

**B.Sc.,
DATA SCIENCE**

SYLLABUS

**FROM THE ACADEMIC YEAR
2023 - 2024**

1. Introduction

B.Sc.Data Science

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 were once referred to as ‘business problem solvers’ who knew how to make sense of incoherent data clusters. Fast-forward to the present, 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, business 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 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.

Data science is the area where applications of various tools and techniques from the disciplines of 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 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., Data Science
Programme Code:	
Duration:	3 years [UG]
Programme Outcomes:	<p>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</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>PO6: Research-related skills: A sense of inquiry and capability for asking relevant/appropriate questions,</p>

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 demonstrating the ability to identify ethical issues related to one's work, avoid unethical behaviour such as

	<p>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.</p> <p>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.</p> <p>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.</p>
<p>Programme Specific Outcomes:</p>	<p>PSO1: To enable students to apply basic microeconomic, macroeconomic and monetary concepts and theories in real life and decision making.</p> <p>PSO 2: To sensitize students to various economic issues related to Development, Growth, International Economics, Sustainable Development and Environment.</p> <p>PSO 3: To familiarize students to the concepts and theories related to Finance, Investments and Modern Marketing.</p> <p>PSO 4: Evaluate various social and economic problems in the society and develop answer to the problems as global citizens.</p> <p>PSO 5: Enhance skills of analytical and critical thinking to analyze effectiveness of economic policies.</p>

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

3 – Strong, 2- Medium, 1- Low

Highlights of the Revamped Curriculum:

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

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

**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
Part-4	Skill Enhancement Course SEC-1	2	2
	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.**

MethodsofEvaluati on		
InternalEv aluation	ContinuousInternalAssessmentTest	25 Marks
	Assignments	
	Seminars	
	AttendanceandClassParticipation	
ExternalEv aluation	EndSemesterExamination	75 Marks
	Total	100 Marks
MethodsofAssesm ent		
Recall(K1)	Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions	
Understand /Comprehend(K2)	MCQ,True/False,Shortessays,Conceptexplanations,Shortsumma ryor 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,Debatin gor Presentations	

Eligibility for Admission to B.Sc., Data Science:

Candidates who have studied Mathematics in HSC areeligible for this programme

Credit Distribution for all UG courses with LAB Hours

B.Sc. 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 Multimedia Lab	3 2	3 2
Part-III		Elective Course I (Generic/Discipline Specific) EC1 Statistics for Data Science/ Discrete Mathematics	3	4
Part- IV		Skill Enhancement Course SEC-1 Problem Solving Techniques	2	2
Part- IV		Foundation Course FC Computer Fundamentals	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 PHP Scripting Lab	3 2	3 2
Part III		Elective Course II (General /Discipline Specific) Optimization Techniques / Artificial Neural Networks	3	\ 4
Part IV		Skill Enhancement Course SEC 2 Quantitative Aptitude	2	2
Part IV		Skill Enhancement Course SEC 3 Software Testing/ Cyber Forensics	2	2
TOTAL			23	30

FIRST YEAR –SEMESTER-I

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	Marks		
								CIA	External	Total
	PYTHON PROGRAMMING LAB	CCH	-	-	3	I	3	25	75	100
<p>Course Objectives:</p> <ol style="list-style-type: none"> 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	
<ol style="list-style-type: none"> 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.									

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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: 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: <ol style="list-style-type: none"> 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: <ol style="list-style-type: none"> 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: <ol style="list-style-type: none"> 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 <ol style="list-style-type: none"> 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

Title of the Course		Statisticsfor Data Science					
Paper Number							
Category	Core	Year	I	Credits	3	Course Code	
		Semester	I				
Instructional Hours per week		Lecture	Tutorial		Lab Practice	Total	
		4			--	4	
Pre-requisite		Basic Statistics					
Objectives of the Course		To develop knowledge and understand fundamental concepts in probability and statistics					
Learning Outcome		<p>Students will be able to</p> <p>CO1: Organize, manage and present data.</p> <p>CO2: Understand, describe, and calculate the measures of data and correlation.</p> <p>CO3: Recognize and understand various probability distribution functions, calculate and interpret expected results</p> <p>CO4: Apply the methods of estimating a parameter.</p> <p>CO5: Understand the concept of probability and apply for simple events</p>					
Course Outline		<p>UNIT-I:</p> <p>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</p>					

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

	<p>UNIT-V :</p> <p>5.1 Basics and Elements of Probability</p> <p>. 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</p>
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	<p>[1] Sheldon M. Ross, Introduction to Probability and Statistics for Engineers And Scientists, Elsevier Academic Press, UK, Fifth Edition, 2023</p> <p>[2]. Rohatgi V.K and Saleh E, An Introduction to Probability and Statistics, 3rd edition, John Wiley & Sons Inc., New Jersey, 2015.</p> <p>[3]. Gupta S.C and Kapoor V.K, Fundamentals of Mathematical Statistics, 11th edition, Sultan Chand & Sons, New Delhi, 2014.</p>
Reference Books	Jim Frost, Introduction to Statistics: An Intuitive Guide for Analyzing Data and Unlocking Discoveries
Website and e-Learning Source	<p>https://onlinestatbook.com/2/</p> <p>https://www.simplilearn.com/tutorials/statistics-tutorial</p> <p>https://towardsdatascience.com/fundamentals-of-statistics-for-data-scientists-and-data-analysts-69d93a05aae7</p>

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

EC1: Elective Course : 1 B

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	DISCRETE MATHEMATICS	Elective	Y	4	-	I	3	25	75	100

COURSE OUTCOMES

On Successful completion of the course, the student will be able to

- 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

Unit – I: RELATIONS**12 Hours**

Introduction to Relations – Binary relation – Classification of Relations – Composition of Relations – Inverse of Relation – Closure operation on Relations – Matrix representation of Relation - digraphs.

Unit – II: FUNCTIONS**12 Hours**

Introduction to Functions – Addition and Multiplication of Functions - Classifications of Functions – Composition of Function – Inverse Function.

Unit – III: MATHEMATICAL LOGIC**12 Hours**

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.

Unit – IV: MATRIX ALGEBRA**12 Hours**

Introduction – 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 of Adjoint of a Matrix – Properties of Inverse of a Matrix.

Unit – V: GRAPH**12 Hours**

Introduction – Graph and Basic Terminologies – Types of Graphs – Sub Graph and Isomorphic Graph – Operations on Graphs – Representation of Graph.

Text Book:

DISCRETE MATHEMATICS, Swapan Kumar Chakraborty and BikashKanti Sarkar, OXFORD University Press.

Reference Books:

1. DISCRETE MATHEMATICS, Third Edition, Seymour Lipschutz and Marc Lars Lipson, Tata McGraw Hill Education Private Limited.
2. Discrete Mathematical Structures with Applications to Computer Science by J.P.Tremblay, R.Manohar TMH edition

3. <https://www.tutorialspoint.com> › discrete_mathematics

Mapping with Programme Outcomes:

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

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	PROBLEM SOLVING TECHNIQUES	FC	2	-	-	1	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 code to 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, 4GL 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	Marks			
								CIA	External	Total	
	COMPUTER FUNDAMENTALS	SEC-2	2	-	-	I	2	25	75	100	
Learning Objectives											
LO1	Discuss the Introduction about Computer and its Components.										
LO2	To Perform the Microsoft Word, Excel, PowerPoint and its operations.										
LO3	To get Knowledge about the Internet and Intranet										
LO4	Insert heading levels within a web page.										
LO5	Insert ordered and unordered lists within a web page. Create a web page.										
UNIT	Contents								No. Of. Hours		
I	Introduction to Computers - Generations of Computer – Data and Information – Components of Computer – Software – Hardware – Input Devices - Output Devices — Types of Operating System.								6		
II	MS Word: Introduction – Elements of Window – Files, Folders and Directories – Text Manipulating: Cut, Copy, Paste, Drag and Drop – Text Formatting: Font – Style, Size, Face and Colors (Both foreground and background) – Alignment - Bullets and Numbering - Header and footer-watermark – inserting objects (images, other application document) – Table creation – Mail merge.								6		
III	Ms Excel: Introduction – Inserting rows and columns – Sizing rows and columns – Implementing formulas – Generating series - Functions in excel – Creation of Chart – Inserting objects – Filter – Sorting – Inserting worksheet.								6		
IV	MS PowerPoint: Introduction – Slides Manipulation (Inserting new, Copy, paste, delete and duplicate slides) – Slide show– Types of Views – Types of Animations – Inserting Objects – Implementing multimedia (Video and Audio) – Templates (Built-in and User-Defined).								6		
V	Internet: Introduction to Internet and Intranet – Services of Internet - Domain Name – URL – Browser – Types of Browsers – Search Engine - E-Mail – Basic Components of E-Mail –How to send group mail. E-Commerce: Digital Signature – Digital Currency – Online shopping and transaction.								6		
TOTAL HOURS								30			
Course Outcomes								Programme Outcomes			
CO	On completion of this course, students will										
CO1	Understand the basics of Computer and its Generations. Be able to understand the components of computer.								PO1, PO2, PO3, PO4, PO5, PO6		

CO2	To Understand the introduction about MS Word. Be able to perform the Elements of window, Text Formatting, Text Manipulating options in MS Word.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	To Understand the introduction about MS Excel. Be able to inserting and sizing the cells Implementing formulas and inserting worksheet.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	To Understand the introduction about MS PowerPoint Be able to perform the slides manipulation. Implementing Multimedia and templates.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	To Understand the introduction about Internet and Intranet. Be able to access the browsers. To get knowledge about basic components of E-Mail and E-Commerce	PO1, PO2, PO3, PO4, PO5, PO6
Textbooks		
1	G. Manjunath, "Computer Basics", Vasan Publications, 2010.	
2	Pradeep K. Sinha&PritiSinha, "Computer Fundamentals", 6th Edition, BPB Publications, 2004.	
Web Resources		
1.	https://www.tutorialspoint.com/computer_fundamentals/index.htm	
2.	https://www.tutorialspoint.com/basics_of_computers/index.htm	
3.	https://www.tutorialspoint.com/word/index.htm	
4.	https://www.tutorialspoint.com/excel/index.htm	
5.	https://www.tutorialspoint.com/powerpoint/index.htm	

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

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	Marks		
								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.

Learning Resources:

• **Recommended Texts**

1. Ellis Horowitz , Sartaj Sahni, 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

• **Reference Books**

1. Seymour Lipschutz ,”Data Structures with C”, First Edition, Schaum’s outline series in computers, Tata McGraw Hill.
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. 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
Weightage of course contributed to each PSO	15	15	14	14	13	14

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

CC4-2: PHP SCRIPTING – PRACTICAL

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks			
							CIA	External	Total	
	0	0	2	II	2	2	25	75	100	
Learning Objectives										
LO1	To enable the student to understand, analyze and build dynamic web pages using PHP with MySQL database									
Prerequisites:										
	Contents							No. of Hours		
	Exercises: 1. Control Structures 2. Working with Forms.							5		
	3. String Manipulations 4. Arrays 5. Functions 6. Sorting							10		
	7. Classes and Objects 8. Cookies and Sessions 9. Graphics							10		
	10. Working with single table 11. Working with multiple tables							5		
TOTAL							30			
CO	Course Outcomes									
CO1	Demonstrates simple programs using PHP and jQuery									
CO2	Apply the interface setup, styles & themes for the given application									
CO3	Analyze the problem and add necessary user interface components, multimedia components and web data source into the application									
CO4	Evaluate the results by implementing the correct techniques on the web form									
CO5	Construct web applications with the facilitated components in PHP and jQuery									
Textbooks										
➤	Kevin Tatroe, Peter MacIntyre, Rasmus Lerdorf, "Programming PHP", O'Reilly Publications, Third Edition									
➤	Joel Murach, Ray Harris (2010), "PHP and MySQL", Shroff Publishers & Distributors									

Reference Books	
1.	W.Jason Gilmore(2010), “BeginningPHP&MySql”,Apress
2.	LarryUllman (2008), “PHP6 and MySQL5”, Pearson Education
3.	John Coggeshall(2006), “PHP5”,Pearson Education
4.	MichaleC.Glass(2004),“BeginningPHP,Apache, MySQLWebDevelopment”,Wiley DreamTechPress
5.	Robin Nixon (2013),“LearningPHP,MySQL, JavaScript &CSS”, O‘Reilly, 2 nd Edition
NOTE: Latest Edition of Textbooks May be Used	
Web Resources	
1.	http://www.w3schools.com/jquery/
2.	http://www.ccc.commnet.edu/faculty/sfreeman/cst%20250/jqueryNotes.pdf
3.	http://www.w3schools.com/php/
4.	http://www.tutorialspoint.com/php/
5.	http://www.tutorialspoint.com/mysql/

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

L	T	P	C
4	0	0	3

EC2 B: 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 QUEUEING 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.

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	ARTIFICIAL NEURAL NETWORK	Elect	4	-	-	II	3	25	75	100
Learning Objectives: The objective of this course is to teach the basics of artificial neural networks, learning process, single layer and multi-layer perceptron networks.										
Course Outcomes: CO1: Understand the basics of artificial neural networks and its architecture. CO2: Understand the various learning algorithms and their applications. CO3: Identify the appropriate neural network model to a particular application. CO4: Apply the selected neural network model to a particular application. CO5: Analyze the performance of the selected neural network.										
Units	Contents						Required Hours			
I	Artificial Neural Model- Activation functions- Feed forward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem - Multilayer Networks. Learning Algorithms- Error correction - Gradient Descent Rules, Perceptron Learning Algorithm, Perceptron Convergence Theorem.						12			
II	Introduction, Error correction learning, Memory-based learning, Hebbian learning, Competitive learning, Boltzmann learning, credit assignment problem, Learning with and without teacher, learning tasks, Memory and Adaptation						12			
III	Single layer Perception: Introduction, Pattern Recognition, Linear classifier, Simple perception, Perception learning algorithm, Modified Perception learning algorithm, Adaptive linear combiner, Continuous perception, learning in continuous perception, Limitation of Perception.						12			
IV	Multi-Layer Perceptron Networks: Introduction, MLP with 2 hidden layers, Simple layer of a MLP, Delta learning rule of the output layer, Multilayer feed forward neural network with continuous perceptions, Generalized delta learning rule, Back propagation algorithm						12			
V	Deep learning- Introduction- Neuro architectures building						12			

	blocks for the DL techniques, Deep Learning and Neocognitron, Deep Convolutional Neural Networks, Recurrent Neural Networks (RNN), feature extraction, Deep Belief Networks, Restricted Boltzmann Machines, Training of DNN and Applications	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. Neural Networks A Classroom Approach- Satish Kumar, McGraw Hill- Second Edition. 2. “Neural Network- A Comprehensive Foundation”- Simon Haykins, Pearson Prentice Hall, 2nd Edition, 1999. • Reference Books <ol style="list-style-type: none"> 1. Artificial Neural Networks-B. Yegnanarayana, PHI, New Delhi 1998. 		

Mapping with Programme Outcomes:

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

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

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

<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> • To improve the quantitative skills of the students • To prepare the students for various competitive exams 		
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1: To gain knowledge on LCM and HCF and its related problems</p> <p>CO2: To get an idea of age, profit and loss related problem solving.</p> <p>CO3: Able to understand time series simple and compound interests</p> <p>CO4: Understanding the problem related to probability, and series</p> <p>CO5: Able to understand graphs, charts</p>		
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	Permutation and combination - probability - True Discount - Bankers Discount - Height and Distances - Odd man out & Series.	
V	Calendar - Clocks - stocks and shares - Data representation - Tabulation – Bar Graphs - Pie charts - Line graphs	6
Learning Resources: <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 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	Marks		
								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	Marks		
								CIA	External	Total
	CYBER FORENSICS	SEC	2	-	-	II	2	25	75	100

Learning Objectives:

- To correctly define and cite appropriate instances for the application of computer forensics.
- To Correctly collect and analyze computer forensic evidence and data seizure. Identify the essential and up-to-date concepts, algorithms, protocols, tools, and methodology of Computer Forensics.

Course Outcomes:

CO1: Understand the definition of computer forensics fundamentals.

CO2: Evaluate the different types of computer forensics technology.

CO3: Analyze various computer forensics systems.

CO4: Apply the methods for data recovery, evidence collection and data seizure.

CO5: Gain your knowledge of duplication and preservation of digital evidence.

Units	Contents	Required Hours
I	<p>Overview of Computer Forensics Technology:</p> <ul style="list-style-type: none"> • Computer Forensics Fundamentals: What is Computer Forensics? Use of Computer • Forensics in Law Enforcement, Computer Forensics Assistance to Human • Resources/Employment Proceedings, Computer Forensics Services, Benefits of professional • Forensics Methodology, Steps taken by Computer Forensics Specialists. Types of Computer. • Forensics Technology: Types of Business Computer Forensic, Technology–Types of 	6
II	<p>Computer Forensics Evidence and capture:</p> <ul style="list-style-type: none"> • Data Recovery: Data Recovery Defined, Data Back-up and Recovery, The Role of Back-up • in Data Recovery, The Data –Recovery Solution. Evidence Collection and Data Seizure: • Collection Options, Obstacles, Types of Evidence, The Rules of Evidence, Volatile Evidence, General Procedure, Collection and Archiving, Methods of Collections, Artefacts, Collection Steps, Controlling Contamination: The chain of custody. 	6

III	<p>Duplication and Preservation of Digital Evidence:</p> <ul style="list-style-type: none"> • Processing steps, Legal Aspects of collecting and Preserving Computer forensic Evidence. Computer image Verification and Authentication: Special needs of Evidential Authentication, Practical Consideration, Practical Implementation. 	6
IV	<p>Computer Forensics Analysis:</p> <ul style="list-style-type: none"> • Discovery of Electronic Evidence: Electronic Document Discovery: A Powerful New Litigation Tool. Identification of Data: Time Travel, Forensic Identification and Analysis of Technical Surveillance Devices. 	6
V	<p>Reconstructing Past Events:</p> <ul style="list-style-type: none"> • How to Become a Digital Detective, Useable File Formats, • Unusable File Formats, Converting Files. • Networks: Network Forensics Scenario, a technical approach, Destruction Of E-Mail, Damaging Computer Evidence, Documenting • The Intrusion on Destruction of Data, System Testing. 	6

Learning Resources:

- **Recommended Texts**

1. John R. Vacca, "Computer Forensics: Computer Crime Investigation", 3/E, Firewall Media, New Delhi, 2002.

- **Reference Books**

1. Nelson, Phillips Enfinger, Steuart, "Computer Forensics and Investigations" Enfinger, Steuart, CENGAGE Learning, 2004.
2. Anthony Sammes and Brian Jenkinson, "Forensic Computing: A Practitioner's Guide", Second Edition, Springer-Verlag London Limited, 2007.
3. Robert M.Slade, " Software Forensics Collecting Evidence from the Scene of a DigitalCrime", TMH 2005.

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

