DON BOSCO INSTITUTE OF TECHNOLOGY

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

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

UNDERGRADUATE PROGRAM

(NBA Accredited 2025-2028)

OUTCOME BASED CURRICULUM & ASSESSMENT

Scheme and Syllabus

III & IV Semester

For the 2024 Admitted Batch

Kumbalgodu, Mysuru Road, Bengaluru 560074

Vision of the Institute

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

Mission of the Institute

M1: To impart quality education in order to meet the needs of industry and society.

M2: To collaborate with academia, industry and research institutes to strengthen teaching and learning process.

M3: To promote equitable and harmonious development of students to work in teams.

M4: To imbibe lifelong learning skills and entrepreneurial skills exhibiting leadership.

Core Values

i) Attain excellence in different disciplines by creating, preserving and disseminating knowledge to all aspiring students

ii) Draw inspiration from the Institutions ethos and develop within its members a sense of accountability towards their community, society and the nation at large

iii) Accept the challenges globalization and changing times throw at us to offer high quality education and developmental services in a competitive manner

iv) Provide every opportunity to the Institutions key constituents–its faculty, staff, students and the community–to excel in their domain of expertise and contribute to every task with sincerity

v) Transition from the teacher – centric focus to the learner - centric approach in imparting knowledge

Vision of the Department
To be a centre of excellence, enabling students in the area of Computer Science & Engineering to become successful and socially responsible software professionals.

Mission of the Department
M1: To impart knowledge that builds software skills with logical and structured thinking.
M2: To provide training on the usage of software tools for developing applications in the multiple domains of Computer Science & Engineering.
M3: To create entrepreneurial manpower to serve in industry, academia, and social setting.
M4: To inculcate professional ethics and concern for the environment so that it benefits society.

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	An ability to analyze algorithms and codes.
PSO2	An ability to design, develop and implement algorithms for real-time applications.
PSO3	An ability to develop mobile and web applications.
PSO4	An ability to inculcate professional skills, entrepreneurship skills, and work in teams for developing engineering solutions for societal needs with ethical practices.

Program Educational Objectives	
PEO1	Graduates with acquired engineering knowledge will be able to comprehend, analyze, design, and create software solutions for real time problems.
PEO2	Graduates will work individually and in teams for software project management.
PEO3	Graduates will be able to grow professionally by enhancing their knowledge and skills by lifelong learning.
PEO4	Graduates will exhibit ethical entrepreneurial skills.

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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31.	B24CS475	Web Analytics
32.	B24UHK48	Universal Human Values
33.	B24CSL46	Database Management Systems Laboratory with Mini Project
34.	B24NSK410	National Service Scheme (NSS) – II
35.	B24PEK410	Physical Education (PE) (Sports and Athletics) – II
36.	B24YOK410	Yoga – II
37.	B24SDC411	Ready to Rise

SCHEME

DON BOSCO INSTITUTE OF TECHNOLOGY
(Autonomous Institution affiliated to VTU, Belagavi)
B.E. in Department of Computer Science and Engineering
Scheme of Teaching and Examinations 2024
(Academic year 2025-26)

SEMESTER: III

Sl No	Course Category	Course Code	Course Title	Teaching Department (TD)	Board of Examiner (BoE)	Teaching Hours / Week	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	B24CS32	Digital Design & Microcontrollers	CS	CS	3:0:2:0	48	03	50:50	100	4
3	IPCC	B24CS33	Computer Organization & Operating Systems	CS	CS	3:0:2:0	48	03	50:50	100	4
4	PCC	B24CS34	Data Structures	CS	CS	3:0:0:0	48	03	50:50	100	3
5	ESC	B24XX35x	ESC / ETC /PLC	CS	CS	If Theory 3:0:0:0	48	03	50:50	100	3
						If Lab 2:0:2:0	32				
6	UHV	B24SCK36	Social Connect and Responsibility	Any Department	CS	0:0:2:0	0	--	100:0	100	0
7	AEC / SEC	B24XX37x	Ability Enhancement Course / Skill Enhancement Course	CS	CS	If Theory 1:0:0:0	16	01	50:50	100	1
						If Lab 0:0:2:0	0	02			
8	PCCL	B24CSL38	Data Structures Laboratory	CS	CS	0:0:2:0	0	03	50:50	100	1
9	NCMC	B24NSK391	National Service Scheme (NSS) - I	NSS Coordinator		0:0:2:0	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	B24CS353	Introduction to Digital Twins
B24CS352	Neuromorphic Computing	B24CS354	Principles of Programming Languages

Ability Enhancement Course			
B24CS371	Data Analytics with Excel	B24CS373	Wearable Systems for Healthcare
B24CS372	Problem Solving Skills	B24CS374	Web Technology

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

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

1. All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE) (Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters.
2. Activities shall be carried out between III semester to the VI semester (for 4 semesters).
3. The candidate has to secure minimum of 40% of maximum marks of CIE to qualify in this course
4. The candidate may continue the same chosen course (NSS/Sports/Yoga) between 3rd to 6th semester. However, the option is given to students to change the activity.
5. He / She may opt for the change of the course in ensuing semester. If the student is opting new course in 5th semester first time, he / she may take the basic modules (lower semester) from the syllabus to complete and if they repeat the same course in ensuing semester, subsequent modules can be offered.
6. Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree.
7. 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.
8. 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.

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B.E. in Department of Computer Science and Engineering
Scheme of Teaching and Examinations 2024
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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	Database Management Systems	CS	IS	3:0:0:0	48	03	50:50	100	3
2	IPCC	B24CS42	Analysis and Design of Algorithms	CS	CS	3:0:2:0	48	03	50:50	100	4
3	IPCC	B24CS43	Data Communication Networks	CS	CS	3:0:2:0	48	03	50:50	100	4
4	PCC	B24CS44	Discrete Mathematical Structures & Graph Theory	CS	CS	3:0:0:0	48	03	50:50	100	3
5	ESC	B24XX45X	ESC / ETC /PLC	CS	CS	2:2:0:0	32	03	50:50	100	3
6	BSC	B24BOE46	Biology for Engineers	CS	CI	1:0:0:0	16	01	50:50	100	1
7	AEC / SEC	B24XX47x	Ability Enhancement Course / Skill Enhancement Course	CS	CS	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	Any department	IS	1:0:0:0	16	--	100:0	100	1
9	PCCL	B24CSL49	Database Management Systems Laboratory with Mini Project	CS	CS	0:0:2:0	0	03	50:50	100	1
10	NCMC	B24NSK410	National Service Scheme (NSS) - II	NSS Coordinator		0:0:2:0	0	--	100:0	100	0
		B24PEK410	Physical Education (PE) (Sports and Athletics) – II	PE Director							
		B24YOK410	Yoga – II	Yoga Teacher							
11	AC	B24SDC411	Ready to Rise	T & P	T & P	0:0:0:2	0	--	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, **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, **AC**: Audit Course.

Engineering Science Course (ESC/ETC/PLC)			
B24CS451	AI in Cyber Security	B24CS453	Operations Research
B24CS452	Quantum Computing	B24IS454	Linear Algebra

Ability Enhancement Course			
B24CS471	Business Intelligence Tools	B24CS473	Capacity Planning for IT
B24CS472	Green IT and Sustainability	B24CS474	Unix Shell Scripting
B24CS475	Web Analytics		

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

1. All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of IV semesters.
2. Activities shall be carried out between III semester to the VI semester (for 4 semesters).
3. The candidate has to secure minimum of 40% of maximum marks of CIE to qualify in this course
4. The candidate may continue the same chosen course (NSS/Sports/Yoga) between 3rd to 6th semester. However, the option is given to students to change the activity.
5. He/ She may opt for the change of the course in ensuing semester. If the student is opting new course in 5th semester first time, he / she may take the basic modules (lower semester) from the syllabus to complete and if they repeat the same course in ensuing semester, subsequent modules can be offered.
6. Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree.
7. 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.
8. 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.

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

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

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

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

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

Pattern of SEE Question Paper

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

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

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

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

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

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

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

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

- 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 chains, Higher transition probabilities, Stationary distribution of Regular Markov chains 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, 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 8 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.	8

	Textbook 1: Chapters 12, 13,14	
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

PRESCRIBED 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	PSO4
CO1	3	3	-	2	-	-	-	-	-	-	2	3	-	-	-
CO2	3	3	-	2	-	-	-	-	-	-	2	3	-	-	-
CO3	3	3	-	2	-	-	-	-	-	-	2	3	-	-	-
CO4	3	3	-	2	-	-	-	-	-	-	2	3	-	-	-
CO5	3	3	-	2	-	-	-	-	-	-	2	3	-	-	-
AVG	3	3	-	2	-	-	-	-	-	-	2	3	-	-	-

Teaching-Learning Process Pedagogy (General Instructions):

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

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the 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 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)

DIGITAL DESIGN AND MICROCONTROLLERS

Course Code	B24CS32	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. Understand the fundamentals of ARM-based systems, ARM programming modules along with registers, CPSR and Flags.
4. Demonstrate knowledge of instruction formats used in typical microcontroller architectures.
5. Understand the Exceptions and Interrupt handling mechanism in Microcontrollers

PREREQUISITES

- Basic Electronics, Digital Electronics.

MODULE #	TOPICS	Hours
1	**Simplification of Boolean Expressions:** Boolean Laws and Theorem, Sum of Product Methods, Truth Table to Karnaugh Maps, Pairs Quads & Octets, Karnaugh Simplification, Don't Care Condition Maps, Product of Sums Method, Product of Sums Simplification. **Textbook 1: 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8**	8
2	**Combinational Circuits:** Binary Adder-Subtractor, Magnitude Comparator, Decoders, Encoders, Multiplexers, Demultiplexers. **Sequential Circuits:** Sequential Circuits, Latches, Flip Flops, Analysis of Clocked Sequential Circuits. **Textbook 2: 4.5, 4.8,4.9,4.10,4.11,5.2,5.3,5.4,5.5**	9
3	**ARM Embedded Systems:** Introduction, The RISC Design Philosophy, The ARM design philosophy, Embedded system hardware. **ARM Processor Fundamentals:** ARM core dataflow model, Registers, Current program status register, Pipeline. **Textbook 3: Chapter 1:1.1-1.3, Chapter 2: 2.1-2.3**	8
4	**Introduction to the ARM Instruction set:** Introduction, Data processing instructions, Branch Instruction, Load - Store instruction, Software interrupt instructions, Program status register instructions, Loading constants. **Textbook 3: Chapter 3: 3.1-3.6**	9
5	**Exceptions and Interrupt Handling:** Exception Handling, Interrupts, Interrupt Handling Schemes. **Efficient C Programming:** Overview of C Compilers and optimization, Basic C Data types, C looping structures. **Textbook 3: Chapter 5: 5.1-5.3, Chapter: 9.**	8

PRACTICAL COMPONENTS OF IPCC

Conduct the following experiments by writing Assembly Language Program (ALP)

1. Design Verilog HDL code to implement Binary Half and Full Adder and Half and Full Subtractor.
2. Design Verilog program to implement different types of multiplexers like 2:1, 4:1 and 8:1.
3. Develop and simulate ARM ALP for Data Transfer, Arithmetic and Logical operations (Demonstrate with the help of a suitable program).
4. Develop an ALP to multiply two 16-bit binary numbers.
5. Develop an ALP to find the sum of first 10 integer numbers.
6. Develop an ALP to find the largest/smallest number in an array of 32 numbers.
7. Develop an ALP to count the number of ones and zeros in two consecutive memory locations.
8. Develop an ALP to demonstrate enabling and disabling of Interrupts in ARM.
9. Simulate a program in C for ARM microcontroller using KEIL to sort the numbers in ascending/descending order using bubble sort.
10. Simulate a program in C for ARM microcontroller to find factorial of a number.

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	**Digital Principles and Applications**	Donald P Leach, Albert Paul Malvino, Goutam Saha	8th	Tata McGraw Hill	2017
2	**Digital Design**	M. Morris Mano, Michael D Ciletti	6th	Pearson	2018
3	**ARM System Developer's Guide**	Andrew N Sloss, Dominic Symes and Chris Wright,	1st	Morgan Kaufman Publishers	2017

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	**Illustrative Approach to Logic Design**	R D Sudhakar Samuel	1st	Sanguine-Pearson	2010
2	**Digital Logic Applications and Design**	John M Yarbrough	India Edition	Thomson	2007
3	**ARM Assembly Language: Fundamentals and Techniques**	William Hohl, Christopher Hinds	2nd Edition	CRC Press	2014

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

Sl. #	Type of E-Resource	URL
1	**NPTEL**	https://archive.nptel.ac.in/courses/106/105/106105193/
2	**NPTEL**	https://onlinecourses.nptel.ac.in/noc22_ee110/preview

COURSE OUTCOMES

CO #	Course Outcome Statement
CO1	Understand the foundational concepts of Boolean simplification, digital circuits, ARM architecture, instruction sets, and C Compilers.
CO2	Interpret how logic circuits, processor features, instruction operations, interrupts, and programming constructs contribute to embedded systems.
CO3	Apply basic Boolean laws, digital design principles, and ARM instruction formats to solve simple computational and logic problems.

CO4	Apply simplified logic expressions, circuit components, and instruction sets to demonstrate basic embedded system concepts..
CO5	Integrate fundamental knowledge of digital logic, ARM core operations, interrupts, and C programming to analyze simple system behaviors.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	–	–	–	–	–	–	–	2	–	2	–	–	–	–
CO2	3	2		–	-	–	–	–	3	–	2	–	–	–	–
CO3	3	3	2	–	1	–	–	1	1	–	2	2	–	–	–
CO4	3	3	3	–	1	–	–	1	1	–	2	2	–	–	–
CO5	3	1	1	–	1	–	–	1	2	–	2	2	–	–	–
AVG	**3**	**2.25**	**2**	–	**1**	–	–	**1**	**1.8**	–	**2**	**2**	–	–	–

Teaching-Learning Process

Pedagogy (General Instructions):

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

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Arrange visits to nearby PSUs such as BHEL, BEL, ISRO, etc., and small-scale hardware Industries to give brief information about the electronics manufacturing industry.
3. Show Video/animation films to explain the functioning of various analogue and digital circuits.
4. Encourage collaborative (Group) Learning in the class.
5. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
6. 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.
7. Topics will be introduced in multiple representations.
8. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
9. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding

COMPUTER ORGANIZATION AND OPERATING SYSTEMS

Course Code	B24CS33	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 realize the basic structure of computer system and machine instructions. 2. To illustrate the working of I/O operations and processing unit. 3. To Demonstrate the need for OS and different types of OS. 4. To discuss suitable techniques for management of different resources. 5. To understand concepts related to memory management & File System.

PREREQUISITES
• Basics of Computer System.

MODULE#	TOPICS	Hours
1	**Basic Structure of Computers:** Basic Operational Concepts, Bus Structures, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. **Machine Instructions and Programs:** Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes. **Textbook 1: 1.3, 1.4, 1.6, 2.2, 2.3, 2.4, 2.5**	7
2	**Accessing I/O Devices, Interrupts** – Interrupt Hardware, Direct Memory Access, Buses, Interface Circuits, Cache Memories-Mapping Functions. **Basic Processing Unit**: Fundamental Concepts, Execution of a Complete Instruction. Pipelining: Basic concepts. **Textbook 1: 4.2.1, 4.4, 4.5, 4.6, 5.5.1, 7.1, 7.2, 8.1**	7
3	**Introduction to Operating Systems, System structures**: What Operating Systems Do; System Calls; Operating-System Structure. **Process Management**: Operations on processes; Interprocess Communication; IPC in Shared-Memory Systems; IPC in Message-Passing; Multithreading Models; **CPU Scheduling:** Basic Concepts; Scheduling Criteria; Scheduling Algorithms. **Textbook 2: 1.1, 2.3, 2.8, 3.3, 3.4, 3.5, 3.6, 4.3, 5.1, 5.2, 5.3**	10
4	**Process Synchronization**: The Critical-Section Problem; Peterson's solution; Mutex Locks; Semaphores; Classic Problems of Synchronization (Reader-Writer Problem). **Deadlocks**: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection; Recovery from Deadlock. **Textbook 2: Chapter -6 (6.2, 6.3, 6.5, 6.6), 7 (7.1.2), 8.1, 8.3 - 8.8**	9
5	**Memory Management:** Main Memory: Background; Contiguous memory allocation; Paging; Structure of page table. Virtual Memory: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing. **File-System:** Directory Structure, File-System Mounting. **Textbook 2: Chapter -9 (9.1-9.4), 10 (10.1-10.6), 13.3, 15.2**	9

PRACTICAL COMPONENT OF IPCC

Sl. #	PROGRAMS
1	Develop a C program to Rotate bits of a given number 'n' by 'd' number of bits.
2	Develop a C program to implement the Process system calls (fork (), exec(), wait(), create process, terminate process).
3	Develop a C program to simulate the following CPU scheduling algorithms to find turnaround time and waiting time. a) SJF b) Round Robin (Experiment with different quantum sizes for RR algorithm)
4	Develop a C program to simulate producer-consumer problem using semaphores.
5	Develop a C program which demonstrates inter process communication between a reader process and a writer process. Use mkfifo, open, read, write and close APIs in your program.
6	Develop a C program to simulate Bankers Algorithm for Deadlock Avoidance.
7	Develop a C program to simulate the following contiguous memory allocation Techniques. a) Worst fit b) Best fit c) First fit.
8	Develop a C program to simulate page replacement algorithms. (Any one) a) LRU b) Optimal

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	**Computer Organization**	Carl Hamacher, ZvonkoVranesic, SafwatZaky	6th	Tata McGraw Hill	2022/2023
2	**Operating System Principles**	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne,	10th	Wiley-India	2021

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	**Computer Organization & Architecture**	William Stallings	11	Pearson	2020
2	**Computer System Architecture**	M. Moris Mano	3	Pearson/PHI	2023
3	**Understanding Operating System**	Ann McHoes, Ida M Fylnn	8	Cengage Learning	2020
4	**Operating Systems: A Concept Based Approach**	D.M Dhamdhere	3	Ed, McGraw- Hill	2012

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

Sl. #	Type of E-Resource	URL
1	**Youtube**	https://youtu.be/mXw9ruZaxzQ
2	**GeeksforGeeks online Platform**	https://www.geeksforgeeks.org/operating-systems/
3	**Swayam NPTEL**	https://onlinecourses.nptel.ac.in/noc20_cs04/preview
4	**Coursera**	https://www.coursera.org/courses?query=operating%20system
5	**Cisco Networking Academy**	https://www.netacad.com/courses/operating-systems- basics?courseLang=en-US

COURSE OUTCOMES

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

CO #	Course Outcome Statement
CO1	Explain computer architecture and processor performance, and illustrate machine instructions and addressing modes for efficient system operation.
CO2	Explain I/O device management, interrupt handling, and basic processing unit concepts including pipelining to enhance system performance.
CO3	Describe operating system concepts and apply process scheduling algorithms to manage system resources and optimize CPU utilization.
CO4	Demonstrate the use of process synchronization mechanisms and deadlock handling techniques to ensure correct and efficient execution of concurrent processes.
CO5	Illustrate memory and virtual memory management techniques with the use of appropriate strategies to improve system performance and resource utilization.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	2	-	-	-
CO3	3	2	2	-	2	-	-	-	-	-	-	2	1	-	-
CO4	3	2	2	-	2	-	-	-	-	-	-	2	1	-	-
CO5	3	2	1	-	2	-	-	-	-	-	-	2	1	-	-
AVG	3	2	1.67	-	2	-	-	-	-	-	-	2	1	-	-

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	PSO4
CO1	3	3	2	-	-	-	-	-	1	1	2	3	3	-	-
CO2	3	3	2	-	-	-	-	-	1	1	2	3	3	-	-
CO3	3	3	2	-	-	-	-	-	1	1	2	3	3	-	-
CO4	3	3	2	-	-	-	-	-	1	1	2	3	3	-	-
CO5	3	3	2	-	-	-	-	-	1	1	2	3	3	-	-
AVG	3	3	2	-	-	-	-	-	1	1	2	3	3	-	-

Teaching-Learning Process Pedagogy (General Instructions):

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

1. Chalk and Talk with Black Board .
2. ICT based Teaching .
3. Demonstration based Teaching.

OBJECT ORIENTED PROGRAMMING USING JAVA

Course Code	B24IS351	Total contact hours / week	4	CIE Marks	50
Course Category	ESC	Total SAAE hours / semester	48	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 programming 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,	5

	Synchronization, Interthread Communication, Suspending, Resuming, and Stopping Threads, Obtaining a Thread's State. **Text Book 1: Chapter 11**	

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 BOOK

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	Java: The Complete Reference	Herbert Schildt	12th	McGraw-Hill,	2021

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	**Programming with Java**	E Balagurusamy	6th	McGraw Hill Education,	2019
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**	Java Tutorial :https://www.geeksforgeeks.org/java/

2	**Online Course Module (OpenCourseWare – OCW)**	Introduction To Programming In Java (by Evan Jones, AdamMarcus and Eugene Wu): https://ocw.mit.edu/courses/6-092-introduction-to-programming-in-java-january-iap-2010/
3	**Web-Based Interactive Tutorial**	Java 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	PSO4
CO1	3	3	2	1	2	-	-	1	1	-	2	3	1	-	-
CO2	3	3	3	1	2	-	-	2	2	1	2	3	2	-	-
CO3	3	3	3	2	2	-	-	2	2	1	2	3	3	-	-
CO4	3	2	3	2	3	-	1	1	1	1	2	3	3	-	-
CO5	3	2	3	2	3	-	-	2	2	1	2	3	2	-	-
AVG	3	2.6	2.8	1.6	2.4	-	1	1.6	1.6	1	2	3	2.2	-	-

Teaching-Learning Process Pedagogy (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.

NEUROMORPHIC COMPUTING

Course Code	B24CS352	**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 introduce the fundamental principles and operating physics.
2. To develop the students' ability to design neuromorphic hardware architectures.
3. To enable understanding of neuromorphic algorithms.
4. To expose students to real-world applications.

PRE-REQUISITES

Digital Logic and Circuits

- Familiarity with logic gates, combinational and sequential circuits.
- Knowledge of memory architecture (RAM, ROM).
- Basic understanding of CPU, memory hierarchy, and data processing.
- Basic concepts of neural networks, supervised/unsupervised learning.

MODULE #	TOPICS	Hours
1	**Introduction to AI and Its Environmental Impact**: Overview of AI technologies, the growing energy demands of AI, The importance of sustainable AI.	8
2	**Fundamentals of Neuromorphic Computing:** Definition and history of neuromorphic computing, Key differences from traditional AI architectures, Introduction to Spiking Neural Networks (SNNs).	9
3	**Spiking Neural Networks (SNNs) Theory**: Difference between SNNs and artificial neural networks (ANNs), Types of neuron models (e.g., Hodgkin-Huxley, Leaky Integrate-and-Fire), Learning mechanisms in SNNs (STDP, Hebbian learning).	9
4	Neuromorphic Hardware Architectures: Overview of neuromorphic chips (Intel Loihi, IBM TrueNorth, SpiNNaker), Comparison with GPUs and TPUs, Energy efficiency and sustainability in neuromorphic hardware.	8
5	**Edge AI and Neuromorphic Computing:** What is edge AI? The role of neuromorphic AI in real-time processing, Applications in IoT, robotics, and mobile AI.	8

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	**Neuromorphic Computing Principles and Organization**	Abderazek Ben Abdallah, Khanh N. Dang,	1st	Springer	2022
2	**Neuromorphic Engineering**	Giacomo Indiveri	1st	Springer	2004

REFERENCE BOOK

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	**Neuromorphic Computing for Computer Scientists**	Dynex Developers	1st	Independently Published	2024

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

Sl. #	Type of E-Resource	URL
1	**Video Lectures**	https://youtu.be/2XX8KLMyQN4?si=Cmm-Dos1f1XhVW-q
2	**Video Lectures**	https://youtu.be/Wc_0gLcnExo
3	**Video Lectures**	https://youtu.be/6Dcs6fQglRA
4	**Video Lectures**	https://youtu.be/Wc_0gLcnExo

COURSE OUTCOMES

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

CO #	Course Outcome Statement
CO1	Explain the operating principles of various Non-Volatile Memory (NVM) devices.
CO2	Apply the principles of neuromorphic circuit design to develop and analyze crossbar arrays and memory-in-compute architectures.
CO3	Implement neuromorphic algorithms, including Spiking Neural Networks (SNNs) and oscillator-based models.
CO4	Compare and apply neuromorphic computing paradigms with conventional computing approaches in edge and AI applications.
CO5	Demonstrate the application of neuromorphic technologies in domains.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	2	1	-	-
CO2	3	2	3	2	2	-	-	-	-	-	-	2	1	-	-
CO3	3	3	3	2	2	-	-	-	-	-	-	3	1	-	-
CO4	3	2	2	3	2	2	-	-	-	-	-	3	2	-	-
CO5	2	2	3	3	2	2	-	-	-	-	-	3	1	-	-
AVG	3	2	3	2	2	2	-	-	-	-	-	2.6	1.2	-	-

Teaching-Learning Process Pedagogy (General Instructions):

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

1. Deliver core concepts through interactive lectures using slides, whiteboard, and models.
2. Emphasize device physics (e.g., RRAM, PCM, spintronics), neuromorphic architectures, and bio-inspired algorithms.
3. Use simulation tools (e.g., NEST, Brian2, snn Torch, Intel Loihi SDK) to demonstrate SNN behavior and circuit-level emulation.
4. Supplement lectures with curated video lectures and research talks (YouTube, Springer, IEEE).
5. Form student groups to debate traditional vs neuromorphic computing approaches.
6. Conduct peer teaching sessions for algorithms or device operation.

INTRODUCTION TO DIGITAL TWINS

Course Code	B24CS353	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 introduce the concept of Digital Twin 2. To understand enabling technologies 3. To explore the architecture and lifecycle 4. To analyze real-world applications 5. To identify opportunities, challenges, and limitations .

PREREQUISITES
• Basic Knowledge of IoT (Internet of Things) • Working knowledge of at least one programming language

MODULE #	TOPICS	Hours
1	What is a Digital Twin? Introduction to technologies, applications, opportunities, and challenges influencing digital twin	9
2	Manufacturing and Production Introduction to the impact of the digital twin, cyber-physical systems, process automation and optimization, predictive maintenance and anomaly detection on the manufacturing ecosystem and its application	9
3	Supply Chain and Warehousing Introduction to digital twin-based operation and management, and simulation-based smart supply chain ecosystem, including quality assurance in the food and beverage sector, warehousing with machine learning and path planning, and warehousing with machine learning and pallet loading	8
4	Healthcare Introduction to healthcare and bioengineering applications of digital twins. The bioprocess and its potential, industrial-scale bioreactors and biomanufacturing,	8
5	Hospital administration in industry 4.0, epidermic control prediction, and cloud computing for radiotherapy systems are covered.	8

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	**Digital Twin Technologies and Smart Cities**	Maryam Farsi, Alireza Daneshkhah, Hamid Jahankhani	1st	Springer	2020
2	**Digital Twin Driven Smart Design**	Fei Tao, Ang , Liu, Tianliang Hu, A.Y.C. Nee	1st	Academic Press	2020

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	**Digital Twin Development and Deployment on the Cloud**	Nassim Khaled, Bibin Pattel, Affan Siddiqui	1st	Elsevier	2020
2	**Digital Twin Technologies: Concepts and Applications in the Industry**	Ian McCarthy	1st	CRC Press	2020

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

Sl. #	Type of E-Resource	URL
1	**Video**	https://youtu.be/iVS-uSjpOQ
2	**Video**	https://youtu.be/taSbwarjGGw

COURSE OUTCOMES

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

CO #	Course Outcome Statement
CO1	Explain the foundational principles of digital twin technology and its evolution.
CO2	Demonstrate the ability to model a digital twin system by applying its architectural components.
CO3	Apply IoT, cloud, and AI technologies to design an integrated digital twin framework.
CO4	Analyze and simulate the use of digital twins in specific industrial domains to derive operational benefits.
CO5	**Develop** practical strategies to address challenges in real-time implementation of digital twin solutions.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	2	-	-	-	-	-	2	3	-	-	-
CO2	3	3	2	2	3	-	-	-	-	-	2	3	-	-	-
CO3	3	2	2	2	3	-	-	-	-	-	3	3	-	2	-
CO4	3	3	3	2	3	-	-	-	-	-	2	3	1	3	-
CO5	3	3	3	3	3	-	-	-	-	-	2	3		2	-
AVG	3.0	2.6	2.2	2.25	2.8	-	-	-	-	-	2.4	3.0	0.2	2.7	-

Teaching-Learning Process

Pedagogy (General Instructions):

1. **Begin with foundational concepts** – Introduce students to Digital Twin principles, evolution, and their significance in Industry 4.0 and smart systems.
2. **Use real-world case studies** – Demonstrate industrial applications in manufacturing, healthcare, automotive, and smart cities to show practical relevance.
3. **Incorporate multimedia resources** – Utilize videos, simulations, and virtual labs to illustrate digital twin architectures, components, and data flows.
4. **Integrate interdisciplinary tools** – Emphasize integration with IoT, cloud computing, AI/ML, and data analytics tools for better conceptual understanding.
5. **Encourage project-based learning** – Assign mini-projects or problem-solving tasks involving modeling and virtual representation of physical systems.

PRINCIPLES OF PROGRAMMING LANGUAGES

Course Code	B24CS354	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 and describe syntax and semantics of programming languages. 2. To understand data, data types, and basic statements. 3. To understand call-return architecture and ways of implementing them. 4. To understand object-orientation, concurrency, and event handling in programming languages. 5. To develop programs in non-procedural programming paradigms.

PREREQUISITES
• Proficiency in at least one programming language (e.g., C, Java, Python).

MODULE #	TOPICS	Hours
1	**SYNTAX AND SEMANTICS** Evolution of programming languages, describing syntax, context-free grammars, attribute grammars, describing semantics, lexical analysis, parsing, recursive-descent, bottom up parsing. **Textbook 1: Chapter 3, Chapter 4.**	5
2	**DATA, DATA TYPES, AND BASIC STATEMENTS** Names, variables, binding, type checking, scope, scope rules, lifetime and garbage collection, primitive data types, strings, array types, associative arrays, record types, union types, pointers and references, Arithmetic expressions, overloaded operators, type conversions, relational and Boolean expressions, assignment statements, mixed mode assignments, control structures, selection, iterations, branching, guarded statement. **Textbook 1: Chapter 5, Chapter 6, Chapter 7.**	6
3	**SUBPROGRAMS AND IMPLEMENTATIONS** Subprograms, design issues, local referencing, parameter passing, overloaded methods, generic methods, design issues for functions, semantics of call and return, implementing simple Subprograms, stack and dynamic local variables, nested subprograms, blocks, dynamic scoping. **Textbook 1: Chapter 9, Chapter 10.**	6
4	**OBJECT-ORIENTATION, CONCURRENCY, AND EVENT HANDLING** Object-orientation, design issues for OOP languages, implementation of object, oriented constructs, concurrency, semaphores, monitors, message passing, threads, statement level concurrency, exception handling, event handling. **Textbook 1: Chapter 12, Chapter 13, Chapter 14.**	5
5	**FUNCTIONAL AND LOGIC PROGRAMMING LANGUAGES** Introduction to lambda calculus, fundamentals of functional programming languages, Programming with Scheme, Programming with ML, Introduction to logic and logic programming, Programming with Prolog, multi-paradigm languages. **Textbook 3: Chapter 15, Chapter: 16.**	6

PRACTICAL COMPONENTS OF IPCC
Conduct the following experiments using programming language: 1. Develop Program to demonstrate Operational Semantics of Assignment and Arithmetic Operations. 2. Develop a program to Implement a Lexical Analyzer Using Regular Expressions. 3. Develop a program to Illustrate Operations on Primitive Data Types in a Language (e.g., C/Python). 4. Develop a program to Implement Basic String Manipulation Functions (Concatenate, Reverse, etc.) 5. Develop a program to Demonstrate One-Dimensional and Multi-Dimensional Array Operations 6. Develop a program to Simulate Function Call and Return with Parameter Stack Tracing. 7. Develop a program to Implement and Call Functions Defined within Other Functions (Nested). 8. Develop a program to Implement Synchronization Using Semaphores for Critical Section Handling 9. Develop a program to Evaluate Simple Lambda Calculus Expressions using Alpha and Beta Reduction. 10. Develop a program to Define Facts, Rules, and Queries to Solve Logical Problems.

PRESCRIBED TEXTBOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	**Concepts of Programming Languages**	Robert W. Sebesta	Global Edition	Pearson	2022
2	**Programming Language Pragmatics**	Michael L. Scott	4th	Elsevier	2018
3	**The Scheme programming language**	R. Kent Dybvig	4th	Prentice Hall	2011

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	**Concepts in Programming Languages**	John C. Mitchell	1st	Cambridge University Press	2002
2	**Programming Languages: Design and Implementation**	Pratt & Zelkowitz	4th	Springer	2000

COURSE OUTCOMES

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

CO #	Course Outcome Statement
CO1	Describe syntax and semantics of programming languages.
CO2	Explain data, data types, and basic statements of programming languages.
CO3	Design and implement subprogram constructs.
CO4	Apply object-oriented, concurrency, and event handling programming constructs and Develop programs in Scheme, ML, and Prolog.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	2	-	-	-	-	-	-	3	-	-	-
CO2	3	3	3	2	2	-	-	-	-	-	-	3	2	-	-
CO3	3	3	3	2	3	-	-	-	-	-	-	3	3	-	-
CO4	3	3	3	2	3	-	-	-	-	-	-	3	3	-	-
CO5	3	3	3	2	3	-	-	-	-	-	-	3	3	-	-
AVG	3	3	2.8	2	2.6	-	-	-	-	-	-	3	2.2	-	-

Teaching-Learning Process Pedagogy (General Instructions):

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

1. Interactive Lectures using flowcharts and evolution timelines.
2. Use of Language Grammar Visualizers (e.g., BNF Playground, ANTLR tools).
3. Hands-On Lab Activities:
4. Write a CFG for simple expressions.
5. Implement lexical analyzers using tools like Lex or Flex.
6. Mini-project: Implement a basic recursive-descent parser.
7. Assessment: Weekly quizzes and group activity on parsing techniques.
8. Analogy-Based Teaching: Compare subprogram calls to stack operations.
9. Demonstrations: Run-time call stack visuals using debuggers (e.g., GDB).
10. Topics will be introduced in multiple representations.
11. Seminar/Presentation: Students present features of multi-paradigm languages (e.g., Python, Scala).
12. Assessment: Concept quizzes + problem solving in functional/logic style.

SOCIAL CONNECT AND RESPONSIBILITY

Course Code	B24SCK36	Total contact hours / week	2	CIE Marks	100
Course Category	UHV	Total SAAE hours / semester	0	SEE Marks	-
L:T:P:S	0:0:2:0	Total Notional Learning Hours	30	Total Marks	100
Total credits	0			Exam Duration	-

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

PREREQUISITES
NIL

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

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
NOT APPLICABLE					

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
NOT APPLICABLE					

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

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

COURSE OUTCOMES

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

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

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	-	-	3	3	3	3	3	3	1	-	-	-
CO2	-	-	-	-	-	3	3	3	3	3	3	1	-	-	-
CO3	-	-	-	-	-	3	3	3	3	3	3	1	-	-	-
CO4	-	-	-	-	-	3	3	3	3	3	3	2	-	-	-
CO5	-	-	-	-	-	3	3	3	3	3	3	2	-	-	-
CO6	-	-	-	-	-	3	3	3	3	3	3	2	-	-	-
AVG	-	-	-	-	-	3	3	3	3	3	3	1.5	-	-	-

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 1

Topic : Plantation and adoption of a tree

Content : Plantation of a tree that will be adopted for four years by a group of B.E. students. They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, and its appearance in folklore and literature.

Group Size : 03 – 05

Location : Farmers Land or Road side or Community area or institution's campus, any one location to be selected.

Magnitude : One Students must monitor it for three years

Activity : 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.

Reporting: Report shall be handwritten or blog with paintings, sketches, poster, video and/or photograph with Geo tag.

Module 2

Topic : Heritage walk and crafts corner

Content : 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.

Group Size : 03 – 05

Location : Preferably Within the city where institution is located or home town of the student group

Magnitude : One or two; One can be a structure or a heritage building the other can be heritage custom or practice .

Activity : 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.

Reporting: Report shall be handwritten or blog with paintings, sketches, poster, video and/or photograph with Geo tag.

Module 3

Topic : Waste management

Content : Wet waste management in neighbouring villages, and implementation in the campus.

Group Size : 03 – 05 More than one group can be assigned one task based on magnitude of task.

Location : Preferably in the nearby villages and within the campus.
Magnitude : One.
Activity : Report on importance and benefits of Waste management. Report on segregation, collection, transportation and disposal.
Suggestion for composting. Visit nearby village/location to sensitize farmers and public about waste management and also document current practises.
Reporting: Report shall be handwritten or blog with paintings, sketches, poster, video and/or photograph with Geo tag.

Module 4
Topic : Organic farming
Content : Usefulness of organic farming in neighbouring villages, and implementation in the campus.
Group Size : 03 – 05
Location : Visit to farming lands where organic farming is going on Campus Garden Roof top Garden or Vertical Garden or hydroponics if land is scarce.
Magnitude : One.
Activity : Collect data on organic farming in the vicinity. Like types of crop, methodology etc. Suggestion for implementation at selected locations.
Reporting: Report shall be handwritten or blog with paintings, sketches, poster, video and/or photograph with Geo tag.

Module 5
Topic : Food Walk
Content : City's culinary practices, food lore, and indigenous materials of the region used in cooking.
Group Size : 03 – 05
Location : Within the city where institution is located Food culture of student's resident region
Magnitude : One.
Activity : Survey local food centres and identify the speciality Identify and study the food ingredients Report on the regional foods Report on Medicinal values of the local food grains, and plants.
Reporting: Report shall be handwritten or blog with paintings, sketches, poster, video and/or photograph with Geo tag.

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%
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**

- 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.

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

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

DATA ANALYTICS WITH EXCEL

Course Code	B24CS371	Total contact hours / week	2	CIE Marks	50
Course Category	AEC	Total SAAE hours / semester	0	SEE Marks	50
L:T:P:S	0:0:2:0	Total Notional Learning Hours	30	Total Marks	100
Total credits	1			Exam Duration	3 Hrs

COURSE LEARNING OBJECTIVES

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

PREREQUISITES

- Analytical Thinking
- Mathematical Reasoning

Sl. #	Programs
1	Perform the following basic EXCEL functions. a) Mathematical operations with functions (SUM, COUNT, MAXIMUM, ROUND) and without functions. b) Logical functions like IF, AND, OR, NOT. c) Miscellaneous functions like RAND, ISBLANK, COUNTIF). d) Additional Excel tricks (paste special -leaving blank fields, transpose rows & columns and paste).
2	Create cells with different Data Formats and apply all the conditional formatting options.
3	Consider Employee Data which consists of the fields- Employee id, Department Name, Employee Name, Date of Joining. Perform advanced data sorting including a) Filtering options b) Date filtering c) Filtering into different sheet d) Custom sorting
4	Consider Students data with the fields Name, Test1, Test2, Test3 and Total. a) Highlight the students who have scored more than 80 in Test2 b) Display Students who scored below below average marks in Test1 c) Show Data Bars for Test2 d) Insert different icons for i) total >200 ii) total between 180 & 200 iii) total<180 e) For students who missed 2 or more test than assign a D and show alert icon
5	Consider Personal Data with the following fields – First Name, Last Name, DOB, State Zip, Description, and Region. Apply the following text formulas: a) Merge First Name and Last Name into Full Name b) Use SEARCH and LEFT/MID to extract specific substrings c) Use RIGHT and LEN to extract Last Name from Full Name d) Format date using the DATE function e) Use MID and - to extract patterns (e.g., from 'California/west:276', extract 'west') f) Demonstrate Absolute, Relative, and Mixed Cell Referencing

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

PRESCRIBED MATERIAL

Sl. #	Type of E-Resource	URL
1	**Online course**	TechA Microsoft Excel for Data Analysts Certification https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01383749751722803259 0_shared/overview

COURSE OUTCOMES:

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

CO #	Course Outcome Statement
CO1	Demonstrate the use of basic Excel functions including mathematical, logical, and text-based operations.
CO2	Apply formatting techniques and data visualization tools (charts and graphs) to interpret and present data effectively.
CO3	Perform data sorting, filtering, and apply conditional formatting to extract meaningful insights from structured datasets.

CO4	Utilize advanced Excel functions and tools like VLOOKUP, HLOOKUP, INDEX, MATCH, Pivot Tables, Power Query, and Macros for efficient data handling and analysis.
CO5	Conduct What-If analysis and financial modeling using PMT, Scenario Manager, and other relevant functions to support business decision-making.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	2	2	-	-	-	-	-	-	1	1	-	-
CO2	2	2	2	3	2	-	-	-	-	-	-	1	1	-	-
CO3	2	2	3	3	2	-	-	-	-	-	-	1	1	-	-
CO4	2	2	3	3	2	-	-	-	-	-	-	1	1	-	-
CO5	2	2	3	3	2	-	-	-	-	-	-	1	1	-	-
AVG	2	2	2.6	2.8	2	-	-	-	-	-	-	1	1	-	-

Teaching-Learning Process Pedagogy (General Instructions)

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

PROBLEM SOLVING SKILLS

Course Code	B24CS372	Total contact hours / week	1	CIE Marks	50
Course Category	AEC /SEC	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	3 Hrs

COURSE LEARNING OBJECTIVES
1. To introduce computational thinking and problem-solving methodologies. 2. To develop logical reasoning and analytical skills.

PREREQUISITES
• NIL

Module #	Topics	Hours
1	**Fundamentals of Problem Solving:** Introduction to Problem Solving and Programming, Steps in Problem Solving, Problem solving heuristics - A case study.	4
2	**Computational Thinking and Logic Building:** Definition of Computational thinking and Logic Building, Key points of Computational Thinking, Modeling Human Thinking, Decomposition, Pattern Recognition, Abstraction and Algorithms. - A case study.	4
3	**Critical Thinking and Creative Thinking:** Definition, characteristics of Critical Thinking, Strategies of Critical Thinking, Definition, Creative Thinking, Approaches in Creative Thinking, strategies in Creative Thinking – A case study.	3
4	**Design Thinking :** Definition, Design Thinking Skills Principles of Design Thinking, Basis for Design Thinking, The 5 stages of Design thinking process, Ideation tools – A case study.	3

PRESCRIBED TEXTBOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	**How to Solve It by Computer**	R.G. Dromey,	1st	Pearson Education.	1982
2	**Design Thinking: Understand – Improve– Apply**	Hasso Plattner, Christoph Meinel, Larry Leifer	1st	Springer	2011

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	**Computational Thinking: A beginner's guide to problem-solving and programming**	Karl Beecher	Illustrated	BCS, The Chartered Institute for IT	2017
2	**Change by Design**	Tim Brown	Revised, Updated	Harper Business	2019

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

Sl. #	Type of E-Resource	URL
1	**NPTEL**	**https://nptel.ac.in/courses/106105171**
2	**NPTEL**	**https://onlinecourses.nptel.ac.in/noc23-cs31/preview**
3	**Online PDF content**	https://dschool.stanford.edu/tools/design-thinking-bootleg
4	**Video Lectures**	https://nptel.ac.in/courses/106/105/106105171/ MOOC courses can be adopted for more clarity in understanding the topics and verities of problem solving methods.
5	**edX**	https://cs50.harvard.edu/x/
6	**Coursera**	https://www.coursera.org/learn/logical-critical-thinking

COURSE OUTCOMES

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

CO #	Course Outcome Statement
CO1	Apply problem-solving strategies and computational thinking techniques to solve problems.
CO2	Demonstrate critical thinking, creative thinking, and logical reasoning to analyze and solve real-world problems.
CO3	Utilize design thinking principles to design user-centric solutions.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	-	-	-	-	-	1	1	3	-	-	-	-
CO2	3	3	3	-	-	-	-	-	1	1	3	-	-	-	-
CO3	3	3	3	-	-	-	-	-	1	1	3	-	-	-	-
AVG	3	3	3	-	-	-	-	-	1	1	3	-	-	-	-

Teaching-Learning Process Pedagogy (General Instructions):

1. Assignments and Practice
2. Case Studies & Application
3. Assessment (Formative & Summative)

WEARABLE SYSTEMS FOR HEALTHCARE

Course Code	B24CS373	Total contact hours / week	1	CIE Marks	50
Course Category	AEC	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 Hr

COURSE LEARNING OBJECTIVES

1. To impart the importance of smart sensors, sensor interface standards for wearable device applications.
2. Identify the need for development of wearable devices and its implications on various sectors.
3. Comprehend the design and development of various wearable bio electrode and physiological activity monitoring devices for use in healthcare applications.

PREREQUISITES

- Basic programming skills are necessary for developing and managing wearable systems.
- Familiarity with wireless communication protocols and networking concepts is important.
- Understanding the principles of Basic circuit theory and electronic components and Operation of various sensors.

MODULE #	TOPICS	Hours
1	**Sensors for wearable systems:** Need for wearable systems, Sensors for wearable systems-Inertia movement sensors, Respiration activity sensors, Inductive plethysmography, Impedance plethysmography pneumography	3
2	**Signal Processing and Energy Harvesting:** Wearability issues -physical shape and placement of sensor, technical challenges – sensor design, signal acquisition, lightweight signal processing, Rejection of irrelevant information, Solar cell	3
3	**Scope of Wearable Devices**: Role of Wearables, Attributes of Wearables, The Meta Wearables – Textiles and clothing, Social Aspects: Interpretation of Aesthetics, Adoption of Innovation, On-Body Interaction; Roadmap.	3
4	**Wireless Health Systems:** Need for wireless monitoring, Definition of Body area network, BAN and Healthcare	3
5	**Wearable Devices for Healthcare:** Wearable ECG devices, Wearable EEG devices, Wearable EMG devices: EMG/ SEMG Signals.	2

PRESCRIBED TEXT BOOKS

TEXT BOOK #	Book Title	Authors	Edition	Publisher	Year
1	**Wearable Sensors: Fundamentals, Implementation and Applications**	Edward Sazonov & Michael R. Neuman	1st	Academic Press	2020
2	**Biomedical Sensors & Measurement**	Laura L. Smith	1st	Springer	2011

REFERENCE BOOKS

REFERENCE BOOK #	Book Title	Authors	Edition	Publisher	Year
1	**Wearable Monitoring Systems.**	Annalisa Bonfiglio, Danilo De Rossi	-	Springer,	2011.
2	**Body Area Networks Safety, Security, and Sustainability.**	Sandeep K.S. Gupta, Tridib Mukherjee, Krishna Kumar Venkatasubramanian	1st	Cambridge University Press	2013.

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

Sl. #	Type of E-Resource	URL
1	**Video Lectures**	https://youtu.be/U-GfPWqcb9M
2	**Video Lectures**	https://youtu.be/3HkYjjmmvTo
3	**Video Lectures**	https://youtu.be/TG5cRvgFEDA

COURSE OUTCOMES

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

CO #	Course Outcome Statement
CO1	Explain the need for wearable systems and differentiate various sensors.
CO2	Illustrate signal processing and energy harvesting methods in wearable devices, while discussing wearability issues.
CO3	Analyze the attributes and scope of wearable devices, including meta-wearables interpret their social aspects.
CO4	Apply knowledge of wireless monitoring to define and describe Body Area Networks (BANs) and evaluate their role in healthcare applications.
CO5	Apply knowledge of wearable healthcare devices to monitor physiological signals for clinical and personal health applications.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	2	-	-	-	-	1	2	1	-	2	-
CO2	3	2	2	-	3	-	1	-	-	1	2	1	-	2	-
CO3	2	3	2	-	2	2	2	-	-	2	2	1	-	2	-
CO4	3	3	2	2	3	2	3	-	-	2	2	1	-	2	-
CO5	3	3	2	2	3	2	1	-	1	2	3	1	-	1	-
AVG	2.8	2.6	2	2	2.6	2	1.75	-	1	1.6	2.2	1	-	1.8	-

Teaching-Learning Process
Pedagogy (General Instructions):

- Use of wearables in instruction: Integrate biofeedback wearable's (e.g., heart rate, EDA, respiration monitors) to gather physiological data during learning activities. This supports personalized feedback and helps monitor engagement or stress
- Use group discussions, hands-on labs, and collaborative projects to involve students actively in exploring wearable sensors and systems
- Implement interactive systems—such as smart watches or apps—for in-class polling, gesture-based responses, or real-time performance notifications to teachers, enhancing engagement and pacing .
- Promote teamwork and peer review to build communication and collaborative skills.
- Provide theoretical lectures online; use in-class time for problem-solving, demonstrations, and debugging.

WEB TECHNOLOGY

Course Code	B24CS374	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. Illustrate the Semantic Structure of HTML and CSS and Compose forms and tables using HTML and CSS.
2. Design Client-Side programs using JavaScript and Server-Side programs using PHP.
3. Examine JavaScript frameworks such as jQuery and Backbone.
4. Design JSON with ReactJS and principles of Devops.

PREREQUISITES

- Fundamental knowledge of HTML, CSS, and JavaScript.

Prg #	Programs
1	Develop the HTML page named as "Myfirstwebpage.html". Add the following tags with relevant content. 1. Set the title of the page as "My First Web Page" 2. Within the body use the following tags: a) Moving text = "Basic HTML Tags" b) Different heading tags (h1 to h6) c) Paragraph d) Horizontal line e) Line Break f) Block Quote g) Pre tag h) Different Logical Style
2	Develop the HTML page named as "Table.html" to display your class time table. a) Provide the title as Time Table with table header and table footer, row-span and col-span etc. b) Provide various colour options to the cells (Highlight the lab hours and elective hours with different colours.) c) Provide colour options for row.
3	Develop an external style sheet named as "style.css" and provide different styles for h2, h3, hr, p, div, span, time, img & a tags. Apply different CSS selectors for tags and demonstrate the significance of each.
4	Develop HTML page named as "registration.html" having variety of HTML input elements with background colors, table for alignment & provide font colors & size using CSS styles.
5	Develop HTML page named as "newpaper.html" having variety of HTML semantic elements with background colors, text-colors & size for figure, table, aside, section, article, header, footer etc.
6	Write the XHTML code using JavaScript Object Notation (JSON) to create the form with the following capabilities a) A text widget to collect the users name b) Four check boxes, one each for the following items i) Four 100 watt light bulbs for Rs. 20=39 ii) Eight 100 watt light bulbs for Rs 40=20 iii) Four 100 watt long life light bulbs for Rs. 30=95 iv) Eight 100 watt long life light bulbs for Rs 70=49 c) A collection of 3 radio buttons that are labeled as follows i) Visa ii) Master Card

	iii) Discover Write a PHP script that computes the total cost of the ordered light bulbs for the above program after adding 13.5% VAT. The program must inform the buyer of exactly what was ordered in table.
7	Create a simple Java web application using Servlet and JDBC HTML File.
8	a) Write a XHTML code to provide a form that collects names and telephone numbers. The phone numbers must be in the format ddd-ddd-dddd. Write a PHP script that checks the submitted telephone number to be sure that it confirms to the required format and then returns a response that indicates whether the number was correct. b) Develop a PHP program (with HTML/CSS) to keep track of the number of visitors visiting the web page and to display this count of visitors, with relevant headings. c) Develop a PHP program (with HTML/CSS) to sort the student records which are stored in the database using selection sort.
9	1) Write the XHTML code using JavaScript Object Notation (JSON) to accept from the user name, phone no, mail-id, stored in database. Retrieve same information from database using a separate PHP script. 2) Develop jQuery script (with HTML/CSS) for: a. Appends the content at the end of the existing paragraph and list. b. Change the state of the element with CSS style using animate() method c. Change the color of any div that is animated.
10	Develop a JavaScript program with Ajax (with HTML/CSS) for: a. Use ajax() method (without Jquery) to add the text content from the text file by sending ajax request. b. Use ajax() method (with Jquery) to add the text content from the text file by sending ajax request. c. Illustrate the use of getJSON() method in jQuery d. Illustrate the use of parseJSON() method to display JSON values.

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	**Fundamentals of Web Development**	Randy Connolly, Ricardo Hoar	1st	Pearson Education India.	2016
2	**DevOps: The Ultimate Beginners Guide to Learn DevOps**	Mark Reed	1st	Publishing Factory LLC	2020

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	**Learning PHP, MySQL & JavaScript with jQuery, CSS and HTML5**	Robin Nixon	4th	O'Reilly Publications,	2015
2	**PHP and MySQL Web Development**	Luke Welling, Laura Thomson	5th	Pearson Education	2016
3	**Professional JavaScript for Web Developers**	Nicholas C Zakas	3rd	Wrox/Wiley India,	2012
4	**JavaScript & jQuery: The Missing Manual**	David Sawyer Mcfarland	1st	O'Reilly/Shroff Publishers	2014
5	**Murach's HTML5 and CSS3**	Zak Ruvalcaba Anne Boehm	3rd	Murachs/Shroff Publishers	2016

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

Sl. #	Type of E-Resource	URL
1	**Fundamentals of WEB Programming**	https://www.youtube.com/watch?v=DR9dr6gxhDM
2	**HTML and XHTML**	http://www.tutorialspoint.com
3	**Java Script and HTML Documents**	http://www.w3schools.com
4	**Dynamic Documents with JavaScript**	https://www.youtube.com/watch?v=A1XlIDDXgwg
5	**CSS**	https://www.youtube.com/watch?v=J35jug1uHzE

COURSE OUTCOMES

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

CO #	Course Outcome Statement
CO1	Explain the syntax and semantics of HTML and CSS and illustrate how they are used to build web pages, tables, and forms.
CO2	Describe the use of Client-Side JavaScript and Server-Side PHP scripts to demonstrate how dynamic content is generated and displayed.
CO3	Discuss the features of a JavaScript-based environment and interpret how it supports scalability in building interactive applications.
CO4	Explain the principles of designing and managing AWS-based DevOps environments.
CO5	Illustrate the role of HTML and CSS syntax and semantics in visually formatting tables, forms, and web page layouts.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	-	1	-	-	-	1	2	1	1	1	2	-
CO2	1	2	2	-	2	-	-	-	1	2	1	1	1	2	-
CO3	2	2	1	-	2	-	-	-	1	1	1	1	1	2	-
CO4	1	2	2	-	1	-	-	-	2	2	1	1	1	2	-
CO5	2	2	2	-	2	-	-	-	2	2	2	1	1	2	-
AVG	1.6	2	1.8	-	1.6	-	-	-	1.4	1.8	1.2	1	1	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. 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 the 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, develops 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. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world- and when that's possible, it helps improve the students' understanding.

DATA STRUCTURES LABORATORY

Course Code	B24CSL38	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 course enables students to get practical experience in design, develop, implement, analyze and evaluation/testing of 1. Dynamic memory management 2. Linear data structures and their applications such as stacks, queues and lists 3. Non-Linear data structures and their applications such as trees and graphs	
Prg.#	**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.

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 stack 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	PSO4
CO1	3	3	3	-	3	-	-	3	-	-	-	3	3	-	-
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	-	-
CO6	3	3	3	-	3	-	-	3	-	-	-	3	3	-	-
AVG	3	3	3	-	3	-	-	3	-	-	-	3	3	-	-

NATIONAL SERVICE SCHEME (NSS) – I

Course Code	B24NSK391	**Total contact hours / week**	2	**CIE Marks**	100
Course Category	NCMC	**Total SAAE hours / semester**	0	**SEE Marks**	-
L:T:P:S	0:0:2:0	**Total Notional Learning Hours**	30	**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.

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
CO 1	Understand the importance of his / her responsibilities towards society.
CO 2	Analyse the environmental and societal problems/issues and will be able to design solutions for the same.
CO 3	Evaluate the existing system and to propose practical solutions for the same for sustainable development.
CO 4	Implement government or self-driven projects effectively in the field.
CO 5	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	PSO4
CO1	-	-	3	-	-	3	3	-	-	-	3	1	3	-	-
CO2	-	-	3	-	-	3	3	-	-	-	3	2	3	-	-
CO3	-	-	3	-	-	3	3	-	-	-	3	3	2	-	-
CO4	-	-	3	-	-	3	3	-	-	-	3	2	3	-	-
CO5	-	-	3	-	-	3	3	-	-	-	3	1	3	-	-
AVG	-	-	3	-	-	3	3	-	-	-	3	2.2	2.8	-	-

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.

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 individuals 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 areas and implementation approaches.	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		
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	0	SEE Marks	-
L:T:P:S	0:0:2:0	Total Notional Learning Hours	30	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	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	PSO4
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

YOGA – I

Course Code	B24YOK391	**Total contact hours / week**	2	CIE Marks	100
Course Category	NCMC	**Total SAAE hours / semester**	0	SEE Marks	-
L:T:P:S	0:0:2:0	**Total Notional Learning Hours**	30	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	

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,	**9**

	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.**	
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	Analyse 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	PSO4
CO1	3	1	2	1	-	-	-	1	1	1	1	-	1	1	-
CO2	3	1	2	1	-	-	-	1	1	1	1	-	1	1	-
CO3	3	1	2	1	-	-	-	1	1	1	1	-	1	1	-
CO4	3	1	2	1	-	-	-	1	1	1	1	-	1	1	-
CO5	3	1	2	1	-	-	-	1	1	1	1	-	1	1	-
AVG	3	1	2	1	-	-	-	1	1	1	1	-	1	1	-

Teaching-Learning Process Pedagogy (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. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. 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	**Design and 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	PSO4
CO1	3	3	3	2	2	-	-	-	-	-	2	1	2	-	-
CO2	3	3	3	2	2	-	-	-	-	-	2	3	2	1	-
CO3	3	3	3	2	2	-	-	-	-	-	2	3	2	1	-
CO4	3	3	3	2	2	-	-	-	-	-	2	3	2	1	-
CO5	3	3	3	2	2	-	-	-	-	-	2	3	2	-	-
AVG	3	3	3	2	2	-	-	-	-	-	2	2.6	2	1	-

Teaching-Learning Process Pedagogy (General Instructions)

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

DATA COMMUNICATION NETWORKS

Course Code	B24CS43	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. Describe communication protocols and layered network architectures and introduce the fundamental various types of computer networks.
2. To demonstrate the TCP/IP and OSI models with merits and demerits and Explain convention computer system interfacing standards and peer to peer data link protocols.
3. To explore the various layers of OSI Model and to introduce UDP and TCP Models.
4. To obtain a thorough knowledge of Information and Network Security.

PREREQUISITES

- An understanding of the basics of computer networking and programming

MODULE #	TOPICS	Hours
1	**Introduction:** Data Communications, Networks, Network Types, Networks Models: Protocol Layering, TCP/IP Protocol suite, The OSI model, Introduction to Physical Layer: Transmission media, Guided Media, Unguided Media: Wireless. Switching: Packet Switching and its types. **Textbook: Ch. 1.1 - 1.3, 2.1 - 2.3, 7.1 – 7.3, 8.3.**	9
2	**Data Link Layer:** Error Detection and Correction: Introduction, Block Coding, Cyclic Codes. Data link control: DLC Services: Framing, Flow Control, Error Control, Connectionless and Connection Oriented, Data link layer protocols, High Level Data Link Control. Media Access Control: Random Access, Controlled Access. Check Sum and Point to Point Protocol. **Textbook: Ch. 10.1-10.4, 11.1 -11.4, 12.1 - 12.2**	8
3	**Network Layer:** Network layer Services, Packet Switching, IPv4 Address, IPv4 Datagram, IPv6 Datagram, Introduction to Routing Algorithms, Unicast Routing Protocols: DVR, LSR, PVR, Unicast Routing protocols: RIP, OSPF, BGP, Multicasting Routing-MOSPF. **Textbook: Ch. 18.1, 18.2, 18.4, 22.2,20.1-20.3, 21.3.2**	8
4	**Introduction to Transport Layer:** Introduction, Transport-Layer Protocols: Introduction, User Datagram Protocol, Transmission Control Protocol: services, features, segments, TCP connections, flow control, Error control, Congestion control. **Textbook: Ch. 23.1- 23.2, 24.1-24.3.4, 24.3.6-24.3.9**	9
5	**Introduction to Application Layer:** Introduction, Client-Server Programming, Standard Client Server Protocols: World Wide Web and HTTP, FTP, Electronic Mail, Domain Name System (DNS), TELNET, Secure Shell (SSH) **Textbook: Ch. 25.1-25.2, 26.1-26.6**	8

PRACTICAL COMPONENT OF IPCC

Sl.#	Programs
1	Implement three nodes point – to – point network with duplex links between them. Set the queue size, vary the bandwidth, and find the number of packets dropped.
2	Implement transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.
3	Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.
4	Develop a program to find the shortest path between vertices using the Bellman-Ford and path vector routing algorithm.
5	Write a program for congestion control using leaky bucket algorithm.
6	Write a program for error detecting code using CRC-CCITT (16- bits).
7	Develop a program to implement a sliding window protocol in the data link layer.
8	Using TCP/IP sockets, write a client – server program to make the client send the file name and to make the server send back the contents of the requested file if present.
9	Write a program on datagram socket for client/server to display the messages on client side, typed at the server side.
10	Write a program for simple RSA algorithm to encrypt and decrypt the data.

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	**Data Communication and Networking**	Behrouz A. Forouzan	5th	McGraw-Hill Higher Education	2017
2	**Computer Networks**	A. S. Tannenbum, D. Wetherall	5th	Prentice Hall, Imprint of Pearson	2010

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	**TCP/IP Protocol Suite**	Behrouz A. Forouzan	4th	McGraw Hill Education	2017
2	**Data Communication and Networks**	Godbole Achyut	2nd	McGraw Hill Education	2017
3	**Computer Networking**	Kurose	8th	PEARSON	2022

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

Sl. #	Type of E- Resource	URL
1	**Geeks for Geeks**	https://www.geeksforgeeks.org/data-communication-definitioncomponents-types- channels
2	**Tutorials point**	https://www.tutorialspoint.com/data_communication_computer_network/index.htm
3	**NPTEL**	https://nptel.ac.in/courses/106105081 Computer Networks
4	**NPTEL**	https://nptel.ac.in/courses/106105183 Computer Networks and Internet Protocol
5	**Studytonight**	https://www. studytonight.com/computer-networks/overview-of-computer-networks

COURSE OUTCOMES

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

CO #	Course Outcome Statement
CO1	Understand the basics of data communication, networking, internet, and their importance.
CO2	Select relevant Transmission Media and Switching Techniques as per need.
CO3	Analyze the services and features of various protocol layers in data networks.
CO4	Recognize the different internet devices and their functions. Configure different TCP/IP services.
CO5	Implement relevant Network Topology using Networking Devices and Identify the basic security threats of a network.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	-	-	-	-	-	-	1	1	2	2	-	-
CO2	3	3	2	-	1	-	-	-	-	1	1	2	2	-	-
CO3	3	3	2	-	2	-	-	-	-	1	1	2	2	-	-
CO4	2	2	2	-	-	-	-	-	-	1	1	1	2	-	-
CO5	3	2	2	-	-	-	-	-	-	1	1	1	2	-	-
AVG	2.8	2.6	2	-	1.5	-	-	-	-	1	1	1.8	2	-	-

Teaching-Learning Process

Pedagogy (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 methods, 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 Programming assignment, which fosters student's Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze

DISCRETE MATHEMATICAL STRUCTURES AND GRAPH THEORY

Course Code	B24CS44	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 help students to understand discrete and continuous mathematical structures.
2. To impart basics of relations and functions.
3. To facilitate students in applying principles of Recurrence Relations to find the generating functions and solve the Recurrence relations.
4. Understand the basic concepts of graphs and their properties, and operations of graphs, Hamiltonian and Euler graphs, trees and matrix representation of the graph.
5. Apply the concepts of a tree and its algorithms in computer science engineering.

PREREQUISITES

Student should be comfortable with:

- Logical reasoning
- Mathematical notation
- Basic algebra and number operations
- Reading and writing simple proofs

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:** Chapter2- 2.1 to2.5	9
2	**Sets, Relations and Functions**: Sets and Subsets, Set operations and laws of set theory, Cartesian Products and Relations, Functions – Plain and One-to- One, Onto Functions. The Pigeonhole 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. **Textbook 1:** Chapter3- 3.1 to 3.2. Chapter5- 5.1 to 5.3, 5.5 to 5.6, Chapter7- 7.1 to 7.4.	8
3	**The Principle of Inclusion and Exclusion:** The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials. **Recurrence Relations:** First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients. **Text book 1:** Chapter 8- 8.1 to 8.4 Chapter10- 10.1, 10.2	8
4	**Introduction to Graph Theory:** Definitions and Examples, Sub graphs, Complements and Graph Isomorphism. Vertex degree: Euler trails and circuits, planar graphs. Graph coloring and chromatic polynomials. **Textbook 1:** Chapter11 – 11.1 to 11.4 and 11.6	9
5	**Trees:** Definitions, Properties, and examples, Rooted trees, Trees and sorting, Weighted trees and Prefix codes. **Connectivity Graphs:** Vertex Connectivity, Edge Connectivity, Cut set and Cut Vertices, separability, Menger's Theorem, Fundamental circuits.	8

	Application to organizing and searching data. **Text book 2:** Chapter3 – 3.1 to 3.8, 4.1 tox 4.5	

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	**Discrete and Combinatorial Mathematics – An Applied Introduction**	Ralph P. Grimaldi	5th	Pearson Education	2023
2	**Graph Theory with Application to Engineering and Computer Science**	Narasingh Deo	Latest	Prentice Hall of India	2016

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	**Discrete Mathematics and its Applications**	Kenneth H. Rosen	6th	McGraw Hill	2004
2	**Discrete Mathematics with Applications**	Thomas Koshy	5th	Elsevier	Reprint 2018
3	**A Treatise on Discrete Mathematical Structures.**	Jayant Ganguly	Latest	Sanguine-Pearson	2010
4	**Introduction to graph theory.**	Douglas B. West	3rd	Prentice Hall	2014

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

Sl. #	Type of E-Resource	URL
1	**Online Lecture Notes & Tutorials**	https://ocw.mit.edu/courses/6-042j-mathematics-for-computer-science-fall-2010/
2	**Video Lectures**	https://www.youtube.com/playlist?list=PLDV1Zeh2NRsAsbafOroUBnNV8f hZa7P4u
3	**Websites**	https://www.geeksforgeeks.org/graph-data-structure-and-algorithms/
4	**Text book**	https://www.shahucollegelatur.org.in/Department/Studymaterial/sci/it/B CS/FY/book.pdf
5	**Text book**	https://www.scribd.com/doc/133436794/Discrete-and-Combinatorial-Mathematics-An-Applied-Introduction-5th-Ed-r-Grimaldi-Pearson-2004-Www

COURSE OUTCOMES

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

CO #	Course Outcome Statement
CO1	Understand the concepts of logical reasoning and mathematical proof techniques in proving theorems and statements.
CO2	Apply the basic concepts of relations, functions and partially ordered sets for computer representations.
CO3	Explore the concepts of recurrence relations and generating functions.
CO4	Discuss the fundamental concepts of properties and representation of graphs.
CO5	Apply the concepts of tree and its algorithms to solve the given problem.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	-	-	-	-	-	-	-	1	2	-	-	-
CO2	3	2	1	-	-	-	-	-	-	-	2	1	-	-	-
CO3	3	2	1	1	-	-	-	-	-	1	2	1	1	-	-
CO4	3	2	1	-	-	-	-	-	-	-	2	1	-	-	-
CO5	3	2	1	-	-	-	-	-	-	-	2	1	1	-	-
AVG	3	2	1.2	1	-	-	-	-	-	1	1.8	1.2	1	-	-

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).

AI IN CYBER SECURITY

Course Code	B24CS451	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 introduce computational thinking and problem-solving methodologies. 2. To develop logical reasoning and analytical skills. 3. To implement solutions using algorithms and basic programming constructs.

PREREQUISITES
• Programming knowledge

Program #	Modules	Hours
1	**Introduction to Cybercrime:** Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals? Classifications of Cybercrimes, An Indian Perspective, Hacking and Indian Laws., Global Perspectives. **Textbook 1**: Chapter 1 1 .1 to 1.5, 1.7-1.9.	9
2	**Cyber Offenses**: Introduction, How criminals plan the attacks, Social Engineering, Cyber Stalking, Cybercafe & cybercrimes. Botnets: The fuel for cybercrime, Attack Vector. **Textbook 1:** Chapter 2 2.1 to 2.7	8
3	**Tools and Methods used in Cybercrime:** Introduction, Proxy Servers, Anonymizers, Phishing, Password Cracking, Key Loggers and Spyways, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDOS Attacks, Attacks on Wireless networks. **Textbook 1:** Chapter 4 4.1 to 4.9, 4.12	9
4	**What is artificial intelligence?** Problems, Problem Spaces and search, Knowledge Representation Issues, Using Predicate Logic, representing knowledge using Rules. **Textbook 2**: Chapter 1, 2, 4, 5, 6.	8
5	**Symbolic Reasoning under Uncertainty:** Statistical reasoning Game Playing, Natural Language Processing. **Textbook 2:** Chapter 7, 8	8

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	**Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives**	Sunit Belapure, Nina Godbole	1st	Wiley India Pvt Ltd,	2018
2	**Artificial Intelligence**	E. Rich , K. Knight, S. B. Nair.	1st	McGraw Hill.	2017

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	**Artificial Intelligence: A Modern Approach, Stuart Rusell, Peter Norving, Pearson Education 2nd Edition**	Stuart Rusell, Peter Norving,	2nd	Pearson Education 2nd Edition	2017

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

Sl. #	Type of E-Resource	URL
1.	**Video Lectures**	https://youtu.be/3tqkiUT9Sxw?si=cK4dUMrtau0Q04Bt
		https://youtu.be/4QzBdeUQ0Dc?si=UsJVv-GiC5Xo_9Fv

COURSE OUTCOMES

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

CO #	Course Outcome Statement
CO1	Understand the fundamentals of cybercrime, its classification, and the role of cybercriminals
CO2	Understand the basics of Artificial Intelligence, problem-solving, and knowledge representation.
CO3	Analyze various cyber offenses and identify attack methods such as social engineering and botnets.
CO4	Explore the tools, techniques, and methods used in cyberattacks including phishing, keyloggers, and DoS attacks.
CO5	Apply symbolic/statistical reasoning and explore AI applications like game playing and NLP.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	3	2	2	-	2	1	3	2	-	-
CO2	3	3	2	2	2	-	-	-	-	2	1	3	2	-	-
CO3	3	3	2	3	3	-	-	-	-	2	1	3	3	-	-
CO4	3	2	2	2	2	-	-	-	-	2	1	3	3	-	-
CO5	3	2	3	2	2	-	-	-	-	2	1	3	3	-	-
AVG	3	2.4	2.25	2.25	2.25	3	2	2	-	2	1	3	2.6	-	-

Teaching-Learning Process Pedagogy (General Instructions):

1. Chalk and board
2. Interactive Lectures

Use multimedia presentations and real-life case studies (e.g., cybercrime incidents, AI demos) to explain fundamental concepts.

QUANTUM COMPUTING

Course Code	B24CS452	Total contact hours / week	4	CIE Marks	50
Course Category	ESC	Total SAAE hours / semester	32	SEE Marks	50
L:T:P:S	2:2:0:0	Total Notional Learning Hours	90	Total Marks	100
Total credits	3			Exam Duration	3 Hrs

COURSE LEARNING OBJECTIVES
1. Understand the basic principles of quantum mechanics. 2. Differentiate classical and quantum computing paradigms. 3. Describe qubits and quantum gates.

PREREQUISITES
• Mathematics Prerequisites are Linear Algebra, Probability Theory, Calculus. • Basic Programming Skills and Basic Knowledge of Classical Computing. • Introduction to Quantum Mechanics and Classical Mechanics

MODULE #	TOPICS	Hours
1	**Introduction:** Elementary quantum mechanics, linear algebra for quantum mechanics, Quantum states in Hilbert space, The Bloch sphere, Density operators, generalized measurements, and no-cloning theorem. **Textbook 1**: Chapter 1-5.	6
2	**Quantum correlations:** Bell inequalities and entanglement, Schmidt decomposition, super dense coding, teleportation. **Textbook 1**: Chapter 6-9.	6
3	**Quantum cryptography**: quantum key distribution. **Textbook 1**: Chapter 10.	5
4	**Quantum gates and algorithms:** Universal set of gates, quantum circuits, Solovay-Kitaev theorem, Deutsch-Jozsa algorithm, factoring. **Textbook 1**: Chapter 11-12.	5
5	**Programming a quantum computer:** The IBMQ, coding a quantum computer using a simulator to carry out basic quantum measurement and state analysis.	5

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	**Quantum Computing Explained**	David McMahon	1st	IEEE Computer Society	2008
2	**An introduction to Quantum Computing**	Phillip Kaye, Raymond Laflamme	1st	Oxford University press	2007

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	**Quantum Computation and Quantum Information**	M. A. Nielsen & I. Chuang,	10th	Cambridge University Press	2013
2	**Quantum Computing, A Gentle Introduction**	Eleanor G. Rieffel and Wolfgang H. Polak	2nd	MIT press	2014

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

Sl. #	Type of E-Resource	URL
1	**MIT OpenCourseWare: Quantum Computation**	https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-897-quantum-computation-fall- 2018/
2	**Quantum Computing for Everyone by University of Maryland(Coursera)**	https://www.coursera.org/learn/quantum-computing
3	**Quantum Computing: A Brief Introduction by CrashCourse**	https://www.youtube.com/watch?v=Jh8uZUzuRvk
4	**Qiskit YouTube Channel (IBM)**	https://www.youtube.com/c/Qiskit
5	**Quantum Computing for the Very Curious by Michael Nielsen**	https://www.youtube.com/playlist?list= PL4ZEKb6d02P0E1YOQ7RVyzDGHM6nHOx3-

COURSE OUTCOMES

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

CO #	Course Outcome Statement
CO1	Explain the fundamental principles of quantum mechanics, linear algebra concepts, quantum states in Hilbert space, the Bloch sphere, density operators, generalized measurements, and the no-cloning theorem.
CO2	Illustrate quantum correlations through entanglement, Bell inequalities, Schmidt decomposition, and demonstrate applications such as superdense coding and quantum teleportation.
CO3	Describe the principles of quantum cryptography and apply quantum key distribution protocols for secure communication.
CO4	Apply knowledge of quantum gates, circuits, and universal gate sets to construct basic quantum algorithms such as Deutsch–Jozsa, Grover's, and Shor's factoring algorithm.
CO5	Demonstrate programming of quantum computers using simulators or platforms like IBMQ to perform quantum state preparation, measurement, and basic algorithm implementation.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	2	2	-	-	1	-	-	-
CO3	3	-	3	3	3	-	-	2	3	-	-	1	-	-	-
CO4	-	3	3	3	3	-	-	3	2	3	-	1	-	-	-
CO5	3	3	3	3	3	3	-	-	-	-	-	1	-	-	-
AVG	3	3	3	3	3	3	-	2.33	2.33	3	-	1	-	-	-

Teaching-Learning Process Pedagogy
(General Instructions):

1. Active Learning and Conceptual Understanding Analogies and Visuals
2. Hands-On Practice with Quantum Programming
3. Problem-Solving and Collaborative Learning
4. Project-Based and Case Study Learning
5. Gamified Learning and Quantum Simulations

OPERATIONS RESEARCH

Course Code	B24CS453	Total contact hours / week	4	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

This course is intended to:

1. To understand the methodology of OR problem solving and formulate linear programming problem.
2. To develop formulation skills in transportation models and finding solutions.
3. To understand the basics in the field of assignment problems.
4. To know how project management techniques help in planning and scheduling a project.

PREREQUISITES

- Basic knowledge of Arithmetic
- Interest

MODULE #	TOPICS	Hours
1	**Introduction, Linear Programming:** Introduction: The origin, nature and impact of OR; Defining the problem and gathering data; Formulating a mathematical model; Deriving solutions from the model; Testing the model; Preparing to apply the model; Implementation. **Introduction to Linear Programming Problem (LPP):** Prototype example, Assumptions of LPP, Formulation of LPP and Graphical method various examples. **Textbook 1**: Chapter1, 2	8
2	**Simplex Method:** The essence of the simplex method; Setting up the simplex method; Types of variables, Algebra of the simplex method; the simplex method in tabular form; Tie breaking in the simplex method. **Textbook 1**: Chapter 3	10
3	**Assignment problems:** A Hungarian algorithm for the assignment problem. Minimization and Maximization varieties in transportation and assignment problems. **Textbook 1**: Chapter 11	8
4	**Transportation Problems:** The transportation problem, Initial Basic Feasible Solution (IBFS) by North West Corner Rule method, Matrix Minima Method, Vogel's Approximation Method. Optimal solution by Modified Distribution Method (MODI). **Textbook 1**: Chapter 10	8
5	**Network Analysis in Project Planning (PERT CPM) –** Project Planning, Scheduling, Controlling, Network Logic, Numbering the Events, Critical Path Method, Project Evaluation and review Technique, Cost Analysis and Crashing the Network. **Textbook 1**: Chapter18	8

PRESCRIBED TEXT BOOK

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	Operations Research	Prem Kumar Gupta and Dr. D S Hira	Revised	S. CHAND	2012

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	**Operation Research – Theory, Methods and Applications**	S D Sharma	10th	Kedar Nath Ram Nath Publishers	2014
2	**Operation Research**	Hamdy Taha	10th	Pearson	2019
3	**Introduction to Operation Research**	Frederick S. Hillier, Gerald J. Lieberman, Bodhibroto Nag, Preetam Basu	11th	McGraw Hill	2021

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

Sl. #	Type of E-Resource	URL
1	**Online Course**	https://www.coursera.org/courses?query=operations%20research
2	**Online Course**	https://www.udemy.com/topic/operations-research/?p=1&srsltid=AfmBOormcKzlhiKvQj05dECh3aEreLNax FMV_s6Kp_CQZx_lB868ehPo
3	**Online Course Materials**	https://archive.org/details/solutions-manual-for-introduction-to-operations-research-10th-edition-by-frederick-hillier

COURSE OUTCOMES

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

CO #	Course Outcome Statement
CO1	Explain the importance of Operations Research and formulate Linear Programming Problems for optimal solutions.
CO2	Apply graphical and simplex methods to solve linear programming problems.
CO3	Solve the problem of transporting the products from origins to destinations to obtain optimal solution.
CO4	Solve specialized linear programming problems called assignment problems.
CO5	Solve problems related to Network models by making use of PERT and CPM methods.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	-	3	-	-	-	-	-	3	1	-	-	-
CO2	3	3	3	-	3	-	-	-	-	-	3	1	-	-	-
CO3	3	3	3	-	3	-	-	-	-	-	3	1	-	-	-
CO4	3	3	3	-	3	-	-	-	-	-	3	1	-	-	-
CO5	3	3	3	-	3	-	-	-	-	-	3	1	-	-	-
AVG	3	3	3	-	3	-	-	-	-	-	3	1	-	-	-

Pedagogy:

1. Usage of Black / White Board along with PPT.
2. More number of problems to be solved

LINEAR ALGEBRA

Course Code	B24IS454	Total contact hours / week	4	CIE Marks	50
Course Category	ESC	Total SAAE hours / semester	32	SEE Marks	50
L:T:P:S	2:2:0:0	Total Notional Learning Hours	90	Total Marks	100
Total credits	3			Exam Duration	3 Hrs

COURSE LEARNING OBJECTIVES

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

PREREQUISITES

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

MODULE #	TOPICS	Hours
1	**Linear Equations:** Fields; system of linear equations, and its solution sets; elementary row operations and echelon forms; matrix operations; invertible matrices, LU-decomposition, Numerical differentiation based on N-G forward and backward interpolation. **Textbook 1**: Chapter 1, 4.1	6
2	**Symmetric Matrices, Quadratic Forms and LINEAR Transformations:** Diagonalization; quadratic forms; constrained optimization; Singular value decomposition, **Linear transformations:** Isomorphism, linear functional, Singular and Non-singular linear transformations, Invertible linear transformations. **Textbook 1**: Chapter 5.1- 5.4, 7.1-7.4	6
3	**Eigenvalues and eigenvectors:** Introduction, Polynomials of Matrices, Applications of Cayley-Hamilton Theorem, Eigen spaces of a linear transformation, Characteristic and Minimal Polynomials of Block Matrices, Jordan Canonical form. **Textbook 1**: Chapter 5.5 - 5.7	6
4	**Inner product spaces:** Inner products, inner product spaces, length and orthogonality, orthogonal sets and Bases, projections, Gram-Schmidt process, QR-factorization, least squares problem and least square error. **Textbook 1**: Chapter 6.1 – 6.6	5
5	**Optimization techniques in linear algebra:** Diagonalization and Orthogonal diagonalization of real symmetric matrices, quadratic forms and its classifications, Hessian Matrix, Method of steepest descent, Singular value decomposition. Dimensionality reduction – Principal component analysis. **Textbook 1**: Chapter 7.2 – 7.5	5

PRESCRIBED TEXT BOOKS

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

REFERENCE BOOKS

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

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

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

COURSE OUTCOMES:

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

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

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	-	-	-	-	-	-	-	2	3	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	2	3	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	2	3	-	-	-
CO4	3	3	3	-	-	-	-	-	-	-	2	3	-	-	-
CO5	3	3	3	-	-	-	-	-	-	-	2	3	-	-	-
AVG	3	3	3	-	-	-	-	-	-	-	2	3	-	-	-

Pedagogy:

1. Usage of Black / White Board along with PPT.
2. More number of problems to be solved

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 Hr

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 bio design 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.	3
2	**Biomolecules and Biosensors:** Biomolecules: Properties and functions of carbohydrates, proteins, lipids. Short Biosensor History, Biosensor Classification.	3
3	**Biochemical Components used in Biosensor Assemblies:** Enzymes, Antibodies, Protein/Peptide Receptors, Nucleic Acids, Whole Cells as Biosensing Elements, Immobilization of Biochemical Elements of Biosensors.	3
4	**Adaptation of Anatomical Principles:** Brain as a CPU system. Eye as a Camera system. Heart as a pump system. Lungs as purification system. Kidney as a filtration system.	3
5	**Biomimetics:** Introduction, Echolocation (ultrasonography / ultrasound Imaging), Photosynthesis (photovoltaic cells, bionic leaf). Birds and insects (flight aerodynamics), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Shark skin (Friction reducing swimsuits), Kingfisher beak (Bullet train).	3

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	**Biology for Engineers**	Rajendra Singh C Rathnakar Rao N, Rajendra Singh C, Rathnakar Rao	--	N Publishing, Bengaluru	2023
2	**Human Physiology**	Stuart Fox, Krista Rompolski	16th	McGraw-Hill	2022
3	**Biosensors: essentials.**	Evtugyn, Gennady.	-	Springer, Vol. 84.	2014
4	**Biomimetics: Nature-Based Innovation**	Yoseph Bar-Cohen	1st	CRC Press.	2012
5	**Biomedical Instrumentation**	Leslie Cromwell	NA	Prentice Hall	2011
6	**Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies**	D. Floreano, 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.	8th	Academic Press	2018
2	**3D Bioprinting: Fundamentals, Principles and Applications**	Ibrahim Ozbolat	NA	Academic Press	2016.
3	**Biology for Engineers**	Sohini Singh 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	PSO4
CO1	3	3	3	3	-	-	-	3	-	-	3	-	-	-	-
CO2	3	3	3	3	-	-	-	3	-	-	3	-	-	-	-
CO3	3	3	3	3	-	-	-	3	-	-	3	-	-	-	-
CO4	3	3	3	3	-	-	-	3	-	-	3	-	-	-	-
AVG	3	3	3	3	-	-	-	3	-	-	3	-	-	-	-

Teaching-Learning Process Pedagogy (General Instructions):

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

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

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

1. Group Discussion of Case studies
2. Model Making and seminar/poster presentations

BUSINESS INTELLIGENCE TOOLS

Course Code	B24CS471	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. To use raw data, monitor it, and visualize it in a form that will provide rich insights with the help of dashboards. 2. Develop Proficiency in Data Visualization and Report Creation using Power BI Desktop. 3. Apply Data Transformation, Modeling, and DAX to Perform Analytical Operations. 4. Integrate Advanced Analytical Techniques and Publish Reports to Power BI Service.

PREREQUISITES
• Data analytics using EXCEL.

Sl. #	PROGRAMS
1	**Getting started to Power BI** Installation of Power BI Desktop Understanding the GUI, toolbar, and navigation Exploring Report views: Report, Data, and Model views.
2	**Visualizations and KPIs** a) Import a csv file which consists of a sales data with fields Country, continent, year and sales. Prepare at least 3 different visualization report (eg:- Barchart, PieChart, Linechart). Apply various formatting option and export it to PDF b) Apply Conditional filtering over the Power BI report. c) Check the card visualization and KPI (Key Performance Indicators)
3	**Perform Data Formatting and Transformation** a) Convert Dimensional data to Fact table b) Fixing and Rendering Date time Using the Query Editor c) Handling missing values and renaming columns
4	Use DAX (Data Analysis Expressions) with columns and measures, filter and calculate, creating tables.
5	**Perform R visualization** a) Generating Data for Monte Carlo Analysis using R b) Importing Excel data and using R visualizations for advanced analytics
6	**Interactive & Enhanced Reports** a) Create a report with multiple pages. Use the duplicate page feature to replicate layout. Add different visuals to demonstrate page customization. b) Load a sample dataset (e.g., Sales or Orders). Insert a **Decomposition Tree** to break down sales by category and region. Add descriptive text using **Text Box** to annotate the insight. c) Use Decision Tree formulae for classifying the data d) Use **Smart Narrative** to auto-generate insights from your visuals. Insert **Key Influencers Visual** to analyze factors impacting performance metrics like profit margin or customer rating. e) Use Insert > Shapes to create background visuals. Add a company logo using Insert > Image. Add navigation buttons and set up page navigation or bookmarks.
7	**Perform Data Modelling and advanced analytics using Power BI** a) Import multiple tables (e.g., Students, Courses). Create relationships using a star

	schema. Use the **Model View** to understand table relationships. b) Create calculated columns and measures using DAX (e.g., Total Sales, Discounted Price). Implement a **What-if Parameter** for changing discount rates or price sensitivity. Add a slicer for the parameter and observe how visuals update dynamically. c) Create a simple role-based access rule using **Row-Level Security**. Assign rules based on regions (e.g., Sales Manager can only see data from their assigned region). d) Test the security view in Power BI Desktop using "View As Role".
8	**Aggregation & Slicers** a) Import a dataset (e.g., Sales data). b) Use **Matrix visual** to display aggregated values by categories (e.g., Region and Product). c) Build a **Line chart** showing cumulative revenue or orders over time. d) Use DAX formula for running total (e.g., CALCULATE(SUM([Sales]), FILTER(...))). e) Add slicers for time period, region, or category. Test interactivity of slicers with visuals.

PRESCRIBED MATERIAL

Sl. #	Type of E-Resource	URL
1	**Online course**	TechA Data Analytics using Power BI Foundation Certification https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013849952348594176138_shared/overview

COURSE OUTCOMES

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

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

CO-PO-PSO Mapping

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	1	-	-	-	3	-	-	-	-	-	-	-	-	-	2
CO2	2	2	-	-	3	-	-	-	-	-	-	-	-	-	2
CO3	1	2	3	-	3	-	-	-	-	-	-	-	-	-	2
CO4	2	3	3	2	3	-	-	-	-	-	-	-	-	-	2
CO5	1	2	3	2	3	-	-	-	-	-	-	-	-	-	2
AVG	1.4	2.25	3	2	3	-	-	-	-	-	-	-	-	-	2

Teaching-Learning Process
Pedagogy(General Instructions):

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

GREEN IT AND SUSTAINABILITY

Course Code	B24CS472	Total contact hours / week	1	CIE Marks	50
Course Category	AEC	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 Hr

COURSE LEARNING OBJECTIVES
1. Understand challenges for Green ICT and the environmental impact. 2. Learn different aspects of ICT metrics and Sustainable Cloud Computing. 3. Explore effects of software design on the sustainability.

PREREQUISITES
• Introduction to IoT and Innovation and Design Thinking.

MODULE #	TOPICS	Hours
1	**Green ICT -History, Agenda, and Challenges Ahead:** Introduction, Industrial Revolution, The Emergence of Information and Communication Technologies, The Agenda and Challenges Ahead.	2
2	**Emerging Technologies and Their Environmental Impact:** Introduction, Number of Connected Devices , Increased , Functionality, Increased Number of Separate Functions , Increased Demand for Speed and Reliability , Obsolescence—The Problem of Backward Compatibility, The Other Side of the Balance Sheet, Videoconference as an Alternative to Business Travel, Dematerialization of Product Chain, Travel Advice/Road Traffic Control, Intelligent Energy Metering , Building Management Systems, Saving IT	3
3	**Measurements and Sustainability:** Introduction, ICT Technical Measures, Ecological Measures and Ethical Consideration, Systems Engineering for Designing Sustainable ICT-Based Architectures.	3
4	**Sustainable Cloud Computing:** Introduction, Challenges in the Use of Cloud Computing As Green Technology, Cloud Computing and Sustainability, Sustainable Applications of Cloud Computing, Technologies Associated with Sustainable Cloud Computing, Future Prospects of Sustainable Cloud Computing, Reflections on Sustainable Cloud Computing Applications.	3
5	**Sustainable Software Design:** Overview and Scope, Evaluating Sustainability Effects, Sustainability and the Product Life Cycle , Direct Effects: Sustainability During Use, Runtime Energy Consumption Basics , Analyzing the Energy Consumption of an Application, Energy Consumption Reduction Using Physical Properties of Semiconductors, Optimizing the Energy Consumption of an Application: Compiler Techniques, Optimizing the Energy Consumption of an Application: Runtime Approaches.	3

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	**Green Information Technology – A Sustainable Approach**	Mohammad Dastbaz Colin Pattinson, Babak Akhgar,	1st	Elsevier	2015
2	**Harnessing Green IT: Principles and Practices.**	San Murugesan, G.R. Gangadharan	1st	Wiley-IEEE Press	2012

REFERENCE BOOKS

Ref Book #	Book Title	Authors	Edition	Publisher	Year
1	**Green Computing for Sustainable Development.**	Niharika Singh, Thipendra P Singh, Amar Ramdane-Cherif, Ravi Tomar, Richa Choudhary	1st	CRC Press	2025
2	**Green Information Technology: A Sustainable Approach.**	Babak Akhgar, Colin Pattinson, Mohammad Dastbaz	1st	Morgan Kaufmaan	2015

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

Sl. #	Type of E-Resource	URL
1	**YouTube**	https://www.youtube.com/watch?v=kvn_-mJ2tSo https://www.youtube.com/watch?v=kxngsYn5N3Y https://www.youtube.com/watch?v=EgdFi3sCgzU https://www.youtube.com/watch?v=S2m49Op25Zw
2	**Brightest**	https://www.brightest.io/sustainability-measurement
3	**NPTEL**	https://onlinecourses.nptel.ac.in/update_profile_and_register?user_email=&raw_slug=/noc25_ge43

COURSE OUTCOMES

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

CO #	Course Outcome Statement
CO1	Classify the challenges for Green ICT.
CO2	Relate the environmental impact due to emerging technologies.
CO3	Demonstrate different aspects of ICT metrics.
CO4	Compare the various parameters related to Sustainable Cloud Computing.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	2	-	-	-	1	3	-	-	-	1	-	-	-	-
CO2	2	2	-	-	-	2	3	1	-	-	1	-	-	-	-
CO3	2	2	-	2	2	-	3	-	-	-	-	-	-	-	-
CO4	2	2	-	2	2	-	3	-	-	-	1	-	-	-	-
AVG	2	2	-	2	2	1.5	3	1	-	-	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. 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 Case study Based Learning (CBL), which fosters students' analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
6. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

CAPACITY PLANNING FOR IT

Course Code	B24CS473	Total contact hours / week	1	CIE Marks	50
Course Category	AEC	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 Hr

COURSE LEARNING OBJECTIVES

1. Understand requirement and measurements for capacity planning, measurement and monitoring.
2. Measurement of data for prediction towards the planning process.
3. Understand concepts related to deployment, installation, configuration, and management.
4. Role of virtualization and cloud services in capacity planning.

PREREQUISITES

- Basic understanding of Computer Organization and Architecture.
- Fundamentals of Operating Systems and Resource Management.
- Mathematical background in Probability and Statistics.

MODULE #	TOPICS	Hours
1	**Goals, Issues, and Processes:** capacity planning, Quick and Dirty Math, Predicting When Your Systems Will Fail, Make Your System Stats Tell Stories, Buying Stuff: Procurement Is a Process, Performance and Capacity: Two Different Animals, The Effects of Social Websites and Open APIs. **Setting Goals for Capacity:** Different Kinds of Requirements and Measurements, Architecture Decisions.	3
2	**Measurement: Units of Capacity:** Aspects of Capacity Tracking Tools, Applications of Monitoring.	3
3	**Measurement:** API Usage and Its Effect on Capacity, Examples and Reality. **Predicting Trends:** Riding Your Waves.	2
4	**Predicting Trends:** Procurement, The Effects of Increasing Capacity, Long-Term Trends, Iteration and Calibration. **Deployment:** Automated Deployment Philosophies, Automated Installation Tools, Automated Configuration.	3
5	**Virtualization and Cloud Computing:** Virtualization, Cloud Computing, Computing Resource Evolutions, Mixed Definitions, Cloud Capacity, Use it or lose it (your wallet), Measuring the clouds, Cloud Case Studies, Cloud Use Case: Anonymous Desktop Software Company.	3

PRESCRIBED TEXT BOOKS

Text Book #	Book Title	Authors	Edition	Publisher	Year
1	The Art of Capacity Planning	John Allspaw	--	O'Reilly Media, Inc.	2008

REFERENCE BOOKS

Ref Book #	Book Title	Authors	Edition	Publisher	Year
1	The Art of Capacity Planning	Arun Kejariwal, John Allspaw	2nd	O'Reilly Media, Inc.	2017
2	Capacity Planning and Resource Management for IT Professionals	James Relington	2nd	Independently Published	2025
3	The Resource Management and Capacity Planning Handbook: A Guide to Maximizing the Value of Your Limited People Resources	Jerry Manas	2nd	McGraw Hill	2014

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

Sl. #	Type of E-Resource	URL
1	**Video Lectures**	https://www.youtube.com/watch?v=w0cD26CLBA0
2	**Video Lectures**	https://www.youtube.com/watch?v=5-hhfBXykec
3	**Video Lectures**	https://www.youtube.com/watch?v=9e4IohiFmZ8&t=63s
4	**Video Lectures**	https://www.youtube.com/watch?v=qj4ziswxupE
5	**Video Lectures**	https://www.youtube.com/watch?v=jTW79ofC6Go

COURSE OUTCOMES:

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

CO #	Course Outcome Statement
CO1	Identify the requirement and measurements for capacity planning by considering the goal, issues, and processes.
CO2	Explain capacity measurement and monitoring.
CO3	Make use of measurement data for prediction towards overall planning process
CO4	Explain the concepts related to deployment, installation, configuration, and management.
CO5	Demonstrate how the virtualization and cloud services fit into a capacity plan.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	-	-	-	-	-	-	-	1	1	-	-
CO2	3	2	2	2	-	-	-	-	-	-	-	1	1	-	-
CO3	3	3	3	3	1	-	-	-	-	-	-	1	1	-	-
CO4	2	1	2	2	2	-	-	-	-	-	-	1	1	-	-
CO5	2	2	2	2	3	-	-	-	-	-	-	1	1	-	-
AVG	2.6	2	2.2	2.2	2	-	-	-	-	-	-	1	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. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain the 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 Case study Based Learning (CBL), which fosters students' analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
6. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

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	3
2	**Handling Ordinary Files:** cat, cp, rm, mv, more, file, wc, cmp, comm, diff, Basic File Attributes: ls –l, file ownership, file permissions, chmod, directory permissions, changing file ownership	3
3	**Simple Filters:** The sample database, head, tail, cut, paste, sort, uniq, tr Filters using Regular Expression: grep. Egrep	3
4	**Essential Shell Programming Part I:** Shell Scripts, read, Using command line arguments, exit and exit status of command, the logical operators && and || - conditional execution	3
5	**Essential Shell Programming Part II:** the if conditional, using test and [ ] to evaluate expressions, the case conditional, expr, $0, while, for, set and shift	3

Laboratory Component

Prg#	PROGRAMS
1	Working on general purpose commands and General-Purpose Utilities.
2	Working on general purpose commands and General-Purpose Utilities.
3	Working on Ordinary files and Attributes.
4	Working on Ordinary files and Attributes.
5	Working on Filter programs and filters using regular expression.
6	Working on Filter programs and filters using regular expression.
7	a) Write a shell script which displays a list of all the files in the current directory to which you have read, write and execute permissions. b) Write a shell script which will accept a filename and starting and ending line numbers and displays these lines from given file. c) Write a shell script which is expected to accept two filenames as its arguments. Check the number of arguments and display the contents of the argument files if the arguments is two, otherwise display an error message an exit.

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

PRESCRIBED TEXT BOOK

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

REFERENCE BOOKS

Reference Book #	Book Title	Authors	Edition	Publisher	Year
1	**UNIX and SHELL Programming**	Behrouz A Forouzan and Richard F Gilberg	INDIA	CENGAGE Learning, 3rd Reprint	2008
2	**UNIX – The Complete Reference**	Kenneth Rosen	2nd	TATA McGraw Hill 4th Reprint	2008

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

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

COURSE OUTCOMES

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

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

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	-	3	-	-	-	-	-	2	1	-	-	-
CO2	3	3	2	-	3	-	-	-	-	-	2	1	-	-	-
CO3	3	3	2	-	3	-	-	-	-	-	2	1	-	-	-
CO4	3	3	2	-	3	-	-	-	-	-	2	1	-	-	-
AVG	3	3	2	-	3	-	-	-	-	-	2	1	-	-	-

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.

WEB ANALYTICS

Course Code	B24CS475	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. Learn HTML 5 elements and their use.
2. Use of CSS for enhanced user interface presentation.
3. Gain knowledge of JavaScript, AJAX and jQuery for dynamic presentation.
4. Understand and apply the basic of data analytics concepts of statistics and probability.
5. Apply the data processing techniques on Data Frame using Python Libraries.

PREREQUISITES
• Basic HTML knowledge • Basic knowledge about website and webpages

MODULE #	TOPICS/EXPERIMENTS
1	Develop the HTML page named as "Myfirstwebpage.html". Add the following tags with relevant content. 1. Set the title of the page as "My First Web Page" 2. Within the body use the following tags: a) Moving text = "Basic HTML Tags" b) Different heading tags (h1 to h6) c) Paragraph d) Horizontal line e) Line Break f) Block Quote g) Pre tag h) Different Logical Style (<b>, <u>, <sub>, <sup> etc.)
2	Develop the HTML page named as "Table.html" to display your class time table. a) Provide the title as Time Table with table header and table footer, row-span and col-span etc. b) Provide various color options to the cells (Highlight the lab hours and elective hours with different color.) c) Provide color options for rows.
3	Develop an external style sheet named as "style.css" and provide different styles for h2, h3, hr, p, div, span, time, img & a tags. Apply different CSS selectors for tags and demonstrate the significance of each.
4	Develop HTML page named as "registration.html" having variety of HTML input elements with background colors, table for alignment & provide font colors & size using CSS styles.
5	Develop HTML page named as "newpaper.html" having variety of HTML semantic elements with background colors, text-colors & size for figure, table, aside, section, article, header, footer… etc.
6	Develop HTML, CSS and JavaScript to design a simple calculator to perform the following operations: sum, product, difference, remainder, quotient, power, square-root and square.

7	Develop a JavaScript program with Ajax (with HTML/CSS) for: a. Use ajax() method (without Jquery) to add the text content from the text file by sending ajax request. b. Use ajax() method (with Jquery) to add the text content from the text file by sending ajax request. c. Illustrate the use of getJSON() method in jQuery d. Illustrate the use of parseJSON() method to display JSON values.
8	Develop jQuery script (with HTML/CSS) for: a. Appends the content at the end of the existing paragraph and list. b. Change the state of the element with CSS style using animate() method c. Change the color of any div that is animated.
9	Write a Python Program to Get Total Price of all FuelType from Toyota.csv file and show it using a line plot with the following Style properties. Generated line plot must include following Style properties: • Line Style dotted and Line-color should be red • Show legend at the lower right location. • X label name = Fuel Type • Y label name = Price • Add a circle marker. • Line marker color as red • Line width should be 3
10	Write a Python program to create and display a DataFrame from a specified dictionary data which has the index labels. exam_data = {'name': ['Dinesh', 'Suresh', 'Rahul', 'Ravi', 'Manoj', 'Hari', 'Yatharth', 'Saurabh', 'Kapil', 'Salini'], 'score': [12.5, 9, 16.5, np.nan, 9, 20, 14.5, np.nan, 8, 19], 'attempts': [1, 3, 2, 3, 2, 3, 1, 1, 2, 1], 'qualify': ['yes', 'no', 'yes', 'no', 'no', 'yes', 'y

REFERENCE BOOKS

Ref Book #	Book Title	Authors	Edition	Publisher	Year
1	**HTML & CSS: The Complete Reference Thomas A. Powell, , Fifth Edition, Tata McGraw Hill,**	Thomas A	5TH	Tata McGraw Hill	2017
2	**WEB PROGRAMMING with HTML5, CSS and JavaScript, John Dean, Jones & Bartlett Learning, First Edition**	Jones & Bartlett	1ST	Jones & Bartlett	2019
3	**Data Science & Big Data Analytics**	David Dietrich	1ST	EMC Education Services	2020

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

Sl. #	Type of E-Resource	URL
1	**SWAYAM**	https://onlinecourses.swayam2.ac.in/aic20_sp11/preview
2	**SWAYAM**	https://onlinecourses.swayam2.ac.in/imb25_mg218/preview

COURSE OUTCOMES

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

CO #	Course Outcome Statement
CO1	Design the experiment for the given problem using HTML, Javascript and CSS
CO2	Develop the solution for the given real-world problem using jQuery, Ajax and PHP.
CO3	Analyze the results and produce substantial written documentation.
CO4	Understand and apply the basic of data analytics concepts of statistics and probability.
CO5	Apply the data processing techniques on Data Frame using Python Libraries.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	-	-	-	-	-	-	-	1	2	1	-	-
CO2	2	3	2	-	-	-	-	-	-	-	1	2	1	-	-
CO3	2	3	2	-	3	-	-	-	-	-	1	2	1	-	-
CO4	2	3	2	-	-	-	-	-	-	-	1	2	1	-	-
CO5	2	3	2	-	-	-	-	-	-	-	1	2	1	-	-
AVG	2	3	2	-	3	-	-	-	-	-	1	2	1	-	-

Teaching-Learning Process Pedagogy (General Instructions):
GUIDELINES TO STUDENTS

A. Standard Operating Procedure

Explanation of experiment by the concerned faculty using PPT covering the following aspects:

1. Name of the Experiment.
2. Aim.
3. Program flow and Logic Explanation.
4. Commands for executing programs.

B. Writing of the experiment in the Observation Book

The students will write the experiment in the Observation book as per the following format:

1. Name of the experiment.
2. Aim.
3. Writing the program.
4. Errors observed(if any)during compilation/execution
5. Output for all the possible cases.

C. Guide Lines to Students in Lab

- Disciplinary to be maintained by the students in the Lab.
- Students are required to carry their lab observation book and record book with completed experiments while entering the lab.
- Students must use the equipment with care. Any damage caused student is punishable.
- Students are not allowed to use their cell phones/pendrives/CDs in labs.

Students are supposed to occupy the computers allotted to them and are not supposed to talk or make noise in the lab. Students, after completion of each experiment they need to be updated in observation notes and same to be updated in the record.

- Lab records need to be submitted after completion of experiment and get it corrected with the concerned lab faculty.
- If a student is absent for any lab, they need to be completed the same experiment in their free time before attending the next lab.

D. Steps to perform experiments in the lab by the student

Step 1: Students have to write the date, and aim for that experiment in the observation book.
Step 2: Students have to listen and understand the experiment explained by the faculty and note down the important points in the observation book.
Step3: Students need to write a procedure/algorithm in the observation book.
Step4: Analyze and Develop/implement the logic of the program by the student in the respective platform.
Step5: After approval of the logic of the experiment by the faculty then the experiment has to be executed on the system.
Step 6: After successful execution, the results are to be shown to the faculty and noted the same in the observation book.

Step 7: Students need to attend the Viva-Voce on that experiment and write the same in the observation book.

Step8: Update the completed experiment in the record and submit it to the concerned faculty in-charge.

E. Instructions to maintain the record

- Before the start of the first lab they have to buy the record and bring the record to the lab.
- Regularly (Weekly) update the record after completion of the experiment and get it corrected with the concerned lab in-charge for continuous evaluation.
- In case the record is lost inform the same day to the faculty in charge and get the new record within 2 days the record has to be submitted and get it corrected by the faculty.
- If a record is not submitted in time or the record is not written properly, the evaluation marks (5M) will be deducted.

F. General Laboratory Instructions

1. Students are advised to come to the laboratory at least 5 minutes before(the starting time), those who come after 5 minutes will not be allowed into the lab.
2. Plan your task properly before the commencement, come prepared to the lab with the synopsis/program/experiment details.
3. Students should enter the laboratory with:
   a) Laboratory observation notes with all the details(Problem statement, Aim, Algorithm, Procedure, Program, Expected Output, etc.,) filled in for the lab session.
   b) Laboratory Records updated up to the last session experiments and other utensils (if any) needed in the lab.
4. Occupy the computer system allotted to you by the faculty.
5. Execute your task in the laboratory, record the results/output in the lab observation notebook, and get corrected by the concerned faculty.
6. All the students should be polite and cooperative with the laboratory staff and must maintain discipline and decency in the laboratory.
7. Computer labs are established with sophisticated and high-end branded systems, which should be utilized properly.
9. Students must take the permission of the faculty in case of any urgency to go out; if anybody is found outside the lab / class without permission during working hours will be treated seriously and punished appropriately.
10. Students should LOG OFF/ SHUT DOWN the computer system before leaving the lab after completing the task (experiment) in all aspects. She must ensure the system/seat is kept properly.

UNIVERSAL HUMAN VALUES

Course Code	B24UHK48	Total contact hours / week	1	CIE Marks	100
Course Category	UHV	Total SAAE hours / semester	16	SEE Marks	-
L:T:P:S	1:0:0:0	Total Notional Learning Hours	30	Total Marks	100
Total credits	1			Exam Duration	-

COURSE LEARNING OBJECTIVES

This course is intended to:

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

PREREQUISITES

NIL

MODULE #	TOPICS	Hours
1	**Introduction to Value Education:** Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations	3
2	**Harmony in the Human Being:** Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health.	3
3	**Harmony in the Family and Society:** Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order	3
4	**Harmony in the Nature/Existence:** Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence	3
5	**Implications of the Holistic Understanding – a Look at Professional Ethics:** Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and	3

	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	

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 PBagaria	2nd	Excel Books, New Delhi	2019
2	**The Teacher's Manual for A Foundation Course in Human Values and Professional Ethics.**	R R Gaur, R Asthana,	NA	NA	NA

REFERENCE BOOKS

Ref 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

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

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

COURSE OUTCOMES:

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

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

Expected to positively impact common graduate attributes like:

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

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	-	-	-	-	3	3	-	3	-	-	-	-
CO2	-	-	-	-	-	-	-	3	3	-	3	-	-	-	-
CO3	-	-	-	-	-	-	-	3	3	-	3	-	-	-	-
CO4	-	-	-	-	-	-	-	3	3	-	3	-	-	-	-
AVG	-	-	-	-	-	-	-	3	3	-	3	-	-	-	-

Teaching-Learning Process Pedagogy (General Instructions):

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

1. The methodology of this course is exploration based and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied skills.
3. State the need for UHV activities and its present relevance in the society and Provide real-life examples.
4. Support and guide the students for self-study activities.
5. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
6. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student in every activity, leading to continuous self-evolution.
7. Encourage the students for group work to improve their creative and analytical skills.

Assessment Details (only CIE):

Continuous Internal Evaluation:

1) Two tests will be administered. Each test will be for 50 marks.
2) Questions will be based on multiple choice
3) Final CIE marks will be the sum total of both the tests.
4) The minimum passing mark for the CIE is 40% of the maximum marks (40 marks out of 100).

DATABASE MANAGEMENT SYSTEMS LABORATORY WITH MINI PROJECT

Course Code	B24CSL49	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 problems.
3. Develop database applications using front-end

Sl.#	PART-A: SQL Programming (Max. Exam Marks. 50)
	Design, develop, and implement the specified queries for the following problems using Oracle, MySQL, MS SQL Server, or any other DBMS under LINUX/Windows environment. Create Schema and insert at least 5 records for each table. Add appropriate database constraints.
1	Aim: Demonstrating creation of tables, applying the view concepts on the tables. Program Consider the following schema for a Library Database: **BOOK(Book_id, Title, Publisher_Name, Pub_Year)** **BOOK_AUTHORS(Book_id, Author_Name)** **PUBLISHER(Name, Address, Phone)** **BOOK_COPIES(Book_id, Programme_id, No-of_Copies)** **BOOK_LENDING(Book_id, Programme_id, Card_No, Date_Out, Due_Date)** **LIBRARY_PROGRAMME(Programme_id, Programme_Name, Address)** Write SQL queries to 1. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each program, etc. 2. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017. 3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation. 4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query. 5. Create a view of all books and its number of copies that are currently available in the Library Reference: https://www.youtube.com/watch?v=AaSU-AOguls https://www.youtube.com/watch?v=-EwEvJxS-Fw
2	Aim: Introduce concepts of PLSQL and usage on the table. Program: Consider the schema for College Database: **STUDENT(USN, SName, Address, Phone, Gender)** **SEMSEC(SSID, Sem, Sec)** **CLASS(USN, SSID)** **COURSE(Subcode, Title, Sem, Credits)** **IAMARKS(USN, Subcode, SSID, Test1, Test2, Test3, FinalIA)** Write SQL queries to

	1. List all the student details studying in fourth semester 'C' section. 2. Compute the total number of male and female students in each semester and in each section. 3. Create a view of Test1 marks of student USN '1BI15CS101' in all Courses. 4. Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students. 5. Categorize students based on the following criterion: If FinalIA = 17 to 20 then CAT = 'Outstanding' If FinalIA = 12 to 16 then CAT = 'Average' If FinalIA< 12 then CAT = 'Weak' Give these details only for 8th semester A, B, and C section students. Reference: https://www.youtube.com/watch?v=horURQewW9c https://www.youtube.com/watch?v=P7-wKbKrAhk
3	Aim: Demonstrate the core concepts on table like nested and correlated nesting queries and also EXISTS and NOT EXISTS keywords. Program: Consider the schema for Company Database: **EMPLOYEE(SSN, Name, Address, Sex, Salary, SuperSSN, DNo)** **DEPARTMENT(DNo, DName, MgrSSN, MgrStartDate)** **DLOCATION(DNo,DLoc)** **PROJECT(PNo, PName, PLocation, DNo)** **WORKS_ON(SSN, PNo, Hours)** Write SQL queries to Make a list of all project numbers for projects that involve an employee whose last nme is 'Scott', either as a worker or as a manager of the department that controls the project. Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent raise. Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department Retrieve the name of each employee who works on all the projects controlled by department number 5 (use NOT EXISTS operator). For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs.6,00,000. **Reference:** https://www.youtube.com/watch?v=Dk8f3ejqKts
Pedagogy	For the above experiments the following pedagogy can be considered. Problem based learning, Active learning, MOOC, Chalk &Talk
PART B	
	Miniproject: For any problem selected, make sure that the application should have five or more tables. Indicative areas include: Organization, health care, Ecommerce etc.

PRESCRIBED TEXT BOOKS

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

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

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

COURSE OUTCOMES

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

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

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	-	3	-	-	-	-	3	-	3	3	-	-	3	-
CO2	3	3	3	-	-	-	-	3	-	3	3	-	-	3	-
CO3	3	-	3	-	3	-	-	3	-	3	3	-	3	3	-
AVG	3	3	3	-	3	-	-	3	-	3	3	-	3	3	-

NATIONAL SERVICE SCHEME (NSS) - II

Course Code	B24NSK410	Total contact hours / week	2	CIE Marks	100
Course Category	NCMC	Total SAAE hours / semester	0	SEE Marks	-
L:T:P:S	0:0:2:0	Total Notional Learning Hours	30	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, Atma nirbhar 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
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.

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	PSO4
CO1	-	-	3	-	-	3	3	-	-	-	3	-	-	-	-
CO2	-	-	3	-	-	3	3	-	-	-	3	-	-	-	-
CO3	-	-	3	-	-	3	3	-	-	-	3	-	-	-	-
CO4	-	-	3	-	-	3	3	-	-	-	3	-	-	-	-
CO5	-	-	3	-	-	3	3	-	-	-	3	-	-	-	-
AVG	-	-	3	-	-	3	3	-	-	-	3	-	-	-	-

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 individuals 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 areas and implementation approaches.	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		
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) – II

Course Code	B24PEK410	Total contact hours / week	2	CIE Marks	100
Course Category	NCMC	Total SAAE hours / semester	0	SEE Marks	-
L:T:P:S	0:0:2:0	Total Notional Learning Hours	30	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 (Anyone 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	PSO4
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

YOGA – II (Semester 4)

Course Code	B24YOK410	Total contact hours / week	2	CIE Marks	100
Course Category	NCMC	Total SAAE hours / semester	0	SEE Marks	-
L:T:P:S	0:0:2:0	Total Notional Learning Hours	30	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 12 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	

READY TO RISE

Course Code	B24SDC411	Total contact hours / week	2	CIE Marks	100
Course Category	NCMC	Total SAAE hours / semester	0	SEE Marks	-
L:T:P:S	0:0:2:0	Total Notional Learning Hours	30	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.