DON BOSCO INSTITUTE OF TECHNOLOGY

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

DEPARTMENT OF ARTIFICIAL INTELLIGENCE & DATA SCIENCE

UNDERGRADUATE PROGRAM

OUTCOME BASED CURRICULUM & ASSESSMENT

Scheme and Syllabus

III & IV Semester

For the 2024 Admitted Batch

Kumbalagodu, 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

To develop high caliber Data Science professionals who can render innovative software services based on AI technologies to provide solutions to ethical problems.

Mission of the Department

M1: To provide skill-based training to students on software tools relevant to AI and DS.

M2: To inculcate specific professional thinking in students which would help them conceptualize AI solutions using DS.

M3: To inculcate professional ethics which supports students to provide AI based solutions limited to ethical problems only.

M4: To provide students with fundamental knowledge of relevant mathematics in order to make them conceptualize AI based solutions.

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	Model specified real life problems using AI paradigms and also to solve challenges of Big data by using the acquired technical knowledge.
PSO2	Develop enough potential to work in teams in order to address multidisciplinary problems using technical knowledge and life skills.
PSO3	Keep pace with technological advancements in order to leverage state-of-the-Art solutions based on Artificial Intelligence and Data Science.

Program Educational Objectives	
PEO1	Graduates shall be able to use their knowledge to identify real life problem that fits well into the solution framework of AI and be able to architect solutions using paradigms of DS.
PEO2	Graduates shall work individually and in teams for developing innovative solutions in the area of AI & DS.
PEO3	Graduates shall be able to grow professionally by enhancing their knowledge and skills through continuous learning.
PEO4	Graduates shall exhibit ethical thinking while leveraging their knowledge of AI and DS to build technology solutions.

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
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Department of Artificial Intelligence and Data Science
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	SAAE Hours / Semester	Examination			CREDITS
						L:T:P:S		Duration in hours	CIE: SEE Marks	Total Marks	
1	PCC/BSC	B24MAT31A	Probability and Statistics	Maths	Maths	3:0:0:0	48	03	50:50	100	3
2	IPCC	B24IS32	Digital Design and Computer Organization	AD	IS	3:0:2:0	48	03	50:50	100	4
3	IPCC	B24IS33	Operating Systems	AD	IS	3:0:2:0	48	03	50:50	100	4
4	PCC	B24CS34	Data Structures	AD	CS	3:0:0:0	48	03	50:50	100	3
5	ESC	B24xx35x	ESC / ETC /PLC	AD		2:0:2:0	-	03	50:50	100	3
6	UHV	B24SCK36	Social Connect and Responsibility	AD	CS	0:0:2:0	0	-	100:0	100	0
7	AEC / SEC	B24xx37x	Ability Enhancement Course / Skill Enhancement Course	AD	AD	If Theory 1:0:0:0	16	01	50:50	100	1
						If Lab 0:0:2:0	0	02			
8	PCCL	B24ADL38	Data Structures Laboratory	AD	AD	0:0:2:0	0	03	50:50	100	1
9	NCMC	B24NSK391	National Service Scheme (NSS) - I	NSS Coordinator		0:0:2:0	-	-	100:0	100	0
		B24PEK391	Physical Education (PE) (Sports and Athletics) – I	PE Director							
		B24YOK391	Yoga I	Yoga Teacher							
TOTAL									**550:350**	**900**	**19**

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			
B24AD371	Data Analytics and Visualization Tools	B24IS373	Project Management with Git
B24AD372	Data Analytics for Internet of Things	B24CI374	PHP Programming

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) can be considered as (3: 0: 2) or (2: 2: 2). 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 /Physical Education/Yoga: 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. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. 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. 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.

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

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Department of Artificial Intelligence and Data Science
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SEMESTER:IV

Sl No	Course Category	Course Code	Course Title	Teaching Department (TD)	Board of Examiner (BoE)	Teaching Hours /Week	SAAE Hours / Semester	Examination			CREDITS
						L:T:P:S		Duration in hours	CIE: SEE Marks	Total Marks	
1	PCC/BSC	B24IS41	Data Base Management Systems	AD	IS	3:0:0:0	48	03	50:50	100	3
2	IPCC	B24CS42	Analysis and Design of Algorithms	AD	CS	3:0:2:0	48	03	50:50	100	4
3	IPCC	B24CI43	Artificial Intelligence	AD	CI	3:0:2:0	48	03	50:50	100	4
4	PCC	B24AD44	Data Science and its Applications	AD	AD	3:0:0:0	48	03	50:50	100	3
5	ESC	B24xx45x	ESC / ETC /PLC	AD/Maths	AD/Maths	2:2:0:0	-	03	50:50	100	3
6	BSC	B24BOE46	Biology for Engineers	AD	CI	1:0:0:0	16	01	50:50	100	1
7	AEC / SEC	B24xx47x	Ability Enhancement Course / Skill Enhancement Course	Concerned Dept.		If Theory 1:0:0:0	16	01	50:50	100	1
						If Lab 0:0:2:0	0	02			
8	UHV	B24UHK48	Universal Human Values	AD	IS	1:0:0:0	16	-	100:0	100	1
9	PCCL	B24ADL49	Data Base Management Systems Laboratory with Mini Project	AD	AD	0:0:2:0	0	03	50:50	100	1
10	NCMC	B24NSK410	National Service Scheme (NSS) - II	NSS Coordinator		0:0:2:0	-	-	100:0	100	0
		B24PEK410	Physical Education (PE) (Sports and 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**

PCC: Professional Core Course, **PCCL:** Professional Core Course Laboratory, **UHV:** Universal Human Value Course, **NCMC:** Mandatory Course (Non-credit), **AEC:** Ability Enhancement Course, **AC:** Audit 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)			
B24CI451	Discrete Mathematical Structures	B24AD453	Optimization Techniques for Machine Learning
B24AD452	Metric Spaces	B24AD454	Algorithms Game Theory
Ability Enhancement Course			
B24AD471	MongoDB	B24AD473	MERN
B24CI472	Introduction to MATLAB	B24CS474	Unix Shell Scripting

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) can be considered as (3: 0: 2) or (2: 2: 2). 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.

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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	**50**
PART B			
2 & 3	Module – I : Question 1 or 2	17	
4 & 5	Module – II : Question 3 or 4	17	
6 & 7	Module – III : Question 5 or 6	17	
8 & 9	Module – IV : Question 7 or 8	17	
10 & 11	Module – V : Question 9 or 10	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 1 or 2	17	
4 & 5	Module – II : Question 3 or 4	17	
6 & 7	Module – III : Question 5 or 6	17	
8 & 9	Module – IV : Question 7 or 8	17	
10 & 11	Module – V : Question 9 or 10	17	
MAXIMUM MARKS FOR SEE THEORY		**100**	

Table - 4: Typical distribution of weightage for CIE & SEE for ONE CREDIT THEORY COURSE. (L:T:P:S – 1:0:0:0) (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:S is 0:0:2:0).

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

PROBABILITY AND STATISTICS

Course Code	B24MAT31A	Total contact hours / week	4	CIE MARKS	50
Course Category	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

This course will enable the students to:

1. To introduce the concept of random variables, probability distributions, specific discrete and continuous distributions with practical application in Computer Science Engineering and social life situations.
2. To Provide the principles of statistical inferences and the basics of hypothesis testing with emphasis on some commonly encountered hypotheses.
3. To Determine whether an input has a statistically significant effect on the system's response through ANOVA testing.

PREREQUISITES

1. Fundamentals of Statistics and Probability Theory

MODULE #	TOPICS	Hours
1	**Probability Distributions**: Review of basic probability theory. Random variables (discrete and continuous), probability mass and density functions. Mathematical expectation, mean and variance. Binomial, Poisson and normal distributions- problems (derivations for mean and standard deviation for Binomial and Poisson distributions only)-Illustrative examples. Exponential distribution. **Textbook 1: Chapter 5**	9
2	**Joint probability distribution**: Joint Probability distribution for two discrete random variables, expectation, covariance and correlation. **Markov Chain:** Introduction to Stochastic Process, Probability Vectors, Stochastic matrices, Regular stochastic matrices, Markov chain, Higher transition probabilities, Stationary distribution of Regular Markov chain and absorbing states. **Textbook 1: Chapter 5**	9
3	**Introduction to Data Analytics:** Review of measures of central tendency, Quartiles, Range, Interquartile range, Moments, Skewness, measures of skewness. Kurtosis and measures of Kurtosis. Population and Samples, Methods for selecting Random samples, Simple Random Sampling, Systematic Sampling, Stratified Sampling, Cluster Sampling. **Textbook 1: Chapter 3 and Chapter 12**	8
4	**Statistical Inference:** Introduction, sampling distribution, standard error, testing of hypothesis, levels of significance, test of significances, confidence limits, simple sampling of attributes, test of significance for large samples, comparison of large samples. Sampling variables, central limit theorem and confidence limits for unknown means. Test of Significance for means of two small samples, students 't' distribution, Chi-square distribution as a test of goodness of fit. F- Distribution. **Textbook 1: Chapters 12, 13 and 14**	8

5	**Design of Experiments & ANOVA:** Principles of experimentation in design, Analysis of completely randomized design, randomized block design. The ANOVA Technique, Basic Principle of ANOVA, One-way ANOVA, Two-way ANOVA, Latin-square Design, and Analysis of Co-Variance. **Textbook 2: Chapter 11**	8

TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	**Fundamentals of Mathematical Statistics**	S C Gupta and V K Kapoor	10th	S Chand and Company	2002
2	**Research Methodology Methods and Techniques**	Kothari C R	2nd	New age International Publisher	2009

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	**Advanced Engineering Mathematics**	E. Kreyszig	10th	John Wiley & Sons	2016
2	**Probability, Queuing Theory & Reliability Engineering**	G. Haribaskaran	Latest Edition	Laxmi Publication	2006
3	**Mathematical Statistics with Applications**	Irwin Miller & Marylees Miller	8th	Pearson. Dorling Kindersley Pvt. Ltd.	2014
4	**Introduction to Probability Theory**	P. G. Hoel, S. C. Port and C. J. Stone	-	Universal Book Stall	2003
5	**Practical Statistics for Data Scientists**	Peter Bruce, Andrew Bruce & Peter Gedeck	2nd	O'Reilly Media, Inc.	2020
6	**A Text book of Engineering Mathematics**	N.P Bali and Manish Goyal	10th	Laxmi Publications	2022
7	**Higher Engineering Mathematics**	B.S. Grewal	44th	Khanna Publishers	2021

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

Sl. #	Type of E-Resource	URL
1	**NPTEL**	http://nptel.ac.in/courses.php?disciplineID=111
2	**MOOCs**	http://www.class-central.com/subject/math
3	**E-VIDEO**	http://academicearth.org/
4	**MOOCs**	http://www.class-central.com/subject/math(MOOCs)

COURSE OUTCOMES

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

CO #	Course Outcome Statement
CO1	Apply suitable probability distribution models for the given scenario.
CO2	Explain the concept of Joint Probability Distribution and apply the notion of a discrete-time Markov chain and n-step transition probabilities to solve the given problem.
CO3	Able to apply the various measures and Sampling Techniques to analyze huge volume of data.
CO4	Use statistical methodology and tools in the engineering problem-solving process.
CO5	Apply the ANOVA test related to engineering problems.

CO-PO-PSO Mapping

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

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 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 also be responsible for assigning homework, grading assignments quiz, and documenting student's 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).

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	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	-	1
CO2	3	2	2	2	2	-	2	1	-	-	-	3	2	2
CO3	2	2	2	2	-	-	1	1	-	-	-	2	-	2
CO4	2	2	2	2	-	-	1	1	-	-	2	1	1	2
CO5	2	2	2	-	-	-	1	1	-	-	2	2	-	3
AVG	2.4	2	2	2	2	-	1.2	1	-	-	1.66	2	1.5	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.	8

	Textbook 1: Chapter -8 (8.1 - 8.6), 9 (9.1 - 9.6)	
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	-	2
CO2	3	3	2	-	-	-	3	3	-	-	2	3	-	2
CO3	3	3	2	-	-	-	3	3	-	-	2	3	2	2
CO4	3	3	2	-	-	-	3	3	-	-	2	3	-	3
CO5	3	3	2	-	-	-	3	3	-	-	2	2	-	2
AVG	3	3	2	-	-	-	3	3	-	-	2	2.6	2	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	1	2
CO3	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**2**	3	2	2
CO4	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**2**	3	1	2
CO5	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**2**	3	2	3
AVG	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**2**	3	1.5	2.2

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. 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_013843642506788864433 75_shared/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	2	-	1
CO2	3	3	3	1	2	-	-	2	2	1	2	2	1	2
CO3	3	3	3	2	2	-	-	2	2	1	2	3	1	2
CO4	3	2	3	2	3	-	1	1	1	1	2	3	2	2
CO5	3	2	3	2	3	-	-	2	2	1	2	2	1	2
AVG	3	2.6	2.8	1.6	2.4	-	1	1.6	1.6	1	2	2.4	1.2	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.

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 and cleaning process.
3. To understand machine instructions and programs.
4. To Work with R charts and Graphs.
5. To Explain the concept 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. **Text book 1: chapter: 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. **Text book 1: 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. **Text book 1: chapter:1.2, 1.3, 1.4, 1.6, 2.2, 2.3, 2.4, 2.5**	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. **Text book 1: chapter: 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 **Text book 1: chapter 5: 5.1, 5.3, 5.4, 5.5, 5.6.1, 5.7**	5

PRACTICAL COMPONENT

Sl. #	PROGRAMS
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
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) Profitmargin 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.
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 bodyweight 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.

<table>
<tr>
<td>7</td>
<td>Develop R program to create a Data Frame with following details and do the following operations.
<table>
<tr><th>itemCode</th><th>itemCategory</th><th>itemPrice</th></tr>
<tr><td>1001</td><td>Electronics</td><td>700</td></tr>
<tr><td>1002</td><td>Desktop Supplies</td><td>300</td></tr>
<tr><td>1003</td><td>Office Supplies</td><td>350</td></tr>
<tr><td>1004</td><td>USB</td><td>400</td></tr>
<tr><td>1005</td><td>CD Drive</td><td>800</td></tr>
</table>
a) Subset the Data frame anddisplay 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 thecategory 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</td>
</tr>
<tr>
<td>8</td>
<td>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</td>
</tr>
<tr>
<td>9</td>
<td>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 inthe IT Department whose salary is greater than 20000 and write these details into another file “output.csv”</td>
</tr>
</table>

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 d) variables are normally distributed or not. If not, what is their skewness? What is the average difference of gross horsepower(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?
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 andcoefficients infiles. Attach the predictedvalues 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

Reference 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 (3.0.1)	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.rproject.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 using R programing.

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	3	1	2
CO3	3	3	3	2	3	1	2	-	-	2	2	3	2	3
CO4	3	3	3	2	3	1	2	-	2	2	2	3	1	2
CO5	3	3	3	2	3	1	2	-	2	2	2	3	1	3
AVG	3	3	3	2	3	1	2	-	2	2	2	2.8	1.25	2.4

Teaching-Learning Process Pedagogy (General Instructions)

1. Chalk and board, power point presentations
2. Online material (Tutorials) and video lectures.
3. Demonstration of programming 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	6

	concepts, reading and writing array data on files. **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. #	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. 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 BOOK

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	**Introduction to Python for Computer Science and Data science**	Paul Deitel and Harvey Deitel	1st	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=PLh2mXjKcTPSACrQxPM2_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	2	2	3	2	1
CO2	2	3	2	1	2	-	1	2	2	2	2	3	2	1
CO3	3	2	3	2	3	1	1	2	3	3	3	3	3	3
CO4	2	2	3	3	3	1	2	2	2	3	3	3	2	2
CO5	3	2	3	2	3	1	2	2	2	3	3	3	2	2
AVG	2.6	2.4	2.6	1.8	2.6	1	1.4	2	2.2	2.6	2.6	3	2.2	1.8

Teaching-Learning Process Pedagogy (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	02	CIE MARKS	100
Course Category	UHV	Total SAAE hours / semester	00	SEE MARKS	-
L:T:P:S	0:0:2:0	Total Notional Learning Hours	90	TOTAL MARKS	100
Total credits	01			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.	**03**
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.	**03**
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.	**03**
4	**Water conservation:** Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photoblog	**03**

	presenting the current practices – Objectives, Visit, case study, report, outcomes.	
5	**Food walk:** City's culinary practices, food lore, and indigenous materials of the region used in cooking – Objectives, Visit, case study, report, outcomes.	**03**

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	1	2	2
CO2	-	-	-	-	-	3	3	3	3	3	3	1	3	2
CO3	-	-	-	-	-	3	3	3	3	3	3	1	3	2
CO4	-	-	-	-	-	3	3	3	3	3	3	2	3	2
CO5	-	-	-	-	-	3	3	3	3	3	3	2	3	2
CO6	-	-	-	-	-	3	3	3	3	3	3	2	3	2
AVG	-	-	-	-	-	3	3	3	3	3	3	1.5	2.8	2

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 evolution and practice of various craft forms.	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 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	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.	

			based on magnitude of task.			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 AND VISUALIZATION TOOLS

Course Code	B24AD371	Total contact hours / week	2	CIE MARKS	50
Course Category	AEC/SEC	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. Understand the importance of data visualization for business intelligence and decision making. 2. To provide hands-on experience in data pre-processing, analysis, visualization, and reporting. 3. Learn different data visualization techniques and tools such as Excel, Power BI, Tableau. 4. Gain knowledge of effective data visuals to solve workplace problems. 5. To build the skillset required for data-driven decision-making. 6. Build presentation ready dashboards in Excel, Power BI, Tableau.

PREREQUISITES
• **Basic Computer Skills** Familiarity with operating systems (Windows or mac OS), file management, and general software navigation is beneficial. • **Understanding of Excel** Proficiency in Microsoft Excel, including functions and formulas, can aid in data manipulation and understanding data structures. • **Fundamental Data Visualization Concepts** A basic grasp of data visualization principles, such as chart types and their appropriate use cases, enhances the effectiveness of your visualizations. • **Basic Statistical Knowledge** Understanding measures of central tendency, dispersion, and probability can assist in interpreting and presenting data effectively. • **Eagerness to Learn** A proactive approach and willingness to explore new concepts are crucial for mastering Excel, Power BI, Tableau.

SL.#	PROGRAMS
1	**Excel Fundamentals** - Data Import & Formatting, Data Cleaning, Text Functions, Date & Time Functions, Descriptive Statistics using Data Analysis Tools, Lookup & Reference Functions, Logical Functions, Pivot Tables and Pivot Charts, Dashboards.
2	**Power BI Fundamentals** - Overview of Power BI , Power BI Components , Understanding the Power BI Workflow, Installing Power BI Desktop, Connecting to Data Sources , Importing Data from Excel, CSV, PDF, SQL Server, Azure, JSON, Folders &Web , Data types in Power BI – How to change the data types, Power BI Query Editor.
3	**Tableau Fundamentals** – Overview of Tableau, Installation of Tableau Public Desktop, Connecting the Data set, Getting Started with Tableau.
4	Analysis of CSV file containing raw student admission data using Excel. • Full Name (with inconsistent formats). • Date of Birth (in text format).

	• Admission Date (in inconsistent formats). • Phone Numbers (with spaces and dashes). • Some missing data and duplicate records. i. Perform data import, apply formatting, sorting & filtering. ii. Handle missing values, remove duplicates, Use Data Validation, split full name into first and last name using Text-to-Columns. iii. Use LEFT( ), RIGHT( ), MID( ), LEN( ), SUBSTITUTE( ), TRIM( ). iv. Use TODAY( ), DATEDIF( ), NOW( ), YEAR( ), MONTH( ) functions. v. Calculate mean, median, mode, standard deviation. vi. Generate summary report.
5	**Analysis of CSV file containing Sales Data & Product Master data using Excel.** **Sales Data** Sales ID, Product ID, Customer ID, Quantity, Unit Price, Region, Date. **Product Master** Product ID, Product Name, Category. i. Merge data using Lookup functions. ii. Apply logical functions for performance analysis. iii. Generate Pivot Tables and Pivot Charts. iv. Design a simple interactive dashboard.
6	**Analysis of revenue in sales dataset using Tableau and Power BI** i. Create a choropleth map (fill the map) to spot the special trends to show the state which has the highest revenue. ii. Create a line chart to show the revenue based on the month of the year. iii. Create a bin of size 10 for the age measure to create a new dimension to show the revenue. iv. Create a donut chart view to show the percentage of revenue per region by creating zero access in the calculated field. v. Create a butterfly chart by reversing the bar chart to compare female & male revenue based on product category. vi. Create a calculated field to show the average revenue per state & display profitable & non-profitable state. vii. Build a dashboard.
7	**Analysis of HR Dataset using Tableau and Power BI** i. Create KPI to show employee count, attrition count, attrition rate, attrition count, active employees, and average age. ii. Create a Lollipop Chart to show the attrition rate based on gender category. iii. Create a pie chart to show the attrition percentage based on Department Category- iv. Create a bar chart to display the number of employees by Age group, v. Create a highlight table to show the Job Satisfaction Rating for each job role based on employee count. vi. Create a horizontal bar chart to show the attrition count for each Education field wise attrition vii. Create multiple donut chart to show the Attrition Rate by Gender for different Age group.
8	**Analysis of Amazon Prime Dataset using Tableau and Power BI** i. Create a Donut chart to show the percentage of movie and tv shows ii. Create an area chart to shows by release year and type iii. Create a horizontal bar chart to show Top 10 genre

	iv. Create a map to display total shows by country v. Create a text sheet to show the description of any movie/movies. vi. Build an interactive Dashboard.

INFOSYS SPRINGBOARD MANDATORY CERTIFICATION COURSE

SL.#	Name of the Certification as per Infosys Springboard	Course Link
1	**TechA Data Analytics using Power BI Foundation Certification**	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013849952348594176138_shared/overview

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	**Data Analysis with Microsoft® Excel: Updated for Office 2007®**	Berk & Carey	3rd	Pearson Education, Inc.	2019
2	**Microsoft Excel 2019: Data Analysis And Business Modelling**	Wayne L Winston	6th	Pearson Education, Inc.	2019
3	**Microsoft Power BI Dashboards Step by Step**	Errin O'Connor	1st	Pearson Education, Inc.	2019
4	**Information Dashboard Design: Displaying Data for At-a-glance Monitoring**	Stephen Few	2nd	O'Reilly Media.	2006

REFERENCE BOOK

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	**Data Visualization with Tableau and Power BI: Unleash the Power of Tableau and Power BI**	Thompson Carter	Kindle	Lincoln	2024

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

SL. #	Type of E-Resource	URL
1	**Online content**	https://www.simplilearn.com/tutorials/excel-tutorial/data-analysis-excel
2	**Online content**	https://www.coursera.org/specializations/excel-data-analytics-visualization
3	**Online content**	https://help.tableau.com/current/guides/get-started-tutorial/en-us/get-started-tutorial- home.htm
4	**Online content**	https://www.tutorialspoint.com/tableau/index.htm
5	**Online content**	https://www.simplilearn.com/tutorials/power-bi-tutorial/power-bi-vs-tableau

COURSE OUTCOMES

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

CO #	Course Outcome Statement
CO1	Design the experiment to create basic charts and graphs using Excel, Tableau and Power BI.
CO2	Develop the solution for the given real-world problem.
CO3	Design presentation ready dashboards in Excel, Power BI, Tableau.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	1	3	-	1	2	2	-	2	3	2	1
CO2	3	3	3	2	3	-	1	2	2	-	3	3	2	2
CO3	2	2	3	2	3	-	2	3	3	-	3	3	3	3
AVG	2.7	2.3	3	1.7	3	-	1.3	2.3	2.3	-	2.7	3	2.3	2

Teaching-Learning Process Pedagogy (General Instructions)

1. PPT - Visualization techniques.
2. Demonstration of operations on plots using Seaborn.

DATA ANALYTICS FOR INTERNET OF THINGS

Course Code	B24AD372	**Total contact hours / week**	2	**CIE MARKS**	50
Course Category	AEC/SEC	**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. Understand the fundamentals of IoT architectures, protocols, and sensor data characteristics. 2. Learn to acquire, pre-process, and analyze real-time sensor data using Python-based tools. 3. Explore data analytics techniques such as regression, clustering, and anomaly detection in IoT contexts. 4. Gain hands-on experience with cloud platforms (e.g., ThingSpeak, Adafruit IO) for IoT data collection and visualization. 5. Apply machine learning models to predict, detect patterns, and automate decision-making in IoT environments.

PREREQUISITES
• Basic programming knowledge (e.g., Python or Java). • Understanding of computer networks and network protocols. • Familiarity with database concepts (SQL/NoSQL). • Basic statistics and data analysis skills. • Some exposure to cloud computing is recommended but not mandatory.

SL. #	**PROGRAMS**
1	Develop a program to blink 5 LEDs back and forth.
2	Develop a program to interface a relay with Arduino board.
3	Perform missing value imputation, outlier detection, noise filtering, normalize, transform and use a Kalman filter for denoising on IoT sensor data using Pandas & Scikit-learn.
4	Build an alert system for anomaly detection (e.g., if temperature exceeds threshold).
5	Collect live IoT data using ThingSpeak or Adafruit IO and visualize trends. Create a dashboard using Microsoft Excel/Power BI.
6	Connect a NodeMCU with DHT11 / DHT22 sensor and send real-time data to a local system via Wi-Fi. Cluster IoT sensor data (e.g., temperature and humidity) using K-Means algorithm to identify similar environmental conditions.
7	Simulate IoT sensor data (e.g., temperature, humidity data from DHT11 / DHT22 sensor using Arduino board / Raspberry Pi) and visualize it using Python (Matplotlib/Plotly).
8	Use MQTT or HTTP to stream IoT sensor data to a local server and log it into a CSV/JSON file. Predict soil moisture based on environmental parameters using linear or multiple regression models.
9	Analyse smart home energy consumption data to find patterns and peak usage periods.
10	Send sensor data from Arduino to cloud platform (e.g., ThingSpeak, Blynk, Adafruit IO).

PRESCRIBED TEXT BOOKS

Text Book	Book Title	Authors	Edition	Publisher	Year
1	**An Introduction to IoT Analytics**	Harry G. Perros	1st	CRC Press	2016
2	**Analytics for the Internet of Things (IoT)**	Andrew Minteer	1st	Packt Publishing	2019

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	**Big Data Analytics for Internet of Things**	Tausifa Jan Saleem, Mohammad Ahsan Chishti	1st	John Wiley & Sons	2021
2	**Analysing Data in the Internet of Things**	Ashish Thusoo	1st	O'Reilly Media	2020

Resources: E-books

SL. #	Type of E-Resource	URL
1	**ThingSpeak for IoT Projects**	https://thingspeak.mathworks.com/
2	**Internet of Things (IoT) Courses**	https://surl.li/tpdhhl
3	**Introduction to the Internet of Things and Embedded Systems**	https://www.coursera.org/learn/iot

COURSE OUTCOMES

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

CO #	Course Outcome Statement
CO1	Interface and program IoT devices (e.g., Arduino, NodeMCU) to collect real-time sensor data.
CO2	Clean, pre-process, and transform IoT datasets using tools like Pandas and Scikit-learn.
CO3	Perform exploratory data analysis and visualize trends using tools like Power BI, matplotlib, or plotly.
CO4	Apply statistical and machine learning models (e.g., regression, clustering, Kalman filter) to IoT sensor data.
CO5	Design and implement IoT analytics solutions that address real-world applications such as smart homes, agriculture, and health monitoring.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	2	-	3	-	-	2	-	-	-	3	1	3
CO2	3	2	-	2	3	-	-	-	-	-	-	3	-	3
CO3	-	3	2	-	3	-	-	-	2	-	-	2	1	3
CO4	3	3	-	2	3	-	-	-	-	-	2	3	-	3
CO5	3	3	3	3	3	2	2	2	2	2	3	3	2	3
AVG	3	2.75	2.33	2.33	3	2	2	2	2	2	2.50	2.8	1.3	3

Teaching-Learning Process Pedagogy (General Instructions)

For the above experiments the following pedagogy can be considered.

1. Problem based learning.
2. Active learning.
3. MOOC.
4. Chalk &Talk.

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_013094443347369984278 2_shared/overview
3	Web-based Learning Experience Platform	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013301347121774592119 26_shared/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	-	-	-	-	-	-	-	-	2	-	2
CO2	3	3	2	1	-	-	-	2	-	-	-	2	2	2
CO3	3	3	3	2	-	-	3	3	-	-	-	2	3	2
CO4	3	2	3	2	2	-	-	2	-	-	-	2	2	2
CO5	3	3	3	3	-	-	-	3	-	-	2	2	2	2
AVG	3	2.6	2.4	2	2	-	3	2.5	-	-	2	2	2.2	2

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.

PHP PROGRAMMING

Course Code	B24CI374	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 PHP syntax, elements, and control structures. 2. To make use of PHP Functions and File handling. 3. To illustrate the concept of PHP arrays and OOPs. 4. To develop the ability to write programs that access, read, write, and manipulate the contents of files for data storage, processing, and retrieval in real-world applications. 5. To enable students to develop dynamic and secure web applications by effectively utilizing PHP super-global arrays and regular expressions for processing user input and solving real-world data validation and extraction problems.

PREREQUISITES
• Programming concepts and basic understanding of web.

SL. #	PROGRAMS
AIM: Introduction to HTML/PHP environment, PHP Data Types, Variables, Literals, and operators.	
1	a. Develop a PHP program to calculate areas of Triangle and Rectangle. b. Develop a PHP program to calculate Compound Interest.
2	Demonstrating the various forms to concatenate multiple strings Develop program(s) to demonstrate concatenation of strings: (i) Strings represented with literals (single quote or double quote). (ii) Strings as variables. (iii) Multiple strings represented with literals (single quote or double quote) and variables. (iv) Strings and string variables containing single quotes as part string contents. (v) Strings containing HTML segments having elements with attributes.
3	a. Develop a PHP Program(s) to check given number is: (i) Odd or even. (ii) Divisible by a given number (N). (iii) Square of a another number. b. Develop a PHP Program to compute the roots of a quadratic equation by accepting the coefficients. Print the appropriate messages.
4	a. Develop a PHP program to find the square root of a number by using the newton's algorithm. b. Develop a PHP program to generate Floyd's triangle.
5	a. Develop a PHP application that reads a list of numbers and calculates mean and standard deviation. b. Develop a PHP application that reads scores between 0 and 100 (possibly including both 0 and 100) and creates a histogram array whose elements contain the number of scores between 0 and 9, 10 and 19, etc. The last "box" in the histogram should include scores between 90 and 100. Use a function to generate the histogram.
6	a. Develop PHP program to demonstrate the date( ) with different parameter options.

	b. Develop a PHP program to generate the Fibonacci series using a recursive function.
7	Develop a PHP program to accept the file and perform the following. (i) Print the first N lines of a file. (ii) Update/Add the content of a file.
8	Develop a PHP program to read the content of the file and print the frequency of occurrence of the word accepted by the user in the file.
9	Develop a PHP program to filter the elements of an array with key names. Sample Input Data: 1st array: ('c1' => 'Red', 'c2' => 'Green', 'c3' => 'White', c4 => 'Black') 2nd array: ('c2', 'c4') Output: Array ([c1] => Red [c3] =>White)
10	Develop a PHP program that illustrates the concept of classes and objects by reading and printing employee data, including Emp_Name, Emp_ID, Emp_Dept, Emp_Salary, and Emp_DOJ.
11	a. Develop a PHP program to count the occurrences of Aadhaar numbers present in a text. b. Develop a PHP program to find the occurrences of a given pattern and replace them with a text.
12	Develop a PHP program to read the contents of a HTML form and display the contents on a browser.

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	**Programming in HTML and PHP (Coding for Scientists and Engineers**	DEVID R BROOKS	1st	Springer International Publishing	2017

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

SL. #	Type of E-Resource	URL
1	**Video Lectures:**	PHP TUTORIALS: [https://www.w3schools.com/php/}
2	**Video Lectures:**	HTML TUTORIALS: [https://www.w3schools.com/html/
3	**Video Lectures:**	PHP TUTORIALS: [https://www.tutorialspoint.com/php/index.htm]

COURSE OUTCOMES

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

CO #	Course Outcome Statement
CO1	Apply basic concepts of PHP to develop web program.
CO2	Develop programs in PHP involving control structures.
CO3	Develop programs to handle structured data (object) and data items (array).
CO4	Develop programs to access and manipulate contents of files.
CO5	Use super-global arrays and regular expressions to solve real world problems.

CO-PO-PSO Mapping

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

Teaching-Learning Process Pedagogy (General Instructions)

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

DATA STRUCTURES LABORATORY

Course Code	B24ADL38	Total contact hours / week	2	CIE MARKS	50
Course Category	PCCL	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
This laboratory courses 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
• Implement all the programs in "C " Programming Language and Linux OS(Fedora).

SI.#	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

PRESCRIBED TEXT BOOK

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	**Data Structures in C**	Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed	2nd	Universities Press	2014

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	**Data Structures Schaum's Outlines**	Seymour Lipschutz	Revised 1st	McGraw Hill	2014
2	**Data Structures: A Pseudo-code approach with C**	Gilberg & Forouzan	2nd	Cengage Learning	2014
3	**Data Structures using C**	Reema Thareja	3rd	Oxford press	2012
4	**An Introduction to Data Structures with Applications**	Jean-Paul Tremblay & Paul G. Sorenson	2nd	McGraw Hill	2013
5	**Data Structures and Program Design in C**	Robert Kruse	2nd	PHI,	1996

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

SL. #	Type of E-Resource	URL
1	**Video Lectures**	http://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS35.html
2	**Video Lectures**	http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html
3	**Video Lectures**	https://www.youtube.com/watch?v=3Xo6P_V-qns&t=201s
4	**Web Links**	https://ds1-iiith.vlabs.ac.in/exp/stacks-queues/index.html
5	**Web Links**	https://ds1-iiith.vlabs.ac.in/exp/linked-list/basics/overview.html

COURSE OUTCOMES

At the end of the Course, student will 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	-	-	-	-	1	-	1
CO2	3	3	3	-	3	-	3	-	-	-	-	1	-	-
CO3	3	3	3	-	3	-	3	-	-	-	-	1	-	-
CO4	3	3	3	-	3	-	3	-	-	-	-	1	1	-
CO5	3	3	3	-	3	-	3	-	-	-	-	1	-	1
CO6	3	3	3	-	3	-	3	-	-	-	-	1	-	1
AVG	3	3	3	-	3	-	3	-	-	-	-	1	1	1

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	0	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.

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	1	3	2
CO2	-	-	3	-	-	3	-	-	-	-	3	2	3	2
CO3	-	-	3	-	-	3	-	-	-	-	3	3	2	2
CO4	-	-	3	-	-	3	-	-	-	-	3	2	3	1
CO5	-	-	3	-	-	3	-	-	-	-	3	1	3	1
AVG	-	-	3	-	-	3	-	-	-	-	3	2.2	2.8	1.6

Plan of Action (Execution of Activities for each semester)

SL. #	Practice Session Description
1	Lecture session by NSS Officer
2	Students Presentation on Topics
3	Presentation - 1 , Selection of topic, PHASE – 1
4	Commencement of activity and its progress - PHASE – 2
5	Execution of Activity
6	Execution of Activity
7	Execution of Activity
8	Execution of Activity
9	Execution of Activity
10	Case study based Assessment, Individual performance
11	Sector wise study and its consolidation
12	Video based seminar for 10 minutes by each student At the end of semester with Report.

- In every semester from 3rd semester to 6th semester, each student should do activities according to the scheme and syllabus.
- At the end of every semester student performance has to be evaluated by the NSS officer for the assigned activity progress and its completion.
- At last in 6th semester consolidated report of all activities from 3rd to 6th semester, compiled report should be submitted as per the instructions.

Assessment Details for CIE

Weightage	CIE – 100%	Implementation strategies of the project (NSS work).
Presentation - 1 Selection of topic, PHASE - 1	10 Marks	1) The last report should be signed by NSS Officer, the HOD and principal. 2) At last report should be evaluated by the NSS officer of the institute. 3) Finally the consolidated marks sheet should be sent to the university and also to be made available at LIC visit.
Commencement of activity and its progress - PHASE – 2	10 Marks	
Case study based Assessment Individual performance	10 Marks	
Sector wise study and its consolidation	10 Marks	
Video based seminar for 10 minutes by each student At the end of semester with Report.	10 Marks	
Total marks for the course in each semester	**50 Marks**	

Marks scored for 50 by the students should be Scale down to 25 marks In each semester for CIE entry in the portal.
25 marks CIE entry will be entered in IA marks portal at the end of each semester 3rd to 6th sem, Report and assessment copy should be made available in the department semester wise.
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.

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.

SL. #	Topic	Group Size	Location	Activity Execution	Reporting	Evaluation of the topic
1	Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.	May be individual or team	Farmers land / Villages / roadside / community area/ College campus etc…..	Site selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
2	Waste management– Public, Private and Govt organization, 5 R's.	May be individual or team	Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc…..	Site selection / proper consultation / Continuous monitoring / Information board		
3	Setting of the information imparting club for women leading to contribution in social and economic issues.	May be individual or team	Women empowerment groups / Consulting NGOs & Govt Teams / College campus etc…..	Group selection / proper consultation / Continuous monitoring / Information board		
4	Water conservation techniques – Role of different stakeholders– Implementation.	May be individual or team	Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc…..	Site selection / proper consultation / Continuous monitoring / Information board		
5	Preparing an actionable business proposal for enhancing the village income and approach for implementation.	May be individual or team	Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc…..	Group selection / proper consultation / Continuous monitoring / Information board		
6	Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.	May be individual or team	Local government / private / aided schools / Government Schemes officers / etc…..	School selection / proper consultation / Continuous monitoring / Information board		
7	Developing Sustainable Water management system for rural	May be individual or team	Villages / City Areas / Grama panchayat / public associations	Site selection / proper consultation / Continuous		

	areas and implementation approaches.		/ Government Schemes officers / campus etc…..	monitoring / Information board		
8	Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.	May be individual or team	Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc…..	Group selection / proper consultation / Continuous monitoring / Information board		
9	Spreading public awareness under rural outreach programs. (minimum5 programs). /// Social connect and responsibilities.	May be individual or team	Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc…..	Group selection / proper consultation / Continuous monitoring / Information board		
10	Plantation and adoption of plants. Know your plants.	May be individual or team	Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc…..	Place selection / proper consultation / Continuous monitoring / Information board		
11	Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).	May be individual or team	Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc…..	Place selection / proper consultation / Continuous monitoring / Information board		
12	Govt. school Rejuvenation and helping them to achieve good infrastructure.	May be individual or team	Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc…..	Place selection / proper consultation / Continuous monitoring / Information board		

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	0	TOTAL MARKS	100
Total credits	0			Exam Duration	-

Module #	CONTENTS	Hours
1	Orientation A) Lifestyle B) Health & Wellness C) Pre-Fitness test.	4
2	General Fitness & Components of Fitness A) Warming up (Free Hand exercises) B) Strength – Push-up / Pull-ups C) Speed – 30 Mtr Dash	4
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

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 computation at regional / State /National / International levels.
CO5	Create consciousness among the students on Health Fitness and Wellness in developing and maintaining a healthy life style.
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	-	3	-
CO2	-	-	-	-	-	-	-	3	-	-	3	-	3	-
CO3	-	-	-	-	-	-	-	3	-	-	3	-	2	2
CO4	-	-	-	-	-	-	-	3	-	-	3	-	3	-
CO5	-	-	-	-	-	-	-	3	-	-	3	-	3	-
CO6	-	-	-	-	-	-	-	3	-	-	3	-	3	-
AVG	-	-	-	-	-	-	-	3	-	-	3	-	2.8	2

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

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	0	TOTAL MARKS	100
Total credits	0			Exam Duration	-

Module #	CONTENTS	Hours
1	Ethics and Moral Values A) Ethics in Sports B) Moral Values in Sports and Games	4
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
3	Role of Organisation and administration	4

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	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	3	3	-	-	3	-	3	-
CO2	-	-	-	-	-	-	-	3	3	-	-	3	-	3	-
CO3	-	-	-	-	-	-	-	3	3	-	-	3	-	2	1
AVG	-	-	-	-	-	-	-	3	3	-	-	3	-	2.6	1

Scheme and Assessment for auditing the course and Grades:

#	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

PHYSICAL EDUCATION (SPORTS & ATHLETICS) – III

Course Code	B24PEK591	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	0	TOTAL MARKS	100
Total credits	0			Exam Duration	-

Module #	CONTENTS	Hours
1	Orientation A) Fitness B) Food & Nutrition	4
2	General Fitness & Components of Fitness A) Agility – Shuttle Run B) Flexibility – Sit and Reach C) Cardiovascular Endurance – Harvard step Test	4
3	Specific games (Any one to be selected by the student) 1) Badminton (Fore hand low/high service, back hand service, smash, drop) 2) Basketball (Dribbling, passing, shooting etc.) 3. Athletics (Field events – Throws)	16

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, Food, Nutrition and general 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	Understand and practice of specific games and athletic throwing events.

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	-	2	1
CO4	-	-	-	-	-	-	3	3	-	-	3	-	3	-
CO5	-	-	-	-	-	-	3	3	-	-	3	-	3	-
AVG	-	-	-	-	-	-	3	3	-	-	3	-	2.8	1

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

PHYSICAL EDUCATION (SPORTS & ATHLETICS) – IV

Course Code	B24PEK691	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	0	TOTAL MARKS	100
Total credits	0			Exam Duration	-

Module #	CONTENTS	Hours
1	Orientation 1) Postural deformities. 2) Stress management	4
2	Specific Games (Any one to be selected by the student) 1) Throw ball 2) Table Tennis 3) Athletics (Field Events- Jumps) – Any event as per availability of Ground.	16
3	Aerobics	4

COURSE OUTCOMES:

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

CO #	Course Outcome Statement
1.	Understand the Postural deformities and Stress management in sports and athletics
2.	Participate in the competition at regional/state / national / international levels.
3.	Understand and practice of specific games and athletic Jumping events.
4.	Understand and practice of Aerobics.

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	-

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 (Semester 3)

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	0	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 hrs 2 hrs 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	

YOGA – II (Semester 4)

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	0	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	Total 20-24 hrs 2 hrs per week
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	
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	

YOGA – III (Semester 5)

Course Code	B24YOK591	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	0	TOTAL MARKS	100
Total credits	0			Exam Duration	-

Course Title	Content	No. of Hours
Patanjali's Ashtanga Yoga 1. Asana 2. Pranayama 3. Pratyahara	Patanjali's Ashtanga Yoga – its need and importance	Total 20-24 hrs 2 hrs per week
Suryanamaskara	Suryanamaskar l2 count 6 rounds	
Different types of Asanas a) Sitting 1. Ardha Ushtrasana 2. Vakrasana 3. Yogamudra in Padmasana b) Standing 1. UrdhvaHastothanasana 2. Hastapadasana 3. ParivrittaTrikonasana 4. Utkatasana c) Supine line 1. Sarvangasana 2. Chakraasana 3. Pavanamuktasana	Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits each asana	
Kapalabhati	Revision of practice. 60 strokes/min 3 rounds	
Pranayama – 1. Ujjayi 2. Sheetali 3. Sheektari	Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama	

YOGA – IV (Semester 6)

Course Code	B24YOK691	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	0	TOTAL MARKS	100
Total credits	0			Exam Duration	-

Course Title	Content	No. of Hours
Patanjali's Ashtanga Yoga 1. Dharana 2. Dhyana (Meditation) 3. Samadhi	Patanjali's Ashtanga Yoga – its need and importance	Total 20-24 hrs 2 hrs per week
Suryanamaskara	Suryanamaskar l2 count 8 rounds	
Different types of Asanas a) Sitting 1. Bakasana 2. Hanumanasana 3. Ekapada Rajakapotasana 4. Yogamudra in Vajrasana b) Standing 1. Vatayanasana 2. Garudasana c) Balancing 1. Veerabhadrasana 2. Sheershasana	Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits each asana	
Kapalabhati	Revision of Kapalabhati practice. 80 strokes/min 3 rounds	
Pranayama – 1. Bhastrika 2. Bhramari	Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama	

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	2	-	2
CO2	3	1	2	1	-	-	-	1	1	1	1	3	1	2
CO3	3	1	2	1	-	-	-	1	1	1	1	3	1	2
CO4	3	1	2	1	-	-	-	1	1	1	1	3	-	2
CO5	3	1	2	1	-	-	-	1	1	1	1	3	2	3
AVG	3	1	2	1	-	-	-	1	1	1	1	2.8	1.3	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) 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	3 Hrs

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, Asymptotic Notations.

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.#	Programs
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 = {s_1 , s_2,..... ,s_n} 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 BOOK

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	**Computer Algorithms/ C++**	Ellis Horowitz, Satraj Sahni Rajasekaran	2nd	Universities Press	2014
2	**Introduction to Algorithms**	Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein	4th	MIT	2022
3	**Designand Analysis of Algorithms**	S. Sridhar	2nd	Oxford	2023

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	3	-	2
CO2	3	3	3	2	2	-	-	-	-	-	2	3	1	2
CO3	3	3	3	2	2	-	-	-	-	-	2	3	1	2
CO4	3	3	3	2	2	-	-	-	-	-	2	3	-	3
CO5	3	3	3	2	2	-	-	-	-	-	2	3	-	2
AVG	3	3	3	2	2	-	-	-	-	-	2	3	1	2.2

Teaching-Learning Process Pedagogy (General Instructions)

1. Outcome-Based and Active Learning
2. Blended and ICT-Enabled Learning
3. Flipped and Experiential Learning
4. Continuous Assessment and feedback

ARTIFICIAL INTELLIGENCE

Course Code	B24CI43	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. Gain a historical perspective of AI and its foundations.
2. Become familiar with basic principles of AI toward problem solving
3. Get to know approaches of inference, perception, knowledge representation, and learning.

PREREQUISITES

- Programming in Python – Control Structures, Functions & Recursions, Data Types.
- Mathematics for Computer Science – Discrete Mathematics, Recurrence Relations, Mathematic Induction

MODULE #	TOPICS	Hours
1	**Introduction**: What is AI? Foundations and History of AI. **Intelligent Agents**: Agents and environment, Concept of Rationality, The nature of environment, The structure of agents. **Textbook 1**: Chapter 1 – 1.1, 1.2, 1.3 Chapter 2-2.1, 2.2, 2.3, 24	8
2	**Problem-solving**: Problem-solving agents, Example problems, Searching for Solutions Uninformed Search Strategies: Breadth First search, Depth First Search, Iterative deepening depth first search. **Textbook 1**: Chapter 3 – 3.1, 3.2, 3.4	9
3	**Informed Search Strategies**: Heuristic functions, Greedy best first search, A*search. Heuristic Functions Logical Agents: Knowledge–based agents, The Wumpus world, Logic, Propositional logic, Reasoning patterns in Propositional Logic. **Textbook 1**: Chapter 3 – 3.5, 3.6 Chapter 4-4.1, 4.2, Chapter 7-7.1,7.2, 7.3, 7.4, 7.5	9
4	**First Order Logic**: Representation Revisited, Syntax and Semantics of First Order logic, Using First Order logic. Inference in First Order Logic: Propositional Versus First Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution. **Textbook 1**: Chapter 8 – 8.1, 8.2, 8.3 Chapter 9-9.1, 9.2, 9.3, 9.4, 9.5	8
5	**Uncertain Knowledge and Reasoning**: Quantifying Uncertainty: Acting under Uncertainty, Basic Probability Notation, Inference using Full Joint Distributions, Independence, Baye's Rule and its use. Wumpus World. Revisited Expert Systems: Representing and using domain knowledge, ES shells. Explanation, knowledge acquisition	8

	Textbook 1: Chapter 13 – 13.1, 13.2, 13.3, 13.4, 13.5, 13.6 **Textbook 2** : Chapter 20.	

PRACTICAL COMPONENT OF IPCC: (May cover all / major modules):
NOTE: Programs need to be implemented in python.

Sl. No	PROGRAMS
1	Implement and Demonstrate Depth First Search Algorithm on Water Jug Problem.
2	Implement and Demonstrate Best First Search Algorithm on Missionaries-Cannibals Problems using Python.
3	Implement A* Search algorithm.
4	Implement AO* Search algorithm.
5	Solve 8-Queens Problem with suitable assumptions.
6	Implementation of TSP using heuristic approach.
7	Implementation of the problem solving strategies: either using Forward Chaining or Backward Chaining.
8	Implementation of the problem solving strategies: either using Forward Chaining or Backward Chaining.
9	Implement Tic-Tac-Toe game using Python.
10	Build a bot which provides all the information related to text in search box.
11	Implement any Game and demonstrate the Game playing strategies.

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	**Artificial Intelligence**	Stuart J. Russell & Peter Norvig	3rd	Pearson	2015
2	**Artificial Intelligence**	Elaine Rich, Kevin Knight	3rd	Tata McGraw Hill	2013

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	**Artificial Intelligence Structure and strategies for complex.**	George F Lugar,	5th	Pearson	2011
2	**Principles of Artificial Intelligence**	Nils J. Nilsson,	-	Elsevier	1980
3	**Artificial Intelligence Cengage learning, 2014**	Saroj Kaushik	8th	Cengage learning	2014

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

SL. #	Type of E-Resource	URL
1	**Video Lectures**	https://www.kdnuggets.com/2019/11/10-free-must-read-books-ai.htm
2	**Video Lectures**	https://www.udacity.com/course/knowledge-based-ai-cognitive-systems--ud409
3	**Video Lectures**	https://nptel.ac.in/courses/106/105/106105077/

COURSE OUTCOMES

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

CO #	Course Outcome Statement
CO1	Apply knowledge of agent architecture, searching and reasoning techniques for different applications.
CO2	Compare various Searching and Inferencing Techniques.
CO3	Develop knowledge base sentences using propositional logic and first order logic
CO4	Describe the concepts of quantifying uncertainty.
CO5	Use the concepts of Expert Systems to build applications.

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	3	1	3
CO2	3	3	3	2	2	-	-	-	-	-	2	3	-	2
CO3	3	3	3	2	2	-	-	-	-	-	2	3	-	2
CO4	3	3	3	2	2	-	-	-	-	-	2	3	-	2
CO5	3	3	3	2	2	-	-	-	-	-	2	3	1	3
AVG	3	3	3	2	2	-	-	-	-	-	2	3	1	2.4

Teaching-Learning Process Pedagogy (General Instructions)

1. Group discussion on Real world examples.
2. Project based learning.
3. Simple strategies on gaming, reasoning and uncertainty etc.

DATA SCIENCE AND ITS APPLICATIONS

Course Code	B24AD44	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. Demonstrate the proficiency with statistical analysis of data to derive insight from results and interpret the data findings visually. 2. Utilize the skills in data management by obtaining, cleaning and transforming the data. 3. Make use of machine learning models to solve the business-related challenges. 4. Experiment with decision trees, neural network layers and data partition. 5. Demonstrate how social clustering shape individuals and groups in contemporary society.

PREREQUISITES
1. Basic programming knowledge of Python. 2. Basic knowledge Mathematics & Statistics

MODULE #	TOPICS	Hours
1	**Introduction:** What is Data Science? Visualizing Data, matplotlib, Bar Charts, Line Charts, Scatterplots, Linear Algebra, Vectors, Matrices, Statistics, Describing a Single Set of Data, Correlation, Simpson's Paradox, Some Other Correlational Caveats, Correlation and Causation, Probability, Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables, Continuous Distributions, The Normal Distribution, The Central Limit Theorem. **Chapters 1, 3, 4, 5 and 6.**	8
2	**Hypothesis and Inference:** Statistical Hypothesis Testing, Example: Flipping a Coin, p-Values, Confidence Intervals, p-Hacking, Example: Running an A/B Test, Bayesian Inference, Gradient Descent, The Idea Behind Gradient Descent Estimating the Gradient, Using the Gradient, Choosing the Right Step Size, Using Gradient Descent to Fit Models, Minibatch and Stochastic Gradient Descent, Getting Data, stdin and stdout, Reading Files, Scraping the Web, Using APIs, Example: Using the Twitter APIs, Working with Data, Exploring Your Data, Using NamedTuples, Dataclasses, Cleaning and Munging, Manipulating Data, Rescaling, An Aside: tqdm, Dimensionality Reduction. **Chapters 7, 8, 9 and 10.**	9
3	**Machine Learning:** Modeling, What Is Machine Learning?, Overfitting and Underfitting, Correctness, The Bias-Variance Tradeoff, Feature Extraction and Selection, k-Nearest Neighbors, The Model, Example: The Iris Dataset, The Curse of Dimensionality, Naive Bayes, A Really Dumb Spam Filter, A More Sophisticated Spam Filter, Implementation, Testing Our Model, Using Our Model, Simple Linear Regression, The Model, Using Gradient Descent, Maximum Likelihood Estimation, Multiple Regression, The Model, Further	8

	Assumptions of the Least Squares Model, Fitting the Model, Interpreting the Model, Goodness of Fit, Digression: The Bootstrap, Standard Errors of Regression Coefficients, Regularization, Logistic Regression, The Problem, The Logistic Function, Applying the Model, Goodness of Fit, Support Vector Machines. **Chapters 11, 12, 13, 14, 15 and 16.**	
4	**Decision Trees:** What Is a Decision Tree?, Entropy, The Entropy of a Partition, Creating a Decision Tree, Putting It All Together, Random Forests, Neural Networks, Perceptrons, Feed-Forward Neural Networks, Backpropagation, Example: Fizz Buzz, Deep Learning, The Tensor, The Layer Abstraction, The Linear Layer, Neural Networks as a Sequence of Layers, Loss and Optimization, Example: XOR Revisited, Other Activation Functions, Example: Fizz Buzz Revisited, Softmaxes and Cross-Entropy, Dropout, Example: MNIST, Saving and Loading Models, Clustering, The Idea, The Model, Example: Meetups, choosing k, Example: Clustering Colors, Bottom-Up Hierarchical Clustering **Chapters 17, 18, 19 and 20.**	9
5	**Natural Language Processing:** Word Clouds, n-Gram Language Models, Grammars, An Aside: Gibbs Sampling, Topic Modeling, Word Vectors, Recurrent Neural Networks, Example: Using a Character-Level RNN, Network Analysis, Betweenness Centrality, Eigenvector Centrality, Directed Graphs and PageRank, Recommender Systems, Manual Curation, Recommending What's Popular, User-Based Collaborative Filtering, Item-Based Collaborative Filtering, Matrix Factorization. **Chapters 21, 22 and 23.**	8

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1.	**Data Science from Scratch**	Joel Grus	2nd	O'Reilly Publications/Shroff Publishers and Distributors Pvt. Ltd., ISBN-13: 978-9352138326	2019

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	**Build a Career in Data Science**	Emily Robinson and Jacqueline Nolis	1st	Manning Publications, ISBN: 978-1617296246	2020
2	**Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems**	Aurélien Géron	2nd	O'Reilly Publications/Shroff Publishers and Distributors Pvt. Ltd., ISBN-13: 978-1492032649.	2019
3	**Deep Learning with Python**	François Chollet	1st	Manning Publications, ISBN-	2017

				13: 978-1617294433	
4	**Deep Learning for Coders with fast ai and PyTorch**	Jeremy Howard and Sylvain Gugger	1st	O'Reilly Publications/Shroff Publishers and Distributors Pvt. Ltd., ISBN-13: 978-1492045526	2020
5	**Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow 2**	Sebastian Raschka and Vahid Mirjalili	3rd	Packt Publishing Limited, ISBN-13: 978-1789955750	2019

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

Sl. #	Type of E-Resource	URL
1	**Using Python**	https://www.python.org
2	**R Programming**	https://www.r-project.org/
3	**Python for Natural Language Processing**	https://www.nltk.org/book/
4	**Data set**	https://bit.ly/2Lm75Ly
5	**Data set**	https://archive.ics.uci.edu/ml/datasets.html
6	**Data set**	www.kaggle.com/ruiromanini/mtcars
7	**Pycharm**	https://www.jetbrains.com/pycharm/
8	**NPTEL**	https://nptel.ac.in/courses/106/106/106106179/
9	**NPTEL**	https://nptel.ac.in/courses/106/106/106106212/
10	**Natural Language Processing**	http://nlp-iiith.vlabs.ac.in/List%20of%20experiments.html

COURSE OUTCOMES

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

CO #	Course Outcome Statement
CO 1	Identify and demonstrate data using visualization tools.
CO 2	Make use of Statistical hypothesis tests to choose the properties of data, curate and manipulate data.
CO 3	Utilize the skills of machine learning algorithms and techniques and develop models.
CO 4	Demonstrate the construction of decision tree and data partition using clustering.
CO 5	Experiment with social network analysis and make use of natural language processing skills to develop data driven applications.

CO-PO-PSO Mapping

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

Teaching-Learning Process (General Instructions)

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

1. Lecturer method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Show Video/animation films to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in a multiple representation.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.

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

DISCRETE MATHEMATICAL STRUCTURES

Course Code	B24CI451	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

1. To help students to understand discrete and continuous mathematical structures.
2. To understand the application of discrete structures in different fields of computer science.
3. To impart basics of relations and functions.
4. To understand the principles of Recurrence Relations to find the generating functions.
5. To understand the fundamental principles of Algebraic structures with the problems related to computer science & engineering, Artificial Intelligence and Machine Learning.

PREREQUISITES

- Basic Algebra
- Pre-Calculus
- Basic Programming
- Logical Reasoning Skills

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, Definitions and the Proofs of Theorems. **Text Book 1:Chapter 2.1 to 2.5**	8
2	**Properties of the Integers:** Mathematical Induction, The Well Ordering Principle – Mathematical Induction, Recursive Definitions. Fundamental Principles of Counting: The Rules of Sum and Product, Permutations, Combinations – The Binomial Theorem, Combinations with Repetition. **Text Book 1:Chapter 1.1 to 1.5, 4.1 , 4.2**	9
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. **Text Book 1:Chapter 5.1 to 5.6, 7.1 to 7.4**	8
4	**The Principle of Inclusion and Exclusion: T**he 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.	9

	Text Book 1:Chapter 8.1 to 8.4, 10.1 , 10.2	
5	**Introduction to Groups Theory:** Definition examples and elementary properties, Homomorphisms, isomorphisms and cyclic groups, cosets, and Lagrange's theorem, Elements of coding theory the hamming metric the parity check and generator matrices **Text Book 1: Chapter 16: 16.1 to 16.3, 16.5 to 16.9**	8

PRESCRIBED TEXT BOOKS

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

REFERENCE BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	**Discrete Mathematics – A Concept-based approach**	Basavaraj S Anami and Venakanna S Madalli	-	Universities Press	2016
2	**Discrete Mathematics and its Applications**	Kenneth H. Rosen:	6th	McGraw Hill	2007
3	**Discrete Mathematics with Applications**	Thomas Koshy	-	Elsevier	2005, Reprint 2008
4	**Discrete Mathematical Structures Theory and Applications**	D.S. Malik and M.K. Sen:	Latest	Thomson	2004
5	**A Treatise on Discrete Mathematical Structures**	Jayant Ganguly	-	Sanguine-Pearson	2010

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

SL. #	Type of E-Resource	URL
1	**Video Lectures**	http://nptel.ac.in/courses.php?disciplineID=111
2	**Video Lectures**	http://www.class-central.com/subject/math(MOOCs)
3	**Video Lectures:**	http://academicearth.org/VTU e-Shikshana ProgramVTU EDUSAT Program.
4	**Video Lectures**	http://www.themathpage.com/
5	**Video Lectures**	http://www.abstractmath.org/

6	**Web links**	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	3	-	-	-	-	-	3	1	3	-	2
CO2	3	3	3	3	-	-	-	-	-	3	1	3	1	2
CO3	3	3	3	3	-	-	-	-	-	3	1	3	-	2
CO4	3	3	3	3	-	-	-	-	-	3	1	3	-	2
CO5	3	3	3	3	-	-	-	-	-	3	1	3	-	2
AVG	3	3	3	3	-	-	-	-	-	3	1	3	1	2

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).

METRIC SPACES

Course Code	B24AD452	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
1. Provide insight into the theory of sets.
2. Learn basic concepts of metric spaces.
3. Understand the concepts of connected sets and compact spaces.

PREREQUISITES:
NIL

MODULE #	TOPICS	Hours
1	**Theory of Sets:** Finite and infinite sets, countable and uncountable sets, cardinality of sets, Schroder-Bernstein theorem, cantor's theorem, Order relation in cardinal numbers, Arithmetic of cardinal numbers, partially ordered set, Zorn's lemma and axioms of choice, various set-theoretic paradoxes.	9
2	**Concepts in Metric Spaces:** Definition and examples of metric spaces, Open spheres and Closed spheres, Neighbourhoods, Open sets, Interior, Exterior and boundary points, Closed sets, Limit points and isolated points, Interior and closure of a set, Boundary of a set, Bounded sets, Distance between two sets, Diameter of a set.	8
3	**Complete Metric Spaces and Continuous Functions:** Cauchy and Convergent sequences, Completeness of metric spaces, Cantor's intersection theorem, Dense sets and separable spaces, Nowhere dense sets and Baire's category theorem, continuous and uniformly continuous functions, Homeomorphism. Banach contraction principle.	9
4	**Compactness:** Compact spaces, Sequential compactness, Bolzano-Weierstrass property, Compactness and finite intersection property, Heine-Borel theorem, totally bounded set, equivalence of compactness and sequential compactness.	8
5	**Connectedness:** Separated sets, Disconnected and connected sets, components, connected subsets of R, Continuous functions on connected sets. Local connectedness and arc-wise connectedness.	8

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	**Metric Spaces**	P.K. Jain & Khalil Ahamad	-	Narosa	2019
2	**Metric spaces**	Micheal O Searcoid	-	Springer-Verlag	2009

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	**Metric Spaces**	Satish Shirali & Harikishan L. Vasudeva	-	Springer-Verlag	2006
2	**Metric Spaces**	E.T. Copson	-	Cambridge University Press	1988
3	**Naive Set Theory**	P.R. Halmos	-	Springer	1974
4	**Topology of Metric spaces**	S. Kumaresan	2nd	Narosa	2011
5	**Introduction to Topology and Modern Analysis**	G.F. Simmons	-	McGraw-Hill	2004

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

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

COURSE OUTCOMES

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

CO #	Course Outcome Statement
CO1	Explain basic facts about the cardinality of a set and various set-theoretic paradoxes.
CO2	Apply the concepts of open and closed spheres and bounded sets to solve problems.
CO3	Demonstrate standard concepts of metric spaces and their properties.
CO4	Identify the continuity of a function defined on metric spaces and homomorphism.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	-	-	-	3	2	-	2
CO2	3	3	2	2	-	-	-	-	-	-		3	-	2
CO3	3	3	3	3	-	-	-	2	-	-	2	3	-	2
CO4	3	3	3	3	-	-	-	2	-	-	3	3	-	2
AVG	2.75	3	2.6	2.6	-	-	-	2	-	-	2.6	2.75	-	2

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).

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:

1. Appreciate the importance of linear algebra in computer science and allied engineering science.
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

To effectively learn optimization 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 BOOK

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).
    - 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).

ALGORITHMIC GAME THEORY

Course Code	B24AD454	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
Comprehend the basics of strategic gaming and mixed strategic equilibrium. 1. Enable students to develop skills on extensive gaming strategies. 2. Analyse and discuss various gaming models. 3. Illustrate some real-time situations.

PREREQUISITES:
NIL

MODULE #	TOPICS	Hours
1	**Introduction to Strategic Games:** What is game theory? The theory of rational choice, Strategic games; Examples: The prisoner's dilemma, Bach or Stravinsky, Matching pennies; Nash equilibrium; Examples of Nash equilibrium; Best response functions; Dominated actions.	9
2	**Introduction:** Strategic games in which players may randomize; Mixed strategy Nash equilibrium; Dominated actions; Pure equilibrium when randomization is allowed. Illustration: Expert Diagnosis; Equilibrium in a single population.	8
3	**Extensive games with perfect Information:** Strategies and outcomes; Nash equilibrium; Subgame perfect equilibrium; Finding sub-game perfect equilibria of **finite horizon games:** Backward induction; Illustrations: The ultimatum game, Stackelberg's model of duopoly.	8
4	**Bayesian Games:** Motivational examples; General definitions; Two examples concerning information; Illustrations: Cournot's duopoly game with imperfect information, Providing a public good; Auctions: Auctions with an arbitrary distribution of valuations.	8
5	**Competitive Games:** Strictly competitive games and maximization. Repeated games: The main idea; Preferences; Repeated games; Finitely and infinitely repeated Prisoner's dilemma; Strategies in an infinitely repeated Prisoner's dilemma; Nash equilibrium of an infinitely repeated Prisoner's dilemma, Nash equilibrium payoffs of an infinitely repeated Prisoner's dilemma.	9

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	**An Introduction to Game Theory**	Martin Osborne	1st Indian	Oxford University Press ISBN – 0195128958	2009

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	**Analysis of Conflict Game Theory**	Roger B. Myerson	Re-print	Harvard University Press ISBN – 978-0674341166	2008
2	**Introduction to Operations Research, Concepts and Cases**	Frederick S. Hillier and Gerald J. Lieberman	9th	Tata McGraw Hill ISBN – 0073376299	2010
3	**An Introduction to Game Theory**	Joel Watson	2nd	W.W. Norton & Company ISBN – 9780393929348	2007

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

SL. #	Type of E-Resource	URL
1	**Web links**	http://www.class-central.com/subject/math(MOOCs)
2	**Web links**	http://academicearth.org/
3	**Web links**	VTU e-Shikshana Program
4	**Video Lectures**	VTU EDUSAT Program.

COURSE OUTCOMES

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

CO #	Course Outcome Statement
CO 1	Interpret the basics of strategic gaming and extensive games.
CO 2	Analyse gaming strategies on real-time incidence.
CO 3	Develop the models of gaming on real-time incidence.
CO 4	Apply game theory in 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	2	-	-	-	-	-	-	-	-	-	2	-	2
CO2	3	3	2	2	-	-	-	-	-	-	-	3	2	2
CO3	3	3	3	2	2	-	-	-	-	-	-	3	2	2
CO4	3	3	3	3	2	-	-	-	-	-	2	3	2	3
AVG	3	2.75	2.6	2.33	2	-	-	-	-	-	2	2.75	2	2.25

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 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
NIL

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.	03
2	**Biomolecules and Biosensors:** Biomolecules: Properties and functions of carbohydrates, proteins, lipids. Short Biosensor History, Biosensor Classification.	03
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.	03
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.	03
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	03

	surfaces), Shark skin (Friction reducing swimsuits), Kingfisher beak (Bullet train).	

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 Edition	McGraw-Hill eBook	2022
3	Biosensors: essentials.	Evtugyn, Gennady.	Vol. 84.	Springer Berlin Heidelberg	2014
4	Biomimetics: Nature-Based Innovation	Yoseph Bar-Cohen	1st edition	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 Edition.		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	1	1	2
CO2	3	3	3	3	-	-	-	3	-	-	3	2	2	3
CO3	3	3	3	3	-	-	-	3	-	-	3	2	2	2
CO4	3	3	3	3	-	-	-	3	-	-	3	2	2	2
AVG	3	3	3	3	-	-	-	3	-	-	3	1.75	1.75	2.25

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

Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A

student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1) Two tests will be administered. Each test will be for 25 marks.
2) Questions will be based on multiple choice
3) Final CIE marks will be the sum total of both the tests.

Semester-End Examination:

1) Theory SEE will be conducted by the Office of COE with common question papers for the course (duration 01 hour).
2) The question paper will have fifty Multiple Choice questions
3) Max marks for SEE is 50

MongoDB

Course Code	B24AD471	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. Understand basic MongoDB functions, operators and types of operations in MongoDB.
2. Demonstrate the use of Indexing, Advanced Indexing in MongoDB.
3. Apply the aggregation and Map Reduction in MongoDB.
4. Demonstrate text searching on collections in MongoDB.

PREREQUISITES:
NIL

Sl. #	PROGRAMS
1	a. Illustration of Where Clause, AND, OR operations in MongoDB. b. Execute the Commands of MongoDB and operations in MongoDB: Insert, Query, Update, Delete and Projection. (Note: use any collection).
2	a. Develop a MongoDB query to select certain fields and ignore some fields of the documents from any collection. b. Develop a MongoDB query to display the first 5 documents from the results obtained in a. [use of limit and find].
3	a. Execute query selectors (comparison selectors, logical selectors) and list out the results on any collection. b. Execute query selectors (Geospatial selectors, Bitwise selectors) and list out the results on any collection.
4	Create and demonstrate how projection operators ($, $elematch and $slice) would be used in the MongoDB.
5	Execute Aggregation operations ($avg, $min,$max, $push, $addToSet etc.). students encourage to execute several queries to demonstrate various aggregation operators)
6	Execute Aggregation Pipeline and its operations (pipeline must contain $match, $group, $sort, $project, $skip etc. students encourage to execute several queries to demonstrate various aggregation operators).
7	a. Find all listings with listing_url, name, address, host_picture_url in the listings and Reviews collection that have a host with a picture url. b. Using E-commerce collection write a query to display reviews summary.
8	a. Demonstrate creation of different types of indexes on collection (unique, sparse, compound and multikey indexes). b. Demonstrate optimization of queries using indexes.
9	a. Develop a query to demonstrate Text search using catalog data collection for a given word. b. Develop queries to illustrate excluding documents with certain words and phrases
10	Develop an aggregation pipeline to illustrate Text search on Catalog data collection.

PRESCRIBED MATERIALS

SL. #	Type of E-Resource	URL
1	**BOOKS**	BOOK 1: "MongoDB: The Definitive Guide", Kristina chodorow, 2nd ed O'REILLY, 2013.
2		BOOK 2: "MongoDB in Action" by KYLE BANKER et. al. 2nd ed, Manning publication, 2016
3		BOOK 3: "MongoDB Complete Guide" by Manu Sharma 1st ed, bpb publication, 2023.
4	**Online Course**	installation of MongoDB Video: https://www.youtube.com/watch?v=dEm2AS5amyA
5		video on Aggregation: https://www.youtube.com/watch?v=vx1C8EyTa7Y
6		MongoDB in action book Code download URL: https://www.manning.com/downloads/529
7		MongoDB Exercise URL: https://www.w3resource.com/mongodb-exercises/

INFOSYS SPRINGBOARD MANDATORY CERTIFICATION COURSE

SL.#	Name of the Certification as per Infosys Springboard	Course Link
1	**TechA MongoDB Administration Certification**	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013826270871085056 5_shared/overview

COURSE OUTCOMES

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

CO#	Course Outcome Statement
CO1	Make use of MongoDB commands and queries.
CO2	Illustrate the role of aggregate pipelines to extract data.
CO3	Demonstrate optimization of queries by creating indexes.
CO4	Develop aggregate pipelines for text search in collections.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	–	–	–	1	–	2	3	–	2
CO2	3	3	3	2	3	–	–	–	1	–	2	3	1	3
CO3	3	3	3	2	3	–	–	–	1	–	2	3	–	3
CO4	3	3	3	2	3	–	–	–	1	–	2	3	1	3
AVG	3	2.75	2.75	1.75	3	–	–	–	1	–	2	3	1	2.75

INTRODUCTION TO MATLAB

Course Code	B24CI472	Total contact hours / week	2	CIE MARKS	50
Course Category	AEC/SEC	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. Understand basic MATLAB functions, operators and types of operations in MATLAB.
2. Demonstrate the use of signals and sequences, Advanced Indexing in MATLAB.
3. Apply the aggregation and Laplace Transforms in MATLAB.
4. Demonstrate Sampling Theorem in MATLAB.
5. Understand Extraction of Periodic Signal masked by noise using Correlation.

PREREQUISITES
• Basic Mathematics
• Linear Algebra
• Programming

SL. #	PROGRAMS
1	Basic Operations on Matrices.
2	Generation of Various Signals and Sequences (Periodic and Aperiodic), such as Unit Impulse, Unit Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sinc.
3	Operations on Signals and Sequences such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power..
4	Finding the Even and Odd parts of Signal/Sequence and Real and Imaginary parts of Signal.
5	Convolution for Signals and sequences.
6	Auto Correlation and Cross Correlation for Signals and Sequences.
7	Verification of Linearity and Time Invariance Properties of a given Continuous/Discrete System..
8	Computation of Unit sample, Unit step and Sinusoidal responses of the given LTI system and verifying its physical realizability and stability properties.
9	Gibbs Phenomenon Simulation.
10	Finding the Fourier Transform of a given signal and plotting its magnitude and phase spectrum.
11	Waveform Synthesis using Laplace Transform.
12	Locating the Zeros and Poles and plotting the Pole-Zero maps in S-plane and Z-Plane for the given transfer function.
13	Generation of Gaussian noise (Real and Complex), Computation of its mean, M.S. Value and its Skew, Kurtosis, and PSD, Probability Distribution Function.
14	Verification of Sampling Theorem.
15	Removal of noise by Autocorrelation / Cross correlation.
16	Extraction of Periodic Signal masked by noise using Correlation.
17	Verification of Weiner-Khinchine Relations.
18	Checking a Random Process for Stationarity in Wide sense.

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	**Understanding MATLAB. A Textbook for Beginners**	S. N ALAM	1st	Dreamtech Press Book	2019
2	**Fundamentals of MATLAB Programming**	K Upendra Raju N. Amrutha Prabha D. Srinivasulu Reddy	1st	Vijaynicole Imprints Pvt. Ltd.	2018

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

SL. #	Type of E-Resource	URL
1	**Video Lectures**	https://www.mathworks.com/videos.html
2	**Video Lectures**	https://www.youtube.com/watch?v=zF5lKWY87z8
3	**Video Lectures**	https://www.youtube.com/watch?v=1PSFLKiEV7U
4	**Video Lectures**	https://www.mathworks.com/videos.html

COURSE OUTCOMES

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

CO #	Course Outcome Statement
CO 1	Make use of MATLAB commands and queries.
CO 2	Illustrate the role of MATLAB to extract data.
CO 3	Demonstrate Synthesis, Simulation and correlations by MATLAB.
CO 4	Develop different structures for simulation of Gaussian Noise, Skew, Kurtosis, and PSD, Probability Distribution Function.
CO 5	Demonstrate Extraction of Periodic Signal masked by noise using Correlation.

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	-	2
CO2	3	3	3	2	2	-	-	-	1	-	2	3	-	2
CO3	3	3	3	2	3	-	-	-	2	-	2	3	-	2
CO4	3	3	3	2	3	-	-	1	2	-	2	3	-	3
CO5	3	3	3	2	3	-	-	1	2	-	2	3	1	2
AVG	3	2.8	2.8	2	2.6	-	-	1	1.6	-	1.8	2.8	1	2.2

Teaching-Learning Process Pedagogy (General Instructions)

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) 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. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters student's Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.

MERN

Course Code	B24AD473	Total contact hours / week	2	CIE MARKS	50
Course Category	AEC/SEC	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. Understand and apply critical web development languages and tools to create dynamic and responsive web applications. **2.** To build server-side applications using Node.js and Express. **3.** Develop user interfaces with React.js. **4.** Manage data using MongoDB, and integrate these technologies to create full stack apps. **5.** Understanding APIs and routing.

PREREQUISITES
• HTML • CSS • JavaScript

SI.NO	Experiments
1	**Environment Setup and Basic Node.js** • Set up development environment and create basic Node.js applications. • Install Node.js, npm, and development tools. • Create a simple HTTP server using Node.js. • Implement basic file operations and modules. • Introduction to package.json and npm commands.
2	**Express.js Fundamentals** • Build web servers using Express.js framework. • Create Express.js application with routing. • Implement middleware functions. • Handle GET, POST, PUT, DELETE requests. • Serve static files and templates.
3	**MongoDB Database Operations** • Learn database operations with MongoDB. • Install and configure MongoDB. • Perform CRUD operations using MongoDB shell. • Create collections and documents. • Implement data validation and indexing.
4	**Mongoose ODM Integration** • Connect Node.js with MongoDB using Mongoose. • Set up Mongoose connection. • Define schemas and models. • Implement database operations with Mongoose. • Handle validation and error management.
5	**RESTful API Development**

	• Build complete RESTful APIs. • Design and implement REST endpoints. • Create API for user management (CRUD). • Implement proper HTTP status codes. Add request validation and error handling.
6	**React.js Fundamentals** • Introduction to React.js frontend development. • Set up React Development Environment. • Create functional and class components. • Implement JSX, props, and state management. Handle events and conditional rendering.
7	**React Hooks and State Management** • Advanced React concepts and state management. • Implement useState, useEffect, and custom hooks. • Manage component lifecycle. • Handle forms and user input. • Implement local storage integration using secured or encrypted local storage. **NOTE:** Normal local storage can be used but is prone to security breaches.
8	**React Router and Navigation** • Implement client-side routing in React applications. • Set up React Router for navigation. • Create protected and public routes. • Implement nested routing (add-on knowledge). Handle route parameters and query strings.
9	**Frontend-Backend Integration** • Connect React frontend with Express.js backend. • Make API calls using fetch/axios. • Handle asynchronous operations. • Implement loading states and error handling. Manage application state with API data.
10	**Authentication and Authorization** • Implement user authentication system. • Create user registration and login APIs. • Implement Basic token-based authentication using user alias ID. **NOTE:** JWT token-based authentication is used for authentication.
11	**Mini Project - Complete MERN Application** • Develop a full-stack web application using MERN stack. **Project Options:** 1. Task Management System: User registration, authentication, task CRUD, dashboard with statistics. 2. Blog Platform: User authentication, blog CRUD, comment system, search/filter functionality. 3. E-commerce Product Catalog: Product management, user cart, order management, admin panel. 4. Social Media Dashboard: User profiles, post creation/sharing, like/comment features, real-time updates.

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

Sl. #	Type of E-Resource	URL
1	**Book**	Vasan SubramanianPro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Apress; 1st ed. edition (1 April 2017)
2	**Book**	Eddy Wilson Iriarte Koroliova, MERN Quick Start Guide, Packt Publishing (31 May 2018),
3	**Online Tutorials**	https://www.geeksforgeeks.org/mern-stack/
4	**Online Tutorials**	https://blog.logrocket.com/mern-stack-tutorial/

COURSE OUTCOMES

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

CO #	Course Outcome Statement
CO1	Apply the fundamentals of MongoDB, such as data modelling, CRUD operations, and basic queries to solve given problem.
CO2	Use constructs of Express.js, including routing, software and constructing RESTful APIs to solve real world problems
CO3	Develop scalable and efficient RESTful APIs using Node JS
CO4	Develop applications using React, including components, state, props, and JSX syntax.

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	3	3	-
CO2	3	3	3	2	2	-	-	-	1	-	2	3	3	2
CO3	3	3	3	2	3	-	-	-	2	-	2	3	3	3
CO4	3	3	3	2	3	-	-	1	2	-	2	3	3	2
AVG	3	2.75	2.75	2	2.5	-	-	1	1.5	-	1.75	3	3	2.3

UNIX SHELL SCRIPTING

Course Code	B24CS474	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
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	**03**
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	**03**
3	**Simple Filters:** The sample database, head, tail, cut, paste, sort, uniq, tr Filters using Regular Expression: grep. Egrep	**03**
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	**03**
5	**Essential Shell Programming Par II:** the if conditional, using test and [ ] to evaluate expressions, the case conditional, expr, $0, while, for, set and shift	**03**

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	UNIX – Concepts and Applications	Sumitabha Das	Fourth Edition	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	Second Edition	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	PO 10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	-	3	-	-	-	-	-	2	2	1	3
CO2	3	3	2	-	3	-	-	-	-	-	2	2	1	3
CO3	3	3	2	-	3	-	-	-	-	-	2	2	1	3
CO4	3	3	2	-	3	-	-	-	-	-	2	3	2	3
AVG	3	3	2	-	3	-	-	-	-	-	2	2.25	1.25	3

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

Laboratory Component

Programming Assignments

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.

Assessment Details (CIE & SEE):

CIE:

i) CIE marks for this particular course is 50 Marks.

ii) Breakup for 50 marks = 2 quiz for 30 marks + lab internal test for 20 marks.

iii) Two quiz will be conducted for 15 marks each.

iv) At the end of the course department will conduct lab internal test for 100 marks. This will be further scaled down to 20.

v) Sum total of quiz and internal lab test will be the FINAL CIE marks scored by the student.

SEE:

1) SEE marks for this course is 50 marks.

2) SEE will be conducted for 100 marks and further it will be scaled down to 50.

3) SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute / Controller of Examinations.

3) These examinations are to be conducted between the schedule mentioned in the academic calendar of the Institute.

4) All laboratory experiments are to be included for practical examination.

5) (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. OR based on the course requirement evaluation rubrics shall be decided jointly by examiners.

6) Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.

7) Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

8) Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero. The minimum duration of SEE is 02 hours

UNIVERSAL HUMAN VALUES

Course Code	B24UHK48	Total contact hours / week	01	CIE MARKS	100
Course Category	UHV	Total SAAE hours / semester	16	SEE MARKS	0
L:T:P:S	1:0:0:0	Total Notional Learning Hours	30	TOTAL MARKS	100
Total credits	01			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	03
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	03

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	**03**
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	**03**
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	**03**

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 Revised Edition	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=0gdNx0X923I

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	1	3	-
CO2	-	-	-	-	-	-	-	3	3	-	3	2	2	1
CO3	-	-	-	-	-	-	-	3	3	-	3	-	3	-
CO4	-	-	-	-	-	-	-	3	3	-	3	1	3	1
AVG	-	-	-	-	-	-	-	3	3	-	3	1.3	2.75	1

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.
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 SYSTEM LABORATORY WITH MINI PROJECT

Course Code	B24ADL49	Total contact hours / week	2	CIE MARKS	50
Course Category	PCCL	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. 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 problem. **3**. Develop database applications using front-end tools and back-end DBMS.

Descriptions (if any):

PART-A: SQL Programming

- 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.
  To begin practicing with SQL, one can install MySQL Workbench 8.0, a free visual tool from Oracle. Visit the official MySQL site, download the MySQL Installer for Windows (or your OS).
- Create Schema and insert at least 5 records for each table. Add appropriate database constraints.

PART-B: Mini Project

- Use Java, C#, MERN, Python, or any other similar front-end tool. All applications must be demonstrated on desktop/laptop as a stand-alone or web based application (Mobile apps on Android/IOS are not permitted.)
- Installation procedure of the required software must be demonstrated, carried out in groups and documented in the journal.

SI.#	PROGRAMS
1	**Aim:** **Program:** Create a table called Employee & execute the following. Employee (EMPNO, ENAME, JOB, MANAGER_NO, AGE, SAL) Write SQL queries to i. Insert null values into the employee table and verify the result. ii. Add a column commission with the domain to the Employee table. iii. Update the column details of Commission. iv. Rename the column SAL of the Employee table as SALARY using the ALTER command. v. Delete the records of the employee whose EMPNO is 105. vi. Demonstrate the Rollback command. vii. Find the Maximum age from the Employee table.

	viii. Find the salaries of employees in Ascending Order. ix. Find grouped salaries of employees based on the JOB category. x. Find the details of the Employees whose name starts with B. Find all the Employees' details whose salary is > 27000. xi. Find all the Employees' details whose salary is between Rs. 24000 and Rs. 29000 **Reference:** https://www.youtube.com/watch?v=VjwoNoU-4j8 https://www.youtube.com/watch?v=HgBOAQ-v7zg https://www.youtube.com/watch?v=sCYebelHhOE
2	**Aim:** Demonstrate the various concepts of row-level trigger using Update constraints. **Program:** Create a row-level trigger for the customers table that would fire for INSERT or UPDATE or DELETE operations performed on the CUSTOMERS table. This trigger will display the salary difference between the old & new Salary. Use the Schema CUSTOMERS (ID, NAME, AGE, ADDRESS, SALARY). **Reference:** https://www.youtube.com/watch?v=m-aYtxMsdKY
3	**Aim:** Discuss the various concepts on constraints and update operations. **Program:** Consider the following schema for Order Database: SALESMAN (SalesmanId, Name, City, Commission) ORDERS (OrdNo, PurchaseAmt, Ord_Date, CustomerID, SalesmanId). CUSTOMER (CustomerID, CustName, City, Grade, SalesmanId) Write SQL queries to i. Count the customers with grades above Bangalore's average. ii. Find the names and numbers of all salesmen who had more than one customer. iii. List all the salesmen and indicate those who have and don't have customers in their cities (Use the UNION operation.) iv. Create a view that finds the salesman who has the customer with the highest order of a day. v. Demonstrate the DELETE operation by removing t h e salesman with id 1000. All his orders must also be deleted. **Reference:** https://www.youtube.com/watch?v=AA-KL1jbMeY https://www.youtube.com/watch?v=7S_tz1z_5bA
4	**Aim:** Demonstrate the concepts of JOIN operations. **Program:** Consider the schema for Movie Database: ACTOR(Act_id, Act_Name, Act_Gender) DIRECTOR(Dir_id, Dir_Name, Dir_Phone) MOVIES(Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id) MOVIE_CAST(Act_id, Mov_id, Role) RATING(Mov_id, Rev_Stars) Write SQL queries to i. List the titles of all movies directed by „Hitchcock". ii. Find the movie names where one or more actors acted in two or more movies. iii. List all actors who acted in a movie before 2000 and also in a movie after 2015 (use JOIN operation). iv. Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by

	movie title. v. Update rating of all movies directed by „Steven Spielberg" to 5. **Reference:** https://www.youtube.com/watch?v=hSiCUNVKJAo https://www.youtube.com/watch?v=Eod3aQkFz84
5	**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 i. List all the student details studying in fourth semester „C" section. ii. Compute the total number of male and female students in each semester and in each section. iii. Create a view of Test1 marks of student USN „1BI15CS101" in all Courses. iv. Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students. v. 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
6	**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) (DNo,DLoc) PROJECT(PNo, PName, PLocation, DNo) WORKS_ON(SSN, PNo, Hours) Write SQL queries to i. 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. ii. Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent raise. iii. 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 iv. Retrieve the name of each employee who works on all the projects controlled by department number 5 (use NOT EXISTS operator). v. 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
	PART B: Mini Project
1	**Demonstration of real time Database projects:** • Write the ER Diagram, apply ER-mapping rules, normalize the relations, and follow the application development process. • Make sure that the application should have five or more tables, at least one trigger and one stored procedure, using suitable frontend tool. • Indicative areas include: E-commerce Platform, Inventory Management, Railway System, College Data Management, Library Data Management, Hospital Data Management, Transport.

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

SL. #	Type of E-Resource	URL
1	**Book**	Learning SQL, Alan Beaulieu, O'Reilly Media Publications, 3rd Edition,2020.
2	**Online Tutorials**	https://www.mysql.com/
3	**Online Tutorials**	https://www.w3schools.com/sql/
4	**Online Tutorials**	https://www.geeksforgeeks.org/dbms/

COURSE OUTCOMES

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

CO #	Course Outcome Statement
CO1	Describe the basic elements of a relational database management system.
CO2	Apply various Structured Query Language (SQL) statements for database manipulation.
CO3	Design entity relationship for the given scenario & Develop database applications for the given real world problem.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	–	2	–	–	–	1	–	2	2	–	–
CO2	3	3	2	2	3	–	–	1	2	1	2	3	2	–
CO3	3	3	3	2	3	–	–	3	3	2	3	3	3	2
AVG	3	2.6	2	2	2.6	–	–	2	2	1.5	2.33	2.6	2.5	2

Teaching-Learning Process Pedagogy (General Instructions):
Pedagogy for the above experiments the following pedagogy can be considered. Problem based learning, Active learning, MOOC, Chalk &Talk.

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	0	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	1	3	2
CO2	-	-	3	-	-	3	-	-	-	-	3	2	3	2
CO3	-	-	3	-	-	3	-	-	-	-	3	3	2	2
CO4	-	-	3	-	-	3	-	-	-	-	3	2	3	1
CO5	-	-	3	-	-	3	-	-	-	-	3	1	3	1
AVG	-	-	3	-	-	3	-	-	-	-	3	2.2	2.8	1.6

Plan of Action (Execution of Activities for each semester):

SL. #	Practice Session Description
1	Lecture session by NSS Officer
2	Students Presentation on Topics
3	Presentation - 1 , Selection of topic, PHASE – 1
4	Commencement of activity and its progress - PHASE – 2
5	Execution of Activity
6	Execution of Activity
7	Execution of Activity
8	Execution of Activity
9	Execution of Activity
10	Case study based Assessment, Individual performance
11	Sector wise study and its consolidation
12	Video based seminar for 10 minutes by each student At the end of semester with Report.

- In every semester from 3rd semester to 6th semester, each student should do activities according to the scheme and syllabus.
- At the end of every semester student performance has to be evaluated by the NSS officer for the assigned activity progress and its completion.
- At last in 6th semester consolidated report of all activities from 3rd to 6th semester, compiled report should be submitted as per the instructions.

Marks scored for 50 by the students should be Scale down to 25 marks In each semester for CIE entry in the portal.

25 marks CIE entry will be entered in IA marks portal at the end of each semester 3rd to 6th sem, Report and assessment copy should be made available in the department semester wise.

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.

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.

SL. #	Topic	Group Size	Location	Activity Execution	Reporting	Evaluation of the topic
1	Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.	May be individual or team	Farmers land / Villages / roadside / community area/ College campus etc…..	Site selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
2	Waste management– Public, Private and Govt organization, 5 R's.	May be individual or team	Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc…..	Site selection / proper consultation / Continuous monitoring / Information board		
3	Setting of the information imparting club for women leading to contribution in social and economic issues.	May be individual or team	Women empowerment groups / Consulting NGOs & Govt Teams / College campus etc…..	Group selection / proper consultation / Continuous monitoring / Information board		
4	Water conservation techniques – Role of different stakeholders– Implementation.	May be individual or team	Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc…..	Site selection / proper consultation / Continuous monitoring / Information board		
5	Preparing an actionable business proposal for enhancing the village income and approach for implementation.	May be individual or team	Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc…..	Group selection / proper consultation / Continuous monitoring / Information board		
6	Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.	May be individual or team	Local government / private / aided schools / Government Schemes officers / etc…..	School selection / proper consultation / Continuous monitoring / Information board		
7	Developing Sustainable Water management system for rural	May be individual or team	Villages / City Areas / Grama panchayat / public associations	Site selection / proper consultation / Continuous		

	areas and implementation approaches.		/ Government Schemes officers / campus etc…..	monitoring / Information board		
8	Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.	May be individual or team	Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc…..	Group selection / proper consultation / Continuous monitoring / Information board		
9	Spreading public awareness under rural outreach programs. (minimum5 programs). /// Social connect and responsibilities.	May be individual or team	Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc…..	Group selection / proper consultation / Continuous monitoring / Information board		
10	Plantation and adoption of plants. Know your plants.	May be individual or team	Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc…..	Place selection / proper consultation / Continuous monitoring / Information board		
11	Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).	May be individual or team	Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc…..	Place selection / proper consultation / Continuous monitoring / Information board		
12	Govt. school Rejuvenation and helping them to achieve good infrastructure.	May be individual or team	Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc…..	Place selection / proper consultation / Continuous monitoring / Information board		

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	0	TOTAL MARKS	100
Total credits	0			Exam Duration	-

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

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	-	3	-
CO2	-	-	-	-	-	-	-	3	-	-	3	-	3	-
CO3	-	-	-	-	-	-	-	3	-	-	3	-	2	2
CO4	-	-	-	-	-	-	-	3	-	-	3	-	3	-
CO5	-	-	-	-	-	-	-	3	-	-	3	-	3	-
CO6	-	-	-	-	-	-	-	3	-	-	3	-	2.8	2
AVG	-	-	-	-	-	-	-	3	-	-	3	-	3	-

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

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	0	TOTAL MARKS	100
Total credits	0			Exam Duration	-

Module #	CONTENTS	Hours
1	Ethics and Moral Values a. Ethics in Sports b. Moral Values in Sports and Games	4
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
3	Role of Organisation and administration	4

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	-	3	-
CO2	-	-	-	-	-	-	3	3	-	-	3	-	3	-
CO3	-	-	-	-	-	-	3	3	-	-	3	-	2	1
AVG	-	-	-	-	-	-	3	3	-	-	3	-	2.6	1

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

PHYSICAL EDUCATION (SPORTS & ATHLETICS) – III

Course Code	B24PEK591	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	0	TOTAL MARKS	100
Total credits	0			Exam Duration	-

Module #	CONTENTS	Hours
1	Orientation a. Fitness b. Food & Nutrition	4
2	General Fitness & Components of Fitness a. Agility – Shuttle Run b. Flexibility – Sit and Reach c. Cardiovascular Endurance – Harvard step Test	4
3	Specific games (Any one to be selected by the student) a. Badminton (Fore hand low/high service, back hand service, smash, drop) b. Basketball (Dribbling, passing, shooting etc.) 3. Athletics (Field events – Throws)	16

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, Food, Nutrition and general 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	Understand and practice of specific games and athletic throwing events.

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	-	2	1
CO4	-	-	-	-	-	-	3	3	-	-	3	-	3	-
CO5	-	-	-	-	-	-	3	3	-	-	3	-	3	-
AVG	-	-	-	-	-	-	3	3	-	-	3	-	2.8	1

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

PHYSICAL EDUCATION (SPORTS & ATHLETICS) – IV

Course Code	B24PEK691	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	0	TOTAL MARKS	100
Total credits	0			Exam Duration	-

Module #	CONTENTS	Hours
1	Orientation a. Postural deformities. b. Stress management	4
2	Specific Games (Any one to be selected by the student) a. Throw ball b. Table Tennis c. Athletics (Field Events- Jumps) – Any event as per availability of Ground.	16
3	Aerobics	4

COURSE OUTCOMES

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

CO #	Course Outcome Statement
CO1	Understand the Postural deformities and Stress management in sports and athletics
CO2	Participate in the competition at regional/state / national / international levels.
CO3	Understand and practice of specific games and athletic Jumping events.
CO4	Understand and practice of Aerobics.

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	-

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 (Semester 3)

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	0	TOTAL MARKS	100
Total credits	0			Exam Duration	-

Course Title	Content	No. of Hours
Introduction 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 hrs 2 hrs 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	

YOGA – II (Semester 4)

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	0	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	Total 20-24 hrs 2 hrs per week
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	
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	

YOGA – III (Semester 5)

Course Code	B24YOK591	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	0	TOTAL MARKS	100
Total credits	0			Exam Duration	-

Course Title	Content	No. of Hours
Patanjali's Ashtanga Yoga 3. Asana 4. Pranayama 5. Pratyahara	Patanjali's Ashtanga Yoga – its need and importance	Total 20-24 hrs 2 hrs per week
Suryanamaskara	Suryanamaskar l2 count 6 rounds	
Different types of Asanas a) Sitting 1. Ardha Ushtrasana 2. Vakrasana 3. Yogamudra in Padmasana b) Standing 1. UrdhvaHastothanasana 2. Hastapadasana 3. ParivrittaTrikonasana 4. Utkatasana c) Supine line 1. Sarvangasana 2. Chakraasana 3. Pavanamuktasana	Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits each asana	
Kapalabhati	Revision of practice. 60 strokes/min 3 rounds	
Pranayama – 1. Ujjayi 2. Sheetali 3. Sheektari	Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama	

YOGA – IV (Semester 6)

Course Code	B24YOK691	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	0	TOTAL MARKS	100
Total credits	0			Exam Duration	-

Course Title	Content	No. of Hours
Patanjali's Ashtanga Yoga 1. Dharana 2. Dhyana (Meditation) 3. Samadhi	Patanjali's Ashtanga Yoga – its need and importance	Total 20-24 hrs 2 hrs per week
Suryanamaskara	Suryanamaskar l2 count 8 rounds	
Different types of Asanas a) Sitting 1. Bakasana 2. Hanumanasana 3. Ekapada Rajakapotasana 4. Yogamudra in Vajrasana b) Standing 1. Vatayanasana 2. Garudasana c) Balancing 1. Veerabhadrasana 2. Sheershasana	Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits each asana	
Kapalabhati	Revision of Kapalabhati practice. 80 strokes/min 3 rounds	
Pranayama – 1. Bhastrika 2. Bhramari	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	NCMC	Total SAAE hours / semester	-	SEE MARKS	-
L:T:P:S	0:0:2:0	Total Notional Learning Hours	0	TOTAL MARKS	100
Total credits	0			Exam Duration	-

Module #	CONTENTS	Hours
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
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

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.