NEW HORIZON
COLLEGE OF ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Academic Year 2026-27



5th and 6th Semester

Scheme and Syllabus

BATCH : 2024-2028

CREDITS: 160

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Department of Computer Science and Engineering

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NEW HORIZON COLLEGE OF ENGINEERING, BANGALORE

Autonomous College affiliated to VTU, Accredited by NAAC with 'A' Grade & NBA

INSTITUTE VISION AND MISSION

VISION

To emerge as an institute of eminence in the fields of engineering, technology and management in serving the industry and the nation by empowering students with a high degree of technical, managerial and practical competence.

MISSION

- To strengthen the theoretical, practical and ethical dimensions of the learning process by fostering a culture of research and innovation among faculty members and students
- To encourage long-term interaction between the academia and industry through their involvement in the design of curriculum and its hands-on implementation
- To strengthen and mould students in professional, ethical, social and environmental dimensions by encouraging participation in co-curricular and extracurricular activities.

QUALITY POLICY

To provide educational services of the highest quality, both curricular and co-curricular, to enable students to integrate skills and serve the industry and society equally well at the global level.

VALUES

- Academic Freedom
- Integrity
- Inclusiveness
- Innovation
- Professionalism
- Social Responsibility

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

VISION

To emerge as a department of eminence in Computer Science and Engineering in serving the Information Technology Industry and the nation by empowering students with a high degree of technical and practical competence.

MISSION

- To strengthen the theoretical and practical aspects of the learning process by strongly encouraging a culture of research, innovation and hands-on learning in Computer Science and Engineering
- To encourage long-term interaction between the department and the IT industry, through the involvement of the IT industry in the design of the curriculum and its hands-on implementation
- To widen the awareness of students in professional, ethical, social and environmental dimensions by encouraging their participation in co-curricular and extracurricular activities

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

The Graduate of the program will be able to:

PE01: Develop proficiency as computer scientists with an ability to solve a wide range of computational problems in industry, government, or other work environments.

PE02: Attain the ability to adapt quickly to new environments and technologies, assimilate new information, and work in multi-disciplinary areas with a strong focus on innovation and entrepreneurship.

PE03: Possess the ability to think logically and the capacity to understand technical problems with computational systems.

PE04: Possess the ability to collaborate as team members and team leaders to facilitate cutting-edge technical solutions for computing systems and thereby providing improved functionality.

PEO TO MISSION STATEMENT MAPPING

Mission Statements	PEO1	PEO2	PEO3	PEO4
To strengthen the theoretical and practical aspects of the learning process by strongly encouraging a culture of research, innovation and hands-on learning in Computer Science and Engineering	**3**	**3**	**3**	**2**
To encourage long-term interaction between the department and the IT industry, through the involvement of the IT industry in the design of the curriculum and its hands-on implementation	**3**	**3**	**3**	**2**
To widen the awareness of students in professional, ethical, social and environmental dimensions by encouraging their participation in co-curricular and extracurricular activities	**2**	**2**	**2**	**3**

Correlation: 3 – High, 2 – Medium, 1 – Low

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, reuse 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 (POs)

The student will be able to:

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 analyse 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 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 (PSOs)

The student will be able to:

PSO1: Ability to design, develop, implement computer programs and use knowledge in various domains to identify research gaps and hence to provide solution to new ideas and innovations.

PSO2: Work with and communicate effectively with professionals in various fields and pursue lifelong professional development in computing.

MAPPING OF PEOs to POs & PSOs

	POs											PSOs	
	1	2	3	4	5	6	7	8	9	10	11	1	2
PEO1	3	3	2	2	2	1	1	1	1	1	1	2	2
PEO2	3	3	3	3	3	2	2	2	2	2	2	3	2
PEO3	3	3	3	3	3	3	2	2	2	2	2	3	3
PEO4	1	1	1	1	1	2	3	3	3	3	3	1	3

Correlation: 3 – High, 2 – Medium, 1 – Low

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NEW HORIZON COLLEGE OF ENGINEERING

B. E. in Computer Science and Engineering

Scheme of Teaching and Examinations for 2024 - 2028 BATCH (2024 Scheme)

V - Semester													
S. No.	Course and Course Code		Course Title	BoS	Credit Distribution				Overall Credits	Contact Hours	Marks		
					L	T	P	S			CIE	SEE	Total
1	IPCC	24CSE51	Fundamentals of Data Science	CS	2	0	1	0	3	4	50	50	**100**
2	PCC	24CSK52	Design and Analysis of Algorithms	CS	3	0	0	0	3	3	50	50	**100**
3	PCCL	24CSLK52	Design and Analysis of Algorithms Lab	CS	0	0	1	0	1	2	50	50	**100**
4	PCC	24CSE53	Computer Networks	CS	3	0	0	0	3	3	50	50	**100**
5	PCCL	24CSL53	Network Simulation Lab	CS	0	0	1	0	1	2	50	50	**100**
6	AEC*	24CSE54	Cloud Native Application Development	CS	3	0	0	0	3	3	50	50	**100**
7	AEC	24RMK55	Research Methodology and IPR	CS	1	0	0	0	1	1	50	50	**100**
8	AEC	24SDK56	Problem Solving Methodologies	-	0	0	1	0	1	2	50	--	**50**
9	PROJ	24CSE57	Societal Based Mini Project	CS	0	0	1	0	1	2	50	50	**100**
10	OEC	26NHOP5XX	Industrial Open Elective Course-I	Offering Dept.	3	0	0	0	3	3	50	50	**100**
11	NCMC	24NSS50	National Service Scheme	-	0	0	0	0	0	2	50	--	**50**
		24PED50	Physical Education and Sports	-									
		24YOG50	Yoga	-									
Total									**20**	**27**	**550**	**450**	**1000**

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **IPCC**: Integrated Professional Core Course, **NCMC:** Non-Credit Mandatory Course, **AEC**: Ability Enhancement Course, **PEC**: Professional Elective Course, **PROJ**: Mini Project work **L:** Lecture, **T**: Tutorial, **P**: Practical **S: SDA**: Self Study for Skill Development, **CIE**: Continuous Internal Evaluation, **SEE**:Semester End Evaluation

AEC* (Skill Based Core Course):
Credit for AEC* with 03 (L: T: P: S) credits can be considered as (3: 0: 0: 0). The teaching and learning of these Courses will be based on hands-on. The Course content will be from Industry Certification Course Content. The Course Assessment will be based on CIE and SEE in practical mode.

Societal Based Mini Project **:

The Mini project can be done in any lab across college. A common slot in time table can be allotted across all departments.

Mini Project is a laboratory-oriented/hands on course that will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications etc. Based on the ability/abilities of the student/s and recommendations of the mentor. A student can do mini project as

(i) A group of 2 if mini project work is single discipline (applicable to all IT allied branches)

(ii) A group of 3- 4 if mini project work is single discipline (applicable to all Core Branches)

(iii) A group of 3 - 4 students if the Mini Project work is a multidisciplinary (Applicable to all Branches)

CIE procedure for Mini-project:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batches mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.

The CIE marks awarded for the Mini-project, shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the percentage ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

Industrial Open Elective Courses-I:
Credit for OEC is 03 (L: T: P: S) can be considered as (3: 0: 0 : 0). The teaching and learning of these Courses will be based on hands-on. The Course Assessment will be based on CIE and SEE in practical mode. This Courses will be offered by Centre of Excellence to students of all the branches. Registration to Industrial open electives shall be documented and monitored on college level.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education(PE) (Sports and Athletics), and Yoga (YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Credit Definition: 1-hour Lecture (L) per week=1Credit 2-hoursTutorial(T) per week=1Credit 2-hours Practical / Drawing (P) per week=1Credit 2-hous Self Study for Skill Development (SDA) per week = 1 Credit	03-Credits courses are to be designed for 40 hours in Teaching-Learning Session 02- Credits courses are to be designed for 25 hours of Teaching-Learning Session 01-Credit courses are to be designed for 15 hours of Teaching-Learning Sessions

NEW HORIZON COLLEGE OF ENGINEERING

B. E. in Computer Science and Engineering

Scheme of Teaching and Examinations for 2024 - 2028 BATCH (2024 Scheme)

VI – Semester														
S. No.	**Course and Course Code**		**Course Title**	**BoS**	**Credit Distribution**				**Overall Credits**	**Contact Hours**	**Marks**		
					L	**T**	**P**	**S**			**CIE**	**SEE**	**Total**
1	PCC	24CSE61	Full stack Technologies	CS	3	0	0	0	3	3	50	50	**100**
2	PCCL	24CSL61	Full stack Technologies Lab	CS	0	0	1	0	1	2	50	50	**100**
3	PCC	24CSE62	Machine Learning	CS	3	0	0	0	3	3	50	50	**100**
4	PCCL	24CSL62	Machine Learning Lab	CS	0	0	1	0	1	2	50	50	**100**
5	AEC*	24CSE63	Cyber Security Principles and Practices	CS	3	0	0	0	3	3	50	50	**100**
6	PEC	24CSE64X	Professional Elective Course-II	CS	3	0	0	0	3	3	50	50	**100**
7	AEC	24CSE65X	Ability Enhancement Course-V	CS	0	0	1	0	1	2	50	50	**100**
8	NCMC	24SDK66	Advanced Problem Solving Methodologies	-	0	0	0	0	0	2	50	--	**50**
9	PROJ	24CSE67	Capstone Project	CS	0	0	2	0	2	4	50	50	**100**
10	OEC	26NHOP6XX	Industrial Open Elective Course-II	Offering Dept.	3	0	0	0	3	3	50	50	**100**
11	NCMC	24NSS60	National Service Scheme	-	0	0	0	0	0	2	50	--	**50**
		24PED60	Physical Education and Sports	-									
		24YOG60	Yoga	-									
Total									**20**	**29**	**550**	**450**	**1000**

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **NCMC:** Non-Credit Mandatory Course, **AEC**: Ability Enhancement Course, **PEC**: Professional Elective Course, **OEC**: Open Elective Course, **PROJ**: Project work**, L:** Lecture, **T**: Tutorial, **P**: Practical **S: SDA**: Self Study for Skill Development, C**IE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation.

Professional Elective Course-II			
24CSE641	Soft Computing	24CSE644	Multimedia Communication
24CSE642	Introduction to Quantum Computing	24CSE645	Cryptocurrency and Blockchain Technologies
24CSE643	Advanced Java		

Ability Enhancement Course – V			
24CSE651	DevOps	24CSE654	Wearable Technology
24CSE652	Containerization Tools	24CSE655	AI with MATLAB SIMULINK
24CSE653	Mobile Application Development		

AEC* (Skill Based Core Course):
Credit for AEC* with 03 (L: T: P: S) credits can be considered as (3: 0: 0: 0). The teaching and learning of these Courses will be based on hands-on. The Course content will be from Industry Certification Course Content. The Course Assessment will be based on CIE and SEE in practical mode.

Industrial Open Elective Courses-II:
Credit for OEC is 03 (L: T: P: S) can be considered as (3: 0: 0 : 0). The teaching and learning of these Courses will be based on hands-on. The Course Assessment will be based on CIE and SEE in practical mode. This Courses will be offered by Centre of Excellence to students of all the branches. Registration to Industrial open electives shall be documented and monitored on college level.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses can be added to supplement the latest trend and advanced technology in the selected stream of engineering.

Capstone Project :

Students have to discuss with the mentor /guide and with their help he/she has to complete the literature survey and prepare the report and finally define the problem statement for the project work.

The objective of the Project work is

- To encourage independent learning and the innovative attitude of the students.
- To develop interactive attitude, communication skills, organization, time management, and presentation skills.
- To impart flexibility and adaptability.
- To inspire team working.
- To expand intellectual capacity, credibility, judgment and intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To install responsibilities to oneself and others.
- To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:

1. **Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.
   The CIE marks awarded for the project work, shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session in the percentage ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.
2. **Interdisciplinary:** Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the percentage ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

   SEE procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the percentage ratio of 50:25:25.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education(PE) (Sports and Athletics), and Yoga (YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Credit Definition: 1-hour Lecture (L) per week=1Credit 2-hoursTutorial(T) per week=1Credit 2-hours Practical / Drawing (P) per week=1Credit 2-hous Self Study for Skill Development (SDA) per week = 1 Credit	03-Credits courses are to be designed for 40 hours in Teaching-Learning Session 02- Credits courses are to be designed for 25 hours of Teaching-Learning Session 01-Credit courses are to be designed for 15 hours of Teaching-Learning Sessions

Fifth Semester Syllabus

FUNDAMENTALS OF DATA SCIENCE			
Course Code	**24CSE51**	**CIE Marks**	**50**
L:T:P:S	**2:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2+2**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

24CSE51.1	Illustrate the concepts of data science, data analytics and data-driven decision-making
24CSE51.2	Apply descriptive analytics, data preprocessing, and feature selection techniques for data analysis
24CSE51.3	Analyze data transformation and dimensionality reduction techniques for efficient data representation
24CSE51.4	Design analytical models using appropriate transformation, feature engineering and performance assessment techniques
24CSE51.5	Implement data-driven solutions using advanced transformation and model-building techniques
24CSE51.6	Interpret intelligent data science applications using advanced analytical techniques

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSE51.1	-	-	-	-	-	-	-	-	-	-	-	2	-
24CSE51.2	3	-	-	-	3	-	-	-	-	-	-	3	3
24CSE51.3	-	3	-	-	3	-	-	-	-	-	-	3	3
24CSE51.4	-	-	3	-	3	-	-	-	-	-	-	3	3
24CSE51.5	-	-	-	2	2	-	-	-	-	-	-	3	3
24CSE51.6	-	-	2	2	2	2	1	2	2	-	2	3	3

MODULE-1	**FOUNDATIONS OF DATA SCIENCE**	**24CSE51.1, 24CSE51.2**	**8 Hours**

Introduction and Motivation to Data Science, Data: Definition, Data Types, Structured and Unstructured Data, Cross-Sectional, Time Series and Panel Data, Data Measurement Scales: Nominal, Ordinal, Interval and Ratio Scales, Data Preparation: Data Cleaning, Feature selection, Data Transform, Feature Engineering, Dimensionality reduction, Data Preparation with training and test sets, K-fold cross validation

Laboratory Component:

1. Hands-on practice with essential Python Data Science libraries: NumPy, Pandas, Matplotlib and SciPy
2. Load a dataset using the Pandas library and examine its structure by displaying the number of rows and columns, attribute names and data types of all attributes.
3. Demonstrate the process of 10-Fold Cross Validation using a dataset stored in a CSV file and analyze how the data is split across different folds.

Case Study	Analyzing Online Customer Reviews for an E-commerce Company.
Text Book	Text Book 2: Chapter:1.3, 3.3, 3.4, 3.5, 3.6, 3.7 ,4.3, 4.4 Text Book 1: 2.2, 2.3

MODULE-2	**DESCRIPTIVE ANALYTICS**	**24CSE51.2, 24CSE51.3**	**8 Hours**

Descriptive Analytics: Measures of Central Tendency, Measures of Variance: Range, Inter-Quartile Distance, Variance and Standard Deviation, Measures of Shape: Skewness and Kurtosis, Correlation Analysis: Correlation and Pearson Correlation Coefficient, Population and Sample, Sampling: Random Sampling, Stratified Sampling, Cluster Sampling, Data Visualization: Histograms, Bar Charts, Scatter Plots and Box Plots

Laboratory Component:

1. Explore descriptive statistical analysis on a given CSV dataset by loading the data using Pandas, displaying the dataset information and data types, calculating the Mean, Median and Mode, computing the Range, Variance, Standard Deviation and Interquartile Range (IQR) and interpreting the results using Python.
2. Perform correlation analysis on a given dataset by loading a dataset containing numerical attributes, computing the correlation coefficient matrix, visualizing the correlation matrix using a heat map, identifying positive, negative and weak correlations and determining highly correlated variable pairs using Python.
3. Visualize a given dataset by generating histograms, bar charts, scatter plots and box plots and interpret the results using Python.

Case Study	Select a publicly available dataset from domains such as retail, healthcare, education, finance or sports. Perform descriptive statistical analysis, correlation analysis and data visualization using Python and prepare a brief report highlighting the major insights obtained from the data.		
Text Book	Text Book 1: 1.4, 2.4, 2.5, 2.7, 2.8, 2.9, 4.3, 4.4, 8.1, 8.2		
MODULE-3	**DATA CLEANING AND FEATURE SELECTION**	**24CSE51.2, 24CSE51.3**	**8 Hours**
Data Cleaning: Basic data cleaning, Outlier Identification and Removal, Identifying and Removing Missing Data, Statistical Imputation, KNN Imputation, Iterative Imputation. Feature Selection: Statistics for feature selection, Methods for categorical input, Methods for Numerical input, Select Features for Numerical Output, RFE for Feature Selection, Significance of feature selection.			
Laboratory Component: 1. Handle missing values and duplicate records in a given dataset by loading the dataset, identifying missing values, removing duplicate records and treating missing data using deletion techniques, statistical imputation methods (mean, median and mode), KNN imputation and iterative imputation using Python. 2. Perform feature selection on a given dataset using Recursive Feature Elimination (RFE) by ranking the features, identifying the most significant features and comparing the selected features with the original feature set using Python. 3. Apply KNN Imputation and Iterative Imputation techniques to treat missing values in a given dataset using Python.			
Case Study	A telecommunications company maintains customer demographic, service usage and billing data to analyse customer churn. The dataset contains missing values, duplicate records, outliers and irrelevant features. Perform data cleaning by handling missing values, removing duplicates and outliers, applying statistical, KNN and iterative imputation techniques. Use feature selection methods, including RFE, to identify the most significant features and summarize the impact of preprocessing on data quality.		
Text Book	Text Book 2: 5.3, 6.2, 7.2, 8.2, 9.2, 10.2, 11.3, 12.3, 13.3, 14.3, 15.2		
MODULE-4	**DATA TRANSFORMATION AND DIMENSIONALITY REDUCTION**	**24CSE51.3, 24CSE51.4**	**8 Hours**
Data Transforms: Scaling data source, min-max scalar and standard scaler, encode categorical data, Make Distributions More Gaussian, Approach for Numerical Data Distributions, Deriving new input variables. Dimensionality reduction: Techniques for Dimensionality Reduction, Linear Discriminant Analysis, PCA Dimensionality Reduction, SVD Dimensionality Reduction			
Laboratory Component: 1. Apply categorical data encoding techniques, including Label Encoding, Ordinal Encoding, One-Hot Encoding and Dummy Variable Encoding, to a dataset containing categorical attributes and analyze the resulting feature representations. 2. Perform dimensionality reduction using Principal Component Analysis (PCA) and compare the resulting feature representation with the original dataset. 3. Implement dimensionality reduction using Linear Discriminant Analysis (LDA) and Singular Value Decomposition (SVD) and analyze and compare the resulting feature representations using Python.			
Case Study	Investigate the impact of different data transformation techniques (scaling, encoding and distribution transformation) and dimensionality reduction methods (PCA, LDA and SVD) on a real-world dataset and compare the resulting feature representations in terms of dimensionality, interpretability and information retention.		
Text Book	Text Book 2: 17.3, 19.3, 20.2, 21.2, 22.2, 23.2, 27.4, 28.2, 29.2, 30.2		
MODULE-5	**ADVANCED TRANSFORMS AND MODEL BUILDING**	**24CSE51.4, 24CSE51.5, 24CSE51.6**	**8 Hours**
Transform Numerical and Categorical Data, Transform the Target in Regression, Save and Load Data Transforms, Introduction to regression - Simple Linear Regression, Steps in building a regression model, Estimation of Parameters Using Ordinary Least Squares, Validation of Simple Linear Regression Model, Multiple Linear Regression Model, Case studies using simple linear regression			

Laboratory Component:

1. Load a dataset containing both numerical and categorical attributes. Preprocess the dataset by transforming the numerical features into a standardized format and converting the categorical features into numerical representations. Display the transformed dataset suitable for machine learning applications.
2. Apply Simple Linear Regression on a given dataset by loading the data, building a regression model using one independent and one dependent variable, visualizing the regression line, and interpreting the relationship between the variables using Python.
3. Build and analyze a Multiple Linear Regression model on a given dataset by considering multiple independent variables, predicting the target variable, and interpreting the influence of input features using Python

Self-study	Case Study: Using an appropriate dataset, build Simple Linear Regression and Multiple Linear Regression models to analyze the impact of input variables on sales. Further, apply Binary Logistic Regression to classify customer purchase decisions or customer response categories. Compare the results obtained from the different models and summarize the key insights derived from the analysis.
Text Book	Text Book 1: 9.1, 9.3, 9.4, 9.5, 9.6, 10.3, 11.1, 11.2, Textbook 2: 24.2, 24.3, 24.4, 25.2, 25.3, 25.4, 26.2,26.3, 26.4

CIE Assessment Pattern (50 Marks – Theory and Lab) –

RBT Levels		Marks Distribution		
		Test (s)	AAT1	LAB
		25	05	20
L1	Remember	-	-	-
L2	Understand	-	-	-
L3	Apply	10	2	10
L4	Analyze	10	3	5
L5	Evaluate	5	-	5
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	-
L3	Apply	20
L4	Analyze	15
L5	Evaluate	15
L6	Create	-

Suggested Learning Resources:

Text Books:

1) "Business Analytics: The Science of Data-Driven Decision Making (2nd Edition)" U. Dinesh Kumar, Wiley India, 2021, ISBN: 9789354246197
2) Jason Brownlee, "Data Preparation for Machine Learning: Data Cleaning, Feature Selection, and Data Transforms in Python", Machine Learning Mastery, 2020. ISBN-13: 979-8468452240

Reference Books:

1) E. Fouda, Learn Data Science Using Python: A Quick-Start Guide. Berkeley, CA, USA: Apress, 2024. ISBN: 979-8-8688-0935-4
2) Andrew Park, "Data Science for Beginners", Eureka Online Ltd,2021. ISBN: 9781914167997

Web links and Video Lectures (e-Resources):

- **nptel.ac.in/courses/106106179**
- **https://nptel.ac.in/courses/106107220**
- **https://www.youtube.com/watch?v=V5fqShLVpoI**
- **https://media.ed.ac.uk/channel/Introduction+to+Predictive+Analytics+using+Python/117185481**
- **https://www.youtube.com/watch?v=GPVsHOlRBBI**
- **IBM SkillsBuild – Data Science Foundations Certification course IBM SkillsBuild Learning Catalog | Free AI, Cybersecurity, Data & Technology Courses**

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

- Case study discussions based on real-world applications
- Group activity for building regression models
- Problem-solving sessions using real dataset
- Student seminars on selected topics
- Quiz and interactive sessions for quick assessment and revision

DESIGN AND ANALYSIS OF ALGORITHMS			
Course Code	**24CSK52**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

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

24CSK52.1	Apply algorithmic design to solve simple to complex problems using various approaches for algorithm design
24CSK52.2	Analyze both brute force and divide-and-conquer design strategies to compute an algorithm's effectiveness in devising a solution.
24CSK52.3	Design and deploy from a variety of techniques to address searching and sorting challenges.
24CSK52.4	Examine both greedy and dynamic programming strategies for solving intricate problems
24CSK52.5	Evaluate backtracking and branch & bound methods for crafting solutions to real-time problems
24CSK52.6	Interpret the P, NP, and NP-complete complexity classes to scrutinize the constraints and boundaries of an algorithm's performance

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSK52.1	3	-	-	-	-	-	-	-	-	-	1	3	-
24CSK52.2	-	3	2	-	-	-	-	-	-	-	1	3	-
24CSK52.3	-	3	3	-	3	-	-	-	-	-	1	3	-
24CSK52.4	-	-	3	-	3	-	-	-	-	-	1	3	1
24CSK52.5	-	-	-	3	2	1	-	-	-	-	2	3	1
24CSK52.6	-	. -	-	3	-	1	-	-	-	-	2	2	1

MODULE-1	**Exploring Algorithms and Analyzing Function Growth**	**24CSK52.1**	**8 Hours**
Algorithm introduction, Fundamentals of Algorithmic problem solving, fundamentals of analysis of algorithm efficiency, analysis framework, Asymptotic notations, Important problem types, Mathematical Analysis of Recursive Algorithms-factorial function, Tower of Hanoi, Binary Recursion, and Mathematical Analysis of Non-Recursive Algorithms-Maximum Element, Element uniqueness problem.			
Self-study	Evaluate a real-world problem where the algorithm is applied and discuss its efficiency.		
Text Book	Text Book 2: 1.1,1.2,1.3,2.2,2.3,2.4		
MODULE-2	**Methods for Evaluating an Algorithm in order to Devise a Solution**	**24CSK52.2**	**8 Hours**
Brute Force String matching algorithms – Naive string matching, Rabin Karp Knuth Morris Pratt. Exhaustive Search, Travelling Salesman problem and Knapsack problem. Divide & Conquer: Merge Sort ,Quick sort, selection sort and their performance analysis.			
Case Study	Read the algorithm, write its pseudocode, implement and analyze its time and space complexity.		
Text Book	Text Book 1:32.1,32.2,32.4 Text Book 2: 3.4,4.1,4.2		
MODULE-3	**Exploring Search Algorithms and Balanced Trees**	**24CSK52.3**	**8 Hours**
Decrease and Conquer: Decrease by constant, Decrease by constant factor-Russian Peasant Multiplication, Fake-Coin Problem, variable size decrease- Breadth First search traversal, Depth First search traversal, Topological sorting. Transform & Conquer: AVL trees, Heap sort.			
Case Study	Solve a practical problem using the algorithm and compare it with alternative methods.		
Text Book	Text Book 2: 3.1, 3.3, 3.5, 3.7, 3.10		
MODULE-4	**Optimizing Algorithms for Efficient Problem Solving**	**24CSK52.4**	**8 Hours**
Greedy Technique: Job sequence with deadlines, Minimum Spanning tree algorithms – Kruskal's & Prim's, Shortest Path algorithm – Dijkstra's, Huffman Trees and codes, Dynamic Programming: 0/1 Knapsack problems, Warshall's Algorithm, Floyd's algorithm			
Case Study	Explore a case study on "Optimizing Algorithms for Efficient Problem Solving" in the context of job scheduling in a manufacturing facility.		
Text Book	Text Book 3: 4.1,4.2.4.4 Text Book 2:8.1,8.2,8.4,9.1,9.2,9.3,9.4		
MODULE-5	**Algorithmic Frontiers and Strategies**	**24CSK52.5, 24CSK52.6**	**8 Hours**

Backtracking: N Queens problem, subset sum problem, graph coloring, Hamiltonian Circuit Problem,Branch & Bound: Travelling Salesman problem, Assignment problem, Limitations of Algorithm Power: Decision Trees, Deterministic Polynomial (P), Non-Deterministic Polynomial (NP) , NP complete & NP Hard.

Self-study	Study reductions between NP-Complete problems and distinguish NP-Hard problems.
Text Book	Text Book 2: 12.1 to 12.10

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution		
		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	-	-	-
L2	Understand	-	-	-
L3	Apply	10	5	5
L4	Analyze	10	5	5
L5	Evaluate	5	5	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	-
L3	Apply	20
L4	Analyze	20
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Text Books:

1. Thomas H Cormen, Charles E Leiserson, Ronald R Rivest & Clifford Stein, "Introduction to Algorithms", fourth edition, 2022, MIT Press, ISBN:9780262367509.
2. Anany Levitin, "Introduction to the Design & Analysis of Algorithms", Third Edition, 2022, Pearson Education, ISBN: 978-9332585485.
3. Ellis Horowitz, Satraj Sahni and Rajasekaran, "Computer Algorithms/C++ ", fourth Edition, 2023, The Orient Blackswan, ISBN: 978-9386235145.

Reference Books:

1. Anuradha A. Puntambekar, "Analysis and Design of Algorithms", 2022, Technical Publications, ISBN: 978-9333223867.
2. Design and Analysis of Algorithms, S. Sridhar, 2023, Oxford University Press, ISBN: 9789354977886.

Web links and Video Lectures (e-Resources):

- **https://www.geeksforgeeks.org/c/c-program-for-rabin-karp-algorithm-for-pattern-searching**
- **https://www.geeksforgeeks.org/c/kmp-algorithm-for-pattern-searching-in-c**
- **https://www.geeksforgeeks.org/cpp/c-cpp-greedy-algorithms-programs**
- **https://www.geeksforgeeks.org/c/c-program-to-solve-the-0-1-knapsack-problem**
- **https://www.geeksforgeeks.org/c/c-program-for-n-queen-problem-backtracking-3**

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

- Algorithmic Problem-Solving Sessions: conducting regular problem-solving sessions where students work in groups to solve algorithmic problems from basic to advance to devise solutions collaboratively.
- Algorithm Visualization and Simulation: Practice interactive algorithm visualization and simulation tools to visually observe how algorithms work in real-time. Modify algorithms by changing the input parameters, and analyze the effects on algorithm performance. This approach promotes active engagement and allows to gain insights into algorithm behavior through experimentation.

DESIGN AND ANALYSIS OF ALGORITHMS LAB			
Course Code	**24CSLK52**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:

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

24CSLK52.1	Apply the divide-and-conquer design strategies to compute an algorithm's effectiveness in devising a solution. And string-matching problems through application of various algorithmic methods.
24CSLK52.2	Analyze decrease and conquer techniques to address graph traversal problems.
24CSLK52.3	Develop both greedy and dynamic programming strategies for solving intricate problems
24CSLK52.4	Implement backtracking and branch & bound methods for crafting solutions to real-time problems

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSLK52.1	3	-	-	-	1	-	-	-	1	-	1	3	-
24CSLK52.2	-	3	-	-	1	-	-	-	1	-	1	3	-
24CSLK52.3	-	-	3	-	1	-	-	-	1	-	1	3	-
24CSLK52.4	-	-	3	-	2	-	-	-	1	-	1	3	1

Pgm. No.	List of Programs	Hours	COs
	Prerequisite		
	Demo of programming language tool Installation with Simple Programs. Design, develop, and implement the specified algorithms for the following problems using programming language under LINUX /Windows environment.	2	NA
	PART-A		
1	Develop a program to perform string matching using the Rabin-Karp Algorithm.	2	24CSLK52.1
2	Examine the time complexity of Merge Sort through the application of the divide and conquer technique	2	24CSLK52.1
3	Examine the time complexity of Quick Sort employing the divide and conquer technique.	2	24CSLK52.1
4	Develop a program for implementing the heap sort algorithm.	2	24CSLK52.2
5	A. Implement the Breadth-First Search (BFS) algorithm to traverse a graph from a given source vertex. The algorithm should visit all vertices level by level using a queue and display the order of traversal. B. Implement the Depth-First Search (DFS) algorithm to traverse a graph from a given source vertex. The algorithm should visit vertices by exploring as far as possible along each branch before backtracking using recursion or a stack.	2	24CSLK52.2
6	Given a connected Graph of some number of vertices, develop a program to find Minimum Spanning Tree of graph by applying Kruskal's algorithm.		24CSLK52.3
	PART-B		
7	Design a program that utilizes Prim's Algorithm to determine the minimum cost spanning tree within a given graph. This algorithm systematically selects edges while ensuring that the resulting tree remains connected and has the lowest possible total edge weight	2	24CSLK52.3

8	Develop a program to find shortest paths from source vertex to other vertices in a weighted connected graph, using Dijkstra's algorithm.	2	24CSLK52.3
9	Develop a program to implement the 0/1 Knapsack problem using Dynamic Programming.	2	24CSLK52.3
10	Develop a program to (a) Implement All-Pairs Shortest Paths problem using Floyd's algorithm. (b) Find transitive closure of a graph using Warshall's algorithm.	2	24CSLK52.3
11	Write a program to color the nodes in the graph such that no two adjacent can have the same color using backtracking.	2	24CSLK52.4
12	Develop a comprehensive program that employs the Backtracking technique to solve the N Queens problem. This classic problem involves placing 'N' chess queens on an 'N x N' chessboard in such a way that no two queens threaten each other, ensuring that no queen can attack any other queen horizontally, vertically, or diagonally.	2	24CSLK52.4

PART-C
Beyond Syllabus Virtual Lab Content
(To be done during Lab but not to be included for CIE or SEE)

- **https://ds2-iiith.vlabs.ac.in/List%20of%20experiments.html**
- **https://daa-dei.vlabs.ac.in/exp/divide-conquer-sorting/html**
- **https://daa-dei.vlabs.ac.in/exp/greedy-coinchange/greehtml**
- **https://daa-dei.vlabs.ac.in/exp/dp-lcs/Dynamic Progra/html**

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	--	-
L2	Understand	--	-
L3	Apply	5	10
L4	Analyze	10	10
L5	Evaluate	5	10
L6	Create	--	--

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	--
L2	Understand	--
L3	Apply	20
L4	Analyze	20
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:
Reference Books:

1) Anany Levitin, "Introduction to the Design & Analysis of Algorithms", Third Edition, 2022, Pearson Education, ISBN: 978-9332585485.
2) Design and Analysis of Algorithms, S. Sridhar, 2023 Oxford University Press, ISBN: 9780198093695.

COMPUTER NETWORKS

Course Code	**24CSE53**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**3 hrs**

Course outcomes:

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

24CSE53.1	Understand communication principles, protocol architectures, transmission techniques, and transmission media selection in networking environments.
24CSE53.2	Apply framing methods, error control techniques, media access protocols, and data link control mechanisms for reliable data transmission
24CSE53.3	Analyze network addressing and routing solutions using IPv4/IPv6 mechanisms for efficient packet delivery.
24CSE53.4	Implement Internet services and application layer protocols for communication in computer networks.
24CSE53.5	Evaluate transport layer services, flow control, congestion control, and quality of service mechanisms in computer networks.
24CSE53.6	Interpret network security mechanisms and cryptographic techniques for securing data communication

Mapping of Course Outcomes to Program Outcomes and Program-Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSE53.1	-	-	-	-	-	-	-	-	-	-	1	3	-
24CSE53.2	3	-	-	-	-	-	-	-	-	-	1	3	-
24CSE53.3	-	3	-	-	-	-	-	-	-	-	1	3	-
24CSE53.4	-	-	3	3	-	-	-	-	-	-	1	3	1
24CSE53.5	-	-	3	3	-	1	-	-	2	-	2	3	1
24CSE53.6	-	-	-	3	-	1	-	-	-	-	2	2	1

MODULE-1	**INTRODUCTION TO DATA COMMUNICATION AND NETWORKING**	**24CSE53.1**	**8 Hours**

Data communication: Network Topologies-Components, Message, Data flow, Networks, Network Types, Protocol Layers, The OSI Model, TCP/IP Protocol suite, Analog and Digital Transmission, Multiplexing, Transmission media: guided and unguided.

Case study	WhatsApp Communication Architecture, Starlink Global Internet Connectivity
Text Book	Text Book 1: 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 2.4, 2.5, 2.6.

MODULE-2	**DATA LINK LAYER AND LOCAL AREA NETWORKS**	**24CSE53.2**	**8 Hours**

Data link control: Framing, Error detection and correction: Parity Checking, CRC, Checksum, Hamming, HDLC, Media access control protocols: Random Access Protocols -ALOHA, CSMA, CSMA/CD, CSMA/CA, Wired LANs: Standard Ethernet, Fast Ethernet, Wireless LAN: IEEE 802.11, Stop-and-Wait Protocol, Go-Back-N Protocol (GBN), Selective-Repeat Protocol

Application	Error Detection in Digital Payment Systems, LAN Infrastructure for Enterprise Networks
Text Book	Text Book 1: 3.2, 3.3, 4.1, 23.2

MODULE-3	**NETWORK LAYER AND ROUTING PROTOCOLS**	**24CSE53.3**	**8 Hours**

IPV4 Addressing: Classful and Classless Addressing, Subnetting, ARP, DHCP, NAT, IPV4 Datagram: Fragmentation, ICMPv4, IPV6 Addressing, IPV6 Datagram, ICMPv6 Messages. Routing algorithms: Distance vector routing, Link State routing, Path Vector Routing, Diffie-Hellman.

Self study	Software Defined Networking (SDN), Border Gateway Protocol (BGP) in the Internet
Text Book	Text Book 1: 7.4.1, 7.4.2, 7.4.4, 7.5.1, 7.5.3, 8.2. Text Book 2: 5.7.4, 8.9.2

MODULE-4	**TRANSPORT LAYER AND QUALITY OF SERVICE**	**24CSE53.4**	**8 Hours**

UDP: Datagram and Services, TCP: Service, Segment, Connection, Congestion, Congestion Control algorithms: Leaky Bucket and Token Bucket Algorithm, Quality of Service, Techniques to improve QoS : Scheduling, Traffic Shaping, Resource Reservation, Admission Control.

Self study	QUIC Protocol and HTTP/3, Network Congestion in Cloud Computing
Text Book	Text Book 1: 9.3, 9.4, 30.2.2

MODULE-5	APPLICATION LAYER AND SECURITY MECHANISMS	24CSE53.5,24CSE53.6	8 Hours

Domain Name Space, WWW, HTTP, FTP, Email, TELNET, Network Security and Cryptography: Symmetric and Asymmetric-Key Cyphers, Data Encryption Standard (DES), AES, RSA

Application	Cybersecurity Practices in Online Banking
Text Book	Text Book 1: 10.3, 13.2

CIE Assessment Pattern (50 Marks)

RBT Levels		Marks Distribution (50)		
		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	-	-	-
L2	Understand	-	-	-
L3	Apply	10	5	5
L4	Analyze	10	5	5
L5	Evaluate	5	5	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	-
L3	Apply	20
L4	Analyze	20
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Textbook:

1. Behrouz A. Forouzan, Data Communications and Networking with TCP/IP Protocol Suite, 6th Edition, McGraw-Hill Education, 2022, ISBN-13: 9780078022098
2. Andrew S. Tanenbaum, David J. Wetherall, and Nick Feamster: Computer Networks, 6th Edition, Pearson Education, 2022, ISBN-13: 9780136764052

Reference Books:

1. James Kurose and Keith Ross: Computer Networking: A Top-Down Approach, 9th Edition, Pearson Education, 2025. ISBN-13: 9780135429334
2. Behrouz A. Forouzan and Firouz Mosharraf: Computer Networks: A Top Down Approach, 1st Edition, McGraw Hill, 2023. ISBN-13: 9781266318245
3. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 6th Edition, Morgan Kaufmann (Elsevier), 2021. ISBN-13: 9780128182000
4. Irv Englander: The Architecture of Computer Hardware, Systems Software, and Networking: An Information Technology Approach, 6th Edition (Indian Adaptation), Wiley, 2024, ISBN-13: 978-9363868311

Web links and Video Lectures (e-Resources)

- https://nptel.ac.in/courses/106106003
- NPTEL Computer Networks Playlist (IIT Kharagpur)
- https://nptel.ac.in/courses/106105082
- https://www.ibm.com/docs/en/i/7.4?topic=cryptography-concepts
- NPTEL Computer Networks Playlist (IIT Kharagpur)
- Cisco Networking Academy Videos
- https://www.coursera.org/learn/computer-networking
- https://www.simplilearn.com/introduction-to-computer-networking-course-skillup
- https://web.mit.edu/2.993/www/index.html

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

- Network Detective Challenge, Network Failure Investigation, Build a Campus Wi-Fi Plan
- Design Your Dream Network, Internet Journey Mapping, Networking Debate
- Animations, Simulations

NETWORK SIMULATION LAB

Course Code	**24CSL53**	**CIE Marks**	**50**
L: T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**02**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:

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

24CSL53.1	Apply programming concepts to implement error detection, reliable data transmission, routing, congestion control, and cryptographic algorithms for computer network applications.
24CSL53.2	Analyze the performance of routing and network security algorithms through C program implementation.
24CSL53.3	Develop, simulate, and evaluate computer network models using network simulation tools to analyze protocol behavior and network performance
24CSL53.4	Implement network traffic analysis and protocol operations using packet capture tools for communication pattern interpretation and network diagnostics.

Mapping of Course Outcomes to Program Outcomes and Program-Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
24CSL53.1	3	-	-	-	1	-	-	-	1	-	1	3	-
24CSL53.2	-	3	-	-	1	-	-	-	1	-	1	3	-
24CSL53.3	-	-	3	-	1	-	-	-	1	-	1	3	-
24CSL53.4	-	-	3	-	2	-	-	-	1	-	1	3	1

Pgm. No.	**List of Programs**	**Hours**	**COs**
	Prerequisite		
	• Fundamentals of Computer Networks and Data Communication. • Basic C Programming skills. • Knowledge of TCP/IP, routing, flow control, and congestion control concepts. • Understanding of cryptography fundamentals. • Familiarity with Linux environment and basic networking tools.		NA
	PART-A		
1	Apply programming concepts to implement CRC-CCITT (16-bit) error-detection coding for generating and verify the CRC values in data transmission using C language.	2	24CSL53.1
2	Apply programming concepts to implement Go-Back-N and Selective Repeat sliding window protocols for reliable data communication using C language.	2	24CSL53.1
3	Analyze the Link State Routing Algorithm by developing C programs for shortest path calculation in computer networks	2	24CSL53.2
4	Analyze the Distance Vector Routing Algorithm by developing C programs for computing optimal routing paths in computer networks.	2	24CSL53.2
5	Analyze the Leaky Bucket Algorithm by developing C programs for network congestion management.	2	24CSL53.2
6	Analyze the RSA algorithm by implementing programs for data encryption and decryption	2	24CSL53.2
	PART-B		
7	Implement the Link State Routing Algorithm using NS2 and analyze the shortest-path selection between network nodes.	2	24CSL53.3
8	Implement a four-node point-to-point network in NS2 using duplex links and evaluate the impact of bandwidth and queue size on network performance.	2	24CSL53.3
9	Implement a four-node network in NS2 with links n0–n2, n1–n2, and n2–n3, apply TCP and UDP agents, and evaluate packet transmission performance.	2	24CSL53.3

10	Implement an Ethernet LAN using 6–10 nodes in NS2 and evaluate the impact of error rate and data rate on network throughput.	2	24CSL53.3
11	Simulate and analyze network traffic using Wireshark by capturing Ethernet frames, examining HTTP GET/POST interactions, and monitoring a bulk TCP data transfer between a local host and a remote server.	2	24CSL53.4
12	Simulate and analyze ICMP-based network communication using Wireshark by capturing and examining PING messages and Traceroute operations.	2	24CSL53.4

PART-C

Beyond Syllabus Virtual Lab Content

(To be done during Lab but not to be included for CIE or SEE)

- https://cn-iiith.vlabs.ac.in/List%20of%20experiments.html
- https://ns-amrt.vlabs.ac.in/List%20of%20experiments.html
- https://cn-iitr.vlabs.ac.in/List%20of%20experiments.html
- https://www.wireshark.org/docs/
- https://www.isi.edu/websites/nsnam/ns/

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		CIE	Weekly Evaluation
		20	**30**
L1	**Remember**	**-**	**-**
L2	**Understand**	**-**	**-**
L3	**Apply**	**10**	**10**
L4	**Analyze**	5	**10**
L5	**Evaluate**	**5**	**10**
L6	**Create**	**-**	**-**

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	**-**
L2	**Understand**	**-**
L3	**Apply**	**20**
L4	**Analyze**	**15**
L5	**Evaluate**	**15**
L6	**Create**	**-**

Suggested Learning Resources:

Reference Books:

1. Behrouz A. Forouzan, Data Communications and Networking with TCP/IP Protocol Suite, 6th Edition, McGraw-Hill Education, 2022.ISBN-13: 9780078022098

CLOUD NATIVE APPLICATION DEVELOPMENT			
Course Code	**24CSE54**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

24CSE54.1	Apply cloud computing principles through virtualization and service models.
24CSE54.2	Analyze Azure architecture and services for reliability and scalability.
24CSE54.3	Design and deploy applications using Azure compute and networking tools.
24CSE54.4	Implement secure cloud operations with identity, RBAC, monitoring, and backup.
24CSE54.5	Evaluate microservices and DevOps practices, and create CI/CD pipelines with Azure AI.
24CSE54.6	Create CI/CD pipelines and AI-enabled apps using Azure to demonstrate automation and innovation.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSE54.1	3	-	-	-	3	-	-	-	-	-	2	3	-
24CSE54.2	-	3	-	-	3	-	-	-	-	-	2	3	-
24CSE54.3	-	-	3	-	3	-	-	-	-	-	2	3	-
24CSE54.4	-	-	3	-	3	-	-	-	-	-	2	3	-
24CSE54.5	-	-	-	3	3	-	-	-	-	-	2	3	-
24CSE54.6	-	-	-	3	3	-	-	-	-	-	**2**	3	-

MODULE-1	**Cloud Computing Fundamentals**	**24CSE54.1**	**8 Hours**

Introduction to Cloud Computing, Cloud Characteristics, Cloud Service Models (Iaas, Paas, Saas), Deployment Models (Public, Private, Hybrid), Virtualization, Cloud Economics, Cloud Adoption.

Hands-on

1) Install and run VirtualBox: Create a Linux VM and explore virtualization basics.
2) Deploy and interact with three different cloud service models Iaas, Paas, Saas to understand their differences in control, responsibility, and ease of use.
3) Use Google Drive or OneDrive to compare SaaS features like file sharing and collaboration.

Case Study	Netflix Cloud Migration**:** How Netflix leveraged AWS for scalability and global content delivery.
Text Book	Text book 1: Ch. 1–3 Text book 2: Ch. 1

MODULE-2	**Microsoft Azure Fundamentals**	**24CSE54.2**	**8 Hours**

Azure Architecture, Azure Regions & Availability Zones, Azure Resource Manager, Azure Portal, Azure Virtual Machines, Azure Storage, Azure Networking Fundamentals.

Hands-on

1) Create a free Azure account and deploy a simple static website using Azure Storage.
2) Explore Azure Portal: Create a resource group, VM, and storage account.
3) Create a storage blob container and upload/download files to see persistence.

Case Study	GE Healthcare on Azure: Using Azure regions and availability zones to ensure healthcare data reliability.
Text Book	Text book 1: Ch. 4–6 Text Book 2: Ch. 2

MODULE-3	**Azure Compute & Networking Services**	**24CSE54.3**	**8 Hours**

Azure Appl Services, Azure Functions, Azure Virtual Networks, Load Balancer, DNS, VPN Gateway, Azure Containers, Storage Solutions.

Hands-on

1) Deploy a Node.js "How to spread harmony" app on Azure App Service.
2) Create an Azure Function that returns the current date/time when triggered.

3) Deploy a Python Flask "Welcome to Cloud Computing" app on Azure App Service.			
Case Study	Adobe Creative Cloud: Running services on Azure App Services and Functions for global creative tools.		
Text Book	Text book 1: Ch. 7–9 Text Book 2: Ch. 2–3		
MODULE-4	**Cloud Security & Management**	**24CSE54.4**	**8 Hours**
Identity & Access Management, Microsoft Entra ID (Azure AD), RBAC, Azure Monitor, Cost Management, Backup & Disaster Recovery, Azure Governance.			
Hands-on 1) Configure Azure Active Directory (Entra ID)**:**Create a user and assign RBAC roles. 2) Perform a backup and restore of a VM using Azure Backup. 3) Apply a resource lock to prevent accidental deletion of a storage account.			
Case Study	HSBC Bank: Implementing Identity & Access Management with Azure AD and RBAC for financial compliance.		
Text Book	Text book 1: Ch. 10–11 Text Book 2: Ch. 3		
MODULE-5	**Azure AI, Devops & Certification Readiness**	**24CSE54.5, 24CSE54.6**	**8 Hours**
Azure AI Services Overview, Azure DevOps Fundamentals, Infrastructure as Code Concepts, Cloud Best Practices, Cloud Migration Basics, AZ-900 Certification Readiness.			
Hands-on 1) Use Azure AI Translator: Translate a text file from English to Kannada. 2) Create a CI/CD pipeline in Azure DevOps : Deploy a simple Node.js app automatically. 3) Use Azure AI Vision to analyze an uploaded image (e.g., detect objects).			
Case Study	Microsoft Learn AZ-900 Prep: Real-world readiness examples for certification pathways.		
Text Book	Text book 1: Ch. 12–13 Text Book 2: Ch. 3–4		
Students will be required to: 1) Students form their own team for Project with 2 members. 2) Preparation of detailed design for the project. 3) Implementation of the sub-modules and their integration for their project. 4) Testing and validation. 5) Prepare and submit the project report and slides at the end of the semester exam.			

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test(s)	Certified Online Learning
		25	25
L1	Remember	-	-
L2	Understand	-	-
L3	Apply	10	10
L4	Analyze	5	5
L5	Evaluate	5	5
L6	Create	5	5

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	-
L3	Apply	20
L4	Analyze	15

L5	**Evaluate**	15	
L6	**Create**	-	

Text Books:

1) Cloud Computing: Theory and Practice (3rd Edition),Dan C. Marinescu, Morgan Kaufmann (Elsevier imprint), 2023**,** ISBN: 9780323852777**,** eBook ISBN**:** 9780323910477.

2) AZ-900 Microsoft Azure Fundamentals (3rd Edition), Jim Cheshire, Microsoft Press, 2022 (latest reprint 2023**),** ISBN: 9780137955145, eBook ISBN: 9780137955244.

Web links and Video Lectures (e-Resources):

- https://learn.microsoft.com/en-us/credentials/certifications/azure-fundamentals/?practice-assessment-type=certification
- Coursera | Online Courses From Top Universities. Join for Free
- Coursera | Online Courses From Top Universities. Join for Free
- nptel.ac.in/courses/106104182

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

- Case studies/Case lets
- Participatory & Industry-integrated learning
- Practical activities / problem solving exercises
- Participation in Seminars/ Workshop

RESEARCH METHODOLOGY AND IPR											
Course Code	**24RMK55**						**CIE Marks**				**50**
L: T: P: S	**1:0:0:0**						**SEE Marks**				**50**
Hours / Week	**01**						**Total Marks**				**100**
Credits	**01**						**Exam Hours**				**02**
Course outcomes: At the end of the course, the student will be able to:											
24RMK55.1	Define research problems and formulate research questions and research objectives.										
24RMK55.2	Demonstrate research processes, critical thinking, and academic writing skills.										
24RMK55.3	Understand the statutory provisions and different forms of Intellectual Property Rights (IPRs).										
24RMK55.4	Identify the significance and procedures of patents, including patent filing and protection.										
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:											
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
24RMK55.1	3	3	2	2	2	–	–	1	2	–	**2**
24RMK55.2	3	3	2	2	2	–	–	1	2	–	**2**
24RMK55.3	3	3	2	1	1	–	1	1	2	–	**2**
24RMK55.4	3	3	2	1	–	–	1	1	2	–	**2**
MODULE-1	**FORMULATION OF RESEARCH PROBLEM**							**24RMK55.1**			**3 Hours**
Research– Meaning and Objectives–Types of Research–Research Approaches-Research Process–Literature Review–Research Problem– Identification and Defining the Research Problem.											
Text Book	Text Book 1: Ch. 1, 2										
MODULE-2	**RESEARCH DESIGN PROCEDURES**							**24RMK55.2**			**3 Hours**
Meaning of Research Design – Features of a Good Design –Concepts Related to Research Design– Different Research Designs – Basic Principles of Experimental Designs.											
Case Study	To find the solution for the given research problem using different types of research methods										
Text Book	Text Book 1: Ch. 3										
MODULE-3	**INTERPRETATION AND REPORT WRITING**							**24RMK55.1 24RMK55.2**			**3 Hours**
Meaning and Technique of Interpretation – Precautions in interpretation – Different Steps in Report Writing – Layout of a Research Report– Types of Report – Mechanics of Writing a Research Report –Conclusion-Referencing in Academic Writing –Bibliography.											
Text Book	Text Book 2: Ch. 14										
MODULE-4	**INTRODUCTION TO IPR**							**24RMK55.3**			**3 Hours**
Introduction and Significance of Intellectual Property Rights –Types of Intellectual Property Rights–Rationale for Protection of IPR–IPR in India and Abroad–Forms of IPR – Royalty – Copyright – Trademark – Patents – Industrial Designs –Application of Different Forms of IPR– Future Aspects of IPR– Some Examples of IPR.											
Text Book	Text Book 2: Ch. 1 and 2										
MODULE-5	**BASICS OF PATENTS**							**24RMK55.3, 24RMK55.4**			**3 Hours**
Patents and its Basics – Patentable and Non-Patentable Inventions–Patent Application Process (National and International level) –Drafting and Filing a Patent –Types of Patent Applications–Patent Documents– Specification and Claims–Assignment, Licensing, Infringement–Different Layers of International Patent System											
Case Study	Analyze different domains of filed patents										
Text Book	Text Book 2: Ch. 1 and 2										
CIE Assessment Pattern (50 Marks – Theory)											

RBT Levels		Marks Distribution		
		Test (s)	Patent drafting	Review paper writing
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	-	-
L3	Apply	5	-	-
L4	Analyze	5	5	5
L5	Evaluate	5	5	5
L6	Create	-	5	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Text Books:

1) Kothari, C.R., Research Methodology: Methods and Techniques, New Age International, 2024, ISBN-9789389802559
2) Ramakrishna Chintakunta, A Text book of Intellectual Property rights, Blue Hill Publication, ASIN: B09T6YDB5N, 2022

Reference Books:

1) Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K, An Introduction to Research Methodology, RBSA Publishers. 2022, ISBN-13:978-8176111652
2) Ranjith Kumar, Research methodology, Saga publications,5th edition, 2024, ISBN- **9781529788785.**
3) Sinha, S.C. and Dhiman, A.K., Research Methodology, EssEss Publications. 2 volumes, 2022. ISBN: 81-7000-324-5(Vol-I), 81-7000-334-2 (Vol-II)
4) Asha Vijay Durafe, Dhanashree K. Toradmalle , Intellectual Property Rights, Dreamtech Press,2024, ISBN: **9789351195191.**

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=GSeeyJVD0JU
- https://www.youtube.com/watch?v=nv7MOoHMM2k
- https://www.youtube.com/watch?v=BGSgZ1J8-yQ
- https://onlinecourses.nptel.ac.in/noc22_ge08/preview
- https://www.coursera.org/learn/research-methods
- https://www.wipo.int/academy/en/

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

- Video Sessions
- Organizing Group Wise Discussions
- Paper Presentation
- Review paper writing
- Patent drafting

PROBLEM SOLVING METHODOLOGIES			
Course Code	**24SDK56**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**-**
Hrs / Week	**2**	**Total Marks**	**50**
Credits	**1**	**Exam Hours**	**02**

Course outcomes:
Upon successful completion of this course, the student will be able to:

24SDK56.1	Demonstrate proficiency in solving quantitative aptitude problems using fundamental concepts
24SDK56.2	Apply advanced quantitative techniques to address and solve complex real-world problems.
24SDK56.3	Develop and enhance logical reasoning skills essential for problem-solving in various competitive examinations.
24SDK56.4	Cultivate critical and creative thinking skills necessary for analytical reasoning and problem-solving.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
24SDK56.1	3	3	-	-	2	-	-	-	-	-	-
24SDK56.2	3	3	-	-	2	-	-	-	-	-	-
24SDK56.3	3	3	-	-	2	-	-	-	-	-	-
24SDK56.4	3	3	-	-	2	-	-	-	-	-	-

MODULE-1	**Critical Thinking through Quantitative Analysis**	**24SDK56.1 24SDK56.2**	**6 Hours**

Number systems: LCM and HCF of numbers, Squaring and Cubing Techniques, Multiplication Tricks, Divisibility rules, Digit sum method, Speed Math, Simplifications, Approximations.

Percentages: Conversion of Fraction to Percentage Table, Percentage Change, Net percentage change/Effective percentage change, Successive Percentage, Concept of more/less percentage, Percentage of percentage, Product constancy, Increased/decreased by P%, Percentage Changes in Numerator and Denominator, Successive Percentage.

Averages: Basic concept, Consecutive Numbers, Non-Consecutive Numbers, Equation Concept, True/False concept, Including/Excluding concept, Replacement concept, Average Speed concept.

MODULE-2	**Numerical Techniques for Problem Solving**	**24SDK56.1 24SDK56.2**	**6 Hours**

Profit and Loss: Basic concept, Profit Percentage, Loss Percentage, Profit/Loss Percentage, Overall Profit/Loss, Dishonest shopkeeper, More/less loss concept, Discounts

Ratio and Proportion: Concept Explanation, Duplicate Ratio, Triplicate Ratio, Direct Proportion, Indirect Proportion, Double rule of three or compound proportion, Ratio in investment, Ratio in partnership, Ratio in averages, Ratio in profit and loss, Ratio in interest rates.

Ages: Ratio and sum of ages, Ratio and Product of Ages, Ratio of Present and Future Ages, Ratio of Past and Present Ages.

Partnership: Simple Partnership, Compound Partnership, Partnership at Will, Partnership for a Fixed Term, Particular Partnership, General Partnership, Limited Partnership, Limited Liability Partnership.

MODULE-3	Quantitative Techniques	24SDK56.1 24SDK56.2	6 Hours

Time and Work: Unit work, Combined work, Individual efficiency, Group efficiencies, Time taken by an individual or a group, Work done by an individual or a group, Total work done, Chain Rule Concept, Pipes and Cisterns, 4 Rules of Pipes and Cistern.

Gamification: Switch Grid, Geo Sudoku, Grid Lock, Number Challenge, Cognitive reasoning games.

Cognitive Ability: Statements & Conclusions, Statements & Assertions, Statements & Assumptions, Causes & Effects and Flow Charts.

MODULE-4	Analytical Reasoning and Creative Problem Solving	24SDK56.3 24SDK56.4	6 Hours

Number Series - Missing numbers, Incomplete series - Odd-even series, primes, Fibonacci series, Arithmetic progression, Geometric progression, Harmonic progression, Squares and cubes, Operations on digits, Exponential series, Increasing multiplication, Hybrid series.

Alphabetical Series- Missing alphabets, incomplete letter series - series of words, series of letters, arrangement of words/letters, letters marked with corresponding numbers sequence, positions of letters, ranking of the word in dictionary; Mixed Series - Missing numbers and words/letters, complete the series. **Analogies:** Alphabet Classification, Word Classification, Number Classification.

Coding and Decoding: Coding based on order, Letter to Letter Mapping, Letter to number mapping, Letter to digit mapping, Re-ordering sequences; Word sequencing, Match the word to code, Symbol Coding.

MODULE-5	Problem Solving through Logical Analysis	24SDK56.3 24SDK56.4	6 Hours

Directions: Eight Directions, Distance, Displacement, Starting and ending points, Referential directions, Directions of shadows, Axis based problems, Actual and conditional directions.

Seating Arrangements: Linear arrangement, Square Arrangement, Rectangular Arrangement, Circular arrangement, Vertical arrangement, Seating arrangement in a photograph, Tabular arrangement, Hexagonal Seating Arrangement, Complex arrangement, Miscellaneous arrangements.

Blood Relations: Relations defined, Generation Verticals, Family Tree, Single Person Blood Relations, Mixed/Chain Blood Relations, Symbol based Blood Relation.

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution
		Tests
		50
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	10
L5	Evaluate	-
L6	Create	-

Suggested Learning Resources:

Text Books:

1. Quantitative Aptitude for Competitive Examinations — R.S. Aggarwal
2. How to Prepare for Quantitative Aptitude for CAT — Arun Sharma

Reference Books:

1. Quantum CAT — Sarvesh K. Verma
2. Fast Track Objective Arithmetic — Rajesh Verma
3. Quantitative Aptitude for Placements — Dinesh Khattar

Web links and Video Lectures (e-Resources):

- Freshersworld: Aptitude & Reasoning
  https://www.youtube.com/results?search_query=Freshersworld+Aptitude+Reasoning
- Adda24/7: Aptitude & Reasoning
  https://www.youtube.com/results?search_query=Adda247+Quantitative+Aptitude+Reasoning

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

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Activity	Aptitude Topic	Description
Math Relay Race	Percentages, Profit & Loss, Time & Work	• Divide students into teams. Each student sol one question and passes the sheet to the next teammate. The first team to finish with the most correct answers wins.
Puzzle & Seating Challenge	Seating Arrangements, Logical Reasoning	• Give each team a seating arrangement or log puzzle. Teams compete to solve it within a fixed tim
DI Detective	Data Interpretation	• Provide charts, graphs, or tables. Students answer questions individually or in groups, explain how they arrived at their answers.
Human Number Line	Number System, Averages, Ratio & Proportion	• Students hold number cards and physically arrange themselves to solve ordering, averages, rat or sequence-based problems.
Aptitude Quiz Bowl	Mixed Aptitude Topics	• Conduct a quiz with multiple rounds (MCQs, rapid fire, visual reasoning, puzzles, and calculation challenges). Award points to teams and maintain a leaderboard.

SOCIETAL BASED MINI PROJECT

Course Code	**24CSE57**	**CIE Marks**	**50**
L: T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**02**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:

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

24CSE57.1	Identify suitable problem statements and its requirements, with the use of technical knowledge gained.
24CSE57.2	Analyse a comprehensive project plan, outlining tasks, timelines, and resource allocation.
24CSE57.3	Develop a system architecture and design that aligns with project goals.
24CSE57.4	Apply programming skills to transform design into a functional software solution
24CSE57.5	Develop and execute a rigorous testing strategy to identify and rectify bugs and issues
24CSE57.6	Demonstrate their communication skill effectively with technical oral presentation and well-structured documents.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
24CSE57.1	3	3	3	3	-	-	-	-	3	3	3	3	3
24CSE57.2	3	3	3	3	-	2	2	2	3	3	3	3	3
24CSE57.3	3	3	3	3	3	-	-	-	3	3	3	3	3
24CSE57.4	3	3	3	3	3	-	-	-	3	3	3	3	3
24CSE57.5	3	3	3	3	3	-	-	-	3	3	3	3	3
24CSE57.6	-	-	-	3	3	2	2	2	3	3	3	3	3

Societal Based Mini Project Roadmap: Guiding Principles for Mini Project Success

Project Overview:

- Clearly define the project's scope, objectives, and expected outcomes.
- Provide a brief description of the problem the project aims to solve or the functionality it should implement.

Project Milestones:

- Set clear project milestones and deadlines for various phases, such as planning, design, implementation, testing, and presentation.

Project Requirements:

- List the specific features or functionality that students need to implement in their projects.
- Clearly state any constraints or limitations they should be aware of during development.

Technology Stack for Development:

- Specify the programming languages, frameworks, libraries, and tools that students should use for the project.
- Ensure that the technology stack aligns with the learning goals and skills you intend for students to develop.

Testing and Quality Assurance:

- Incorporate testing practices into their development process.
- Specify the types of testing (e.g., unit testing, integration testing)

Collaboration and Communication:

- If the project involves teamwork, outline expectations for collaboration, including communication channels and responsibilities within the team.

Documentation:

- Emphasize the importance of thorough documentation throughout the project.
- Require students to maintain documentation for code, design, and usage instructions.

Presentation:

- Require students to present their projects to the class, explaining their design choices, challenges faced, and how they overcame them.

Note: Students can choose any known platform and domain knowledge studied and gained in their previous semester for doing their Mini Project.

CIE Assessment Pattern (50 Marks)

RBT Levels		Periodical Reviews and Evaluation
		50
L1	Remember	-
L2	Understand	05
L3	Apply	15
L4	Analyze	10
L5	Evaluate	10
L6	Create	10

SEE Assessment Pattern (50 Marks)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	05
L3	Apply	15
L4	Analyze	10
L5	Evaluate	10
L6	Create	10

Suggested Learning Resources:

Text Books:

1. Smith, J. A., & Johnson, P. R. (2020), Software Project Management: A Comprehensive Guide (3rd ed.). Acme Publishing. ISBN: 123-456-7890.
2. Johnson, L. M., & Brown, A. S. (2021), Modern Software Project Management: Strategies and Best Practices. Tech Knowledge Publishers.

Reference Books:

1. McConnell, S. (2021), Software Project Survival Guide (2nd ed.). Microsoft Press.
2. Schwalbe, K. (2022), Information Technology Project Management (9th ed.). Cengage Learning

Web links and Video Lectures (e-Resources):

- GitHub: GitHub is a platform for software development that hosts millions of open-source projects. You can explore projects, read their documentation, and gain insights into various software development ideas and practices. https://github.com/
- Dev.to: Dev.to is a community-driven platform for developers. It features articles, discussions, and posts on various software development ideas, best practices, and emerging trends. https://dev.to/
- Hacker Rank Blog: Hacker Rank's blog contains articles and insights on coding challenges, data structures, algorithms, and software development topics. https://www.hackerrank.com/blog
- Medium: Medium is a platform where many software developers share their thoughts, experiences, and project ideas. You can find a wide range of articles on software development.
- edX: edX offers video courses on software development, including topics like web development, mobile app development, and more. https://www.edx.org/
- Coursera: Coursera hosts video lectures and courses on a variety of software development subjects. You can explore courses from top universities and institutions. https://www.coursera.org/
- MIT Open Courseware: MIT provides free access to video lectures and course materials on computer science and software development. You can find lectures on various programming concepts and project ideas. https://ocw.mit.edu/index.htm
- Google Developers YouTube Channel: Google Developers offers video content on various software development topics, including APIs, web development, and mobile app development. https://www.youtube.com/user/GoogleDevelopers.

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

These challenging mini project activities can provide students with opportunities to think critically, apply their knowledge, and develop problem-solving skills in a practical context.

Interdisciplinary Projects:

- Encourage collaboration among students from different disciplines to work on projects that require diverse expertise.

Prototype Development:

- Challenge students to create a functional prototype of a product, software, or device.

Simulation and Modelling:

- Task students with creating computer simulations or mathematical models to solve complex problems or simulate real-world scenarios.

Humanitarian and Social Impact Projects:

- Challenge students to develop projects that address social or humanitarian issues, such as providing clean water solutions, designing low-cost healthcare devices, or improving education in underserved communities.

Advanced Coding and Software Development:

- Assign complex software development projects that involve advanced programming, algorithms, and data structures.

Environmental Sustainability Projects:

- Challenge students to propose and implement sustainability initiatives or renewable energy projects.

Crisis Response and Disaster Management:

- Have students create plans and systems for responding to emergencies or natural disasters.

Scientific Research Projects:

- Assign students to conduct scientific research experiments, gather data, and present findings**.**

NATIONAL SERVICE SCHEME			
Course Code	**24NSS50**	**CIE Marks (each Semester)**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**--**
Hrs / Week	**2**	**Total Marks**	**50 x 4 = 200**
Credits	**00**	**Exam Hours**	**02**

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

24NSS50.1	Understand the importance of his / her responsibilities towards society.
24NSS50.2	Analyse the environmental and societal problems/issues and will be able to design solutions for the same.
24NSS50.3	Evaluate the existing system and to propose practical solutions for the same for sustainable development. Implement government or self-driven projects effectively in the field.
24NSS50.4	Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
24NSS50.1	-	-	-	-	-	3	3	2	-	-	1
24NSS50.2	-	-	-	-	-	3	3	2	-	-	1
24NSS50.3	-	-	-	-	-	3	3	2	-	-	1
24NSS50.4	-	-	-	-	-	3	3	2	-	-	1

Semester/ Course Code	CONTENT	COs	HOURS
3RD 24NSS30	1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing 2. Waste management–Public, Private and Govt organization, 5R's. 3. Setting of the information imparting club for women leading to contribution in social and economic issues.	24NSS30.1, 24NSS30.2, 24NSS30.3, 24NSS30.4	30 HRS
4TH 24NSS40	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.	24NSS40.1, 24NSS40.2, 24NSS40.3, 24NSS40.4	30 HRS
5TH 24NSS50	7. Developing Sustainable Water management system for rural areas and implementationapproaches. 8. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill developmentprograms etc. 9. Spreading public awareness under rural outreach programs. (minimum 5 programs).	24NSS50.1, 24NSS50.2, 24NSS50.3, 24NSS50.4	30 HRS
6TH 24NSS60	10. Organize National integration and social harmony events / workshops / seminars. (Minimum TWO programs). 11. Govt. school Rejuvenation and helping them to achieve good infrastructure.	24NSS60.1, 24NSS60.2, 24NSS60.3, 24NSS60.4	30 HRS

CIE Assessment Pattern (50 Marks – Activity based) –

CIE component for every semester	Marks
Presentation - 1 Selection of topic, PHASE - 1	10
Commencement of activity and its progress -	10

PHASE - 2	
Case study-based Assessment Individual performance	10
Sector wise study and its consolidation	10
Video based seminar for 10 minutes by each student at the end of semester with Report.	10
Total marks for the course in each semester	**50**

- 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.

Suggested Learning Resources:

Reference Books:

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.

Pre-requisites to take this Course:

1. Students should have a service-oriented mindset and social concern.
2. Students should have dedication to work at any remote place, anytime with available resources and proper time management for the other works.
3. Students should be ready to sacrifice some of the time and wishes to achieve service-oriented targets on time.

Pedagogy:

- 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.
- State the need for NSS activities and its present relevance in the society and provide real-life examples.
- Support and guide the students for self-planned activities.
- NSS coordinator will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
- Encourage the students for group work to improve their creative and analytical skills.

Plan of Action:

- 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.
- At the end of every semester, activity report should be submitted for evaluation.
- Practice Session Description:
    - Lecture session by NSS Officer
    - Students Presentation on Topics
    - Presentation - 1, Selection of topic, PHASE – 1
    - Commencement of activity and its progress - PHASE – 2
    - Execution of Activity
    - Case study-based Assessment, Individual performance
    - Sector/ Team wise study and its consolidation
    - Video based seminar for 10 minutes by each student at the end of semester with Report.

Sl No	Topic	Groupsize	Location	Activity execution	Reporting	Evaluation of the Topic
1.	Organic farming, IndianAgriculture (Past, Present and Future) Connectivity for marketing.	May be individual or team	Farmers land/Villages/ roadside / Community area / College campus	Site selection /proper consultation/ Continuous monitoring/ Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
2.	Waste management– Public, Private and Govtorganization, 5 R's.	May be individual or team	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	Site selection /proper consultation/ Continuous monitoring/ Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
3.	Setting of the information imparting club for women leading to contributionin social and economic issues.	May be individual or team	Women empowerment groups/ Consulting NGOs & Govt Teams / College campus	Group selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
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	site selection / proper consultation/ Continuous monitoring/ Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
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	Group selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
6.	Helping local schools toachieve good results and enhance their enrolment in Higher/ technical/ vocational education.	May be individual or team	Local government / private/ aided schools/Government Schemes officers	School selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

7.	Developing SustainableWater management system for rural areas and implementation approaches.	May be individual or team	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	site selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
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	Group selection/proper consultation/ Continuous monitoring / Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
9.	Spreading public awareness under ruraloutreach programs. (minimum5 programs)	May be individual or team	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/proper consultation/ Continuous monitoring / Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
10.	Organize National integration and socialharmony events / workshops / seminars. (Minimum 02 programs).	May be individual or team	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	Place selection/proper consultation/ Continuous monitoring / Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
11.	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	Place selection/proper consultation/ Continuous monitoring / Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

PHYSICAL EDUCATION AND SPORTS			
Course Code	**24PED50**	**CIE Marks (each semester)**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**--**
Hrs / Week	**2**	**Total Marks**	**50 x 4= 200**
Credits	**00**	**Exam Hours**	**02**

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

24PED50.1	Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness
24PED50.2	Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle
24PED50.3	Perform in the selected sports or athletics of student's choice and participate in the competition at regional/state / national / international levels.
24PED50.4	Understand the roles and responsibilities of organization and administration of sports and games

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
24PED50.1	-	-	-	-	-	2	-	3	3	-	-	2
24PED50.2	-	-	-	-	-	2	-	3	3	-	-	2
24PED50.3	-	-	-	-	-	2	-	3	3	-	-	2
24PED50.4	-	-	-	-	-	2	-	3	3	-	-	2

Semester	CONTENT	COs	HOURS
3RD 24PED30	**Module 1: Orientation** A. Lifestyle, B. Fitness C. Food & Nutrition D. Health & Wellness E. Pre-Fitness test.	24PED30.1 24PED30.2	5 HRS
	Module 2: General Fitness & Components of Fitness A. Warming up (Free Hand exercises) B. Strength – Push-up / Pull-ups C. Speed – 30 Mtr Dash D. Agility – Shuttle Run E. Flexibility – Sit and Reach F. Cardiovascular Endurance – Harvard step Test	24PED30.2 24PED30.3	15 HRS
	Module 3: Recreational Activities A. Postural deformities. B. Stress management. C. Aerobics. D. Traditional Games.	24PED30.3 24PED30.4	10 HRS
4TH 24PED40	**Module 1: Ethics and Moral Values** A. Ethics in Sports B. Moral Values in Sports and Games	24PED40.1 24PED40.2	5 HRS
	Module 2: Specific Games (Anyone to be selected by the student) A. Volleyball – Attack, Block, Service, Upper Hand Pass and Lower hand Pass. B. Throwball – Service, Receive, Spin attack, Net Drop & Jump throw. C. Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus. D. Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up. E. Table Tennis – Service (Fore Hand & Back Hand), Receive (Fore Hand & Back Hand), Smash.	24PED40.3	20 HRS

	F. Athletics (Track / Field Events) – Any event as per availability of Ground.		
	Module 3: Role of Organization and administration	24PED40.4	5 HRS
5TH 24PED50	**Fitness Components:** Meaning and Importance, Fit India Movement, Definition of fitness, Components of fitness, Benefits of fitness, Types of fitness and Fitness tips. **Practical Components:** Speed, Strength, Endurance, Flexibility, and Agility **Athletics**: 1. Track -Sprints: • Starting Techniques: Standing start and Crouch start (its variations) use of Starting Block. • Acceleration with proper running techniques. • Finishing technique: Run Through, Forward Lunging and Shoulder Shrug. 2. Jumps- Long Jump: Approach Run, Take-off, Flight in the air (Hang Style/Hitch Kick)and Landing 3. Throws- Shot Put: Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O'Brien Technique) **Handball OR Ball Badminton** **Handball:** A. Fundamental Skills 1. Catching, Throwing and Ball control, 2. Goal Throws: Jumpshot, Centershot, Diveshot, Reverseshot. 3. Dribbling: High and low. 4. Attack and counter attack, simple counter attack, counter attack from two wings and center. 5. Blocking, Goal Keeping and Defensive skills. 6. Game practice with application of Rules and Regulations. B. Rules and their interpretations and duties of officials **Ball badminton:** A. Fundamental Skills 1. Basic Knowledge: Various parts of the Racket and Grip. 2. Service: Short service, Long service, Long-high service. 3. Shots: Overhead shot, Defensive clearshot, Attacking clearshot, Dropshot, Netshot, Smash. 4. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials.	24PED50.1 24PED50.2 24PED50.3 24PED50.4	Total 30 Hrs/ Semester 2 Hrs/week
6TH 24PED60	**Athletics**: 1. Track -110 Mtrs and 400Mtrs: • Hurdling Technique: Lead leg Technique, Trail leg Technique, Side Hurdling, Over the Hurdles • Crouch start (its variations) use of Starting Block. • Approach to First Hurdles, In Between Hurdles, Last Hurdles to Finishing. 2. Jumps- High jump: Approach Run, Take-off, Bar Clearance (Straddle) and Landing. 3. Throws- Discus Throw: Holding the Discus, Initial Stance Primary Swi	24PED60.1 24PED60.2 24PED60.3 24PED60.4	Total 30 Hrs/ Semester 2 Hrs/week

	Release and Recovery (Rotation in the circle). **Football OR Hockey** **Football:** A. Fundamental Skills 1. Kicking: Kicking the ball with inside of the foot, Kicking the ball with Full Instep of the foot, Kicking the ball with Inner Instep of the foot, Kicking the ball with Outer Instep of the foot and Lofted Kick. 2. Trapping: Trapping- the Rolling ball, and the Bouncing ball with sole of the foot. 3. Dribbling: Dribbling the ball with Instep of the foot, Dribbling the ball with Inner and Outer Instep of the foot. 4. Heading: In standing, running and jumping condition. 5. Throw-in: Standing throw-in and Running throw-in. 6. Feinting: With the lower limb and upper part of the body. 7. Tackling: Simple Tackling, Slide Tackling. 8. Goal Keeping: Collection of Ball, Ball clearance-kicking, throwing and deflecting. 9. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials. **Hockey:** A. Fundamental Skills 1. Passing: Short pass, Longpass, pushpass, hit 2. Trapping. 3. Dribbling and Dozing 4. Penalty stroke practice. 5. Penalty corner practice. 6. Tackling: Simple Tackling, Slide Tackling. 7. Goal Keeping, Ball clearance- kicking, and deflecting. 8. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials		

CIE Assessment Pattern (50 Marks – Practical) –

CIE to be evaluated every semester end based on practical demonstration of Sports and Athletics activities learnt in the semester.

CIE	Marks
Participation of student in all the modules	10
Quizzes – 2, each of 7.5 marks	15
Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	25
Total	**50**

Suggested Learning Resources:

Reference Books:

1. Saha, A.K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
2. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata.
3. Petipus, et.al., Athlete's Guide to Career Planning, Human Kinetics.
4. Dharma, P.N. Fundamentals of Track and Field, Khel Sahitya Kendra, New Delhi.
5. Jain, R. Play and Learn Cricket, Khel Sahitya Kendra, New Delhi.

6. Vivek Thani, Coaching Cricket, Khel Sahitya Kendra, New Delhi.
7. Saha, A.K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
8. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata
9. Naveen Jain, Play and Learn Basketball, Khel Sahitya Kendra, New Delhi.
10. Dubey H.C., Basketball, Discovery Publishing House, New Delhi.
11. Rachana Jain, Teach Yourself Basketball, Sports Publication.
12. Jack Nagle, Power Pattern Offences for Winning basketball, Parker Publishing Co., New York.
13. Renu Jain, Play and Learn Basketball, Khel Sahitya Kendra, New Delhi.
14. SallyKus, Coaching Volleyball Successfully, Human Kinetics.

YOGA			
Course Code	**24YOG50**	**CIE Marks**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**--**
Hrs / Week	**2**	**Total Marks**	**50 x 4 = 200**
Credits	**00**	**Exam Hours**	**02**

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

24YOG50.1	Understanding the origin, history, aim and objectives of Yoga
24YOG50.2	Become familiar with an authentic foundation of Yogic practices
24YOG50.3	Practice different Yogic methods such as Suryanamaskara, Pranayama and some of the Shat
24YOG50.4	Use the teachings of Patanjali in daily life.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
24YOG50.1	-	-	-	-	-	3	-	-	-	-	1
24YOG50.2	-	-	-	-	-	3	-	-	-	-	1
24YOG50.3	-	-	-	-	-	3	-	-	-	-	1
24YOG50.4	-	-	-	-	-	3	-	-	-	-	1

Semester / Course Code	CONTENT	COs	HOURS
3rd 24YOG30	**Introduction of Yoga:** Aim and Objectives of yoga, Prayer: Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, importance of prayer **Brief introduction of yogic practices for common man:** Yogic practices for common man to promote positive health **Rules and regulations:** Rules to be followed during yogic practices by practitioner **Misconceptions of yoga:** Yoga its misconceptions, Difference between yogic and non-yogic practices. **Suryanamaskara:** 1. Suryanamaskar prayer and its meaning, Need, importance and b of Suryanamaskar. 2. Suryanamaskar 12 count,2rounds **Different types of Asanas**: 1. Sitting: Padmasana, Vajrasana, Sukhasana 2. Standing: Vrikshana, Trikonasana, Ardhakati Chakrasana 3. Prone line: Bhujangasana, Shalabhasana 4. Supineline: Utthitadvipadasana, Ardhahalasana, Halasana	24YOG30.1, 24YOG30.2, 24YOG30.3, 24YOG30.4	Total 30 Hrs/ Semester 2 Hrs/week
4TH 24YOG40	**Suryanamaskara:** Suryanamaskar 12 count,4rounds **Brief introduction and importance of:** **Kapalabhati:** Revision of Kapalabhati -40strokes/min3rounds **Different types of Asanas**: 1. Sitting: Paschimottanasana, Ardha Ushtrasana, Vakrasana, Aakarna Dhanurasana 2. Standing: Parshva Chakrasana, Urdhva Hastothanasana, Hastapadasana 3. Prone line: Dhanurasana 4. Supine line: Karna Peedasana, Sarvangasana, Chakraasana **Patanjali's Ashtanga Yoga**: Asana, Pranayama **Pranayama:** Chandra Bhedana, Nadishodhana, Surya Bhedana	24YOG40.1, 24YOG40.2, 24YOG40.3, 24YOG40.4	Total 30 Hrs/ Semester 2 Hrs/week

5TH 24YOG50	**Kapalabhati:** Revision of Kapalabhati - 60strokes/min3rounds **Brief introduction and importance of:** **Different types of Asanas**: 1. Sitting: Yogamudra in Padmasana, Vibhakta Paschimottanasana, Yogamudra in Vajrasana 2. Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana 3. Prone line: Padangushtha Dhanurasana, Poorna Bhujangasana / Rajakapotasana 4. Supine line: Navasana/Noukasana, Pavanamuktasana, Sarvanga **Patanjali's Ashtanga Yoga**: Pratyahara, Dharana **Pranayama:** Ujjayi, Sheetali, Sheektari	24YOG50.1, 24YOG50.2, 24YOG50.3, 24YOG50.4	Total 30 Hrs/ Semester 2 Hrs/week
6TH 24YOG60	**Kapalabhati:** Revision of Kapalabhati – 80 strokes/min3rounds **Brief introduction and importance of:** **Different types of Asanas**: 1. Sitting: Bakasana, Hanumanasana, Ekapada Rajakapotasana 2. Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana 3. Supine line: Setubandhasana, Shavasanaa (Relaxation posture) 4. Balancing: Sheershasana **Patanjali's AshtangaYoga**: Dhyana (Meditation), Samadhi **Pranayama:** Bhastrika, Bhramari, Ujjai **Shat Kriyas:** Jalaneti and sutraneti, Sheetkarma Kapalabhati	24YOG60.1, 24YOG60.2, 24YOG60.3, 24YOG60.4	Total 30 Hrs/ Semester 2 Hrs/week

CIE Assessment Pattern (50 Marks – Practical)

CIE to be evaluated every semester based on practical demonstration of Yogasana learnt in the semester and internal tests (objective type)

CIE	Marks
Avg of Test 1 and Test 2	25
Demonstration of Yogasana	25
Total	**50**

Suggested Learning Resources:

Reference Books:

1. Swami Kuvulyananda: Asma (Kavalyadhama, Lonavala)
2. Tiwari, O P: Asana Why and How
3. Ajitkumar: Yoga Pravesha (Kannada)
4. Swami Satyananda Saraswati: Asana Pranayama, Mudra, Bandha (Bihar School of yoga, Munger)
5. Swami Satyananda Saraswati: Surya Namaskar (Bihar School of yoga, Munger)
6. Nagendra H R: The art and science of Pranayama
7. Tiruka: Shatkriyegalu (Kannada)
8. Iyengar B K S: Yoga Pradipika (Kannada)
9. Iyengar B K S: Light on Yoga (English)

Web links and Video Lectures (e-Resources):

- https://youtu.be/KB-TYlgd1wE
- https://youtu.be/aa-TG0Wg1Ls

Sixth Semester Syllabus

FULL STACK TECHNOLOGIES			
Course Code	**24CSE61**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

24CSE61.1	Understand the concepts of Full Stack Development, web architecture, MVC framework and different technology stacks used for modern web applications
24CSE61.2	Apply Node.js, Express framework and MongoDB concepts to implement server-side web applications through routing, middleware, RESTful APIs and database integration
24CSE61.3	Analyze React-based single-page applications using components, state management, routing, forms and reusable user interface components
24CSE61.4	Design secure and scalable MERN stack solutions using authentication, authorization, advanced database operations, modular architecture and deployment strategies.
24CSE61.5	Evaluate MERN stack solutions developed using React, Express, Node.js, MongoDB, modular architecture and server rendering for modern web applications.
24CSE61.6	Implement advanced MERN stack features such as ESLint configuration, Webpack, MongoDB aggregation, pagination, search and deployment

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
24CSE61.1	-	-	-	-	-	-	-	-	-	-	-	2	-
24CSE61.2	3	-	-	-	2	-	-	-	-	-	-	3	-
24CSE61.3	-	3	-	-	3	-	-	-	-	-	-	3	-
24CSE61.4	-	-	2	-	3	-	-	-	-	-	-	3	1
24CSE61.5	-	-	-	3	3	-	-	-	-	-	-	2	1
24CSE61.6	-	-	3	2	3	2	1	2	3	-	1	2	1

MODULE-1	**INTRODUCTION TO FULL STACK**	**24CSE61.1**	**8 Hours**
Basic Web Development Framework, User, Browser, Webserver, Backend Services, MVC Architecture, Different Kinds of Stacks (LAMP, MEAN, MERN), Applications of Full Stack Technologies.			
Applications	Explore full stack development through modern web architecture using Angular, React and modern tools such as Node.js and MongoDB.		
Text Book	Text Book 2: 1.1, 1.2.		

MODULE-2	**NODE.JS AND EXPRESS**	**24CSE61.2 24CSE61.5**	**8 Hours**
Introduction to Node.js, Project Setup, Node Package Manager (npm), Express Framework, Event-driven Programming, Asynchronous Programming, File System Operations, HTTP Services, Routing, Route Parameters, Request and Response Objects, Middleware, REST API Development.			
Applications	Develop backend web applications using Node.js and Express by implementing routing, middleware and RESTful APIs for client-server communication.		
Text Book	Text Book 1: Chapter 2, 5		

MODULE-3	**MONGODB**	**24CSE61.2 24CSE61.5**	**8 Hours**
MongoDB Basics, Documents, Collections, Databases, Query Language, MongoDB CRUD Operations (Create, Read, Projection, Update, Delete, Aggregate), MongoDB Node.js Driver, Schema Initialization, Reading from MongoDB, Writing to MongoDB, Connecting MongoDB with Node.js.			
Applications	Develop NoSQL database applications using MongoDB and integrate MongoDB with Node.js for efficient data storage, retrieval and management.		

Text Book	Text Book 1: Chapter 6		
MODULE-4	**REACT DEVELOPMENT**	**24CSE61.3 24CSE61.5**	**8 Hours**
React Components, JSX, React Classes, Component Composition, Props, React State, State Management, Event Handling, Stateless Components, React Router, Forms, Controlled Components, React Bootstrap.			
Applications	Build responsive Single Page Applications using React components, state management, routing and reusable user interface components.		
Text Book	Text Book 1: Chapter 3, 4, 9, 10, 11		
MODULE-5	**MERN STACK APPLICATION DEVELOPMENT**	**24CSE61.4 24CSE61.5 24CSE61.6**	**8 Hours**
MERN Stack Architecture, ESLint Configuration, Modularization and Webpack, Server Rendering, REST API Integration, Authentication using JSON Web Tokens (JWT), Authorization, React Context, Advanced Features (MongoDB Aggregate, Pagination, Search), Deployment of MERN Applications.			
Self Study	Design, develop and deploy a complete MERN stack application by integrating MongoDB, Express, React and Node.js with authentication, modular architecture and production deployment.		
Text Book	Text Book 1: Chapter 7, 8,12,13 ,14,15		

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution		
		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	-	-	-
L2	Understand	-	-	-
L3	Apply	10	5	5
L4	Analyze	10	5	5
L5	Evaluate	5	5	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	-
L3	Apply	20
L4	Analyze	15
L5	Evaluate	15
L6	Create	--

Suggested Learning Resources:

Text Books:

1) Vasan Subramanian, Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Second Edition, Apress, Reprint 2025. ISBN-13: 978-1484252758.
2) David Choi, Full-Stack React, TypeScript, and Node, 2nd Edition, Packt Publishing, 2026. ISBN: 978-1803235776.

Reference Books:

1) Mario Casciaro, Luciano Mammino, Matteo Collina, Colin J. Ihrig, Node.js Design Patterns, 4th Edition, Packt Publishing, 2025. ISBN-13: 978-1803238944.
2) Carl Rippon, Learn React with TypeScript, 3rd Edition, Packt Publishing, 2025. ISBN-13: 978-1836643173.

3) Mykyta Chernenko, Full-Stack Web Development with TypeScript 5: Craft Modern Full-Stack Projects with Bun, PostgreSQL, Svelte, TypeScript, and OpenAI, First Edition, Packt Publishing Ltd., 2024. ISBN-13: 978-1835885581.

Web links and Video Lectures (e-Resources):

- https://learn.mongodb.com/?utm_source
- https://www.coursera.org/courses?query=mongodb
- https://nodejs.org/docs/latest/api/
- https://www.mongodb.com/docs/
- https://developer.mozilla.org/en-US/
- https://learn.mongodb.com/

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

- Case studies/Case lets
- Participatory & Industry-integrated learning
- Practical activities / problem solving exercises
- Participation in Seminars/ Workshop

FULL STACK TECHNOLOGIES LAB			
Course Code	**24CSL61**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:

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

24CSL61.1	Apply HTML5, CSS3 and JavaScript to create responsive and interactive web pages
24CSL61.2	Analyze server-side web application requirements to implement RESTful APIs using Node.js and Express
24CSL61.3	Design database-driven web applications by integrating MongoDB with Node.js and Express for efficient data management
24CSL61.4	Evaluate complete MERN stack web applications developed by integrating React, Express, Node.js, MongoDB, authentication and deployment

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSL61.1	3	-	-	-	2	-	-	-	-	-	-	3	-
24CSL61.2	-	3	-	-	3	-	-	-	-	-	-	3	-
24CSL61.3	-	-	3	-	3	-	-	-	-	-	-	3	1
24CSL61.4	-	-	-	3	3	-	-	-	-	-	-	2	1

Pgm. No.	List of Programs	Hours	COs
	Prerequisite		
	• Basics of Web Programming using HTML, CSS and JavaScript • HTML5 Semantic Elements • CSS Flexbox/Grid for Layout	2	NA
	PART-A		
1	Develop a responsive web page using HTML5, CSS3 and JavaScript.	2	24CSL61.1
2	Create a Node.js application demonstrating modules, asynchronous programming and HTTP services.	2	24CSL61.2
3	Develop REST APIs using Express.js with routing and middleware.	2	24CSL61.2
4	Perform CRUD operations using MongoDB and integrate MongoDB with Node.js	2	24CSL61.3
5	Develop React components using JSX, Props and State	2	24CSL61.4
6	Develop a Single Page Application using React Router and Forms.	2	24CSL61.4
	PART-B		
7	Integrate React frontend with Express REST APIs and MongoDB backend.	2	24CSL61.4
8	Develop a MERN-based User Authentication System using JWT.	2	24CSL61.4
9	Develop a MERN-based Product Catalog Management System.	2	24CSL61.4
10	Develop a MERN-based Leave Management or Task Management System.	2	24CSL61.4
11	Develop a MERN-based Blog or Content Management System.	2	24CSL61.4
12	Design, develop and deploy a complete MERN Stack web application with authentication and CRUD operations.	2	24CSL61.4
	PART-C		

Beyond Syllabus Virtual Lab Content
(To be done during Lab but not to be included for CIE or SEE)

- https://www.vlab.co.in/
- https://developer.mozilla.org/
- https://react.dev/learn
- https://nodejs.org/en/learn
- https://learn.mongodb.com/
- https://expressjs.com/
- https://www.freecodecamp.org/learn/

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	5
L3	Apply	10	10
L4	Analyze	5	10
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	05
L3	Apply	15
L4	Analyze	20
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Reference Books:

1. Vasan Subramanian, Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Second Edition, Apress, Reprint 2025. ISBN-13: 978-1484252758.
2. David Choi, Full-Stack React, TypeScript, and Node, 2nd Edition, Packt Publishing, 2026. ISBN: 978-1803235776
3. Mario Casciaro, Luciano Mammino, Matteo Collina, Colin J. Ihrig, Node.js Design Patterns, 4th Edition, Packt Publishing, 2025. ISBN-13: 978-1803238944.
4. Carl Rippon, Learn React with TypeScript, 3rd Edition, Packt Publishing, 2025. ISBN-13: 978-1836643173.

MACHINE LEARNING			
Course Code	**24CSE62**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

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

24CSE62.1	Apply mathematical foundations such as gradient descent, probability, and statistical decision theory to formulate and solve machine learning problems.
24CSE62.2	Analyze regression and linear classification models to identify predictive patterns and validate performance using appropriate evaluation metrics.
24CSE62.3	Examine decision trees, kernel methods, and instance-based learning approaches to detect complex structures and anomalies in data
24CSE62.4	Design ensemble learning strategies and dimensionality reduction techniques to optimize performance on high-dimensional datasets.
24CSE62.5	Evaluate clustering algorithms and single-layer neural networks for unsupervised discovery, segmentation, and classification tasks.
24CSE62.6	Interpret the paradigms of machine learning and model evaluation concepts while reflecting on the need for continuous learning to adapt to evolving ML technologies.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSE62.1	3	-	-	-	1	-	-	-	-	-	-	2	-
24CSE62.2	3	3	-	-	2	-	-	-	-	-	-	3	-
24CSE62.3	3	3	-	-	2	-	-	-	-	-	-	3	-
24CSE62.4	3	3	3	-	3	-	-	-	2	2	-	3	2
24CSE62.5	3	2	2	3	3	-	-	-	2	2	-	3	2
24CSE62.6	3	2	2	3	3	-	-	-	2	2	2	3	2

MODULE-1	**Introduction to Machine Learning & Mathematical Foundations**	**24CSE62.1, 24CSE62.6**	**8 Hours**

Overview: Introduction to Machine Learning, perspectives, types of learning and real-world applications.
Statistical Decision Theory & Problem Formulation: Concept of learnability, inductive bias, data-driven solutions versus traditional programming, and workflow of machine learning projects.
Mathematical Foundations: Gradient descent optimization, Probability theory, Bayes' theorem, and Conditional probability.
Model Evaluation Basics: Notions of Training, Validation, and Testing sets, Generalization, Underfitting, Overfitting, and Bias-Variance tradeoff.

Case Study	A retail startup compares rule-based systems with a data-driven model using gradient descent and probability. Evaluate training and validation splits to minimize prediction errors while preventing overfitting.
Text Book 1:	Chapter 1: 1.1, 1.2, 1.3, Chapter 2: 2.1, 2.2, 2.3, 2.4

MODULE-2	**Supervised Learning – Regression & Linear Classification**	**24CSE62.2, 24CSE62.6**	**8 Hours**

Regression Methods: Simple Linear Regression, Multivariate Linear Regression, Ordinary Least Squares (OLS), cost functions, MSE, RMSE, R^2 score, Regularization techniques: Ridge (L2) and Lasso (L1) regression.
Linear Classification: Discriminant functions and linear models. Logistic Regression, multi-class classification using Linear Discriminant Analysis LDA.
Probabilistic Classifiers: Naive Bayes Classifier, Bayes optimal classifier, and text classification fundamentals.
Classification Evaluation Metrics: Confusion matrix, accuracy, precision, recall, F1-score, ROC-AUC curve, and precision-recall curve.

Case Study	A real estate firm builds an automated pricing and tier classification system using regularized regression and logistic models. Performance is validated with root mean square error and ROC-AUC metrics.

Text Book 1:	Chapter 3: 3.1, 3.2, 3.3, 3.5, 3.5, 3.6		
MODULE-3	**Supervised Learning – Non-Linear Models & Kernel Methods**	**24CSE62.3, 24CSE62.6**	**8 Hours**
Decision Tree Learning: Representation of decision trees, CART/ID3 algorithms, entropy, information gain, Gini impurity, regression trees, stopping criteria, tree pruning. **Support Vector Machines (SVM):** Maximum margin classification, hyperplanes, and linear SVM formulation. **Kernel Methods:** The Kernel Trick, polynomial kernels, Radial Basis Function (RBF) kernel, and non-linear classification with SVMs. **Instance-Based Learning:** K-Nearest Neighbors (KNN) algorithm, distance metrics (Euclidean, Manhattan), curse of dimensionality, and locally weighted regression.			
Case Study	A cybersecurity team detects complex intrusions in non-linear network traffic using decision trees and kernel-based SVMs. K-Nearest Neighbors is also integrated for instance-based anomaly detection.		
Text Book 1:	Chapter 4: 4.1, 4.2, 4.3, 4.4		
MODULE-4	**Ensemble Learning and Dimensionality Reduction**	**24CSE62.4, 24CSE62.6**	**8 Hours**
Ensemble Methods: Concept of ensemble learning, committee machines, and bias-reduction vs. variance-reduction strategies. **Bagging & Random Forests:** Bootstrap aggregating, decision trees as base learners, out-of-bag (OOB) error estimation, Random Forest Classifier: feature randomness, voting mechanisms, and hyperparameter tuning. **Boosting & Stacking:** Gradient Boosting, AdaBoost algorithm, margin and complexity, and Stacking. **Dimensionality Reduction:** Feature selection techniques, Principal Component Analysis (PCA) mathematical formulation (covariance matrix, eigenvalue decomposition), singular value decomposition (SVD), and applications in noise reduction and visualization.			
Case Study	A biomedical lab analyzes high-dimensional genetic datasets using Principal Component Analysis for noise reduction. Researchers then apply gradient boosting and bagging ensembles to maximize diagnostic reliability.		
Text Book 1:	Chapter 5: 5.1, 5.2, 5.3, 5.4, Chapter 6: 6.1, 6.2		
MODULE-5	**Unsupervised Learning & Single-Layer Neural Networks**	**24CSE62.5, 24CSE62.6**	**8 Hours**
Clustering Fundamentals: Concept of unsupervised discovery, distance measures for clustering. **Partitioning & Hierarchical Clustering:** K-Means clustering (algorithm, initialization, choosing optimal K, limitations), Hierarchical clustering (Agglomerative and Divisive), and Density-Based Clustering (DBSCAN). **Mixture Models & Expectation-Maximization**: Gaussian Mixture Models (GMM) and the Expectation-Maximization (EM) algorithm introduction. **Single-Layer Neural Networks**: Biological inspiration, McCulloch-Pitts neuron model, Perceptron learning algorithm, convergence theorem, Delta rule, and single-layer networks for classification and regression.			
Case Study	A logistics company segments delivery routes using K-Means and Gaussian Mixture clustering algorithms. A single-layer perceptron neural network is additionally implemented for route efficiency classification.		
Text Book 1:	Chapter 7: 7.1, 7.2, 7.3, 7.4, Chapter 8: 8.1, 8.2		

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	-	-	-
L2	Understand	-	-	-
L3	Apply	10	-	-
L4	Analyze	10	5	5
L5	Evaluate	5	10	5
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	-
L3	Apply	20
L4	Analyze	15
L5	Evaluate	15
L6	Create	--

Suggested Learning Resources:

Textbook:

1. Saikat Dutt, Subramanian Chandramouli, and Amit Kumar Das, "Machine Learning", Pearson Education India, 2nd Edition, 2024 (Reprint 2025), ISBN-10: 8119896734, ISBN-13: 978-8119896738

Reference book:

1. Kevin P. Murphy, "Probabilistic Machine Learning: An Introduction", MIT Press, 1st Edition, 2022, ISBN-10: 0262046822, ISBN-13: 978-0262046824.
2. Andreas Lindholm, Niklas Wahlström, Fredrik Lindsten, and Thomas B. Schön, "Machine Learning: A First Course for Engineers and Scientists", Cambridge University Press, 1st Edition, 2022, ISBN-10: 1108843603, ISBN-13: 978-110884360724.
3. Jeeva Jose, "Introduction to Machine Learning", Khanna Publishing House, 2nd Edition, 2023, ISBN-10: 9391505342, ISBN-13: 978-9391505341.
4. Tom M. Mitchell, "Machine Learning", McGraw Hill Education, 1st Edition, 2017, ISBN-10: 1259096955, ISBN-13: 978-1259096958.

Web links and Video Lectures (e-Resources):

- https://www.cs.cmu.edu/~tom/mlbook.html
- https://nptel.ac.in/courses/106106198
- https://www.youtube.com/watch?v=Uzxae4k0Edg
- https://www.youtube.com/watch?v=gmvvaobm7SQ
- https://nptel.ac.in/courses/106105152
- https://www.youtube.com/watch?v=jGwO_UgTS7I
- https://ocw.mit.edu/courses/6-036-introduction-to-machine-learning-fall-2020/
- https://www.youtube.com/watch?v=OGxgnH8y2AU
- https://scikit-learn.org/stable/user_guide.html
- https://developers.google.com/machine-learning/crash-course
- https://www.geeksforgeeks.org/machine-learning/

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

- Think – pair -share
- Flipped class room
- Cross word puzzle
- Code tracing Activity

MACHINE LEARNING LAB			
Course Code	**24CSL62**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:

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

24CSL62.1	Apply data preprocessing, feature engineering, and data transformation techniques using Python-based machine learning libraries
24CSL62.2	Analyze machine learning models using supervised learning algorithms for prediction and classification
24CSL62.3	Implement machine learning models using dimensionality reduction, clustering and Ensemble learning techniques
24CSL62.4	Evaluate intelligent machine learning applications using neural networks and advanced machine learning techniques

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSL62.1	3	-	-	-	2	-	-	-	-	-	-	3	-
24CSL62.2	-	3	-	-	3	-	-	-	-	-	-	3	-
24CSL62.3	-	-	-	3	3	-	-	-	-	-	-	3	1
24CSL62.4	-	-	-	3	3	-	-	-	-	-	-	2	1

Pgm. No.	List of Programs	Hours	COs
	Prerequisite		
	• Demo on installation of Jupyter notebook including the uploading of data sets. • Introduction of the python packages Numpy, Pandas, Scikit Learn, Matplotlib, Seaborn etc.	2	NA
	PART-A		
1	a. Given a dataset, analyze whether there is missing data in the dataset and handle it with different data preprocessing methods. b. Write a program to handle imbalanced data classification using appropriate resampling techniques.	2	24CSL62.1
2	Given a dataset, a. perform the required data standardization and normalization on the data. b. Explore Label encoding and other encoding methods on various attributes of the data	2	24CSL62.1
3	Write a Python program to implement a Decision Tree classifier for a given dataset. The program should: 1. Accept a dataset with multiple attributes and a target class. 2. Encode categorical attributes into numerical form if necessary. 3. Split the dataset into training and testing sets. 4. Train a Decision Tree classifier using the entropy criterion. 5. Display the accuracy of the model on the test set. 6. Visualize the Decision Tree structure.	2	24CSL62.2
4	Write a program to demonstrate dimensionality reduction using PCA.	2	24CSL62.3

5	Write a program to implement the naive Bayesian classifier for a sample training data set. Compute the accuracy of the classifier, considering few test data sets.	2	24CSL62.2
6	Write a program to implement the support vector machine classifier for a sample training data set stored. Compute the accuracy of the classifier, considering few test data sets.	2	24CSL62.2
PART-B			
7	Implement Linear Regression and Logistic Regression using Python with the given dataset. Train and test the models, obtain predictions, and evaluate their performance using suitable evaluation metrics. Train the model using training data, predict the output for test data, and evaluate the model performance.	2	24CSL62.2
8	Implement the k-Nearest Neighbour (k-NN) algorithm to classify a given dataset. Print both correct and incorrect predictions. You may use Java or Python machine learning library classes for this problem.	2	24CSL62.2
9	Implement a Random Forest Classifier in Python for a given dataset and analyze its performance using test data.	2	24CSL62.3
10	Implement Hierarchical Clustering and draw a dendrogram.	2	24CSL62.3
11	Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.	2	24CSL62.4
12	Build a classifier using any ensemble learning method and compare the results against the classic learning models	2	24CSL62.4

PART-C

Beyond Syllabus Virtual Lab Content

(To be done during Lab but not to be included for CIE or SEE)

- https://vlabs.iitr.ac.in/vlabs-ml/exp-genetic-algorithm-iitr/
- https://virtual-labs.github.io/exp-candidate-elimination-iitr/
- https://ml-dei.vlabs.ac.in/
- https://scikit-learn.org/stable/modules/decomposition.html

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	-
L3	Apply	10	15
L4	Analyze	5	10
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	-
L3	Apply	20
L4	Analyze	20
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Reference Books:

1) Miroslav Kubat, "An Introduction to Machine Learning", Springer, 3rd Edition, 2021, ISBN-10: 3030819345, ISBN-13: 978-3030819347.
2) John V. Guttag, "Introduction to Computation and Programming Using Python: With Application to Computational Modeling and Understanding Data", MIT Press, 3rd Edition, 2021, ISBN-10: 0262542366, ISBN-13: 978-0262542364.
3) Manaranjan Pradhan, U Dinesh Kumar, "Machine Learning using Python", Wiley, 2nd Edition, 2025, ISBN-13: 978-9370605244
4) Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, *Mathematics for Machine Learning*, Cambridge University Press, 2020 (Reprinted 2025), ISBN-13: 978-1108470049.

CYBER SECURITY PRINCIPLES AND PRACTICES			
Course Code	**24CSE63**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**3**	**Exam Hours**	**3**

Course outcomes:

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

24CSE63.1	Understand the fundamental concepts, principles, and threat landscape of cybersecurity.
24CSE63.2	Apply network security mechanisms and protocols to protect systems from network-based attacks.
24CSE63.3	Analyse cryptographic techniques, authentication mechanisms, and access control models for securing information systems.
24CSE63.4	Design security assessment workflows using industry-standard cybersecurity tools.
24CSE63.5	Evaluate information security governance, incident response, and business continuity strategies for effective security management.
24CSE63.6	Interpret emerging cybersecurity challenges and legal/regulatory frameworks to ensure ethical and compliant practices.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSE63.1	-	-	-	-	-	-	-	-	-	-	-	2	-
24CSE63.2	3	-	-	-	-	-	-	-	-	-	-	3	-
24CSE63.3	-	3	-	-	3	-	-	-	-	-	-	3	-
24CSE63.4	-	-	3	-	-	-	-	-	-	-	-	2	-
24CSE63.5	-	-	-	3	2	-	-	-	-	-	-	2	-
24CSE63.6	-	-	-	2	2	2	1	2	2	-	2	2	3

MODULE-1	**INTRODUCTION TO CYBERSECURITY**	**24CSE63.1**	**8 Hours**

Fundamentals of Cybersecurity, CIA Triad (Confidentiality, Integrity, Availability) , Security Goals and Principles, Cyber Threat Landscape, Types of Attackers and Threat Actors, Malware: Virus, Worm, Trojan, Ransomware, Spyware, Social Engineering and Phishing Attacks, Cyber Kill Chain Concept, Recent Cybersecurity Breaches (Case Studies)

Hands-on:

1. To understand and demonstrate the core principles of the CIA Triad (Confidentiality, Integrity, and Availability) by implementing encryption, file integrity verification using SHA-256 hashing, and basic network connectivity testing.
2. To identify and analyze social engineering and phishing attacks by detecting suspicious email characteristics, evaluating phishing indicators, and understanding preventive measures against cyber threats.
3. To analyze recent cybersecurity breaches by identifying the attack type, threat actor, attack vector, security principles violated, impact on the organization, and recommending appropriate preventive measures.

Text Book	T1**:** 1.1, 1.2, 1.3, 1.4, 1.5,1.6, 2.1, 2.2 ,2.3, 21.1–21.5 T2: 1.1–1.3, 2.1–2.4, 2.5, 2.6, 3.1–3.4

MODULE-2	**NETWORK SECURITY FUNDAMENTALS**	**24CSE63.2**	**8 Hours**

Computer Network Security Concepts, OSI and TCP/IP Security Issues, Network Attacks -DoS and DDoS, Spoofing, Sniffing, Session Hijacking, Firewalls and IDS/IPS, Virtual Private Networks (VPN), Wireless Network Security, Secure Communication Protocols -HTTPS, SSL/ TLS, SSH

Hands-on:

1. To analyze network communication using Wireshark by capturing packets, mapping them to the OSI and TCP/IP models, and identifying potential security vulnerabilities in network protocols.
2. To understand the role of Firewalls, Intrusion Detection Systems (IDS), and Intrusion Prevention Systems (IPS) by configuring firewall rules and analyzing their effectiveness in protecting network resources.
3. To explore secure communication protocols by analyzing SSL/TLS certificates, comparing HTTP and HTTPS communication, and establishing secure remote access using SSH.

Text Book	T1: 8.1–8.4, 17.1–17.5, 18.1–18.3, 20.1, 20.2, 20.3,20.4, 23.1–23.5, 24.1–24.4 T2: 5.1–5.4		
MODULE-3	**CRYPTOGRAPHY AND ACCESS CONTROL**	**24CSE63.3**	**8 Hours**

Introduction to Cryptography, Symmetric Encryption, Asymmetric Encryption, Hash Functions and Digital Signatures, Public Key Infrastructure (PKI) , Authentication Mechanisms, Multi-Factor Authentication (MFA), Access Control Models -DAC, MAC, RBAC, Password Security and Identity Management

Hands-on:

1. Generate a pair of RSA public and private keys using Python or OpenSSL. Encrypt a message using the RSA public key and decrypt it using the corresponding private key.
2. Demonstrate Discretionary Access Control (DAC) by assigning file permissions to different users in Linux or Windows.
3. Develop a secure file protection system that performs: Password authentication, AES file encryption, SHA-256 integrity verification, Digital signature verification.

Text Book	T1: 1.1–1.4, 2.1–2.5, 3.1–3.4, 9.1–9.4, 11.1–11.4, 13.1–13.3, 14.1–14.4; T2: 3.1–3.5, 4.1–4.5, 5.1–5.3		
MODULE-4	**INTRODUCTION TO TOOLS & SECURITY MANAGEMENT**	**24CSE63.4**	**8 Hours**

Introduction to security tools- Network Protocol Analyzer -Wireshark, Network Discovery and Security Auditing-Nmap, Cryptography tools-CrypTool2/CyberChef, Vulnerability Assessment & Ethical Hacking tools-OWASP ZAP, Cyber Forensics & Incident Response tool- Autopsy.

Hands-on:

1. To perform network discovery and security auditing using Nmap by identifying active hosts, open ports, running services, and preparing a basic security assessment report.
2. To perform vulnerability assessment of a web application using OWASP ZAP by identifying security weaknesses, analysing scan results, and recommending appropriate mitigation measures.
3. To investigate digital evidence using Autopsy by analysing forensic images, recovering deleted files, examining user activity, and generating a forensic investigation report.

Text Book	T1: 16.1–16.4, 18.1–18.3; T2**:** 4.1–4.7, 5.1–5.4, 10.1–10.5, 11.1–11.4, 12.1–12.5		
MODULE-5	**EMERGING TRENDS, CYBER LAWS AND ETHICS**	**24CSE63.5, 24CSE63.6**	**8 Hours**

Emerging cybersecurity challenges pertaining to IoT cloud & AI, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security Information Security Governance, Security Policies and Standards, Incident Response Lifecycle, Digital Forensics Fundamentals, Business Continuity Planning (BCP), Disaster Recovery Planning (DRP), Introduction to GDPR (General Data Protection Regulation)

Hands-on:

1. Examine the security settings of an Android or iOS device and identify enabled security features such as screen lock, encryption, biometric authentication, and app permissions.
2. Configure screen lock, biometric authentication, automatic updates, and backup settings on a mobile device and document the changes.
3. Analyze a sample organization's privacy policy and identify whether it addresses key GDPR principles such as consent, data minimization, and user rights.

Text Book	T1: 16.1–16.4, 18.1–18.3; T2: 4.1–4.7, 5.1–5.4, 10.1–10.5, 11.1–11.4, 12.1–12.5

CIE Assessment Pattern (50 Marks – Lab)

		Test(s)	Certified Online Learning
		25	**25**
L1	**Remember**	-	-
L2	**Understand**	-	-
L3	**Apply**	10	10
L4	**Analyze**	10	15
L5	**Evaluate**	5	-
L6	**Create**	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	**-**
L2	**Understand**	-
L3	**Apply**	20
L4	**Analyze**	20
L5	**Evaluate**	10
L6	**Create**	-

Suggested Learning Resources:

Text Books:

1. "Computer Security: Principles and Practice", William Stallings and Lawrie Brown, 5th Edition, Pearson Education, 2024. ISBN: 978-0-13-809167-5
2. "Cybersecurity Essentials", Charles J. Brooks, Christopher Grow, Philip Craig, Donald Short,3rd Edition, John Wiley & Sons,2023. ISBN: 978-1-119-36239-5.

Reference Books:

1. "Principles of Information Security", Michael E. Whitman and Herbert J. Mattord, 7th Edition, Cengage Learning. 7th Edition, 2023. ISBN - 978-9-355-73890-5
2. "Cryptography and Network Security: Principles and Practice", William Stallings, 8th Edition, Pearson Education 2022/2024 Global Edition. ISBN: 978-1-292-43748-4
3. "Network Security Essentials: Applications and Standards" , William Stallings, 7th Edition, Pearson. 2018. ISBN: 978-9-352-86660-1
4. "Cyber Security and Cyber Laws", Nina Godbole and Sunit Belapure, Wiley India. 1st Edition, 2018. ISBN: 978-81-265-2179-1.

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=Yr0xPVFcf-U
- https://pll.harvard.edu/course/cs50s-introduction-cybersecurity
- https://www.youtube.com/watch?v=sW0Wiepofo4
- https://www.netacad.com/courses/introduction-to-cybersecurity?courseLang=en-US
- https://www.cdse.edu/Training/Security-Training-Videos/Cybersecurity/

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

Contents related activities (Activity-based discussions)

- Problem solving Approach
- Organizing Group wise discussions on related topics
- Class presentations

Professional Elective Course-II			
24CSE641	Soft Computing	24CSE644	Multimedia Communication
24CSE642	Introduction to Quantum Computing	24CSE645	Cryptocurrency and Blockchain Technologies
24CSE643	Advanced Java		

SOFT COMPUTING			
Course Code	**24CSE641**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs./Week	**03**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

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

24CSE641.1	Apply soft computing techniques to solve engineering problems involving uncertainty.
24CSE641.2	Analyze fuzzy logic models and decision-making techniques for solving problems under uncertain environments.
24CSE641.3	Design optimization solutions using Genetic Algorithms by selecting appropriate representations and operators.
24CSE641.4	Implement swarm intelligence algorithms to solve engineering optimization problems.
24CSE641.5	Evaluate the suitability of soft computing techniques for real-world engineering applications.
24CSE641.6	Identify ethical and societal implications of soft computing applications.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
24CSE641.1	3	-	-	-	-	-	-	-	-	-	2	2	-
24CSE641.2	-	3	-	-	-	-	-	-	-	-	2	2	-
24CSE641.3	-	-	3	-	-	-	-	-	-	-	2	2	-
24CSE641.4	-	-	3	-	-	-	-	-	-	-	2	2	-
24CSE641.5	-	-	-	3	-	-	-	-	-	-	2	2	-
24CSE641.6	-	-	-	-	-	3	3	3	-	-	2	2	-

MODULE-1	**INTRODUCTION TO SOFT COMPUTING**	**24CSE641.1**	**8 Hours**

Soft Computing Constituents: From Conventional AI to Computational Intelligence- Evolution of neural networks- basic models - important technologies - applications. Classical Sets and Fuzzy Sets: Introduction, Basic concepts, Representation, Basic operations, Fuzzy Complements, Intersections, Unions, Intuitionistic Fuzzy Sets.

Self Study:	Study the evolution of computational intelligence from conventional AI and investigate the applications of fuzzy sets and neural networks in solving real-world decision-making problems.
Text book	Textbook1:Chapter1.1-1.5, 7.1-7.10

MODULE-2	**FUZZY LOGIC AND DECISION MAKING**	**24CSE641.2**	**8 Hours**

Classical Predicate Logic, Interval Analysis, Fuzzy Numbers, Linguistic variables, modifiers, Fuzzy propositions, Problem solving, Decision making, Individual Fuzzy decision making, multiperson decision making, Multi criteria, Fuzzy Rule Based Systems

Self-Study	Explore the use of fuzzy numbers, linguistic variables, and fuzzy reasoning in solving an uncertain real-world problem such as medical diagnosis, weather forecasting, or traffic management.
Text book	Textbook1: Chapter 9, 10.1-10.3

MODULE-3	**GENETIC ALGORITHMS**	**24CSE641.3**	**8 Hours**

Introduction to Genetic Algorithms, traditional Search Techniques versus Genetic Algorithms, Chromosome Representation and Encoding, Fitness Function, Population Initialization, Selection Methods, Crossover Operators, Mutation Operators, Working of Genetic Algorithms, Control Parameters and Termination Criteria, Genetic Algorithms for Optimization, Applications of Genetic Algorithms			
Self Study:	Explore how Genetic Algorithm concepts are combined with reinforcement learning; find one real-world application.		
Text book	Textbook 2: Chapter 3,13.1,13.2		
MODULE-4	**SWARM INTELLIGENCE: ALGORITHMS AND APPLICATIONS**	**24CSE641.4**	**8 Hours**
Introduction to Swarm Intelligence Algorithms, classification and fundamentals, Particle Swarm optimization, Mathematical Modeling, Hybrid PSO, Grey Wolf Optimization, Moth Flame Optimization, Whale Optimization, Tunicate Swarm Algorithm.			
Self Study	Compare two swarm intelligence algorithms based on their inspiration, search strategy, and engineering applications using a suitable optimization problem.		
Text book	Textbook 3: Chapter 1.1-1.4,2.1-2.3, Chapter 3		
MODULE-5	**SOFT COMPUTING IN REAL WORLD APPLICATIONS**	**24CSE641.5 24CSE641.6**	**8 Hours**
A fusion approach of multispectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach, Intrusion Detection Systems using Neural Networks and Fuzzy Logic, Prediction of Disease Outbreaks using Neuro-Fuzzy Systems.			
Self Study	Explore how neural networks, fuzzy logic, or evolutionary algorithms are used in image fusion for satellite imagery. Identify at least one case study (e.g., COVID-19, dengue, malaria) where prediction was enhanced using soft computing.		
Text Book	Textbook 1: Chapter 17		

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution		
		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	-	-	-
L2	Understand	-	-	-
L3	Apply	10	5	-
L4	Analyze	10	10	5
L5	Evaluate	5	-	5
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	-
L3	Apply	20
L4	Analyze	20
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Text Books:

1. B. K. Tripathy and J. Anuradha, "Soft Computing Techniques: Fuzzy Logic, Neural Networks, and

Genetic Algorithms", Cengage Learning India, 2022. ISBN: 978-8131526194.
2. Altaf Q. H. Badar, Evolutionary Optimization Algorithms, CRC Press, 2022 (Print), ISBN: 9780367750541.
3. Abhishek Sharma, Abhinav Sharma, Jitendra Kumar Pandey and Mangey Ram, Swarm Intelligence, CRC Press, 2022. ISBN: 9781032188836 (Hardback), 9781032188843 (Paperback), 9781003256090

Reference Books:

1. D. K. Pratihar, "Soft Computing: Fundamentals and Applications", Revised Edition, Narosa Publishing House, 2021. ISBN: 978-8184874952
2. S. Rajasekaran and G. A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis and Applications", 2nd Edition, PHI Learning, 2021. ISBN: 978-8120353350

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/106105173
- https://nptel.ac.in/courses/108104157
- https://www.coursera.org/learn/evolutionary-computation-and-its-engineering-applications
- https://nptel.ac.in/courses/106108705

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

- Problem solving exercises
- Class Presentations
- Case Studies

INTRODUCTION TO QUANTUM COMPUTING			
Course Code	**24CSE642**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

24CSE642.1	Apply the fundamental principles of quantum computing to represent qubits, quantum states, superposition, measurement, and basic quantum operations.
24CSE642.2	Analyze quantum gates, quantum circuits, entanglement, and multi-qubit systems for solving basic quantum computation problems.
24CSE642.3	Design quantum circuits and algorithmic models using basic quantum gates for quantum computation tasks.
24CSE642.4	Implement simple quantum algorithms and circuits using quantum computing platforms such as IBM Quantum Composer or Qiskit.
24CSE642.5	Evaluate quantum algorithms, quantum communication, quantum cryptography, and error correction techniques with respect to classical approaches.
24CSE642.6	Interpret basic quantum computing solutions or case-based models for applications in cybersecurity, AI, optimization, quantum machine learning, VQE, QAOA, and emerging quantum technologies.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSE642.1	3	-	-	-	-	-	-	-	-	-	-	2	1
24CSE642.2	-	3	-	-	-	-	-	-	-	-	-	2	1
24CSE642.3	-	-	3	-	-	-	-	-	-	-	-	3	2
24CSE642.4	-	-	3	-	-	-	-	-	-	-	-	3	2
24CSE642.5	-	-	-	3	-	1	-	-	-	-	-	3	2
24CSE642.6	-	-	-	3	2	1	2	-	-	-	-	3	3

MODULE-1	**Fundamentals of Quantum Computing**	**24CSE642.1**	**8 Hours**

Evolution of Computing, Limitations of Classical Computing, History of Quantum Computing, Basic Principles of Quantum Mechanics, Classical Bits vs Qubits, Superposition, Measurement, Probability Amplitudes, Quantum Computing Models, Current Quantum Hardware.

Self-study	Evolution from classical computing to quantum computing and current quantum hardware platforms.
Text Book	T1: 2.2 - 2.3, T2: 2, 3.3 – 3.6, T3: 2.2 – 2.4, 3.2

MODULE-2	**Quantum Information and Quantum Gates**	**24CSE642.2**	**8 Hours**

Qubits, Bloch Sphere, Bra-Ket Notation, Tensor Product, Multi-Qubit Systems, Entanglement, Measurement, Quantum Circuit Model, X, Y, Z, H, Phase, CNOT and Universal Gates.

Case Study	Construction of simple quantum circuits using X, H, Z, and CNOT gates.
Text Book	T1: 2.4 – 2.5, 2.12 – 2.13, 3.2 – 3.6 , T2: 3.2 – 3.7 , T3: 2.4, 4.5 – 4.6

MODULE-3	**Quantum Algorithms**	**24CSE642.3**	**8 Hours**

Quantum Parallelism, Quantum Interference, Deutsch Algorithm, Deutsch-Jozsa Algorithm, Bernstein-Vazirani Algorithm, Grover's Search Algorithm, Introduction to Shor's Algorithm, Variational Quantum Eigensolver (VQE), Quantum Approximate Optimization Algorithm (QAOA), and Complexity Comparison.

Self-study	Working principle of Deutsch-Jozsa, Grover, VQE, and QAOA.
Text Book	T1: 3.6, T2: 3.8, 4.2 – 4.6, 5.4, T3: 3.5 – 3.6

MODULE-4	Quantum Communication and Error Correction	24CSE642.4	8 Hours
No-Cloning Theorem, Quantum Teleportation, Quantum Key Distribution, BB84 Protocol, Quantum Noise, Decoherence, Introduction to Quantum Error Correction, Challenges.			
Applications	Cybersecurity, secure data transmission, quantum-safe communication, and error correction in noisy quantum systems.		
Text Book	T1: 2.5, 3.2 – 3.3, T3: 3.4, 4.6		
MODULE-5	**Applications and Future Trends**	**24CSE642.5**	**8 Hours**
Quantum Machine Learning Algorithms, Quantum Optimization, Quantum Simulation, Quantum Chemistry, Cybersecurity, Finance, Drug Discovery, Current Quantum Platforms, Ethical Issues, Future Directions, and demonstration of simple circuits/algorithms using quantum platforms.			
Case Study	Quantum computing applications in cybersecurity, drug discovery, finance, and AI.		
Text Book	T2:5.2 – 5.4, T3: 3.3 – 3.7		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	-	-	-
L2	Understand	-	-	-
L3	Apply	10	5	5
L4	Analyze	10	5	5
L5	Evaluate	5	5	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	-
L3	Apply	20
L4	Analyze	20
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Text Books:

1) Hiu Yung Wong, Introduction to Quantum Computing: From a Layperson to a Programmer in 30 Steps, 2nd Edition, Springer Cham, 2024. ISBN: 978-3-031-36987-2.
2) Belal Ehsan Baaquie and Leong-Chuan Kwek, Quantum Computers: Theory and Algorithms, Springer Singapore, 2023. ISBN: 978-981-19-7516-5.
3) Jack D. Hidary, Quantum Computing: An Applied Approach, 2nd Edition, Springer Cham, 2021. ISBN: 978-3-030-83273-5.

Reference Books:

1) Robert Loredo, Quantum Computing by Practice: Python Programming in the Cloud with Qiskit and IBM-Q, Apress, 2023. ISBN: 978-1-4842-9990-6.
2) Himanshu Thapliyal and Travis S. Humble, Quantum Computing: Circuits, Systems, Automation and Applications, Springer, 2024. ISBN: 978-3-031-37968-0.
3) Amit Kumar Tyagi, Ajith Abraham and Surendra S. Yadav, Quantum Computing: Applications and Challenges, Springer, 2024. ISBN: 978-3-031-59317-8.

Web links and Video Lectures (e-Resources):

- https://www.nptel.ac.in/courses/106106232
- https://ocw.mit.edu/courses/18-435j-quantum-computation-fall-2003/
- https://ocw.mit.edu/courses/8-370x-quantum-information-science-i-spring-2018/
- https://quantum.cloud.ibm.com/learning
- https://quantum.cloud.ibm.com/learning/en/courses/basics-of-quantum-information
- https://quantum.cloud.ibm.com/docs
- https://www.ibm.com/quantum/qiskit
- https://github.com/Qiskit/qiskit

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

- Think-Pair-Share method
- Flipped classroom method
- Concept mapping method
- Peer instruction method
- Problem-solving worksheet method
- Simulation-based learning method
- Case study analysis method
- Group discussion method
- Seminar presentation method
- Quiz-based formative assessment method
- Demonstration-based learning method using quantum computing platforms/tools

ADVANCED JAVA			
Course Code	**24CSE643**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs./Week	**03**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

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

24CSE643.1	Apply event-driven programming concepts to develop Java GUI applications.
24CSE643.2	Analyze the database connectivity using JDBC to perform CRUD operations in Java applications.
24CSE643.3	Design server-side web applications using Java Servlets to process client requests and generate dynamic responses.
24CSE643.4	Develop dynamic web applications using Java Server Pages (JSP) for server-side content generation.
24CSE643.5	Evaluate the role of software frameworks in simplifying enterprise application development.
24CSE643.6	Create the enterprise applications using the Spring Framework to build reliable and scalable software solutions.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
24CSE643.1	3	-	-	-	3	-	-	-	-	-	2	2	-
24CSE643.2	-	3	-	-	3	-	-	-	-	-	2	2	-
24CSE643.3	-	-	3	-	3	-	-	-	-	-	2	2	-
24CSE643.4	-	-	3	-	3	-	-	-	-	-	2	2	-
24CSE643.5	-	-	-	3	3	-	-	-	-	-	2	2	-
24CSE643.6	-	-	-	3	3	-	-	-	-	-	**2**	2	-

MODULE-1	**INTRODUCTION TO EVENT HANDLING**	**24CSE643.1**	**8 Hours**

Event-Driven Programming in Java, Swing Controls and UI elements, Event- Handling Process, The Delegation Model of Event Handling, Swing Event Classes, Event Sources, Event Listeners, Adapter Classes as Helper Classes in Event Handling.

Self Study	Investigate the use of Java Swing components and event-driven programming in desktop application development.
Text book	Text Book 1: Chapter 27,28

MODULE-2	WORKING WITH JDBC	24CSE643.2	8 Hours
Exploring web architecture models, Exploring the MVC architecture, Introducing JDBC, Exploring JDBC Drivers, Describing JDBC APIs, Exploring JDBC processes with java. sql package			
Case Study	Study the design of a student information management system and identify how JDBC is used to perform database operations (insert, update, delete, and retrieve records) while following the MVC architecture.		
Text book	Text Book 2: Chapter 1, 2		
MODULE-3	**WORKING WITH SERVLETS**	**24CSE643.3**	**8 Hours**
MVC Design Pattern, Http protocol, and html introduction, Exploring the features of java servlets, Exploring the servlets API, Servlets life cycle, Working with the Http servlets request and Http servlets response interfaces.			
Self Study	Develop web application for inventory management portal using servlet		
Text book	Text Book 1: Chapter 32 , Text Book 2 : Chapter 5		
MODULE-4	**WORKING WITH JAVA SERVER PAGES**	**24CSE643.4**	**8 Hours**
Working with Java server pages: Introducing JSP, Listing advantages of JSP over java servlets, Exploring the architecture of a JSP page, Describing the life cycle of a JSP page, Working with JSP basic tags and implicit objects, Working with the action tags			
Case Study	Develop a web application for inventory management portal using JSP as front end, and MySQL as back end		
Text book	Text Book 2: Chapter 7		
MODULE-5	**SPRING FRAMEWORK**	**24CSE643.5 24CSE643.6**	**8 Hours**
Spring Architecture, bean life cycle, XML Configuration on Spring, Aspect-oriented Programming with Spring (AOP), Spring Model View Controller (MVC), Spring & Web Services, Spring Boot, Spring Security, REST API.			
Case Study	Design an application for train ticket reservation using spring framework		
Text Book	Text Book 2: Chapter 13,14 ,Text Book 3 : Chapter 7.1,8.1		

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution		
		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	-	-	-
L2	Understand	-	-	-
L3	Apply	10	5	5
L4	Analyze	10	5	5
L5	Evaluate	5	5	-

L6	**Create**	**-**	**-**	**-**

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	**-**
L2	**Understand**	**10**
L3	**Apply**	**15**
L4	**Analyze**	**15**
L5	**Evaluate**	**10**
L6	**Create**	**-**

Suggested Learning Resources:

Text Books:

1. Herbert Schildt and Danny Coward, "JAVA: the Complete Reference", 13th Edition, Tata McGraw Hill, 2023(print), ISBN: 9781265062705
2. Dr. Nirali Dabhi, Dr. Dharmendra Patel and Dr. Atul Patel, "Web Development Toolkit for Java Developers", BPB Publications, 2023 (Print), ISBN: 9789355510341.
3. Laurentiu Spilca, "Spring Start Here: Learn What You Need and Learn It Well", Manning Publications, 2021 (Print), ISBN: 9781617298691.

REFERENCE BOOKS:

1. Sarika Agarwal and Vivek Gupta, "Java for Web Development", BPB Publications, 2022 (Print), ISBN: 9789355511430.
2. Benjamin Evans, Jason Clark and Martijn Verburg, "The Well-Grounded Java Developer", 2nd Edition, Manning Publications, 2022 (Print), ISBN: 9781617298875.
3. Greg L. Turnquist, "Learning Spring Boot 3.0", 3rd Edition, Packt Publishing, 2022 (Print), ISBN: 9781803233307.

Web links and Video Lectures (e-Resources):

- https://www.coursera.org/learn/advanced-java-certification-course
- https://www.coursera.org/learn/java-servlets-tutorial
- https://www.coursera.org/learn/java-servlet-pages
- https://spring.io/projects/spring-framework

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

- Problem Solving Approach
- Case Studies
- Class Presentations

MULTIMEDIA COMMUNICATIONS			
Course Code	**24CSE644**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

24CSE644.1	Understand the concepts of multimedia information representation, networking, quality of service, digitization and multimedia applications
24CSE644.2	Apply multimedia compression techniques for text, image, audio and video data
24CSE644.3	Analyze multimedia compression methods and coding techniques for efficient multimedia communication
24CSE644.4	Examine multimedia standards, frameworks and communication protocols for multimedia applications
24CSE644.5	Evaluate multimedia synchronization, resource management and multimedia operating system techniques for efficient multimedia communication
24CSE644.6	Interpret multimedia communication solutions using synchronization, resource management and multimedia operating system techniques

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSE644.1	-	-	-	-	-	-	-	-	-	-	-	2	-
24CSE644.2	3	-	-	-	2	-	-	-	-	-	-	2	-
24CSE644.3	-	3	-	-	-	-	-	-	-	-	-	2	-
24CSE644.4	-	-	3	-	1	-	-	-	-	-	-	2	-
24CSE644.5	-	-	-	2	2	-	-	-	-	-	-	2	-
24CSE644.6	-	-	-	3	3	-	-	-	-	-	-	3	-

MODULE-1	**INTRODUCTION TO MULTIMEDIA COMMUNICATIONS**	**24CSE644.1 24CSE644.2**	**8 Hours**

Introduction, multimedia information representation, multimedia networks, multimedia applications, Application and networking terminology, network QoS and application QoS, Digitization principles, Text, images, audio and video.

Case Study	Analyze the multimedia communication architecture of Zoom, Google Meet, or Microsoft Teams. Study how text, audio, video, and screen sharing are integrated while maintaining Quality of Service (QoS).
Text Book	Text Book 1: 1.2, 1.3, 1.4, 1.13, 1.15, 1.16

MODULE-2	**COMPRESSION TECHNIQUES FOR TEXT AND IMAGE**	**24CSE644.2 24CSE644.3**	**8 Hours**

Text and image compression,, compression principles, text compression- Runlength, Huffman, LZW, Document Image compression using T2 and T3coding, image compression- GIF, TIFF and JPEG.

Case Study	Compare the performance of JPEG, PNG, GIF, and TIFF image compression techniques by evaluating compression ratio, storage requirements, and image quality for multimedia applications.
Text Book	Text Book 1: 2.2, 2.3, 2.4 to 2.15

MODULE-3	**COMPRESSION TECHNIQUES FOR AUIDO AND VIDEO**	**24CSE644.3 24CSE644.4**	**8 Hours**

Audio and video compression, audio compression – principles, DPCM, ADPCM, Adaptive and Linear predictive coding, Code-Excited LPC, Perceptual coding, MPEG and Dolby coders video compression, video compression principles.

Case Study	Investigate the use of MPEG-4/H.264 video compression in YouTube or Netflix. Analyze how compression enables high-quality video streaming with reduced bandwidth consumption.		
Text Book	Text Book 2: 3.1, 3.3, 3.5, 3.7, 3.10		
MODULE-4	**STANDARDS AND FRAMEWORK**	**24CSE644.4 24CSE644.5**	**8 Hours**
Video compression standards: H.261, H.263, MPEG, MPEG 1, MPEG 2, MPEG-4 and Reversible VLCs, MPEG 7 standardization process of multimedia content description, MPEG 21 multimedia framework.			
Case Study	Study the multimedia standards used in OTT platforms (Netflix, Amazon Prime Video, Disney+ Hotstar). Analyze the role of MPEG standards and multimedia frameworks in delivering adaptive streaming services.		
Text Book	Text Book 1: 6.1, 6.3, 6.5, 6.7, Text Book 2: 10.1, 10.3, 10.5, 10.7		
MODULE-5	**SYNCHRONIZATION AND MANAGEMENT**	**24CSE644.5 24CSE644.6**	**8 Hours**
Notion of synchronization, presentation requirements, reference model for synchronization, Introduction to SMIL, Multimedia operating systems, Resource management, process management techniques.			
Self Study	Analyze synchronization and resource management techniques in video conferencing systems such as Zoom or Google Meet. Study how audio-video synchronization, buffering, and operating system resource allocation ensure smooth multimedia communication.		
Text Book	Text Book 2: 12.1 to 12.10		

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution		
		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	-	-	-
L2	Understand	-	5	-
L3	Apply	10	5	5
L4	Analyze	10	5	5
L5	Evaluate	5	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	-
L3	Apply	20
L4	Analyze	20
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Text Books:

1. Li, Ze-Nian, Mark S. Drew, and Jiangchuan Liu, Fundamentals of Multimedia, 3rd Edition, Springer International Publishing, 2022. ISBN: 978-3-030-62124-7.
2, Vaughan, Tay, Multimedia: Making It Work, 10th Edition, McGraw-Hill Education, 2024. ISBN: 9781266791963.

Reference Books:

1. Steinmetz, Ralf, and Klara Nahrstedt, Multimedia Systems, Springer International Publishing, 2023 Reprint Edition. ISBN: 9783319141640.
2. Behrouz A. Forouzan, Data Communications and Networking, 6th Edition, McGraw-Hill Education, 2022. ISBN: 9789355320940

Web links and Video Lectures (e-Resources): • SWAYAM Portal – https://swayam.gov.in?utm_source=chatgpt.com • NPTEL Online Courses – https://nptel.ac.in/courses?utm_source=chatgpt.com • https://www.w3.org/AudioVideo/?utm_source=chatgpt.com • https://www.netacad.com?utm_source=chatgpt.com
Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning • Video Streaming Simulation • Image format comparison • Audio recording and analysis • Codec comparison activity

CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES			
Course Code	**24CSE645**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**03**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

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

24CSE645.1	Understand the fundamentals of Blockchain Technology in different domains
24CSE645.2	Apply the various cryptographic mechanisms and network protocols used in Blockchain
24CSE645.3	Analyze smart contracts using solidity programs
24CSE645.4	Design the decentralized applications using Blockchain
24CSE645.5	Classify the industry applications using regulatory considerations
24CSE645.6	Identify projects which are ethical and contain social Implications

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSE645.1	-	-	-	-	3	-	-	-	-	-	-	3	-
24CSE645.2	3	-	-	-	3	-	-	-	-	-	-	3	-
24CSE645.3	-	3	-	-	3	-	-	-	3	-	-	3	-
24CSE645.4	-	-	3	-	3	-	-	-	3	-	-	3	-
24CSE645.5	-	3	-	-	3	-	-	-	3	-	2	3	-
24CSE645.6	-	-	-	-	-	3	3	3	3	-	2	3	-

MODULE-1	**OVERVIEW OF BLOCKCHAIN AND CRYPTOCURRENCY**	**24CSE645.1**	**8 Hours**

Overview of Blockchain Technology: Introduction to Blockchain, Introduction to Cryptocurrency, Evolution and Historical Background, Characteristics, Advantages and Limitations of Blockchain, Blockchain Architecture, Distributed Ledger Technology, Consensus Mechanisms, Mining.
Types of Blockchains: Public, Private, Consortium and Hybrid Blockchains, Permissioned and Permissionless Blockchains, Blockchain Wallets, Blockchain Transactions, and Use Cases of Different Blockchain Types.

Case Study	Walmart Food Supply Chain Using Blockchain.
Text Book	Text Book 1: Chapter 1,2,3

MODULE-2	**BLOCKCHAIN SECURITY PROTOCOLS**	**24CSE645.2**	**8 Hours**

Cryptography and Security: Cryptographic principles in blockchain, Cryptographic Hash Functions (SHA-256), Public and Private Key Cryptography, Digital Signatures, Merkle Trees, Security Challenges and Solutions in Blockchain.
Blockchain Networks and Protocols: Bitcoin Architecture and Transactions, Ethereum Architecture, Consensus Mechanisms (Proof of Work and Proof of Stake), Blockchain Forks, Hyperledger Fabric, Corda, Interoperability and Cross-chain Communication.

Self-Study	Secure Cross-Border Payment Using Hyperledger Fabric.
Text Book	Text Book 1 : Chapter 4,5

MODULE-3	**SMART CONTRACT APPLICATION DEVELOPMENT**	**24CSE645.3, 24CSE645.4**	**8 Hours**

Solidity: Introduction to Solidity, Need and Features, Data Types, Variables, Functions, Control Flow Statements, Structures, Arrays, Mappings, Events, Modifiers, Smart Contract Structure, Smart Contract Security Patterns, Development of Smart Contract Programs using Solidity.
Decentralized Applications (DApps): Introduction to DApps and their Characteristics, Ethereum Virtual Machine (EVM), Building DApps using Blockchain Platforms, Deployment of Smart Contracts, Layer-2 Scaling Solutions, DeFi Protocol Analysis, Tokenomics Concepts, DApp Architecture, Usability and Scalability Challenges of DApps.

Case Study	Blockchain-Based Digital Certificate Verification System.
Text Book	Text Book 1 : Chapter 10, Text Book 2: Steps 16–20

MODULE-4	**INDUSTRY USECASES AND LEGAL**	**24CSE645.5**	**8 Hours**

Use Cases and Industry Applications: Cryptocurrency Applications, Digital Payments, Finance (DeFi), Supply Chain Management, Healthcare, Identity Management, Voting and Governance Systems, Enterprise Blockchain Applications using Hyperledger Fabric.

Legal and Regulatory Considerations: Blockchain and Data Privacy, Intellectual Property Rights in Blockchain Applications, Regulatory Challenges and Compliance, Smart Contract Security and Legal Issues.

Self-Study	Secure and Transparent Electronic Voting System Using Blockchain
Text Book	Text Book 1 : Chapter 8,9, Text Book 2: Steps 21–22

MODULE-5	**ETHICAL CONSIDERATIONS AND FUTURE TRENDS**	**24CSE645.6**	**8 Hours**

Ethical and Social Implications: Addressing trust and transparency, Potential societal impacts of blockchain adoption, Responsible block chain development and usage.

Future Trends and Challenges: Emerging technologies in blockchain (e.g., sharding, sidechains), Environmental impact and sustainability, Scalability and performance improvements.

Case Study	Blockchain for Renewable Energy Trading in Smart Grids
Text Book	Text Book1: Chapter 10, Text Book 2: Steps 23–25

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	-	-	-
L2	Understand	-	-	-
L3	Apply	10	5	-
L4	Analyze	10	10	5
L5	Evaluate	5	-	5
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	-
L3	Apply	20
L4	Analyze	20
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Text Books:

1) Mark Gates, Blockchain: Ultimate Guide to Understanding Blockchain, Bitcoin, Cryptocurrencies, Smart Contracts and the Future of Money, Wise Fox Publishing, 2017, ISBN: 978-1976271599.

2) Daniel Drescher, Blockchain Basics: A Non-Technical Introduction in 25 Steps, Apress, 2017, ISBN: 978-1484226032.

Reference Books:

1) Imran Bashir, Mastering Blockchain: A Deep Dive into Distributed Ledgers, Consensus Protocols, Smart Contracts, DApps, Cryptocurrencies, Ethereum, and More, 4th Edition, Packt Publishing, 2023, ISBN: 978-1803241061.

2) Andreas M. Antonopoulos, Mastering Bitcoin: Programming the Open Blockchain, 2nd Edition, O'Reilly Media, 2017, ISBN: 978-1491954386.

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=SSo_EIwHSd4
- Learn Blockchain, Solidity, and Full Stack Web3 Development – freeCodeCamp
- https://www.youtube.com/watch?v=yubzJw0uiE4
- https://www.youtube.com/watch?v=ZE2HxTmxfrI

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

- Visit to any IT company which uses Blockchain Technology
- Demonstration of sample projects done using Blockchain
- Video demonstration of latest trends in Blockchain Technology
- Contents related activities (Activity-based discussions)

Ability Enhancement Course–V			
24CSE651	DevOps	24CSE654	Wearable Technologies
24CSE652	Containerization Tools	24CSE655	AI with MATLAB SIMULINK
24CSE653	Mobile Application Development		

DEVOPS			
Course Code	**24CSE651**	**CIE Marks**	**50**
L:T:P:S	**0:0:2:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**1**	**Exam Hours**	**03**

Course outcomes:

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

24CSE651.1	Apply DevOps fundamentals, version control concepts, and build automation tools such as Maven and Gradle for developing and building software applications.
24CSE651.2	Analyze Continuous Integration, Continuous Testing, and Continuous Deployment workflows using Jenkins with Maven/Gradle projects.
24CSE651.3	Implement configuration management and deployment automation using Ansible playbooks.
24CSE651.4	Evaluate cloud-based DevOps pipelines using Azure DevOps services for build, test, release, and deployment automation.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSE651.1	3	-	-	-	3	-	-	-	-	-	-	2	1
24CSE651.2	-	3	-	-	3	-	-	-	-	-	-	3	2
24CSE651.3	-	-	3	-	3	-	-	-	-	-	-	3	2
24CSE651.4	-	-	-	3	3	-	-	-	-	-	-	3	2

Pgm. No.	List of Programs	Hours	COs
	Prerequisites		
	Fundamentals of coding & programming language and basic understanding of SDLC, Linux commands and networking concepts.	**2**	**NA**
	PART - A		
1	Install and configure Maven and Gradle in a local system. Verify the installation using command-line commands and compare the basic project structure of Maven and Gradle.	2	24CSE651.1
2	Create a Maven-based Java application and configure the pom.xml file to manage dependencies and plugins. Build and execute the application using Maven commands.	2	24CSE651.1 24CSE651.2
3	Create a Gradle-based Java application using Groovy/Kotlin DSL build scripts. Configure dependencies and automate build tasks using Gradle commands.	2	24CSE651.1 24CSE651.2
4	Build and run a Java application using Maven and migrate the same application to Gradle. Compare the build configuration files and execution steps of both tools.	2	24CSE651.1 24CSE651.2
5	Install and configure Jenkins on a local or cloud environment. Create a basic Jenkins job to execute a simple Java/Maven/Gradle build.	2	24CSE651.2
6	Develop a Continuous Integration (CI) pipeline using Jenkins by integrating a Maven/Gradle project, triggering automated builds, and running test cases.	2	24CSE651.2
	PART - B		
7	Write and execute an Ansible playbook using inventory, modules, and YAML syntax to automate basic server configuration tasks.	2	24CSE651.3
8	Create a Jenkins CI pipeline for a Maven project and deploy the generated build artifact using Ansible playbook.	2	24CSE651.2 24CSE651.3

9	Create an Azure DevOps account and project. Configure an Azure DevOps repository/project board and explore the basic services required for a DevOps workflow.	2	24CSE651.4
10	Create an Azure Build Pipeline for a Maven/Gradle project by integrating GitHub/Azure Repos, running unit tests, and generating build reports.	2	24CSE651.1 24CSE651.4
11	Create an Azure Release Pipeline to deploy an application to Azure App Service. Configure secrets and application settings using Azure Key Vault.	2	24CSE651.4
12	Design and implement a complete DevOps pipeline for a sample application by integrating build automation, CI, configuration management, deployment, and reporting.	2	24CSE651.2 24CSE651.3 24CSE651.4

PART-C
Beyond Syllabus Virtual Lab Content
(To be done during Lab but not to be included for CIE or SEE)

- https://www.geeksforgeeks.org/devops-tutorial/
- https://www.javatpoint.com/devops
- https://maven.apache.org/guides/
- https://docs.gradle.org/
- https://www.jenkins.io/doc/
- https://docs.ansible.com/
- https://learn.microsoft.com/en-us/azure/devops/
- https://learn.microsoft.com/en-us/azure/devops/pipelines/
- https://learn.microsoft.com/en-us/azure/key-vault/
- https://www.youtube.com/watch?v=2N-59wUIPVI

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test(s)	Weekly Evaluation
		20	30
L1	Remember	-	-
L2	Understand	-	10
L3	Apply	10	10
L4	Analyze	5	5
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	5
L3	Apply	20
L4	Analyze	15
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:
Reference Books:

1) Mikael Krief, Learning DevOps: A Comprehensive Guide to Accelerating DevOps Culture Adoption with Terraform, Azure DevOps, Kubernetes, and Jenkins, 2nd Edition, Packt Publishing, 2022, ISBN-13: 978-1801813464.

2) Yevgeniy Brikman, Fundamentals of DevOps and Software Delivery: A Hands-On Guide to Deploying and Managing Software in Production, O'Reilly Media, 2025, ISBN-13: 978-1098174552.
3) Gaurav Agarwal, Modern DevOps Practices: Implement, Secure, and Manage Applications on the Public Cloud by Leveraging Cutting-Edge Tools, 2nd Edition, Packt Publishing, 2024, ISBN-13: 978-1805121824.
4) Bradley Smith, DevOps for the Desperate: A Hands-On Survival Guide, No Starch Press, 2022, ISBN-13: 978-1718502482.

CONTAINERIZATION TOOLS			
Course Code	**24CSE652**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

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

24CSE652.1	Apply Docker to create images and manage containers.
24CSE652.2	Analyze and configure secure Docker-based multi-container applications.
24CSE652.3	Design advanced Kubernetes solutions to deploy, manage, and protect containerized applications.
24CSE652.4	Implement CI/CD pipelines and Docker Swarm to deploy and manage containerized applications.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSE652.1	3	-	-	-	3	-	-	-	-	-	-	2	-
24CSE652.2	-	3	-	-	3	-	-	-	-	-	-	2	-
24CSE652.3	-	-	3	-	3	-	-	-	-	-	-	3	1
24CSE652.4	-	-	-	3	3	-	-	-	-	-	-	2	1

Pgm. No.	List of Programs	Hours	COS
	Prerequisite		
	Proficiency in a programming language and basic understanding of python, command-line interfaces, and networking concepts.	2	NA
	PART-A		
1	Install and set up Docker, then create and run a container that prints Student Details.	2	24CSE652.1
2	Create a Docker image using a Docker file and deploy a simple Python Flask web application.	2	24CSE652.1
3	Build a Docker container to run a Python script that performs basic file operations.	2	24CSE652.2
4	Create a Docker image for a Node.js application that serves a static HTML page.	2	24CSE652.2
5	Use Docker Compose to set up a multi-container application with a web server and a database.	2	24CSE652.2
6	Enhance with Trivy/Grype vulnerability scanning for image analysis.	2	24CSE652.2
	PART-B		
7	Deploy a simple application on a local Kubernetes cluster using Minikubes.	2	24CSE652.3
8	Implement Kubernetes Network Policies to restrict traffic between pods and configure an Ingress Controller to manage external access to services.	2	24CSE652.3
9	Set up monitoring and logging for a Kubernetes cluster using Prometheus and Grafana.	2	24CSE652.3
10	Create a CI/CD pipeline to automate the build, test, and deployment of a Docker application.	2	24CSE652.3

11	Explore and implement Docker Swarm for container orchestration and compare it with Kubernetes.	2	24CSE652.4
12	Deploy a Multi-Tier Application Using Helm.	2	24CSE652.4

PART-C

Beyond Syllabus Virtual Lab Content

(To be done during Lab but not to be included for CIE or SEE)

- https://www.docker.com/
- https://kubernetes.io/
- https://docker.com/
- https://kubernetes.io/
- **Docker Compose | Docker Course Labs**

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	5
L3	Apply	10	10
L4	Analyze	5	10
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	-
L3	Apply	20
L4	Analyze	20
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Reference Books:

1. Nisarg Vasavada, Dhwani Sametriya, "Cracking Containers with Docker and Kubernetes ", BPB Publications, 2021, ISBN-9391030793, 9789391030797.
2. Kelsey Hightower, Brendan Burns, and Joe Beda, Kubernetes: Up & Running, 3rd Edition, O'Reilly Media, 2022**,** ISBN-13 (O'Reilly eBook): 978-1098110192.
3. Nigel Poulton, Docker Deep Dive, Updated Edition, Lean pub, 2023, ISBN-13: 978-1916585256**.**
4. Nigel Poulton, The Kubernetes Book, 2024 Edition, Lean pub, 2024, ISBN-13: 978-1916585225**.**
5. Sean P. Kane and Karl Matthias, Docker: Up & Running: Shipping Reliable Containers in Production, 3rd Edition, O'Reilly Media, 2023, ISBN-13: 978-1098131821.
6. Marko Lukas and Justin Domingue, Kubernetes in Action, 2nd Edition, Manning Publications, 2025, ISBN-13: 978-1633436206.

MOBILE APPLICATION DEVELOPMENT			
Course Code	**24CSE653**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

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

24CSE653.1	Apply android development tools to build single screen mobile applications.
24CSE653.2	Analyze mobile applications using Intents for navigation and communication.
24CSE653.3	Design and implement data storage using files and SQLite databases in mobile application.
24CSE653.4	Develop android applications that integrates cloud-based messaging services for real-time user notifications.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSE653.1	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**
24CSE653.2	**-**	**3**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**
24CSE653.3	**-**	**-**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**1**
24CSE653.4	**-**	**-**	**-**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**1**

Pgm. No.	List of Programs	Hours	COs
	Prerequisite		
	Proficiency in a programming language (Java) and design guidelines.	2	**NA**
	PART-A		
1	Design an Android application that displays the message "Success Comes Through Practice" and customize its appearance using different font styles, text colors, font sizes and background colors.	2	**24CSE653.1**
2	Develop an Android application that displays information about a small business, design must include: - Business name - Photo of business - Contact information and - Description of Business	2	**24CSE653.1**
3	Develop an Android application using Button, TextView and EditText for designing a Calculator having basic functionality like Addition, Subtraction, Multiplication and Division.	2	**24CSE653.2**
4	Develop an Android application for an Expense Tracker using SharedPreferences to store, retrieve, update, and clear expense details. Display the saved expense information through an intuitive user interface.	2	**24CSE653.2**
5	Develop an Android application that performs currency conversion using Spinners for currency selection.	2	**24CSE653.2**
6	Develop an Android application using an Explicit Intent to navigate from a login screen to a welcome screen after validating user credentials. Display appropriate Toast messages for invalid login attempts.	2	**24CSE653.2**
	PART-B		

7	Develop an Android application that uses Implicit Intents to open the device's Gallery and Dialer applications through Gallery and Call buttons.	2	**24CSE653.2**
8	Develop an Android application using an Implicit Intent to share text content through WhatsApp or other social media applications using the Android Share Intent.	2	**24CSE653.2**
9	Develop an Android application, Tourist spot with three activities: Welcome page, Display attractions of tourist spot and Webpage of the tourist spot.	2	**24CSE653.2**
10	Develop an Android application The Expense Manager using Android. The application should store all the expenses in a file.	2	**24CSE653.3**
11	Develop an Android application Student Database App using Android. The app should store USN, Student name and Semester of student in SQLite database.	2	**24CSE653.3**
12	Develop an Android application using Firebase Cloud Messaging (FCM) to receive and display push notifications.	2	**24CSE653.4**

PART-C
Beyond Syllabus Virtual Lab Content
(To be done during Lab but not to be included for CIE or SEE)

- https://developer.android.com/courses/android-basics-compose/course
- https://www.geeksforgeeks.org/android/android-tutorial/
- https://developer.android.com/get-started/overview
- https://www.codecademy.com/catalog/subject/mobile-development
- https://developer.android.com/get-started/overview
- https://livelabs.oracle.com/ords/r/dbpm/livelabs/run-workshop?p210_wid=3620&P0_REDIRECT=Y

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	5
L3	Apply	10	10
L4	Analyze	5	10
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	-
L3	Apply	20
L4	Analyze	20
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Reference Books:

1) Sills, Bryan; Gardner, Brian; Marsicano, Kristin; Stewart, Chris; Android Programming, 5th Edition - Big Nerd Ranch Guide; 2022; ISBN-13: 978-0137645916.

2) Dawn Griffiths and David Griffiths**;** Head First Android Development; O'Reilly Media; 3rd Edition; 2021; ISBN- 13: 978- 1492076520.

3) Bryan Sills, Brian Gardner, Kristin Marsicano and Chris Stewart; Android Programming: The Big Nerd Ranch Guide*;* 5th Edition; Addison-Wesley Professional; 2022; ISBN-13: 978-0137645541.

WEARABLE TECHNOLOGIES			
Course Code	**24CSE654**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**02**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:

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

24CSE654.1	Apply the fundamental concepts of wearable technology and external metrics to improve the usability and functionality of wearable systems.
24CSE654.2	Analyze human body signals acquired from wearable devices.
24CSE654.3	Design wearable data analytics solutions by integrating external and internal metrics form wearable devices.
24CSE654.4	Implement wearable applications using real-time data to generate meaningful insights.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02
24CSE654.1	3	-	-	-	3	-	-	-	-	-	-	2	-
24CSE654.2	-	3	-	-	3	-	-	-	-	-	-	2	-
24CSE654.3	-	-	3	-	3	-	-	-	-	-	-	3	1
24CSE654.4	-	-	-	3	3	-	--	-	-	-	-	2	1

Pgm. No.	List of Programs	Hours	COs
	Prerequisite		
	• Usage of smart devices • Installation and Familiarization of Python Environment (Jupyter Notebook/Google Colab) • Importing Wearable Device Datasets from Smart watches/Mobile Health Applications (Google Fit/Fitbit/Apple Health)	2	NA
	PART-A		
1	Measure Step Counts using Python with data collected from Smartwatch/Mobile Health Applications (Google Fit/Fitbit/Apple Health datasets)	2	24CSE654.1
2	Track Heart Rate Changes Across Various Physical Activities using Python and Smartwatch Heart Rate Datasets	2	24CSE654.1
3	Record and Assess Sleep Patterns using Python with Sleep Tracking Data from Wearable Devices	2	24CSE654.2
4	Examine the Influence of Motion on Heart Rate using Python and Accelerometer & Heart Rate Datasets collected from Wearable Devices	2	24CSE654.2
5	Analyze the relationship between power consumption and data collection frequency in wearable devices using Python and battery usage datasets collected from smart wearable devices.	2	24CSE654.2
6	Analyze GPS Accuracy in Wearable Devices: Signal Strength and Analysis using Python and GPS Tracking Data from Smart watches/Mobile Applications.	2	24CSE654.2
	PART-B		
7	Analyze Heart Rate Variability (HRV) and Sleep Stage Monitoring using Python with data collected from Smartwatches/Wearable Devices	2	24CSE654.3
8	Analyze SpO_2 (Blood Oxygen Saturation) Data and Perform Anomaly Detection using Python and SpO_2 Datasets collected from Smartwatches/Wearable Devices.	2	24CSE654.3
9	Explore the interplay between wearable devices and posture-related feedback using Python and Accelerometer/Gyroscope Datasets.	2	24CSE654.3

	Analyze how wearable devices collect data, integrate external and internal metrics, and assess their impact on health and performance.		
10	Quantify Wellness by calculating a Comprehensive Wellness Index using Python and multiple wearable datasets (heart rate, sleep, step count, activity level, and body temperature).	2	24CSE654.4
11	Fitness Evaluation: Assess individual fitness levels using Python and wearable datasets to generate personalized fitness reports and goal recommendations.	2	24CSE654.4
12	Stress Management Index**:** Analyze physiological data using Python and wearable datasets to estimate stress levels and visualize stress trends using interactive dashboards.	2	24CSE654.4

PART-C
Beyond Syllabus Virtual Lab Content
(To be done during Lab but not to be included for CIE or SEE)

- https://sl-coep.vlabs.ac.in/exp/characterize-temperature-sensor/
- https://sl-coep.vlabs.ac.in/exp/temperature-sensor/
- https://sl-coep.vlabs.ac.in/exp/performance-bio-sensor/
- https://sl-coep.vlabs.ac.in/exp/performance-chemical-sensor/

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Weekly Evaluation	Lab CIE Test
		30	**20**
L1	**Remember**	**-**	**-**
L2	**Understand**	-	-
L3	**Apply**	10	10
L4	**Analyze**	10	5
L5	**Evaluate**	10	5
L6	**Create**	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	**-**
L2	**Understand**	-
L3	**Apply**	20
L4	**Analyze**	15
L5	**Evaluate**	15
L6	**Create**	**-**

Suggested Learning Resources:
Reference Books:

1) The Ultimate Guide to Informed Wearable Technology by Christine Farion, Packt, ISBN: 9781803230597, 2022.
2) Designing Wearable Technologies by Shuvra S. Bhattacharyya, Edward A. Lee, and Hiren Patel, Springer, ISBN: 9783030679736, 2021.
3) Wearable Telemedicine Technology for the Healthcare Industry by Hemanth D. Jude, Deepak Gupta, Ashish Khanna, and Aditya Khamparia, Academic Press, ISBN: 9780323858540, 2022.
4) Embedded Systems – A Hardware-Software Co-Design Approach: Unleash the Power of Arduino! by Bashir I. Morshed, Springer, ISBN: 9783030668075, 2021.

AI with MATLAB SIMULINK			
Course Code	**24CSE655**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:

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

24CSE655.1	Develop Simulink models for mathematical and signal-processing applications using standard blocks.
24CSE655.2	Examine logical and decision-making systems using Simulink for engineering applications.
24CSE655.3	Design an automation systems using MATLAB Simulink for real-world engineering problems.
24CSE655.4	Evaluate intelligent control systems using MATLAB Fuzzy Logic Toolbox for AI-based applications.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSE655.1	3	-	-	-	3	-	-	-	-	-	-	3	2
24CSE655.2	-	3	-	-	3	-	-	-	-	-	-	3	2
24CSE655.3	-	-	3	-	3	-	-	-	-	-	-	3	2
24CSE655.4	-	-	-	2	3	-	-	-	-	-	-	3	2

Pgm. No.	List of Programs	Hours	COs
	Prerequisite		
	• Verification of MATLAB installation and Simulink environment. • Introduction to MATLAB commands, variables, and basic Simulink blocks (Constant, Scope, Display, Sum, Gain).	2	NA
	PART-A		
1	Illustrate the MATLAB Simulink environment by creating a simple model using Constant and Scope blocks, which helps in understanding the basic structure and execution of a Simulink model.	2	24CSE655.1
2	Compute a Simulink model to compare two input signals using Relational Operator blocks and display the output using a Display block.	2	24CSE655.1
3	Use a Simulink model to generate and visualize different signals such as sine wave and ramp wave using Source and Scope blocks, which helps in understanding signal generation and observation.	2	24CSE655.1
4	Compute a Simulink model using a Saturation block to limit the amplitude of an input signal and analyze the output using a Scope block.	2	24CSE655.1
5	Implement a logical AND operation using Simulink Logic Operator blocks, which demonstrates the application of basic digital logic in model-based design.	2	24CSE655.2
6	Implement a logical OR operation using Simulink Logic Operator blocks and verify the output for different input combinations.	2	24CSE655.2
	PART-B		
7	Demonstrate a simple decision-making system using Relational Operator and Switch blocks in Simulink, which selects an output based on a specified condition.	2	24CSE655.2
8	Create a temperature monitoring system using Compare and Display blocks in Simulink to indicate whether the temperature is above or below a predefined threshold value.	2	24CSE655.3

9	Design an automatic street light controller using Simulink blocks, which switches the light ON during night conditions and OFF during day conditions.	2	24CSE655.3
10	Create a basic traffic light controller in Simulink that simulates the sequence of Red, Yellow, and Green signals using suitable timing blocks.	2	24CSE655.3
11	Design a water tank level indicator using Simulink blocks to display Low, Medium, and High water levels based on predefined level conditions.	2	24CSE655.3
12	Evaluate a simple fuzzy logic controller for fan speed regulation using the Fuzzy Logic Toolbox in Simulink, where the fan speed varies according to the temperature input.	2	24CSE655.4

PART-C
Beyond Syllabus Virtual Lab Content
(To be done during Lab but not to be included for CIE or SEE)

- http://vlabs.iitkgp.ac.in/ctrl/Exp9/index.html
- http://vlabs.iitkgp.ac.in/ctrl/Exp10/index.html
- https://dsp-iitkgp.vlabs.ac.in/exp/sampling-theorem/
- http://vlabs.iitkgp.ac.in/ctrl/Exp12/index.html

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	-
L3	Apply	10	10
L4	Analyze	5	10
L5	Evaluate	5	10
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	-
L3	Apply	20
L4	Analyze	20
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Reference Books:

1) Eklas Hossain, MATLAB and Simulink Crash Course for Engineers, Springer Nature Switzerland AG, 1st Edition, 2022. ISBN-978-3-030-89761-1
2) Marco P. Schoen, Introduction to Intelligent Systems, Control, and Machine Learning using MATLAB, Cambridge University Press, 1st Edition, 2023. ISBN-978-1-316-51825-0
3) Farzin Asadi, Applied Numerical Analysis with MATLAB®/Simulink: For Engineers and Scientists, Springer Nature, 1st Edition, 2023. ISBN-978-3-030-89761
4) The MathWorks, Inc., MATLAB and Simulink Documentation, Latest Online Documentation, 2025–Present. (Recommended online learning resource.)

ADVANCED PROBLEM SOLVING METHODOLOGIES			
Course Code	**24SDK66**	**CIE Marks**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**-**
Hrs / Week	**2**	**Total Marks**	**50**
Credits	**0**	**Exam Hours**	**02**

Course outcomes:
Upon successful completion of this course, the student will be able to:

24SDK66.1	Infer the complex problems using the concepts of data structures and C programming
24SDK66.2	Apply object-oriented programming concepts in C++and Java to solve real time problem statements.
24SDK66.3	Solve real-world problem using python and C#
24SDK66.4	Develop the skills of handling data base queries and procedures

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
24SDK66.1	3	3	-	-	2	-	-	-	-	-	-
24SDK66.2	2	3	3	-	3	-	-	-	-	-	-
24SDK66.3	2	2	3	2	3	-	-	-	-	-	-
24SDK66.4	2	3	3	-	3	-	-	-	-	-	-

MODULE-1	**Problem Solving On Data Structures and C**	**24SDK66.1**	**6 Hours**

Data Structures using C: Stack and queues, list, graph, tree, sorting and searching, Hash functions
Advanced C programming: Pointers, Recursion, Functions, Structure, Union, C Preprocessor

MODULE-2	**Problem Solving on Object Oriented Programming Using CPP**	**24SDK66.2**	**6 Hours**

Object Oriented Programming: Inheritance, Polymorphism, Exception handling, File Handling, Predefined function, Void function, Name spaces, Input and output streams.

MODULE-3	**Problem Solving on JAVA And XML**	**24SDK66.2**	**6 Hours**

Object oriented programming using Java: Inheritance, Polymorphism, Abstract class and Interface, Collections, Exception handling, Streams, Functional Interface.
XML: DTD, Schema, Server Path, DOM, XSLT, Name Space, AJAX.

MODULE-4	**Problem Solving Using C # And Python**	**24SDK66.3**	**6 Hours**

Python: Functions, iterators, Object oriented Programming, Exception Handling, Packages, Frame works- Django, Collections.
C#: Object oriented Programming, Delegate, Collections and generic, Name space.

MODULE-5	**Scenario Based Problems On DBMS**	**24SDK66.4**	**6 Hours**

ER Model, SQL- DDL, DML, TCL, DCL, Joins, subquery, PL/SQL-Index, Sequence, procedures and functions, normalization, B tree, B+ tree, Forms.

Note:

1. **Students shall solve the programming exercises and scenario-based problems available on the designated portal as part of the prescribed boot camp.**
2. **The CIE assessment and evaluation will be as per the guidelines framed by CDC.**

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		**Marks Distribution**
		Tests
		50
L1	**Remember**	5
L2	**Understand**	10
L3	**Apply**	20
L4	**Analyze**	15
L5	**Evaluate**	-
L6	**Create**	-

Suggested Learning Resources:

Reference Books:

1. Martin C Brown, "Python-The Complete Reference", Mc Graw Hill, 4th edition, 2020
2. Reema Tharega, "Data Structures using C", Oxford University Press, 2020
3. Ullakirch-Prinz, "A complete guide to program in C++", Jonas and Bartlett Learning, 2022
4. Kathy Sierra, "Headfirst Java", O'reilly Media, 2021
5. Andrew Stellman, "Headfirst C#", O'reilly Media, 2021

Web links and Video Lectures (e-Resources):

- https://www.learncpp.com/
- https://www.programiz.com/dsa
- https://code.visualstudio.com/Docs/languages/csharp
- https://www.udemy.com/course/the-complete-java-course-from-basics-to-advanced/?couponCode=ST16MT70224
- https://www.codecademy.com/learn/paths/c

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

- Analysis of industry relevant use cases
- Problem solving on scenario-based questions
- Placement portal practice sessions

CAPSTONE PROJECT

Course Code	**24CSE67**	**CIE Marks**	**50**
L:T:P:S	**0:0:2:0**	**SEE Marks**	**50**
Hrs / Week	**04**	**Total Marks**	**100**
Credits	**02**	**Exam Hours**	**03**

Course outcomes:

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

24CSE67.1	Identify societal problems under sustainable development goals and classify them under different domains of computer science and engineering and interdisciplinary perspective.
24CSE67.2	Demonstrate the ability to conduct comprehensive literature reviews using appropriate research databases, search strategies, and citation management tools to identify relevant sources of information.
24CSE67.3	Analyze existing literature and formulate the problem statement.
24CSE67.4	Formulate an idea and share the idea in a suitable platform
24CSE67.5	Organize the article logically, following a structured format with well-defined sections such as introduction, background, methodology, Analysis discussion, and conclusion.
24CSE67.6	Demonstrate their communication skill effectively with the technical presentation.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
24CSE67.1	3	3	2	-	-	3	2	3	3	3	2	-	2
24CSE67.2	3	3	3	2	-	3	2	3	3	3	2	-	2
24CSE67.3	3	3	3	2	1	3	-	3	3	3	2	2	2
24CSE67.4	3	3	3	2	2	-	-	3	3	3	2	2	2
24CSE67.5	3	3	3	2	2	-	1	3	3	3	2	2	2
24CSE67.6	3	-	-	-	2	-	-	3	3	3	2	2	2

Capstone Project : Roadmap, activities, and deliverables

Goal Selection and Project Planning:

- Identification of suitable topic based on Sustainable Development Goals.
- Forming project teams based on common interests and skill sets.
- Teams' involvement in developing project proposals outlining objectives, strategies, and expected outcomes.

Research and Needs Assessment:

- Survey conduction by thorough research on the chosen SDGs, including global and local context, challenges, and opportunities.
- Conduct needs assessments to identify specific issues or gaps that student projects can address

Interdisciplinary approaches:

- Applying interdisciplinary approaches and innovative solutions to tackle sustainability challenges.

Knowledge Sharing and Communication:

- Students share their project experiences and insights through presentations, reports, and social media.
- Foster peer-to-peer learning and collaboration by creating platforms for knowledge exchange and networking.

CIE Assessment Pattern (50 Marks – Demo and Viva)

RBT Levels		**Periodical Reviews & Evaluation**
		50
L1	**Remember**	**5**
L2	**Understand**	**5**
L3	**Apply**	**10**
L4	**Analyze**	**10**
L5	**Evaluate**	**10**
L6	**Create**	**10**

SEE Assessment Pattern (50 Marks – Demo and Viva)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	**-**
L2	**Understand**	**-**
L3	**Apply**	**20**
L4	**Analyze**	**10**
L5	**Evaluate**	**10**
L6	**Create**	**10**

Suggested Learning

Resources:

1. Johnson, L. M., & Brown, A. S. (2021), Modern Software Project Management: Strategies and Best Practices. Tech Knowledge Publishers.
2. Sustainable Development Goals: An Indian Perspective (Sustainable Development Goals Series) 1st ed. 2020 Edition,Somnath Hazra , Springer
3. McConnell, S. (2021), Software Project Survival Guide (2nd ed.). Microsoft Press. Schwalbe, K. (2022), Information Technology Project Management (9th ed.). Cengage Learning.

Web links and Video Lectures (e-Resources):

- https://www.project-everyone.org/
- https://www.instructables.com/Engineering-1/
- https://www.hackster.io/
- https://owl.purdue.edu/ (For writing effective articles)
- https://github.com/

NATIONAL SERVICE SCHEME			
Course Code	**24NSS60**	**CIE Marks (each Semester)**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**--**
Hrs / Week	**2**	**Total Marks**	**50 x 4 = 200**
Credits	**00**	**Exam Hours**	**02**

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

24NSS60.1	Understand the importance of his / her responsibilities towards society.
24NSS60.2	Analyse the environmental and societal problems/issues and will be able to design solutions for the same.
24NSS60.3	Evaluate the existing system and to propose practical solutions for the same for sustainable development. Implement government or self-driven projects effectively in the field.
24NSS60.4	Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
24NSS60.1	-	-	-	-	-	3	3	2	-	-	1
24NSS60.2	-	-	-	-	-	3	3	2	-	-	1
24NSS60.3	-	-	-	-	-	3	3	2	-	-	1
24NSS60.4	-	-	-	-	-	3	3	2	-	-	1

Semester/ Course Code	CONTENT	COs	HOURS
3RD 24NSS30	1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing 2. Waste management–Public, Private and Govt organization, 5R's. 3. Setting of the information imparting club for women leading to contribution in social and economic issues.	24NSS30.1, 24NSS30.2, 24NSS30.3, 24NSS30.4	30 HRS
4TH 24NSS40	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.	24NSS40.1, 24NSS40.2, 24NSS40.3, 24NSS40.4	30 HRS
5TH 24NSS50	7. Developing Sustainable Water management system for rural areas and implementationapproaches. 8. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill developmentprograms etc. 9. Spreading public awareness under rural outreach programs. (minimum 5 programs).	24NSS50.1, 24NSS50.2, 24NSS50.3, 24NSS50.4	30 HRS
6TH 24NSS60	10. Organize National integration and social harmony events / workshops / seminars. (Minimum TWO programs). 11. Govt. school Rejuvenation and helping them to achieve good infrastructure.	24NSS60.1, 24NSS60.2, 24NSS60.3, 24NSS60.4	30 HRS

CIE Assessment Pattern (50 Marks – Activity based) –

CIE component for every semester	Marks
Presentation - 1 Selection of topic, PHASE - 1	10
Commencement of activity and its progress - PHASE - 2	10
Case study-based Assessment Individual performance	10
Sector wise study and its consolidation	10
Video based seminar for 10 minutes by each student at the end of semester with Report.	10
Total marks for the course in each semester	**50**

- 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.

Suggested Learning Resources:

Reference Books:

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.

Pre-requisites to take this Course:

1. Students should have a service-oriented mindset and social concern.
2. Students should have dedication to work at any remote place, anytime with available resources and proper time management for the other works.
3. Students should be ready to sacrifice some of the time and wishes to achieve service-oriented targets on time.

Pedagogy:

- 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.
- State the need for NSS activities and its present relevance in the society and provide real-life examples.
- Support and guide the students for self-planned activities.
- NSS coordinator will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
- Encourage the students for group work to improve their creative and analytical skills.

Plan of Action:

- 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.
- At the end of every semester, activity report should be submitted for evaluation.
- Practice Session Description:
    - Lecture session by NSS Officer
    - Students Presentation on Topics
    - Presentation - 1, Selection of topic, PHASE – 1

- Commencement of activity and its progress - PHASE – 2
- Execution of Activity
- Case study-based Assessment, Individual performance
- Sector/ Team wise study and its consolidation
- Video based seminar for 10 minutes by each student at the end of semester with Report.

Sl No	Topic	Groupsize	Location	Activity execution	Reporting	Evaluation of the Topic
1.	Organic farming, IndianAgriculture (Past, Present and Future) Connectivity for marketing.	May be individual or team	Farmers land/Villages/ roadside / Community area / College campus	Site selection /proper consultation/ Continuous monitoring/ Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
2.	Waste management– Public, Private and Govtorganization, 5 R's.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Site selection /proper consultation/ Continuous monitoring/ Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
3.	Setting of the information imparting club for women leading to contributionin social and economic issues.	May be individual or team	Women empowerment groups/ Consulting NGOs & Govt Teams / College campus	Group selection/pro per consultation/ Continuous monitoring/ Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
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	site selection / proper consultation/ Continuous monitoring/ Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

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	Group selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
6.	Helping local schools toachieve good results and enhance their enrolment in Higher/ technical/ vocational education.	May be individual or team	Local government / private/ aided schools/Government Schemes officers	School selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
7.	Developing SustainableWater management system for rural areas and implementation approaches.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	site selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
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	Group selection/proper consultation/ Continuous monitoring / Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

9.	Spreading public awareness under ruraloutreach programs. (minimum5 programs)	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/pro per consultation/ Continuous monitoring / Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
10.	Organize National integration and socialharmony events / workshops / seminars. (Minimum 02 programs).	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Place selection/pro per consultation/ Continuous monitoring / Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
11.	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	Place selection/pro per consultation/ Continuous monitoring / Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

PHYSICAL EDUCATION AND SPORTS			
Course Code	**24PED60**	**CIE Marks (each semester)**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**--**
Hrs / Week	**2**	**Total Marks**	**50 x 4= 200**
Credits	**00**	**Exam Hours**	**02**

Course outcomes:

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

24PED6s0.1	Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness
24PED60.2	Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle
24PED60.3	Perform in the selected sports or athletics of student's choice and participate in the competition at regional/state / national / international levels.
24PED60.4	Understand the roles and responsibilities of organization and administration of sports and games

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO12
24PED60.1	-	-	-	-	-	2	-	3	3	-	2
24PED60.2	-	-	-	-	-	2	-	3	3	-	2
24PED60.3	-	-	-	-	-	2	-	3	3	-	2
24PED60.4	-	-	-	-	-	2	-	3	3	-	2

Semester	CONTENT	COs	HOURS
3RD 24PED30	**Module 1: Orientation** A. Lifestyle, B. Fitness C. Food & Nutrition D. Health & Wellness E. Pre-Fitness test.	24PED30.1, 24PED30.2	5 HRS
	Module 2: General Fitness & Components of Fitness A. Warming up (Free Hand exercises) B. Strength – Push-up / Pull-ups C. Speed – 30 Mtr Dash D. Agility – Shuttle Run E. Flexibility – Sit and Reach F. Cardiovascular Endurance – Harvard step Test	24PED30.2, 24PED30.3	15 HRS
	Module 3: Recreational Activities A. Postural deformities. B. Stress management. C. Aerobics. D. Traditional Games.	24PED30.3, 24PED30.4	10 HRS
4TH 24PED40	**Module 1: Ethics and Moral Values** A. Ethics in Sports B. Moral Values in Sports and Games	24PED40.1, 24PED40.2	5 HRS
	Module 2: Specific Games (Anyone to be selected by the student) A. Volleyball – Attack, Block, Service, Upper Hand Pass and Lower hand Pass.	24PED40.3	20 HRS

	B. Throwball – Service, Receive, Spin attack, Net Drop & Jump throw. C. Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus. D. Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up. E. Table Tennis – Service (Fore Hand & Back Hand), Receive (Fore Hand & Back Hand), Smash. F. Athletics (Track / Field Events) – Any event as per availability of Ground.		
	Module 3: Role of Organization and administration	24PED40.4	5 HRS
5TH 24PED50	**Fitness Components:** Meaning and Importance, Fit India Movement, Definition of fitness, Components of fitness, Benefits of fitness, Types of fitness and Fitness tips. **Practical Components:** Speed, Strength, Endurance, Flexibility, and Agility **Athletics**: 1. Track -Sprints: • Starting Techniques: Standing start and Crouch start (its variations) use of Starting Block. • Acceleration with proper running techniques. • Finishing technique: Run Through, Forward Lunging and Shoulder Shrug. 2. Jumps- Long Jump: Approach Run, Take-off, Flight in the air (Hang Style/Hitch Kick)and Landing 3. Throws- Shot Put: Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O'Brien Technique) **Handball OR Ball Badminton** **Handball:** A. Fundamental Skills 1. Catching, Throwing and Ball control, 2. Goal Throws: Jumpshot, Centershot, Diveshot, Reverseshot. 3. Dribbling: High and low. 4. Attack and counter attack, simple counter attack, counter attack from two wings and center. 5. Blocking, Goal Keeping and Defensive skills. 6. Game practice with application of Rules and Regulations. B. Rules and their interpretations and duties of officials **Ball badminton:** A. Fundamental Skills 1. Basic Knowledge: Various parts of the Racket and Grip. 2. Service: Short service, Long service, Long-high service. 3. Shots: Overhead shot, Defensive clearshot, Attacking clearshot, Dropshot, Netshot, Smash. 4. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials.	24PED50.1, 24PED50.2, 24PED50.3, 24PED50.4	Total 30 Hrs/ Semester 2 Hrs/week
6TH 24PED60	**Athletics**: 1. Track -110 Mtrs and 400Mtrs:	24PED60.1, 24PED60.2, 24PED60.3,	Total 30 Hrs/ Semester

	• Hurdling Technique: Lead leg Technique, Trail leg Technique, Side Hurdling, Over the Hurdles • Crouch start (its variations) use of Starting Block. • Approach to First Hurdles, In Between Hurdles, Last Hurdles to Finishing. 2. Jumps- High jump: Approach Run, Take-off, Bar Clearance (Straddle) and Landing. 3. Throws- Discus Throw: Holding the Discus, Initial Stance Primary Swing, Turn, Release and Recovery (Rotation in the circle). **Football OR Hockey** **Football:** A. Fundamental Skills 1. Kicking: Kicking the ball with inside of the foot, Kicking the ball with Full Instep of the foot, Kicking the ball with Inner Instep of the foot, Kicking the ball with Outer Instep of the foot and Lofted Kick. 2. Trapping: Trapping- the Rolling ball, and the Bouncing ball with sole of the foot. 3. Dribbling: Dribbling the ball with Instep of the foot, Dribbling the ball with Inner and Outer Instep of the foot. 4. Heading: In standing, running and jumping condition. 5. Throw-in: Standing throw-in and Running throw-in. 6. Feinting: With the lower limb and upper part of the body. 7. Tackling: Simple Tackling, Slide Tackling. 8. Goal Keeping: Collection of Ball, Ball clearance-kicking, throwing and deflecting. 9. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials. **Hockey:** A. Fundamental Skills 1. Passing: Short pass, Longpass, pushpass, hit 2. Trapping. 3. Dribbling and Dozing 4. Penalty stroke practice. 5. Penalty corner practice. 6. Tackling: Simple Tackling, Slide Tackling. 7. Goal Keeping, Ball clearance- kicking, and deflecting. 8. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials	24PED60.4	2 Hrs/week

CIE Assessment Pattern (50 Marks – Practical) –

CIE to be evaluated every semester end based on practical demonstration of Sports and Athletics activities learnt in the semester.

CIE	Marks
Participation of student in all the modules	10
Quizzes – 2, each of 7.5 marks	15
Final presentation / exhibition / Participation	25

	in competitions/ practical on specific tasks assigned to the students	
	Total	**50**

Suggested Learning Resources:

Reference Books:

1. Saha, A.K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
2. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata.
3. Petipus, et.al., Athlete's Guide to Career Planning, Human Kinetics.
4. Dharma, P.N. Fundamentals of Track and Field, Khel Sahitya Kendra, New Delhi.
5. Jain, R. Play and Learn Cricket, Khel Sahitya Kendra, New Delhi.
6. Vivek Thani, Coaching Cricket, Khel Sahitya Kendra, New Delhi.
7. Saha, A.K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
8. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata
9. Naveen Jain, Play and Learn Basketball, Khel Sahitya Kendra, New Delhi.
10. Dubey H.C., Basketball, Discovery Publishing House, New Delhi.
11. Rachana Jain, Teach Yourself Basketball, Sports Publication.
12. Jack Nagle, Power Pattern Offences for Winning basketball, Parker Publishing Co., New York.
13. Renu Jain, Play and Learn Basketball, Khel Sahitya Kendra, New Delhi.
14. SallyKus, Coaching Volleyball Successfully, Human Kinetics.

YOGA			
Course Code	**24YOG60**	**CIE Marks**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**--**
Hrs / Week	**2**	**Total Marks**	**50 x 4 = 200**
Credits	**00**	**Exam Hours**	**02**

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

24YOG60.1	Understanding the origin, history, aim and objectives of Yoga
24YOG60.2	Become familiar with an authentic foundation of Yogic practices
24YOG60.3	Practice different Yogic methods such as Suryanamaskara, Pranayama and some of the Shat
24YOG60.4	Use the teachings of Patanjali in daily life.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
24YOG60.1	-	-	-	-	-	3	-	-	-	-	1
24YOG60.2	-	-	-	-	-	3	-	-	-	-	1
24YOG60.3	-	-	-	-	-	3	-	-	-	-	1
24YOG60.4	-	-	-	-	-	3	-	-	-	-	1

Semester / Course Code	CONTENT	COs	HOURS
3rd 24YOG30	**Introduction of Yoga:** Aim and Objectives of yoga, Prayer: Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, importance of prayer **Brief introduction of yogic practices for common man:** Yogic practices for common man to promote positive health **Rules and regulations:** Rules to be followed during yogic practices by practitioner **Misconceptions of yoga:** Yoga its misconceptions, Difference between yogic and non-yogic practices. **Suryanamaskara:** 1. Suryanamaskar prayer and its meaning, Need, importance and b of Suryanamaskar. 2. Suryanamaskar 12 count,2rounds **Different types of Asanas**: 1. Sitting: Padmasana, Vajrasana, Sukhasana 2. Standing: Vrikshana, Trikonasana, Ardhakati Chakrasana 3. Prone line: Bhujangasana, Shalabhasana 4. Supineline: Utthitadvipadasana, Ardhahalasana, Halasana	24YOG30.1, 24YOG30.2, 24YOG30.3, 24YOG30.4	Total 30 Hrs/ Semester 2 Hrs/week

4TH 24YOG40	**Suryanamaskara:** Suryanamaskar 12 count,4rounds **Brief introduction and importance of:** **Kapalabhati:** Revision of Kapalabhati -40strokes/min3rounds **Different types of Asanas**: 1. Sitting: Paschimottanasana, Ardha Ushtrasana, Vakrasana, Aakarna Dhanurasana 2. Standing: Parshva Chakrasana, Urdhva Hastothanasana, Hastapadasana 3. Prone line: Dhanurasana 4. Supine line: Karna Peedasana, Sarvangasana, Chakraasana **Patanjali's Ashtanga Yoga**: Asana, Pranayama **Pranayama:** Chandra Bhedana, Nadishodhana, Surya Bhedana	24YOG40.1, 24YOG40.2, 24YOG40.3, 24YOG40.4	Total 30 Hrs/ Semester 2 Hrs/week
5TH 24YOG50	**Kapalabhati:** Revision of Kapalabhati - 60strokes/min3rounds **Brief introduction and importance of:** **Different types of Asanas**: 1. Sitting: Yogamudra in Padmasana, Vibhakta Paschimottanasana, Yogamudra in Vajrasana 2. Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana 3. Prone line: Padangushtha Dhanurasana, Poorna Bhujangasana / Rajakapotasana 4. Supine line: Navasana/Noukasana, Pavanamuktasana, Sarvanga **Patanjali's Ashtanga Yoga**: Pratyahara, Dharana **Pranayama:** Ujjayi, Sheetali, Sheektari	24YOG50.1, 24YOG50.2, 24YOG50.3, 24YOG50.4	Total 30 Hrs/ Semester 2 Hrs/week
6TH 24YOG60	**Kapalabhati:** Revision of Kapalabhati – 80 strokes/min3rounds **Brief introduction and importance of:** **Different types of Asanas**: 1. Sitting: Bakasana, Hanumanasana, Ekapada Rajakapotasana 2. Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana 3. Supine line: Setubandhasana, Shavasanaa (Relaxation posture) 4. Balancing: Sheershasana **Patanjali's AshtangaYoga**: Dhyana (Meditation), Samadhi **Pranayama:** Bhastrika, Bhramari, Ujjai **Shat Kriyas:** Jalaneti and sutraneti, Sheetkarma Kapalabhati	24YOG60.1, 24YOG60.2, 24YOG60.3, 24YOG60.4	Total 30 Hrs/ Semester 2 Hrs/week

CIE Assessment Pattern (50 Marks – Practical)

CIE to be evaluated every semester based on practical demonstration of Yogasana learnt in the semester and internal tests (objective type)

CIE	Marks
Avg of Test 1 and Test 2	25
Demonstration of Yogasana	25
Total	**50**

Suggested Learning Resources:

Reference Books:

1. Swami Kuvulyananda: Asma (Kavalyadhama, Lonavala)
2. Tiwari, O P: Asana Why and How
3. Ajitkumar: Yoga Pravesha (Kannada)
4. Swami Satyananda Saraswati: Asana Pranayama, Mudra, Bandha (Bihar School of yoga, Munger)
5. Swami Satyananda Saraswati: Surya Namaskar (Bihar School of yoga, Munger)
6. Nagendra H R: The art and science of Pranayama

7. Tiruka: Shatkriyegalu (Kannada) 8. Iyengar B K S: Yoga Pradipika (Kannada) 9. Iyengar B K S: Light on Yoga (English)
Web links and Video Lectures (e-Resources): • https://youtu.be/KB-TYlgd1wE • https://youtu.be/aa-TG0Wg1Ls

APPENDIX A: List of Assessment Patterns

S.NO	Pattern of Assessments
1	Group Discussions
2	Case Study / Caselets
3	Practical-Orientation on Design Thinking
4	Participatory & Industry-Integrated Learning
5	Practical Activities / Problem Solving Exercises
6	Class Presentations
7	Analysis of Industry / Technical / Business Reports
8	Reports on Industrial Visit
9	Industrial / Social / Rural Projects
10	Participation in external seminars / Workshops
11	Any Other Academic Activity
12	Online / Offline Quizzes

APPENDIX B: Outcome Based Education

Outcome-based education (OBE) is an educational theory that bases each part of an educational system around goals (outcomes). By the end of the educational experience each student should have achieved the goal. There is no specified style of teaching or assessment in OBE; instead classes, opportunities, and assessments should all help students achieve the specified outcomes.

There are three educational Outcomes as defined by the National Board of Accreditation:

Program Educational Objectives: The Educational objectives of an engineering degree program are the statements that describe the expected achievements of graduate in their career and also in particular what the graduates are expected to perform and achieve during the first few years after graduation. [nbaindia.org]

Program Outcomes: What the student would demonstrate upon graduation. Graduate attributes are separately listed in Appendix C

Course Outcome: The specific outcome/s of each course/subject that is a part of the program curriculum. Each subject/course is expected to have a set of Course Outcomes

Mapping of Outcomes



APPENDIX C: The Graduate Attributes of NBA

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

Problem Analysis: Identify, formulate, review research literature and analyse complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

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)

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)

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)

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)

Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams

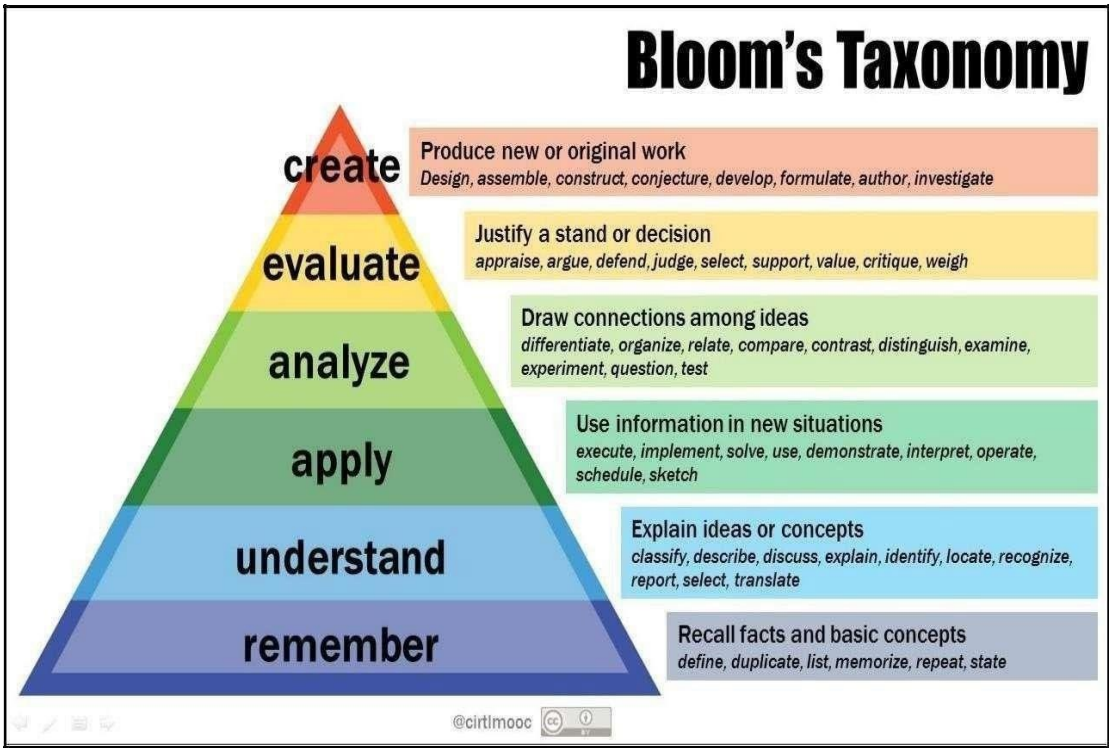
Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective language, and learning differences

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

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)

APPENDIX D: BLOOM'S TAXONOMY

Bloom's taxonomy is a classification system used to define and distinguish different levels of human cognition—i.e., thinking, learning, and understanding. Educators have typically used Bloom's taxonomy to inform or guide the development of assessments (tests and other evaluations of student learning), curriculum (units, lessons, projects, and other learning activities), and instructional methods such as questioning strategies.



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