DON BOSCO INSTITUTE OF TECHNOLOGY

(Autonomous Institute Affiliated to VTU, Belgavi, Approved by AICTE, Recognised by the Government of Karnataka, NAAC A Grade Accredited).

DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING

UNDER GRADUATE PROGRAM

(NBA Accredited 2025-2028)

OUTCOME BASED CURRICULUM & ASSESSMENT

Scheme and Syllabus

III & IV Semester

For the 2024 Admitted Batch

Kumbalgodu, Mysuru Road, Bengaluru - 560074

Vision of the Institute
To be a center of excellence to transform young minds in technical and management education fostering innovation and entrepreneurial skills with ethical, environmental, and social responsibility.

Mission of the Institute
M1: To impart quality education in order to meet the needs of industry and society.
M2: To collaborate with academia, industry and research institutes to strengthen teaching and learning process.
M3: To promote equitable and harmonious development of students to work in teams.
M4: To imbibe lifelong learning skills and entrepreneurial skills exhibiting leadership.

Core Values
i) Attain excellence in different disciplines by creating, preserving and disseminating knowledge to all aspiring students
ii) Draw inspiration from the Institutions ethos and develop within its members a sense of accountability towards their community, society and the nation at large
iii) Accept the challenges globalization and changing times throw at us to offer high quality education and developmental services in a competitive manner
iv) Provide every opportunity to the Institutions key constituents–its faculty, staff, students and the community–to excel in their domain of expertise and contribute to every task with sincerity
v) Transition from the teacher – centric focus to the learner - centric approach in imparting knowledge

Vision of the Department
Empower the students to thrive for excellence in the area of Information Science and Engineering to use technology for sustainable development for social needs.

Mission of the Department
M1: To provide theoretical and practical knowledge of Information Science and Engineering. **M2:** To provide inter disciplinary knowledge to be the leaders with social responsibility. **M3:** To collaborate with industry to facilitate content beyond syllabus. **M4:** To promote team work through projects, co-curricular and social activities.

Knowledge and Attitude Profile (WK)	
WK1	A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.
WK2	Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.
WK3	A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.
WK4	Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.
WK5	Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.
WK6	Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.
WK7	Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development
WK8	Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.
WK9	Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

	Program Outcomes
PO1	**Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO2	**Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
PO3	**Design/development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
PO4	**Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
PO5	**Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
PO6	**The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
PO7	**Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9).
PO8	**Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
PO9	**Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.
PO10	**Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO11	**Life-long learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8).

Program Specific Outcomes	
PSO1	Apply the Mathematical tools, Electronics & Embedded Systems Knowledge, and Programming Knowhow to develop softwares.
PSO2	Use of Artificial Intelligence and Machine Learning, High-Performance Computing, Cloud Computing, Network Security technologies and Software Engineering for providing solutions to the technological and social needs.
PSO3	Work individually and in teams, ethically exhibiting the managerial and leadership skills with sustainable Environment.

Program Educational Objectives	
PEO1	Graduates will contribute in development of software applications keeping abreast of the development.
PEO2	Exhibit competence as an individual, in teams with leadership and managerial skills.
PEO3	By optimizing the technology, the graduates will be able to adopt lifelong learning.

COURSE CATEGORY

Humanities, Social Sciences, and Management Courses	HSMC
Basic Science Courses	BSC
Engineering Science Courses	ESC
Emerging Technology Courses	ETC
Professional Core Courses	PCC
Professional Elective Courses	PEC
Open Elective Courses	OEC
Integrated Professional Core Courses	IPCC
Project Work: Dissertation, Mini-project work and Major Project work	PROJ
Seminar	SEM
Internship	INT
Ability Enhancement Courses	AEC
Mandatory Non Credit Courses	MNC
Audit Course	AC

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DON BOSCO INSTITUTE OF TECHNOLOGY
(Autonomous Institution Affiliated to VTU, Belagavi)
Department of Information Science and Engineering
Scheme of Teaching and Examinations 2024
(Academic Year 2025-26)

SEMESTER: III

Sl. No.	Course Category	Course Code	Course Title	Teaching Department (TD)	Board of Examiner (BoE)	Teaching Hours / Week L:T:P:S	SAAE Hours / Semester	Duration in Hours	CIE: SEE Marks	Total Marks	Credits
1	PCC / BSC	B24MAT31B	Discrete Mathematical Structures	Maths	IS	3:0:0:0	48	03	50:50	100	3
2	IPCC	B24IS32	Digital Design & Computer Organization	IS	IS	3:0:2:0	48	03	50:50	100	4
3	IPCC	B24IS33	Operating Systems	IS	IS	3:0:2:0	48	03	50:50	100	4
4	PCC	B24CS34	Data Structures	IS	CS	3:0:0:0	48	03	50:50	100	3
5	ESC	B24XX35x	ESC / ETC /PLC	IS	IS	2:0:2:0	32	03	50:50	100	3
6	UHV	B24SCK36	Social Connect and Responsibility	Any Dept.	CS	0:0:2:0	00	-	100:0	100	0
7	AEC / SEC	B24XX37x	Ability Enhancement Course / Skill Enhancement Course	IS	IS	If Theory 1:0:0:0	16	01	50:50	100	1
						If Lab 0:0:2:0	00	03			
8	PCCL	B24ISL38	Data Structures Laboratory	IS	IS	0:0:2:0	00	03	50:50	100	1
9	NCMC	B24NSK391	National Service Scheme (NSS) - I	NSS Coordinator		0:0:2:0	00	-	100:0	100	0
		B24PEK391	Physical Education (Sports & Athletics) - I	PE Director							
		B24YOK391	Yoga – I	Yoga Teacher							
			TOTAL			-	-	-	550:350	900	19

Dept. Member Convenor   **Head of the Department**   **Dean – Academics**   **Principal**

PCC: Professional Core Course, **PCCL:** Professional Core Course laboratory, **UHV:** Universal Human Value Course, **NCMC:** Mandatory Course (Non-credit), **AEC:** Ability Enhancement Course, **SEC:** Skill Enhancement Course, **L:** Lecture, **T:** Tutorial, **P:** Practical **S= SDA:** Skill Development Activity, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Evaluation. ESC: Engineering Science Course, ETC: Emerging Technology Course, PLC: Programming Language Course

Engineering Science Course (ESC / ETC / PLC) (Note- Student should opt for the course which should not be similar to the course opted in 1st Year			
B24IS351	Object Oriented Programming using Java	B24CI353	Data Analytics with R
B24IS352	Object Oriented Programming using C++	B24AD354	Python Programming for Data Science

Ability Enhancement Course			
B24CS371	Data Analytics with EXCEL	B24IS373	Project Management with GIT
B24IS372	R Programming	B24IS374	Data Visualization with PYTHON

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching Learning hours (L : T : P : S) can be considered as (3 : 0 : 2 : 0) or (2 : 2 : 2 : 0). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23 may please be referred.

National Service Scheme (NSS) / Physical Education (PE) (Sports and Athletics) / Yoga:

1) All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga (YOG) with the concerned coordinator of the course during the first week of III semesters. 2) Activities shall be carried out between III semester to the VI semester (for 4 semesters). 3) The candidate has to secure minimum of 40% of maximum marks of CIE to qualify in this course 4) The candidate may continue the same chosen course (NSS/Sports/Yoga) between 3rd to 6th semester. However, the option is given to students to change the activity. He / She may opt for the change of the course in ensuing semester. If the student is opting new course in 5th semester first time, he / she may take the basic modules (lower semester) from the syllabus to complete and if they repeat the same course in ensuing semester, subsequent modules can be offered. 5) Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. 6) The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. 7) These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

DON BOSCO INSTITUTE OF TECHNOLOGY
(Autonomous Institution Affiliated to VTU, Belagavi)
Department of Information Science and Engineering
Scheme of Teaching and Examinations 2024
(Academic Year 2025-26)

SEMESTER: IV

Sl. No.	Course Category	Course Code	Course Title	Teaching Department (TD)	Board of Examiner (BoE)	Teaching Hours / Week L:T:P:S	SAAE Hours / Semester	Duration in Hours	CIE: SEE Marks	Total Marks	Credits
1	PCC / BSC	B24IS41	Database Management Systems	IS	IS	3:0:0:0	48	03	50:50	100	3
2	IPCC	B24CS42	Analysis & Design of Algorithms	IS	CS	3:0:2:0	48	03	50:50	100	4
3	IPCC	B24IS43	Advanced Java	IS	IS	3:0:2:0	48	03	50:50	100	4
4	PCC	B24IS44	File Structures	IS	IS	3:0:0:0	48	03	50:50	100	3
5	ESC	B24XX45x	ESC / ETC / PLC	IS	IS	2:0:2:0	32	03	50:50	100	3
6	BSC	B24BOE46	Biology for Engineers	Any Dept.	CI	1:0:0:0	16	01	50:50	100	1
7	AEC / SEC	B24XX47x	Ability Enhancement Course / Skill Enhancement Course	IS	IS	If Theory 1:0:0:0	16	01	50:50	100	1
						If Lab 0:0:2:0	00	03			
8	UHV	B24UHK48	Universal Human Values	Any Dept.	IS	1:0:0:0	16	-	100:0	100	1
9	PCCL	B24ISL49	Database Management Systems Laboratory with Mini Project	IS	IS	0:0:2:0	00	03	50:50	100	1
10	NCMC	B24NSK410	National Service Scheme (NSS) - II	NSS Coordinator		0:0:2:0	00	-	100:0	100	0
		B24PEK410	Physical Education (Sports & Athletics) – II	PE Director							
		B24YOK410	Yoga – II	Yoga Teacher							
11	AUDIT	B24SDC411	Ready to Rise	T&P	T&P	0:0:0:2		-	100:0	100	0
			TOTAL			-	-	-	**700:400**	**1100**	**21**

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Engineering Science Course (ESC / ETC / PLC)

B24IS451	Web Technology and its Applications	B24AD453	Optimization Techniques for Machine Learning
B24IS452	Graph Theory	B24IS454	Linear Algebra

Ability Enhancement Course

B24CS471	Business Intelligence Tools	B24IS473	Technical Writing using LATEX
B24IS472	Unified Modelling Language Tools - Star	B24CS474	UNIX Shell Scripting

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ASSESSMENT PATTERN

Alternative Assessment Tool (AAT):

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). Thus AAT enables faculty to employ innovative methods and design own assessment patterns during the CIE. The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. If properly applied, the AAT converts the classroom into an effective learning space. **Some possible AAT are:** QUIZ / seminar/ assignments / term paper / open ended experiments / mini-projects / concept videos / partial reproduction of research work / oral presentation of research work / group activity / developing a generic tool-box for problem solving / report based on participation in create-a-thon / make-a-thon / code-a-thon / hack-a-thon conducted by reputed organizations / any other.

Table - 1: Typical distribution of weightage for CIE & SEE for Regular Theory (Non Integrated) Courses.

Assessment	Component	Marks	Reduced to	TOTAL Marks
CIE	Internals - I	40	-	40 (Average of 3 Test)
	Internals - II	40	-	
	Internals - III	40	-	
	AAT - I	10	-	10 (Average)
	AAT - II	10	-	
SEE	Semester End Exam	100	50	50
TOTAL MARKS				100

Pattern of SEE Question Paper

Q. #	CONTENTS	MARKS	Reduced to
PART A			
1	Objective type questions / 1 or 2 mark questions covering entire syllabus	15	
PART B			
2 & 3	Module – I : Question 2 or 3	17	
4 & 5	Module – II : Question 4 or 5	17	**50**
6 & 7	Module – III : Question 6 or 7	17	
8 & 9	Module – IV : Question 8 or 9	17	
10 & 11	Module – V : Question 10 or 11	17	
MAXIMUM MARKS FOR SEE THEORY		**100**	

Table - 2: Typical distribution of weightage for CIE & SEE for Practical Courses.

Assessment	Component	Marks	Reduced to	TOTAL Marks
CIE	Lab - Continuous Internal Assessment (Weekly Performance)	30	-	50
	Internal Test	20	-	
SEE	Semester End Exam	100	50	50
TOTAL MARKS				100

Table - 3: Typical distribution of weightage for Integrated Courses.

Assessment	Component	Marks	Reduced to	TOTAL Marks
CIE	Internals - I	40	Average of all 3 tests is considered for 40	40 Marks is scaled down to 30
	Internals - II	40		
	Internals - III	40		
	Lab - Continuous Internal Assessment (Weekly Performance)	10	-	20
	Internal Test	50	10	
SEE	Semester End Exam	100	50	50
TOTAL MARKS				100

Pattern of SEE Question Paper

Q. #	CONTENTS	MARKS	Reduced to
PART A			
1	Objective type questions / 1 or 2 mark questions covering entire syllabus	15	**50**
PART B			
2 & 3	Module – I : Question 2 or 3	17	
4 & 5	Module – II : Question 4 or 5	17	
6 & 7	Module – III : Question 6 or 7	17	
8 & 9	Module – IV : Question 8 or 9	17	
10 & 11	Module – V : Question 10 or 11	17	
MAXIMUM MARKS FOR SEE THEORY		**100**	

Table - 4: Typical distribution of weightage for CIE & SEE for ONE CREDIT THEORY COURSE. (L:T:P – 1:0:0) (AEC / SEC courses - Assessment will be Multiple Choice Questions based)

Assessment	Component	Marks	TOTAL Marks
CIE	Internals – I	50	50 (Average)
	Internals – II	50	
SEE	Semester End Exam	50	50
TOTAL MARKS			100

Table - 5: Typical distribution of weightage for NON CREDIT COURSES / AUDIT COURSES (Only CIE)

Assessment	Component	Marks	TOTAL Marks
CIE	Internals - I	50	100
	Internals - II	50	
TOTAL MARKS			100

Table - 6: Typical distribution of weightage for CERTIFICATION COURSES (ONE CREDIT COURSE – provided L:T:P is 0:0:2).

Assessment	Component	Marks	Reduced to	TOTAL Marks
CIE	Lab - Continuous Internal Assessment (Weekly Performance)	30	10	50
	Internal Lab Test	30	10	
	Proctored (Certification) Exam	100	30	
SEE	Semester End Exam	100	50	50
TOTAL MARKS				100

DISCRETE MATHEMATICAL STRUCTURES

Course Code	B24MAT31B	Total Contact Hours / Week	3	CIE Marks	50
Course Category	PCC / BSC	Total SAAE Hours / Semester	48	SEE Marks	50
L:T:P:S	3:0:0:0	Total Notional Learning Hours	90	Total Marks	100
Total Credits	3			Exam Duration	3 Hrs

COURSE LEARNING OBJECTIVES
1. To help students to understand discrete and continuous mathematical structures.
2. To impart basics of relations and functions.
3. To facilitate students in applying principles of Recurrence Relations to find the generating functions and solve the Recurrence relations.
4. To have the knowledge of groups and their properties to understand the importance of algebraic properties relative to various number systems.

PREREQUISITES
• Familiarity with set theory concepts, such as elements, subsets, unions, and intersections, is important for building a foundation in discrete mathematics.
• A basic understanding of propositional logic, including truth tables and logical operators, is crucial for understanding mathematical arguments and proofs.
• Familiarity with permutations, and combinations.
• A certain level of mathematical maturity is required to grasp the abstract nature of discrete structures and to follow complex logical arguments.

MODULE #	TOPICS	Hours
1	**Fundamentals of Logic:** Basic Connectives and Truth Tables, Logic Equivalence – The Laws of Logic, Logical Implication –Rules of Inference. The Use of Quantifiers, Quantifiers.	**8**
2	**Properties of the Integers:** Mathematical Induction, The Well Ordering Principle – Mathematical Induction. **Fundamental Principles of Counting:** The Rules of Sum and Product, Permutations, Combinations –The Binomial Theorem, Combinations with Repetition.	**8**
3	**Relations and Functions:** Cartesian Products and Relations, Functions – Plain and One-to-One, Onto Functions. The Pigeon- hole Principle, Function Composition and Inverse Functions. **Properties of Relations**, Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders – Hasse Diagrams, Equivalence Relations and Partitions.	**10**

4	**The Principle of Inclusion and Exclusion:** The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials. **Recurrence Relations:** First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients.	**8**
5	**Introduction to Groups Theory:** Definitions and Examples of Particular Groups Klein 4-group, Permutation groups, Properties of groups, Subgroups, cyclic groups, Cosets, Lagrange's Theorem.	**8**

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	Discrete Mathematical Structures an Applied Introduction	Ralph P. Grimaldi, B V Ramana	5th	Pearson Education	2004
2	Discrete and Combinatorial Mathematics	Ralph P. Grimaldi	5th	Pearson Education	2004

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	Discrete Mathematics – A Concept-Based Approach	Basavaraj S Anami & Venakanna S Madalli	-	Universities Press	2016
2	Discrete Mathematics and its Applications	Kenneth H. Rosen	6th	McGraw Hill	2007
3	A Treatise on Discrete Mathematical Structures	Jayant Ganguly	-	Sanguine-Pearson	2010
4	Discrete Mathematical Structures Theory and Applications	D.S. Malik and M.K. Sen	Latest Edition	Thomson	2004
5	Discrete Mathematics with Applications	Thomas Koshy	-	Elsevier Reprint	2004
6	Discrete Mathematical Structures	Dr. D S C	5th	Prism books Pvt. Ltd.	2016

E-Resources: E-books / Online Course materials / Online Courses / Video Lectures:

Sl. #	Type of E-Resource	URL
1	NPTEL Course	http://nptel.ac.in/courses.php?disciplineID=111
2	Online Course Materials	http://www.class-central.com/subject/math(MOOCs)
3	Video Lecture	http://academicearth.org/
4	Online Course Materials	VTU e-Shikshana Program
5	Online Course Materials	VTU EDUSAT Program.
6	Online Course Material	http://www.themathpage.com/
7	E-Learning Resource	http://www.ocw.mit.edu/courses/mathematics/

COURSE OUTCOMES:

At the end of the Course, student will be able to:

CO #	Course Outcome Statement
CO1	Apply concepts of logical reasoning and mathematical proof techniques in proving theorems and statements.
CO2	Demonstrate the application of discrete structures in different fields of computer science.
CO3	Apply the basic concepts of relations, functions and partially ordered sets for computer representations.
CO4	Solve problems involving recurrence relations and generating functions.
CO5	Illustrate the fundamental principles of Algebraic structures with the problems related to computer science & engineering.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	-	-	-	2	3	-	-
CO2	3	3	3	-	-	-	-	-	-	-	2	3	-	-
CO3	3	3	3	-	-	-	-	-	-	-	2	3	-	-
CO4	3	3	3	-	-	-	-	-	-	-	2	3	-	-
CO5	3	3	3	-	-	-	-	-	-	-	2	3	-	-
AVG	3	3	3	-	-	-	-	-	-	-	2	3	-	-

Teaching-Learning Process
Pedagogy (General Instructions):
These are sample strategies, teachers can use to accelerate the attainment of the various course outcomes.
  1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied Mathematical skills.
  2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
  3. Support and guide the students for self–study.
  4. You will assign homework, grading assignments and quizzes, and documenting students' progress.
  5. Encourage the students to group learning to improve their creative and analytical skills.
  6. Show short related video lectures in the following ways:
     ● As an introduction to new topics (pre-lecture activity).
     ● As a revision of topics (post-lecture activity).
     ● As additional examples (post-lecture activity).
     ● As an additional material of challenging topics (pre-and post-lecture activity).
     ● As a model solution for some exercises (post-lecture activity).

DIGITAL DESIGN AND COMPUTER ORGANIZATION

Course Code	B24IS32	**Total Contact Hours / Week**	5	**CIE Marks**	50
Course Category	IPCC	**Total SAAE Hours / Semester**	48	**SEE Marks**	50
L:T:P:S	3:0:2:0	**Total Notional Learning Hours**	120	**Total Marks**	100
Total Credits	4			**Exam Duration**	3 Hrs

COURSE LEARNING OBJECTIVES
1. To demonstrate the functionalities of binary logic system
2. To explain the working of combinational and sequential logic system
3. To realize the basic structure of computer system
4. To illustrate the working of I/O operations and processing unit

PREREQUISITES
• Basic Knowledge of Number Systems.
• Fundamentals of Boolean Algebra, Arithmetic operations, Logic Gates and basic logic circuit design.
• Familiarity with computer components and their basic functions (CPU, memory, input/output).

MODULE #	TOPICS	Hours
1	**Introduction to Digital Design:** Binary Logic, Basic Theorems and Properties Of Boolean Algebra, Boolean Functions, Digital Logic Gates, Introduction, The Map Method, Four-Variable Map, Don't-Care Conditions, NAND and NOR Implementation, Other Hardware Description Language – Verilog Model of a simple circuit. **Text book 1: 1.9, 2.4, 2.5, 2.8, 3.1, 3.2, 3.3, 3.5, 3.6, 3.9**	**10**
2	**Combinational Logic:** Introduction, Combinational Circuits, Design Procedure, Binary Adder-Subtractor, Decoders, Encoders, Multiplexers. HDL Models of Combinational Circuits – Adder, Multiplexer. **Sequential Logic:** Introduction, Sequential Circuits, Storage Elements: Latches, Flip-Flops. **Text book 1: 4.1, 4.2, 4.4, 4.5, 4.9, 4.10, 4.11, 4.12, 5.1, 5.2, 5.3, 5.4.**	**8**
3	**Basic Structure of Computers:** Functional Units, Basic Operational Concepts, Bus structure, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. **Machine Instructions and Programs:** Memory Location and Addresses, Memory Operations, Instruction and Instruction sequencing, Addressing Modes. **Text book 2: 1.2, 1.3, 1.4, 1.6, 2.2, 2.3, 2.4, 2.5**	**8**

| 4 | **Input/output Organization:** Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Direct Memory Access: Bus Arbitration, Speed, size and Cost of memory systems. Cache Memories – Mapping Functions. **Text book 2: 4.1, 4.2.1, 4.2.2, 4.2.3, 4.4, 5.4, 5.5.1** | **8** |
| 5 | **Basic Processing Unit:** Some Fundamental Concepts: Register Transfers, Performing ALU operations, fetching a word from Memory, Storing a word in memory. Execution of a Complete Instruction. **Pipelining:** Basic concepts, Role of Cache memory, Pipeline Performance. **Text book 2: 7.1, 7.2, 8.1** | **8** |

PRACTICAL COMPONENT OF IPCC

Sl. No.	Experiments Simulation Packages preferred: Multisim, Modelsim, PSpice or any other relevant
1	Given a 4-variable logic expression, simplify it using appropriate technique and simulate the same using basic gates.
2	Design a 4 bit full adder and subtractor and simulate the same using basic gates.
3	Design Verilog HDL to implement simple circuits using structural, Data flow and Behavioural model.
4	Design Verilog HDL to implement Binary Adder-Subtractor – Half and Full Adder, Half and Full Subtractor.
5	Design Verilog HDL to implement Decimal adder.
6	Design Verilog program to implement Different types of multiplexer like 2:1, 4:1 and 8:1.
7	Design Verilog program to implement types of De-Multiplexer.
8	Design Verilog program for implementing various types of Flip-Flops such as SR, JK and D.

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	Digital Design with an Introduction to Verilog Design	M. Morris Mano & Michael D. Ciletti	6th	Pearson Education	2024
2	Computer Organization	Carl Hamacher, Zvonko Vranesic, SafwatZaky	6th	Tata McGraw Hill.	2023

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	Computer Organization & Architecture.	William Stallings	9th	Pearson	2014
2	"Fundamentals of Digital Logic with Verilog design".	Stephen Brown, Zvonko Vranesic	1st	McGraw Hill	2009
3	Computer Organization and Architecture.	William Stallings	6th	Pearson / PHI	2004
4	Fundamentals of HDL.	Cyril Prasanna Raj	1st	Pearson Education	2009

E-Resources: E-books / Online Course materials / Online Courses / Video Lectures:

Sl. #	Type of E-Resource	URL
1	Web-Based Interactive Educational Resource	https://cse11-iiith.vlabs.ac.in/
2	NPTEL	https://archive.nptel.ac.in/courses/106/105/106105165/
3	NPTEL	https://nptel.ac.in/courses/117105080
4	Suggested Activities in Class	Activity Based Learning

COURSE OUTCOMES:

At the end of the Course, student will be able to:

CO #	Course Outcome Statement
CO1	Apply the K–Map techniques to simplify various Boolean expressions.
CO2	Design different types of combinational and sequential circuits along with Verilog programs.
CO3	Describe the fundamentals of machine instructions, addressing modes and Processor performance.
CO4	Explain the approaches involved in achieving communication between processor and I/O devices.
CO5	Analyze internal Organization of Memory and Impact of cache/Pipelining on Processor Performance.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	2	-	-	2	1	-	-	1	2	-	-
CO2	3	2	2	2	2	-	2	1	-	-	-	2	-	-
CO3	2	2	2	2	-	-	1	1	-	-	-	1	-	-
CO4	2	2	2	2	-	-	1	1	-	-	2	1	-	-
CO5	2	2	2	-	-	-	1	1	-	-	2	1	-	-
AVG	2.4	2	2	2	2	-	1.2	1	-	-	1.66	1.2	-	-

Teaching-Learning Process
Pedagogy (General Instructions):
Teachers can use following strategies to accelerate the attainment of the various course outcomes.
1. Chalk and Talk with Black Board
2. ICT based Teaching
3. Demonstration based Teaching

OPERATING SYSTEMS

Course Code	B24IS33	**Total Contact Hours / Week**	5	**CIE Marks**	50
Course Category	IPCC	**Total SAAE Hours / Semester**	48	**SEE Marks**	50
L:T:P:S	3:0:2:0	**Total Notional Learning Hours**	120	**Total Marks**	100
Total Credits	4			**Exam Duration**	3 Hrs

COURSE LEARNING OBJECTIVES
1. To explain main components of OS and their working.
2. To familiarize the operations performed by OS as a resource Manager.
3. To impart various scheduling policies of OS.
4. To infer the different memory management techniques.
5. To describe the structure of Secondary Memory system and Disk Scheduling.

PREREQUISITES
• Knowledge of Computer system with CPU, Memory and I/O Devices.
• Knowledge of RAM, ROM and Hard Disk of a computer system.
• Basic fundamentals of Hardware and Software.

MODULE #	TOPICS	Hours
1	**Introduction to operating systems, System structures:** What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems; Computing environments. **Operating System Services:** User - Operating System interface; System calls; Types of system calls; Virtual machines; System boot. **Textbook 1: Chapter – 1 (1.1 - 1.12), 2 (2.2-2.4, 2.8, 2.11)**	**8**
2	**Process Management:** Process concept; Process scheduling; Operations on processes; Inter process communication. **Multi-threaded Programming:** Overview; Multithreading models; Threading issues. **Process Scheduling**: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Thread scheduling; Multiple-processor scheduling, **Textbook 1: Chapter – 3 (3.1 - 3.4), 4 (4.1, 4.2, 4.4), 5 (5.1 - 5.5)**	**9**
3	**Process Synchronization:** Synchronization: The critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; **Deadlocks:** System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock. **Textbook 1: Chapter – 6 (6.1 - 6.6), 7 (7.1 - 7.7)**	**9**

4	**Memory Management:** Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation. **Virtual Memory Management:** Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing. **Textbook 1: Chapter -8 (8.1 - 8.6), 9 (9.1 - 9.6)**	**8**
5	**File System, Implementation of File System:** File system: File concept; Access methods; Directory and Disk structure; **Implementing File system:** File system structure; File system implementation; Directory implementation; Allocation methods. **Secondary Storage Structure, Protection:** Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; **Protection**: Goals of protection, Principles of protection, Domain of protection, Access matrix. **Textbook 1: Chapter – 10 (10.1 - 10.3), 11 (11.1 - 11.4), 12 (12.1 - 12.5), 14 (14.1-14.4)**	**8**

PRACTICAL COMPONENT OF IPCC

Sl. No.	Experiments Simulation packages preferred: Turbo C, Linux, DEV C
1	Develop a c program to implement the Process system calls (fork (), exec(), wait(), create process, terminate process.
2	Simulate the following CPU scheduling algorithms to find turnaround time and waiting time a) FCFS b) SJF c) Round Robin d) Priority.
3	Develop a C program to simulate producer-consumer problem using semaphores.
4	Develop a C program to simulate Bankers Algorithm for DeadLock Avoidance.
5	Develop a C program to simulate the following contiguous memory allocation Techniques: a) Worst fit b) Best fit c) First fit.
6	Develop a C program to simulate page replacement algorithms: a) FIFO b) LRU
7	Simulate following File Organization and File Allocation Techniques a) Single level directory b) Linked file allocation strategies.
8	Develop a C program to simulate **SCAN** disk scheduling algorithm.

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	Operating System Principles	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne	8th	Wiley-India	2015

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	Understanding Operating System	Ann McHoes, Ida M. Fylnn	8th	Cengage Learning	2018
2	Operating Systems: A Concept Based Approach	D.M Dhamdhere	3rd	McGraw-Hill	2013
3	An Introduction to Operating Systems: Concepts and Practice	P.C.P. Bhatt	4th	PHI(EEE)	2014

E-Resources: E-books / Online Course materials / Online Courses / Video Lectures:

Sl. #	Type of E-Resource	URL
1	You Tube - Dr. Mike Murphy Lecture Series	https://youtu.be/mXw9ruZaxzQ
2	You Tube-Introduction to OS	https://youtu.be/vBURTt97EkA
3	You Tube -Gate Smashers	operating system gate smashers - Search
4	Cursa-Free online course	Operating System - Free Course | Cursa

COURSE OUTCOMES:

At the end of the Course, student will be able to:

CO	Course Outcome Statement
CO1	Explain the structure and functionality of operating system
CO2	Apply appropriate CPU scheduling algorithms for the given problem.
CO3	Analyse the various techniques for process synchronization and deadlock handling.
CO4	Apply the various techniques for memory management.
CO5	Explain file and secondary storage management strategies and protection.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	3	3	-	-	2	2	-	-
CO2	3	3	2	-	-	-	3	3	-	-	2	2	-	-
CO3	3	3	2	-	-	-	3	3	-	-	2	2	-	-
CO4	3	3	2	-	-	-	3	3	-	-	2	2	-	-
CO5	3	3	2	-	-	-	3	3	-	-	2	2	-	-
AVG	3	3	2	-	-	-	3	3	-	-	2	2	-	-

Teaching-Learning Process (General Instructions):

Teachers can use the following strategies to accelerate the attainment of the various course outcomes.

1. Lecturer methods (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
5. Role play for process scheduling.
6. Demonstrate the installation of any one Linux OS on VMware/Virtual Box

DATA STRUCTURES

Course Code	B24CS34	Total Contact Hours / Week	3	CIE Marks	50
Course Category	PCC	Total SAAE Hours / Semester	48	SEE Marks	50
L:T:P:S	3:0:0:0	Total Notional Learning Hours	90	Total Marks	100
Total Credits	3			Exam Duration	3 Hrs

COURSE LEARNING OBJECTIVES
1. To explain fundamentals of data structures and their applications.
2. To understanding and apply different sorting techniques.
3. To illustrate representation of different data structures such as Stack, Queues, Linked Lists, Trees and Graphs.
4. To design and develop solutions to problems using linear and nonlinear data structures.

PREREQUISITES
• Basics of C programming..

MODULE #	TOPICS	Hours
1	**INTRODUCTION TO DATA STRUCTURES:** Data Structures, Classification of Data Structures (Primitive & Non-Primitive), Operations on Data structure, **Sparse Matrix**-Abstract data type, sparse matrix representation, transposing matrix. **SORTING TECHNIQUES-** Merge sort, Quick sort, Radix sort, insertion sort. **HASHING**: Hash functions, collision-chaining, open addressing-linear probing, quadratic probing, double hashing. **Textbook1:** Chapter 2(2.1, 2.2, 2.3), Chapter 14(14.8, 14.10, 14.11, 14.12), Chapter 15 (15.3, 15.4, 15.5.1). **Textbook2**: Chapter 2(2.5.1,2.52,2.5.3).	8
2	**STACKS:** Introduction, array Representation of stack, Basic operation of stack, Applications - Conversion of Expressions, Evaluation of expression. **QUEUES:** Basic operation of queue, Types of queues- Circular Queues, priority and Double ended queue. **Textbook1**: Chapter 7 (7.1-7.3, 7.7-7.7.3), Chapter 8 (8.2, 8.4- 8.4.1, 8.4.2, 8.4.3).	9
3	**LINKED LISTS:** Dynamic Memory Allocation, Linked Lists- Introduction, Singly Linked Lists (SLL), Circular Linked Lists, Doubly Linked Lists(DLL), Circular DLL, Application – Linked Stacks and Queues, Polynomials-Polynomial Representation, Adding Polynomials. **Textbook1:** Chapter 6 (6.1, 6.2, 6.3, 6.4, 6.5) **Textbook2:** Chapter 1 (1.2-1.2.2), Chapter 4 (4.3, 4.4-4.4.1, 4.4.2).	8
4	**TREES:** Introduction, Types of Trees - Binary Trees, Binary Search Trees, Expression Trees, creating a Binary Tree from a General Tree, traversing a Binary Tree, Binary Search Trees, Threaded Binary Trees, Applications of Trees. **Textbook1:** Chapter 9 (9.1, 9.2-9.2.3, 9.2.4, 9.2.5, 9.3, 9.4, 9.6), Chapter 10 (10.1, 10.3).	9

5	**GRAPHS:** Introduction, Graph Terminology, Directed Graphs, Bi-connected Components, Representation of Graphs - Adjacency Matrix Representation and Adjacency List Representation, Graph Traversal Algorithms - Breadth-First Search Algorithm, Depth-first Search Algorithm, Application - topological sort. **Textbook1:** Chapter 13 (13.1, 13.2, 13.3, 13.4, 13.5-13.5.1, 13.5.2, 13.6, 13.7)	**8**

PRESCRIBED TEXT BOOKS

Text Book	Book Title	Authors	Edition	Publisher	Year
1	Data Structures using C	Reema Thareja	3rd	Oxford Press,	2023
2	Fundamentals of Data Structures in C	Ellis Horowitz and Sartaj Sahni,	2nd	Universities Press	2018

REFERENCE BOOKS

Reference Book	Book Title	Authors	Edition	Publisher	Year
1	Data Structures: A Pseudo-Code Approach with C.	Gilberg and Forouzan	2nd	Cengage Learning	2014
2	Programming in ANSI C.	E. Bala Guruswamy	9th	McGraw Hill	2024
3	Data Structures using C.	A M Tenenbaum,	7th	PHI	2018
4	Data Structures and Program Design in C.	Robert Kruse	2nd	PHI	2006
5	Data Structures using C.	Seymour	13th	McGraw Hill Special Indian Edition	2017

E-Resources: E-books / Online Course materials / Online Courses / Video Lectures:

Sl. #	Type of E-Resource	URL
1	VTU E-learning	http://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS35.html
2	Swayam NPTEL	https://nptel.ac.in/courses/106/105/106105171/ http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html
3	Virtual labs	https://ds2-iiith.vlabs.ac.in/exp/selection-sort/index.html
4	Geeks for geeks	https://www.geeksforgeeks.org/data-structures-and-algorithms-online-courses-free-and-paid/
5	Simply learn	https://www.simplilearn.com/free-data-structures-algorithms-course-skillup

COURSE OUTCOMES:

At the end of the Course, student will be able to:

CO	Course Outcome Statement
CO1	Apply array concepts to sort the elements, sparse matrix, hashing and hashing-based sorting techniques.
CO2	Develop programs on operations of stack and its applications, queue operations.
CO3	Apply the concepts of singly linked lists, doubly linked lists, circular linked lists into different applications.
CO4	Illustrate the construction of binary trees, binary search tress, and its traversal techniques.
CO5	Develop solutions using graphs to model the real-world problem.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	-	-	1	1	2	3	-	2
CO2	3	3	2	-	-	-	-	-	1	1	2	3	-	2
CO3	3	3	2	-	-	-	-	-	1	1	2	3	-	2
CO4	3	3	2	-	-	-	-	-	1	1	2	3	-	2
CO5	3	3	2	-	-	-	-	-	1	1	2	3	-	2
AVG	3	3	2	-	-	-	-	-	1	1	2	3	-	2

Teaching-Learning Process

Pedagogy (General Instructions):

Teachers can use following strategies to accelerate the attainment of the various course outcomes.

1. Chalk and Talk with Black Board.

2. ICT based Teaching.

3. Demonstration based Teaching.

OBJECT ORIENTED PROGRAMMING USING JAVA

Course Code	B24IS351	Total Contact Hours / Week	4	CIE Marks	50
Course Category	ESC	Total SAAE Hours / Semester	32	SEE Marks	50
L:T:P:S	2:0:2:0	Total Notional Learning Hours	90	Total Marks	100
Total Credits	3			Exam Duration	3 Hrs

COURSE LEARNING OBJECTIVES
1. To learn primitive constructs JAVA programming language.
2. To understand Object Oriented Programming Features of JAVA.
3. To gain knowledge on: packages, multithreaded programing and exceptions.

PREREQUISITES
• Students should know solid understanding of basic C programming concepts such as Data Types, Variables, Control flow and Basic Syntax.
• Understanding of object-oriented programming concepts.
• Knowledge of Data Structures, Algorithms and Debugging tools would be an additional helpful.

MODULE #	TOPICS	Hours
1	**An Overview of Java:** Object-Oriented Programming (Two Paradigms, Abstraction, The Three OOP Principles), Using Blocks of Code, Lexical Issues (Whitespace, Identifiers, Literals, Comments, Separators, The Java Keywords). **Data Types, Variables, and Arrays:** The Primitive Types (Integers, Floating-Point Types, Characters, Booleans), Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, Introducing Type Inference with Local Variables. **Operators:** Arithmetic Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The? Operator, Operator Precedence, Using Parentheses. **Control Statements:** Java's Selection Statements (if, The Traditional switch), Iteration Statements (while, do-while, for, The For-Each Version of the for Loop, Local Variable Type Inference in a for Loop, Nested Loops), Jump Statements (Using break, Using continue, return). **Text Book 1: Chapter 2, 3, 4, 5.**	6
2	**Introducing Classes:** Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection. **Methods and Classes:** Overloading Methods, Objects as Parameters, Argument Passing, Returning Objects, Recursion, Access Control, Understanding static, Introducing final, Introducing Nested and Inner Classes. **Text Book 1: Chapter 6, 7.**	5

3	**Inheritance:** Inheritance Basics, Using super, Creating a Multilevel Hierarchy, When Constructors Are Executed, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, Local Variable Type Inference and Inheritance, The Object Class. **Interfaces:** Interfaces, Default Interface Methods, Use static Methods in an Interface, Private Interface Methods. **Text Book 1: Chapter 8, 9.**	**6**
4	**Packages:** Packages, Packages and Member Access, Importing Packages. **Exceptions:** Exception-Handling Fundamentals**,** Exception Types**,** Uncaught Exceptions**,** Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions. **Text Book 1: Chapter 9, 10.**	**6**
5	**Multithreaded Programming:** The Java Thread Model, The Main Thread, Creating a Thread, Creating Multiple Threads, Using isAlive() and join(), Thread Priorities, Synchronization, Interthread Communication, Suspending, Resuming, and Stopping Threads, Obtaining a Thread's State. **Text Book 1: Chapter 11.**	**5**

Sl. No.	Lab Experiments
1	Develop a JAVA program to add TWO matrices of suitable order N (The value of N should be read from command line arguments).
2	Develop a stack class to hold a maximum of 10 integers with suitable methods. Develop a JAVA main method to illustrate Stack operations.
3	A class called Employee, which models an employee with an ID, name and salary, is designed as shown in the following class diagram. The method raiseSalary (percent) increases the salary by the given percentage. Develop the Employee class and suitable main method for demonstration.
4	Develop a JAVA program to create a class named shape. Create three sub classes namely: circle, triangle and square, each class has two member functions named draw () and erase (). Demonstrate polymorphism concepts by developing suitable methods, defining member data and main program.
5	Develop a JAVA program to create an abstract class Shape with abstract methods calculateArea() and calculatePerimeter(). Create subclasses Circle and Triangle that extend the Shape class and implement the respective methods to calculate the area and perimeter of each shape.
6	Develop a JAVA program to create an interface Resizable with methods resizeWidth(int width) and resizeHeight(int height) that allow an object to be resized. Create a class Rectangle that implements the Resizable interface and implements the resize methods
7	Develop a JAVA program to raise a custom exception (user defined exception) for Division ByZero using try, catch, throw and finally
8	Write a program to illustrate creation of threads using runnable class. (start method start each of the newly created thread. Inside the run method there is sleep() for suspend the thread for 500 milliseconds).
9	Develop a program to create a class My Thread in this class a constructor, call the base class constructor, using super and start the thread. The run method of the class starts after this. It can be observed that both main thread and created child thread are executed concurrently

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	Java: The Complete Reference	Herbert Schildt	12th	McGraw-Hill	2023

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	Programming with Java	E Balagurusamy	6th	McGraw Hill Education	2022
2	Thinking in Java	Bruce Eckel	4th	Prentice Hall	2006

E-Resources: E-books / Online Course materials / Online Courses / Video Lectures:

Sl. #	Type of E-Resource	URL
1	Web based Tutorial	https://www.geeksforgeeks.org/java/
2	Online Course Module (OpenCourseWare – OCW)	https://ocw.mit.edu/courses/6-092-introduction-to-programming-in-java-january-iap-2010/
3	Web-Based Interactive Tutorial	https://www.w3schools.com/java/
4	Web-Based Text Tutorial	https://www.javatpoint.com/java-tutorial

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO #	Course Outcome Statement
CO1	Demonstrate proficiency in writing simple programs involving branching and looping structures.
CO2	Design a class involving data members and methods for the given scenario.
CO3	Apply the concepts of inheritance and interfaces in solving real world problems.
CO4	Use the concept of packages and exception handling in solving complex problem
CO5	Apply concepts of multithreading in program development

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	1	2	-	-	1	1	-	2	3	1	1
CO2	3	3	3	1	2	-	-	2	2	1	2	3	2	2
CO3	3	3	3	2	2	-	-	2	2	1	2	3	3	2
CO4	3	2	3	2	3	-	1	1	1	1	2	3	3	1
CO5	3	2	3	2	3	-	-	2	2	1	2	3	2	2
AVG	3	2.6	2.8	1.6	2.4	-	1	1.6	1.6	1	2	3	2.2	1.6

Teaching-Learning Process (General Instructions):

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes and make Teaching –Learning more effective

1. Use Online Java Compiler IDE: https://www.jdoodle.com/online-java-compiler/ or any other.

2. Demonstration of programing examples.

3. Chalk and board, power point presentations

4. Online material (Tutorials) and video lectures.

OBJECT ORIENTED PROGRAMMING USING C++

Course Code	B24IS352	Total Contact Hours / Week	4	CIE Marks	50
Course Category	ESC	Total SAAE Hours / Semester	32	SEE Marks	50
L:T:P:S	2:0:2:0	Total Notional Learning Hours	90	Total Marks	100
Total Credits	3			Exam Duration	3 Hrs

COURSE LEARNING OBJECTIVES
1. To understand object-oriented programming using C++ and Gain knowledge about the capability to store information together in an object.
2. To illustrate the capability of a class to rely upon another class and functions.
3. To Create and process data in files using file I/O functions.
4. To understand the generic programming features of C++ including Exception handling.

PREREQUISITES
• Students should know solid understanding of basic C programming concepts such as Data Types, Variables, Control flow and Basic Syntax.
• Knowledge of Data Structures, Algorithms and Debugging tools would be an additional helpful.
• Understanding of Hardware, Software, Compiler and Operating system.

MODULE #	TOPICS	Hours
1	**An overview of C++**: What is object-Oriented Programming? Introducing C++ Classes, The General Form of a C++ Program. **Classes and Objects:** Classes, Friend Functions, Friend Classes, Inline Functions, Parameterized Constructors, Static Class Members, When Constructors and Destructors are Executed, The Scope Resolution Operator, Passing Objects to functions, Returning Objects, Object Assignment. **Text Book 1: Chapter 11 and 12.**	**5**
2	**Arrays, Pointers, References, and the Dynamic Allocation Operators:** Arrays of Objects, Pointers to Objects, The this Pointer, Pointers to derived types, Pointers to class members. **Functions Overloading, Copy Constructors**: Functions Overloading, Overloading Constructor Functions. Copy Constructors, Default Function Arguments, Function Overloading and Ambiguity. **Text Book 1: Chapter 13 and 14.**	**6**
3	**Operator Overloading:** Creating a Member Operator Function, Operator Overloading Using a Friend Function, Overloading new and delete. **Inheritance:** Base-Class Access Control, Inheritance and Protected Members, Inheriting Multiple Base Classes, Constructors, Destructors and Inheritance, Granting Access, Virtual Base Classes. **Text Book 1: Chapter 15 and 16.**	**5**
4	**Virtual Functions and Polymorphism:** Virtual Functions, The Virtual Attribute is Inherited, Virtual Functions are Hierarchical, Pure Virtual Functions, Using Virtual Functions, Early vs Late Binding. **Templates:** Generic Functions, Applying Generic Functions, Generic Classes. The type name and export Keywords. The Power of Templates. **Text Book 1: Chapter 17 and 18.**	**6**

| 5 | **Exception Handling:** Exception Handling Fundamentals, Handling Derived-Class Exceptions, Exception Handling Options, Applying Exception Handling.
The C++ I/O System Basics: C++ Streams, The C++ Classes, Formatted I/O.
File I/O: <fstream> and File Classes, Opening and Closing a File, Reading and Writing Text Files, Detecting EOF.
Text Book 1: Chapte 19, 20 and 21. | 6 |

Sl. No.	Lab Experiments
1	Develop a C++ program to find the largest of three numbers.
2	Develop a C++ program to sort the elements in ascending and descending order.
3	Develop a C++ program using classes to display student name, roll number, marks obtained in two subjects and total score of student.
4	Develop a C++ program for a bank empolyee to print name of the employee, account_no. & balance. Print invalid balance if amount<500, Display the same, also display the balance after withdraw and deposit.
5	Develop a C++ program to demonstrate function overloading for the following prototypes. add(int a, int b) add(double a, double b.
6	Develop a C++ program using Operator Overloading for overloading Unary minus operator.
7	Develop a C++ program to implement Multiple inheritance for performing arithmetic operation of two numbers.
8	Develop a C++ program using Constructor in Derived classes to initialize alpha, beta and gamma and display corresponding values.
9	Develop a C++ program to create a text file, check file created or not, if created it will write some text into the file and then read the text from the file.
10	Develop a C++ program to write and read time in/from binary file using fstream.
11	Develop a function which throws a division by zero exception and catch it in catch block. Write a C++ program to demonstrate usage of try, catch and throw to handle exception.
12	Develop a C++ program that handles array out of bounds exception using C++.

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	The Complete Reference C++	Herbert Schildt	4th	Tata McGraw Hill	2011

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	Object Oriented Programming with C++.	Balagurusamy E	6th	Tata McGraw Hill Education Pvt. Ltd	2018
2	Object Oriented Programming with C++.	Bhave	1st	Pearson Education	2005

E-Resources: E-books / Online Course materials / Online Courses / Video Lectures:

Sl. #	Type of E-Resource	URL
1	Multimedia E-Resource.	Basics of C++ - https://www.youtube.com/watch?v=BClS40yzssA
2	Video Lecture (Multimedia E-Resource).	Functions of C++ - https://www.youtube.com/watch?v=p8ehAjZWjPw
Tutorial Link:		
1	Web-Based Textual E-Resource	https://www.w3schools.com/cpp/cpp_intro.asp
2	Online Course (Archived)	https://www.edx.org/course/introduction-to-c-3
3	Online course web based	https://infyspringboard.onwingspan.com/web/en/app/toc/ lex_auth_0138436425067886443375_s hared/overview

COURSE OUTCOMES:

At the end of the Course, student will be able to:

CO #	Course Outcome Statement
CO1	Illustrate the basic concepts of object-oriented programming.
CO2	Design appropriate classes for the given real world scenario.
CO3	Apply the knowledge of compile-time / run-time polymorphism to solve the given problem.
CO4	Use the knowledge of inheritance for developing optimized solutions.
CO5	Apply the concepts of templates and exception handling for the given problem.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	1	2	-	-	1	1	-	2	3	1	1
CO2	3	3	3	1	2	-	-	2	2	1	2	3	2	2
CO3	3	3	3	2	2	-	-	2	2	1	2	3	3	2
CO4	3	2	3	2	3	-	1	1	1	1	2	3	3	1
CO5	3	2	3	2	3	-	-	2	2	1	2	3	2	2
AVG	3	2.6	2.8	1.6	2.4	-	1	1.6	1.6	1	2	3	2.2	1.6

Teaching-Learning Process (General Instructions):
These are sample strategies, which teachers can use to accelerate the attainment of the various course outcomes.
1. Chalk and board, power point presentations
2. Online material (Tutorials) and video lectures.
3. Demonstration of programing examples.

DATA ANALYTICS WITH R

Course Code	B24CI353	Total Contact Hours / Week	4	CIE Marks	50
Course Category	ESC	Total SAAE Hours / Semester	32	SEE Marks	50
L:T:P:S	2:0:2:0	Total Notional Learning Hours	90	Total Marks	100
Total Credits	3			Exam Duration	3 Hrs

COURSE LEARNING OBJECTIVES
1. To gain the knowledge of R Programming concepts.
2. To understand data exploration, cleaning process.
3. To understand machine instructions and programs.
4. To Work with R charts and Graphs.
5. To explain the concepts of statistics in R.

PREREQUISITES
• Foundational knowledge in statistics, programming basics, and data manipulation is highly recommended.

MODULE #	TOPICS	Hours
1	**Basics of R** Introducing R, Initiating R, Packages in R, Environments and Functions, Flow Controls, Loops, Basic Data Types in R, Vectors. **Chapter 1: 1.1 to 1.7 Chapter 2: 2.1, 2.2.**	**6**
2	**Basics of R Continued** Matrices and Arrays, Lists, Data Frames, Factors, Strings, Dates and Times. **Chapter 2: 2.3, 2.4, 2.5, 2.6, 2.7, 2.8.1, 2.8.2.**	**6**
3	**Basic Structure of Computers:** Functional Units, Basic Operational Concepts, Bus structure, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. **Machine Instructions and Programs:** Memory Location and Addresses, Memory Operations, Instruction and Instruction sequencing, Addressing Modes. **Chapter 3: 3.1, 3.2, 3.3, 3.4**	**6**
4	**Graphics using R** Exploratory Data Analysis, Main Graphical Packages, Pie Charts, Scatter Plots, Line Plots, Histograms, Box Plots, Bar Plots, Other Graphical packages. **Chapter 4: 4.1 to 4.9.**	**5**
5	**Statistical Analysis using R** Basic Statistical Measures, Normal distribution, Binomial distribution, Correlation Analysis, Regression Analysis-Linear Regression Analysis of Variance. **Chapter 5: 5.1, 5.3, 5.4, 5.5, 5.6.1, 5.7.**	**5**

PRACTICAL COMPONENT OF IPCC

Sl. No.	**Experiments** **Simulation packages preferred: Multisim, Modelsim, PSpice or any other relevant**
1	Demonstrate the steps for installation of R and R Studio. Perform the following: a) Assign different type of values to variables and display the type of variable. Assign different types such as Double, Integer, Logical, Complex and Character and understand the difference between each data type. b) Demonstrate Arithmetic and Logical Operations with simple examples. c) Demonstrate generation of sequences and creation of vectors. d) Demonstrate Creation of Matrices. e) Demonstrate the Creation of Matrices from Vectors using Binding Function. Demonstrate element extraction from vectors, matrices and arrays.
2	Assess the Financial Statement of an Organization being supplied with 2 vectors of data: Monthly Revenue and Monthly Expenses for the Financial Year. You can create your own sample data vector for this experiment) Calculate the following financial metrics: a) Profit for each month. b) Profit after tax for each month (Tax Rate is 30%). c) Profit margin for each month equals to profit after tax divided by revenue. d) Good Months – where the profit after tax was greater than the mean for the year. e) Bad Months – where the profit after tax was less than the mean for the year. f) The best month – where the profit after tax was max for the year. g) The worst month – where the profit after tax was min for the year. **Note:** a) All Results need to be presented as vectors. b) Results for Dollar values need to be calculated with \$0.01 precision, but need to be presented in Units of \$1000 (i.e 1k) with no decimal points. c) Results for the profit margin ratio need to be presented in units of % with no decimal point.. d) It is okay for tax to be negative for any given month (deferred tax asset) Generate CSV file for the data.
3	Develop a program to create two 3 X 3 matrices A and B and perform the following operations a) Transpose of the matrix b) addition c) subtraction d) multiplication.
4	Develop a program to find the factorial of given number using recursive function calls.
5	Develop an R Program using functions to find all the prime numbers up to a specified number by the method of Sieve of Eratosthenes.
6	The built-in data set mammals contain data on body weight versus brain weight. Develop R commands to: a) Find the Pearson and Spearman correlation coefficients. Are they similar? b) Plot the data using the plot command. Plot the logarithm (log) of each variable and see if that makes a difference.

7	Develop R program to create a Data Frame with following details and do the following operations.

itemCode	itemCategory	itemPrice
1001	Electronics	700
1002	Desktop Supplies	300
1003	Office Supplies	350
1004	USB	400
1005	CD Drive	800

a) Subset the Data frame and display the details of only those items whose price is greater than or equal to 350.
b) Subset the Data frame anddisplay only the items where the category is either "Office Supplies" or "Desktop Supplies".
c) Create another Data Frame called "item-details" with three different fields itemCode, ItemQtyonHand and ItemReorderLvl and merge the two frames.

8	Let us use the built-in dataset air quality which has Daily air quality measurements in New York, May to September 1973. Develop R program to generate histogram by using appropriate arguments for the following statements. a) Assigning names, using the air quality data set. b) Change colors of the Histogram. c) Remove Axis and Add labels to Histogram. d) Change Axis limits of a Histogram. Add Density curve to the histogram.

9	Design a data frame in R for storing about 20 employee details. Create a CSV file named "input.csv" that defines all the required information about the employee such as id, name, salary, start_date, dept. Import into R and do the following analysis. a) Find the total number rows & columns. b) Find the maximum salary. c) Retrieve the details of the employee with maximum salary. d) Retrieve all the employees working in the IT Department. Retrieve the employees in the IT Department whose salary is greater than 20000 and write these details into another file "output.csv".

10	Using the built in dataset mtcars which is a popular dataset consisting of the design and fuel consumption patterns of 32 different automobiles. The data was extracted from the 1974 Motor Trend US magazine, and comprises fuel consumption and 10 aspects of automobile design and performance for 32 automobiles (1973-74 models). Format A data frame with 32 observations on 11 variables : [1] mpg Miles/(US) gallon, [2] cyl Number of cylinders [3] disp Displacement (cu.in.), [4] hp Gross horsepower [5] drat Rear axle ratio,[6] wt Weight (lb/1000) [7] qsec 1/4 mile time, [8] vs V/S, [9] am Transmission (0 = automatic, 1 = manual), [10] gear Number of forward gears, [11] carb Number of carburetors. Develop R program, to solve the following: a) What is the total number of observations and variables in the dataset? b) Find the car with the largest hp and the least hp using suitable functions c) Plot histogram / density for each variable and determine whether continuous variables are normally distributed or not. If not, what is their skewness? d) What is the average difference of gross horse power(hp) between automobiles with 3 and 4 number of cylinders(cyl)? Also determine the difference in their standard deviations. Which pair of variables has the highest Pearson correlation?

11	Demonstrate the progression of salary with years of experience using a suitable data set (You can create your own dataset). Plot the graph visualizing the best fit line on the plot of the given data points. Plot a curve of Actual Values vs. Predicted values to show their correlation and performance of the model. Interpret the meaning of the slope and y-intercept of the line with respect to the given data. Implement using lm function. Save the graphs and coefficients in files. Attach the predicted values of salaries as a new column to the original data set and save the data as a new CSV file.

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	R Programming: An Approach to Data Analytics	G. Sudhamathy and C. Jothi Venkateswaran	-	MJP Publishers	2019

REFERENCE BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	An Introduction to R, Notes on R: A Programming Environment for Data Analysis and Graphics.	W. N. Venables, D.M. Smith	-	Core Team. Version	2013
2	Learning R: A Step by Step Function Guide to Data Analysis	Cotton R.	1st	O'Reilly Media Inc.	2013

E-Resources: E-books / Online Course materials / Online Courses / Video Lectures:

Sl. #	Type of E-Resource	URL
1	Video Lectures	https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf
2	Video Lectures	http://www.tutorialspoint.com/r/r_tutorial.pdf
3	Video Lectures	https://users.phhp.ufl.edu/rlp176/Courses/PHC6089/R_notes/intro.html
4	Video Lectures	https://cran.r- project.org/web/packages/explore/vignettes/explore_mtcars.html
5	Video Lectures	https://www.w3schools.com/r/r_stat_data_set.asp
6	Web links	https://rpubs.com/BillB/217355

COURSE OUTCOMES:

At the end of the Course, student will be able to:

CO #	Course Outcome Statement
CO1	Describe the structures of R programming examples.
CO2	Illustrate the basics of data preparation with real world examples.
CO3	Design and implement machine instructions and programs.
CO4	Apply the graphical packages of R for visualization.
CO5	Apply various statistical analysis methods for data analytics.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	1	2	-	-	2	2	2	2	-
CO2	3	3	3	2	3	1	2	-	-	2	2	2	2	-
CO3	3	3	3	2	3	1	2	-	-	2	2	2	2	2
CO4	3	3	3	2	3	1	2	-	2	2	2	2	2	-
CO5	3	3	3	2	3	1	2	-	2	2	2	2	2	-
AVG	3	3	3	2	3	1	2	-	2	2	2	2	2	2

Teaching-Learning Process
Pedagogy (General Instructions):

1. Chalk and board, power point presentations
2. Online material (Tutorials) and video lectures.
3. Demonstration of programing examples.

PYTHON PROGRAMMING FOR DATA SCIENCE

Course Code	B24AD354	Total Contact Hours / Week	4	CIE Marks	50
Course Category	ESC	Total SAAE Hours / Semester	32	SEE Marks	50
L:T:P:S	2:0:2:0	Total Notional Learning Hours	90	Total Marks	100
Total Credits	3			Exam Duration	3 Hrs

Note - Students who have undergone " Introduction to Python Programming-BPLCK105B/205B" in first year are not eligible to opt this course.
COURSE LEARNING OBJECTIVES
1. To understand Python looping, conditional & Functions constructs to build programs.
2. Illustrate the process of structuring the data using lists, tuples, dictionaries.
3. To learn and demonstrate array manipulations by reading data from files.
4. Demonstrate the use of built in functions to navigate the file system.
5. Appraise the need for working with various documents like excel, pdf, word & others.

PREREQUISITES
• Students should be familiarized about Python installation and setting Python environment.
• Usage of IDLE or IDE like PyCharm should be introduced Python Installation: https://www.youtube.com/watch?v=Kn1HF3oD19c
• PyCharm Installation: https://www.youtube.com/watch?v=SZUNUB6nz3g

MODULE #	TOPICS	Hours
1	**Introduce the Python fundamentals**: **Flow control**: Flow control Statements, Importing Modules, Ending a Program Early with sys.exit(), **Functions:** def Statements with Parameters, Return Values and return Statements, The None Value, Keyword Arguments and print(), Local and Global Scope, The global Statement, Exception Handling. **Lists:** The List Data Type, working with Lists, Augmented Assignment Operators, Methods, List-like Types: Strings and Tuples, References **Textbook 1: Chapters 2-4**	**6**
2	**Dictionaries and Structuring Data**: The Dictionary Data Type, Pretty Printing, Using Data Structures to Model Real-World Things **Manipulating Strings:** Working with Strings, Useful String Methods, Project: Password Locker, Project: Adding Bullets to Wiki Markup **Reading and Writing Files:** Files and File Paths, The os.path Module, The File Reading / Writing Process, Saving Variables with the shelve Module, Saving Variables with the print.format() Function, Project: Generating Random Quiz Files, Project: Multiclipboard **Textbook 1: Chapters 5,6 & 8**	**6**
3	**The NumPy Library**: Ndarray: the heart of the library, Basic operations, indexing, slicing and iterating, conditions and boolean arrays, array manipulation, general concepts, reading and writing array data on files.	**6**

	The pandas Library: an introduction to Data structure, other functionalities on indexes, operations between data structures, function application and mapping **Pandas in Depth:** data manipulation: data preparation, concatenating data transformation discretization binning, permutation, string manipulation, data aggregation group iteration. **Text Book 2: Chapter 3 ,4 & 6.**	
4	**Organizing Files:** The shutil Module, walking a Directory Tree, Compressing Files with the zipfile Module, Project: Renaming Files with American-Style Dates to European-Style Dates, Project: Backing Up a Folder into a ZIP File, **Debugging:** Raising Exceptions, Getting the Traceback as a String, Assertions, Logging, IDLE‟s Debugger. **Web Scraping: Project:** MAPIT.PY with the web browser Module, Downloading Files from the Web with the requests Module, Saving Downloaded Files to the Hard Drive, HTML, Parsing HTML with the Beautiful Soup Module. **Textbook 1: Chapters 9-11**	**5**
5	**Working with Excel Spreadsheets,** Excel Documents, Installing the openpyxl Module, Reading Excel Documents **Working with PDF and Word Documents,** PDF Documents, **Working with CSV files and JSON data,** The csv Module. **Textbook 1: Chapters 12 – 14**	**5**

Practical Component:

Sl. No.	List of problems for which student should develop program and execute in the Laboratory

1	**Aim:** Introduce the Python fundamentals, data types, operators, flow control and exception handling in Python
	    a) Write a python program to find the best of two test average marks out of three test's marks accepted from the user.
	    b) Develop a Python program to check whether a given number is palindrome or not and also count the number of occurrences of each digit in the input number.
	Datatypes: https://www.youtube.com/watch?v=gCCVsvgR2KU
	Operators: https://www.youtube.com/watch?v=v5MR5JnKcZI
	Flow Control: https://www.youtube.com/watch?v=PqFKRqpHrjw
	For loop: https://www.youtube.com/watch?v=0ZvaDa8eT5s
	While loop: https://www.youtube.com/watch?v=HZARImviDxg
	Exceptions: https://www.youtube.com/watch?v=6SPDvPK38tw

2	**Aim:** Demonstrating creation of functions, passing parameters and return values
	    a) Defined as a function F as Fn = Fn-1 + Fn-2. Write a Python program which accepts a value for N (where N >0) as input and pass this value to the function. Display suitable error message if the condition for input value is not followed.
	    b) Develop a python program to convert binary to decimal, octal to hexadecimal using functions.
	Functions: https://www.youtube.com/watch?v=BVfCWuca9nw
	Arguments: https://www.youtube.com/watch?v=ijXMGpoMkhQ
	Return value: https://www.youtube.com/watch?v=nuNXiEDnM44

3	**Aim:** Discuss different collections like list, tuple and dictionary
	    a) Write a python program to implement insertion sort and merge sort using lists
	    b) Write a program to convert roman numbers in to integer values using dictionaries.
	Lists: https://www.youtube.com/watch?v=Eaz5e6M8tL4

	List methods: https://www.youtube.com/watch?v=8-RDVWGktuI Tuples: https://www.youtube.com/watch?v=bdS4dHIJGBc Tuple operations: https://www.youtube.com/watch?v=TItKabcTTQ4 Dictionary: https://www.youtube.com/watch?v=4Q0pW8XBOkc Dictionary methods: https://www.youtube.com/watch?v=oLeNHuORpNY

4	**Aim:** Demonstration of reading, writing and organizing files.
	     a) Write a python program to accept a file name from the user and perform the following operations
	         1. Display the first N line of the file
	         2. Find the frequency of occurrence of the word accepted from the user in the file
	     b) Write a python program to create a ZIP file of a particular folder which contains several files inside it.
	 Files: https://www.youtube.com/watch?v=vuyb7CxZgbU
	 https://www.youtube.com/watch?v=FqcjKewJTQ0
	 File organization: https://www.youtube.com/watch?v=MRuq3SRXses

5	**Aim:** Demonstration of working with Data Frames and Series. Load data from CSV, Excel, and JSON files.
	     a) Perform operations like grouping, aggregation, merging, filtering, and pivoting
	     b) Handle missing values and perform data cleaning tasks.
	 https://www.youtube.com/watch?v=F08ZiZzcyf0

6	**Aim:** Demonstration of working with The json Module. a) Removing Headers from CSV, Handling JSON & APIs, and Using the json Module in Python. https://www.youtube.com/watch?v=9N6a-VLBa2I https://www.youtube.com/watch?v=bHiiTWn2Kd4
7	**Aim:** Demonstration of working with **web scraping** a) Write a Python program that uses **web scraping** techniques to extract and display the **top news headlines** from a major online news website https://www.youtube.com/watch?v=8dTpNajxaH0
8	**Aim:** Demonstration of working with excel spreadsheets a) Updating a Spreadsheet, Setting the Font Style of Cells, Font Objects, Formulas, Adjusting Rows and Columns, Charts.

9	**Aim:** Demonstration of working with excel spreadsheets
	     a) Write a python program to download the all XKCD comics
	     b) Demonstrate python program to read the data from the spreadsheet and write the data in to the spreadsheet
	 Web scraping: https://www.youtube.com/watch?v=ng2o98k983k
	 Excel: https://www.youtube.com/watch?v=nsKNPHJ9iPc

10	**Aim:** Demonstration of working with PDF, word and JSON files
	     a) Write a python program to combine select pages from many PDFs, word documents.
	     b) Write a python program to fetch current weather data from the JSON file.
	 PDFs:
	 https://www.youtube.com/watch?v=q70xzDG6nls
	 https://www.youtube.com/watch?v=JhQVD7Y1bsA
	 https://www.youtube.com/watch?v=FcrW-ESdY-A
	 Word files: https://www.youtube.com/watch?v=ZU3cSl51jWE
	 JSON files: https://www.youtube.com/watch?v=9N6a-VLBa2I

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	Python Data Analytics	Fabio Nelli	1st	A press Publishing	2015
2	Automate the Boring Stuff with python	AL Sweigart	-	No Starch Press	2015

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	Introduction to Python for Computer Science and Data Science	Paul Deitel and Harvey Deitel	I	Pearson Publisher	2020

E-Resources: E-books / Online Course materials / Online Courses / Video Lectures:

Sl. #	Type of E-Resource	URL
1	Nptel: Introduction to Python for Data Science	https://www.youtube.com/watch?v=tA42nHmmEKw&list=PLh2mXjKc TPSACrQxPM2_1Ojus 5HX88ht7
2	Python (Full Course)	https://www.youtube.com/watch?v=_uQrJ0TkZlc

COURSE OUTCOMES:

At the end of the Course, student will be able to:

CO #	Course Outcome Statement
CO1	Use looping, conditional & Functions constructs to build programs.
CO2	Identify the methods to create and manipulate lists, tuples and dictionaries.
CO3	Use the NumPy & Panda constructs for data analytics.
CO4	Develop programs for file organization & need for scraping websites.
CO5	Determine working with CSV, JSON and other file formats.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	1	2	-	1	2	2	1	2	3	2	1
CO2	2	3	2	1	2	-	1	2	2	1	2	3	2	1
CO3	3	2	3	2	3	1	1	2	3	2	3	3	3	3
CO4	2	2	3	3	3	2	2	2	2	2	3	3	2	2
CO5	3	2	3	2	3	1	2	2	2	2	3	3	2	2
AVG	2.6	2.4	2.6	1.8	2.6	1.3	1.4	2	2.2	1.6	2.6	3	2.2	1.8

Teaching-Learning Process (General Instructions):

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Chalk and board, power point presentations.

2. Online material (Tutorials) and video lectures.

3. Demonstration of programing examples.

SOCIAL CONNECT AND RESPONSIBILITY

Course Code	B24SCK36	**Total Contact Hours / Week**	2	**CIE Marks**	100
Course Category	UHV	**Total SAAE Hours / Semester**	-	**SEE Marks**	-
L:T:P:S	0:0:2:0	**Total Notional Learning Hours**	-	**Total Marks**	100
Total Credits	0			**Exam Duration**	-

COURSE LEARNING OBJECTIVES
1. Provide a formal platform for students to communicate and connect to the surrounding.
2. Create a responsible connection with the society.
3. Understand the community in general in which they work.
4. Identify the needs and problems of the community and involve them in problem –solving.
5. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
6. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

PREREQUISITES
NIL

MODULE #	TOPICS	Hours
1	**Plantation and adoption of a tree:** Plantation of a tree that will be adopted for four years by a group of BE / B.Tech students. (ONE STUDENT ONE TREE) They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, its appearance in folklore and literature - – Objectives, Visit, case study, report, outcomes.	**3**
2	**Heritage walk and crafts corner:** Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms - – Objectives, Visit, case study, report, outcomes.	**3**
3	**Organic farming and waste management:** Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus – Objectives, Visit, case study, report, outcomes.	**3**
4	**Water conservation:** Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photoblog presenting the current practices – Objectives, Visit, case study, report, outcomes.	**3**
5	**Food walk:** City's culinary practices, food lore, and indigenous materials of the region used in cooking – Objectives, Visit, case study, report, outcomes.	**3**

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
NOT APPLICABLE					

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
NOT APPLICABLE					

E-Resources: E-books / Online Course materials / Online Courses / Video Lectures:

Sl. #	Type of E-Resource	URL
1	e-Book	https://www.intechopen.com/books/6630
2	e-Book	https://www.amazon.in/Social-Responsibility-Sustainability-Multidisciplinary-Perspectives-ebook/dp/B015YFJ9FW
3	Online course	https://www.coursera.org/courses?query=social%20responsibility
4	Online course	https://onlinecourses.nptel.ac.in/noc24_mg86/preview

COURSE OUTCOMES:

At the end of the Course, student will be able to:

CO #	Course Outcome Statement
CO1	Communicate and connect to the surrounding.
CO2	Create a responsible connection with the society.
CO3	Involve in the community in general in which they work.
CO4	Notice the needs and problems of the community and involve them in problem –solving.
CO5	Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
CO6	Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	3	3	3	3	3	3	-	-	-
CO2	-	-	-	-	-	3	3	3	3	3	3	-	-	-
CO3	-	-	-	-	-	3	3	3	3	3	3	-	-	-
CO4	-	-	-	-	-	3	3	3	3	3	3	-	-	-
CO5	-	-	-	-	-	3	3	3	3	3	3	-	-	-
AVG	-	-	-	-	-	3	3	3	3	3	3	-	-	-

Teaching-Learning Process

Pedagogy (General Instructions):

These are sample strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1) In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied social and cultural skills.

2) State the need for activities and its present relevance in the society and Provide real-life examples.

3) Support and guide the students for self-planned activities.

4) You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.

5) Encourage the students for group work to improve their creative and analytical skills.

PEDAGOGY: The pedagogy will include interactive lectures, inspiring guest talks, field visits, social immersion, and a course project. Applying and synthesizing information from these sources to define the social problem to address and take up the solution as the course project, with your group. Social immersion with NGOs/social sections will be a key part of the course. Will all lead to the course project that will address the needs of the social sector.

Pedagogy – Guidelines: It may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.

Module	Topic	Content	Group Size	Location	Magnitude	Activity	Reporting
1	Plantation and adoption of a tree	Plantation of a tree that will be adopted for four years by a group of B.Tech. students. They will also make an excerpt either as a documentary or a photoblog describing the plant's origin, its usage in daily life, and its appearance in folklore and literature.	03 – 05	Farmers Land or Road side or Community area or institution's campus, any one location to be selected.	One Students must monitor it for three years	Site selection Select suitable species in consultation with horticulture, forest or agriculture department. Interact with NGO / Industry and community to plant Tag the plant for continuous monitoring	Report shall be handwritten or blog with paintings, sketches, poster, video and/or photograph with Geo tag.
2	Heritage walk and crafts corner	Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photoblog and documentary on	03 – 05	Preferably Within the city where institution is located or home town of the student group	One or two One can be a structure or a heritage building the other can be heritage custom or practise	Survey in the form of questioner by connecting to the people and asking. No standard questioner to be given by faculty and has to be evolved involving	

		evolution and practice of various craft forms.				students. Questions during survey can be asked in local language but report language is English.
3	Waste management	Wet waste management in neighbouring villages, and implementation in the campus.	03 - 05 More than one group can be assigned one task based on magnitude of task.	Preferably in the nearby villages and within the campus.	One	Report on importance and benefits of Waste management. Report on segregation, collection, transportation and disposal. Suggestion for composting. Visit nearby village/location to sensitize farmers and public about waste management and also document current practises.
4	Organic farming	Usefulness of organic farming in neighbouring villages, and implementation in the campus.	03 – 05	Visit to farming lands where organic farming is going on Campus Garden Roof top Garden or Vertical Garden or hydroponics if land is scarce.	One	Collect data on organic farming in the vicinity. Like types of crop, methodology etc.. Suggestion for implementation at selected locations
5	Food Walk	City's culinary practices, food lore, and indigenous materials of the region used in cooking.	03 – 05	Within the city where institution is located Food culture of student's resident region	One	Survey local food centres and identify the speciality Identify and study the food ingredients Report on the regional foods Report on Medicinals values of the local food grains, and plants.

Assessment Details (only CIE):

After completion of the course, the student shall prepare, with daily diary as reference, a comprehensive report in consultation with the mentor/s to indicate what he has observed and learned in the social connect period. The report should be signed by the mentor. The report shall be evaluated on the basis of the following criteria and/or other relevant criteria pertaining to the activity completed. Marks allotted for the diary are out of 50. Planning and scheduling the social connect Information / Data collected during the social connect Analysis of the information / data and report writing Considering all above points allotting the marks as mentioned below

  i)   Excellent: 80 to 100

  ii)   Good: 60 to 79

  iii)   Satisfactory: 40 to 59

  iv)   Unsatisfactory and fail : <39

Plan of Action (Execution of Activities)

SL. #	Practice Session Description
1	Lecture session in field to start activities
2	Students Presentation on Ideas
3	Commencement of activity and its progress
4	Execution of Activity
5	Execution of Activity
6	Execution of Activity
7	Execution of Activity
8	Case study based Assessment, Individual performance
9	Sector/ Team wise study and its consolidation
10	Video based seminar for 10 minutes by each student At the end of semester with Report.

- Each student should do activities according to the scheme and syllabus.

- At the end of semester student performance has to be evaluated by the faculty for the assigned activity progress and its completion.

- At last consolidated report of all activities from 1st to 5th, compiled report should be submitted as per the instructions and scheme.

Assessment Details for CIE

Weightage	CIE – 100%	- Implementation strategies of the project (NSS work). - The last report should be signed by NSS Officer, the HOD and principal. - At last report should be evaluated by the NSS officer of the institute. - Finally the consolidated marks sheet should be sent to the university and also to be made available at LIC visit.
Field Visit, Plan, Discussion	10 Marks	
Commencement of activities and its progress	20 Marks	
Case study based Assessment Individual performance with report	20 Marks	
Sector wise study & its consolidation 5*5 = 25	25 Marks	
Video based seminar for 10 minutes by each student at the end of semester with Report. Activities 1 to 5, 5*5 = 25	25 Marks	
Total marks for the course in each semester	**100 Marks**	

For each activity, 20 marks CIE will be evaluated for IA marks at the end of semester, Report and assessment copy should be made available in the department.

Students should present the progress of the activities as per the schedule in the prescribed practical session in the field. There should be positive progress in the vertical order for the benefit of society in general through activities.

DATA ANALYTICS WITH EXCEL

Course Code	B24CS371	Total Contact Hours / Week	2	CIE Marks	50
Course Category	AEC	Total SAAE Hours / Semester	0	SEE Marks	50
L:T:P:S	0:0:2:0	Total Notional Learning Hours	30	Total Marks	100
Total Credits	1			Exam Duration	3 Hrs

COURSE LEARNING OBJECTIVES
1. Develop proficiency in using Excel for performing basic to advanced data operations, functions, and formulae.
2. Enable students to analyse and visualize data effectively using various charting tools and pivot tables.
3. Apply logical and conditional functions to solve real-life decision-making problems in data.
4. Explore advanced data handling and analysis features such as lookup functions, conditional formatting, scenario analysis, and data referencing.

PREREQUISITES
• Analytical Thinking
• Mathematical Reasoning

Sl. No	Experiments
1	Perform the following basic EXCEL functions. a) Mathematical operations with functions (SUM, COUNT, MAXIMUM, ROUND) and without functions. b) Logical functions like IF, AND, OR, NOT. c) Mischalleneous functions like RAND, ISBLANK, COUNTIF). d) Additional Excel tricks (paste special -leaving blank fields, transpose rows & columns and paste).
2	Create cells with different Data Formats and apply all the conditional formatting options.
3	Consider Employee Data which consists of the fields- Employee id, Department Name, Employee Name, Date of Joining. Perform advanced data sorting including a) Filtering options. b) Date filtering. c) Filtering into different sheet. d) Custom sorting.
4	Consider Students data with the fields Name, Test1, Test2, Test3 and Total. a) Highlight the students who have scored more than 80 in Test2. b) Display Students who scored below average marks in Test1. c) Show Data Bars for Test2. d) Insert different icons for i) total >200 ii) total between 180 & 200 iii) total<180. e) For students who missed 2 or more test than assign a D and show alert icon.

5	Consider Personal Data with the following fields – First Name, Last Name, DOB, State Zip, Description, and Region. Apply the following text formulas: a) Merge First Name and Last Name into Full Name. b) Use SEARCH and LEFT/MID to extract specific substrings. c) Use RIGHT and LEN to extract Last Name from Full Name. d) Format date using the DATE function. e) Use MID and - to extract patterns (e.g., from 'California/west:276', extract 'west'). f) Demonstrate Absolute, Relative, and Mixed Cell Referencing.
6	Consider a Sales Data with the following fields Month, sales- Product1, sales-product2. a) Perform a VLOOKUP and HLOOKUP operations (Ex.- lookup product1 sales and copy in another table).
7	Consider an employee sales data in several months. a) Apply INDEX and MATCH formulas to lookup sales values of employees in different months. b) Apply Text to column Field to delimit with special characters, custom pattern. Perform nested MATCH function and other advance functions.
8	Consider a customer sales order (large data set). Use Pivot table to a) Check total sales by region. b) Filter data to focus on specific products/order method.
9	Consider a Retail Sales dataset containing Order ID, Date, Region, Product Category, Sales Amount, Quantity, and Sales Representative. Create an interactive dashboard to provide managerial insights: a) Use Pivot Charts, Slicers, and Timeline Filters. b) Show total sales by Region, Top Products, and monthly trends. c) Arrange all components in a single dashboard view.
10	10. Perform What-If Analysis using PMT formula and Scenario Manager on loan details: a) Analyse how varying Loan Amount, Interest Rate, and Time Period affect monthly EMI. b) Create at least three scenarios and compare results visually.
11	Consider a raw Excel file with quarterly sales data from different branches. The data includes merged cells, inconsistent date formats, and null values. Use Power Query to restructure and clean the data: a) Remove merged cells and fill down missing values. b) Standardize date formats. c) Unpivot quarterly columns for normalized analysis. d) Merge/append tables if needed.
12	Consider a monthly sales report containing sales data of different products. The file includes columns such as Product Name, Sales Amount, Region, and Month. Automate formatting using Macros. a) Highlight sales above ₹50,000 using conditional formatting. b) Adjust column widths for all columns. c) Insert a summary table to calculate Total and Average sales per report. d) Record the macro and assign it to a command button for reuse.

PRESCRIBED MATERIAL

Sl. #	Type of E-Resource	URL
1	Online Course	TechA Microsoft Excel for Data Analysts Certification https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0138 37497517228032590_shared/overview

COURSE OUTCOMES:

At the end of the Course, student will be able to:

CO #	Course Outcome Statement
CO1	Demonstrate the use of basic Excel functions including mathematical, logical, and text-based operations.
CO2	Apply formatting techniques and data visualization tools (charts and graphs) to interpret and present data effectively.
CO3	Perform data sorting, filtering, and apply conditional formatting to extract meaningful insights from structured datasets.
CO4	Utilize advanced Excel functions and tools like VLOOKUP, HLOOKUP, INDEX, MATCH, Pivot Tables, Power Query, and Macros for efficient data handling and analysis.
CO5	Conduct What-If analysis and financial modeling using PMT, Scenario Manager, and other relevant functions to support business decision-making.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	-	-	-	-	-	-	1	1	-
CO2	2	2	2	3	2	-	-	-	-	-	-	1	1	-
CO3	2	2	3	3	2	-	-	-	-	-	-	1	1	-
CO4	2	2	3	3	2	-	-	-	-	-	-	1	1	-
CO5	2	2	3	3	2	-	-	-	-	-	-	1	1	-
AVG	2	2	2.6	2.8	2	-	-	-	-	-	-	1	1	-

Teaching-Learning Process

Pedagogy (General Instructions):

1. Outcome-Based Education (OBE)	— Emphasizes defining and achieving measurable learning outcomes, aligning course objectives with program outcomes and graduate attributes.
2. Active Learning	— Involves students actively in the learning process through activities like problem-solving, discussions, and group tasks rather than passive listening.
3. Blended Learning	— Combines traditional classroom instruction with digital platforms such as Springboard for a more flexible and engaging learning experience.
4. Project-Based Learning (PBL)	— Encourages students to apply concepts in real-world projects, fostering creativity, innovation, and teamwork.
5. Experiential Learning	— Provides hands-on experience through labs, simulations, industry internships, and workshops to connect theory with practice.
6. ICT-Enabled Teaching	— Leverages smart tools, learning management systems, programming environments, and multimedia content for enhanced delivery.
7. Continuous Assessment and Feedback	— Implements regular formative assessments and feedback mechanisms to monitor and support student progress.

R PROGRAMMING

Course Code	B24IS372	Total Contact Hours / Week	2	CIE Marks	50
Course Category	AEC	Total SAAE Hours / Semester	-	SEE Marks	50
L:T:P:S	0:0:2:0	Total Notional Learning Hours	30	Total Marks	100
Total Credits	1			Exam Duration	3 Hrs

COURSE LEARNING OBJECTIVES
1. To explore and understand how R and R Studio interactive environment.
2. To understand the different data Structures, data types in R.
3. To learn and practice programming techniques using R programming.
4. To import data into R from various data sources and generate visualizations.
5. To draw insights from datasets using data analytics techniques.

PREREQUISITES
• Familiarity with using a computer, navigating files, and installing software.
• A foundational knowledge of statistical concepts Such as mean, median, standard deviation, etc.
• Understanding basic data structures such as vectors, lists, matrices, and data frames.
• Some exposure to programming concepts like variables, Data Types, loops, and conditionals.

Sl. No.	Experiments
1	Demonstrate the steps for installation of R and R Studio. Perform the following: a) Assign different type of values to variables and display the type of variable. Assign different types such as Double, Integer, Logical, Complex and Character and understand the difference between each data type. b) Demonstrate Arithmetic and Logical Operations with simple examples. c) Demonstrate generation of sequences and creation of vectors. d) Demonstrate Creation of Matrices e) Demonstrate the Creation of Matrices from Vectors using Binding Function. f) Demonstrate element extraction from vectors, matrices and arrays **Text Book 1: Chapter 1, 2 and 3.**
2	Assess the Financial Statement of an Organization being supplied with 2 vectors of data: Monthly Revenue and Monthly Expenses for the Financial Year. You can create your own sample data vector for this experiment) Calculate the following financial metrics: a. Profit for each month. b. Profit after tax for each month (Tax Rate is 30%). c. Profit margin for each month equals to profit after tax divided by revenue. d. Good Months – where the profit after tax was greater than the mean for the year. e. Bad Months – where the profit after tax was less than the mean for the year. f. The best month – where the profit after tax was max for the year. g. The worst month – where the profit after tax was min for the year. **Note:** a. All Results need to be presented as vectors b. Results for Dollar values need to be calculated with $0.01 precision, but need to be presented in Units of $1000 (i.e 1k) with no decimal points

	c. Results for the profit margin ratio need to be presented in units of % with no decimal point. d. It is okay for tax to be negative for any given month (deferred tax asset) e. Generate CSV file for the data. **Text Book 1: Chapter 4.**
3	Develop a program to create two 3 X 3 matrices A and B and perform the following operations a) Transpose of the matrix b) addition c) subtraction d) multiplication **Text Book 1: Chapter 4.**
4	Develop a program to find the factorial of given number using recursive function calls. **Text Book 1: Chapter 8 and Chapter 6.** **Reference Book 1: Chapter 5 (5.5).**
5	Develop an R Program using functions to find all the prime numbers up to a specified number by the method of Sieve of Eratosthenes. **Text Book 1: Chapter 6 8.** **Reference Book 1: Chapter 5 (5.5).**
6	The built-in data set mammals contain data on body weight versus brain weight. Develop R commands to: a) Find the Pearson and Spearman correlation coefficients. Are they similar? b) Plot the data using the plot command. c) Plot the logarithm (log) of each variable and see if that makes a difference. **Text Book 1: Chapter 12 and 14.** **Reference Book 2: Chapter 13 (13.2.5).**
7	Develop R program to create a Data Frame with following details and do the following operations. | itemCode	itemCategory	itemPrice
---	---	---
1001	Electronics	700
1002	Desktop Supplies	300
1003	Office Supplies	350
1004	USB	400
1005	CD Drive	800	 a) Subset the Data frame and display the details of only those items whose price is greater than or equal to 350. b) Subset the Data frame and display only the items where the category is either "Office Supplies" or "Desktop Supplies" c) Create another Data Frame called "item-details" with three different fields itemCode, ItemQtyonHand and ItemReorderLvl and merge the two frames. **Textbook 1: Chapter 5.**
8	Let us use the built-in dataset air quality which has Daily air quality measurements in New York, May to September 1973. Develop R program to generate histogram by using appropriate arguments for the following statements. a) Assigning names, using the air quality data set. b) Change colors of the Histogram c) Remove Axis and Add labels to Histogram d) Change Axis limits of a Histogram e) Add Density curve to the histogram **Reference Book 2: Chapter 7 (7.4) and 24.**

9	Design a data frame in R for storing about 20 employee details. Create a CSV file named "input.csv" that defines all the required information about the employee such as id, name, salary, start_date, dept. Import into R and do the following analysis. a) Find the total number rows & columns b) Find the maximum salary c) Retrieve the details of the employee with maximum salary d) Retrieve all the employees working in the IT Department. e) Retrieve the employees in the IT Department whose salary is greater than 20000 and write these details into another file "output.csv" **Text Book 1: Chapter 12.**
10	Using the built in dataset mtcars which is a popular dataset consisting of the design and fuel consumption patterns of 32 different automobiles. The data was extracted from the 1974 Motor Trend US magazine, and comprises fuel consumption and 10 aspects of automobile design and performance for 32 automobiles (1973-74 models). Format A data frame with 32 observations on 11 variables : [1] mpg Miles/(US) gallon, [2] cyl Number of cylinders [3] disp Displacement (cu.in.), [4] hp Gross horsepower [5] drat Rear axle ratio,[6] wt Weight (lb/1000) [7] qsec 1/4 mile time, [8] vs V/S, [9] am Transmission (0 = automatic, 1 = manual), [10] gear Number of forward gears, [11] carb Number of carburetors Develop R program, to solve the following: a) What is the total number of observations and variables in the dataset? b) Find the car with the largest hp and the least hp using suitable functions c) Plot histogram / density for each variable and determine whether continuous variables are normally distributed or not. If not, what is their skewness? d) What is the average difference of gross horse power(hp) between automobiles with 3 and 4 number of cylinders(cyl)? Also determine the difference in their standard deviations. e) Which pair of variables has the highest Pearson correlation? **References (Web links):** 1. https://cran.r-project.org/web/packages/explore/vignettes/explore_mtcars.html 2. https://www.w3schools.com/r/r_stat_data_set.asp 3. https://rpubs.com/BillB/217355
11	Demonstrate the progression of salary with years of experience using a suitable data set (You can create your own dataset). Plot the graph visualizing the best fit line on the plot of the given data points. Plot a curve of Actual Values vs. Predicted values to show their correlation and performance of the model. Interpret the meaning of the slope and y-intercept of the line with respect to the given data. Implement using lm function. Save the graphs and coefficients in files. Attach the predicted values of salaries as a new column to the original data set and save the data as a new CSV file. **Reference Book 2: Chapter 20.**

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	Learning R: A Step by Step Function Guide to Data Analysis	Cotton, R	1st	O'Reilly Media Inc.	2013

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	Introduction to Scientific Programming and Simulation using R.	Jones, O, Maillardet. R. and Robinson, A	2nd	CRC Press	2014
2	The Book of R: A First Course in Programming and Statistics.	Tilman M Davies	-	No Starch Press	2016

E-Resources: E-books / Online Course materials / Online Courses / Video Lectures:

Sl. #	Type of E-Resource	URL
1	Video Lecture	https://www.youtube.com/watch?v=Q5g6lYUn6Q4&pp=0gcJCdgAo7VqN5tD
2	Video Lecture	https://www.youtube.com/watch?v=ZYdXI1GteDE

COURSE OUTCOMES:

At the end of the Course, student will be able to:

CO #	Course Outcome Statement
CO1	Explain the fundamental syntax of R data types, expressions and the usage of the R-Studio IDE
CO2	Develop a program in R with programming constructs: conditionals, looping and functions.
CO3	Apply the list and data frame structure of the R programming language.
CO4	Use visualization packages and file handlers for data analysis..

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	2	-	-	3	-	-
CO2	3	3	2	1	-	-	-	-	2	-	-	3	2	-
CO3	3	3	2	2	-	-	-	-	2	-	-	2	2	-
CO4	3	3	3	3	2	-	-	-	3	-	2	3	3	-
AVG	3	2.75	2	2	2	-	-	-	2.25	-	2	2.75	2.33	-

Teaching-Learning Process (General Instructions):

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but different types of teaching methods may be adopted to achieve the outcomes.
2. Promote collaborative learning (Group Learning) in the class.
3. Pose at least three HOT (Higher Order Thinking) questions in the class to stimulate critical thinking.
4. Incorporate Problem-Based Learning (PBL) to foster students' analytical skills and develop their ability to evaluate, generalize, and analyze information rather than merely recalling it.
5. Introduce Topics in manifold representations.
6. Demonstrate ways to solve the same problem and encourage the students to come up with their own creative solutions.

Discuss application of every concept to solve the real world problems.

PROJECT MANAGEMENT WITH GIT

Course Code	B24IS373	**Total Contact Hours / Week**	2	**CIE Marks**	50
Course Category	AEC	**Total SAAE Hours / Semester**	-	**SEE Marks**	50
L:T:P:S	0: 0 : 2: 0	**Total Notional Learning Hours**	30	**Total Marks**	100
Total Credits	1			**Exam Duration**	3 Hrs

COURSE LEARNING OBJECTIVES
1. To familiar with basic command of Git.
2. To create and manage branches.
3. To understand how to collaborate and work with Remote Repositories.
4. To familiar with virion controlling commands.

PREREQUISITES
• Familiarity with using a computer, navigating files and directories, and basic troubleshooting.
• Understanding how to use the command line terminal is beneficial, as Git commands are often executed there.
• Knowing how to use a text editor like VS Code, Atom, or even Notepad++) is important for writing and editing code.
• A general understanding of version control principles.

Sl. No.	Experiments
1	**Setting Up and Basic Commands** Initialize a new Git repository in a directory. Create a new file and add it to the staging area and commit the changes with an appropriate commit message.
2	**Creating and Managing Branches** Create a new branch named "feature-branch." Switch to the "master" branch. Merge the "feature-branch" into "master."
3	**Creating and Managing Branches** Write the commands to stash your changes, switch branches, and then apply the stashed changes.
4	**Collaboration and Remote Repositories** Clone a remote Git repository to your local machine.
5	**Collaboration and Remote Repositories** Fetch the latest changes from a remote repository and rebase your local branch onto the updated remote branch.
6	**Collaboration and Remote Repositories** Write the command to merge "feature-branch" into "master" while providing a custom commit message for the merge.
7	**Git Tags and Releases** Write the command to create a lightweight Git tag named "v1.0" for a commit in your local repository.

8	**Advanced Git Operations** Write the command to cherry-pick a range of commits from "source-branch" to the current branch.
9	**Analysing and Changing Git History** Given a commit ID, how would you use Git to view the details of that specific commit, including the author, date, and commit message?
10	**Analysing and Changing Git History** Write the command to list all commits made by the author "JohnDoe" between "2023-01-01" and "2023-12-31."
11	**Analysing and Changing Git History** Write the command to display the last five commits in the repository's history.
12	**Analysing and Changing Git History** Write the command to undo the changes introduced by the commit with the ID "abc123".

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	Version Control with Git	Prem Kumar Ponuthorai, Jon Loeliger	3rd	O'Reilly Media, Inc.	October 2022.
2	Pro Git	Scott Chacon, Ben Straub	-	Apress	2014

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	Beginning Git and GitHub: Version Control, Project Management and Teamwork for the New Developer	Mariot Tsitoara	2nd	Apress (Springer Nature imprint)	March 2024

E-Resources: E-books / Online Course materials / Online Courses / Video Lectures:

Sl. No.	Type of E-Resource	URL
1	Web-Based Open Educational Resource (OER) and Interactive Online Reference Manual	https://git- scm.com/book/en/v2
2	Web-Based Learning Platform	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013094443473699842782_shared/overview
3	Web-based Learning Experience Platform	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013301347121774599211926_share d/overview

COURSE OUTCOMES:

At the end of the Course, student will be able to:

CO #	Course Outcome Statement
CO1	Use the basics commands related to git repository.
CO2	Create and manage the branches.
CO3	Apply commands related to Collaboration and Remote Repositories.
CO4	Use the commands related to Git Tags, Releases and advanced git operations.
CO5	Analyse and change the git history.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	2	1	-	-	-	2	-	-	-	2	-	-
CO3	3	3	3	2	-	-	3	3	-	-	-	3	2	-
CO4	3	2	3	2	2	-	-	2	-	-	-	2	-	-
CO5	3	3	3	3	-	-	-	3	-	-	2	3	1	-
AVG	3	2.6	2.4	2	2	-	3	2.5	-	-	2	2.6	1.5	-

Teaching-Learning Process (General Instructions):

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but different types of teaching methods may be adopted to achieve the outcomes.
2. Promote collaborative learning (Group Learning) in the class.
3. Pose at least three HOT (Higher Order Thinking) questions in the class to stimulate critical thinking.
4. Incorporate Problem-Based Learning (PBL) to foster students' analytical skills and develop their ability to evaluate, generalize, and analyze information rather than merely recalling it.
5. Introduce Topics in manifold representations.
6. Demonstrate ways to solve the same problem and encourage the students to come up with their own creative solutions.

Discuss application of every concept to solve the real world problems.

DATA VISUALIZATION WITH PYTHON

Course Code	B24IS374	Total Contact Hours / Week	2	CIE Marks	50
Course Category	AEC	Total SAAE Hours / Semester	-	SEE Marks	50
L:T:P:S	0: 0: 2: 0	Total Notional Learning Hours	30	Total Marks	100
Total Credits	1			Exam Duration	3 Hrs

COURSE LEARNING OBJECTIVES
1. Demonstrate the use of IDLE or PyCharm IDE to create Python Applications.
2. Using Python programming language to develop programs for solving real-world problems.
3. Implementation of Matplotlib for drawing different Plots.
4. Demonstrate working with Seaborn, Bokeh.
5. Working with Plotly for 3D, Time Series and Maps.

PREREQUISITES
• Familiarity with web frameworks HTML, CSS, and JavaScript, as well as front-end technologies.
• Knowledge of relational databases (SQL) and potentially NoSQL databases.
• Good understanding of data structures (lists, dictionaries, etc.) and algorithms

Sl. No.	Experiments
	PART A – List of problems for which student should develop program and execute in the Laboratory.
1	a) Write a python program to find the best of two test average marks out of three test's marks accepted from the user. b) Develop a Python program to check whether a given number is palindrome or not and also count the number of occurrences of each digit in the input number. **Datatypes:** https://www.youtube.com/watch?v=gCCVsvgR2KU **Operators:** https://www.youtube.com/watch?v=v5MR5JnKcZI **Flow Control:** https://www.youtube.com/watch?v=PqFKRqpHrjw **For loop:** https://www.youtube.com/watch?v=0ZvaDa8eT5s **While loop:** https://www.youtube.com/watch?v=HZARImviDxg **Exceptions:** https://www.youtube.com/watch?v=6SPDvPK38tw
2	a) Defined as a function F as Fn = Fn-1 + Fn-2. Write a Python program which accepts a value for N (where N >0) as input and pass this value to the function. Display suitable error message if the condition for input value is not followed. b) Develop a python program to convert binary to decimal, octal to hexadecimal using functions. **Functions:** https://www.youtube.com/watch?v=BVfCWuca9nw **Arguments:** https://www.youtube.com/watch?v=ijXMGpoMkhQ **Return value:** https://www.youtube.com/watch?v=nuNXiEDnM44

3	a) Write a Python program that accepts a sentence and find the number of words, digits, uppercase letters and lowercase letters. b) Write a Python program to find the string similarity between two given strings **Sample Output:** **Sample Output:** Original string: Original string: Python Exercises Python Exercises Python Exercises Python Exercise Similarity between two said strings: Similarity between two said strings:1.0 0.967741935483871 **Strings:** https://www.youtube.com/watch?v=lSItwlnF0eU **String functions:** https://www.youtube.com/watch?v=9a3CxJyTq00
4	a) Write a Python program to Demonstrate how to Draw a Bar Plot using Matplotlib. b) Write a Python program to Demonstrate how to Draw a Scatter Plot using Matplotlib. https://www.youtube.com/watch?v=RRHQ6Fs1b8w&list=PLjVLYmrlmjGcC0B_FP3bkJ-JIPkV5GuZR&index=3 https://www.youtube.com/watch?v=7ABCuhWO9II&list=PLjVLYmrlmjGcC0B_FP3bkJ-JIPkV5GuZR&index=4
5	a) Write a Python program to Demonstrate how to Draw a Histogram Plot using Matplotlib. b) Write a Python program to Demonstrate how to Draw a Pie Chart using Matplotlib. https://www.youtube.com/watch?v=Qk7caotaQUQ&list=PLjVLYmrlmjGcC0B_FP3bkJ-JIPkV5GuZR&index=6 https://www.youtube.com/watch?v=PSji21jUNO0&list=PLjVLYmrlmjGcC0B _FP3bkJ-JIPkV5GuZR&index=7
6	a) Write a Python program to illustrate Linear Plotting using Matplotlib. b) Write a Python program to illustrate liner plotting with line formatting using Matplotlib. https://www.youtube.com/watch?v=UO98lJQ3QGI&list=PL-osiE80TeTvipOqomVEeZ1HRrcEvtZB_
7	Write a Python program which explains uses of customizing seaborn plots with Aesthetic functions. https://www.youtube.com/watch?v=6GUZXDef2U0
8	Write a Python program to explain working with bokeh line graph using Annotations and Legends. a) Write a Python program for plotting different types of plots using Bokeh. https://www.youtube.com/watch?v=HDvxYoRadcA
9	Write a Python program to draw 3D Plots using Plotly Libraries. https://www.youtube.com/watch?v=cCck7hCanpw&list=PLE50-dh6JzC4onX-qkv9H3HtPbBVA8M94&index=4
10	a) Write a Python program to draw Time Series using Plotly Libraries. b) Write a Python program for creating Maps using Plotly Libraries.

	https://www.youtube.com/watch?v=xnJ2TNrGYik&list=PLE50-dh6JzC4onX-qkv9H3HtPbBVA8M94&index=5
	https://www.youtube.com/watch?v=D35m2CdMhVs&list=PLE50-dh6JzC4onX-qkv9H3HtPbBVA8M94&index=6

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	Automate the Boring Stuff with Python	Al Sweigart	1st	No Starch Press	2015
2	Python Programming Using Problem Solving Approach	Reema Thareja	-	Oxford University Press	2019
3	Think Python: How to Think Like a Computer Scientist	Allen B. Downey	2nd	Green Tea Press	2015
4	Python Data Science Handbook	Jake VanderPlas	2nd	O'REILLY	2022

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
NIL					

E-Resources: E-books / Online Course materials / Online Courses / Video Lectures:

Sl. #	Type of E-Resource	URL
1	web-based OER	https://automatetheboringstuff.com/
2	Open Educational Resource (OER) and Web-based & Downloadable Textbook (PDF)	http://greenteapress.com/thinkpython2/thinkpython2.pdf)

COURSE OUTCOMES:

At the end of the Course, student will be able to:

CO #	Course Outcome Statement
CO1	Demonstrate the use of IDLE or PyCharm IDE to create Python Applications.
CO2	Use Python programming constructs to develop programs for solving real-world problems.
CO3	Use Matplotlib for drawing different Plots.
CO4	Demonstrate working with Seaborn, Bokeh for visualization.
CO5	Use Plotly for drawing Time Series and Maps.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	3	-	-	-	1	-	-	2	-	1
CO2	3	2	1	-	3	-	-	-	1	-	-	2	-	1
CO3	3	2	1	-	3	-	-	-	1	-	-	2	-	1
CO4	3	2	1	-	3	-	-	-	1	-	-	2	-	1
CO5	3	2	1	-	3	-	-	-	1	-	-	2	-	1
AVG	3	2	1	-	3	-			1	-	-	2	-	1

Teaching-Learning Process (General Instructions):

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but different types of teaching methods may be adopted to achieve the outcomes.
2. Promote collaborative learning (Group Learning) in the class.
3. Pose at least three HOT (Higher Order Thinking) questions in the class to stimulate critical thinking.
4. Incorporate Problem-Based Learning (PBL) to foster students' analytical skills and develop their ability to evaluate, generalize, and analyze information rather than merely recalling it.
5. Introduce Topics in manifold representations.
6. Demonstrate ways to solve the same problem and encourage the students to come up with their own creative solutions.

Discuss application of every concept to solve the real world problems.

DATA STRUCTURES LABORATORY

Course Code	B24ISL38	Total Contact Hours / Week	2	CIE Marks	50
Course Category	PCCL	Total SAAE Hours / Semester	-	SEE Marks	50
L:T:P:S	0:0:2:0	Total Notional Learning Hours	30	Total Marks	100
Total Credits	1			Exam Duration	3 Hrs

COURSE LEARNING OBJECTIVES
This laboratory course enables students to get practical experience in design, develop, implement, analyze and evaluation / testing of 1. Dynamic memory management. 2. Linear data structures and their applications such as stacks, queues and lists. 3. Non-Linear data structures and their applications such as trees and graphs.

PREREQUISITES
Students must meet the following prerequisites before enrolling in the Data Structures Laboratory course: • Completion of an introductory programming course (e.g., Introduction to C Programming) • Understanding of basic programming constructs (variables, loops, conditionals statements, functions) • Recommended to ensure a strong theoretical foundation that complements lab work.

PROGRAMS LIST

Sl. No.	PROGRAMS
1.	Develop a C program to sort the elements of an array using Radix sort technique.
2.	Develop a C Program to implement Hashing using Linear and Quadratic Probing.
3.	Develop a menu driven program in C to implement primitive operations on stack a) Push b) Pop c) Display. The program should print appropriate messages for stack overflow and stack underflow.
4.	Develop a C program to convert INFIX notation to POSTFIX notation.
5.	Develop a C program for evaluation of POSTFIX notation.
6.	Develop a menu driven program in C language to implement QUEUE data structures that performs following primitive operations: a) insert b) delete and c) display.
7.	Develop a menu driven program in C language to for CIRCULAR QUEUE that performs following primitive operations: a) insert b) delete and c) display.
8.	Develop a menu driven program in C to perform primitive operations on single linked list.
9.	Develop a C program to perform insertion, deletion, and traversal of a binary search tree.
10.	Develop a C program to traverse a graph using Breadth First Search.

LABORATORY OUTCOMES:

The student should be able to:

CO #	Course Outcome Statement
CO1	Develop programs related to arrays and hashing.
CO2	Develop programs related to stacks and its applications.
CO3	Develop programs related to queues.
CO4	Demonstrate use of dynamic memory allocation to implement single linked list.
CO5	Develop programs related to trees.
CO6	Apply concept of graphs to implement traversal algorithms.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	-	3	-	-	3	-	-	-	3	-	-
CO2	3	3	3	-	3	-	-	3	-	-	-	3	-	-
CO3	3	3	3	-	3	-	-	3	-	-	-	3	-	-
CO4	3	3	3	-	3	-	-	3	-	-	-	3	-	-
CO5	3	3	3	-	3	-	-	3	-	-	-	3	-	-
CO6	3	3	3	-	3	-	-	3				3		
AVG	3	3	3	-	3	-	-	3	-	-	-	3	-	-

NATIONAL SERVICE SCHEME (NSS) – I

Course Code	B24NSK391	Total Contact Hours / Week	2	CIE Marks	100
Course Category	NCMC	Total SAAE Hours / Semester	-	SEE Marks	-
L:T:P:S	0:0:2:0	Total Notional Learning Hours	-	Total Marks	100
Total Credits	0			Exam Duration	-

COURSE LEARNING OBJECTIVES
National Service Scheme (NSS) will enable the students to: 1) Understand the community in general in which they work. 2) Identify the needs and problems of the community and involve them in problem –solving. 3) Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems. 4) Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes. 5) Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

General Instructions - Pedagogy
These are sample strategies; which teachers can use to accelerate the attainment of the various course outcomes. 1) In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied social and cultural skills. 2) State the need for NSS activities and its present relevance in the society and Provide real-life examples. 3) Support and guide the students for self-planned activities. 4) You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field. 5) Encourage the students for group work to improve their creative and analytical skills.

Sl. #	CONTENTS
1	Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.
2	Waste management– Public, Private and Govt. organization, 5 R's.
3	Setting of the information imparting club for women leading to contribution in social and economic issues.
4	Water conservation techniques – Role of different stakeholders– Implementation.
5	Preparing an actionable business proposal for enhancing the village income and approach for implementation.
6	Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.

7	Developing Sustainable Water management system for rural areas and implementation approaches.
8	Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swatch Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.
9	Spreading public awareness under rural outreach programs. (minimum5 programs).
10	Social connect and responsibilities.
11	Plantation and adoption of plants. Know your plants.
12	Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).
13	Govt. school Rejuvenation and helping them to achieve good infrastructure.

NOTE:

1) Student/s in individual or in a group Should select any one activity in the beginning of each semester till end of that respective semester for successful completion as per the instructions of NSS officer with the consent of HOD of the department.
2) At the end of every semester, activity report should be submitted for evaluation.

Semester	Sl. #	TOPICS TO BE COVERED
3rd Sem B24NSK391	1	Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.
	2	Waste management– Public, Private and Govt organization, 5 R's.
	3	Setting of the information imparting club for women leading to contribution in social and economic issues.
4th Sem B24NSK410	4	Water conservation techniques – Role of different stakeholders– Implementation.
	5	Preparing an actionable business proposal for enhancing the village income and approach for implementation.
	6	Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.
5th Sem B24NSK591	7	Developing Sustainable Water management system for rural areas and implementation approaches.
	8	Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swatch Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.
	9	Spreading public awareness under rural outreach programs. (minimum5 programs).
	10	Social connect and responsibilities.
6th Sem B24NSK691	11	Plantation and adoption of plants. Know your plants.
	12	Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).
	13	Govt. school Rejuvenation and helping them to achieve good infrastructure.

Suggested Learning Resources
1) NSS Course Manual, Published by NSS Cell, VTU Belagavi.
2) Government of Karnataka, NSS cell, activities reports and its manual.
3) Government of India, NSS cell, Activities reports and its manual.

COURSE OUTCOMES:

At the end of the Course, student will be able to:

CO #	Course Outcome Statement
CO1	Understand the importance of his / her responsibilities towards society.
CO2	Analyse the environmental and societal problems/issues and will be able to design solutions for the same.
CO3	Evaluate the existing system and to propose practical solutions for the same for sustainable development.
CO4	Implement government or self-driven projects effectively in the field.
CO5	Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	3	-	-	3	3	-	-	-	3	-	-	-
CO2	-	-	3	-	-	3	3	-	-	-	3	-	-	-
CO3	-	-	3	-	-	3	3	-	-	-	3	-	-	-
CO4	-	-	3	-	-	3	3	-	-	-	3	-	-	-
CO5	-	-	3	-	-	3	3	-	-	-	3	-	-	-
AVG	-	-	3	-	-	3	3	-	-	-	3	-	-	-

PHYSICAL EDUCATION (SPORTS & ATHLETICS) – I

Course Code	B24PEK391	Total Contact Hours / Week	2	CIE Marks	100
Course Category	NCMC	Total SAAE Hours / Semester	-	SEE Marks	-
L:T:P:S	0:0:2:0	Total Notional Learning Hours	-	Total Marks	100
Total Credits	0			Exam Duration	-

COURSE OUTCOMES:

At the end of the Course, student will be able to:

CO #	Course Outcome Statement
CO1	Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness
CO2	Familiarization of health-related Exercises, Sports for overall growth and development
CO3	Create a foundation for the professionals in Physical Education and Sports
CO4	Participate in the competition at regional /state / national / international levels.
CO5	Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.
CO6	Understand and practice of Traditional Games

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	3	-	-	3	-	-	-
CO2	-	-	-	-	-	-	-	3	-	-	3	-	-	-
CO3	-	-	-	-	-	-	-	3	-	-	3	-	-	-
CO4	-	-	-	-	-	-	-	3	-	-	3	-	-	-
CO5	-	-	-	-	-	-	-	3	-	-	3	-	-	-
CO6	-	-	-	-	-	-	-	3	-	-	3	-	-	-
AVG	-	-	-	-	-	-	-	3	-	-	3	-	-	-

Module #	CONTENTS	DURATION
1	Orientation A) Lifestyle B) Health & Wellness C) Pre-Fitness test.	**4 Hours**
2	General Fitness & Components of Fitness A) Warming up (Free Hand exercises) B) Strength – Push-up / Pull-ups C) Speed – 30 Mtr Dash	**4 Hours**
3	Specific games (Any one to be selected by the student) 1) Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus. 2) Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up.	**16 Hours**

Scheme and Assessment for auditing the course and Grades:

SL #	Activity	Marks
1	Participation of student in all the modules	20
2	Quizzes – 2, each of 15 marks	30
3	Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	50
	TOTAL	100

YOGA – I

Course Code	B24YOK391	Total Contact Hours / Week	2	CIE Marks	100
Course Category	NCMC	Total SAAE Hours / Semester	-	SEE Marks	-
L:T:P:S	0:0:2:0	Total Notional Learning Hours	-	Total Marks	100
Total Credits	0			Exam Duration	-

Course Title	Content	No. of Hours
lntroduction of Yoga, Aim and Objectives of yoga, Prayer Brief introduction of yogic practices for common man Rules and regulations Misconceptions of yoga	Yoga, its meaning, definitions. Different schools of yoga, importance of prayer Yogic practices for common man to promote positive health Rules to be followed during yogic practices by practitioner Yoga its misconception	**Total 20 - 24 Hours, 2 Hours per Week**
Suryanamaskara	Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar 12 count, 2 rounds	

Different types of Asanas
 	
a) Sitting
   1. Padmasana 2. Vajrasana
 	
b) Standing
   1. Vrikshana 2. Trikonasana
 	
c) Prone line
   1. Bhujangasana 2. Shalabhasana
 	
d) Supine line
   1. utthitadvipadasana
   2. Ardhahalasana
	Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana	

DATABASE MANAGEMENT SYSTEMS

Course Code	B24IS41	Total Contact Hours / Week	3	CIE Marks	50
Course Category	PCC / BSC	Total SAAE Hours / Semester	48	SEE Marks	50
L:T:P:S	3:0:0:0	Total Notional Learning Hours	90	Total Marks	100
Total Credits	3			Exam Duration	3 Hrs

COURSE LEARNING OBJECTIVES
1. To Provide a strong foundation in database concepts, technology, and practice.
2. To Practice SQL programming through a variety of database problems.
3. To Understand the relational database design principles.
4. To Demonstrate the use of concurrency and transactions in database.
5. To Design and build database applications for real world problems.
6. To become familiar with database storage structures and access techniques.

PREREQUISITES
To effectively study Database Management Systems (DBMS), a foundational understanding of data structures, file system, basic programming concepts and Knowledge of Excel.

MODULE #	TOPICS	Hours
1	**Introduction to Databases:** Introduction, Characteristics of Database Approach, Actors on the Scene, Workers behind the Scene, Advantages of Using the DBMS Approach, A Brief History of Database Applications. **Overview of Database Languages and Architectures:** Data Models, Schemas, and Instances. Three-Schema Architecture and Data Independence, Database Languages, and Interfaces, The Database System Environment. **Conceptual Data Modelling using Entities and Relationships:** Entity Types, Entity Sets and Structural Constraints, Weak Entity Types, ER Diagrams. **Textbook 1: Chapter 1.1 to 1.8, 2.1 to 2.6, 3.1 to 3.10**	**8**
2	**Relational Model**: Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update Operations, Transactions, and Dealing with Constraint Violations. **Relational Algebra:** Unary and Binary Relational Operations, Additional Relational Operations (aggregate, grouping, etc.) Examples of Queries in Relational Algebra. **SQL:** SQL Data Definition and Data Types, Specifying Constraints in SQL, Retrieval Queries in SQL, INSERT, DELETE, and UPDATE Statements in SQL, Additional Features of SQL **Textbook 1: Chapter 5.1 to 5.3,8.1 to 8.5, 6.1 to 6.5.**	**8**

3	**SQL: Advanced Queries:** More Complex SQL Retrieval Queries, Specifying Constraints as Assertions and Action Triggers, Views in SQL. Schema Change Statements in SQL, **Database Application Development:** Accessing Databases from Applications, An Introduction to JDBC, JDBC Classes and Interfaces, SQLJ, Stored Procedures, Case Study: The Internet Book Shop. **NOSQL Databases and Big Data Storage Systems:** Introduction to NOSQL Systems, The CAP Theorem, Document-Based NOSQL Systems and MongoDB, NOSQL Key-Value Stores, Column-Based or Wide Column NOSQL Systems, NOSQL Graph Databases and Neo4j. **Textbook 1: Chapter7.1 to 7.4; 24.1 to 24.6** **Textbook 2: Chapter 6.1 to 6.6.**	9
4	**Normalization: Database Design Theory –** Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. Examples on normal forms. **Normalization Algorithms:** Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Nulls, Dangling tuples, and alternate Relational Designs, Further discussion of Multivalued dependencies and 4NF, Other dependencies and Normal Forms **Textbook 1: Chapter 14.1 to -14.7, 15.1 to 15.6**	9
5	**Transaction Processing:** Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL. **Concurrency Control in Databases:** Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking. **Textbook 1: Chapter 20.1 to 20.6, 21.1 to 21.7.**	8

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	Fundamentals of Database Systems	Ramez Elmasri and Shamkant B. Navathe	7th	Pearson	2017
2	Database Management Systems	Ramakrishnan, and Gehrke	3rd	McGraw Hill	2014

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	Database System Concepts	Silberschatz Korth and Sudharshan	7th	Mc-GrawHill	2021
2	Database Systems: Design, Implementation, Management	Carlos Coronel, Steven Morris	13th	Course Technology Inc.	2018

E-Resources: E-books / Online Course materials / Online Courses / Video Lectures:

Sl. #	Type of E-Resource	URL
1	Lecture Video	https://www.youtube.com/watch?v=3EJlovevfcA 2.
2	Lecture Video	https://www.youtube.com/watch?v=9TwMRs3qTcU 3.
3	Lecture Video	https://www.youtube.com/watch?v=ZWl0Xow304I 4.
4	Lecture Video	https://www.youtube.com/watch?v=4YilEjkNPrQ 5.
5	Lecture Video	https://www.youtube.com/watch?v=CZTkgMoqVss 6.
6	Lecture Video	https://www.youtube.com/watch?v=Hl4NZB1XR9c 7.
7	Lecture Video	https://www.youtube.com/watch?v=EGEwkad_llA 8.
8	Lecture Video	https://www.youtube.com/watch?v=t5hsV9lC1rU

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO #	Course Outcome Statement
CO1	Describe the basic elements of a relational database management system
CO2	Design entity relationship for the given scenario.
CO3	Apply various Structured Query Language (SQL) statements for database manipulation.
CO4	Analyze various normalization forms for the given application.
CO5	Develop database applications for the given real world problem and understand the concepts related to NoSQL databases.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	2	1	-	-	-	1	1	1	1	-	1	1
CO2	3	1	2	1	-	-	-	1	1	1	1	-	1	1
CO3	3	1	2	1	-	-	-	1	1	1	1	-	1	1
CO4	3	1	2	1	-	-	-	1	1	1	1	-	1	1
CO5	3	1	2	1	-	-	-	1	1	1	1	-	1	1
AVG	3	1	2	1	-	-	-	1	1	1	1	-	1	1

Teaching-Learning Process (General Instructions):

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) needs not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.

2. Use of Video/Animation to explain functioning of various concepts.

3. Encourage collaborative (Group Learning) Learning in the class.

4. Ask at least three HOT (Higher Order Thinking) questions in the class, which promotes critical thinking.

5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.

6. Introduce Topics in manifold representations.

7. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Use any of these methods: Chalk and board, Active Learning, Case Studies

ANALYSIS AND DESIGN OF ALGORITHMS

Course Code	B24CS42	**Total Contact Hours / Week**	5	**CIE Marks**	50
Course Category	IPCC	**Total SAAE Hours / Semester**	48	**SEE Marks**	50
L:T:P:S	3:0:2:0	**Total Notional Learning Hours**	120	**Total Marks**	100
Total Credits	4			**Exam Duration**	

COURSE LEARNING OBJECTIVES
1. To learn the methods for analyzing algorithms and evaluating their performance.
2. To demonstrate the efficiency of algorithms using asymptotic notations.
3. To solve problems using various algorithm design methods, including brute force, greedy, divide and conquer, decrease and conquer, transform and conquer, dynamic programming, backtracking, and branch and bound.
4. To learn the concepts of P and NP complexity classes.

PREREQUISITES
• Programming in C / Python – Control Structures, Functions & Recursions, Data Types.
• Data Structures and Applications – Arrays, Stacks, Queue, Linked Lists, Binary Search Tree, Graphs.
• Mathematics for Computer Science – Discrete Mathematics, Recurrence Relations, Mathematic Induction

MODULE #	TOPICS	Hours
1	**INTRODUCTION:** What is an Algorithm? Fundamentals of Algorithmic Problem Solving. Important Problem types **FUNDAMENTALS OF THE ANALYSIS OF ALGORITHM EFFICIENCY:** Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non recursive Algorithms, Mathematical Analysis of Recursive Algorithms. **Chapter 1(Sections 1.1-1.3), Chapter 2(Sections 2.1-2.4)**	**9**
2	**THE GREEDY METHOD:** Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees and codes **DECREASE-AND-CONQUER:** Insertion Sort, Topological Sorting. **Chapter 9 (Sections 9.1,9.2,9.4), Chapter 4 (Sections 4.1,4.2)**	**8**
3	**DIVIDE AND CONQUER:** Multiplication of Large Integers and Strassen's Matrix Multiplication. **TRANSFORM-AND-CONQUER:** Balanced Search Trees – AVL Tree, 2-3 Tree, Heaps and Heapsort. **Chapter 5 (Section 5.3, 5.4) Chapter 6 (Sections 6.3, 6.4)**	**9**
4	**DYNAMIC PROGRAMMING:** Three basic examples (Coin Row Problem, Change Making Problem, Coin Collecting Problem). The Knapsack Problem and Memory Functions, Warshall's and Floyd's Algorithms. **Chapter 8 (Sections 8.1,8.2,8.4)**	**8**

| 5 | **LIMITATIONS OF ALGORITHMIC POWER:** Decision Trees, P, NP, and NP-Complete Problems. **COPING WITH LIMITATIONS OF ALGORITHMIC POWER**: Backtracking (n-Queens problem, Subset-sum problem), Branch-and-Bound (Knapsack problem)
Chapter 11 (Section 11.2, 11.3), Chapter 12 (Sections 12.1,12.2) | **8** |

Practical component of IPCC

Sl. No.	Experiments
1	Write a C Program to find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm.
2	Write a C Program to find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm.
3	Write C Program to obtain the Topological ordering of vertices in a given digraph using source removal method.
4	Write a C Program to Construct an AVL Tree with 5 elements and perform the necessary rotations for balancing the tree whenever required.
5	Write a C Program to implement Heapsort Algorithm.
6	Write a C Program to solve discrete Knapsack and continuous Knapsack problems using greedy approximation method.
7	Write a C Program to solve All-Pairs Shortest Paths problem using Floyd's algorithm.
8	Write a C Program to find the transitive closure using Warshal's Algorithm.
9	Write C Program to find a subset of a given set S = {sl , s2,.....,sn} of n positive integers whose sum is equal to a given positive integer d.
10	Write C Program for N Queen's problem using Backtracking.

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	Introduction to the Design and Analysis of Algorithms	Anany Levitin	3rd	Pearson	2017

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	Introduction to Algorithms	Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein	4th	MIT	2022
2	Design and Analysis of Algorithms	S. Sridhar	2nd	Oxford	2023
3	Computer Algorithms/C++	Ellis Horowitz, Satraj Sahni Rajasekaran	2nd	Universities Press	2014

E-Resources: E-books / Online Course materials / Online Courses / Video Lectures:

Sl. #	Type of E-Resource	URL
1	E-book	https://homel.vsb.cz/~fai0013/Kniha_Algoritmy.pdf
2	Online course	Design and Analysis of Algorithms: https://nptel.ac.in/courses/106/101/106101060/

COURSE OUTCOMES:

At the end of the Course, student will be able to:

CO #	Course Outcome Statement
CO1	Explain the fundamental concepts of algorithms, problem-solving strategies, and evaluate algorithm efficiency using asymptotic notations and mathematical analysis.
CO2	Apply greedy technique and decrease and conquer method to solve graph based & combinatorial computational problems.
CO3	Demonstrate divide & conquer approaches and transform & conquer approaches to solve computational problems.
CO4	Make use of dynamic programming strategies to solve classical problems such as the coin row problem, change making, coin collecting, knapsack, and shortest path algorithms.
CO5	Discuss the limitations of algorithmic approaches through NP-completeness, and design solutions using backtracking and branch-and-bound methods.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	-	-	-	-	-	2	1	2	-
CO2	3	3	3	2	2	-	-	-	-	-	2	3	2	1
CO3	3	3	3	2	2	-	-	-	-	-	2	3	2	1
CO4	3	3	3	2	2	-	-	-	-	-	2	3	2	1
CO5	3	3	3	2	2	-	-	-	-	-	2	3	2	-
AVG	3	3	3	2	2	-	-	-	-	-	2	2.6	2	1

Teaching-Learning Process
Pedagogy (General Instructions):
- Outcome-Based and Active Learning
- Blended and ICT-Enabled Learning
- Flipped and Experiential Learning
- Continuous Assessment and Feedback

ADVANCED JAVA

Course Code	B24IS43	Total Contact Hours / Week	5	CIE Marks	50
Course Category	IPCC	Total SAAE Hours / Semester	48	SEE Marks	50
L:T:P:S	3:0:2:0	Total Notional Learning Hours	120	Total Marks	100
Total Credits	4			Exam Duration	3 Hrs

COURSE LEARNING OBJECTIVES
1. Understanding the fundamentals of collection framework
2. Demonstrate the fundamental concepts of String operations and Swing applications
3. Design and develop web applications using Java servlets and JSP
4. Apply database interaction through Java database Connectivity

PREREQUISITES
• Strong understanding of OOP concepts (inheritance, polymorphism, encapsulation, abstraction).   • Familiarity with basic Java syntax, data types, control structures, and exception handling   • Experience working with classes, objects, and interfaces   • Proficiency in writing modular code using methods and constructors.   • Understanding of file handling and multithreading basics.   • Basic understanding of HTML

MODULE #	TOPICS	Hours
1	**The collections and Framework**: Collections Overview, The Collection Interfaces, The Collection Classes, Accessing a collection Via an Iterator, Storing User Defined Classes in Collections, The Random Access Interface, Working With Maps, Comparators, , Arrays ,The legacy Classes and Interfaces, Parting Thoughts on Collections. **Text Book 1: Chapter 20**	**8**
2	**String Handling:** The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion Using valueOf( ), Changing the Case of Characters Within a String, joining strings, Additional String Methods, StringBuffer , StringBuilder **Text Book 1: Chapter 18.**	**8**
3	**Introducing Swing:** The Origin of Swing, Swing Is Built on AWT, Two Key Swing Features, The MVC Connection, Components and Containers, The Swing Packages, A Simple Swing Application, Event Handling, Painting in Swing, **Exploring Swing :** JLabel and ImageIcon,JTextField,The Swing Buttons-JButton, JToggleButton, Check Boxes, Radio Buttons. **Text Book 1: Chapter 32 and 33.**	**9**

4	**Introducing servlets**: Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The Jakarta. Servlet Package; Reading Servlet Parameter; The Jakarta.servlet.http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking. Java Server Pages (JSP); JSP tags, Variables and Objects, Methods, Control statements, Loops, Request String, Parsing other information, User sessions, Cookies, Session Objects. **Text Book 1**: **Chapter 36.** **Text Book 2**: **Chapter 11.**	**9**
5	**JDBC Objects**: The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing; Metadata, Data types; Exceptions. **Text Book 2**: **Chapter 06.**	**8**

PRACTICAL COMPONENT OF IPCC (May cover all / major modules)

Sl. No.	Experiments
1	Implement a java program to demonstrate creating an ArrayList, adding elements, removing elements, sorting elements of ArrayList. Also illustrate the use of toArray() method.
2	Develop a program to read random numbers between a given range that are multiples of 2 and 5, sort the numbers according to tens place using comparator.
3	Implement a java program to illustrate storing user defined classes in collection.
4	Implement a java program to illustrate the use of different types of string class constructors.
5	Implement a java program to illustrate the use of different types of character extraction, string comparison, string search and string modification methods.
6	Implement a java program to illustrate the use of different types of StringBuffer methods
7	Demonstrate a swing event handling application that creates 2 buttons Alpha and Beta and displays the text "Alpha pressed" when alpha button is clicked and "Beta pressed" when beta button is clicked.
8	A program to display greeting message on the browser "Hello UserName", "How Are You?", accept username from the client using servlet.
9	A servlet program to display the name, USN, and total marks by accepting student detail
10	A Java program to create and read the cookie for the given cookie name as "EMPID" and its value as "AN2356".
11	Write a JAVA Program to insert data into Student DATA BASE and retrieve info based on particular queries(For example update, delete, search etc…).
12	A program to design the Login page and validating the USER_ID and PASSWORD using JSP and DataBase.

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	Java The complete Reference.	Herbert Schildt	12th	Tata Mc Graw Hill	2023
2	The Complete Reference J2EE	Jim Keogh	7th	Tata Mc Graw Hill	2012

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	Introduction to JAVA Programming	Y. Daniel Liang	7th	Pearson Education	2007
2	The J2EE Tutorial	Stephanie Bodoff et al	2nd	Pearson Education	2004
3	Advanced JAVA Programming	Uttam K Roy	Illustrated	Oxford University Press	2015

E-Resources: E-books / Online Course materials / Online Courses / Video Lectures:

Sl. #	Type of E-Resource	URL
1	Video Lecture	https://nptel.ac.in/courses/106/105/106105191/
2	Video Lecture	https://nptel.ac.in/courses/106/105/106105225/
3	Video Lecture / MOOC-style content	https://youtu.be/qGMxs-PbFPk

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO #	Course Outcome Statement
CO1	Apply appropriate collection class/interface to solve the given problem.
CO2	Demonstrate the concepts of String operations in Java.
CO3	Apply the concepts of Swings to build Java applications.
CO4	Develop web based applications using Java servlets and JSP.
CO5	Use JDBC to build database applications.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	-	-	-	-	-	-	3	-	-
CO2	3	1	1	-	-	-	-	-	-	-	-	2	-	-
CO3	3	2	3	-	2	-	-	1	-	-	-	3	2	-
CO4	3	2	3	2	2	-	-	1	2	-	-	3	3	-
CO5	3	2	3	2	1	-	-	-	1	-	-	3	3	-
AVG	3	1.8	2.4	2	1.6	-	-	1	1.5	-	-	2.8	2.6	-

Teaching-Learning Process (General Instructions):

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but different types of teaching methods may be adopted to achieve the outcomes.
2. Promote collaborative learning (Group Learning) in the class.
3. Pose at least three HOT (Higher Order Thinking) questions in the class to stimulate critical thinking.
4. Incorporate Problem-Based Learning (PBL) to foster students' analytical skills and develop their ability to evaluate, generalize, and analyze information rather than merely recalling it.
5. Introduce Topics in manifold representations.
6. Demonstrate ways to solve the same problem and encourage the students to come up with their own creative solutions.

Discuss application of every concept to solve the real world problems.

FILE STRUCTURES

Course Code	B24IS44	**Total Contact Hours / Week**	3	**CIE Marks**	50
Course Category	PCC	**Total SAAE Hours / Semester**	48	**SEE Marks**	50
L:T:P:S	3:0:0:0	**Total Notional Learning Hours**	90	**Total Marks**	100
Total Credits	3			**Exam Duration**	3 Hrs

COURSE LEARNING OBJECTIVES
1. Provide an introduction to the fundamental file operations and storage systems.
2. Introducing fundamental concepts of file structure.
3. Introducing the most important high-level file structures tools which include indexing, co sequential processing, B trees, Hashing.
4. Applying the techniques in the design of C++ programs for solving various file management problems.

PREREQUISITES
• Programming Knowledge (C / C++).
• Data Structures and Algorithms.
• Computer Organization / Operating Systems Basics.

MODULE #	TOPICS	Hours
1	**Introduction:** File Structures: The Heart of the file structure Design, A Short History of File Structure Design, A Conceptual Toolkit; Fundamental File Operations: Physical Files and Logical Files, Opening Files, Closing Files, Reading and Writing, Seeking, Special Characters, The Unix Directory Structure, Physical devices and Logical Files, File-related Header Files, UNIX file System Commands; Secondary Storage and System Software: Disks **Fundamental File Structure Concepts**, **Managing Files of Records:** Field and Record Organization, Using Classes to Manipulate Buffers, Using Inheritance for Record Buffer Classes, Managing Fixed Length, Fixed Field Buffers, An Object-Oriented Class for Record Files, Record Access, more about Record Structures, Encapsulating Record Operations in a Single Class, File Access and File Organization. **Text book 1: Chapter 1, Chapter 2, Chapter 3 (3.1, 3.7 - 3.10) Chapter 4, Chapter 5 (5.1-5.4)**	**9**
2	**Organization of Files for Performance, Indexing:** Data Compression, Reclaiming Space in files, Internal Sorting and Binary Searching, Key sorting; What is an Index? A Simple Index for Entry-Sequenced File, Using Template Classes in C++ for Object I/O, Object-Oriented support for Indexed, Entry-Sequenced Files of Data Objects, Indexes that are too large to hold in Memory, Indexing to provide access by Multiple keys, Retrieval Using Combinations of Secondary Keys, Improving the Secondary Index structure: Inverted 03092022 Lists, Selective indexes, Binding. **Text book 1: Chapter 6, Chapter 7**	**8**

3	**Co-sequential Processing and the Sorting of Large Files:** A Model for Implementing Co-Sequential Processes, Application of the Model to a General Ledger Program, Extension of the Model to include Multiway Merging, A Second Look at Sorting in Memory, Merging as a Way of Sorting Large Files on Disk. Multi-Level Indexing and B-Trees: The invention of B-Tree, Statement of the problem, Indexing with Binary Search Trees; Multi-Level Indexing. **Text book 1: Chapter 8 – 8.1 to 8.5.4, Chapter 9 – 9.1 – 9.4**	8
4	**Multi-Level Indexing and B-Trees:** B-Trees, Example of Creating a B-Tree, An Object-Oriented Representation of B-Trees, B-Tree Methods; Nomenclature, Formal Definition of B-Tree Properties, Worst-case Search Depth, Deletion, Merging and Redistribution, Redistribution during insertion; B* Trees, Buffering of pages; Virtual B-Trees; Variable-length Records and keys. **Indexed Sequential File Access and Prefix B + Trees:** Indexed Sequential Access, maintaining a Sequence Set, adding a Simple Index to the Sequence Set, The Content of the Index: Separators Instead of Keys, The Simple Prefix B+ Tree and its maintenance, Index Set Block Size, Internal Structure of Index Set Blocks: A Variable-order B- Tree, Loading a Simple Prefix B+ Trees, B-Trees, B+ Trees and Simple Prefix B+ Trees in Perspective. **Text book 1: Chapter 8 - 9.5 - 9.16, Chapter 10.**	9
5	**Hashing:** Introduction, A Simple Hashing Algorithm, Hashing Functions and Record Distribution, how much Extra Memory should be used? Collision resolution by progressive overflow, Buckets, Making deletions, Other collision resolution techniques, Patterns of record access. Extendible Hashing: How Extendible Hashing Works, Implementation, Deletion, Extendible Hashing Performance, Alternative Approaches. **Text Book 1: Chapter 11, Chapter 12**	8

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	File Structures-An Object Oriented Approach with C++.	Michael J. Folk, Bill Zoellick, Greg Riccardi:	3rd	Pearson Education	2020
2	Database System Concepts	Abraham Silberschatz, Henry F. Korth, S. Sudarshan.	7th	*McGraw-Hill*	2020.
3	Operating System Concepts	Abraham Silberschatz, Peter B. Galvin, Greg Gagne.	10th	*Wiley*	2018.
4	Algorithms in C++: Parts 1-4 (Fundamentals, Data Structures, Sorting, Searching)	Robert Sedgewick, Kevin Wayne. *Addison Wesley,*	4th	Addison-Wesley	2011.

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	File Structures using C++	K.R. Venugopal, K.G. Srinivas, P.M. Krishnaraj	Single Edition	Tata McGraw-Hill	2008
2	C++ Components and Algorithms	Scot Robert Ladd Dhamdhere	Single Edition	BPB Publications,	1993

E-Resources: E-books / Online Course materials / Online Courses / Video Lectures:

Sl. #	Type of E-Resource	URL
1	**You Tube**	https://www.slideshare.net/shyamujaco/file-structures
2	**You Tube**	https://www.vtuplanet.com/m/browse.php?type=papers&dir=B.E +%28 Engineering%29%2F Information+Science+ %28ISE%29%2FSem+ 6%2FFile+structures
3	**NPTEL**	File Structures & Database Systems Courses
4	**MIT Open Course Ware**	Operating System Engineering
5	**Stanford CS Education**	Algorithms & Data Structures Resources

COURSE OUTCOMES:

At the end of the Course, student will be able to:

CO	Course Outcome Statement
CO1	Understand the fundamental concepts of file processing operations and storage structures
CO2	Apply object orientation concepts to manipulate records
CO3	Apply concepts of sorting and merging on multiple files
CO4	Analyse the sequential and indexing file accessing techniques with appropriate data structures
CO5	Illustrate the usage of hashing techniques to organize file structures

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	-	3	3	-	2	2	-	-
CO2	3	3	2	-	-	-	-	3	3	-	2	2	-	-
CO3	3	3	2	-	-	-	-	3	3	-	2	2	-	-
CO4	3	3	2	-	-	-	-	3	3	-	2	2	-	-
CO5	3	3	2	-	-	-	-	3	3	-	2	2	-	-
AVG	3	3	2	-	-	-	-	3	3	-	2	2	-	-

Teaching-Learning Process (General Instructions):

These are sample strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.

2. Use of Video/Animation to explain functioning of various concepts.

3. Encourage collaborative (Group Learning) Learning in the class.

4. Ask at least three HoT (Higher order Thinking) questions in the class, which promotes critical thinking.

5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.

6. Introduce Topics in manifold representations.

7. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

WEB TECHNOLOGY AND ITS APPLICATIONS

Course Code	B24IS451	Total Contact Hours / Week	4	CIE Marks	50
Course Category	ESC	Total SAAE Hours / Semester	32	SEE Marks	50
L:T:P:S	2:2:0:0	Total Notional Learning Hours	90	Total Marks	100
Total Credits	3			Exam Duration	3 Hrs

COURSE LEARNING OBJECTIVES
1. Illustrate the Semantic Structure of HTML and CSS
2. Compose forms and tables using HTML and CSS
3. Design Client-Side programs using JavaScript and Server-Side programs using PHP
4. Infer Object Oriented Programming capabilities of PHP
5. Examine JavaScript frameworks such as jQuery and Backbone

PREREQUISITES
• Foundational knowledge of HTML, CSS, and JavaScript is essential.
• Understanding basic programming concepts and databases will be beneficial.
• Understanding Internet Basics, URLs and Domain Names.
• Understanding the role of web servers in delivering web content to users is also helpful.

MODULE #	TOPICS	Hours
1	Introduction to HTML, What is HTML and Where did it come from?, HTML Syntax, Semantic Markup, Structure of HTML Documents, Quick Tour of HTML Elements, HTML5 Semantic Structure Elements, Introduction to CSS, What is CSS, CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling. **Textbook 1: Ch. 2, 3.**	**6**
2	HTML Tables and Forms, Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements, Table and Form Accessibility, Microformats, Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks. **Textbook 1: Ch. 4, 5.**	**5**
3	JavaScript: Client-Side Scripting, What is JavaScript and What can it do?, JavaScript Design Principles, Where does JavaScript Go?, Syntax, JavaScript Objects, The Document Object Model (DOM), JavaScript Events, Forms, Introduction to Server-Side Development with PHP, What is Server-Side Development, A Web Server"s Responsibilities, Quick Tour of PHP, Program Control, Functions **Textbook 1: Ch. 6, 8.**	**5**

4	PHP Arrays and Superglobals, Arrays, $_GET and $_POST Superglobal Arrays, $_SERVER Array, $_Files Array, Reading/Writing Files, PHP Classes and Objects, Object-Oriented Overview, Classes and Objects in PHP, Object Oriented Design, Error Handling and Validation, What are Errors and Exceptions?, PHP Error Reporting, PHP Error and Exception Handling **Textbook 1: Ch. 9, 10.**	**6**
5	Managing State, The Problem of State in Web Applications, Passing Information via Query Strings, Passing Information via the URL Path, Cookies, Serialization, Session State, HTML5 Web Storage, Caching, Advanced JavaScript and jQuery, JavaScript Pseudo- Classes, jQuery Foundations, AJAX, Asynchronous File Transmission, Animation, Backbone MVC Frameworks, XML Processing and Web Services, XML Processing, JSON, Overview of Web Services. **Textbook 1: Ch. 13, 15,17.**	**6**

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	Fundamentals of Web Development	Randy Connolly, Ricardo Hoar	1st	Pearson Education India.	2022

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	Learning PHP, MySQL &JavaScript with jQuery, CSS and HTML5	Robin Nixon	4th	O‟Reilly Publications	2015
2	PHP and MySQL Web Development	Luke Welling, Laura Thomson	5th	Pearson Education	2016
3	Professional JavaScript for Web Developers	Nicholas C Zakas	3rd	Wrox/Wiley India	2012
4	JavaScript & jQuery: The Missing Manual	David Sawyer Mcfarland	1st	O‟Reilly/Shroff Publishers & Distributors Pvt Ltd	2014

E-Resources: E-books / Online Course materials / Online Courses / Video Lectures:

Sl. #	Type of E-Resource	URL
1	Web-based technical tutorial/article	https://www.geeksforgeeks.org/web-technology/
2	Web-Based Interactive Educational Resource & Online Reference Manual & Tutorial Platform	https://www.w3schools.com/
3	video lecture/tutorial	https://www.youtube.com/watch?v=8sXRyHI3bLw

COURSE OUTCOMES:

At the end of the Course, student will be able to:

CO #	Course Outcome Statement
CO1	Adapt HTML and CSS syntax and semantics to build web pages.
CO2	Construct and visually format tables and forms using HTML and CSS.
CO3	Develop Client-Side Scripts using JavaScript and Server-Side Scripts using PHP to generate and display the contents dynamically.
CO4	Appraise the principles of object oriented development using PHP.
CO5	Inspect JavaScript frameworks like jQuery and Backbone which facilitates developer to focus on core features.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	-	-	-	-	-	1	2	2	2
CO2	3	3	3	2	3	-	-	1	2	-	2	3	3	3
CO3	3	3	3	2	3	-	-	2	2	-	2	3	3	3
CO4	2	2	3	2	3	-	-	2	2	2	2	3	3	3
CO5	2	3	3	2	3	-	1	3	3	3	3	3	3	3
AVG	2.6	2.6	2.6	1.8	2.8	-	1	2	2.25	2.5	2	2.8	2.8	2.8

Teaching-Learning Process

Pedagogy (General Instructions):

These are sample Strategies; teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied Mathematical skills.

2. State the need for Mathematics with Engineering Studies and Provide real-life examples.

3. Support and guide the students for self–study.

4. You will assign homework, grading assignments and quizzes, and documenting students' progress.

5. Encourage the students to group learning to improve their creative and analytical skills.

6. Show short related video lectures in the following ways:

   ● As an introduction to new topics (pre-lecture activity).

   ● As a revision of topics (post-lecture activity).

   ● As additional examples (post-lecture activity).

   ● As an additional material of challenging topics (pre-and post-lecture activity).

As a model solution for some exercises (post-lecture activity).

GRAPH THEORY

Course Code	B24IS452	Total Contact Hours / Week	4	CIE Marks	50
Course Category	ESC	Total SAAE Hours / Semester	32	SEE Marks	50
L:T:P:S	2:2:0:0	Total Notional Learning Hours	90	Total Marks	100
Total Credits	3			Exam Duration	3 Hrs

COURSE LEARNING OBJECTIVES
1. Understand the basic concepts of graphs and their properties, and operations of graphs.
2. Hamiltonian and Euler graphs, trees and matrix representation of the graph.
3. Apply the concepts of a planar graph, matching and colouring in computer science engineering.

PREREQUISITES
• Representing graphs using adjacency matrices is a common technique in graph theory, and understanding matrices and their operations is useful for applying linear algebra to graph problems
• Some advanced graph theory concepts, like spectral graph theory, rely on vector spaces and linear transformations
• A comfortable understanding of mathematical proofs, definitions, and theorems is beneficial for navigating the theoretical aspects of graph theory

MODULE #	TOPICS	Hours
1	**Introduction to Graphs**: Introduction- Basic definition – Application of graphs – finite, infinite and bipartite graphs – Incidence and Degree – Isolated vertex, pendant vertex and Null graph. Paths and circuits – Isomorphism, sub-graphs, walks, paths and circuits, connected graphs, disconnected graphs and components.	**6**
2	**Eulerian and Hamiltonian graphs**: Euler graphs, Operations on graphs, Hamiltonian paths and circuits, Travelling salesman problem. Directed graphs – types of digraphs, Digraphs and binary relation.	**5**
3	**Trees** – properties, pendant vertex, Distance and centres in a tree - Rooted and binary trees, counting trees, spanning trees. **Connectivity Graphs**: Vertex Connectivity, Edge Connectivity, Cut set and Cut Vertices, Fundamental circuits.	**5**
4	**Planar Graphs**: Planar graphs, Kuratowski's theorem (proof not required), Different representations of planar graphs, Euler's theorem, Geometric dual. **Graph Representations:** Matrix representation of graphs - Adjacency matrix, Incidence Matrix, Circuit Matrix, Path Matrix.	**6**
5	**Graph Colouring:** Colouring- Chromatic number, Chromatic polynomial, Matchings, Coverings, Four colour problem and Five colour problem. Greedy colouring algorithm.	**6**

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	Graph Theory with the Applications to Engineering & Computer Science	Narsingh Deo	1st	Dovers Publications	2016
2	Graph Theory with Applications, Springer	J.A. Bondy and U.S.R. Murty	1st	Elsevier Science Publishing Co.., Inc.	2008

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	Introduction to Graph Theory	Garry Chartand and Ping Zhang	Indian Edition	Tata McGraw-Hill	2006
2	Graph Theory	Frank Harary	Latest Edition	Narosa Publishing House	2022
3	Graph Theory	R. Diestel	5th Edition	Springer	2016
4	Introduction to Graph Theory	Douglas B. West	2nd	Prentice Hall India Ltd	2001
5	Introduction to Graph Theory	Robin J. Wilson	5th	Longman Group Ltd	2010

E-Resources: E-books / Online Course materials / Online Courses / Video Lectures:

Sl. #	Type of E-Resource	URL
1	NPTEL online courses	http://nptel.ac.in/courses.php?disciplineID=111
2	Online courses	http://www.class-central.com/subject/math(MOOCs)
3	Video Lectures	http://academicearth.org/
4	Online Course materials	VTU e-Shikshana Program
5	Online Course materials	VTU EDUSAT Program.

COURSE OUTCOMES:

At the end of the Course, student will be able to:

CO #	Course Outcome Statement
CO1	Explain the fundamental concepts of properties and representation of graphs.
CO2	Solve the problems involving characterization and operations on graphs.
CO3	Apply concepts of trees and graph connectivity to solve real world problems.
CO4	Apply the concepts of planar graph and graph representations to solve the given problem.
CO5	Use the concepts of matching and coloring of graphs to solve the real world problems.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	-	-	-	-	3	3	-	-
CO2	3	3	2	-	-	-	-	-	-	-	3	3	-	-
CO3	3	3	2	-	-	-	-	-	-	-	3	3	-	-
CO4	3	3	2	-	-	-	-	-	-	-	3	3	-	-
CO5	3	3	2	-	-	-	-	-	-	-	3	3	-	-
AVG	3	3	2	-	-	-	-	-	-	-	3	3	-	-

Teaching-Learning Process (General Instructions):

These are sample Strategies; teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied Mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will assign homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students to group learning to improve their creative and analytical skills.
6. Show short related video lectures in the following ways:
   ● As an introduction to new topics (pre-lecture activity).
   ● As a revision of topics (post-lecture activity).
   ● As additional examples (post-lecture activity).
   ● As an additional material of challenging topics (pre-and post-lecture activity).

As a model solution for some exercises (post-lecture activity).

OPTIMIZATION TECHNIQUES FOR MACHINE LEARNING

Course Code	B24AD453	Total Contact Hours / Week	3	CIE Marks	50
Course Category	ESC	Total SAAE Hours / Semester	48	SEE Marks	50
L:T:P:S	3:0:0:0	Total Notional Learning Hours	90	Total Marks	100
Total Credits	3			Exam Duration	3 Hrs

COURSE LEARNING OBJECTIVES
The objectives of the course are to facilitate the learners to:
• Appreciate the importance of linear algebra in computer science and allied engineering science.   • Gain the knowledge of linear algebra tools and concepts to implement them in their core domain.   • Improve their mathematical thinking and acquire skills required for sustained lifelong learning.

PREREQUISITES
To effectively learn optimization techniques for machine learning, it's essential to have a solid foundation in several key areas. Here are the primary prerequisites: • **Linear Algebra**: Understanding vectors, matrices, eigenvalues, and eigenvectors is crucial, as these concepts form the backbone of many optimization algorithms and machine learning models.   • **Calculus**: Familiarity with differentiation and integration, especially in multiple dimensions, is important for grasping how optimization algorithms like gradient descent work.   • **Probability and Statistics**: A good grasp of probability distributions, statistical measures, and inferential statistics helps in understanding stochastic optimization methods and evaluating model performance.   • **Programming Skills**: Proficiency in a programming language, particularly Python, is essential for implementing optimization algorithms and using machine learning libraries.   • **Basic Machine Learning Concepts**: Familiarity with fundamental machine learning algorithms and concepts will provide context for where and how optimization techniques are applied.

MODULE #	TOPICS	Hours
1	**Vector Calculus** - Functions of several variables, Differentiation and partial differentials, gradients of vector-valued functions, gradients of matrices, useful identities for computing gradients, linearization and multivariate Taylor series.	**9**
2	**Applications of Vector Calculus** - Backpropagation and automatic differentiation, gradients in a deep network, Mean Squared Error and the applications, The Gradient Descent to optimize the cost function.	**8**
3	**Convex Optimization** - Local and global optima, convex sets and functions, application of Hessian matrix in optimization, Optimization using Sequential Search Methods - 3 Point Search Method and Fibonacci Search Method.	**8**
4	**Constrained and Unconstrained Optimization** - Lagrange's Method of Multipliers, Method of steepest ascent / descent, Newton's method, Mini batch gradient descent, Stochastic gradient descent.	**9**

5	**Advanced Optimization** - Momentum-based gradient descent methods: Adagrad, RMSprop, and Adam, Understanding Moving Average, Exponential Moving Average.	**8**

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1.	Mathematics for Machine learning	Marc Peter Deisennroth, A. Aldo Faisal, Cheng Soon Ong	1st	Cambridge University Press	2020
2.	Convex Optimization: Algorithms and Complexity, Foundations and Trends in Optimization	S. Bubeck	1st	Now Publishers Inc.	2015
3.	Distributed optimization and statistical learning via the alternating direction method of multipliers", Foundations and Trends in Machine Learning,	S. Boyd, N. Parikh, and E. Chu	-	Now Publishers Inc.	2010
4.	Linear Algebra and Optimization for Machine Learning	Charu C. Aggarwal	-	Springer	2020

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	First-Order Methods in Optimization, MOS-SIAM Series on Optimization	A. Beck	-	-	2017

E-Resources: E-books / Online Course materials / Online Courses / Video Lectures:

Sl. #	Type of E-Resource	URL
1	Video and Content	https://ocw.mit.edu/courses/mathematics/18-06sc-linear-algebra-fall 2011/index.htm
2	Text Book	https://www.math.ucdavis.edu/~linear/linear.pdf •
3	Online Course	https://www.coursera.org/learn/linear-algebra-machine-learning

COURSE OUTCOMES:

At the end of the Course, student will be able to:

CO #	Course Outcome Statement
CO1	Apply the concepts of vector calculus to solve the given problem.
CO2	Apply the concepts of partial differentiation in machine learning and deep neural networks.
CO3	Analyse the convex optimization algorithms and their importance in computer science & engineering.
CO4	Apply the optimization algorithms to solve the problem.
CO5	Analyse the advanced optimization algorithms for machine learning.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	3	3	-	2
CO2	3	3	3	3	-	-	-	-	-	-	3	3	-	3
CO3	3	3	3	3	-	-	-	-	-	-	3	3	-	3
CO4	3	3	3	3	-	-	-	-	-	-	3	3	-	3
CO5	3	3	3	3	-	-	-	-	-	-	3	3	-	3
AVG	3	3	3	3	-	-	-	-	-	-	3	3	-	2.8

Teaching-Learning Process

Pedagogy (General Instructions):

These are sample Strategies; teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied Mathematical skills.

2. State the need for Mathematics with Engineering Studies and Provide real-life examples.

3. Support and guide the students for self–study.

4. You will assign homework, grading assignments and quizzes, and documenting students' progress.

5. Encourage the students to group learning to improve their creative and analytical skills.

6. Show short related video lectures in the following ways:

   ● As an introduction to new topics (pre-lecture activity).

   ● As a revision of topics (post-lecture activity).

LINEAR ALGEBRA

Course Code	B24IS454	**Total Contact Hours / Week**	4	**CIE Marks**	50
Course Category	ESC	**Total SAAE Hours / Semester**	32	**SEE Marks**	50
L:T:P:S	2:2:0:0	**Total Notional Learning Hours**	90	**Total Marks**	100
Total Credits	3			**Exam Duration**	3 Hrs

COURSE LEARNING OBJECTIVES
1. To equip the students with standard concepts and tools in Linear algebra which will find them useful in their disciplines.
2. Gain the knowledge of linear algebra tools and concepts to implement them in their core domain.
3. Improve their mathematical thinking and acquire skills required for sustained lifelong learning.

PREREQUISITES
1. Basic knowledge of matrices and methods for solving systems of linear equations, such as substitution and elimination, is beneficial.
2. Solving linear equations, manipulating expressions, understanding functions and their properties.
3. Understanding how mathematical proofs work (especially if studying theoretical linear algebra).

MODULE #	TOPICS	Hours
1	**Linear Equations:** Fields; system of linear equations, and its solution sets; elementary row operations and echelon forms; matrix operations; invertible matrices, LU-decomposition, Numerical differentiation based on N-G forward and backward interpolation.	**5**
2	**Symmetric Matrices, Quadratic Forms and LINEAR TRANSFORMATIONS:** Diagonalization; quadratic forms; constrained optimization; Singular value decomposition. **Linear transformations:** Isomorphism, linear functional, Singular and Non-singular linear transformations, Invertible linear transformations.	**6**
3	**EIGENVALUES AND EIGENVECTORS:** Introduction, Polynomials of Matrices, Applications of Cayley-Hamilton Theorem, Eigen spaces of a linear transformation, Characteristic and Minimal Polynomials of Block Matrices, Jordan Canonical form.	**6**
4	**INNER PRODUCT SPACES:** Inner products, inner product spaces, length and orthogonality, orthogonal sets and Bases, projections, Gram-Schmidt process, QR-factorization, least squares problem and least square error.	**5**
5	**OPTIMIZATION TECHNIQUES IN LINEAR ALGEBRA:** Diagonalization and Orthogonal diagonalization of real symmetric matrices, quadratic forms and its classifications, Hessian Matrix, Method of steepest descent, Singular value decomposition. Dimensionality reduction – Principal component analysis.	**6**

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	Linear Algebra and its Applications	David C. Lay, Steven R. Lay, Judi J Mc. Donald	6th	Pearson Education	2021
2	Linear Algebra and its Applications	Gilbert Strang	4th	Brooks Cole	2005

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	Linear Algebra: An Introduction	Richard Bronson & Gabriel B. Costa	2nd	Academic Press	2014
2	Theory and Problems of Linear Algebra	Seymour Lipschutz, Marc Lipso	6th	McGraw-Hill Education	2017
3	Mathematics for Machine Learning	Marc Peter Deisennroth, A. Aldo Faisal, Cheng Soon Ong	1st	Cambridge University Press	2020

E-Resources: E-books / Online Course materials / Online Courses / Video Lectures:

Sl. #	Type of E-Resource	URL
1	Online Courses	https://ocw.mit.edu/courses/mathematics/18-06sc-linear-algebra-fall- 2011/index.htm
2	E-books	https://www.math.ucdavis.edu/~linear/linear.pdf
3	Online Courses	https://www.coursera.org/learn/linear-algebra-machine-learning
4	Online Courses	https://nptel.ac.in/syllabus/111106051/
5	Online Courses	http://nptel.ac.in/courses.php?disciplineID=111
6	Online Courses	http://www.class-central.com/subject/math(MOOCs)
7	Video Lectures	http://academicearth.org/
8	Online Course materials	VTU e-Shikshana Program
9	Online Course materials	VTU EDUSAT Program.

COURSE OUTCOMES:

At the end of the Course, student will be able to:

CO #	Course Outcome Statement
CO1	Formulate and solve systems of linear equations using various methods.
CO2	Use matrices and linear transformations to solve the given problem.
CO3	Compute Eigenvalues and Eigenvectors for the linear transformations
CO4	Determine orthogonality of inner product spaces.
CO5	Apply the optimization techniques to solve the problems.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	-	-	-	2	3	-	-
CO2	3	3	3	-	-	-	-	-	-	-	2	3	-	-
CO3	3	3	3	-	-	-	-	-	-	-	2	3	-	-
CO4	3	3	3	-	-	-	-	-	-	-	2	3	-	-
CO5	3	3	3	-	-	-	-	-	-	-	2	3	-	-
AVG	3	3	3	-	-	-	-	-	-	-	2	3	-	-

Teaching-Learning Process (General Instructions):

These are sample Strategies, teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied Mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will assign homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students to group learning to improve their creative and analytical skills.
6. Show short related video lectures in the following ways:
   ● As an introduction to new topics (pre-lecture activity).
   ● As a revision of topics (post-lecture activity).
   ● As additional examples (post-lecture activity).
   ● As an additional material of challenging topics (pre-and post-lecture activity).
As a model solution of some exercises (post-lecture activity).

BIOLOGY FOR ENGINEERS

Course Code	B24BOE46	Total Contact Hours / Week	1	CIE Marks	50
Course Category	BSC	Total SAAE Hours / Semester	16	SEE Marks	50
L:T:P:S	1:0:0:0	Total Notional Learning Hours	30	Total Marks	100
Total Credits	1			Exam Duration	1 Hrs

COURSE LEARNING OBJECTIVES
This course is intended to:
1. To familiarize the students with the basic biological concepts and their engineering applications.
2. To enable the students with an understanding of biodesign principles to create novel devices and structures.
3. To provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems.
4. To motivate the students to develop interdisciplinary vision of biological engineering.

PREREQUISITES
• Understanding of cell structure, genetics, human physiology, and basic biochemistry.
• Familiarity with chemical bonding, biomolecules, acids & bases, and reactions relevant to biological systems.
• Ability to observe, analyse, and apply scientific principles logically.

MODULE #	TOPICS	Hours
1	**Introduction to Biology:** The cell: The basic unit of life, Structure and functions of a cell. Plant Cell and animal cell, Prokaryotic and Eukaryotic cell, Stem cells and their application.	**3**
2	**Biomolecules and Biosensors:** Biomolecules: Properties and functions of carbohydrates, proteins, lipids. Short Biosensor History, Biosensor Classification.	**3**
3	**Biochemical Components used in Biosensor Assemblies:** Enzymes, Antibodies, Protein/Peptide Receptors, Nucleic Acids, Whole Cells as Biosensing Elements, Immobilization of Biochemical Elements of Biosensors.	**3**
4	**Adaptation of Anatomical Principles:** Brain as a CPU system. Eye as a Camera system. Heart as a pump system. Lungs as purification system. Kidney as a filtration system.	**3**
5	**Biomimetics:** Introduction, Echolocation (ultrasonography / ultrasound Imaging), Photosynthesis (photovoltaic cells, bionic leaf). Birds and insects (flight aerodynamics), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Shark skin (Friction reducing swimsuits), Kingfisher beak (Bullet train).	**3**

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	Biology for Engineers	Rajendra Singh C and Rathnakar Rao N, Rajendra Singh C and Rathnakar Rao	-	N Publishing, Bengaluru	2023
2	Human Physiology	Stuart Fox, Krista Rompolski	16th	McGraw-Hill eBook	2022
3	Biosensors: Essentials.	Evtugyn, Gennady.	Vol. 84	Springer Berlin Heidelberg	2014
4	Biomimetics: Nature-Based Innovation	Yoseph Bar-Cohen	1st	CRC Press	2012
5	Biomedical Instrumentation	Leslie Cromwell	NA	Prentice Hall	2011
6	Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies	D. Floreano and C. Mattiussi	NA	MIT Press	2008

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	Wilson and Walker-Principles and Techniques of Biochemistry and Molecular Biology	Andreas Hofmann, Samuel Clokie.	-	-	2018
2	3D Bioprinting: Fundamentals, Principles and Applications	Ibrahim Ozbolat	NA	Academic Press	2016
3	Biology for Engineers	Sohini Singh and Tanu Allen	NA	Vayu Education of India, New Delhi	2014
4	Biology for Engineers	Arthur T. Johnson	NA	CRC Press, Taylor and Francis	2011

E-Resources: E-books / Online Course materials / Online Courses / Video Lectures:

Sl. #	Type of E-Resource	URL
1	Online courses	https://nptel.ac.in/courses/121106008
2	Online courses	https://freevideolectures.com/course/4877/nptel-biology-engineers-other-nonbiologists
3	Online courses	https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-designspring-2009
4	Online courses	https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring2006
5	Online courses	https://www.coursera.org/courses?query=biology
6	Online courses	https://onlinecourses.nptel.ac.in/noc19_ge31/preview
7	Online courses	https://www.classcentral.com/subject/biology
8	Online courses	https://www.futurelearn.com/courses/biology-basic-concepts

COURSE OUTCOMES:

At the end of the Course, student will be able to:

CO #	Course Outcome Statement
CO1	Interpret the components of a basic biological cell and their functions
CO2	Understand the principles of bioengineering sensors.
CO3	Compare the adaptation of anatomical principles in day-to-day engineering applications.
CO4	Relate the solution offered by nature to analogous engineering problems.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	3	-	-	3	-	-	-
CO2	3	3	3	3	-	-	-	3	-	-	3	-	-	-
CO3	3	3	3	3	-	-	-	3	-	-	3	-	-	-
CO4	3	3	3	3	-	-	-	3	-	-	3	-	-	-
AVG	3	3	3	3	-	-	-	3	-	-	3	-	-	-

Teaching-Learning Process

Pedagogy (General Instructions):

These are sample Strategies which teachers can use to accelerate the attainment of the various course outcomes.

1) Explanation via real life problem, situation modelling, and deliberation of solutions, hands-on sessions, reflective and questioning /inquiry-based teaching.
2) Instructions with interactions in classroom lectures (physical/hybrid).
3) Use of ICT tools, including YouTube videos, related MOOCs, AR/VR/MR tools.
4) Flipped classroom sessions (~10% of the classes).
5) Industrial visits, Guests talks and competitions for learning beyond the syllabus.
6) Students' participation through audio-video based content creation for the syllabus (as assignments).
7) Use of gamification tools (in both physical/hybrid classes) for creative learning outcomes.
8) Students' seminars (in solo or group) /oral presentations.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1) Group Discussion of Case studies.
2) Model Making and seminar/poster presentations.
3) Design of novel device/equipment like Cellulose-based water filters, Filtration system.

BUSINESS INTELLIGENCE TOOLS

Course Code	B24CS471	Total Contact Hours / Week	2	CIE Marks	50
Course Category	AEC	Total SAAE Hours / Semester	-	SEE Marks	50
L:T:P:S	0:0:2:0	Total Notional Learning Hours	30	Total Marks	100
Total Credits	1			Exam Duration	3 Hrs

COURSE LEARNING OBJECTIVES
1. To use raw data, monitor it, and visualize it in a form that will provide rich insights with the help of dashboards.
2. Develop Proficiency in Data Visualization and Report Creation using Power BI Desktop
3. Apply Data Transformation, Modelling, and DAX to Perform Analytical Operations
4. Integrate Advanced Analytical Techniques and Publish Reports to Power BI Service

PREREQUISITES
• B24CS371 (DATA ANALYTICS USING EXCEL) -PREFERRABLE

Sl. No.	Experiments
1	**Getting started to Power BI** Installation of Power BI Desktop Understanding the GUI, toolbar, and navigation Exploring Report views: Report, Data, and Model views
2	**Visualizations and KPIs** a) Import a csv file which consists of a sales data with fields Country, continent, year and sales. Prepare at least 3 different visualization report (e.g Bar chart, Pie Chart, Linechart). Apply various formatting option and export it to PDF b) Apply Conditional filtering over the Power BI report. c) Check the card visualization and KPI (Key Performance Indicators)
3	**Perform Data Formatting and Transformation** a) Convert Dimensional data to Fact table b) Fixing and Rendering Date time Using the Query Editor c) Handling missing values and renaming columns
4	Use DAX (Data Analysis Expressions) with columns and measures, filter and calculate, creating tables.
5	**Perform R visualization** a) Generating Data for Monte Carlo Analysis using R b) Importing Excel data and using R visualizations for advanced analytics
6	**Interactive & Enhanced Reports** a) Create a report with multiple pages. Use the duplicate page feature to replicate layout. Add different visuals to demonstrate page customization. b) Load a sample dataset (e.g., Sales or Orders). Insert a **Decomposition Tree** to break down sales by category and region. Add descriptive text using **Text Box** to annotate the insight.

	c) Use Decision Tree formulae for classifying the data d) Use **Smart Narrative** to auto-generate insights from your visuals. Insert **Key Influencers Visual** to analyze factors impacting performance metrics like profit margin or customer rating. e) Use Insert > Shapes to create background visuals. Add a company logo using Insert > Image. Add navigation buttons and set up page navigation or bookmarks.
7	**Perform Data Modelling and advanced analytics using Power BI** a) Import multiple tables (e.g., Students, Courses). Create relationships using a star schema. Use the **Model View** to understand table relationships. b) Create calculated columns and measures using DAX (e.g., Total Sales, Discounted Price). Implement a **What-if Parameter** for changing discount rates or price sensitivity. Add a slicer for the parameter and observe how visuals update dynamically. c) Create a simple role-based access rule using **Row-Level Security**. Assign rules based on regions (e.g., Sales Manager can only see data from their assigned region). d) Test the security view in Power BI Desktop using "View As Role".
8	**Aggregation & Slicers** a) Import a dataset (e.g., Sales data). b) Use **Matrix visual** to display aggregated values by categories (e.g., Region and Product). c) Build a **Line chart** showing cumulative revenue or orders over time. d) Use DAX formula for running total (e.g., CALCULATE(SUM([Sales]), FILTER(...))). e) Add slicers for time period, region, or category. Test interactivity of slicers with visuals.

PRESCRIBED MATERIAL

Sl. #	Type of E-Resource	URL
1	Online course	TechA Data Analytics using Power BI Foundation Certification https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0138 49952348594176138_shared/overview

COURSE OUTCOMES:

At the end of the Course, student will be able to:

CO #	Course Outcome Statement
CO1	Understand and demonstrate the use of data visualization tools and their core interface components.
CO2	Import and transform datasets using Power Query, applying data cleaning and formatting techniques.
CO3	Create meaningful visualizations and interactive dashboards using charts, KPIs, and filters.
CO4	Develop DAX expressions and use data modelling to derive business insights and metrics.
CO5	Integrate R visuals and storytelling elements to enhance reports with analytics and user interactivity.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	-	-	-	3	-	-	-	-	-	-	1	-	1
CO2	2	2	-	-	3	-	-	-	-	-	-	1	-	1
CO3	1	2	3	-	3	-	-	-	-	-	-	1	-	1
CO4	2	3	3	2	3	-	-	-	-	-	-	1	-	1
CO5	1	2	3	2	3	-	-	-	-	-	-	1	-	1
AVG	1.4	2.25	3	2	3	-	-	-	-	-	-	1	-	1

Teaching-Learning Process

Pedagogy (General Instructions):

1. Outcome-Based Education (OBE)	– Emphasizes defining and achieving measurable learning outcomes, aligning course objectives with program outcomes and graduate attributes.
2. Active Learning	– Involves students actively in the learning process through activities like problem-solving, discussions, and group tasks rather than passive listening.
3. Blended Learning	– Combines traditional classroom instruction with digital platforms such as Springboard for a more flexible and engaging learning experience.
4. Project-Based Learning (PBL)	– Encourages students to apply concepts in real-world projects, fostering creativity, innovation, and teamwork.
5. Experiential Learning	– Provides hands-on experience through labs, simulations, industry internships, and workshops to connect theory with practice.
6. ICT-Enabled Teaching	– Leverages smart tools, learning management systems, programming environments, and multimedia content for enhanced delivery.
7. Continuous Assessment and Feedback	– Implements regular formative assessments and feedback mechanisms to monitor and support student progress.

UNIFIED MODELING LANGUAGE TOOLS – STAR UML

Course Code	B24IS472	Total Contact Hours / Week	2	CIE Marks	50
Course Category	AEC	Total SAAE Hours / Semester	-	SEE Marks	50
L:T:P:S	0:0:2:0	Total Notional Learning Hours	30	Total Marks	100
Total Credits	1			Exam Duration	3 Hrs

COURSE LEARNING OBJECTIVES
1. Master Object-Oriented Principles and UML Fundamentals for a Strong Foundation.
2. Attain a comprehensive grasp on UML application and design diagram utilization.
3. Acquire knowledge of iterative, incremental, and development processes.
4. Examine Extreme Programming (XP) principles through comprehensive study and practical application.
5. Discover and apply key design patterns in practical contexts for hands-on experience.

PREREQUISITES
• Basic OOP knowledge – **classes,** objects, inheritance, polymorphism, encapsulation**.**
• Familiarity with programming – Java, C++, or Python can help in mapping code structures to UML diagrams.

Sl. No.	Programs
1	Imagine you are tasked with developing a comprehensive UML diagram for an Automated Teller Machine (ATM) application. The ATM system should support basic banking transactions such as cash withdrawals, balance inquiries, and fund transfers.
2	Describe the UML representation of interactions in a Library Management System's book borrowing process, emphasizing actor roles, event flow, decision points, and ensuring scalability for future system enhancements.
3	Design an UML representation of interactions in an Online Book Shop, emphasizing system components, user roles, transaction processes, and scalability features for future enhancements.
4	Design the UML diagram for a Railway Reservation System, emphasizing interactions, user roles, booking processes, and scalability features tailored for accommodating future system enhancements.
5	Demonstrate the UML representation of the Banking System's Account Transfer Process, highlighting interactions, user roles, transaction sequence, security measures, validation, exception handling, and scalability for future enhancements.
6	Draw a model for Airport management system in different views i.e. Use case view, logical view, component view, Deployment view, Database design, forward and Reverse Engineering, and Generation of documentation of the project.
7	Draw a model for E-commerce sites in different views i.e Use case view, logical vie component view, Deployment view,Database design, forward and Reverse Engineering, and Generation of documentation of the project.
8	Design Activity and Class Diagram for Hospital management system to demonstrate the activities which will be carried out in Hospital.

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	UML Distilled: A Brief Guide to the Standard Object Modeling Language	Martin Fowler	3rd	Addison – Wesley	2003

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	The Unified Modeling Language User Guide	Grady Booch,James Rumbaugh and Ivar Jacobson	2nd	Addison-Wesley	2005

E-Resources: E-books / Online Course materials / Online Courses / Video Lectures:

Sl. #	Type of E-Resource	URL
1	Video Lecture	https://nptel.ac.in/courses/106105224
2	Tutorial	https://staruml.io/docs

COURSE OUTCOMES:

At the end of the Course, student will be able to:

CO #	Course Outcome Statement
CO1	Analyze complex problems, design effective solutions and communicate their ideas through UML diagrams.
CO2	Develop the expertise needed to employ UML as a powerful tool for precise and effective communication in the analysis and design phases of software development.
CO3	Gain competency in understanding and applying iterative, incremental and agile development processes.
CO4	Develop practical proficiency in Extreme Programming principles through in-depth study and hands-on application.
CO5	Design the application of key design patterns in real-world scenarios and demonstrating hands-on proficiency.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	-	1	-	-	-	-	-	-	1	-	-
CO2	3	3	3	-	1	-	-	-	-	-	-	1	-	-
CO3	3	3	3	-	1	-	-	-	-	-	-	1	-	-
CO4	3	3	3	-	1	-	-	-	-	-	-	1	-	-
CO5	3	3	3	-	1	-	-	-	-	-	-	1	-	-
AVG	3	3	3	-	1	-	-	-	-	-	-	1	-	-

Teaching-Learning Process (General Instructions):

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but different types of teaching methods may be adopted to achieve the outcomes.
2. Promote collaborative learning (Group Learning) in the class.
3. Pose at least three HOT (Higher Order Thinking) questions in the class to stimulate critical thinking.
4. Incorporate Problem-Based Learning (PBL) to foster students' analytical skills and develop their ability to evaluate, generalize, and analyze information rather than merely recalling it.
5. Introduce Topics in manifold representations.
6. Demonstrate ways to solve the same problem and encourage the students to come up with their own creative solutions.

Discuss application of every concept to solve the real world problems.

TECHNICAL WRITING USING LaTeX

Course Code	B24IS473	Total Contact Hours / Week	2	CIE Marks	50
Course Category	AEC	Total SAAE Hours / Semester	-	SEE Marks	50
L:T:P:S	0:0:2:0	Total Notional Learning Hours	30	Total Marks	100
Total Credits	1			Exam Duration	3 Hrs

COURSE LEARNING OBJECTIVES
1. To introduce the basic syntax and semantics of the LaTeX scripting language.
2. To understand the presentation of tables and figures in the document.
3. To illustrate the LaTeX syntax to represent the theorems and mathematical equation.
4. To make use of the libraries (Tikz, algorithm) to design the diagram and algorithms in the document

PREREQUISITES
1. Familiarize yourself with basic document structure, understand the role of a text editor.
2. Basic understanding of LaTeX syntax. It's also helpful to have some prior experience with text editors.
3. Willingness to learn and experiment with LaTeX's features.

Sl. No.	Experiments
1	Develop a LaTeX script to create a simple document that consists of 2 sections [Section1, Section2], and a paragraph with dummy text in each section. And also include header [title of document] and footer [institute name, page number] in the document.
2	Develop a LaTeX script to create a document that displays the sample Abstract/Summary.
3	Develop a LaTeX script to create a simple title page of the VTU project Report [Use suitable Logos and text formatting]
4	Develop a LaTeX script to create the Certificate Page of the Report [Use suitable commands to leave the blank spaces for user entry]
5	Develop a LaTeX script to create a document that contains the following table with proper labels.
6	Develop a LaTeX script to include the side-by-side graphics/pictures/figures in the document by using the subgraph concept
7	a. Develop a LaTeX script to create a simple flowcharts using Tikz Library.

Table for experiment 5:

Sl No	USN	Student Name	Marks		
			Subject1	Subject2	Subject3
1	4XX22XX001	Name 1	89	60	90
2	4XX22XX002	Name 2	78	45	98
3	4XX22XX003	Name 3	67	55	59

	b. Develop a LaTeX script to design a simple tree diagram or hierarchical structure in the document with appropriate labels using the Tikz library
8	Develop a LateXscript to plot any Simple Plots/Graph using pgfplots and Tikz Libraries.
9	Develop a LaTeX script to demonstrate the presentation of Numbered theorems, definitions, corollaries, and lemmas in the document.
10	Develop a LaTeX script to create a document that consists of two paragraphs with a minimum of 10 citations in it and display the reference in the section
11	Develop a LaTeX script to create a document that consists of the following two mathematical equations $$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$ $$= \frac{-2 \pm \sqrt{2^2 - 4*(1)*(-8)}}{2*1}$$ $$= \frac{-2 \pm \sqrt{4+32}}{2}$$ $$\varphi_\sigma^\lambda A_t = \sum_{\pi \in C_t} \text{sgn}(\pi) \varphi_\sigma^\lambda \varphi_\pi^\lambda$$ $$= \sum_{\tau \in C_{\sigma t}} \text{sgn}(\sigma^{-1}\tau\sigma) \varphi_\sigma^\lambda \varphi_{\sigma^{-1}\tau\sigma}^\lambda$$ $$= A_{\sigma t}\varphi_\sigma^\lambda$$
12	Develop a LaTeX script to present an algorithm in the document using algorithm / algorithmic / algorithm2e library.
Mini- Project	
1.	Develop a LaTeX script to create a simple report and article by using suitable commands and formats of user choice.

E-Resources: E-books / Online Course materials / Online Courses / Video Lectures:

Sl. #	Type of E-Resource	URL
1	Video Lectures	LaTeX Tutorial: [https://www.javatpoint.com/latex]
2	Video Lectures	LaTeX Tutorial : [https://latex-tutorial.com/tutorials/]

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	A Short Introduction to LaTeX - A book for beginners.	Firuza Karmali (Aibara)	Kindle Edition	Createspace Independent Publishing Platform	2019
2	Formatting Information: A Beginner's Introduction to Typesetting with LaTeX,	Flynn, Peter	-	Comprehensive TeX Archive Network	2005

COURSE OUTCOMES:

At the end of the Course, student will be able to:

CO #	Course Outcome Statement
CO1	Apply basic LaTeX command to develop simple document.
CO2	Develop LaTeX script to present the tables and figures in the document.
CO3	Illustrate LaTeX script to present theorems and mathematical equations in the document.
CO4	Develop programs to generate the complete report with citations and a bibliography.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	-	-	1	-	-	-	-	-	2	3	-	-
CO2	3	3	-	-	1	-	-	-	-	-	2	3	-	-
CO3	3	3	-	-	1	-	-	-	-	-	2	3	-	-
CO4	3	3	-	-	1	-	-	-	-	-	2	3	-	-
AVG	3	3	-	-	1	-	-	-	-	-	2	3	-	-

Teaching-Learning Process (General Instructions):

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but different types of teaching methods may be adopted to achieve the outcomes.
2. Promote collaborative learning (Group Learning) in the class.
3. Pose at least three HOT (Higher Order Thinking) questions in the class to stimulate critical thinking.
4. Incorporate Problem-Based Learning (PBL) to foster students' analytical skills and develop their ability to evaluate, generalize, and analyze information rather than merely recalling it.
5. Introduce Topics in manifold representations.
6. Demonstrate ways to solve the same problem and encourage the students to come up with their own creative solutions.

Discuss application of every concept to solve the real world problems.

UNIX SHELL SCRIPTING

Course Code	B24CS474	Total Contact Hours / Week	2	CIE Marks	50
Course Category	AEC	Total SAAE Hours / Semester	-	SEE Marks	50
L:T:P:S	0:0:2:0	Total Notional Learning Hours	30	Total Marks	100
Total Credits	1			Exam Duration	3 Hrs

COURSE LEARNING OBJECTIVES
This course is intended to:
1) Understand the features, architecture of UNIX and its commands.
2) Discuss different UNIX files, attributes and permissions
3) Discuss filter programs and regular expressions
4) Understand essential facets of shell programming in order solve the shell script problems

PREREQUISITES
NIL

MODULE #	TOPICS	Hours
1	**UNIX Architecture and Command Usage:** Unix Architecture, Features of UNIX, Internal and External Commands. **General-Purpose Utilities:** cal, date, echo, printf, bc, passwd, who, uname, tty, stty. **The File System:** The Parent-Child Relationship, the HOME variable, pwd, cd, mkdir, rmdir, Absolute Pathnames, Relative Pathnames	3
2	**Handling Ordinary Files:** cat, cp, rm, mv, more, file, wc, cmp, comm, diff, Basic File Attributes: ls –l, file ownership, file permissions, chmod, directory permissions, changing file ownership	3
3	**Simple Filters:** The sample database, head, tail, cut, paste, sort, uniq, tr Filters using Regular Expression: grep. Egrep	3
4	**Essential Shell Programming Part I:** Shell Scripts, read, Using command line arguments, exit and exit status of command, the logical operators && and || - conditional execution	3
5	**Essential Shell Programming Part II:** the if conditional, using test and [ ] to evaluate expressions, the case conditional, expr, $0, while, for, set and shift	3

Laboratory Component

1	Working on general purpose commands and General-Purpose Utilities
2	Working on general purpose commands and General-Purpose Utilities
3	Working on Ordinary files and Attributes
4	Working on Ordinary files and Attributes
5	Working on Filter programs and filters using regular expression
6	Working on Filter programs and filters using regular expression
7	a) Write a shell script which displays a list of all the files in the current directory to which you have read, write and execute permissions. b) Write a shell script which will accept a filename and starting and ending line numbers and displays these lines from given file. c) Write a shell script which is expected to accept two filenames as its arguments. Check the number of arguments and display the contents of the argument files if the arguments is two, otherwise display an error message an exit.
8	a) Write a shell program that will do the following tasks in order: i) clear the screen ii) print the current directory iii) display current login users iv) list of users v) list of processes vi) list of files vii) today's date viii) Quit to UNIX b) Write a shell script that reads data from a text file and appends the lines starting with an alphabet from 'a' through 'k' to a file named "ak" and the lines from 'l' through 'r' to a file named "lr" and the lines from 's' through 'z' to a file named "sz". Then display the number of lines in each of the files ak, lr and sz individually. c) Write a shell script which will receive login name during execution, obtain information about it from /etc/passwd and display this information on screen in easily understandable format.
9	a) A shell script receives even number of filenames as arguments. Suppose four files are supplied as arguments then the first file should get copied into second, third file into fourth and so on. If odd number of filenames is supplied then no copying should take place and an error message should be displayed. b) Write a shell script which will receive any number of filenames as arguments. The shell script should check whether every argument supplied is a file or a directory. If it a directory it should be appropriately reported. If it is a filename then name of the file as well as the number of lines present in it should be reported.
10	a) Write a shell script which expects two parameters, a file name and a number. The script deletes the line with given number from given file. b) Write a shell script which accepts any number of arguments and prints them in reverse order. Ex : If file name is test then $ sh test A B C should produce C B A. c) Write script average which computes the average value (rounded to an integer as computed with expr) of the numeric values given in the parameters and writes the result to standard output. For example average 4 13 112 7 outputs 34.

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	UNIX – Concepts and Applications	Sumitabha Das	4th	Mc. Graw Hill	2017

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	UNIX and SHELL Programming	Behrouz A Forouzan and Richard F Gilberg	INDIA Edition	CENGAGE Learning, Third Reprint	2008
2	UNIX – The Complete Reference	Kenneth Rosen et al	2nd	TATA McGraw Hill Fourth Reprint	2008

E-Resources: E-books / Online Course materials / Online Courses / Video Lectures:

Sl. #	Type of E-Resource	URL
1	Web Resources	http://www.ee.surrey.ac.uk/Teaching/Unix/unixintro.html
2	Web Resources	https://www.tutorialspoint.com/unix/index.htm
3	MOOC Course	https://nptel.ac.in/courses/117106113
4	MOOC Course	https://onlinecourses.swayam2.ac.in/aic20_sp05/preview
5	MOOC Course	http://elearning.vtu.ac.in/econtent/courses/video/CSE/CS36.htm
6	YOUTUBE	https://www.youtube.com/@profngp5213/videos
7	E-BOOK	https://fisnikd.wordp ress.com/wp-content /uploads/2009/11/beginning-shell scripting.pdf
8	MOOC Course	https://www.coursera.org/learn/hands-on-introduction to-linux-commands-and shell-scripting

COURSE OUTCOMES:

At the end of the Course, student will be able to:

CO #	Course Outcome Statement
CO1	Explain the fundamental concepts of UNIX Operating system along with the working of various commands
CO2	Illustrate various filters to solve variety of applications
CO3	Write Regular expressions for pattern matching
CO4	Write shell scripts

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	-	3	-	-	-	-	-	2	-	-	-
CO2	3	3	2	-	3	-	-	-	-	-	2	-	-	-
CO3	3	3	2	-	3	-	-	-	-	-	2	-	-	-
CO4	3	3	2	-	3	-	-	-	-	-	2	-	-	-
AVG	3	3	2	-	3	-	-	-	-	-	2	-	-	-

Teaching-Learning Process

Pedagogy (General Instructions):

A successful pedagogy for Unix shell scripting focuses on practical application, gradual complexity, and real-world scenarios. This approach involves teaching fundamental concepts, then moving to more advanced techniques and scripting best practices. It also emphasizes hands-on experience and real-world problem-solving to solidify learning. Have a look at how the course can be made more interesting:

Practical Learning:

1) **Hands-on Exercises:** Encourage students to practice writing scripts to solve real-world problems.

2) **Project-Based Learning:** Assign projects that involve creating scripts for specific tasks, such as automating backups, managing users, or monitoring system resources.

3) **Debugging Techniques:** Teach students how to identify and fix errors in their scripts using tools like set -x for tracing execution and error messages.

Resources and Tools:

1) **Online Courses and Tutorials:** Few links are given for references in the E-Resources table above.

2) **Documentation:** Recommend using the official Unix documentation (e.g., man pages) and online tutorials for reference.

Community Resources: Encourage students to participate in online forums and communities where they can ask questions and share knowledge.

UNIVERSAL HUMAN VALUES

Course Code	B24UHK48	Total Contact Hours / Week	1	CIE Marks	100
Course Category	UHV	Total SAAE Hours / Semester	16	SEE Marks	-
L:T:P:S	1:0:0:0	Total Notional Learning Hours	30	Total Marks	100
Total Credits	1			Exam Duration	-

COURSE LEARNING OBJECTIVES
This course is intended to:

1. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.
4. This course is intended to provide a much-needed orientation input in value education to the young enquiring minds.

PREREQUISITES
NIL

MODULE #	TOPICS	Hours
1	**Introduction to Value Education:** Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations	**3**
2	**Harmony in the Human Being:** Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health	**3**
3	**Harmony in the Family and Society:** Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order	**3**

4	**Harmony in the Nature/Existence:** Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence	**3**
5	**Implications of the Holistic Understanding – a Look at Professional Ethics:** Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession	**3**

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	A Foundation Course in Human Values and Professional Ethics	R R Gaur, R Asthana, G P Bagaria	2nd	Excel Books, New Delhi	2019
2	The Teacher's Manual for A Foundation Course in Human Values and Professional Ethics	R R Gaur, R Asthana, G	NA	NA	NA

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	Jeevan Vidya: Ek Parichaya	A Nagaraj	NA	Jeevan Vidya Prakashan, Amar Kantak	1999
2	Human Values	A.N. Tripathi	NA	New Age Intl. Publishers, New Delhi	2004
3	Foundations of Ethics and Management	B P Banerjee	NA	Excel Books.	2005

E-Resources: E-books / Online Course materials / Online Courses / Video Lectures:

Sl. #	Type of E-Resource	URL
1	Online resource	https://www.uhv.org.in/uhv-ii
2	Online resource	http://uhv.ac.in
3	Online resource	http://www.uptu.ac.in
4	You tube link	https://www.youtube.com/watch?v=8ovkLRYXIjE
5	You tube link	https://www.youtube.com/watch?v=OgdNx0X923I

COURSE OUTCOMES:

At the end of the Course, student will be able to:

CO #	Course Outcome Statement
CO1	They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
CO2	They would have better critical ability.
CO3	They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
CO4	It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

Expected to positively impact common graduate attributes like:

1) Ethical human conduct.
2) Socially responsible behaviour.
3) Holistic vision of life.
4) Environmentally responsible work.
5) Having Competence and Capabilities for Maintaining Health and Hygiene 6. Appreciation and aspiration for excellence (merit) and gratitude for all.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	3	-	3	3	-	3	-	-	-
CO2	-	-	-	-	-	3	-	3	3	-	3	-	-	-
CO3	-	-	-	-	-	3	-	3	3	-	3	-	-	-
CO4	-	-	-	-	-	3	-	3	3	-	3	-	-	-
AVG	-	-	-	-	-	3	-	3	3	-	3	-	-	-

Teaching-Learning Process

Pedagogy (General Instructions):

These are sample Strategies which teachers can use to accelerate the attainment of the various course outcomes.

1) The methodology of this course is exploration based and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.

2) In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied skills.

3) State the need for UHV activities and its present relevance in the society and Provide real-life examples.

4) Support and guide the students for self-study activities.

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5) You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.

6) This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student in every activity, leading to continuous self-evolution.

7) Encourage the students for group work to improve their creative and analytical skills.

Assessment Details (only CIE):

Continuous Internal Evaluation:

1) Two tests will be administered. Each test will be for 50 marks.

2) Questions will be based on multiple choice

3) Final CIE marks will be the sum total of both the tests.

4) The minimum passing mark for the CIE is 40% of the maximum marks (40 marks out of 100)

DATABASE MANAGEMENT SYSTEMS LABORATORY WITH MINI PROJECT

Course Code	B24ISL49	Total Contact Hours / Week	2	CIE Marks	50
Course Category	PCCL	Total SAAE Hours / Semester	-	SEE Marks	50
L:T:P:S	0:0:2:0	Total Notional Learning Hours	30	Total Marks	100
Total Credits	1			Exam Duration	3 Hrs

COURSE LEARNING OBJECTIVES
1. Foundation knowledge in database concepts, technology and practice to groom students into well-informed database application developers.
2. Strong practice in SQL programming through a variety of database problems.
3. Develop database applications using front-end

Design, develop, and implement the specified queries for the following problems using Oracle, MySQL, MS SQL Server, or any other DBMS under LINUX/Windows environment. Create Schema and insert at least 5 records for each table. Add appropriate database constraints.

Sl. No.	Programs

1	**Aim:** Demonstrating creation of tables, applying the view concepts on the tables.
	
	Program: Consider the following schema for a Library Database:
	BOOK(Book_id, Title, Publisher_Name, Pub_Year)
	BOOK_AUTHORS(Book_id, Author_Name)
	PUBLISHER(Name, Address, Phone)
	BOOK_COPIES(Book_id, Programme_id, No-of_Copies)
	BOOK_LENDING(Book_id, Programme_id, Card_No, Date_Out, Due_Date)
	LIBRARY_PROGRAMME(Programme_id, Programme_Name, Address)
	Write SQL queries to
	  1. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each Programme, etc.
	  2. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017.
	  3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation.
	  4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query.
	  5. Create a view of all books and its number of copies that are currently available in the Library
	Reference:
	https://www.youtube.com/watch?v=AaSU-AOguls
	https://www.youtube.com/watch?v=-EwEvJxS-Fw

2	**Aim:** Introduce concepts of PLSQL and usage on the table. **Program:** Consider the schema for College Database:

	STUDENT(USN, SName, Address, Phone, Gender)

	SEMSEC(SSID, Sem, Sec)
	CLASS(USN, SSID)
	COURSE(Subcode, Title, Sem, Credits)
	IAMARKS(USN, Subcode, SSID, Test1, Test2, Test3, FinalIA)
	Write SQL queries to
	  1. List all the student details studying in fourth semester 'C' section.
	  2. Compute the total number of male and female students in each semester and in each section.
	  3. Create a view of Test1 marks of student USN '1BI15CS101' in all Courses.
	  4. Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students.
	  5. Categorize students based on the following criterion: If
	    FinalIA = 17 to 20 then CAT = 'Outstanding'
	    If FinalIA = 12 to 16 then CAT = 'Average'
	    If FinalIA< 12 then CAT = 'Weak'
	Give these details only for 8th semester A, B, and C section students.
	Reference:
	https://www.youtube.com/watch?v=horURQewW9c
	https://www.youtube.com/watch?v=P7-wKbKrAhk

3	**Aim:** Demonstrate the core concepts on table like nested and correlated nesting queries and also EXISTS and NOT EXISTS keywords. **Program:** Consider the schema for Company Database: **EMPLOYEE(SSN, Name, Address, Sex, Salary, SuperSSN, DNo)** **DEPARTMENT(DNo, DName, MgrSSN, MgrStartDate)** **DLOCATION(DNo,DLoc)** **PROJECT(PNo, PName, PLocation, DNo)** **WORKS_ON(SSN, PNo, Hours)** Write SQL queries to Make a list of all project numbers for projects that involve an employee whose last name is 'Scott', either as a worker or as a manager of the department that controls the project. Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent raise. Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department Retrieve the name of each employee who works on all the projects controlled by department number 5 (use NOT EXISTS operator). For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs.6,00,000. **Reference:** https://www.youtube.com/watch?v=Dk8f3ejqKts
Pedagogy	For the above experiments the following pedagogy can be considered. Problem based learning, Active learning, MOOC, Chalk &Talk
PART B	
Mini project: For any problem selected, make sure that the application should have five or more tables. Indicative areas include: Organization, health care, Ecommerce etc.	

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	Fundamentals of Database Systems	Ramez Elmasri and Shamkant B. Navathe	7th	Pearson	2017
2	Database Management Systems	Ramakrishnan, and Gehrke	3rd	McGraw Hill	2014

E-Resources: E-books / Online Course materials / Online Courses / Video Lectures:

Sl. #	Type of E-Resource	URL
1	Tutorial	https://www.tutorialspoint.com/sql/index.htm

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO #	Course Outcome Statement
CO1	Create, Update and query on the database.
CO2	Demonstrate the working of different concepts of DBMS.
CO3	Implement, analyze and evaluate the project developed for an application.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	3	-	-	-	-	3		3	3	-	-	3
CO2	3	3	3	-	-	-	-	3		3	3	-	-	3
CO3	3	-	3	-	3	-	-	3		3	3	-	3	3
AVG	3	3	3	-	3	-	-	3		3	3	-	3	3

NATIONAL SERVICE SCHEME (NSS) – II

Course Code	B24NSK410	Total Contact Hours / Week	2	CIE Marks	100
Course Category	NCMC	Total SAAE Hours / Semester	-	SEE Marks	-
L:T:P:S	0:0:2:0	Total Notional Learning Hours	-	Total Marks	100
Total Credits	0			Exam Duration	-

COURSE LEARNING OBJECTIVES
National Service Scheme (NSS) will enable the students to:
1. Understand the community in general in which they work.
2. Identify the needs and problems of the community and involve them in problem –solving.
3. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
4. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
5. Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

General Instructions - Pedagogy
These are sample strategies, which teachers can use to accelerate the attainment of the various course outcomes.
1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied social and cultural skills.
2. State the need for NSS activities and its present relevance in the society and Provide real-life examples.
3. Support and guide the students for self-planned activities.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
5. Encourage the students for group work to improve their creative and analytical skills.

Sl. #	CONTENTS
1	Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.
2	Waste management– Public, Private and Govt. organization, 5 R's.
3	Setting of the information imparting club for women leading to contribution in social and economic issues.
4	Water conservation techniques – Role of different stakeholders– Implementation.
5	Preparing an actionable business proposal for enhancing the village income and approach for implementation.

6	Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.
7	Developing Sustainable Water management system for rural areas and implementation approaches.
8	Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swatch Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.
9	Spreading public awareness under rural outreach programs. (minimum5 programs).
10	Social connect and responsibilities.
11	Plantation and adoption of plants. Know your plants.
12	Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).
13	Govt. school Rejuvenation and helping them to achieve good infrastructure.

NOTE:

1) Student/s in individual or in a group Should select any one activity in the beginning of each semester till end of that respective semester for successful completion as per the instructions of NSS officer with the consent of HOD of the department.

2) At the end of every semester, activity report should be submitted for evaluation.

Semester	Sl. #	TOPICS TO BE COVERED
3rd Sem B24NSK391	1	Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.
	2	Waste management– Public, Private and Govt organization, 5 R's.
	3	Setting of the information imparting club for women leading to contribution in social and economic issues.
4th Sem B24NSK410	4	Water conservation techniques – Role of different stakeholders– Implementation.
	5	Preparing an actionable business proposal for enhancing the village income and approach for implementation.
	6	Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.
5th Sem B24NSK591	7	Developing Sustainable Water management system for rural areas and implementation approaches.
	8	Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swatch Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.
	9	Spreading public awareness under rural outreach programs. (minimum5 programs).
	10	Social connect and responsibilities.
6th Sem B24NSK691	11	Plantation and adoption of plants. Know your plants.
	12	Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).
	13	Govt. school Rejuvenation and helping them to achieve good infrastructure.

	Suggested Learning Resources
1)	NSS Course Manual, Published by NSS Cell, VTU Belagavi.
2)	Government of Karnataka, NSS cell, activities reports and its manual.
3)	Government of India, NSS cell, Activities reports and its manual.

COURSE OUTCOMES:

At the end of the Course, student will be able to:

CO #	Course Outcome Statement
CO1	Understand the importance of his / her responsibilities towards society.
CO2	Analyse the environmental and societal problems/issues and will be able to design solutions for the same.
CO3	Evaluate the existing system and to propose practical solutions for the same for sustainable development.
CO4	Implement government or self-driven projects effectively in the field.
CO5	Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	3	-	-	3	3	-	-	-	3	-	-	-
CO2	-	-	3	-	-	3	3	-	-	-	3	-	-	-
CO3	-	-	3	-	-	3	3	-	-	-	3	-	-	-
CO4	-	-	3	-	-	3	3	-	-	-	3	-	-	-
CO5	-	-	3	-	-	3	3	-	-	-	3	-	-	-
AVG	-	-	3	-	-	3	3	-	-	-	3	-	-	-

PHYSICAL EDUCATION (SPORTS & ATHLETICS) – II

Course Code	B24PEK410	Total Contact Hours / Week	2	CIE Marks	100
Course Category	NCMC	Total SAAE Hours / Semester	-	SEE Marks	-
L:T:P:S	0:0:2:0	Total Notional Learning Hours	-	Total Marks	100
Total Credits	0			Exam Duration	-

COURSE OUTCOMES:

At the end of the Course, student will be able to:

CO #	Course Outcome Statement
CO1	Understand the ethics and moral values in sports and athletics
CO2	Perform in the selected sports or athletics of student's choice.
CO3	Understand the roles and responsibilities of organisation and administration of sports and games.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	3	3	-	3	-	-	-
CO2	-	-	-	-	-	-	-	3	3	-	3	-	-	-
CO3	-	-	-	-	-	-	-	3	3	-	3	-	-	-
AVG	-	-	-	-	-	-	-	3	3	-	3	-	-	-

Module #	CONTENTS	DURATION
1	Ethics and Moral Values A) Ethics in Sports B) Moral Values in Sports and Games	4 Hours
2	Specific Games (Any one to be selected by the student) A) Volleyball – Attack, Block, Service, Upper Hand Pass and Lower hand Pass. B) Athletics (Track Events) – Any event as per availability of Ground.	16 Hours
3	Role of Organisation and administration	4 Hours

Scheme and Assessment for auditing the course and Grades:

SL #	Activity	Marks
1	Participation of student in all the modules	20
2	Quizzes – 2, each of 15 marks	30
3	Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	50
	TOTAL	100

YOGA – II

Course Code	B24YOK410	Total Contact Hours / Week	2	CIE Marks	100
Course Category	NCMC	Total SAAE Hours / Semester	-	SEE Marks	-
L:T:P:S	0:0:2:0	Total Notional Learning Hours		Total Marks	100
Total Credits	0		-	Exam Duration	-

Course Title	Content	No. of Hours
Patanjali's Ashtanga Yoga 1. Yama 2. Niyama	Patanjali's Ashtanga Yoga. Yama: Ahimsa, satya, asteya, brahm acarya, aparigraha Niyama: shoucha, santosh, tapa svaadhyaya, Eshvarapranidhan	
Suryanamaskara	Suryanamaskar l2 count 4 rounds	

Different types of Asanas
 	
a) Sitting
  1. Sukhasana 2. Paschimottanasana
 	
b) Standing
  1. Ardhakati Chakrasana
  2. Parshva Chakrasana
 	
c) Prone line
  1. Dhanurasana
 	
d) Supine line
  1. Halasana 2. Karna Peedasana
	Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits each asana	**Total 20-24 Hours**
		
		2 Hours per week

Kapalabhati	Meaning, importance and benefits of Kapalabhati. 40 strokes/min 3 rounds	

Pranayama –
  1. Suryanuloma -Viloma
  2. Chandranuloma-Viloma
  3. Suryabhedana
  4. Chandra Bhedana
  5. Nadishodhana
	Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama	

READY TO RISE

Course Code	B24SDC411	Total Contact Hours / Week	2	CIE Marks	100
Course Category	AUDIT	Total SAAE Hours / Semester	-	SEE Marks	-
L:T:P:S	0:0:2:0	Total Notional Learning Hours	-	Total Marks	100
Total Credits	0			Exam Duration	-

Module #	CONTENTS	DURATION
1	**Aptitude Training** **A) Quantitative Aptitude**: Focus on basics like percentages, ratios, averages, time-speed-distance, and profit & loss. **B) Logical Reasoning**: Introduce puzzles, syllogisms, number series, and basic data interpretation. **C) Verbal Ability**: Emphasize vocabulary building, grammar, sentence correction, and comprehension.	**6 Hours**
2	**Communication Skills**: Enhance verbal and written communication through activities like debates and presentations. **Teamwork**: Engage in group projects to foster collaboration. **Time Management**: Workshops on prioritizing tasks and meeting deadlines.	**6 Hours**

Suggested Resources:

- Books like *Quantitative Aptitude for Competitive Examinations* by R.S. Aggarwal.
- Online platforms such as GeeksforGeeks, lofoya and IndiaBix for practice questions.

Suggested Activities:

- Participate in student clubs or societies to practice interpersonal skills.
- Attend workshops or seminars on effective communication.

Evaluation:

- 2-Internal Tests along with regular subjects (MCQs with OMR Sheets).
- Weekly online assessments.