzy logic and its Relations.	PO3, PO8

Text Book	
1	S. N. Sivanandam, S. Sumathi and S. N. Deepa-Introduction to Fuzzy Logic using MATLAB, Springer-Verlag Berlin Heidelberg 2007.
Reference Books	
1.	Guanrong Chen and Trung Tat Pham- Introduction to Fuzzy Sets, Fuzzy Logic and Fuzzy Control Systems
2.	Timothy J Ross , Fuzzy Logic with Engineering Applications
Web Resources	
1.	https://www.javatpoint.com/fuzzy-logic
2.	https://www.guru99.com/what-is-fuzzy-logic.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

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 Techniques.	PO3, PO8

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

Course Objective	
C1	To understand the robotics fundamentals
C2	Understand the sensors and matrix methods
C3	Understand the Localization: Self-localizations and mapping
C4	To study about the concept of Path Planning, Vision system
C5	To learn about the concept of robot artificial intelligence

UNIT	**Details**	**No. of Hours**	**Course Objective**
I	Introduction: Introduction, brief history, components of robotics, classification, workspace, work-envelop, motion of robotic arm, end-effectors and its types,	12	CO1

	service robot and its application, Artificial Intelligence in Robotics.		
II	Actuators and sensors :Types of actuators, stepper-DC-servo-and brushless motors- model of a DC servo motor-types of transmissions-purpose of sensor-internal and external sensor-common sensors-encoders tachometers-strain gauge based force torque sensor-proximity and distance measuring sensors Kinematics of robots: Representation of joints and frames, frames transformation, homogeneous matrix, D-H matrix, Forward and inverse kinematics: two link planar (RR) and spherical robot (RRP). Mobile robot Kinematics: Differential wheel mobile robot	12	CO2
III	Localization: Self-localizations and mapping - Challenges in localizations – IR based localizations – vision based localizations – Ultrasonic based localizations - GPS localization systems.	12	CO3
IV	Path Planning: Introduction, path planning-overview-road map path planning-cell decomposition path planning potential field path planning-obstacle avoidance-case studies Vision system: Robotic vision systems-image representation-object recognition-and categorization-depth measurement- image data compression-visual inspection-software considerations	12	CO4
V	Application: Ariel robots-collision avoidance robots for	12	CO5

	agriculture-mining-exploration-underwater-civilian- and military applications-nuclear applications-space Applications-Industrial robots-artificial intelligence in robots-application of robots in material handling-continuous arc welding-spot welding-spray painting-assembly operation-cleaning-etc.		
	Total	**60**	

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Describe the different physical forms of robot architectures.	PO1
2	Kinematically model simple manipulator and mobile robots.	PO1, PO2
3	Mathematically describe a kinematic robot system	PO4, PO6
4	Analyze manipulation and navigation problems using knowledge of coordinate frames, kinematics, optimization, control, and uncertainty.	PO4, PO5, PO6
5	Program robotics algorithms related to kinematics, control, optimization, and uncertainty.	PO3, PO8

Text Book	
1	RicharedD.Klafter. Thomas Achmielewski and MickaelNegin, Robotic Engineering and Integrated Approach, Prentice Hall India-Newdelhi-2001
2	SaeedB.Nikku, Introduction to robotics, analysis, control and applications, Wiley-India, 2 nd edition 2011

Reference Books	
1.	Industrial robotic technology-programming and application by M.P.Groover et.al, McGrawhill2008
2.	Robotics technology and flexible automation by S.R.Deb, THH-2009

Web Resources	
1.	https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_robotics.htm
2.	https://www.geeksforgeeks.org/robotics-introduction/

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**
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 – Important Terminologies of ANNs – McCulloch-Pitts Neuron – Linear Separability – Hebb Network.	12	C4
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**
	Grid Computing	Elective	-	Y	-	-	3	4	25	75	100

EC-DS											
Course Objective											
C1	To learn the basic construction and application of Grid computing.										
C2	To learn grid computing organization and their Role.										
C3	To learn Grid Computing Anotomy.										
C4	To learn Grid Computing road map.										
C5	To learn various type of Grid Architecture.										
UNIT	**Details**										**No. of Hours**
I	Introduction: Early Grid Activity, Current Grid Activity, Overview of Grid Business areas, Grid Applications, Grid Infrastructures.										12
II	Grid Computing organization and their Roles: Organizations Developing Grid Standards, and Best Practice Guidelines, Global Grid Forum (GCF), #Organization Developing Grid Computing Toolkits and Framework#, Organization and building and using grid based solutions to solve computing, commercial organization building and Grid Based solutions.										12
III	Grid Computing Anatomy: The Grid Problem, The conceptual of virtual organizations, # Grid Architecture # and relationship to other distributed technology.										12
IV	The Grid Computing Road Map: Autonomic computing, Business on demand and infrastructure virtualization, Service-Oriented Architecture and Grid, #Semantic Grids#.										12
V	Merging the Grid services Architecture with the Web Services Architecture: Service-Oriented Architecture, Web Service Architecture, #XML messages and Enveloping#, Service message description Mechanisms, Relationship between Web Services and Grid Services, Web services Interoperability and the role of the WS-I Organization.										12
	Total										**60**
Course Outcomes											**Programme Outcome**
CO	On completion of this course, students will										
1	To understand the basic elements and concepts of Grid computing.										PO1
2	To understand the Grid computing toolkits and Framework.										PO1, PO2
3	To understand the concepts of Anotomy of Grid Computing.										PO4, PO6
4	To understand the concept of service oriented architecture.										PO4, PO5, PO6
5	To Gain knowledge on grid and web service architecture.										PO3, PO8
Text Book											
1	Joshy Joseph and Craig Fellenstein, Grid computing, Pearson / IBM Press, PTR, 2004.										

Reference Books	
1.	1. Ahmer Abbas and Graig computing, A Practical Guide to technology and applications, Charles River Media, 2003.
Web Resources	
1.	https://en.wikipedia.org/wiki/Grid_computing
2.	https://link.springer.com/chapter/10.1007/978-1-84882-409-6_4
3.	https://www.redbooks.ibm.com/redbooks/pdfs/sg246778.pdf

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 Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
EC-DS	**Trends in Computing**	Elective	-	Y	-	-	3	4	25	75	100
Course Objective											
C1	Learning current trends in various computer science and information technology fields.										
C2	Learning various fields of Cloud computing, Green computing ,the Edge and Fog computing technology.										
C3	To learn about Architecture and Application design of Cloud, Edge & fog computing.										
C4	To know computingandtoimprove security services of computing technologies.										

C5	To learn the various Case Studies in Cloud, Edge & fog Computing.	
UNIT	**Details**	**No. of Hours**
I	**Era of Cloud Computing**: Introduction – Components of Cloud Computing – Cloud Types: Private, Public and Hybrid clouds – Limitations of the Cloud - **Virtualization**: Structure and Mechanisms.	12
II	**Cloud computing Services**: Software as a Service(SaaS) – Platform as a Service(PaaS)- Infrastructure as a Service(IaaS)-Database as a Service(DBaaS)- Recent Trends in cloud computing and Standards- **Data Security in Cloud** – Risks and Challenges with Cloud Data-Security as a Service.	12
III	**EdgeComputing:**EdgeComputing and Its Essentials: Introduction-EdgeComputing Architecture- Advantages and Limitations of EdgeComputingSystems- EdgeComputing Interfaces and Devices - EdgeAnalytics: Edge Data Analytics – Potential of EdgeAnalytics – Architecture of EdgeAnalytics – Case study	12
IV	**Edge Data storage Security:** Edge-Based Attack Detection and Prevention-Edge Computing Use Cases and Case Studies: Edge Computing High- Potential Use Cases. **Introductiontogreen computing**–Calculatingcarbonfootprint-**Choosing Green PC path:** A green make over – Buying green computer- ChoosingEarthFriendlyperipherals	12
V	Fog Computing: Introduction to Fog computing – Architecture - Characteristics - Fog Computing Services – Fog Resource Estimation and Its Challenges-Fog computing on 5G networks – Fog computing Use cases and Case studies.	12
	Total	**60**
Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Outline the concepts, applications, benefits and limitations of various computing paradigms.	PO1

2	Classify the computing technologies based on its architecture and infrastructure and identify its strategies.	PO1, PO2
3	Examinevariouscloudservices, Securitythreatexposurewithinacloudcomputing infrastructure.	PO4, PO6
4	Asses the problems and solutions involved in various stages of different computing environments.	PO4, PO5, PO6
5	Discuss the importance of cloud, edge and Fog technology and implement innovative ideas and practices for regulating green IT.	PO3, PO8
Text Book		
1	Kailas Jayaswal,JagannathKallakurchi,DonaldJ.Houde,Dr.Devan Shah " Cloud Computing –Black Book" Edition :2020 (UNIT I & II : CHAPTER 1,2,3,9,11)	
2	K. AnithaKumari G. SudhaSadasivam D. Dharani M. Niranjanamurthy, "EDGE COMPUTING Fundamentals, Advances and Applications", First Edition 2022, CRC Press. (UNIT III & IV : CHAPTER 1, 2 , 3, 4,5,6)	
3	Woody Leonhard and Katherine Murray (2009) ,Green Home Computing forDummies,WilleyPublishingInc. (UNIT IV : CHAPTER 2 ,5,6,7)	
4	EvangelosMarkakis, George Mastorakis, ConstandinosX.Mavromoutakis and Evangelospallis "Cloud and Fog computing in 5G mobile Networks" ,First edition 2017. (UNIT V: CHAPTER 2)	
Reference Books		
1.	RajKumarBuyya,ChristianVecchiola,S.ThamaraiSelvi,(2013),MasteringCloudComputing,McGraw Hill Education.	
2.	MichaelMiller,(2009), CloudComputing,PearsonEducation.	
3.	Shijun Liu BedirTekinerdoganMikio Aoyama Liang-Jie Zhang" Edge Computing – EDGE " 2018.	
4.	FlavioBonomi, Rodolfo Milito, Jiang Zhu, SateeshAddepalli, ―Fog Computing and Its Role in the Internet of Things‖, MCC'12, August 17, 2012, Helsinki, Finland. Copyright 2012.	
5	Amir M. Rahmani · Pasi LiljebergJürgo-Sören Preden "Fog Computing in the Internet of Things"Springer,2018. (UNIT V: PART/CHAPTER (1.4,2.5)	
Web Resources		
1.	https://static.googleusercontent.com/media/www.google.com/en//green/pdfs/google-	

	green- computing.pdf(CaseStudy)
2.	http://whatiscloud.com/basic_concepts_and_terminology/cloud
3.	http://www.computerweekly.com/guides/Using-green-computing-for-improving-energy- efficiency

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 Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
EC-DS	**Artificial Neural Networks**	Core	4	Y	-	-	3	4	25	75	100
Course Objective											
C1	**Understand the basics of artificial neural networks, learning process, single layer and multi-layer perceptron networks.**										
C2	Understand the Error Correction and various learning algorithms and tasks.										
C3	Identify the various Single Layer Perception Learning Algorithm.										
C4	Identify the various Multi-Layer Perception Network.										
C5	Analyze the Deep Learning of various Neural network and its Applications.										
UNIT	**Details**										**No. of**

		Hours
I	Artificial Neural Model- Activation functions- Feed forward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem - Multilayer Networks. Learning Algorithms- Error correction - Gradient Descent Rules, Perception Learning Algorithm, Perception Convergence Theorem.	12
II	Introduction, Error correction learning, Memory-based learning, Hebbian learning, Competitive learning, Boltzmann learning, credit assignment problem, Learning with and without teacher, learning tasks, Memory and Adaptation.	15
III	.Single layer Perception: Introduction, Pattern Recognition, Linear classifier, Simple perception, Perception learning algorithm, Modified Perception learning algorithm, Adaptive linear combiner, Continuous perception, Learning in continuous perception. Limitation of Perception.	12
IV	Multi-Layer Perception Networks: Introduction, MLP with 2 hidden layers, Simple layer of a MLP, Delta learning rule of the output layer, Multilayer feed forward neural network with continuous perceptions, Generalized delta learning rule, Back propagation algorithm	12
V	Deep learning- Introduction- Neuro architectures building blocks for the DL techniques, Deep Learning and Neocognitron, Deep Convolutional Neural Networks, Recurrent Neural Networks (RNN), feature extraction, Deep Belief Networks, Restricted Boltzman Machines, Training of DNN and Applications	12
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	**Students will learn the basics of artificial neural networks with single layer and multi-layer perception networks.**	PO1
2	Learn about the Error Correction and various learning algorithms and tasks.	PO1, PO2

3	Learn the various Perception Learning Algorithm.	PO4, PO6
4	Learn about the various Multi-Layer Perception Network.	PO4, PO5, PO6
5	Understand the Deep Learning of various Neural network and its Applications.	PO3, PO8
Text Book		
1	Neural Networks A Classroom Approach- Satish Kumar, McGraw Hill- Second Edition.	
2.	"Neural Network- A Comprehensive Foundation"- Simon Haykins, Pearson Prentice Hall, 2nd Edition, 1999.	
Reference Books		
1.	Artificial Neural Networks-B. Yegnanarayana, PHI, New Delhi 1998.	
Web Resources		
1.	https://www.w3schools.com/ai/ai_neural_networks.asp	
2.	https://en.wikipedia.org/wiki/Artificial_neural_network	
3.	https://link.springer.com/chapter/10.1007/978-3-642-21004-4_12	

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 Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
EC-DS	**Agile Project Management**	Elective	-	Y	-	-	3	4	25	75	100
Course Objective											
C1	Learning of software design, software technologies and APIs.										
C2	Detailed demonstration about Agile development and testing techniques.										
C3	Learning about Agile Planning and Execution.										
C4	Learning of Agile Management Design and Quality Check.										
C5	Detailed examination of Agile development and testing techniques.										
UNIT	**Details**										**No. of Hours**
I	**Introduction:Modernizing Project Management:** Project Management Needed a Makeover – Introducing Agile Project Management. **Applying the Agile Manifesto and Principles:** Understanding the Agile manifesto – Outlining the four values of the Agile manifesto – Defining the 15 Agile Principles – Adding the Platinum Principles – Changes as a result of Agile Values – The Agile litmus test. **Why Being Agile Works Better:** Evaluating Agile benefits – How Agile approaches beat historical approaches – Why people like being Agile.										12
II	**Being Agile** **Agile Approaches:** Diving under the umbrella of Agile approaches – Reviewing the Big Three: Lean, Scrum, Extreme Programming - Summary **Agile Environments in Action:** Creating the physical environment –										12

	Low-tech communicating – High-tech communicating – Choosing tools. **Agile Behaviours in Action:** Establishing Agile roles – Establishing new values – Changing team philosophy.	
III	**Agile Planning and Execution** **Defining the Product Vision and Roadmap:** Agile planning – Defining the product vision – Creating a product roadmap – Completing the product backlog. **Planning Releases and Sprints:** Refining requirements and estimates – Release planning – Sprint planning. **Working Throughout the Day:** Planning your day – Tracking progress – Agile roles in the sprint – Creating shippable functionality – The end of the day. **Showcasing Work, Inspecting and Adapting:** The sprint review – The sprint retrospective. **Preparing for Release:** Preparing the product for deployment (the release sprint) – Preparing the operational support – Preparing the organization for product deployment - Preparing the marketplace for product deployment	12
IV	**Agile Management** **Managing Scope and Procurement:** What's different about Agile scope management – Managing Agile scope – What's different about Agile procurement – Managing Agile procurement. **Managing Time and Cost:** What's different about Agile time management – Managing Agile schedules – What's different about Agile cost management – Managing Agile budgets. **Managing Team Dynamics and Communication:** What's different about Agile team dynamics – Managing Agile team dynamics – What's different about Agile communication – Managing Agile communication. **Managing Quality and Risk:** What'sdifferent about Agile quality – Managing Agile quality – What's different about Agile risk management – Managing Agile risk.	12
V	**Implementing Agile** **Building a Foundation:** Organizational and individual commitment – Choosing the right pilot team members – Creating and environment that enables Agility – Support Agility initially and over time. **Being a Change Agent:** Becoming Agile requires change – why change	12

	doesn't happen on its own – Platinum Edge's Change Roadmap – Avoiding pitfalls – Signs your changes are slipping. **Benefits, Factors for Success and Metrics:** Ten key benefits of Agile project management – Ten key factors for project success – Ten metrics for Agile Organizations.	
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Understanding of software design, software technologies and APIs using Agile Management.	PO1
2	Understanding of Agile development and testing techniques.	PO1, PO2
3	Understanding about Agile Planning and Execution using Sprint.	PO4, PO6
4	Understanding of Agile Management Design, scope , Procurement, managing Time and Cost and Quality Check.	PO4, PO5, PO6
5	Analysing of Agile development and testing techniques.	PO3, PO8

Text Book	
1	Mark C. Layton, Steven J. Ostermiller, Agile Project Management for Dummies, 2nd Edition, Wiley India Pvt. Ltd., 2018.
	Jeff Sutherland, Scrum – The Art of Doing Twice the Work in Half the Time, Penguin, 2014.
Reference Books	
1.	Mark C. Layton, David Morrow, *Scrum for Dummies*, 2nd Edition, Wiley India Pvt. Ltd., 2018.
2.	Mike Cohn, Succeeding with Agile – Software Development using Scrum, Addison-Wesley Signature Series, 2010.
3.	Alex Moore, Agile Project Management, 2020.
4.	Alex Moore, *Scrum*, 2020.
5.	Andrew Stellman and Jennifer Greene, *Learning Agile: Understanding Scrum, XP, Lean, and Kanban*, Shroff/O'Reilly, First Edition, 2014.
Web Resources	
1.	www.agilealliance.org/resources

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

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..

Skill Enhancement Course SEC1 – SEC8

Subject	Subject Name	C a t e	L	T	P	S	C	I	Marks

Code									CIA	External	Total
SEC	**OFFICE AUTOMATION**	Specific Elective		Y	-	-	2	2	25	75	100

Course Objective	
C1	Understand the basics of computer systems and its components.
C2	Understand and apply the basic concepts of a word processing package.
C3	Understand and apply the basic concepts of electronic spreadsheet software.
C4	Understand and apply the basic concepts of database management system.
C5	Understand and create a presentation using PowerPoint tool.

UNIT	**Details**	**No. of Hours**
I	**Introductory concepts:** Memory unit– CPU-Input Devices: Key board, Mouse and Scanner. Outputdevices: Monitor, Printer. Introduction to Operating systems & its features: DOS– UNIX–Windows. Introduction to Programming Languages.	6
II	**Word Processing:** Open, Save and close word document; Editing text – tools, formatting, bullets; Spell Checker - Document formatting – Paragraph alignment, indentation, headers and footers, numbering; printing–Preview, options, merge.	6
III	**Spreadsheets :** Excel–opening, entering text and data, formatting, navigating; Formulas–entering, handling and copying; Charts–creating, formatting and printing,analysistables,preparationoffinancialstatements,introductiontodataanalytics.	6
IV	**Database Concepts:** The concept of data base management system; Data field, records, and files,Sorting and indexing data; Searching records. Designing queries, and reports; Linking of datafiles; Understanding Programming environment in DBMS; Developing menu drive applicationsinquerylanguage(MS–Access).	6
V	**Power point:** Introduction to Power point - Features – Understanding slide typecasting & viewingslides – creating slide shows. Applying special object – including objects & pictures – Slidetransition–Animationeffects,audioinclusion,timers.	6
	Total	**30**

Course Outcomes	**Programme Outcomes**

CO	On completion of this course, students will	
1	Possess the knowledge on the basics of computers and its components	PO1,PO2,PO3,PO6,PO8
2	Gain knowledge on Creating Documents, spreadsheet and presentation.	PO1,PO2,PO3,PO6
3	Learn the concepts of Database and implement the Query in Database.	PO3,PO5,PO7
4	Demonstrate the understanding of different automation tools.	PO3,PO4,PO5,PO7
5	Utilize the automation tools for documentation, calculation and presentation purpose.	PO4,PO6,PO7,PO8
Text Book		
1	PeterNorton,"IntroductiontoComputers"–TataMcGraw-Hill.	
Reference Books		
1.	Jennifer Ackerman Kettel, Guy Hat-Davis, Curt Simmons, "Microsoft 2003", Tata McGrawHill.	
Web Resources		
1.	https://www.udemy.com/course/office-automation-certificate-course/	
2.	https://www.javatpoint.com/automation-tools	

Mapping with Programme Outcomes:

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

S-Strong M-Medium L-Low

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
SEC	**BASICS OF INTERNET**	Specific Elective	2	-	-		2	25	75	100

Learning Objectives	
LO1	Knowledge of Internet medium
LO2	Internet as a mass medium
LO3	Features of Internet Technology,
LO4	Internetas sourceof infotainment
LO5	Studyofinternet audiences andabout cyber crime

UNIT	Contents	No. Of. Hours
I	Theemergenceofinternet asamassmedium–theworld of‘worldwideweb’.	**6**
II	Featuresofinternetasatechnology.	**6**
III	Internetas asourceofinfotainment – classificationbasedoncontentandstyle.	**6**
IV	Demographic and psychographic descriptions of internet ‘audiences’ – effect of internet onthevalues and life-styles.	**6**
V	Presentissuessuchascybercrime andfuturepossibilities.	**6**
	TOTAL HOURS	**30**

CO	**Course Outcomes**
CO1	Knows the basic concept in HTML Concept of resources in HTML
CO2	Knows Design concept. Concept of Meta Data Understand the concept of save the files.
CO3	Understand the page formatting. Concept of list
CO4	Creating Links. Know the concept of creating link to email address
CO5	Concept of adding images Understand the table creation.

Textbooks

1	“Mastering HTML5 and CSS3 Made Easy”, TeachUComp Inc., 2014.
2	**Thomas Michaud, “Foundations of Web Design: Introduction to HTML & CSS”**

Web Resources

1.	https://www.teachucomp.com/samples/html/5/manuals/Mastering-HTML5-CSS3.pdf
2.	https://www.w3schools.com/html/default.asp

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 of an integer – Base Conversion.	6
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	6

	power – Computing the *n*th Fibonacci number.	
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

Multimedia Lab

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
SEC	**0**	**0**	**2**	**III**	**1**	**2**	**25**	**75**	**100**

Learning Objectives		
LO1	Understands the basics of multimedia	
LO2	Acquire knowledge of image editing and animation techniques.	
LO3	Apply multimedia concepts to real world projects	
Unit	**Contents**	**No. of Hours**
I	GIMP's Tools- Taking Advantage of Paths - Working with Layers and masks - Using Channels **Exercises:** 1. Enlarge a Logo using path 2. Create an ink drawing using path 3. Replace Background of image using Channels	**6**
II	Manipulating Images: Transforming Images - Using The Image Tools - Adjusting Colors - Working with Text - Painting in Gimp: Creating new brushes - Enhancing Photos - Exploring Filters and Effects. Exercises: 1. Design Front Cover for a Book. 2. Create a customized logo 3. Use clone tool to remove text from an image	**6**

	4. Remove Red eye using Filter.	
III	Using GIMP animation package - Managing the Frames of Image Sequence with GAP - Morphing - onion skinning - Creating a Storyboard. **Exercises:** 1. Morphing - Create smooth transitions from one image to another. 2. Create a Story board for your project	**6**
IV	Flash: Introduction - Creating and Editing Objects - Color and Text. Animations: Frame- by- frame animation-Motion Tweening- Motion Guides 1. Creating Frame-by-frame Animation 2. Create a Motion Tween for Graphic and Text Object 3. Create a Motion guide Layer	**6**
V	Shape Tweening - Masking - Interactivity: Adding Script to Buttons - Testing and Publishing. **Exercises:** 1. Create a Shape Tween for Graphic Object 2. Create a Mask Layer 3. Adding buttons with Action Script	**6**
TOTAL		**30**

CO	Course Outcomes
CO1	Demonstrate understanding and use of multimedia fundamentals
CO2	Implement appropriate techniques required for editing images and designing animated system
CO3	Solve various design and implementation issues materialize on the development of multimedia systems
CO4	Assess different Photo Editing, Video Editing and animation tools and select the appropriate tool based on the requirements
CO5	Design and develop Multimedia Projects

Textbooks

➢	1. Jason Van Gumster& Robert Shimonski (2010), "GIMP Bible", Wiley, 2nd edition. 2. Chris Gover, 2010, "Flash CS5: The missing Manual", 1st Edition, O" Reilly India.

Reference Books

1	Juan Manuel Ferreyra (2011), "GIMP 2.6 Cookbook", PACK publishing Ltd.
2	Robert Reinhard (2003), "Macromedia Flash MX Bible", Wiley Dreamtech India Pvt Ltd.
NOTE: Latest Edition of Textbooks May be Used	
Web Resources	
1.	https://www.youtube.com/watch?v=T8NIK3RdoIc (Unit IV: Gimp Video Editing)
2.	https://www.youtube.com/watch?v=Jz9WrbELGYA

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

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Marks**		
								CIA	**External**	**Total**
SEC	**FUNDAMENTALS OF INFORMATION TECHNOLOGY**	Specific Elective	2	-	-	I	2	25	75	100

Learning Objectives	
LO1	Understand basic concepts and terminology of information technology.
LO2	Have a basic understanding of personal computers and their operation
LO3	Be able to identify data storage and its usage
LO4	Get great knowledge of software and its functionalities
LO5	Understand about operating system and their uses

UNIT	**Contents**	**No. Of. Hours**

I	**Introduction to Computers:** Introduction, Definition, .Characteristics of computer, Evolution of Computer, Block Diagram Of a computer, Generations of Computer, Classification Of Computers, Applications of Computer, Capabilities and limitations of computer	**6**
II	**Basic Computer Organization:** Role of I/O devices in a computer system. Input Units: Keyboard, Terminals and its types. Pointing Devices, Scanners and its types, Voice Recognition Systems, Vision Input System, Touch Screen, Output Units: Monitors and its types. Printers: Impact Printers and its types. Non Impact Printers and its types, Plotters, types of plotters, Sound cards, Speakers.	**6**
III	**Storage Fundamentals:** Primary Vs Secondary Storage, Data storage & retrieval methods. Primary Storage: RAM ROM, PROM, EPROM, EEPROM. Secondary Storage: Magnetic Tapes, Magnetic Disks. Cartridge tape, hard disks, Floppy disks Optical Disks, Compact Disks, Zip Drive, Flash Drives	**6**
IV	**Software:** Software and its needs, Types of S/W. System Software: Operating System, Utility Programs Programming Language: Machine Language, Assembly Language, High Level Language their advantages & disadvantages. Application S/W and its types: Word Processing, Spread Sheets Presentation, Graphics, DBMS s/w	**6**
V	**Operating System:** Functions, Measuring System Performance, Assemblers, Compilers and Interpreters.Batch Processing, Multiprogramming, Multi Tasking, Multiprocessing, Time Sharing, DOS, Windows, Unix/Linux.	**6**
	TOTAL HOURS	**30**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Learn the basics of computer, Construct the structure of the required things in computer, learn how to use it.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Develop organizational structure using for the devices present currently under input or output unit.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Concept of storing data in computer using two header namely RAM and ROM with different types of ROM with advancement in	PO1, PO2, PO3, PO4, PO5, PO6

	storage basis.	
CO4	Work with different software, Write program in the software and applications of software.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Usage of Operating system in information technology which really acts as a interpreter between software and hardware.	PO1, PO2, PO3, PO4, PO5, PO6
Textbooks		
1	Anoop Mathew, S. KavithaMurugeshan (2009), " Fundamental of Information Technology", Majestic Books.	
2	Alexis Leon, Mathews Leon," Fundamental of Information Technology", 2nd Edition.	
3	S. K Bansal, "Fundamental of Information Technology".	
Reference Books		
1.	BhardwajSushilPuneet Kumar, "Fundamental of Information Technology"	
2.	GG WILKINSON, "Fundamentals of Information Technology", Wiley-Blackwell	
3.	A Ravichandran , "Fundamentals of Information Technology", Khanna Book Publishing	
Web Resources		
1.	https://testbook.com/learn/computer-fundamentals	
2.	https://www.tutorialsmate.com/2020/04/computer-fundamentals-tutorial.html	
3.	https://www.javatpoint.com/computer-fundamentals-tutorial	
4.	https://www.tutorialspoint.com/computer_fundamentals/index.htm	
5.	https://www.nios.ac.in/media/documents/sec229new/Lesson1.pdf	

Mapping with Programme Outcomes:

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

S-Strong-3 M-Medium-2 L-Low-1

Subject	Subject Name	↵ ค ↵	L	T	P	S	↵ ↵	Marks

Code								CIA	Exter	Total
SEC	**INTRODUCTION TO HTML**	Specific Elective	2	-	-		2	25	75	100

Learning Objectives	
LO1	Insert a graphic within a web page.
LO2	Create a link within a web page.
LO3	Create a table within a web page.
LO4	Insert heading levels within a web page.
LO5	Insert ordered and unordered lists within a web page. Create a web page.

UNIT	**Contents**	**No. Of. Hours**
I	Introduction :WebBasics: WhatisInternet–Webbrowsers–WhatisWebpage – HTMLBasics:Understandingtags.	**6**
II	TagsforDocumentstructure(HTML,Head,BodyTag).Blockleveltextelements:Headingsparagraph(<p> tag)– Fontstyleelements:(bold,italic,font,small,strong,strike,bigtags)	**6**
III	Lists:Typesoflists:Ordered,Unordered– NestingLists– Othertags:Marquee,HR,BR-UsingImages –CreatingHyperlinks.	**6**
IV	Tables:CreatingbasicTable,Tableelements,Caption–Tableandcellalignment– Rowspan,Colspan–Cellpadding.	**6**
V	Frames:Frameset–TargetedLinks–Noframe–Forms:Input, Textarea,Select,Option.	**6**
	TOTAL HOURS	**30**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO 1	Knows the basic concept in HTML Concept of resources in HTML	PO1, PO2, PO3, PO4, PO5, PO6
CO 2	Knows Design concept. Concept of Meta Data Understand the concept of save the files.	PO1, PO2, PO3, PO4, PO5, PO6
CO 3	Understand the page formatting. Concept of list	PO1, PO2, PO3, PO4, PO5, PO6
CO	Creating Links. Know the concept of creating link to email address	PO1, PO2, PO3, PO4,

4		PO5, PO6
CO 5	Concept of adding images Understand the table creation.	PO1, PO2, PO3, PO4, PO5, PO6

	Textbooks
1	"Mastering HTML5 and CSS3 Made Easy", TeachUComp Inc., 2014.
2	**Thomas Michaud, "Foundations of Web Design: Introduction to HTML & CSS"**
	Web Resources
1.	https://www.teachucomp.com/samples/html/5/manuals/Mastering-HTML5-CSS3.pdf
2.	https://www.w3schools.com/html/default.asp

Mapping with Programme Outcomes:

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

S-Strong-3 M-Medium-2 L-Low-1

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	**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

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

		Elective									

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 Gamesofskill.	6	CO3
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	PO3, PO8

	stocks & shares, graphs	
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

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-HypermediaandHypertext.	12	C1
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 Charts with PowerPoint / MS Word, Dynamically- New Features Of Excel Sparklines, Inline Charts, data Charts- Overview of all the new features.	6	C5
	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**	**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 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	6	CO1

	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 Watermarking Process, Image Watermarking Techniques, Watermarking Algorithm, Experimental Results, Effect of Attacks on Watermarking Techniques, Attacks on Spatial Domain Watermarking.	6	CO4
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	6	CO5

	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.		
	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

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	6	C1

	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.		
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 Data: Time Travel, Forensic Identification and Analysis of Technical Surveillance Devices.	6	C4
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	PO1	

	fundamentals.	
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	**Pattern Recognition**	Specific Elective	Y	-	-	-	2	2	75	25	100

Course Objective	
CO1	To learn the fundamentals of Pattern Recognition techniques
CO2	To learn the various Statistical Pattern recognition techniques
CO3	To learn the linear discriminant functions and unsupervised learning and clustering
CO4	To learn the various Syntactical Pattern recognition techniques
CO5	To learn the Neural Pattern recognition techniques

UNIT	**Details**	**No. of Hours**	**Course Objective**
I	PATTERN RECOGNITION OVERVIEW: Pattern recognition, Classification and Description-Patterns and feature Extraction with Examples-Training and Learning in PR systems-Pattern recognition Approaches	6	CO1
II	STATISTICAL PATTERN RECOGNITION: Introduction to statistical Pattern Recognition-supervised Learning using Parametric and Non-Parametric Approaches.	6	CO2
III	LINEAR DISCRIMINANT FUNCTIONS AND UNSUPERVISED LEARNING AND CLUSTERING: Introduction-Discrete and binary Classification Problems-Techniques to directly Obtain linear Classifiers - Formulation of Unsupervised Learning Problems-Clustering for unsupervised learning and classification	6	CO3
IV	SYNTACTIC PATTERN RECOGNITION: Overview of Syntactic Pattern Recognition-Syntactic recognition via parsing and other grammars–Graphical Approaches to syntactic pattern recognition-Learning via	6	CO4

	grammatical inference.		
V	NEURAL PATTERN RECOGNITION: Introduction to Neural Networks-Feedforward Networks and training by Back Propagation-Content Addressable Memory Approaches and Unsupervised Learning in Neural PR	6	CO5
	Total		

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	understand the concepts, importance, application and the process of developing Pattern recognition over view	PO1
2	to have basic knowledge and understanding about parametric and non-parametric related concepts.	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	Robert Schalkoff, "Pattern Recognition: Statistical Structural and Neural Approaches", John wiley& sons.
2	Duda R.O., P.E.Hart& D.G Stork, " Pattern Classification", 2nd Edition, J.Wiley.
3	Duda R.O.& Hart P.E., "Pattern Classification and Scene Analysis", J.wiley.
4	Bishop C.M., "Neural Networks for Pattern Recognition", Oxford University Press.
Reference Books	
1.	1. Earl Gose, Richard johnsonbaugh, Steve Jost, "Pattern Recognition and Image Analysis", Prentice Hall of India, Pvt Ltd, New Delhi.
Web Resources	
1.	https://www.geeksforgeeks.org/pattern-recognition-introduction/
2.	https://www.mygreatlearning.com/blog/pattern-recognition-machine-learning/

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	**Enterprise Resource Planning**	Specific Elective	Y	-	-	-	4	4	25	75	100

Course Objectives		
CO1	To understand the basic concepts, Evolution and Benefits of ERP.	
CO2	To know the need and Role of ERP in logical and Physical Integration.	
CO3	Identify the important business functions provided by typical business software such as enterprise resource planning and customer relationship management	
CO4	To train the students to develop the basic understanding of how ERP enriches the business organizations in achieving a multidimensional growth	
CO5	To aim at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills	
UNIT	**Details**	**No. of Hours**
I	ERP Introduction, Benefits, Origin, Evolution and Structure: Conceptual Model of ERP, the Evolution of ERP, the Structure of ERP, Components and needs of ERP, ERP Vendors; Benefits & Limitations of ERP Packages.	6
II	Need to focus on Enterprise Integration/ERP; Information mapping; Role of common shared Enterprise database; System Integration, Logical vs. Physical System Integration, Benefits & limitations of System Integration, ERP's Role in Logical and Physical Integration. Business Process Reengineering, Data ware Housing, Data Mining, Online Analytic Processing (OLAP), Product Life Cycle Man-	6

	agement (PLM), LAP, Supply chain Management.	
III	ERP Marketplace and Marketplace Dynamics: Market Overview, Marketplace Dynamics, the Changing ERP Market. ERP- Functional Modules: Introduction, Functional Modules of ERP Software, Integration of ERP, Supply chain and Customer Relationship Applications. Cloud and Open Source, Management, Material Management, Financial Module, CRM and Case Study.	6
IV	ERP Implementation Basics, , ERP implementation Strategy, ERP Implementation Life Cycle ,Pre- Implementation task,Role of SDLC/SSAD, Object Oriented Architecture, Consultants, Vendors and Employees.	6
V	ERP & E-Commerce, Future Directives- in ERP, ERP and Internet, Critical success and failure factors, Integrating ERP into organizational culture. Using ERP tool: either SAP or ORACLE format to case study.	6
	Total	**30**
Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Understand the basic concepts of ERP.	
CO2	Identify different technologies used in ERP	
CO3	Understand and apply the concepts of ERP Manufacturing Perspective and ERP Modules	
CO4	Discuss the benefits of ERP	
CO5	Apply different tools used in ERP	
Reference Text :		
1.	Enterprise Resource Planning – Alexis Leon, Tata McGraw Hill.	
References :		
1.	Enterprise Resource Planning – Diversified by Alexis Leon, TMH.	
2.	Enterprise Resource Planning – Ravi Shankar & S. Jaiswal , Galgotia	
Web Resources		
1.	1. https://www.tutorialspoint.com/management_concepts/enterprise_resource_planning.htm	
2.	1. https://www.saponlinetutorials.com/what-is-erp-systems-enterprise-resource-planning/	
3.	1. https://www.guru99.com/erp-full-form.html	
4.	2. https://www.oracle.com/in/erp/what-is-erp/	

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	M		L			M
CO 2	M	S			L	M
CO 3		L	M			
CO 4				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	**Robotics and Its Applications**	Specific Elective	Y	-	-	-	2	2	25	75	100

Course Objective	
C1	To understand the robotics fundamentals
C2	Understand the sensors and matrix methods
C3	Understand the Localization: Self-localizations and mapping
C4	To study about the concept of Path Planning, Vision system
C5	To learn about the concept of robot artificial intelligence

UNIT	Details	No. of Hours	Course Objective
I	Introduction: Introduction, brief history, components of robotics, classification, workspace, work-envelop, motion of robotic arm, end-effectors and its types, service robot and its application, Artificial Intelligence in Robotics.	6	CO1
II	Actuators and sensors :Types of actuators, stepper-DC-servo-and brushless motors- model of a DC servo motor-types of transmissions-purpose of sensor-internal and external sensor-common sensors-encoders tachometers-strain gauge based force torque sensor-proximity and distance measuring sensors Kinematics of robots: Representation of joints and frames, frames transformation, homogeneous matrix, D-H matrix, Forward and inverse kinematics: two link planar (RR) and spherical robot (RRP). Mobile robot Kinematics: Differential wheel mobile robot	6	CO2

III	Localization: Self-localizations and mapping - Challenges in localizations – IR based localizations – vision based localizations – Ultrasonic based localizations - GPS localization systems.	6	CO3
IV	Path Planning: Introduction, path planning-overview-road map path planning-cell decomposition path planning potential field path planning-obstacle avoidance-case studies Vision system: Robotic vision systems-image representation-object recognition-and categorization-depth measurement- image data compression-visual inspection-software considerations	6	CO4
V	Application: Ariel robots-collision avoidance robots for agriculture-mining-exploration-underwater-civilian- and military applications-nuclear applications-space Applications-Industrial robots-artificial intelligence in robots-application of robots in material handling-continuous arc welding-spot welding-spray painting-assembly operation-cleaning-etc.	6	CO5
	Total		

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Describe the different physical forms of robot architectures.	PO1
2	Kinematically model simple manipulator and mobile robots.	PO1, PO2
3	Mathematically describe a kinematic robot system	PO4, PO6
4	Analyze manipulation and navigation problems using knowledge of coordinate frames, kinematics, optimization, control, and uncertainty.	PO4, PO5, PO6
5	Program robotics algorithms related to kinematics, control, optimization, and uncertainty.	PO3, PO8

Text Book

1	RichardD.Klafter. Thomas Achmielewski and MickaelNegin, Robotic Engineering and Integrated Approach, Prentice Hall India-Newdelhi-2001
2	SaeedB.Nikku, Introduction to robotics, analysis, control and applications, Wiley-India, 2 nd edition 2011

Reference Books

1.	Industrial robotic technology-programming and application by M.P.Groover et.al, McGrawhill2008
2.	Robotics technology and flexible automation by S.R.Deb, THH-2009

Web Resources

1.	https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_robotics.htm
2.	https://www.geeksforgeeks.org/robotics-introduction/

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	S					
CO 2	M	S				
CO 3				S		S
CO 4				S	S	M
CO 5			S			

S-Strong M-Medium L-Low

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
SEC	**Simulation and Modeling**	Specific Elective	Y	-	-	-	4	4	25	75	100

Course Objectives	
CO1	Generates computer simulation technologies and techniques, lays the groundwork for students to comprehend computer simulation requirements, and implements and tests a variety of simulation and data analysis libraries and programmes. This course focuses on what is required to create simulation software environments rather than just simulations using pre-existing packages
CO2	Discuss the concepts of modelling layers of critical infrastructure networks in society.
CO3	Create tools for viewing and controlling simulations and their results.
CO4	Understand the concept of Entity modelling, Path planning
CO5	To learn about the Algorithms and Modelling.

UNIT	Details	No. of Hours	Course Objectives
I	Introduction To Modeling & Simulation – What is Modeling and Simulation? – Complexity Types – Model Types – Simulation Types – M&S Terms and Definitions Input Data Analysis – Simulation Input Modeling – Input Data Collection - Data Collection Problems - – Input Modeling Strategy - Histograms -Probability Distributions - Selecting a Probability	6	CO1

	Distribution.		
II	Random Variate Generation – Random Numbers – Random Number Generators – General principles – Inverse Transform Method –Acceptance Rejection Method –Composition Method –Relocate and Rescale Method - Specific distributions-Output Data Analysis – Introduction -Types of Simulation With Respect to Output Analysis - Stochastic Process and Sample Path - Sampling and Systematic Errors - Mean, Standard Deviation and Confidence Interval - Analysis of Finite-Horizon Simulations - Single Run - Independent Replications - Sequential Estimation – Analysis of Steady-State Simulations - Removal Initialization Bias (Warm-up Interval) -Replication-Deletion Approach - Batch-Means Method .	6	CO2
III	Comparing Systems via Simulation – Introduction – Comparison Problems - Comparing Two Systems - Screening Problems - Selecting the Best - Comparison with a Standard - Comparison with a Fixed Performance Discrete Event Simulations – Introduction - Next-Event Time Advance - Arithmetic and Logical Relationships - Discrete-Event Modeling Approaches – Event-Scheduling Approach – Process Interaction Approach.	6	CO3
IV	Entity Modeling – Entity Body Modeling – Entity Body Visualization – Entity Body Animation – Entity Interaction Modeling – Building Modeling Distributed Simulation – High Level Architecture (HLA) – Federation Development and Execution Process (FEDEP) – SISO RPR FOM Behavior Modeling – General AI Algorithms - Decision Trees - Neural Networks - Finite State Machines - Logic Programming - Production Systems – Path Planning - Off-Line Path Planning - Incremental Path Planning - Real-Time Path Planning – Script Programming -Script Parsing - Script Execution.	6	CO4
V	Optimization Algorithms – Genetic Algorithms – Simulated Annealing Examples: Sensor Systems	6	CO5

	Modeling – Human Eye Modeling – Optical Sensor Modeling – Radar Modeling.		
	Total	**30**	
Course Outcomes			
Course Outcomes	On completion of this course, students will;	**Programme Outcomes**	
CO1	Introduction To Modeling & Simulation, Input Data Analysis and Modeling.	PO1	
CO2	Random Variate and Number Generation. Analysis of Simulations and methods.	PO1, PO2	
CO3	Comparing Systems via Simulation	PO4, PO6	
CO4	Entity Body Modeling, Visualization, Animation.	PO4, PO5, PO6	
CO5	Algorithms and Sensor Modeling.	PO3, PO8	
Text Books			
1.	Jerry Banks, "Handbook of Simulation: Principles, Methodology, Advances, Applications, and Practice", John Wiley & Sons, Inc., 1998.		
2.	George S. Fishman, "Discrete-Event Simulation: Modeling, Programming and Analysis", Springer-Verlag New York, Inc., 2001.		
References Books			
1.	Andrew F. Seila, Vlatko Ceric, PanduTadikamalla, "Applied Simulation Modeling", Thomson Learning Inc., 2003.		
Web Resources			
1.	https://www.tutorialspoint.com/modelling_and_simulation/index.htm		
2.	https://www.javatpoint.com/verilog-simulation-basics		

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(3) M-Medium (2) L-Low (1)

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**O**	**Hours**	**Marks**

									CIA	External	Total
SEC	**Organizational Behaviour**	Specific Elective	Y	-	-	-	2	2	25	75	100

Learning Objectives	
LO1	To have extensive knowledge onOB and the scope of OB.
LO2	To create awareness of Individual Behaviour.
LO3	To enhance the understanding of Group Behaviour
LO4	To know the basics of Organizational Culture and Organizational Structure
LO5	To understand Organizational Change, Conflict and Power

UNIT	**Details**	**No. of Hours**
I	INTRODUCTION : Concept of Organizational Behavior (OB): Nature, Scope and Role of OB: Disciplines that contribute to OB; Opportunities for OB (Globalization, Indian workforce diversity, customer service, innovation and change, networked organizations, work-life balance, people skills, positive work environment, ethics)	6
II	INDIVIDUAL BEHAVIOUR: 1. Learning, attitude and Job satisfaction: Concept of learning, conditioning, shaping and reinforcement. Concept of attitude, components, behavior and attitude. Job satisfaction: causation; impact of satisfied employees on workplace. 2. Motivation : Concept; Theories (Hierarchy of needs, X and Y, Two factor, McClelland, Goal setting, Self-efficacy, Equity theory); Job characteristics model; Redesigning jobs, 3. Personality and Values : Concept of personality; Myers-Briggs Type Indicator (MBTI); Big Five model. Relevance of values; Linking personality and values to the workplace (person-job fit, person-organization fit) 4. Perception, Decision Making : Perception and Judgements; Factors; Linking perception to individual decision making:	6
III	GROUP BEHAVIOUR : 1. Groups and Work Teams : Concept : Five Stage model of group development; Group norms, cohesiveness ; Group think and shift ; Teams; types of teams; Creating team players from individuals and team based work(TBW) 2. Leadership : Concept; Trait theories; Behavioral theories (Ohio and Michigan studies); Contingency theories (Fiedler, Hersey and Blanchard, Path-Goal);	6

IV	ORGANISATIONAL CULTURE AND STRUCTURE : Concept of culture; Impact (functions and liability); Creating and sustaining culture: Concept of structure, Prevalent organizational designs: New design options	6
V	ORGANISATIONAL CHANGE, CONFLICT AND POWER: Forces of change; Planned change; Resistance; Approaches (Lewin's model, Organisational development);. Concept of conflict, Conflict process; Types, Functional/ Dysfunctional. Introduction to power and politics.	6
		30
Course Outcomes	On Completion of the course the students will	
CO1	To define OrganisationalBehaviour, Understand the opportunity through OB.	
CO2	To apply self-awareness, motivation, leadership and learning theories at workplace.	
CO3	To analyze the complexities and solutions of group behaviour.	
CO4	To impact and bring positive change in the culture of the organisaiton.	
CO5	To create a congenial climate in the organization.	
Reading List		
1.	NeharikaVohra Stephen P. Robbins, Timothy A. Judge , *Organizational Behaviour*, Pearson Education, 18th Edition, 2022.	
2.	Fred Luthans, *Organizational Behaviour*, Tata McGraw Hill, 2017.	
3.	Ray French, Charlotte Rayner, Gary Rees & Sally Rumbles, *Organizational Behaviour*, John Wiley & Sons, 2011	
4.	Louis Bevoc, Allison Shearsett, Rachael Collinson, *Organizational BehaviourReference*, Nutri Niche System LLC (28 April 2017)	
5.	Dr. Christopher P. Neck, Jeffery D. Houghton and Emma L. Murray, *Organizational Behaviour: A Skill-Building Approach*, SAGE Publications, Inc; 2nd edition (29 November 2018).	
References Books		
1.	Uma Sekaran, Organizational Behaviour Text & cases, 2nd edition, Tata McGraw Hill Publishing CO. Ltd	
2.	GangadharRao, Narayana, V.S.P Rao, Organizational Behaviour 1987, Reprint 2000, Konark Publishers Pvt. Ltd, 1st edition	
3.	S.S. Khanka, Organizational Behaviour, S. Chand & Co, New Delhi.	
4.	J. Jayasankar, Organizational Behaviour, Margham Publications, Chennai, 2017.	

	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