B.Sc., COMPUTER SCIENCE
WITH
DATA SCIENCE

SYLLABUS

FROM THE ACADEMIC YEAR
2024 - 2025

1. Introduction

B.Sc Computer Science with Data Science

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. Learning Outcomes-based Curriculum Framework (LOCF) 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.

Computer Science 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 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 application domain.

Data Science is a vast field comprising many topics of Statistics, Mathematics and Information Technology. Data Science course syllabus for beginners covers basic and advanced concepts of data analytics, machine learning, statistics, and programming languages like Python or R. It also teaches students how to interpret large datasets and identify patterns to create predictive models. Data Science has come a long way. Data Scientists are the most important resources for

any business looking to thrive in this mad rush. They are now the 'wizards of all problem solvers'.

This course is enabled to include several interdisciplinary areas like: programming languages, algorithms, operating systems, databases, machine learning, data mining, artificial intelligence, big data, probability and statistics, data optimization, statistical simulation and data analysis, management decision analysis, decision models and predictive analysis. Data Science has gained paramount importance in the Computer Science domain. The need for scientists who understand data in all its aspects will continue to grow strongly. Students graduating from the program will have significantly more depth and breadth in the broad area of Data Science and receive all the information they need to work with various kinds of data and statistical data. The program is designed so that students have in-depth knowledge of the many approaches, aptitudes, methodologies, and instruments needed to deal with corporate data. Students receive instruction in the abilities needed to find the needed solutions and assist in making significant judgments.

The future of Data Science is estimated to bring opportunities in various areas of banking, finance, insurance, entertainment, telecommunication, automobile, etc. A data scientist will help grow an organization by assisting them in making better decisions. The present era is full of technological advances in almost all spectrum of life and we are flooded with enormous amount of data. There is an increasing demand of capturing, analyzing, and synthesizing this large amount of data sets in a number of application domains to better understand various phenomena and to convert the information available in the data into actionable strategies such as new scientific discoveries, business applications, policy making, and healthcare etc.

The study of Computer Science with Data Science as a discipline has become essential to cater the growing need for professionals and researchers to deal with the future challenges.

LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK GUIDELINES BASED REGULATIONS FOR UNDER GRADUATE PROGRAMME

Programme:	**B.Sc., Computer Science with Data Science**
Eligibilty	**Candidates who have studied Mathematics in HSC are eligible for this programme** **Refer Tamil Nadu Admission Guidelines G.O(D) No. 110 dt 22.05.2024**
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.

	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 curriculum is designed so as to strengthen the Industry-Academia interface and provide more job opportunities for the students.
- The Internship during the 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 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.

Choice Based Credit System (CBCS), Learning Outcomes Based Curriculum Framework (LOCF)

Methods of Evaluation - Theory		
Internal Evaluation	Continuous Internal Assessment Test	25 Marks
	Assignments	
External Evaluation	End Semester Examination	75 Marks
	Total	100 Marks
Methods of Assessment		
Recall(K1)	Simple definitions, MCQ, Recall steps, Concept definitions	
Understand/ Comprehend(K2)	MCQ, True/False, Short essays, Concept explanations, Short summary or Overview	
Application (K3)	Suggest idea/concept with examples, Suggest formulae, Solve problems, Observe, Explain	
Analyze(K4)	Problem- solving questions, Finish a procedure in many steps, Differentiate between various ideas, Map knowledge	
Evaluate(K5)	Longer essay/ Evaluation essay, Critique or justify with pros and cons	
Create(K6)	Check knowledge in specific or off beat situations, Discussion, Debating or Presentations	

Practicals & Projects : Internal - 50   External - 50

Internship: The students should submit certificate of attendance from the industry along with report for external evaluation.

Industrial visit/Field visit/Knowledge Updation Activity: A report should be submitted for external evaluation.

Internship/ Industrial visit/Field visit/Research Knowledge Updation Activity: Internal – 50 Marks, External – 50 Marks

Project/ Mini Project: Individual or Group of Maximum Three members
Project report should be submitted for external evaluation.
Internal – 50 Marks, External – 50 Marks

Students who couldn't appear for Naan Muthalvan Course in a particular semester or who have failed in Naan Muthalvan Course should write the following papers (External – 100 marks)

Semester	Title of the Paper
II	Soft Skills for Employability
III	Digital Skills for Employability – Office Fundamentals
IV	Web Design with HTML
V	Internet & E-Commerce
VI	C Programming

2024-'25   B.Sc., Computer Science with Data Science

Semester-I

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language – Tamil	3	6
Part-II	English	3	6
Part-III	Core –C++ Programming	4	5
	Core Practical -- C++ Programming Laboratory	4	5
	EC1 Statistics for Data Science/ Discrete Mathematics	3	4
Part-IV	SEC 1 Practical –Office Automation Laboratory	2	2
	Foundation Course: Computer Fundamentals	2	2
		21	30

Semester-II

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language – Tamil	3	6
Part-II	English	3	4
Part-III	Core: Programming with Python	4	5
	Core Practical: Python Programming Laboratory	4	5
	Elective Course 2: Optimization Techniques / Computational Intelligence	3	4
Part-IV	SEC 2 : Data Structures	2	2
	SEC-3 : Practical –Multimedia Laboratory	2	2
	Naan Muthalvan – Language Proficiency for Employability	2	2
		23	30

Second Year

	Semester III		
Part	List of Courses	Credit	No. of Hours
Part-1	Language – Tamil	3	6
Part-2	English	3	6
Part-3	Core Course- Java Programming	4	4
	Core Lab 3.1 Java Programming Laboratory	3	4
	Elective: Graph Theory and its Applications/ Operating Systems	3	4
Part-4	SEC 4: Web Design Laboratory	2	2
	SEC 5 - Naan Mudhalvan	2	2
	E.V.S	2	2
		22	30

Semester-IV

Part	List of Courses	Credit	No. of Hours
Part-1	Language – Tamil	3	6
Part-2	English	3	6
Part 3	Core Course - Database Management Systems	4	4
	Core Lab 4 1- Database Management Systems Laboratory	3	4
	Elective- Data Mining and Data Warehousing/ Cloud Computing	3	4
Part-4	SEC 6 Perl Programming Laboratory	2	2
	SEC 7 Naan Muthalvan	2	2
	Value Education	2	2
		22	30

Third Year
Semester-V

Part	List of Courses	Credit	No. of Hours
Part 3	**Core Course 5 1 Generative Artificial Intelligence for Data Science**	4	4
	Core Course 5 2 Machine Learning	4	4
	Core Course 5 3 Data Science	4	4
	core lab 5.1 Machine Learning Laboratory	3	4
	core lab 5.2 Android Programming Laboratory	3	4
	Mini Project	4	4
	Elective 5: Bio-Inspired Computing/ Computer Networks	3	4
Part-4	**Naan Muthalvan**	2	2
	Internship / Industrial Visit / Field Visit	2	-
		29	**30**

Semester-VI

Part	List of Courses	Credit	No. of Hours
Part-3	**Core Course 6 1 Data Analytics using R**	4	5
	Core Course 6 2 Software Engineering	4	5
	Core lab 6 1 Data Analytics using R Laboratory	3	4
	Elective 6.1 Social Media Analytics/ Data Visualization	3	4
	Elective 6.2 Data Security/ Deep Learning	3	4
	Major Project	4	6
Part-4	**Extension Activity**	1	-
	Naan Muthalvan	2	2
	TOTAL	**24**	**30**

FIRST YEAR –SEMESTER- I

C++ Programming

Semester	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
I	4	1	0	I	4	5	25	75	100

Learning Objectives	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	Introduction to C++ - key concepts of Object-Oriented Programming – Advantages -I/O in C++ - C++ Declarations. Control Structures : - Decision Making Statements : If ..else, jump, goto, break, continue, Switch case statements - Loops in C++ :for, while, do – while	15
II	Classes and Objects: Declaring Objects – Defining Member Functions – Static Member variables and functions – array of objects –friend functions – Function Overloading Constructors – Parameterized Constructors – Copy Constructor – Destructors	15
III	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	Files – File stream class – file modes – Sequential Read / Write operations - 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. Balagurusamy, (2013), "Object Oriented Programming using C++", 6th Edition, Tata McGraw Hill.

Reference Books	
1	Bjarne Stroustrup, "The C++ Programming Language", Fourth Edition, Pearson Education.
2	Hilbert Schildt, (2009), "C++ - The Complete Reference", 4th Edition, Tata Mc Graw Hill

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 of course contributed to each PSO	15	14	11	15	15	10

Core Practical 1 : C++ Programming Laboratory

Semester	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
I	0	0	5	I	4	5	50	50	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 Exercises	

1. Working with Classes and Objects
2. Using Constructors and Destructors
3. Using Function Overloading
4. Using Unary Operator Overloading
5. Using Binary Operator Overloading
6. Using Friend Function
7. Using Simple Inheritance
8. Using Multiple Inheritance
9. Using Virtual Function
10. Using Command Line Arguments
11. Using Exception Handling
12. Writing into and Reading from a Text file

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, qu lists to solve various computing problems in C++ by incorporat concepts.
CO5	Develop a program in C++ with the concepts of object oriented programming to solve real-world 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 of course contributed to each PSO	15	14	11	15	15	10

Title of the Course	Statistics for Data Science			
Semester I		Credits	3	
Instructional Hours per week	Lecture	Tutorial	Lab Practice	Total
	4		--	4
Objectives of the Course	To develop knowledge and understand fundamental concepts in probability and statistics			
Learning Outcome	Students will be able to

CO1: Organize, manage and present data.

CO2: Understand, describe, and calculate the measures of data and correlation.

CO3: Recognize and understand various probability distribution functions, calculate and interpret expected results

CO4: Apply the methods of estimating a parameter.

CO5: Understand the concept of probability and apply for simple events | | | |

UNIT-I:

Introduction to Statistics: Types of data: primary, secondary - quantitative and qualitative data. Types of Measurements: nominal, ordinal, discrete and continuous data. Presentation of data by tables: construction of frequency distributions for discrete and continuous data, graphical representation of a frequency distribution by histogram and frequency polygon, cumulative frequency distributions

UNIT-II:

Descriptive statistics: Describing Data Sets-Frequency Tables and Graphs-Histograms, Ogives, and Stem and Leaf Plots-Summarizing Data Sets-Sample Mean, Sample Median, and Sample Mode-Sample Variance and Sample Standard Deviation-Sample Percentiles -Chebyshev's Inequality-Normal Data Sets-Paired Data Sets

Correlation: Karl Pearson coefficient of correlation, Spearman's rank correlation coefficient

UNIT-III:

Random variables and expectation: The Bernoulli and Binomial Random Variables-Computing the Binomial Distribution Function-The Poisson Random Variable-Computing the Poisson Distribution Function - Normal Random Variables-Exponential Random Variables-The Poisson Process-The Gamma Distribution- The Chi-Square Distribution-The t-Distribution-The F Distribution

Unit IV
Analysis of variance: -One-Way Analysis of Variance-Multiple Comparisons of Sample Means-One-Way Analysis of Variance with Unequal Sample Sizes-Two-Factor Analysis of Variance:
Goodness of fit tests and categorical data analysis: Goodness of Fit Tests When All Parameters Are Specified-Determining the Critical Region by Simulation-Goodness of Fit Tests When Some Parameters Are Unspecified- The Kolmogorov–Smirnov Goodness of Fit Test for Continuous Data

UNIT-V :
Elements of Probability: classical, empirical and axiomatic approaches to probability, conditional probability and independent events, Laws of total probability, Baye's theorem and its applications- Axioms of Probability-Sample Spaces Having Equally Likely Outcomes

Recommended Text	[1] Sheldon M. Ross, Introduction to Probability and Statistics for Engineers And Scientists, Elsevier Academic Press, UK, Fifth Edition, 2023
	[2]. Rohatgi V.K and Saleh E, An Introduction to Probability and Statistics, 3rd edition, John Wiley & Sons Inc., New Jersey, 2015.
	[3]. Gupta S.C and Kapoor V.K, Fundamentals of Mathematical Statistics, 11th edition, Sultan Chand & Sons, New Delhi, 2014.
Reference Books	Jim Frost, Introduction to Statistics: An Intuitive Guide for Analyzing Data and Unlocking Discoveries
Website and e-Learning Source	https://onlinestatbook.com/2/
	https://www.simplilearn.com/tutorials/statistics-tutorial
	https://towardsdatascience.com/fundamentals-of-statistics-for-data-scientists-and-data-analysts-69d93a05aae7

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	3	3	3
CO2	2	3	3	3	3	2
CO3	2	3	3	3	3	2
CO4	3	3	3	3	3	2
CO5	3	3	2	3	3	3
Weightage of course contributed to each PSO	13	15	13	15	15	12

DISCRETE MATHEMATICS

Semester	L	T	P	Semester	Credits	Inst. Hours	Marks		
							CIA	External	Total
I	4	0	0	I	3	4	25	75	100

	Learning Objectives
LO1	To get the knowledge about the relations
LO2	To understand the functions and their classifications
LO3	To understand the propositions and normal forms
LO4	To understand the usage of matrix
LO5	To acquire knowledge about the graphs

Prerequisites: Mathematics Fundamentals

Unit	Contents	No. of Hours
I	Introduction to Relations – Binary relation – Classification of Relations – Composition of Relations–Inverse of Relation– Closure operation on Relations–Matrix representation of Relation – digraphs	12
II	Introduction to Functions–Addition and Multiplication of Functions –Classifications of Functions – Composition of Function – Inverse Function	12
III	Introduction – Statement (Propositions) – Laws of Formal Logic –Basic Set of Logical operators/operations- Propositions and Truth Tables–Algebra Propositions- Tautologies and Contradictions – Logical Equivalence – Logical Implication – Normal Forms.	12
IV	Definition of a Matrix –Types of Matrices– Operations on Matrices – Related Matrices–Transpose of a Matrix–Symmetric and Skew-symmetric Matrices – Complex Matrix–Conjugate of a Matrix– Determinant of a Matrix– Typical Square Matrices– Adjoint and Inverse of a Matrix – Singular and Non-singular Matrices – Adjoint of a Square Matrix – Properties – Properties of Inverse of a Matrix.	12
V	Introduction–Graph and Basic Terminologies–Types of Graphs–Sub Graph and Isomorphic Graph – Operations on Graphs – Representation of Graph	12
TOTAL		60

CO	Course Outcomes
CO1	To recall basic concepts for clear understanding of mathematical principles

CO2	**To explain practical problems**
CO3	**To construct matrices using discrete mathematics**
CO4	**To analyze techniques to draw graph using mathematics**
CO5	**To design graphs using the representations**
Textbooks	
Ø	**DISCRETE MATHEMATICS, Swapan Kumar Chakraborty and Bikash Kanti Sarkar, OXFORD University Press**
Reference books	
Ø	**DISCRETE MATHEMATICS, Third Edition, Seymour Lipschutz and Marc Lars Lipson, Tata McGraw Hill Education Private Limited**
Ø	**Discrete Mathematical Structures with Applications to Computer Science by J.P.Tremblay, R.Manohar TMH edition**
Web Reference	
Ø	**https://www.tutorialspoint.com›discrete_mathematics**

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO 1	**3**	**3**	**3**	**3**	**3**	**3**
CO2	**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

Semester	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
I	Office Automation Laboratory	SEC		Y	2	I	2	2	50	50	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.

Exercises

MS – Word

1. Prepare a word document for spell checking and Thesaurus.
2. Apply Cut, Copy and Paste operations in a document.
3. Find a word and Replace with another in a document.
4. Insert Header with College Name, Footer with Page No., and Footnote in a document.
5. Insert mathematical symbols using Microsoft equation 3.0.
6. Preparing Newspaper format (Apply Alignment, Font, Property, Line spacing, Picture Format).
7. Prepare a Bio-Data and insert the contents of qualification within the table.
8. Mail Merge

MS – Excel

1. Apply formulas and functions
2. Prepare a chart for population growth.
3. Apply ascending and descending order

MS – PowerPoint

1. Create a power point presentation with 3 slides.
2. Create a design template with 3 slides.
3. Create a presentation with animation.
4. Create a power point presentation with 4 slides. Set slide transition time of 3 seconds and Display your presentation.
5. Create a presentation with auto content wizard.

MS – Access

1. Create an employee database.
2. Create a student database. Set primary key.
3. Prepare salary list.
4. Create a report.

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

Semester	Subject Name	Category	L	T	P	S	Credits	CIA	External	Total
								Marks		
I	Computer Fundamentals	FC	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

UNIT	Contents	No. Of. Hours
I	**Introduction to Computers:** .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, Pointing Devices, Scanners, Voice Recognition Systems, Vision Input System, Touch Screen, Output Units: Monitors Printers: Impact Printers -Non Impact Printers, Plotters, 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 Software: System Software: Operating System, Utility Programs Programming Language: Machine Language, Assembly Language, High Level Language their advantages & disadvantages. Application Software and its types: Word Processing, Spread Sheets Presentation, Graphics, DBMS	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 storage basis.	PO1, PO2, PO3, PO4, PO5, PO6
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. Kavitha Murugeshan (2009), " Fundamental of Information Technology", Majestic Books.
2	Alexis Leon, Mathews Leon," Fundamental of Information Technology", 2nd Edition.
3	Peter Norton, Introduction to Computers" Sixth Edition

Reference Books	
1.	Bhardwaj Sushil Puneet 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

Semester	Subject Name	Category	L	T	P	Credits	CIA	External	Total
							Marks		
II	**PROGRAMMING WITH PYTHON**	C	4	1	-	4	25	75	100

	Learning Objectives
LO1	To understand the concepts of Python programming.
LO2	To apply the OOPs concept in PYTHON programming.
LO4	To make the students learn best practices in PYTHON programming

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. Arrays: Defining & 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 & its Lifetime- Return Statement. Function Arguments: Required Arguments, Keyword Arguments, Default Arguments & Variable Length Arguments-Recursion.	15
IV	Python Strings: String operations- Immutable Strings - Built-in String Methods & Functions - String Comparison. Modules: import statement- The Python module – dir() function – Modules and Namespace – Defining own modules. Lists: Creating a list -Access values & Updating values in Lists-Nested lists -Basic list operations-List Methods.	15
V	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
TOTAL HOURS		**75**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Learn the basics of python, Do simple programs on python, Learn how to use an array.	PO1, PO2, PO3,

		PO4, PO5, PO6
CO2	**Develop program using selection statement, Work with Looping and jump statements, Do programs on Loops and jump statements.**	**PO1, PO2, PO3, PO4, PO5, PO6**
CO3	**Concept of function, function arguments, Implementing the concept strings in various application, Significance of Modules, Work with functions, Strings and modules.**	**PO1, PO2, PO3, PO4, PO5, PO6**
CO4	**Work with List, tuples and dictionary, Write program using list, tuples and dictionary.**	**PO1, PO2, PO3, PO4, PO5, PO6**
CO5	**Usage of File handlings in python, Concept of reading and writing files, Do programs using files.**	**PO1, PO2, PO3, PO4, PO5, PO6**

	Textbooks
1	Reema Thareja, "Python Programming using problem solving approach", First Edition, 2017, Oxford University Press.
2	Dr. R. Nageswara Rao, "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.
3.	Adam Stewarts, "Python Programming", Online.
4.	Fabio Nelli, "Python Data Analytics", APress.
5.	Kenneth A. Lambert, "Fundamentals of Python – First Programs", CENGAGE Publication.

	Web Resources
1.	https://www.programiz.com/python-programming
2.	https://www.guru99.com/python-tutorials.html
3.	https://www.w3schools.com/python/python_intro.asp
4.	https://www.geeksforgeeks.org/python-programming-language/
5.	https://en.wikipedia.org/wiki/Python_(programming_language)

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	2	3
CO 3	3	3	3	3	2	2
CO 4	3	3	3	3	2	3
CO 5	3	2	3	3	3	3
Weightage of course contributed to each PSO	15	14	15	15	13	14

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

Semester	Subject Name	L	T	P	Credits	CIA	External	Total
							Marks	
II	**PYTHON PROGRAMMING LABORATORY**	-	-	5	4	50	50	100

Course Objectives

1. **Be able to design and program Python applications.**
2. **Be able to create loops and decision statements in Python.**
3. **Be able to work with functions and pass arguments in Python.**
4. **Be able to build package with Python modules for reusability.**
5. **Be able to read and write files in Python.**

LAB EXERCISES	Required 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

Course Outcomes	
On completion of this course, students will	
CO1	**Demonstrate the understanding of syntax and semantics**
CO2	**Identify the problem and solve using PYTHON programming techniques.**
CO3	**Identify suitable programming constructs for problem solving.**
CO4	**Analyze various concepts to solve the problem in an efficient way.**
CO5	**Develop program for a given problem and test for its correctness.**

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

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

Semester	Subject Name	Category	L	T	P	Credits	Marks		
							CIA	External	Total
II	OPTIMIZATION TECHNIQUES	E	4	-	-	3	25	75	100

Course objectives:

1. **To apply various optimization techniques for decision making.**
2. **To introduce the use of variables for formulating complex mathematical models in management, science and industrial applications**

Course Outcome:

 On successful completion of the course, the learners will be able to CO1.
 Formulate and solve Linear Programming Problems.
 CO2. Analyze the usage of Sequencing Problems.
 CO3. Evaluate Queueing Models.
 CO4. Apply PERT and CPM techniques to find the optimal solution.

UNIT I   **12 hours**
INTRODUCTION-LINEAR PROGRAMMING PROBLEM
 The Nature and Meaning of OR – Management – Applications of OR — Scope of OR. Linear Programming Problem: Formulation of LP problems – Graphical solution of LP problems – General formulation of LPP – Slack and Surplus variables – Canonical & Standard form of LPP – – Simplex Method I (only)

UNIT II   **10hours**
ASSIGNMENT PROBLEMS: Assignment Problem: Mathematical formulation–Hungarian method–Unbalanced Assignment problem

UNIT III   **14 hours**
TRANSPORTATION PROBLEMS: Transportation Model: Mathematical formulation – Matrix form–Methods for finding Initial Basic Feasible solution and Optimal solution – Degeneracy in Transportation Problems – Unbalanced Transportation Problem.

UNIT IV   **12 hours**
QUEUING MODELS: Queuing System – Transient and Steady States– Kendal's Notation for representing Queuing Models – Various Models in Queuing System – Problems in Birth and Death Model(only)

UNIT V   **12 hours**
PERT AND CPM TECHNIQUES: Basic Steps – Network Diagram representation–Rules for drawing Network Diagram – Labeling Fulkerson's I–J Rule – Time Estimates and Critical Path in Network Analysis – Examples on optimum duration and minimum duration cost – PERT.

CO-PO –PSO Mapping

OPTIMIZATION TECHNIQUES											
CO	PO					PSO					COGNITIVE LEVEL
	1	2	3	4	5	1	2	3	4	5	
CO1	S	S	S	M	S	S	S	M	S	S	K-2
CO2	S	S	M	S	S	S	S	S	S	S	K-1
CO3	S	S	M	S	S	S	S	S	S	S	K-3
CO4	S	S	M	S	S	S	S	S	S	S	K-5
CO5	S	S	M	S	S	S	S	S	S	S	K– 6

Strongly Correlated–S, Moderately Correlated–M, Weekly Correlated-L

TEXT BOOK

V.K. Kapoor "Problems and Solutions in Operations Research" Sultan Chand and Sons, New Delhi

S.D.Sharma, "Operations Research", Tenth Edition,Pearson,2017.

REFERENCE BOOKS

1. **Hamdy A Taha,"Operations Research", Ninth Edition,2016.**

2. **V.Sundaresan, K.S.Ganapathy Subramanian, K.Ganesan, "Resource Management Techniques", Ninth Edition,   A.R.Publications, 2015.**

Semester	Subject Name	Category	L	T	P	S	Credits	Inst.	CIA	External	Total
										Marks	
II	Computational Intelligence	Elective	4	-	-	-	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
I	Artificial Intelligence: 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
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
III	Neural Networks: Learning rules and various activation functions, Single layer Perception Back Propagation networks, Architecture of Backpropagation (BP) Networks, Back propagation Learning -Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map,	12
IV	Artificial Neural Networks: Fundamental Concepts – Basic Models of Artificial Neural Networks – Important Terminologies of ANNs – McCulloch-Pitts Neuron – Linear Separability – Hebb Network.	12
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
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, Mc neill, 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

Semester	Subject Name	Category	L	T	P	S	Credits	CIA	External	Total
									Marks	
II	DATA STRUCTURES	SEC	2	-	-	II	2	25	75	100

Learning Objectives	
LO1	Understand the meaning asymptotic time complexity analysis and various data structures
LO2	To enhancing the problem solving skills and thinking skills
LO3	To write efficient algorithms and Programs
LO4	To make the students learn best practices in programming
LO5	To understand how to handle the files in Data Structure

UNIT	Contents	No. Of. Hours
I	Arrays and ordered Lists Abstract data types – asymptotic notations – complexity analysis- Linked lists: Singly linked list – doubly linked lists-	6
II	Stacks – Queues – Circular Queues Trees – Binary Trees – Binary Tree Traversal – Binary Tree Representations – Binary Search Trees	6
III	Graphs - Representation of Graphs – Graph implementation – graph Traversals - Minimum Cost Spanning Trees	6
IV	Searching and Sorting Sorting – Insertion Sort, Quick Sort, Merge Sort Searching – Linear search, Binary search	6
V	Backtracking – 8-Queen"s problem - Graph Colouring– Branch And Bound:– Travelling Sales Person Problem	6
	TOTAL HOURS	30

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	To understand the concepts of Linked List, Stack and Queue.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	To understand the Concepts of Trees and Graphs	PO1, PO2, PO3, PO4, PO5, PO6
CO3	To apply searching and sorting techniques	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks	
1	Seymour Lipshutz(2011),Schaum"s Outlines - Data Structures with C, Tata McGraw Hill publications.

2	**Ellis Horowitz and SartajSahni (2010), Fundamentals of Computer Algorithms, Galgotia Publications Pvt., Ltd.**
3	**Dr. K. Nagesware Rao, Dr. Shaik Akbar, ImmadiMurali Krishna, Problem Solving and Python Programming(2018)**
	Reference Books
1.	**Gregory L.Heileman(1996), Data Structures, Algorithms and Object-Oriented Programming, McGraw Hill International Edition, Singapore.**

MULTIMEDIA LABORATORY (USING REACT)

Semester	L	T	P		Credits	Inst. Hours	Marks	
							CIA	External
II	0	0	2		2	0	50	50

	Learning Objectives
LO1	To get the knowledge to write the programs using React
LO2	To understand the usage of functions
LO3	To understand the usage of mapping
LO4	To understand the application of various components
LO5	To understand the usage of audio and video players

Prerequisites: None

Contents

1. Create an image gallery component that displays a list of images.

2. Create a video player component that can play, pause, and control the volume of a video.

3. Create an audio player component with play, pause, and volume controls.

4. Create a component that allows users to upload an image and preview it before submission.

5. Create a component that visualizes audio frequencies using the Web Audio API.

6. Create an image slider that automatically transitions between images.

7. Create a Picture-in-Picture (PiP) video player that allows users to watch a video in a small overlay window while continuing to browse the page.

8. Create a component that allows users to draw annotations on an image.

9. Create an interactive map component using a mapping library like Leaflet.

10. Create a 3D model viewer using Three.js and React.

Semester III	Java Programming		Credits 4
Lecture Hours: (L) per week: 4	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week: 4

Learning Objectives:

- **To provide fundamental knowledge of object-oriented programming.**

- **To equip the student with programming knowledge in Core Java from the basics up.**

- **To enable the students to use AWT controls, Event Handling and Swing for GUI.**

Course Outcomes: (for students: To know what they are going to learn)
CO1:Understand the basic Object-oriented concepts.

Implement the basic constructs of Core Java

CO2:Implement inheritance, packages, interfaces and exception handling of Core Java.

CO3:Implement multi-threading and I/O Streams of Core Java

CO4: Implement AWT

CO5: Implement Event handling.

Units	Contents	Required Hours
I	**Introduction: Object-Oriented Programming concepts - History of Java - Java buzzwords - JVM architecture - Data types - Variables - Scope and life time of variables - arrays - operators - control statements - type conversion and casting -**	**12**
II	**simple java program - constructors - methods - Static block - Static Data - Static Method String and String Buffer Classes simple java program - constructors - methods - Static block - Static Data - Static Method String and String Buffer Classes** **Inheritance: Basic concepts - Types of inheritance - Member access rules - Usage of this and Super key word - Method Overloading - Method overriding - Abstract classes - Dynamic method dispatch - Usage of final keyword.**	**12**
III	**Multithreaded Programming: Thread Class - Runnable interface – Synchronization – Using synchronized methods – Using *synchronized* statement - Interthread Communication – Deadlock.** **I/O Streams: Concepts of streams - Stream classes- Byte and Character stream - Reading console Input and Writing Console output - File Handling.**	**12**

IV	**AWT Controls: The AWT class hierarchy - user interface components- Labels - Button - Text Components - Check Box - Check Box Group - Choice - List Box - Panels – Scroll Pane - Menu - Scroll Bar. Working with Frame class - Colour - Fonts and layout managers.**	12
V	**Event Handling: Events - Event sources - Event Listeners - Event Delegation Model (EDM) - Handling Mouse and Keyboard Events - Adapter classes - Inner classes.** **Exception Handling: *try – catch - throw - throws – finally* – Built-inexceptions - Creating own Exception classes.**	12

Learning Resources:

- **Recommended Texts**
   1. Herbert Schildt, The Complete Reference, Tata McGraw Hill, New Delhi, 7th Edition, 2010.
   2. Gary Cornell, Core Java 2 Volume I – Fundamentals, Addison Wesley, 1999.
- **Reference Books**

   1. **Head First Java, O'Rielly Publications,**

   2. **Y. Daniel Liang, *Introduction to Java Programming*, 7th Edition, Pearson Education India, 2010.**

Java Programming Laboratory								
Practical	**L**	**T**	**P**	**Credits**	**Inst. Hours**	**Marks**		
						CIA	**External**	**Total**
	0	**0**	**4**	**3**	**4**	**50**	**50**	**100**

Learning Objectives:

- **To gain practical expertise in coding Core Java programs**

- **To become proficient in the use of AWT, Event Handling**

Course Outcomes: (for students: To know what they are going to learn)

CO1:Code, debug and execute Java programs to solve the given problems

CO2:Implement multi-threading and exception-handling

CO3:Implement functionality using String and StringBuffer classes

CO4: Demonstrate Event Handling.

CO5: Create applications using Swing and AWT

	Contents	

1. **Write a Java program that prompts the user for an integer and then prints out all the prime numbers up to that Integer**

2. **Write a Java program that displays the number of characters, lines and words in a text**

3. **Write a program to do String Manipulation using Character Array and perform the following string operations:**

    a. **String length**

    b. **Finding a character at a particular position**

    c. **Concatenating two strings**

4. **Write a program to perform the following string operations using String class/ String Buffer class:**

    a. **String Concatenation**

    b. **Search a substring**

    c. **To extract substring from given string**

    d. **Reverse a string**

    e. **Delete a substring from the given string**

5. **Write a java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.**

6. **Write a threading program which uses the same method asynchronouslyto print the numbers 1 to 10 using Thread1 and to print 90 to 100 using Thread2.**

7. **Write a program to demonstrate the use of following exceptions.**
   a. **Arithmetic Exception**
   b. **Number Format Exception**
   c. **Array Index Out of Bound Exception**
   d. **Negative Array Size Exception**
8. **Write a Java program that reads on file name from the user, then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes**
9. **Write a program to accept a text and change its size and font. Include bold italic options. Use frames and controls.**
10. **Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired. (Use adapter classes).**
11. **Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result. Handle any possible exceptions like divide by zero.**
12. **Write a Java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with "stop" or "ready" or "go" should appear above the buttons in a selected color. Initially there is no message shown.**

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	2	3
CO 3	3	3	3	3	2	2
CO 4	3	3	3	3	2	3
CO 5	3	2	3	3	3	3
Weightage of course contributed to each PSO	15	14	15	15	13	14

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

Elective	Graph Theory and its applications		Credits: 3
Semester III	Lecture Hours:(L) per week: 4	Lab Practice Hours: (P)per week	Total:(L+T+P) per week: 4

Learning Objectives:

1. Definition of Graph, sub graph their representations, degree and algebraic operations.

2. Connected graphs, weighted graphs and shortest paths

3. Trees: Characterizations, spanning tree, minimum spanning trees

4. Eulerian and Hamiltonian graphs: Characterization, Necessary and sufficient conditions

5. Special classes of graphs: Bipartite graphs, line graphs, chordal graphs.

Course Outcome:

CO1: To Introduce the fundamental concepts in graph theory Graphs, subgraphs, walks, Euler graphs, Hamiltonian Paths Tree Properties, Hamiltonian paths and circuits

CO2: Understanding the concepts of Circuits, Cut set and its Properties, Network Flows, Isomorphism and Combinatorial and Planar Graphs.

CO3: Applying the concept of Colouring with Chromatic Number, Directed Graphs, Matching, Covering Pattern and Euler Graphs

CO4: Analysing the Various Concepts of Representation of Graphs, Euler Paths Circuit, Kruskals and Prims Algorithms, Connected Components.

CO5: 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.

Units	Contents	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

	Directed Graph – undirected graphs	
II	**CONNECTIVITY AND PLANARITY:** Introduction to circuits - cut set- properties of cut set- All cut sets –connectivity & 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	**GRAPH: REPRESENTATION & TRAVERSAL:** 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 Kruskal's Algorithm.	**12**
V	**APPLICATIONS OF GRAPH:** Traveling Sales Person Problem with Directed and Undirected Graph, Graph with n vertices and k colours- Shortest path from one to many Cities with directed graph- Shortest Paths with Undirected Graphs - Connected Components.	**12**

Learning Resources:

1   Narsingh Deo, " Graph Theory with Application to Engineering and Computer Science" Prentice Hall of India 2010(Reprint)

2   Rosen H "Discrete Mathematics and Its Application" Mc Graw Hill, 2007

Reference Books:

1   Discrete Mathematics for Computer Scientists & Mathematicians - Mott, Kandel, Baker

2   Clark J and Holton DA "First look at Graph Theory" Allied Publishers 1995

Web resources: NDL Library, E-content from open source libraries

https://d3gt.com/

https://www.coursera.org/courses?query=graph%20theory

Semester III Elective (L-4 C-3)	OPERATING SYSTEMS	Credits 3

UNIT I 12 Hours

Introduction: Computer System Organization – Computer System Architecture – Operating System Structure - Operating System Operations - Process Management. Operating-System Structures: Operating System Services – User and Operating-System Interface – System Calls – System Programs – Operating System Design and Implementation - System Boot.

UNIT II 12 Hours

Processes: Process Concept- Process Scheduling –Operations on Processes- Interprocess Communication – Communication in Client – Server Systems. Process Synchronization: Background - The Critical Section Problem-Peterson's Solution – Mutex Locks - Semaphores – Classic Problems of Synchronization.

UNIT III 12 Hours

CPU Scheduling: Scheduling Criteria- Scheduling Algorithms-Thread Scheduling-Real Time CPU Scheduling- Algorithm Evaluation. DeadLocks: System Model-Deadlock Characterization- Methods for Handling Deadlocks- Deadlock Prevention-Deadlock Avoidance-Deadlock Detection - Recovery from Deadlock.

UNIT IV 12 Hours

Memory Management: Swapping - Contiguous Memory Allocation – Segmentation – Paging. Virtual Memory: Background - Demand Paging - Copy on Write- Page Replacement-Allocation of Frames - Thrashing.

UNIT V 12 Hours

Mass-Storage Structure: Mass-Storage Structure-Disk Structure - Disk Scheduling - Disk Management -RAID Struture. File System Interface: File Concept-Access Methods-Directory and Disk Structure - File Sharing- Protection. File System Implementation : File System Structure - File System Implementation- Directory Implementation-Allocation Methods - Free Space Management – Recovery.

TEXT BOOK:
Operating System Concepts – Abraham Silberscartz, Peter Baer Galvin, and Greg Gange. Addision Wesley Publishing Company – Ninth Edition.

REFERENCE BOOKS:

1. Operating System: Internal and Design Principles – Fifth Edition, William Stalling, PHI Learning Private Limited.

2. Understanding Operating Systems: Ida M.Flynn, Ann McIverMcHoes

1. Operating System: Internal and Design Principles – Fifth Edition, William Stalling, PHI Learning Private Limited.

Semester III SEC 4: (P – 2 C - 2)					Web Design Laboratory			Credits 2	
Practical	**L**	**T**	**P**		**Credits**	**Inst. Hours**	**Marks**		
							CIA	**External**	**Total**
		0	2		2	0	50	50	100

Objective: To highlight the basic concepts of HTML and help the student to equip with the programming skills in implementing and developing web based applications

1. Create a website using internal links and images.

2. Design a calendar using table tag.

3. Create a HTML document to display a list of five flowers and link each one to another document displaying brief description of the flower, Add pictures wherever possible.

4. Write an HTML code to display a list of 5 cars in a frame, Link each one to a brief description in second frame. The left frame should display the list and the right frame should display the paragraph about the list item.

5. Create a simple HTML Form covering major form elements.

6. Embed Audio and Video in an HTML page.

7. Rotate an element using CSS.

8. Build a simple quiz.

Semester IV Core (L-4 C-4)	DATABASE MANAGEMENT SYSTEMS	Credits 4

UNIT I: Introduction to Databases and Database System Concepts   12 hours

Introduction – Characteristics of the Database Approach – Actors on the Scene and Workers behind the Scene – Advantages of Using the Database Management System Approach – Database Applications – Data Models, Schemas, and Instances – Three-Schema Architecture of a Database Management System – Data Independence – Database Languages and Interfaces – Database System Environment – Architectures for Database Management Systems Database Management Systems – Classification of Database Management Systems.

UNIT II: Entity Relationship Model and Relational Model   12 hours

Entity Types, Entity Sets, Attributes, and Keys – Relationship Types – Steps to Model an Entity Relationship Diagram – Relational Model Concepts – Relational Model Constraints and Relational Database Schemas – Update Operations, Transactions, and Dealing with Constraint Violations – Mapping Entity Relationship Model to Relational Data Model.

UNIT III: Relational Algebra and Structured Query Language   12 hours

Unary Relational Operations: SELECT and PROJECT – Relational Algebra Operations from Set Theory – Binary Relational Operations: Cartesian Product – Equi Join – Left Outer Join – Right Outer Join – Full Outer Join – Data Definition Language – Data Manipulation Language – Transaction Control Language – Aggregate Functions – Joins – Nested Queries –Views – Stored Procedures – Cursors – Functions – Triggers.

UNIT IV: Database Normalization   12 hours

Functional Dependencies – First Normal Form – Second Normal Form – Third Normal Form – Boyce-Codd Normal Form – Multivalued Dependency and Fourth Normal Form – Join Dependencies and Fifth Normal Form.

UNIT V: Transaction Processing and Concurrency Control   12 hours

Introduction to Transaction Processing – Transaction and System Concepts – Properties of Transactions – Characterizing Schedules Based on Recoverability – Characterizing Schedules Based on Serializability – Transaction Support in SQL –

Concurrency Control Techniques – Two-Phase Locking Techniques for Concurrency Control – Concurrency Control Based on Timestamp Ordering.

Text Books:

1.   Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, Seventh Edition, Pearson Education, 2016.

2.   Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, Seventh Edition, McGraw Hill Education, 2020.

Reference:

http://www.uoitc.edu.iq/images/documents/informaticsinstitute/Competitive_exam/Database_Systems.pdf

An Introduction Relational Database Theory, Hugh Darwen, EBook

http://www.zums.ac.ir/files/research/site/ebooks/it-programming/an-introductionto-relational-database-theory.pdf

Semester IV Core (P – 4 C - 3)	DATABASE MANAGEMENT SYSTEMS LABORATORY	Credits 3

Practical	L	T	P		Credits	Inst. Hours	Marks		
							CIA	External	Total
	0	0	4		3		50	50	100

1. Data Definition Language – Create – Alter – Drop – Enforcing Primary Key and Foreign Key Constraints – Data Manipulation Language – Insert – Delete – Update – Transaction Control Language – Commit – Rollback – Save Points.

2. Cartesian Product – Equi Join – Left Outer Join – Right Outer Join – Full Outer Join.

3. Set Operations – Creating Views – Creating Sequence – Indexing – Aggregate Functions – Analytic Functions – Nested Queries.

4. Creating Stored Procedures, Functions and Triggers

Semester IV Elective	Data Mining and Data Warehousing		Credits:3
Lecture Hours: (L) per week: 4	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week: 4

Learning Objectives: (for teachers: what they have to do in the class/lab/field)

- To provide the knowledge on Data Mining and Warehousing concepts and techniques.

- To study the basic concepts of cluster analysis

- To study a set of typical clustering methodologies, algorithms, and applications

Course Outcomes: (for students: To know what they are going to learn)

CO1: To understand the basic concepts and the functionality of the various data mining and data warehousing component

CO2: To know the concepts of Data mining system architectures

CO3: To analyse the principles of association rules

CO4: To get analytical idea on Classification and prediction methods.

CO5: To Gain knowledge on Cluster analysis and its methods.

Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the

course) [This is done during 2 Tutorial hours)

Units	Contents	Required Hours
I	**DATA WAREHOUSING AND DATA MINING** **UNIT I: Data Warehousing and Online Analytical Processing** Data Warehouse – Major Features of a Data Warehouse – Operational Database Systems and Data Warehouses – Three-tier Data Warehousing Architecture – Data Warehouse Models – Extraction, Transformation, and	12

	Loading – Metadata Repository – Multidimensional Data Model – Schemas for Multidimensional Data Models – Concept Hierarchies – OLAP Operations.	
II	**UNIT II: Data Mining Fundamentals** Data Mining – Knowledge Discovery from Databases – Data Objects and Attribute Types – Mean, Median, and Mode – Range, Quartiles, and Interquartile Range – Outliers – Variance and Standard Deviation – Data Preprocessing – Major Tasks in Data Preprocessing – Forms of Data Preprocessing – Data Cleaning – Missing Values – Noisy Data – Data Cleaning as a Process.	12
III	**UNIT III: Mining Frequent Patterns, Associations, and Correlations** Market Basket Analysis – Frequent Itemsets, Closed Itemsets, and Association Rules – Apriori Algorithm – Pattern-Growth Approach for Mining Frequent Itemsets – Mining Frequent Itemsets Using the Vertical Data Format – Mining Closed and Max Patterns – Correlation Analysis.	12
IV	**UNIT IV: Classification** Classification – General Approach to Classification – Decision Tree Induction – Basic Algorithm for Inducing a Decision Tree from Training Tuples – Attribute Selection Measures: Information Gain – Gain Ratio – Gini Index.	12
V	**UNIT V: Clustering** Cluster Analysis – Requirements for Cluster Analysis – Overview of Basic Clustering Methods Partitioning Methods: k-means clustering – k-medoids clustering – Hierarchical Methods: Agglomerative versus Divisive Hierarchical Clustering – Balanced Iterative Reducing and Clustering using Hierarchies – Chameleon – Probabilistic Hierarchical Clustering.	12

Learning Resources:

- **Recommended Texts**

- **Jiawei Han, Micheline Kamber and Jian Pei, Data Mining Concepts and Techniques, Third Edition, Morgan Kaufmann Publishers, 2012.**

- **/Han and M. Kamber, "Data Mining Concepts and Techniques", 2001, Harcourt India Pvt. Ltd, New Delhi.**

- **Reference Books**

- **K.P. Soman, Shyam Diwakar, V. Ajay "Insight into Data Mining Theory and Practice ",**
  Prentice Hall of India Pvt. Ltd, New Delhi

- **Parteek Bhatia, 'Data Mining and Data Warehousing: Principles and Practical Techniques',**
  Cambridge University Press, 2019

Web resources: Web resources from NDL Library, E-content from open-source libraries

Semester IV - Elective	Cloud Computing		Credits: 3
Lecture Hours: (L) per week 4	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week: 2

Learning Objectives: (for teachers: what they have to do in the class/lab/field)

- To impart fundamental concepts of Cloud Computing.

- To impart a working knowledge of the various cloud service types and their uses and pitfalls.

- To enable the students to know the common features and differences in the service offerings of the three major Cloud Computing service providers, namely Amazon, Microsoft and Google.

- To provide know-how of the various aspects of application design, benchmarking and security on the Cloud.

Course Outcomes: (for students: To know what they are going to learn)

CO1: To understand the concepts and technologies involved in Cloud Computing.

CO2: To understand the concepts of various cloud services and their implementation in the Amazon, Microsoft and Google cloud computing platforms.

 CO3: To understand the aspects of application design for the Cloud.

CO4: To understand the concepts involved in benchmarking and security on the Cloud.

CO5: To understand the way in which the cloud is used in various domains.

Units	Contents	Required Hours
I	Introduction to Cloud Computing:– Characteristics of Cloud Computing – Cloud Models Cloud Concepts and Technologies: Virtualization – Load balancing – Scalability and Elasticity – Deployment – Replication – Monitoring – Virtualization	12
II	Cloud Application Design: Introduction – Design Consideration for Cloud Applications – Scalability – Reliability and Availability – Security – Maintenance and Upgradation – Performance – Reference Architectures for Cloud Applications	12
III	Design Methodologies: Service Oriented Architecture (SOA), Cloud Component Model, IaaS, PaaS and SaaS Services for Cloud Applications, Model View Controller (MVC), RESTful Web Services – Data Storage Approaches: Relational Approach (SQL), Non-Relational Approach (NoSQL).	12
IV	Cloud Application Benchmarking and Tuning:	12

	Introduction to Benchmarking – Steps in Benchmarking – Workload Characteristics – Application Performance Metrics – Design Consideration for Benchmarking Methodology – Benchmarking Tools and Types of Tests – Deployment Prototyping.	
V	Cloud Security: Introduction – CSA Cloud Security Architecture – Authentication (SSO) – Authorization – Identity and Access Management – Data Security : Securing data at rest, securing data in motion – Key Management – Auditing.	12

- **Recommended Texts**

- **Arshdeep Bahga, Vijay Madisetti,** *Cloud Computing – A Hands On Approach*, **Universities Press (India) Pvt. Ltd., 2018.**

- **Reference Books**

   1. **Anthony T Velte, Toby J Velte, Robert Elsenpeter,** *Cloud Computing: A Practical Approach*, **Tata McGraw-Hill, 2013.**

   2. **Barrie Sosinsky,** *Cloud Computing Bible,* **Wiley India Pvt. Ltd., 2013.**

   3. **David Crookes,** *Cloud Computing in Easy Steps*, **Tata McGraw Hill, 2012.**

   4. **Dr. Kumar Saurabh,** *Cloud Computing*, **Wiley India, Second Edition 2012.**

Semester IV SEC 6				PERL PROGRAMMING LABORATORY			Credits 2 P 2	
Practical	**L**	**T**	**P**		**Credits**	**Inst. Hours**	**Marks**		
							CIA	**External**	**Total**
	0	0	2		2	2	50	50	100

1. Concatenate two strings

2. Reverse a string using subroutine

3. Currency conversion

4. Convert hexadecimal and octal numbers to decimal

5. Bubble sort

6. Reverse an array

7. Simple Calculator

8. Find out odd and even numbers in a list of numbers

9. CGI Programming: Creating form elements, form fields, providing submit form button

10. File Handling

Semester V Core (L– 4 C - 4)	GENERATIVE ARTIFICIAL INTELLIGENCE FOR DATA SCIENCE	Credit 4

Unit I : Scope of Generative AI- Overview of generative models and their applications - Importance of Generative AI in various domains- Ethical considerations and challenges. Language Models and LLM Architectures: Language models and their role in AI

Unit II Understanding GPT (Generative Pre-trained Transformer): GPT and its significance - Pre-training and fine-tuning processes in GPT - Architecture and working of GPT models - ChatGPT: ChatGPT and its purpose - Training data and techniques for ChatGPT - Handling user queries and generating responses

Unit III LangChain: Simplifying Development with Language Models - LangChain and its objectives - LangChain framework and its components - Streamlining application development using LangChain

Unit IV Prompt Engineering: Enhancing Model Outputs - Significance of prompt engineering - Strategies for designing effective prompts- Techniques for controlling model behavior and output quality

Unit V: The Future of Generative Modeling: The Transformer Positional Encoding Multihead Attention The Decoder Analysis of the Transformer BERT GPT-2 MuseNet Advances in Image Generation ProGAN Self-Attention GAN (SAGAN)

Textbooks:

1. **Generative Deep Learning: A Practical Guide by David Foster, O'Reilly, 2019**

2. **Applied Generative AI for Beginners: Practical Knowledge on Diffusion Models, ChatGPT, and Other LLMs by Akshay Kulkarni, Adarsha Shivananda, Anoosh Kulkarni and Dilip Gudivada, Springer, 2023**

3. **Modern Generative AI with ChatGPT and OpenAI Models by Valentina Alto, 2023, O'Reilly**

Reference Books:

1. **Generative AI by Tom Taulli**
2. **Deep Learning by Ian Goodfellow, Yoshua Bengio, and Aaron Courville**
3. **Generative Adversarial Networks: An Introductory Guide by Luke Metz**
4. **Autoencoders: Neural Networks for Unsupervised Learning by Ian Goodfellow**

Semester	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
V	**MACHINE LEARNING**	Core	4	-	-	-	4	25	75	100

	Learning Objectives	
LO1	**To Learn about Machine Intelligence and Machine Learning applications**	
LO2	**To implement and apply machine learning algorithms to real-world applications**	
LO3	**To identify and apply the appropriate machine learning technique to classification, pattern recognition, optimization and decision problems**	
LO4	**To create instant based learning**	
LO5	**To apply case based learning**	
UNIT	**Contents**	**No. Of. Hours**
I	**Introduction Machine Learning - Difference between AI, Machine Learning and Big data. Supervised and unsupervised learning, parametric vs non-parametric models, parametric models for classification and regression- Linear Regression, Logistic Regression**	**12**
II	**Neural networks Neural Network Representation – Problems – Perceptron – Activation Functions- Single Layer Perceptron - Multilayer Networks and Back Propagation Algorithms**	**12**
III	**Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning.**	**12**
IV	**Bayesian and computational learning Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning**	**12**
V	**Instant based learning K- Nearest Neighbour Learning – Locally weighted Regression – Radial Basis Functions – Case Based Learning.**	**12**
	TOTAL HOURS	**60**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Appreciate the importance of visualization in the data analytics solution	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Apply structured thinking to unstructured problems	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Understand a very broad collection of machine learning algorithms and problems	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Learn algorithmic topics of machine learning and mathematically deep enough to introduce the required theor	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Develop an appreciation for what is involved in learning from data.	PO1, PO2, PO3, PO4, PO5, PO6
1	Tom M. Mitchell, —Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.	
2	Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning" 2015, MIT Press	
Reference Books		
1.	Ethem Alpaydin, —Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.	
2	Stephen Marsland, —Machine Learning: An Algorithmic Perspective, CRC Press, 2009.	

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	2	3
CO 3	3	3	3	3	3	3
CO 4	3	3	2	3	3	3
CO 5	3	3	3	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

Semester	Subject Name	Category	L	T	P	S	Credits		Marks		
									CIA	External	Total
V	DATA SCIENCE	Core	4	-	-	-	4		25	75	100

Unit I- Data Science Fundamentals

Data Science – Fundamentals and Components – Data Scientist – Terminologies Used in Big Data Environments – Types of Digital Data – Classification of Digital Data

Introduction to Big Data – Characteristics of Data – Evolution of Big Data

Unit II – Big Data Analytics – Classification of Analytics – Top Challenges Facing Big Data – Importance of Big Data Analytics – Data Analytics Tools. Linear Regression – Polynomial Regression – Multivariate Regression

Unit III Introduction to Hadoop

Introducing Hadoop –Hadoop Overview – RDBMS versus Hadoop – HDFS (Hadoop Distributed File System): Components and Block Replication – Processing Data with

Hadoop – Introduction to MapReduce – Features of MapReduce

Unit III -Introduction to NoSQL

Introduction to NoSQL: CAP theorem – MongoDB: RDBMS Vs MongoDB – Mongo DB Database Model – Data Types and Sharding – Introduction to Hive – Hive Architecture – Hive Query Language (HQL).

Unit IV- Data Science using Python

Introduction to Essential Data Science Packages: Numpy, Scipy, Jupyter, Statsmodels and Pandas Package – Data Munging: Introduction to Data Munging, Data Pipeline and Machine Learning in Python

Unit V- Data Visualization using Python

Data Visualization Using Matplotlib – Interactive Visualization with Advanced Data Learning Representation in Python.

Text Book

Seema Acharya and Subhashini Chellapan. (2015). Big Data and Analytics, 2nd Edition, Wiley Publishers.

DT Editorial Services. (2015). Big Data Black Book, 1st Edition Dream Tech Press.

Suggested Readings:

1. Frank Pane. (2017). Hands on Data Science and Python Machin Learning, 1st Edition Packt Publishers.

2. Yuxi (Hayden) Liu. (2017). Python Machine Learning by Example, 2nd Edition, Packt Publication.

3. Alberto Boschetti and Luca Massaron, (2016). Python Data Science Essentials, 2nd Edition, Packt Publishers.

Websites:

1. www.nptel.ac.in/courses/106/106/106106179/

2. www.nptel.ac.in/courses/106/106/106106212/

3. www.nptel.ac.in/noc/courses/noc17/SEM2/no17-mg24/

4. www.nptel.ac.in/courses/106/104/106104189/

5. www.coursera.org/specializations/advanced-data-science-ibm

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	3	3	3	3
CO2	3	3	2	3	2	2
CO3	3	2	3	3	3	2
CO4	3	2	3	2	3	3
CO5	2	3	3	3	3	3
Weightage of course contributed to each PSO	14	13	14	14	14	13

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

Semester	Subject Name	Category	L	T	P	S	Instruction Hours	Credits	Marks		
									CIA	External	Total
V	**MACHINE LEARNING LABORATORY**		-	-	4	-		3	50	50	100

Learning Objectives: To apply the concepts of Machine Learning to solve real-world problems and to implement basic algorithms in clustering & classification applied to text & numeric data

LAB EXERCISES

1. **Solving Regression & Classification using Decision Trees**
2. **Bayesian Inference in Gene Expression Analysis**
3. **Pattern Recognition Application using Bayesian Inference**
4. **Bagging, Boosting applications using Regression Trees**
5. **Data & Text Classification using Neural Networks**
6. **Using Weka tool for SVM classification for chosen domain application**
7. **Data & Text Clustering using K-means algorithm**

Course Outcomes	
CO	**On completion of this course, students will**
CO1	**Effectively use the various machine learning tools**
CO2	**Understand and implement the procedures for machine learning algorithms**
CO3	**Design Python programs for various machine learning algorithms**
CO4	**Apply appropriate datasets to the Machine Learning algorithms**
CO5	**Analyze the graphical outcomes of learning algorithms with specific datasets**

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**	**2**
CO 2	**3**	**3**	**3**	**2**	**3**	**3**
CO 3	**3**	**3**	**3**	**3**	**3**	**3**
CO 4	**2**	**3**	**3**	**3**	**3**	**3**
CO 5	**3**	**3**	**3**	**3**	**3**	**3**
Weightage of course contributed to each PSO	**14**	**15**	**15**	**14**	**15**	**14**

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

Semester V	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	ANDROID PROGRAMMING LABORATORY	Core	-	-	4	-	3	50	50	100

Learning Objectives:

LO1. To explain user defined functions and the concepts of class.

LO2. To demonstrate the creation cookies and sessions

LO3. To facilitate the creation of Database and validate the user inputs

Lab Exercises	Required Hours

1. **Develop a Simple Calculator that uses radio buttons and text view.**

2. **Develop an application that uses Intent and Activity.**

3. **Develop an application that uses Dialog Boxes.**

4. **Develop an application to display a Splash Screen.**

5. **Develop an application that uses Layout Managers.**

6. **Develop an application that uses different types of Menus.**

7. **Develop an application that sends messages from one mobile to another mobile.**

8. **Develop an application that uses to send E-mail. Develop an application that plays Audio and Video.**

9. **Develop an application for Simple Animation.**

10. **Develop an application for Login Page using SQLite.**

Course Outcomes	
CO	**On completion of this course, students will able to**
CO1	**Understand the concepts of dialogs.**
CO2	**Analyze Concepts of Layout Managers. Perform sending email on audio and video** **To enable the applications of audio and video.**
CO3	**To apply Local File Storage and Development of files.**

CO4	To determine the concepts of Simple Animation To apply searching pages.
CO5	Usage of Student mark sheet- preparation in MAD. Concepts of processing Sqlite are implemented.

Semester V		Mini Project		Credits:4
Lecture Hours: (L) per week		**Tutorial Hours : (T) per week**	**Lab Practice Hours: 4**	**Total: (L+T+P) per week:4**
Units	**Contents**			**Required Hours**
	Students(Individual or maximum three in a group) will take a specific problem for the Mini Project and solve it using any one of latest tool and submit a report. Further each student will participate in regular project review with group project guide / Faculty.			

Semester V Elective	BIO-INSPIRED COMPUTING	Credits:3
L – 4 C – 3		

OBJECTIVES:
- **To Learn bio-inspired theorem and algorithms**
- **To Understand random walk and simulated annealing**
- **To Learn genetic algorithm and differential evolution**
- **To Learn swarm optimization and ant colony for feature selection**
- **To understand bio-inspired application in image processing**

UNIT I INTRODUCTION
Optimisation, Modelling, and Simulation Problems Evolutionary Computing
Evolutionary Algorithm Representation, Mutation, and Recombination Fitness,
Selection, and Population Management

UNIT II RANDOM WALK AND ANEALING
Random variables - Isotropic random walks - Levy distribution and flights - Markov
chains - step sizes and search efficiency
importance of randomization- Eagle strategy-Annealing and Boltzmann Distribution -
parameters -SA algorithm - Stochastic Tunneling.

UNIT III GENETIC ALOGORITHMS AND DIFFERENTIAL EVOLUTION
Genetic Algorithms - Evolution Strategies - Evolutionary Programming - Genetic
Programming - Learning Classifier Systems - Differential Evolution
Evolutionary Algorithm Parameters= EAs and EA Instances - Designing Evolutionary
Algorithms

UNIT IV SWARM OPTIMIZATION Swarm intelligence - PSO algorithm - accelerated
PSO - implementation - convergence analysis - binary PSO
Ant colony optimization -toward feature selection. – Bee colony optimization

UNIT V
FIREFLY ALGORITHM
The Firefly algorithm - - implementation - Cuckoo Search Algorithm – Bat Algorithm –
Feature Selection

OUTCOME:
Upon completion of the course, the students should be able to
- **Explain random walk and simulated annealing**
- **Implement and apply genetic algorithms**
- **Explain swarm intelligence and ant colony for feature selection**
- **Apply bio-inspired techniques in image processing.**

Text Book
1. **Xin-She Yang, ''Nature Ispired Optimization Algorithm,Elsevier First Edition 2014**

2. Eiben,A.E.,Smith,James E, "Introduction to Evolutionary Computing", Springer 2015.
3. Yang ,Cui,XIao,Gandomi,Karamanoglu ,"Swarm Intelligence and Bio-Inspired Computing", Elsevier First Edition 2013

REFERENCES:
1. Helio J.C. Barbosa, "Ant Colony Optimization - Techniques and Applications", Intech 2013
2. Xin-She Yang , Jaao Paulo papa, "Bio-Inspired Computing and Applications in Image Processing",Elsevier 2016

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	2
CO 2	3	3	3	2	3	3
CO 3	3	3	3	2	3	3
CO 4	3	3	3	3	3	3
CO 5	3	3	3	3	3	3
Weightage of course contributed to each PSO	15	15	15	13	15	14

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

Semester V Elective	Computer Networks		Credits:3
Lecture Hours: (L) per week: 4	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week: 4

Learning Objectives:

- **To understand the concept of Data communication and Computer network**

- **To get a knowledge on routing algorithms.**

- **To impart knowledge about networking and inter networking devices**
- **To gain the knowledge on Security over Network communication**

Course Outcomes: (for students: To know what they are going to learn)

CO1:To Understand the basics of Network architecture, OSI & TCP/IP reference models

CO2:To gain knowledge on Telephone systems and Satellite communications

CO3:To impart the concept of Elementary data link protocols

CO4: To analyze the characteristics of Routing and Congestion control algorithms

CO5: To understand network security & defines protocols such as FTP, HTTP, Telnet, DNS

Units	Contents	Required Hours
I	Introduction – DATA COMMUNICATIONS – NETWORKS - PROTOCOLS AND STANDARDS - Network Models - THE OSI MODEL - TCP/IP PROTOCOL SUITE	12
II	Bandwidth Utilization: Multiplexing and Spreading – MULTIPLEXING - SPREAD SPECTRUM Transmission Media - GUIDED MEDIA - UNGUIDED MEDIA: WIRELESS Svvitching - CIRCUIT-SWITCHED NETWORKS - DATAGRAM NETWORKS - VIRTUAL-CIRCUIT NETWORKS	12
III	Data Link Layer: Error Detection and Correction - Types of Errors -BLOCK CODING - CYCLIC CODES – CHECKSUM	12
IV	Network Layer: Internet Protocol – IPv4 – IPv6 - Delivery, Forwarding, and Routing Transport Layer - PROCESS-TO-PROCESS DELIVERY - USER DATAGRAM PROTOCOL (UDP) – TCP – SCTP - Congestion Control and Quality of Service	12
V	Application Layer: DO/nain Name Svstem - DOMAIN	12

	NAME SPACE - Remote Logging, Electronic Mail, and File Transfer – HTTP - SIMPLE NETWORK MANAGEMENT PROTOCOL (SNMP)	

Recommended Texts

- B. A. Forouzan, "Data Communications and Networking", Tata McGraw Hill, 4th Edition, 2017.

Reference Books

1. A. S. Tanenbaum, "Computer Networks", 4th Edition, Prentice-Hall of India, 2008.
2. F. Halsall, "Data Communications, Computer Networks and Open Systems", Pearson Education, 2008.

3. D. Bertsekas and R. Gallagher, "Data Networks", 2nd Edition, PHI, 2008.

4. Lamarca, "Communication Networks", Tata McGraw- Hill, 2002

Semester VI	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	CIA	External	Total
											Marks
	Data Analytics using R	Core	4	1	-	-	4	5	25	75	100

Course Objective	
C1	To understand the problem solving approaches
C2	To learn the basic programming constructs in R Programming
C3	To learn the basic programming constructs in R Programming
C4	To use R Programming data structures - lists, tuples, and dictionaries.
C5	To do input/output with files in R Programming.

UNIT	Contents	No. of Hours
I	**R Studio -**	12
II	**CONTROL STRUCTURES AND VECTORS -Control structures, functions, scoping rules, dates and times, Introduction to Functions, preview of Some Important R Data Structures, Vectors, Character Strings, Matrices, Lists, Data Frames, Classes Vectors: Generating sequences, Vectors and subscripts, Extracting elements of a vector using subscripts, Working with logical subscripts, Scalars, Vectors, Arrays, and Matrices, Adding and Deleting Vector Elements, Obtaining the Length of a Vector, Matrices and Arrays as Vectors Vector Arithmetic and Logical Operations, Vector Indexing, Common Vector Operations**	12
III	**LISTS- Lists: Creating Lists, General List Operations, List Indexing Adding and Deleting List Elements, Getting the Size of a List, Extended Example: Text Concordance Accessing List Components and Values Applying Functions to Lists, Data Frames, Creating Data Frames, Accessing Data Frames, Other Matrix-Like Operations**	12

IV	FACTORS AND TABLES - Factors and Levels, Common Functions Used with Factors, Working with Tables, Matrix/Array-Like Operations on Tables , Extracting a Sub table, Finding the Largest Cells in a Table, Math Functions, Calculating a Probability, Cumulative Sums and Products, Minima and Maxima, Calculus, Functions for Statistical Distributions R PROGRAMMING .	12
V	OBJECT-ORIENTED PROGRAMMING S Classes, S Generic Functions, Writing S Classes, Using Inheritance, S Classes, Writing S Classes, Implementing a Generic Function on an S Class, visualization, Simulation, code profiling, Statistical Analysis with R, data manipulation	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, PO3
3	Learn and apply different mining algorithms and recommendation systems for large volumes of data.	PO2, PO6
4	Perform analytics on data streams.	PO4, PO5, PO6
5	Learn NoSQL databases and management.	PO5, PO6

	Text Book
1	Roger D. Peng," R Programming for Data Science ", 2012
2	Norman Matloff, "The Art of R Programming- A Tour of Statistical Software Design", 2011

	Reference Books
1.	Garrett Grolemund, Hadley Wickham,"Hands-On Programming with R: Write Your Own Functions and Simulations" , 1st Edition, 2014
2.	Venables ,W.N.,andRipley,"S programming", Springer, 2000.

	Web Resources
1.	https://www.simplilearn.com

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	3	3	3	3
CO2	3	3	2	3	2	2
CO3	3	2	3	3	3	2
CO4	3	2	3	2	3	3
CO5	2	3	3	3	3	3
Weightage of course contributed to each PSO	14	13	14	14	14	13

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

Semester VI - Core	SOFTWARE ENGINEERING								
	L	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
							CIA	**External**	**Total**
	4	1	0	V	4	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.

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.**	12
II	**Software Requirements Analysis and Specifications: Requirements Engineering - Type of Requirements - Feasibility Studies - Requireents Elicitation - Requirements Analysis - Requirements Documentation - Requirements Validation.**	12
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.**	12
IV	**Software Testing: A Strategic Approach to Software Testing - Terminologies - Functional Testing - Structural Testing - Levels**	12

	of Testing - Validation Testing - Testing Tools.	
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.	12
TOTAL		60

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 Mc Graw Hill Publication.
2.	Panaj Jalote (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	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
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
Weightage of course contributed to each PSO	13	12	14	14	14	13

Semester VI	Subject Name	Category	L	T	P	S	Credits	Inst.	Marks		
									CIA	External	Total
Core - Lab	Data analytics using R Laboratory	Core	-	-	4	-	3	4	50	50	100
		Course Objective									
C1	To understand problem solving approaches										
C2	To learn the basic programming constructs in R Programming										
C3	To practice various computing strategies for R Programming -based solutions to real world problems										
C4	To use R Programming data structures - lists, tuples, and dictionaries.										
C5	To do input/output with files in R Programming.										
Sl. No	Contents										
1.	convert the given temperature from Fahrenheit to Celsius and vice versa depending upon user's choice.									60	
2.	find the area of rectangle, square, circle and triangle by accepting suitable input parameters from user.										
3.	Write a program to find list of even numbers from 1 to n using R-Loops.										
4.	Create a function to print squares of numbers in sequence.										
5.	join columns and rows in a data frame using cbind() and rbind()										
6.	Implement different String Manipulation functions										
7.	Implement different data structures (Vectors, Lists, Data Frames)										
8	Write a program to read a csv file and analyze the data in the file										
9	Create pie chart and bar chart										
10	Create a data set and do statistical analysis on the data										
11	Program to find factorial of the given number using recursive function										
12	count the number of even and odd numbers from array of N numbers.										
	Total									60	

Course Outcomes		Programme Outcome
CO	On completion of this course, students will	
1	Acquire programming skills in core R Programming	PO1,PO4,PO5
2	Acquire Object-oriented programming skills in R Programming.	PO1, PO4,PO6
3	Develop the skill of designing graphical-user interfaces (GUI) in R Programming	PO1,PO3,PO6
4	Acquire R Programming skills to move into specific branches	PO3,PO4
5		PO1,PO5,PO6
Text Book		
1	Roger D. Peng," R Programming for Data Science ", 2012	
2	Norman Matloff, "The Art of R Programming- A Tour of Statistical Software Design", 2011	
Reference Books		
1	Garrett Grolemund, Hadley Wickham,"Hands-On Programming with R: Write Your Own Functions and Simulations" , 1st Edition, 2014	
2.	Venables ,W.N., and Ripley,"S programming", Springer, 2000.	
Web Resources		
1.	https://www.simplilearn.com	

Semester VI Elective	Social Media Analytics		Credits:3
Lecture Hours: (L) per week: 4	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week: 4

Course Objectives:

The main objectives of this course are to:

• **Give an overview of social networks and its importance.**

• **Understand the social network concepts and various methods of analysis.**

• **Expose and train on various tools and techniques for analyzing and visualizing social media networks.**

Unit:1 INTRODUCTION TO SOCIAL NETWORKS AND SNA   12 hours

Connected World – Networks: Actors, Relations and Attributes - Networks as Information. Maps - Networks as Conduits – Leaders and Followers – Psychological foundations of social networks – Basic building Blocks – Brief history of Social Network Analysis.

Unit:2 NETWORK CONCEPTS   12 hours

Individual Members of the Network – Sociological Questions about Relationships – Whole Social Networks- Distributions – Multiplexity – Roles and Positions – Network Segmentation – Graph Theory – Notations for Social Network Data

Unit:3 SOCIAL NETWORK ANALYSIS FUNDAMENTALS   12 hours
Points, Lines and Density – Centrality and Centralization – Components, Cores and Cliques – Positions, Roles and Clusters – Dimensions and Displays.

Unit:4 METHODS OF SOCIAL NETWORK ANALYSIS   12 hours

Graphs – Matrices – Relationship Measures – Centrality and Prestiges – Cliques – Structural Equivalence – Visual Displays – Book models – Network Position Measures – Logit Models – Affiliation networks – Lattices- Levels of Analysis

Unit:5 TOOLS AND TECHNOLOGIES   12 hours

Twitter Analytics – Facebook Analytics – Google+ Analytics – Google+ Ripples – R for Social Network Analysis – Pajek – Network Visualization Tools – Analyzing Social Media Networks with NodeXL.

Course Outcomes:

On the successful completion of the course, student will be able:

1 Analyze social network data using various software packages.

2 Implement statistical models of social networks to analyze network formation and evolution.

3 Implement the basic concepts and theories of network analysis in the social sciences.

4 Use statistical software to visualize networks and analyze their properties.

Text Book(s)
1 Charles Kadushin, "Understanding Social Networks: Theories, Concepts, and Findings", Oxford University Press,USA,2011

2 David Knoke, Song Yang, "Social Network Analysis", 2nd Edition, SAGE Publications,2007

References
Christina Prell, "Social Network Analysis: History, Theory and Methodology", 1st Edition, SAGE Publications Ltd, 2012

Semester VI Elective	Data Visualization		Credits:3
Lecture Hours: (L) per week: 4	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week: 4

Unit:1 Introduction to Data Visualization   **12 hours**

Definition – Methodology – Seven Stages of Data Visualization - Data Visualization Tools. Visualizing Data: Mapping Data onto Aesthetics – Visualizing Amounts – Visualizing Distributions: Histograms and Density Plots – Visualizing Propositions: – Visualizing Associations: Among Two or More Quantitative Variables – Visualizing Time Series and Other Functions of an Independent Variable – Trends – Visualizing Geospatial Data.

Unit:2 Interactive Data Visualization   **12 hours**

Introduction to D3 - Fundamental Technology: The Web – HTML – DOM – CSS – JavaScript –SVG. D3 Setup – Generating Page Elements – Binding Data - Drawing with data – Scales: Domains and Ranges – Normalization – Creating a Scale – Scaling the Scatter Plot – Other Methods and Other Scales. Axes – Modernizing the Chart – Update the Data – Transition – Updates – Interactivity.

Unit:3 D3 Based Reusable Chart Library   **12 hours**

Setup and Deployment – Generate Chart – Customize Chart: Additional Axis – Show Axis Label – Change Chart Type – Format Values – Size – Color – Padding –Tooltip. Use APIs: Load and Unload – Show and Hide – Focus – Transform – Groups – Grid – Regions – Flow – Revert – Toggle –Legend – Sub chart – Zoom – Resize. Customize Style. Building Real time and Live Updating animated graphs with C3.

Unit:4 Tableau Introduction   **12 hours**

Environment Setup – Navigation – File & Data Types. TA SOURCE: Custom Data View – Extracting Data – Fields Operations – Editing Meta Data – Data Joining – Data Blending. Worksheets.

Unit:5 Basic and Advanced Charts in Tableau   **12 hours**

Bar Chart – Line Chart – Pie Chart – Scatter Plot – Bubble Chart –Gantt Chart – Histograms -Waterfall Charts. Dashboard – Formatting – Forecasting – Trend Lines

Text Book(s)

1 Ben Fry, "Visualizing Data: Exploring and Explaining Data with the Processing

Environment", O'Reilly, 1st Edition, 2008.

2 Scott Murray, "Interactive data visualization for the web: An Introduction to Designing with D3", O'Reilly, 2nd Edition, 2017.

3 Joshua N. Milligan, "Learning Tableau 2019: Tools for Business Intelligence, data prep, and visual analytics", Packt Publishing Limited, 2019.

4 Claus O. Wilke, "Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures", O.Reilly, 2019.

Reference Books :

1 Ritchie S. King, "Visual Storytelling with D3: An Introduction to Data Visualization in JavaScript", Addison-wesley Data and Analytics, 2014.

2 Elijah Meeks, "D3.js in Action: Data visualization with JavaScript", Second Edition, Manning Publications, 2017.

3 Lindy Ryan, "Visual Data Storytelling with Tableau", 1st Edition, Pearson, 2018..

Semester VI	Subject Name	Category	L	T	P	S	Credits	CIA	External	Total
										Marks
	Data Security	Elective	4				3	25	75	100

Course Objective	
C1	Understand the Security requirements, components, and processes
C2	Understand the various needs, risks and issues related to Information Security
C3	To plan information security risk management
C4	Understand Physical, Operational and Personnel Security
C5	Comprehend the Information Security and Privacy Compliance Requirements

UNIT	Details	No. of Hours
I	Introduction: History - Information Security - CIA requirements- security model - Components of an information system - Securing the components - Balancing security and access - The SDLC –Security in SDLC	12
II	Needs, Information Threats, Attacks and Issues: Need for security - Business needs - Threats – Attacks – Legal - Ethical and professional issues	12
III	Risk Management: Identifying and assessing risk - Assessing and controlling risk – Risk control strategies – Quantitative and qualitative risk control practices – Risk management decision points	12
IV	Security Technology: Intrusion Detection and Prevention Systems – Honeypots – Scanning and Analysis tools – Biometric Access Controls	12
V	Physical Security: Physical access controls – Fire Security & Safety – Failure of Supporting utilities and structural collapse- Interception of data – Mobile and Portable system – Special consideration for physical security	12
	Total	60

Text Book	
1	Michael E Whitman and Herbert J Mattord, "Principles of Information

	Security", Sixth Edition, Cengage Learning, 2017		
	Reference **Alan Calder, Steve Watkins, "IT Governance: An International Guide to Data Security and ISO27001/ISO27002", Kogan Page; 6th edition, 2015** **Web Resources**		
1.	**ISO/IEC**	**27701**	**PIMS:**
	https://query.prod.cms.rt.microsoft.com/cms/api/am/binary/ RE3uDwE		

Semester VI Elective	DEEP LEARNING		Credits:3
Lecture Hours: (L) per week: 4	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week: 4

Unit I: Basics of artificial neural networks (ANN): Artificial neurons, Computational models of neurons, Structure of neural networks, Functional units of ANN for pattern recognition tasks Feedforward neural networks: Pattern classification using perceptron, Multilayer feedforward neural networks (MLFFNNs), Backpropagation learning, Empirical risk minimization, Regularization, Autoencoders

Unit II: Deep neural networks (DNNs): Difficulty of training DNNs, Greedy layer wise training, Optimization for training DNNs, Newer optimization methods for neural networks (AdaGrad, RMSProp, Adam), Second order methods for training, Regularization methods (dropout, drop connect, batch normalization)

Unit III: Convolution neural networks (CNNs): Introduction to CNNs – convolution, pooling, Deep CNNs, Different deep CNN architectures – LeNet, AlexNet, VGG, PlacesNet, training a CNNs: weights initialization, batch normalization, hyperparameter optimization, Understanding and visualizing CNNs.

Unit IV: Recurrent neural networks (RNNs): Sequence modeling using RNNs, Backpropagation through time, Long Short Term Memory (LSTM), Bidirectional LSTMs, Bidirectional RNNs, Gated RNN Architecture - Generative models: Restricted Boltzmann Machines (RBMs), Stacking RBMs, Belief nets.

Unit V: Learning sigmoid belief nets, Deep belief nets Under complete - Auto encoder, Regularized Auto encoder, stochastic Encoders and Decoders, Contractive Encoders. Applications: Applications in vision, speech and natural language processing

Recommended Texts:

1. S. Haykin, Neural Networks and Learning Machines, Prentice Hall of India, 2016

2. Ian Goodfellow, Yoshua Bengio and Aaron Courville, " Deep Learning", MIT Press, 2017

Reference Books:

1. Satish Kumar, Neural Networks - A ClassRoom

2. B. Yegnanarayana, Artificial Neural Networks, Prentice- Hall of India, 1999

3. Giancarlo Zaccone, Md. RezaulKarim, Ahmed Menshawy "Deep Learning with TensorFlow: Explore neural networks with Python", Packt Publisher, 2017.

4. Antonio Gulli, Sujit Pal "Deep Learning with Keras", Packt Publishers, 2017.

5. Francois Chollet "Deep Learning with Python", Manning Publications, 2017.

Web References:

https://www.youtube.com/watch?v=aPfkYu_qiF4&list=PLEAYkSg4uSQ1r2XrJ_GBzzS6I-f8yfRU

Course Code		Major	Project	Credits:4
Lecture Hours: (L) per week		Tutorial Hours : (T) per week	Lab Practice Hours: 6	Total: (L+T+P) per week:6
Course Category :		Year & Semester:		Admission Year:
Units	Contents			Required Hours
	Students (Individual or maximum three in a group) will take a specific problem for the Project and solve it using any one of latest tool and submit a report. Further each student will participate in regular project review with group project guide / Faculty.			

Students who couldn't appear for Naan Muthalvan Course in a particular semester or who have failed in Naan Muthalvan Course should write the following papers (External – 100 marks)

Semester	Title of the Paper
II	Soft Skills for Employability
III	Digital Skills for Employability – Office Fundamentals
IV	Web Design with HTML
V	Internet & E-Commerce
VI	C Programming

SOFT SKILLS FOR EMPLOYABILITY

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
-	-	-	-	II	2	-	0	100	100

Learning Objectives	
LO1	The course aims to acquaint the students with some very relevant and necessary soft skills and also to help them to develop their personality as well as to be self-motivated.
LO2	To get the knowledge about the meditation techniques and mental conditioning
LO3	To get the knowledge about the social skills and etiquette
LO4	To get the knowledge about the communication and negotiation skills
LO5	To get the knowledge about the preparation of resumes, appearing for interviews and handling both after campus issues that people normally face while setting foot on the professional sphere

Prerequisites: None

Unit	Contents
I	**Minding the Mind: This Unit will focus on meditation techniques and mental conditioning** 1.1 Understanding YOU, which denotes 'Your Own Universe', wherein a person will be encouraged to self-introspect and critically analyse oneself. 1.2 Self-Analysis 1.3 Ice Breaker 1.4 Warming Up
II	**The Charming Skills: This Unit will focus on training the students to develop and enhance their social skills, etiquette and basic personal grooming.** 2.1 Introduction 2.2 Social Skill 2.3 Etiquette (This will be broad-based delving on various etiquettes necessary for varied areas such as general conversation, table party, official meets and social media)
III	**The Communication Mechanism : This Unit will focus on developing skills in both verbal and non-verbal communications (body language, framing emails, and social media communications). Moreover, inputs on importance of graphology will be taught.** 3.1 Introduction to Communication 3.2 Types of Communication 3.3 Public Speaking 3.4 Group Conversation 3.5 Letter writing and email
IV	**The Negotiator: This unit will focus on inculcating good negotiations and conflict management skills.** 3.6 **Introduction to Negotiation** 3.6.1 **The Negotiation Clock Face**

	3.6.2 **Assertiveness Matters** 3.6.3 **Traits of Negotiations** 3.6.4 **Factors that Make a Difference** 3.6.5 **Tactics and Values**
V	**Campus to Corporate:** This Unit will focus on training about preparation of resumes, appearing for interviews and handling both after campus issues that people normally face while setting foot on the professional sphere. 4.1 **The Doorstep** 4.2 **Resume Preparation / Portfolio Management** 4.3 **Interviews: The Different Types and How to face the same**

CO	Course Outcomes
CO1	The students will be able to appreciate the significance of soft skills.
CO2	The students will be able to get the personality augmentation with reference to their personal life.
CO3	The students will be able to get the personality augmentation with reference to their professional life.
CO4	The students will get the professional efficiency.
CO5	The course module will enhance the employability quotient of the students
Textbooks	
1.	*Bezborah, P.*, Soft Skills and Personality Development. Banalata, Dibrugarh.
2.	*Hartely C. B..*, The Gentlemen's Book of Etiquette and Manual of Politeness. Julia Miller.
3.	*Rai, U.*, English Language Communication Skills, Himalaya Publishing House
Reference Books	
1.	*Amen, K. K. and Ruiz, M.* S., Hand Writing Analysis – The Complete Basic Book. New Page Books, New Jersey.
2.	*Gates,* S., The Negotiation Book. T J International Limited, Cornwall.
3.	*Wainright. G. R.*, Understand Body Language. Hodder Education, London.

Digital Skills for Employability – Office Fundamentals

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
	-	-	-	III	2	-	0	100	100

Unit I:
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

Unit II:
Spreadsheets : Excel–opening, entering text and data, formatting, navigating; Formulas–entering, handling and copying; Charts–creating, formatting and printing

Unit III:
Power point: Introduction to Power point - Features – Understanding slide typecasting & viewing slides – creating slide shows. Applying special object – including objects & pictures – Slide transition–Animation effects, audio inclusion, timers.

Unit IV:
Database Concepts: The concept of Database 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 driven applications in query language (MS–Access).

Unit V:
Microsoft Access – Creating Tables — Creating database - Creating a Table – Working on Tables – Saving the Table – Defining primary Key – Closing the Table – Closing the Database window

Text Book:
1. Jennifer Ackerman Kettel, Guy Hat-Davis, Curt Simmons, "Microsoft 2003", Tata McGrawHill.
2. VIKAS GUPTA, "Comdex Computer Course Kit (XP Edition)", Dreamtech press, New Delhi.

References:
1. Stephen L. Nelson, "The Complete Reference office 2000" Tata McGraw – Hill Publishing Company limited, New Delhi.
2. N.Krishnan, "Window and MS Office 2000 with Database Concepts" Scitech publications (India) Pvt Ltd., Chennai

https://www.udemy.com/course/office-automation-certificate-course/
https://www.javatpoint.com/automation-tools

Web Design with HTML

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
	-	-	-	IV	2	-	0	100	100

Unit I: Introduction to HTML
: Designing a Home page – History of HTML – HTML generations – HTML tags

Unit II: HTML Documents-Anchor tag –Hyper links –Sample HTML documents -Designing a web page

Unit III: Head and Body section: Header Section –Title-Prologue-Links-Colorful web page –Comments lines Designing the body: Heading printing

Unit IV: Aligning the headings-Horizontal rule- paragraph-Tab settings-Image and pictures-Embedding PNG format Images.

Unit V: Ordered and unordered lists: List-Unordered lists- headings in a list – ordered lists- Nested lists.

Text Book:
World Wide Web Design with HTML, C. Xavier, TMH, 2001

Reference Book:
1. Internet & World Wide Web, H.M.Deital, P.J.Deital & A.B.Goldberg, Pearson Education
2. Fundamentals of information technology, Mathew's lenon and Alxis leon, Vijay Nicole private limited, Chennai.

Internet & E-Commerce

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
	-	-	-	V	2	-	0	100	100

Unit I

The Internet: Introduction – From Computers to the Internet - Advantages of the Internet – Major Internet Services – Hardware and Software for the Internet - – TCP/IP - The Protocols of the Internet.

World Wide Web: Architecture of the World Wide Web –Types of websites – Uniform Resource Locator – Domain Name System – Web Pages and Web Links – Visiting Web Pages — Searching the Web – Google & Chrome Search Engines.

Unit II

Types of Internet Accounts – Selecting Internet Service Providers –Electronic Mail: Advantages of E-mails – E-mail addresses – Mail transfer protocols – Working of E-mail system.

Hosting Websites: Structure of Websites – Web Development tools – Hosting Websites –Getting a Domain /name – Visitor Analysis and Statistics –

Unit III

Electronic Commerce: E-Business and E-Commerce – Types of business in the internet – M-Commerce - Marketing Strategies on the Web – Making Payments in Virtual Stores – Shopping in Virtual Stores — Major issues of E-commerce and M-Commerce

Unit IV

Blogs and Social Networking: Blogs – Uses of Blogs – Blogs System Components –Steps for Blogging – Building a Blog site – Social Networking – Etiquette in networking sites.

Unit V

Internet Security: Internet Threats – Identity theft and Cybersquatting – Hacking – Spamming and Spoofing – Phishing and Pharming – Denial of Service – spyware – Viruses and worms- Security solutions – Firewalls and Intrusion Prevention Systems –Internet Security Precautions-

Text Book:

The Internet A User's Guide Second Edition by K.L. James – PHI Learning Private Limited Reference Books:

1. Internet, World Wide Web, How to program, 4th Edition, Paul Deital, Harvey M Deitel, Pearson

2. Learning Internet & Email, 4th Revised Rdition, Ramesh Bangia, Khanna Book Publishing Co Pvt Ltd.

3. Internet & Ecommerce, C. Nellai Kannan, NELS Publications.

Programming in C

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
	-	-	-	VI	2	-	0	100	100

Objective: To obtain knowledge about the structure of the programming language C and to develop the program writing and logical thinking skill.

Unit – I: INTRODUCTION C Declarations:- Character Set – C tokens – Keywords and Identifiers – Identifiers – Constants – Variables – Data types – Declaration of Variables –Assigning Values to Variables
Operators and Expressions:- Introduction – Arithmetic Operators – Relational Operators – Logical Operators – Assignment Operators – Increment and Decrement Operators – Conditional Operator – Bitwise Operators – Special Operators
Input and Output Operations:- getchar( ) – putchar( ) – scanf( ) – printf( ).

Unit – II: CONTROL STRUCTURES Decision Making and Branching:- Decision Making with IF Statement – Simple IF statement – The IF...Else Statement – Nesting of IF...Else Statements – The ELSE IF ladder – The Switch Statement – The ?: Operator – The GOTO statement.

Unit – III: Decision Making and Looping:- The WHILE Statement – The DO Statement – The FOR statement.
ARRAYS One-dimensional arrays – Declaration of One-dimensional arrays – Initialization of One dimensional arrays - Two-dimensional arrays – Initialization of Two-dimensional arrays

Unit – IV: Character Arrays and Strings:- Declaring and Initializing String Variables – Reading Strings from Terminal – Writing Strings to Screen – String Handling Functions.

Unit V: FUNCTIONS User-Defined functions:- Need for User-defined functions – Definition of functions – Return Values and their Types – Function Calls – Function Declaration
The Scope, Visibility and lifetime of a variables.
Structures and Unions

Text Book :
Programming in ANSI C – 6 th Edition by E Balagurusamy – Tata McGraw Hill Publishing Company Limited.

Reference Books:
1. Computer System and Programming in C by Manish Varhney, Naha Singh – CBS Publishers and Distributors Pvt Ltd.
2. Introduction to Computer Science, ITL Education Solutions Limited, Second Edition, Pearson Education
3. Computer Basics and C Programming by V. Rajaraman – PHI Learning Private Limited 4. Programming with C, Third Edition, Byron S Gottfried, Tata McGraw Hill Education Private Limited.