B.Sc.,
ARTIFICIAL
INTELLIGENCE
&
DATA SCIENCE

SYLLABUS

FROM THE ACADEMIC YEAR
2023 - 2024

1. Introduction

B.Sc.Artificial Intelligence &Data Science

Artificial Intelligence or AI, is a branch of computer science that deals with building smart machines that are capable of performing complex tasks that normally require human interference and intelligence. It combines <u>Data Science</u> with real-life data to leverage machines and computers to imitate the decision-making and problem-solving capabilities that the human mind has. Many human mental activities such as writing computer programs, doing mathematics, engaging in common sense reasoning, understanding language, and even driving an automobile are said to demand "intelligence". AI systems are developed, undergo experimentation, and are improved.

Data Science is a vast field comprising many topics of Statistics, Mathematics, and IT. A 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'.

The 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.

This is the primary reason the syllabus of Artificial Intelligence &Data Science courses includes concepts that touch base on cloud computing, big data, natural language processing, and data sentiment analysis.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.Data science has become important due to recent technology disruptions. Most fundamental is Moore's Law which has driven an exponential growth in computing, storage, and communications per rupee over the past 50 years. This rate of growth shows no signs of abating. Consequently, today we have the Internet of Things: a plethora of sensors costing 10s of rupees or less, a global Internet with almost limitless bandwidth, and enormous storage in global clouds. 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.

Artificial Intelligence & Data Science is the area where applications of various tools and techniques from the disciplines of Artificial Intelligence & Data Science, applied statistics, mathematics and computer science are used to get greater insight and to make better and informed decisions for various purposes by analyzing a large amount of data. Consequently, the study of Artificial Intelligence & 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.,** Artificial Intelligence & Data Science
Programme Code:	
Duration:	**3 years [UG]**
Programme Outcomes:	**PO1: Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study **PO2: Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups. **PO3: Critical thinking:** Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. **PO4: Problem solving: Capacity** to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations. **PO5: Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints. **PO6: Research-related skills**: A sense of inquiry and capability for asking relevant/appropriate questions,

| | problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation

PO7: Cooperation/Team work: Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team

PO8: Scientific reasoning: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.

PO9: Reflective thinking: Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society.

PO10 Information/digital literacy: Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.

PO 11 Self-directed learning: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.

PO 12 Multicultural competence: Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.

PO 13: Moral and ethical awareness/reasoning: Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demon starting the ability to identify ethical issues related to one"s work, avoid unethical behaviour such as |

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

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

3 – Strong, 2- Medium, 1- Low

Highlights of the Revamped Curriculum:

➢ Student-centric, meeting the demands of industry & society, incorporating industrial components, hands-on training, skill enhancement modules, industrial project, project with viva-voce, exposure to entrepreneurial skills, training for competitive examinations, sustaining the quality of the core components and incorporating application oriented content wherever required.

➢ The Core subjects include latest developments in the education and scientific front, advanced programming packages allied with the discipline topics, practical training, devising mathematical models and algorithms for providing solutions to industry / real life situations. The curriculum also facilitates peer learning with advanced mathematical topics in the final semester, catering to the needs of stakeholders with research aptitude.

➢ The General Studies and Mathematics based problem solving skills are included as mandatory components in the 'Training for Competitive Examinations' course at the final semester, a first of its kind.

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

➢ The Internship during the second year vacation will help the students gain valuable work experience, that connects classroom knowledge to real world experience and to narrow down and focus on the career path.

➢ Project with viva-voce component in the fifth semester enables the student, application of conceptual knowledge to practical situations. The state of art technologies in conducting a Explain in a scientific and systematic way and arriving at a precise solution is ensured. Such innovative provisions of the industrial training, project and internships will give students an edge over the counterparts in the job market.

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

Choice Based Credit System (CBCS), Learning Outcomes Based Curriculum Framework (LOCF) Guideline Based Credit and Hours Distribution System
for all UG courses including Lab Hours

First Year – Semester-I

Part	List of Courses	Credit	No. of Hours
Part-1	Language – Tamil	3	6
Part-2	English	3	6
Part-3	Core Courses & Elective Courses [in Total]	13	14
	Skill Enhancement Course SEC-1	2	2
Part-4	Foundation Course	2	2
		23	**30**

Semester-II

Part	List of Courses	Credit	No. of Hours
Part-1	Language – Tamil	3	6
Part-2	English	3	6
Part-3	Core Courses & Elective Courses including laboratory [in Total]	13	14
Part-4	Skill Enhancement Course -SEC-2	2	2
	Skill Enhancement Course -SEC-3 (Discipline / Subject Specific)	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 Courses & Elective Courses including laboratory [in Total]	13	14
Part-4	Skill Enhancement Course -SEC-4 (Entrepreneurial Based)	1	1
	Skill Enhancement Course -SEC-5 (Discipline / Subject Specific)	2	2
	E.V.S	-	1
		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 Courses & Elective Courses including laboratory [in Total]	13	13
Part-4	Skill Enhancement Course -SEC-6 (Discipline / Subject Specific)	2	2
	Skill Enhancement Course -SEC-7 (Discipline / Subject Specific)	2	2
	E.V.S	2	1
		25	**30**

Third Year
Semester-V

Part	List of Courses	Credit	No. of Hours
Part-3	Core Courses including Project / Elective Based	22	26
Part-4	Value Education	2	2
	Internship / Industrial Visit / Field Visit	2	2
		26	**30**

Semester-VI

Part	List of Courses	Credit	No. of Hours
Part-3	Core Courses including Project / Elective Based & LAB	18	28
Part-4	Extension Activity	1	-
	Professional Competency Skill	2	2
		21	**30**

Consolidated Semester wise and Component wise Credit distribution

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

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

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

Eligibility for Admission to B.Sc., Artificial Intelligence & Data Science :

Candidates who have studied Mathematics in HSC areeligible for this programme

Credit Distribution for all UG courses with LAB Hours

B.Sc. ARTIFICIAL INTELLIGENCE & DATA SCIENCE

Semester I				
Component	**Course code**	**List of courses**	**Credits**	**No. of Hrs**
Part I		Language – Tamil	3	6
Part II		English	3	6
Part-III		**Core Course CC- I** Python Programming	5	5
Part-III		**Core Course CC-II** **CC2-1 Python Programming Lab** **CC2-2 Prolog Lab**	3 2	3 2
Part-III		**Elective Course I (Generic/Discipline Specific)** **EC1 Statistics for Data Science/ Applied Mathematics**	3	4
Part- IV		**Skill Enhancement Course SEC-1** **Problem Solving Techniques**	2	2
Part- IV		**Foundation Course FC** **Artificial Intelligence**	2	2
TOTAL			**23**	**30**
Semester II				
Component	**Course code**	**List of courses**	**Credits**	**No. of Hrs**
Part I		Language – Tamil	3	6
Part II		English	3	6
Part III		**Core Course CC III** Data Structures and Algorithms	5	5
Part III		**Core Course CC IV** **CC4-1 Data Structures & Algorithm Lab** **CC4-2 MultimediaLab**	3 2	3 2
Part III		**Elective Course II (General /Discipline Specific)** **Optimization Techniques / Trends in Computing**	3	\ 4
Part IV		Skill Enhancement Course SEC 2**Quantitative Aptitude**	2	2
Part IV		Skill Enhancement Course SEC 3 **Software Testing/ Web Designing**	2	2
TOTAL			**23**	**30**

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	PYTHON PROGRAMMING	CCI	5	-	-	I	5	25	75	100
Learning Objectives										
LO1	To make students understand the concepts of Python programming.									
LO2	To apply the OOPs concept in PYTHON programming.									
LO3	To impart knowledge on demand and supply concepts									
LO4	To make the students learn best practices in PYTHON programming									
LO5	To know the costs and profit maximization									
UNIT	**Contents**									**No. of Hours**
I	**Basics of Python Programming:** History of Python-Features of Python-Literal-Constants-Variables - Identifiers–Keywords-Built-in Data Types-Output Statements – Input Statements-Comments – Indentation- Operators-Expressions-Type conversions. **Python Arrays:** Defining and Processing Arrays – Array methods.									**15**
II	**Control Statements:** Selection/Conditional Branching statements: if, if-else, nested if and if-elif-else statements. Iterative Statements: while loop, for loop, else suite in loop and nested loops. **Jump Statements:** break, continue and pass statements**.**									**15**
III	**Functions:** Function Definition – Function Call – Variable Scope and its Lifetime-Return Statement. **Function Arguments**: Required Arguments, Keyword Arguments, Default Arguments and Variable Length Arguments- Recursion. **Python Strings:** String operations- Immutable Strings - Built-in String Methods and Functions - String Comparison. **Modules**: import statement- The Python module – dir() function – Modules and Namespace – Defining our own modules.									**15**
IV	**Lists:** Creating a list -Access values in List-Updating values in Lists-Nested lists -Basic list operations-List Methods. Tuples: Creating, Accessing, Updating and Deleting Elements in a tuple – Nested tuples–Difference between lists and tuples. **Dictionaries:** Creating, Accessing, Updating and Deleting Elements in a Dictionary – Dictionary Functions and Methods - Difference between Lists and Dictionaries.									**15**

V	**Python File Handling:** Types of files in Python - Opening and Closing files-Reading and Writing files: write() and writelines() methods- append() method – read() and readlines() methods – with keyword – Splitting words – File methods - File Positions- Renaming and deleting files.		**15**
		TOTAL 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	ReemaThareja, "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

Subject Code	Subject Name	Category	L	T	P	S	Credits	CIA	External	Total
	PYTHON LAB	CCII	-	-	3	I	3	25	75	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 and package 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 of
CO2	Identify the problem and solve using PYTHON programming techniques.
CO3	Identify suitable programming constructs for problem solving.
CO4	Analyze various concepts of PYTHON language to solve the problem in an efficient way.
CO5	Develop a PYTHON 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

CC2-2: Core Practical 2:
  Core Practical 2

PROLOG LAB

L T P C

0 0 2 2

List of programs
1. Write Prolog program to implement A* algorithm.
2. Write Prolog program to implement MinMax search
3. Write Prolog program to implement alpha-beta pruning
4. Write Prolog program to solve 4 Queen problem

Course Outcome:

On successful completion of the course, the learners will be able to

1. Think logical solution to problems

2. Understand and solve complex problems

3. Select an appropriate algorithm for the problem

4. Evolve as a competent programmer capable of designing algorithms

5. Analyze algorithms

CO - PO - PSO Mapping

PROLOG LAB											
CO	**PO**					**PSO**					**COGNITIVE LEVEL**
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**	
CO 1	S	S	S	M	S	S	S	M	S	S	K – 1
CO 2	S	S	M	S	S	S	S	S	S	S	K – 4
CO 3	S	S	M	S	S	S	S	S	S	S	K – 5
CO 4	S	S	M	S	S	S	S	S	S	S	K – 3
CO 5	S	S	M	S	S	S	S	S	S	S	K – 5

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

Title of the Course	Statisticsfor Data Science					
Paper Number						
Category	Core	**Year**	I	**Credits**	3	**Course Code**
		Semester	I			
Instructional Hours		**Lecture**		**Tutorial**	**Lab Practice**	**Total**
per week		4			--	4
Pre-requisite		Basic Statistics				
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				
Course Outline		**UNIT-I:** **1.1 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: **2.1 Descriptive statistics** Introduction-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 **2.2 Correlation** Karl Pearson coefficient of correlation, Spearman's rank correlation coefficient, multiple and partial correlations (for 3 variates only).
	UNIT-III: **3.1 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 **4.1 Analysis of variance** Introduction-An Overview-One-Way Analysis of Variance-Multiple Comparisons of Sample Means-One-Way Analysis of Variance with Unequal Sample Sizes-Two-Factor Analysis of Variance: **4.2 Goodness of fit tests and categorical data analysis** Introduction-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 :
	5.1 Basics and Elements of Probability
	. Definition 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
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Problems related to the above topics to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
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 ofcourse contributedtoeachPSO	13	15	13	15	15	12

EC1: Elective Course : 1 B

APPLIED MATHEMATICS

Course Objective:

1. To understand matrix operations
2. To study the basic operations of Octave

UNIT I: Linear Algebra: Matrix, Representation, Examples of matrix Data, Vectors, examples, Representation, Matrix Addition, Scalar Multiplication, Multiplication properties, Matrix Vector Multiplication, Matrix Multiplication, Inverse and Transpose.

Unit II: Applications of Matrix operations on Real Time Data, Parallel Matrix Multiplication, Dimensionality Reduction by Principal Component Analysis and Eigen Values, Eigen Vectors.

UNIT III Basic operations of Octave: Installation of Octave, Logical & Arithmetic Operations, Assignment of Different Variables, Assigning Matrices, Vector Representation, Histogram of matrices, Diagonal Matrices.

UNIT IV: Data Visualization and Processing using Octave: Finding the size of a Matrix, Loading Data into Octave, Viewing the Workspace of Octave, Accessing the elements of Matrix, Arithmetic operations on matrices- Addition, Multiplication, log, exponentiation, Transpose, Maximum and Minimum Value of a Matrix

Unit V: Control Statements in Octave, Visualizing Data in Octave-Plotting Data, giving labels, axes and titles, Victimization, Vector implementation, Advantages.

Course Outcome:

On successful completion of the course, the learners will be able to

1. Acquire knowledge of processing using octave

2. Statistically analyse data

3. Compute solutions of linear equations and system of equations

4. Understand the basic concepts of Data Visualization

5. Understand matrices

CO - PO - PSO Mapping

CO	PO					PSO					COGNITIVE LEVEL
	1	2	3	4	5	1	2	3	4	5	
CO 1	S	S	S	M	S	S	S	M	S	M	K – 1
CO 2	S	S	M	S	S	S	S	S	M	S	K – 4
CO 3	M	S	M	S	S	S	S	M	S	S	K – 5
CO 4	S	M	M	S	S	S	M	S	S	S	K – 3
CO 5	S	S	M	S	S	S	S	S	S	S	K – 5

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

Books:

1. Jason Lachniet, "Introduction to GNU Octave"
2. Lectures of Professor Dr. Andrew Ng, Stanford University, Coursera.
3. Gene H.Golub, Charles F.Van Loan, "Matrix Computations", John Hopkins University Press.
4. https://skymind.ai/wiki/eigenvector
5. Randolf H. Reiss, B.S, "Eigen Values and Eigen Vectors in Data dimension Reduction for Regression", San Marcos, Texas.
6. Gilbert Strang, "Linear Algebra and its Applications", Thomson Learning Inc., 4th Edition.
7. https://www.cs.utah.edu/~jeffp/M4D/M4D-v0.4.pdf

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	PROBLEM SOLVING TECHNIQUES	FC	2	-	-	I	2	25	75	100

	Learning Objectives
LO1	Familiarize with writing of algorithms, fundamentals of C and philosophy of problem solving.
LO2	Implement different programming constructs and decomposition of problems into functions.
LO3	Use data flow diagram, Pseudo codeto implement solutions.
LO4	Define and use of arrays with simple applications
LO5	Understand about operating system and their uses

UNIT	Contents	No. Of. Hours
I	**Introduction:** History, characteristics and limitations of Computer. Hardware/Anatomy of Computer: CPU, Memory, Secondary storage devices, Input Devices and Output devices. Types of Computers: PC, Workstation, Minicomputer, Main frame and Supercomputer. Software: System software and Application software. **Programming Languages:** Machine language, Assembly language, High-level language,4 GL and 5GL-Features of good programming language. Translators: Interpreters and Compilers.	6
II	**Data:** Data types, Input, Processing of data, Arithmetic Operators, Hierarchy of operations and Output. Different phases in Program Development Cycle (PDC).**Structured Programming: Algorithm:** Features of good algorithm, Benefits and drawbacks of algorithm. **Flowcharts:** Advantages and limitations of flowcharts, when to use flowcharts, flowchart symbols and types of flowcharts. **Pseudocode:** Writing a pseudocode. Coding, documenting and testing a program: Comment lines and types of errors. **Program design:** Modular Programming.	6
III	**Selection Structures:** Relational and Logical Operators - Selecting from Several Alternatives – Applications of Selection Structures. **Repetition Structures:** Counter Controlled Loops –Nested Loops– Applications of Repetition Structures.	6
IV	**Data:** Numeric Data and Character Based Data. **Arrays:** One Dimensional Array - Two Dimensional Arrays – Strings as Arrays of Characters.	6

V	**Data Flow Diagrams:** Definition, DFD symbols and types of DFDs. **Program Modules:** Subprograms-Value and Reference parameters- Scope of a variable - Functions – Recursion. **Files:** File Basics-Creating and reading a sequential file- Modifying Sequential Files.	6
	TOTAL HOURS	**30**

	Course Outcomes	Programme Outcomes
CO	On completion of this course, students will	
CO1	Study the basic knowledge of Computers. Analyze the programming languages.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Study the data types and arithmetic operations. Know about the algorithms. Develop program using flow chart and pseudocode.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Determine the various operators. Explain about the structures. Illustrate the concept of Loops	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Study about Numeric data and character-based data. Analyze about Arrays.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Explain about DFD Illustrate program modules. Creating and reading Files	PO1, PO2, PO3, PO4, PO5, PO6

	Textbooks
1	**Stewart Venit,** "Introduction to Programming: Concepts and Design", Fourth Edition, 2010, Dream Tech Publishers.

	Web Resources
1.	https://www.codesansar.com/computer-basics/problem-solving-using-computer.htm
2.	http://www.nptel.iitm.ac.in/video.php?subjectId=106102067
3.	http://utubersity.com/?page_id=876

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	2	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	14	14	15	15	14

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Artificial Intelligence	Core	2	-	-	I	2	2	25	75	100

	Course Objective	
C1	To learn various concepts of AI Techniques.	
C2	To learn various Search Algorithm in AI.	
C3	To learn probabilistic reasoning and models in AI.	
C4	To learn about Markov Decision Process.	
C5	To learn various type of Reinforcement learning.	

UNIT	Contents	No. of Hours
I	**Fundamentals of Artificial Intelligence** Introduction: What is AI? AI Techniques, Representation of Knowledge, Knowledge Based Systems, State Space Search. Production Systems:	6
II	Generate & test, Hill Climbing, Best First Search, A* and AO* Algorithm	6
III	*Game playing: Minimax Search, Alpha-Beta Cutoffs, Waiting for Quiescence*	4
IV	Propositional Logic: Representation, Inference, Reasoning Patterns, Resolution, Forward and Backward Chaining.	4
V	**Prolog Programming:** Introduction to Prolog: Syntax and Numeric Function, Basic List Manipulation Functions in Prolog, Functions, Predicates and Conditional, Input, Output and Local Variables, Iteration and Recursion, Property Lists and Arrays	10
	Total	**30**

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

| 5 | Understand various Reinforcement learning Techniques. | PO3, PO4 |

	Text Book	
1	Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill	
2	Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition, Prentice Hall.	
3	Carl Townsend, "Introduction to Prolog Programming"	
4	Ivan Bratko, "PROLOG Programming for Artificial Intelligence", Addison-Wesley, 2nd Edition.	
5	Klocksin and Mellish, "Programming with PROLOG"	
	Reference Books	
1.	Trivedi, M.C., "A Classical Approach to Artifical Intelligence", Khanna Publishing House, Delhi.	
2.	SarojKaushik, "Artificial Intelligence", Cengage Learning India, 2011	
3.	David Poole and Alan Mackworth, "Artificial Intelligence: Foundations for Computational Agents", Cambridge University Press 2010	
	Web Resources	
1.	https://github.com/dair-ai/ML-Course-Notes	
2.	https://web.cs.hacettepe.edu.tr/~erkut/ain311.f21/index.html	
3.	https://www.toolify.ai/?gclid=CjwKCAjwvdajBhBEEiwAeMh1U6tlqU1LXlRFbcghLMZVwlCm_4PklRcDRE-VYq_wTDcuaQeq_bCHnhoCcm4QAvD_BwE	

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	1	2	1	2
CO2	3	3	2	2	3	3
CO3	3	3	2	3	3	2
CO4	3	2	3	2	2	3
CO5	3	2	2	2	3	3
Weightage ofcoursecontributedto eachPSO	15	12	10	11	12	13

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

FIRST YEAR –SEMESTER- II

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	DATA STRUCTURES AND ALGORITHMS	CC III	5	-	-	II	5	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 PYTHON 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 - Circular linked list, General lists- stacks – Queues – Circular Queues – Evaluation of expressions	15
II	**Trees and Graphs** Trees – Binary Trees – Binary Tree Traversal – Binary Tree Representations – Binary Search Trees - threaded Binary Trees - Application of trees (Sets). Representation of Graphs – Graph implementation – graph Traversals - Minimum Cost Spanning Trees – Shortest Path Problems-Application of graphs	15
III	**Searching and Sorting** Sorting – Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Selection Sort. Searching – Linear search, Binary search	15
IV	**Greedy Method and Dynamic programming** Greedy Method: Knapsack problem– Job Sequencing with deadlines – Optimal storage on tapes. General method – Multistage Graph Forward Method– All pairs shortest path – Single source shortest path – Search Techniques for Graphs – DFS – Connected Components – Bi-Connected Components	15
V	**Backtracking** General Method – 8-Queen‟s – Sum Of Subsets – Graph Colouring – Hamiltonian Cycles – Branch And Bound: General Method – Travelling Sales Person Problem	15

		TOTAL HOURS	75

	Course Outcomes	Programme Outcomes
CO	On completion of this course, students will	
CO1	To understand the asymptotic notations and analysis of time and space complexity 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 Perform traversal operations on Trees and Graphs. To enable the applications of Trees and Graphs.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	To apply searching and sorting techniques	PO1, PO2, PO3, PO4, PO5, PO6
CO4	To understand the concepts of Greedy Method To apply searching techniques.	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	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.
2.	A.V.Aho, J.D. Ullman, J.E.Hopcraft(2000). Data Structures and Algorithms, Addison Wesley Publication.
3.	Ellis Horowitz and SartajSahni, Sanguthevar Raja sekaran (2010) ,Fundamentals of Computer Algorithms, Galgotia Publications Pvt.Ltd.

Web Resources

1.	https://www.tutorialspoint.com/data_structures_algorithms/index.htm
2.	https://www.programiz.com/dsa
3.	https://www.geeksforgeeks.org/learn-data-structures-and-algorithms-dsa-tutorial/

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

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	CIA	External	Total
	DATASTRUCTURES ANDALGORITHMS LAB	CC IV	-	-	3	II	3	25	75	100

Objectives

To predict the performance of different algorithms in order to guide design decisions, provide theoretical estimation for the required resources of an algorithm to solve a specific computational problem

LIST OF PROGRAMS	Required Hour
1. Perform stack operations 2. Perform queue operations 3. Perform tree traversal operations 4. Search an element in an array using linear search. 5. Search an element in an array using binary search 6. Sort the given set of elements using Merge Sort. 7. Sort the given set of elements using Quick sort. 8. Search the Kth smallest element using Selection Sort 9. Find the Optimal solution for the given Knapsack Problem using Greedy Method. 10. Find all pairs shortest path for the given Graph using Dynamic Programming method 11. Find the Single source shortest path for the given Travelling Salesman problem using Dynamic Programming method 12. Find all possible solution for an N Queen problem using backtracking method 13. Find all possible Hamiltonian Cycle for the given graph using backtracking method	75

Course Outcomes	
CO	On completion of this course, students will
CO1	To understand the concepts of Linked List, Stack and Queue.
CO2	Concepts of Trees and Graphs. Perform traversal operations on Trees and Graphs. To enable the applications of Trees and Graphs.
CO3	To apply searching and sorting techniques
CO4	To determine the concepts of Greedy Method To apply searching techniques.
CO5	Usage of File handlings in python, Concept of reading and writing files, Do programs

		using files.

LearningResources:

- **RecommendedTexts**

  1. Ellis Horowitz , SartajSahni, Susan Anderson Freed, Second Edition , "Fundamentals of Data in C", Universities Press

  2. E. Horowitz, S. Sahni and S. Rajasekaran,   Second Edition ,"Fundamentals of Computer Algorithms " Universities Press

- **ReferenceBooks**

  1.   Seymour Lipschutz ,"Data Structures with C", First Edition, Schaum's outline series in computers, Tata McGraw Hill.

  2.   .2. R.Krishnamoorthy and G.IndiraniKumaravel, Data Structures using C, Tata McGrawHill – 2008.

  3.   A.K.Sharma, Data Structures using C , Pearson Education India,2011.

  4.   . G. Brassard and P. Bratley, "Fundamentals of Algorithms", PHI, New Delhi, 1997.

  5.   4, . A.V. Aho, J.E. Hopcroft, J.D. Ullmann,, "The design and analysis of Computer

  6.   Algorithms", Addison Wesley, Boston, 1974

  7.   5. Thomas H. Cormen, C.E. Leiserson, R L.Rivest and C. Stein, Introduction to Algorithms, Third edition, MIT Press, 2009

  8.   SanjoyDasgupta, C.Papadimitriou and U.Vazirani , Algorithms , Tata McGraw-Hill, 2008.

Course Outcomes	
CO	On completion of this course, students will
CO1	Implement data structures using C
CO2	Implement various types of linked lists and their applications
CO3	Implement Tree Traversals
CO4	Implement various algorithms in C
CO5	Implement different sorting and searching algorithms

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	2	2	3	3
CO 4	3	3	3	3	3	3
CO 5	3	3	3	3	1	2
Weightageof coursecontributedtoeachPSO	15	15	14	14	13	14

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

CC4-2: Multimedia Lab

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
SEC4	0	0	2	I	2	2	25	75	100

Learning Objectives	
LO1	Understands the basics of multimedia
LO2	Acquire knowledge of image editing and animation techniques.
LO3	Apply multimedia concepts to real world projects

Unit	Contents	No. of Hours
I	GIMP's Tools- Taking Advantage of Paths - Working with Layers and masks - Using Channels Exercises: 1. Enlarge a Logo using path 2. Create an ink drawing using path 3. Replace Background of image using Channels	6
II	Manipulating Images: Transforming Images - Using The Image Tools - Adjusting Colors - Working with Text - Painting in Gimp: Creating new brushes - Enhancing Photos - Exploring Filters and Effects. Exercises: 1. Design Front Cover for a Book. 2. Create a customized logo 3. Use clone tool to remove text from an image 4. Remove Red eye using Filter.	6
III	Using GIMP animation package - Managing the Frames of Image Sequence with GAP - Morphing - onion skinning - Creating a Storyboard. Exercises: 1. Morphing - Create smooth transitions from one image to another. 2. Create a Story board for your project	6
IV	Flash: Introduction - Creating and Editing Objects - Color and Text. Animations: Frame- by- frame animation-Motion Tweening- Motion Guides 1. Creating Frame-by-frame Animation 2. Create a Motion Tween for Graphic and Text Object 3. Create a Motion guide Layer	6

V	Shape Tweening - Masking - Interactivity: Adding Script to Buttons - Testing and Publishing.
	Exercises:
	   1. Create a Shape Tween for Graphic Object
	   2. Create a Mask Layer
	   3. Adding buttons with Action Script
		6

	TOTAL	30

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

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

	Reference Books
1	Juan Manuel Ferreyra (2011), "GIMP 2.6 Cookbook", PACK publishing Ltd.
2	Robert Reinhard (2003), "Macromedia Flash MX Bible", Wiley Dreamtech India Pvt Ltd.

NOTE: Latest Edition of Textbooks May be Used

	Web Resources
1.	https://www.youtube.com/watch?v=T8NIK3RdoIc (Unit IV: Gimp Video Editing)
2.	https://www.youtube.com/watch?v=Jz9WrbELGYA

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

EC2 : Elective Course

OPTIMIZATION TECHNIQUES

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 – Modeling in OR – General methods for solving OR models – Scope of OR.

Linear Programming Problem: Formulation of LP problems – Graphical solution of LP problems – General formulation of LPP – Slack and Surplus variables – Standard form of LPP – Some important forms of LPP – Simplex Method I.

UNIT II 12 hours

ASSIGNMENT PROBLEMS

Assignment Problem: Mathematical formulation–Hungarian method–Unbalanced assignment problem – Various types

UNIT III 12 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

SEQUENCING PROBLEMS AND QUEUING MODELS

Sequencing Problems: Assumptions – Solutions to Sequencing Problems: Processing n jobs through 2 machines – Processing n jobs through 3 machines – Processing n jobs on m machines.

Queuing Models: Queuing System – Transient and Steady States– Kendal's Notation for representing Queuing Models – Various Models in Queuing System – Birth and Death Model.

UNIT V   12 hours
PERT AND CPM TECHNIQUES

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

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.

EC2: Elective Course 2 B

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Trends in Computing	Elective	-	Y	-	II	3	4	25	75	100

	Course Objective	
C1	Learning current trends in various computer science and information technology fields.
C2	Learning various fields of Cloud computing, Green computing ,the Edge and Fog computing technology.
C3	To learn about Architecture and Application design of Cloud, Edge & fog computing.
C4	To know computingandtoimprove security services of computing technologies.
C5	To learn the various Case Studies in Cloud, Edge & fog Computing.

UNIT	Details	No. of Hours
I	**Era of Cloud Computing**: Introduction – Components of Cloud Computing – Cloud Types: Private, Public and Hybrid clouds – Limitations of the Cloud - **Virtualization**: Structure and Mechanisms.	12
II	**Cloud computing Services**: Software as a Service(SaaS) – Platform as a Service(PaaS)- Infrastructure as a Service(IaaS)-Database as a Service(DBaaS)- Recent Trends in cloud computing and Standards- **Data Security in Cloud** – Risks and Challenges with Cloud Data- Security as a Service.	12
III	**EdgeComputing:**EdgeComputing and Its Essentials: Introduction-EdgeComputing Architecture- Advantages and Limitations of EdgeComputingSystems- EdgeComputing Interfaces and Devices - EdgeAnalytics: Edge Data Analytics – Potential of EdgeAnalytics – Architecture of EdgeAnalytics – Case study	12
IV	**Edge Data storage Security:** Edge-Based Attack Detection and Prevention-Edge Computing Use Cases and Case Studies: Edge Computing High- Potential Use Cases. **Introductiontogreen computing**–Calculatingcarbonfootprint-**Choosing Green PC path:** A green make over – Buying green	12

	computer- ChoosingEarthFriendlyperipherals	
V	**Fog Computing:** Introduction to Fog computing – Architecture - Characteristics - Fog Computing Services – Fog Resource Estimation and Its Challenges-Fog computing on 5G networks – Fog computing Use cases and Case studies.	12
	Total	**60**

	Course Outcomes	**Programme Outcome**
CO	On completion of this course, students will	
1	Outline the concepts, applications, benefits and limitations of various computing paradigms.	PO1
2	Classify the computing technologies based on its architecture and infrastructure and identify its strategies.	PO1, PO2
3	Examinevariouscloudservices, Securitythreatexposurewithinacloudcomputing infrastructure.	PO4, PO6
4	Asses the problems and solutions involved in various stages of different computing environments.	PO4, PO5, PO6
5	Discuss the importance of cloud, edge and Fog technology and implement innovative ideas and practices for regulating green IT.	PO3
	Text Book	
1	Kailas Jayaswal,JagannathKallakurchi,DonaldJ.Houde,Dr.Devan Shah " Cloud Computing –Black Book" Edition :2020 (UNIT I & II : CHAPTER 1,2,3,9,11)	
2	K. AnithaKumari G. SudhaSadasivam D. Dharani M. Niranjanamurthy, "EDGE COMPUTING Fundamentals, Advances and Applications", First Edition 2022, CRC Press. (UNIT III & IV : CHAPTER 1, 2 , 3, 4,5,6)	
3	Woody Leonhard and Katherine Murray (2009) ,Green Home Computing forDummies,WilleyPublishingInc. (UNIT IV : CHAPTER 2 ,5,6,7)	
4	Evangelos Markakis, George Mastorakis, ConstandinosX.Mavromoutakis and Evangelospallis "Cloud and Fog computing in 5G mobile Networks" ,First edition 2017. (UNIT V: CHAPTER 2)	
	Reference Books	
1.	RajKumarBuyya,ChristianVecchiola,S.ThamaraiSelvi,(2013),MasteringCloudComputi	

	ng,McGraw Hill Education.	
2.	MichaelMiller,(2009), CloudComputing,PearsonEducation.	
3.	Shijun Liu BedirTekinerdoganMikio Aoyama Liang-Jie Zhang" Edge Computing – EDGE " 2018.	
4.	FlavioBonomi, Rodolfo Milito, Jiang Zhu, SateeshAddepalli, ―Fog Computing and Its Role in the Internet of Things‖, MCC'12, August 17, 2012, Helsinki, Finland. Copyright 2012.	
5	Amir M. Rahmani · Pasi LiljebergJürgo-Sören Preden "Fog Computing in the Internet of Things"Springer,2018. (UNIT V: PART/CHAPTER (1.4,2.5)	
Web Resources		
1.	https://static.googleusercontent.com/media/www.google.com/en//green/pdfs/google-green- computing.pdf(CaseStudy)	
2.	http://whatiscloud.com/basic_concepts_and_terminology/cloud	
3.	http://www.computerweekly.com/guides/Using-green-computing-for-improving-energy- efficiency	

Mapping with Programme Outcomes:

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

S-Strong   M-Medium   L-Low

Subject Code	Subject Name	Category	L	T	P	S	Credits	CIA	External	Total
	QUANTITATIVE APTITUDE	SEC	2	-	-	II	2	25	75	100

LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)

- To improve the quantitative skills of the students
- To prepare the students for various competitive exams

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

CO1: To gain knowledge on LCM and HCF and its related problems

CO2: To get an idea of age, profit and loss related problem solving.

CO3: Able to understand time series simple and compound interests

CO4: Understanding the problem related to probability, and series

CO5: Able to understand graphs, charts

Units	Contents	Required Hours
I	Numbers- HCF and LCM of numbers-Decimal fractions- Simplification- Square roots and cube roots- Average- problems on Numbers	6
II	Problems on Ages - Surds and Indices - percentage - profits and loss - ratio and proportion-partnership- Chain rule.	6
III	Time and work - pipes and cisterns - Time and Distance - problems on trains -Boats and streams - simple interest - compound interest - Logarithms - Area –Volume and surface area- races and Games of skill	6
IV	Permutationandcombination-probability-TrueDiscount-BankersDiscount	

	- Height and Distances-Odd man out & Series.	
V	Calendar - Clocks - stocks and shares - Data representation - Tabulation – Bar Graphs- Pie charts- Lin egraphs	6

Learning Resources:

- **Recommended Texts**
  1. ."Quantitative Aptitude",R.S.AGGARWAL.,S.Chand& Company Ltd.,

- **Web resources: Authentic** Web resources related to Competitive examinations

MAPPING TABLE						
CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	2	2	3
CO2	3	3	3	3	3	3
CO3	3	2	2	2	3	3
CO4	3	3	2	3	3	3
CO5	3	3	3	3	3	3
Weightage of course contributed to each PSO	15	13	13	13	14	15

Subject Code	Subject Name	Category	L	T	P	S	Credits	CIA	External	Total
	SOFTWARE TESTING	SEC	2	-	-	II	2	25	75	100

Learning Objectives:

- To study various Software techniques
- To study fundamental concepts in software testing

Course Outcomes:
CO1: Understand and describe the basic concepts of functional (black box) software testing.
CO2: Understand the basic application of techniques used to identify useful ideas for tests.
CO3: Help determine the mission and communicate the status of your testing with the rest of your project team.
CO4: Characterize a good bug report, peer-review the reports of your colleagues, and improve your own report writing.
CO5: Understand where key testing concepts apply within the context of unified processes.

Units	Contents	Required Hours
I	Introduction: Purpose–Productivity and Quality in Software– Testing Vs Debugging– Model for Testing– Bugs– Types of Bugs – Testing and Design Style.	6
II	Flow / Graphs and Path Testing – Achievable paths – Path instrumentation – Application– Transaction Flow Testing Techniques	6
III	Data Flow Testing Strategies - Domain Testing: Domains and Paths – Domains and Interface Testing.	6
IV	Linguistic–Metrics – Structural Metric – Path Products and Path Expressions. Syntax Testing– Formats–Test Cases.	6
V	Logic Based Testing – Decision Tables– Transition Testing– States, State Graph, State Testing.	6

Learning Resources:Recommended Texts

1. B.Beizer,"SoftwareTestingTechniques",IIEdn.,DreamTechIndia ,NewDelhi,2003.
2. K.V.K.Prasad,"SoftwareTestingTools",DreamTech.India,New Delhi,2005.

- **Reference Books**

1. Burnstein, 2003,"PracticalSoftwareTesting",SpringerInternationalEdn.

2. . Kit, 1995, "Software Testing in the Real World: Improving the Process", Pearson Education, Delhi.

   3. R.RajaniandP, P.Oak, 2004, "SoftwareTesting", TataMcgrawHill, NewDelhi.

MAPPING TABLE						
CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	2	2	2
CO2	2	3	3	2	3	2
CO3	3	3	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	14	13	14	13	14	13

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst.	CIA	External	Total
									Marks		
	WEB DESIGNING		2	-	II	2	2	25	75	100	

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

UNIT	Details	No. of Hours	Course Objective
I	HTML: HTML-Introduction-tag basics- page structure-adding comments working with texts, paragraphs and line break. Emphasizing test- heading and horizontal rules-list-font size, face and color-alignment links-tables-frames.	6	C1
II	Forms & Images Using Html: Graphics: Introduction-How to work efficiently with images in web pages, image maps, GIF animation, adding multimedia, data collection with html forms textbox, password, list box, combo box, text area, tools for building web page front page.	6	C2
III	XML & DHTML: Cascading style sheet (CSS)-what is CSS-Why we use CSS-adding CSS to your web pages-Grouping styles-extensible markup language (XML).	6	C3
IV	Dynamic HTML: Document object model (DCOM)-Accessing HTML & CSS through DCOM Dynamic content styles & positioning-Event bubbling-data binding. JavaScript: Client-side scripting, What is JavaScript, How to develop JavaScript, simple JavaScript, variables, functions, conditions, loops and repetition,	6	C4
V	Advance script, JavaScript and objects, JavaScript own objects, the DOM and web browser environments, forms and validations.	6	C5
	Total	**60**	

Course Outcomes		Programme Outcome
CO	On completion of this course, students will	
1	Develop working knowledge of HTML	PO1, PO3, PO6, PO8
2	Ability to Develop and publish Web pages using Hypertext Markup Language (HTML).	PO1,PO2,PO3,PO6
3	Ability to optimize page styles and layout with Cascading Style Sheets (CSS).	PO3, PO5
4	Ability to develop a java script	PO1, PO2, PO3, PO7
5	An ability to develop web application using Ajax.	P02, PO6, PO7
Text Book		
1	Pankaj Sharma, "Web Technology", SkKataria& Sons Bangalore 2011.	
2	Mike Mcgrath, "Java Script", Dream Tech Press 2006, 1st Edition.	
3	Achyut S Godbole&AtulKahate, "Web Technologies", 2002, 2nd Edition.	
Reference Books		
1.	Laura Lemay, RafeColburn , Jennifer Kyrnin, "Mastering HTML, CSS &Javascript Web Publishing", 2016.	
2.	DT Editorial Services (Author), "HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)", Paperback 2016, 2nd Edition.	
Web Resources		
1.	NPTEL & MOOC courses titled Web Design and Development.	
2.	https://www.geeksforgeeks.org	

Mapping with Programme Outcomes:

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

S-Strong   M-Medium   L-Low