माधव प्राद्यागिका एव विज्ञान सस्थान, ग्वालियर (म.प्र.), भारत
MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR (M.P.), INDIA
Deemed to be University
(Declared under Distinct Category by Ministry of Education, Government of India)
NAAC ACCREDITED WITH A++ GRADE

Department of Computer Science and Engineering
Scheme of Evaluation
B. Tech. VIII Semester *(CSE)*

(for batch admitted in academic session 2022-23)

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted									Total Marks	Contact Hours per week			Total Credits	Mode of Teaching	Mode of Exam.	Duration of Exam.
				Theory Slot				Practical Slot			MOOCs									
				End Term Evaluation		Continuous Evaluation		End Sem. Exam.	Continuous Evaluation					L	T	P				
				End Sem. Exam	$Proficiency in subject /course	Mid Sem. Exam.	Quiz/ Assignment		Lab Work & Sessional	Skill Based Mini Project	Assignment	Exam								
1.	DE	DE	Departmental Elective*(DE-4)	-	-	-	-	-		-	25	75	100	3	-	-	3	Online	MCQ	3 Hrs
2.	OC	OC	Open Category * (OC-3)	-	-	-	-	-		-	25	75	100	3		-	3	Online	MCQ	3 Hrs
3.	2150811	DLC	Internship/Project Project/Innovation & start-up	-	-	-	-	250	150	-	-	-	400	-	-	18	9	offline	SO	
4.	2150812	-	Professional Development#	-	-	-	-	50	-	-	-	-	50	-	-	4	2			
Total				-	-	-	-	300	150	-	50	150	650	06	-	22	17	-		
	Additional Courses for obtaining Honours or minor Specialization by desirous students			Permitted to opt for maximum two additional courses for the award of Honours or Minor specialization																

$Proficiency in course/subject – includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in that particular course/subject

Natural Sciences & Skills: Engineering Physics / Engineering Chemistry / Environmental Engineering / Language

Credits of Natural Sciences & Skills will be added in the VI Semester

MCQ: Multiple Choice Question **AO:** Assignment + Oral **PP:** Pen Paper **SO:** Submission + Oral

Mode of Teaching						Mode of Examination					Total Credits
Theory				Lab	NEC/professional development	Theory			Lab	SIP/SLP/NEC/ professional development	
Offline	Online	Blended		Offline	Interactive	PP	AO	MCQ	SO	SO	
		Offline	Online								
-	06			09	02			06	09	02	17
-	35			53	12			35	53	12	Credits %

DE-5*		
S. No.	Subject Code	Subject Name
1.	2150871	Natural Language Processing
2.	2150872	Blockchain and its Applications
3.	2150863	Selected Topics in Algorithms

OC-3*		
S. No.	Subject Code	Subject Name
1.		Affective Computing
2.		Natural Language Processing
3		Compiler Design

List of courses to be opted for Honors or Minor specialization in VIII Semester

Minor Specialization* *(to be opted by students of Other Department)*
Advanced Computer Networks
Data Mining
Foundations of Deep Learning: Concepts and Applications

Honors* ***(to be opted by students of Parent Department)***	
Track	**Course**
Information Security	Cryptography and Network Security
	Foundations of Cyber Physical Systems
IoT	**VLSI Physical Design**
	Introduction to Information Retrieval
High Performance Computing	Edge Computing
	Embedded System Design with ARM

*** Course run through SWAYAM/NPTEL/MOOC Learning Based Platform**

Department of Computer Science and Engineering
Scheme of Evaluation
B. Tech. VI Semester *(CSE)*

(for batch admitted in academic session 2023-24)

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted									Total Marks	Contact Hours per week			Total Credits	Mode of Teaching	Mode of Exam.	Duration of Exam.
				Theory Slot				Practical Slot			MOOCs									
				End Term Evaluation		Continuous Evaluation		End Sem. Exam.	Continuous Evaluation		Assignment	Exam		L	T	P				
				End Sem. Exam	$Proficiency in subject /course	Mid Sem. Exam.	Quiz/ Assignment		Lab Work & Sessional	Skill Based Mini Project										
1.	3150601	DC	Digital Image Processing	50	10	20	20	40	30	30	-	-	200	3	-	2	**4**	**Blended**	PP	2 Hrs
2.	3150602	DC	Machine Learning	50	10	20	20	40	30	30	-	-	200	3	-	2	**4**	**Blended**	**PP**	2 Hrs
3.	DE	DE	Departmental Elective* (DE-1)	-	-	-	-	-	-	-	25	75	100	3	-	-	**3**	**online**	MCQ	3 Hrs
4.	OC	OC	Open Category (OC-1)	50	10	20	20	-	-	-	-	-	100	3	-	-	**3**	**Blended**	**PP**	2 Hrs
5.	3150603	DLC	Minor Project-II	-	-	-	-	40	60	-	-	-	100	-	-	6	**3**	**Offline**	**SO**	
6.	200XXX	**CLC**	Novel Engaging Course (Informal Learning)	-	-	-	-	50	-	-	-	-	50	-	-	2	**1**	**SO**	**SO**	-
7.		**NSS**	Natural Science & Skills	200	40	80	80	120	40	40	-	-	600	1	-	2	**2***			
Total				**350**	**70**	**140**	**140**	**290**	**160**	**100**	**25**	**75**	**1350**	**13**	**-**	**14**	**20**			
10.	**1000007$$**	**MAC**	**Intellectual Property Rights(IPR)**	50	10	20	20	-	-				100	2	-	-	Grade	Online	M CQ	1.5 Hrs

$Proficiency in course/subject – includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in that particular course/subject

Natural Sciences & Skills: Engineering Physics / Engineering Chemistry / Environmental Engineering / Language

Credits of Natural Sciences & Skills will be added in the VI Semester

MCQ: Multiple Choice Question **AO:** Assignment + Oral **PP:** Pen Paper **SO:** Submission + Oral

Mode of Teaching						Mode of Examination					Total Credits
Theory				Lab	NEC	Theory			Lab	SIP/SLP/NEC	
Offline	Online	Blended		Offline	Interactive	PP	AO	MCQ	SO	SO	
		Offline	Online								
	3	9+2*	-	5	1	11	-	03+2*	03	01	20
	15	45+10*		25	5	55		15+10*	15	5	Credits %

DE-1*		
S. No.	Subject Code	Subject Name
1.	3150611	User-centric Computing For Human-Computer Interaction
2.	3150612	Games and Information

OC-1		
S. No.	Subject Code	Subject Name
1.		Database Management System
2.		Operating Systems

List of courses to be opted for Honors or Minor specialization in VI Semester

Minor Specialization* *(to be opted by students of Other Department)*
Programming in Modern C++
Introduction To Internet of Things

Honors* ***(to be opted by students of Parent Department)***	
Track1	**Course**
Information Security	Foundations of Cryptography
	Secure Computation: Part I
IoT	Introduction To Industry 4.0 And Industrial Internet Of Things
	Wireless Ad Hoc and Sensor Networks
High Performance Computing	Parallel Computer Architecture
	Advanced Computer Architecture

***Course run through SWAYAM/NPTEL/MOOC Learning Based Platform**

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Digital Image Processing

3150601

COURSE OBJECTIVES:

1. To understand the fundamentals of image acquisition, image processing in spatial and frequency domain.
2. To understand image transforms used in digital image processing.
3. To know about the image restoration techniques and methods used in image processing.

Unit I Introduction and Fundamentals

Introduction to Image Processing Systems, Digital Image fundamentals: Components of Digital Image Processing Systems, Image Model, Image Geometry, Sampling and Quantization of Images, Classification of Digital Images, Zooming and Shrinking, Relationship between pixels.

Unit II Image Enhancement in Spatial Domain

Introduction, Basic Gray Level Function, Piecewise Linear

Transformation, Contrast Stretching, Histogram Specification, Histogram Equalization, Local Enhancement using arithmetic and logical operation- Image Subtraction, Image averaging, Image Smoothing: Smoothing Spatial Filters, Smoothing Linear Filters, Image Sharpening.

Unit III Image Enhancement in Frequency Domain:

Introduction to Fourier Transform, Filters: Low Pass and High Pass, Gaussian Filters, Homomorphic Filtering, Image Restoration: Model of Image Degradation/Restoration process, Noise Models, Noise Reduction in Spatial and Frequency Domain, Inverse Filtering, Mean Filters, Least Mean Square (Wiener) Filtering, FIR Wiener Filter.

Unit IV Morphological Image Processing

Logic operation involving binary images, Dilation and Erosion, Opening and Closing, Morphological Algorithms: Boundary Extraction, Region filling, Extraction of connected components, Convex Hull, Thinning and Thickening.

Unit V Image Registration: Introduction, Geometric Transformation, Plane to plane Transformation, Mapping,

Image Segmentation: Introduction, Region Extraction, Pixel based approach, Multilevel Thresholding, Local Thresholding, Region based approach, Geometric Transformation Optimization for High-Resolution Image Registration, Multi-Thresholding and Region-Growing Algorithms for Complex Image Segmentation

RECOMMENDED BOOKS

1. Digital Image Processing 2nd Edition, Rafael C. Gonzalvez and Richard E. Woods. Published by: Pearson Education.

2. Digital Image Processing and Computer Vision, R.J. Schalkoff. Published by: John Wiley and Sons.

3. Fundamentals of Digital Image Processing, A.K. Jain. Published by Prentice Hall

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COURSE OUTCOMES

After completion of the course students would be able to:

CO1: Describe the fundamental concepts of digital image processing

CO2: Apply techniques for spatial domain image enhancement

CO3: Analyze frequency domain methods for image enhancement and restoration

CO4: Evaluate morphological image processing techniques, such as dilation, erosion, and algorithms for region filling, boundary extraction, and thinning.

CO5: Develop and implement methods for image segmentation and registration

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Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2		1	2		3			1	3	1	3	2	2
CO2	3	2	1	2		3			2		2	3	2	3
CO3	3	3	2			3			3			3	2	3
CO4	2	3	2	2		3			2		2	3	2	2
CO5	3	2	2			3		1	2		2	3	3	3

1 - Slightly; 2 - Moderately; 3 - Substantially

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Machine Learning

3150602

COURSE OBJECTIVES:

1. To understand types of issues and challenges that could be solved by machine learning.
2. To be able to understand wide variety of learning models and use them.
3. To be able to evaluate and optimize these models

Unit – I:

Introduction to Machine Learning: Learning, Traditional Vs Machine Learning, Types Of ML, Classification and Regression model, Challenges faced by ML, Steps of developing an ML model, Bias and Variance, Underfitting and Overfitting, Regularization, Data visualization, Outlier, Testing and validating, K cross validation, Hyperparameter tuning, Model Selection.

Unit – II:

Model optimization and Evaluation: Parametric and non- Parametric model, Learner performance evaluation, confusion matrix, Recall, accuracy, precision, Model optimization, Cost/Loss Function, Derivative of cost function and non-derivative cost function, Gradient descent, Mini-batch Gradient Descent (sckit-learn), Stochastic Gradient descent(sckit-learn), Momentum(sckit-learn).

Unit – III:

Supervised Machine Learning Algorithim with python: Model Complexity vs Dataset Size, Supervised Machine Learning Algorithms, k-Nearest Neighbors, Linear Regression, RMSE, Logistic Regression, Log Loss**,** Support Vector Machine, Hinge Loss, Kernel Trick, polynomial Kernal, Decision Trees, Gini impurity.

Unit – IV:

Ensemble Learner with python: Ensemble learner, Bagging, Pasting , Voting Classifiers, Out-of-Bag, Evaluation, Random Patches and Random Subspaces , Random Forests , Extra-Trees, Boosting , AdaBoost, Gradient Boosting, Stacking.

Unit –V:

Unsupervised Machine Learning with python: The Curse of Dimensionality, Principal component analysis, Clustering , K-Means, Limits of K-Means,Clustering,. Introduction to deep Learning ElasticNet, Transformer-based models, Explainable ML, Ethical ML, AutoML,, Capstone Project and Case Studies: Build an end-to-end supervised or unsupervised ML pipeline.

RECOMMENDED BOOKS:

1. Hands-On Machine Learning with Scikit-Learn, Keras and TensorFlow by Aurélien Géron
2. Introduction to Machine Learning with Python by Andreas C. Müller & Sarah Guido, O'reilly
3. Machine Learning For Absolute Beginners: A Plain English Introduction (Second Edition)" by Oliver Theobald
4. Machine Learning For Dummies" by John Paul Mueller and Luca Massaron
5. Machine Learning in Action" by Peter Harrington

COURSE OUTCOMES: After completing the course, the student will be able to:

CO1: Define basic concepts of Machine Learning.

CO2: Illustrate various techniques for learner evaluation and optimization using python

CO3: Implement various types of supervised machine learning algorithm using python

CO4: Apply ML ensemble model to solve real world problem using python

CO5: Apply unsupervised ML techniques to solve real world problems using python

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Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	3	2	1	1	-	1	1	2	3	3	1
CO2	3	3	3	1	2	1	-	-	1	1	1	3	3	1
CO3	3	3	3	2	3	1	1	-	1	1	2	3	3	2
CO4	3	2	2	2	3	1	-	-	1	1	2	3	3	3
CO5	2	2	3	3	3	1	-	-	2	3	3	3	3	2

1 - Slightly; 2 - Moderately; 3 – Substantially

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Machine Learning

2150602(OLD)

COURSE OBJECTIVES:

4. To understand types of issues and challenges that could be solved by machine learning.
5. To be able to understand wide variety of learning models and use them.
6. To be able to evaluate and optimize these models

Unit – I:

Introduction to Machine Learning: Learning, Traditional Vs Machine Learning, Types Of ML, Classification and Regression model, Challenges faced by ML, Steps of developing an ML model, Bias and Variance, Underfitting and Overfitting, Regularization, Data visualization, Outlier, Testing and validating, K cross validation, Hyperparameter tuning, Model Selection.

Unit – II:

Model optimization and Evaluation: Parametric and non- Parametric model, Learner performance evaluation, confusion matrix, Recall, accuracy, precision, Model optimization, Cost/Loss Function, Derivative of cost function and non-derivative cost function, Gradient descent, Mini-batch Gradient Descent (sckit-learn), Stochastic Gradient descent(sckit-learn), Momentum(sckit-learn).

Unit – III:

Supervised Machine Learning Algorithim with python: Model Complexity vs Dataset Size, Supervised Machine Learning Algorithms, k-Nearest Neighbors, Linear Regression, RMSE, Logistic Regression, Log Loss**,** Support Vector Machine, Hinge Loss, Kernel Trick, polynomial Kernal, Decision Trees, Gini impurity.

Unit – IV:

Ensemble Learner with python: Ensemble learner, Bagging, Pasting , Voting Classifiers, Out-of-Bag, Evaluation, Random Patches and Random Subspaces , Random Forests , Extra-Trees, Boosting , AdaBoost, Gradient Boosting, Stacking.

Unit –V:

Unsupervised Machine Learning with python: The Curse of Dimensionality, Principal component analysis, Clustering , K-Means, Limits of K-Means,Clustering, DBSCAN. ElasticNet, Transformer-based models, Explainable ML, Ethical ML, AutoML,, Capstone Project and Case Studies: Build an end-to-end supervised or unsupervised ML pipeline.

RECOMMENDED BOOKS:

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7. Introduction to Machine Learning with Python by Andreas C. Müller & Sarah Guido, O'reilly
8. Machine Learning For Absolute Beginners: A Plain English Introduction (Second Edition)" by Oliver Theobald
9. Machine Learning For Dummies" by John Paul Mueller and Luca Massaron
10. Machine Learning in Action" by Peter Harrington

COURSE OUTCOMES: After completing the course, the student will be able to:

CO1: Define basic concepts of Machine Learning.

CO2: Illustrate various techniques for learner evaluation and optimization using python

CO3: Implement various types of supervised machine learning algorithm using python

CO4: Apply ML ensemble model to solve real world problem using python

CO5: Apply unsupervised ML techniques to solve real world problems using python

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Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	3	2	1	1	-	1	1	2	3	3	1
CO2	3	3	3	1	2	1	-	-	1	1	1	3	3	1
CO3	3	3	3	2	3	1	1	-	1	1	2	3	3	2
CO4	3	2	2	2	3	1	-	-	1	1	2	3	3	3
CO5	2	2	3	3	3	1	-	-	2	3	3	3	3	2

1 - Slightly; 2 - Moderately; 3 – Substantially

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

OPERATING SYSTEMS
OC-1

COURSE OBJECTIVES

- Provide basic knowledge of computer operating system structures and functioning.
- Compare several different approaches to memory management, file management and process management
- Understand various problems related to concurrent operations and their solutions.

Unit- I

Basics of operating systems: Generations, Types, Structure, Services, System Calls, System Boot, System Programs, Protection and Security.
Process management: Process Concepts, Process States, Process Control Block, Scheduling-Criteria, Scheduling Algorithms and their Evaluation, Threads, Threading Issues.

Unit-II

Process synchronization: Background, Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors.
Deadlock: System Model, Deadlock Characterization, Deadlock Prevention, Detection and Avoidance, Recovery form Deadlock.

Unit-III

Memory management: Main Memory, Swapping, Contiguous Memory Allocation, Paging, Structure of Page Table, Segmentation, Virtual Memory, Demand Paging, Page Replacement Algorithms, Allocation of Frames, Thrashing.

Unit-IV

Storage management: Mass-Storage Structure, Disk Structure, Disk Attachment, Disk Scheduling, RAID Structure.

Unit-V

File system interface: File Concept, Access Methods, Directory Structure, File System Structure, Allocation Methods, and Free-Space Management.
System Protection: Goals, Principles, Domain of Protection, Access Matrix, Access Control.
Emerging topics: Real-Time Operating systems (RTOS), Sustainable Software Lifecycle Management in Software engineering, Ethical Software Designed Development

RECOMMENDED BOOKS

- Operating System Concepts, Silberschatz, Ninth Edition, Willey Publication.
- Operating Systems, Internals and Design Principles, Stallings, Seventh Edition, Pearson Publication.
- OPERATING SYSTEMS, Dr. Sukomal Pal, AICTE
- Modern Operating Systems, Tanenbaum, Fourth Edition. Pearson Publication.

COURSE OUTCOMES

After the successful completion of this course, the student will be able to:

CO1. **Outline** the basic concept of operating systems
CO2. **Analyze** the working of operating system
CO3. **Examine** the working of various scheduling/allocation approaches
CO4. **Measure** the performance of various scheduling/allocation approaches
CO5. **Develop** the Solution of various operating system problems/issues

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	1	2	1	1	1	1	3	3	3
CO2	3	3	3	3	3	1	1	1	1	1	1	3	3	3
CO3	3	3	3	3	3	2	1	1	1	1	1	3	3	3
CO4	3	3	2	3	2	1	1	1	1	1	1	3	3	3
CO5	3	3	3	3	2	1	1	1	1	1	1	3	3	3

1 - Slightly; 2 - Moderately; 3 – Substantially

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DATA BASE MANAGEMENT SYSTEM
OC-1

COURSE OBJECTIVES

- To understand the fundamental concepts of a database management system.
- To analyses database requirements and determine the entities involved in the system and their relationship to one another.
- To develop the logical design of the database using data modelling concepts &normalization.
- To manipulate a database using SQL commands.

Unit-I

Introduction: DBMS Concepts & Architecture, File processing system, limitation of file processing system, Advantages of Database System, Schemas, Instances, Data Independence, Data dictionary, Functions of DBA, Database languages, Data Models: Hierarchical Data Model, Network Data Model & Relational Data Model, E-R Model, Comparison between Models, Introduction of File organization Techniques.

Unit-II

Relational Data Models: Entities & Attributes, Entity types, Key Attributes, Relationships, Domains, Tuples, types of Attributes, Relations, Characteristics of Relations, Keys, Attributes of Relation, Relational Database, Integrity Constraints.
Relational Algebra: Concept and Relational Algebra operations like Select, Project, Join, Division, Union etc.

Unit-III

SQL: Introduction of SQL, features of SQL, Data Definition & Data Manipulation commands in SQL, SQL operators, Update Statements & Views in SQL, Query & Sub query, Data Retrieval Queries & Data Manipulation Statements examples etc.Overview of Tuple Oriented Calculus & Domain Oriented Relational Calculus.

Unit-IV

Normalization: Introduction to Normalization, concepts of anomalies and its types, closure set of dependencies and of attributes, Various Normal Forms: 1NF, 2NF, 3NF, BCNF, Functional Dependency, Decomposition, Dependency Preservation, Loss Less & Lossy Join, Definition of Dangling Tuple, and Multi-values Dependencies.

Unit-V

Transaction Processing & Concurrency Control: Transaction Processing Concepts, ACID properties, State Diagram, Types of Transaction, Basic idea of serializability, Concurrency Control, Concurrent operation of Databases, Recovery, Types of Recovery, Basic overview of Distributed Databases System and Relational Database Management System, Concepts of Object-Oriented Database System and its tools. Database design for ORDBMS, ORBMS implementation and challenges, OODBMS, comparison of RDBMS, OODBMS and ORDBMS

RECOMMENDED BOOKS

- Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", McGraw-Hill, 6th Edition.
- Raghu Ramakrishnan, Johannes Gehrke,"Database Management System", McGraw Hill., 3rd Edition.
- Elmasri & Navathe, "Fundamentals of Database System", Addison-Wesley Publishing, 5th Edition.
- Date C.J, "An Introduction to Database", Addison-Wesley Pub Co, 8th Edition.
- B.C. Desai, "An introduction to Database systems"

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1. Explain the terminology, features, classifications, characteristics, and data models embodied in database systems.

CO2. Describe the concepts related to the data modeling techniques, relational database model and relational algebra.

CO3. Apply the SQL commands over a given relational schema.

CO4. Analyze database schema to apply normalization technique for schema refinement.

CO5. Apply the transaction processing concepts and recovery methods over a real-time database system.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3					3	3	1	3	1
CO2	3	3	2	3	1					3	1	1	3	1
CO3	3	2	1	3	1						2	1	3	1
CO4	3	3	1	3	3						2	1	3	3
CO5	3	3	3	1	3	3					2	2	3	3

1 - Slightly; 2 - Moderately; 3 – Substantially

Department of Computer Science and Engineering

Digital Image Processing

3150601

LIST OF EXPERIMENT

1. Program to read an image and display it on the screen.
2. Program to determine image negative.
3. Read an image and perform different filtering operations (Average, Median etc.)
4. Program to create motion blur.
5. Program performs gray level slicing without background.
6. Program to perform brightness enhancement and brightness suppression of an image.
7. To create a vision program to find histogram value and display histograph of a grayscale and color image.
8. Read an RGB image and segment it using threshold method.
9. Read a colour image and separate the colour image into red green and blue planes.
10. Perform gamma correction for the given colour image
11. Program to perform different image conversion techniques
12. To create a color image and perform read and write operation
13. Code to implement watermarking in spatial domain.
14. Code to generate different levels of Gaussian Pyramid.

COURSE OUTCOMES

After completion of the course students would be able to:

CO1: Apply basic image processing techniques like filtering, enhancement, and transformation using suitable tools.

CO2: Design and implement image processing solutions for real-time and GUI-based applications.

CO3: Demonstrate teamwork, communication, and tool usage through project work and documentation.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1			1		2	2					1		3	
CO2			3	2	2	2			3		2	3	3	3
CO3			1		3	3		2	3	2	3	3		3

1 - Slightly; 2 - Moderately; 3 – Substantiall

Department of Computer Science and Engineering

Digital Image Processing

3150601

List of Skill Based Mini Project

1. Read multiple images from a folder and show them using sub plotting operation.
2. Read an image given by the user and perform different filtering operations (Average, Median etc.)
3. Implement Smart selfie using image processing techniques.
4. Object detection (eg. Face mask, Number plate etc.)
5. Bookshop management system using Image processing techniques
6. Real time sentiment analysis.
7. Apply image segmentation techniques on original image given by the user.
8. Implement a GUI to enhance the image using Histogram equalization techniques.
9. Implement a GUI for Edge detection (Sobel, Prewitt, Canny etc.)

Machine Learning

3150602

LIST OF EXPERIMENT

1. Perform exploratory data analysis and visualization after importing a .CSV file.
    - Handle missing data by detecting and dropping/ filling missing values.
    - Transform data using different methods.
    - Detect and filter outliers.
    - Perform Vectorized String operations on Pandas Series.
    - Visualize data using Line Plots, Bar Plots, Histograms, Density Plots and Scatter Plots.
2. Recognize data Skew-ness, outliers both using statistical function and Graphical representation.
3. Write a Python program to implement Simple Linear Regression to predict if male or female based on Height.
4. Implement Various Regression algorithm for House Price Prediction (USA housing Dataset) and compare their accuracy using scikit learn
    - Linear Regression
    - Polynomial Regression
    - Support Vector machine
5. Implement Logistic regression using softmax on iris dataset using scikit learn.
6. Implement Regularized Regression for house price prediction and evaluate their accuracy using scikit learn.
    - Ridge Regression
    - Lasso Regression
7. Implement Various Classification algorithms for iris data sets and evaluate their performance.
    - Naive Bayes Classifier
    - Logistic Regression

- Support vector Machine
- Decision tree

8. Implement Various ensemble on housing and iris dataset and evaluate their performance
    - Voting classifier
    - Random Forest (Bagging and pasting)
9. Implement principle component analysis on any chosen dataset/
10. Implement various clustering algorithm on chosen dataset
    1. K-Mean
    2. DBSCAN

COURSE OUTCOMES: After completing the course, the student will be able to:

CO1: Apply data preprocessing and visualization techniques using suitable tools.

CO2: Implement machine learning models for prediction, classification, and clustering.

CO3: Demonstrate teamwork, documentation, and model evaluation through project work.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	3	2	-	-	-	-	2	1	2	3	2
CO2	3	3	3	3	3	-	-	-	-	2	1	2	3	3
CO3	2	1	2	2	3	-	-	-	3	3	2	3	2	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Machine Learning

3150602

List of Skill Based Mini Project

1. Implement a regressor for any medical disease diagnosis.
2. Implement a Cervical Cancer Risk Classifier
3. Regression model for Video Game Sales Prediction
4. Regression model for predicting if song will be popular
5. Regression model for Customer Behavior Analysis
6. Regression model to predict health insurance cost
7. Titanic Survival Prediction
8. Spam and not Spam Classifier
9. Spotify Music Recommendation System
10. Target Customer segmentation.

Scheme of Evaluation

B. Tech. II Semester *(Computer Science and Engineering)* *(for batch admitted in academic session 2025-26)*

S. No.	Course Code	Category Code	Course Name	Maximum Marks Allotted						Total Marks	Contact Hours per week			Total Credits	Mode of Learning	Mode of Major Exam.	Duration of Major Exam.
				Theory Block				Practical Block									
				Continuous Evaluation			Major Evaluation	Continuous Evaluation	Major Evaluation		L	T	P				
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment		Lab Work & Sessional									
1.	15251201	DC	Computer Graphics	25	25	20	30	-	-	100	3	-	-	3	Face to Face	MCQ	2 Hrs
2.	15251202	DC	Object oriented Programming & Methodology	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
3.	15251203	DC	Computer System and Organization	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
4.	15251204	DC	Operating Systems	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
5.	15251205	ESC	**Basic Electrical & Electronics Engineering**	25	25	20	30	-	-	100	2	-	-	2	Face to Face	MCQ	2 Hrs
6.	15251206	DLC	Computer Graphics & Modelling Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
7.	15251207	DLC	Object oriented Programming & Methodology Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
8.	15251208	DLC	**Electrical & Electronics Engineering Lab**	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
9.	15251209	SP	**Semester Proficiency$**	-	-	-	-	50	-	50	-	-	2	1	Face to Face	SO	-
10.	15251210	PBL	**Micro Project-II#**	-	-	-	-	70	30	100	-	-	2	1	Experiential	SO	-
11.	NECXXXX X	NEC	**Novel Engaging Course (Activity Based Learning)**	-	-	-	-	50	-	50	-	1	-	1	Interactive	SO	-
12.	SIP1XXXX	SIP	**Skill Internship Program (Soft Skill)**	-	-	-	-	60	-	60	-	-	-	2**	Experiential	SO	-
Total				**125**	**125**	**100**	**150**	**440**	**120**	**1060**	**11**	**04**	**10**	**22**	-	-	-
13.	15251211	MAC	Sustainability & Environmental Science	-	-	-	-	100	-	100	-	2	-	GRADE	Blended	SO	-
14.	15251212	MWS	Mandatory Workshop on Career Planning & Goal Setting at Department Level											GRADE	Interactive	MCQ	-

Summer Semester of six-eight week duration will be conducted for makeup of I & II semester examination.

$Semester Proficiency– includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in the semester courses

MCQ: Multiple Choice Question **AO:** Assignment + Oral **PP:** Pen Paper **SO:** Submission + Oral **OB:** Open Book

** These credits will be transferred from Skill Internship Program (Soft Skill).

Micro Project-II will be presented and evaluated through an interdisciplinary project evaluation committee.

HSMC	BSC	ESC	DC	DE	SPC	OC	DLC	NEC	SP	SIP	SLP	PDC	PBL	MAC	MWS
0	0	1	4	0	0	0	3	1	1	0	0	0	1	1	1

Mode of Learning								Mode of Examination								Total Credits
Theory		Lab				NEC	SIP	Theory				Lab		NEC	SIP	
Face to Face	Online	Face to Face	Blended	Experiential	Experimental	Interactive	Experiential	PP	AO	MCQ	OB	SO	AO	SO	SO	
14		1	-	1	3	1	2	6		8		2	3	1	2	22
63.5		4.5		4.5	14	4.5	9	27.2		36.3		9	14	4.5	9	Credits %

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

COMPUTER GRAPHICS
15251201

COURSE OBJECTIVES

- To provide an introduction to the theory and practice of computer graphics.
- To give a good exposure related to Computer Graphics algorithms and to design various graphics primitives.
- To enhance the proficiency in programming skills related to animation and graphics object Design

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Unit-I

Introduction to Computer Graphics: Interactive Computer Graphics, Application of Computer Graphics, Random and Raster Scan Displays, Storage Tube Graphics Display, Calligraphic Refresh Graphics Display, Flat Panel Display, Refreshing, Flickering, Interlacing, Resolution, Bit Depth, Aspect Ratio etc. Societal and legal implications of CG, Real-world applications of CG in social problem-solving, sustainable use of graphics hardware

Unit-II

Scan Conversion Technique: Image representation, Line drawing: DDA, Bresenham's Algorithm. Circle Drawing: General Method, Mid-Point, DDA, Bresenham's Circle Generation Algorithm, And Ellipse Generation Algorithm, Curves: Parametric Function, Bezier Method, B-Spline Method.

Unit-III

2D & 3D Transformations: Translation, Rotation, Scaling, Reflection, Shearing, Inverse Transformation, Composite Transformation, World Coordinate System, Viewing Transformation, Representation of 3D object on Screen, Parallel and Perspective Projections.

Unit-IV

Clipping: Point clipping, Line Clipping, Simple Visibility Line Clipping Algorithm, Cohen Sutherland Line Clipping Algorithm, etc., Polygon Clipping, Convex and Concave Polygon, Sutherland Hodgeman Polygon Clipping Algorithm etc., Area Filling, Hidden Surface Elimination: Z- Buffer algorithm and Painter's Algorithm. Performance evaluation and comparison of graphics algorithms;

Unit-V

Basic Illumination Models: Diffuse & specular reflection; Phong/Blinn–Phong and Gouraud

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

OBJECT ORIENTED PROGRAMMING & METHODOLOGY
15251202

COURSE OBJECTIVES

- To study about the concept of object oriented programming.
- To create C++ programs that leverage the object oriented features of the C++ Language.
- To apply object oriented or non-object oriented techniques to solve bigger computing problems.

Unit-I

Introduction to C++ and Object Oriented Concepts: Basics of C++, Tokens, I/O Statements, Structure of Program, Operators and Expressions, Flow of Control, Arrays, Structures, Functions and its type, Programming Techniques: Unstructured & Structured Programming, Object Oriented Paradigm, Features of Oops, Comparison with Procedural Oriented Programming & Object Oriented Programming.

Unit-II

Classes & Objects: Creating of Objects, Characteristics of Object, Static Data Member, Static Member Function, Array of Objects, Object as Arguments, Inline Function, Default Arguments, Friend Function, and Recursion. Introduction, Types of Constructors.

Unit-III

Polymorphism: Introduction, Type of Polymorphism: Compile Time Polymorphism & Run Time Polymorphism, Function Overloading, Operator Overloading: Binary Operators, Arithmetic Assignment Operators, Unary Operators, Rules for Operator Overloading, Pitfalls of Operator Overloading.

Unit-IV

Inheritance: Types of Inheritance, Virtual Base Classes, Abstract Classes, Constructors in Derived Classes, Nesting of Classes, Overriding Member Function. Pointers Overview, Pointers to Objects, This Pointer, Pointers to Derived Classes, Virtual Functions & Pure Virtual Function, Association, Type of Association, Aggregation, File Handling Concepts

Unit-V

Emerging Oops concept: Standard Template Library (STL) / Collections Framework: Utilizing pre-built data structures, applying associated algorithms and iterators for efficient data manipulation, Multithreading, Interface-Driven Design.

RECOMMENDED BOOKS

- C++ How to Program, H M Deitel and P J Deitel, Prentice Hall..
- Programming with C++, D Ravichandran, T.M.H.
- Computing Concepts with C++ Essentials, Horstmann, John Wiley.
- The Complete Reference in C++, Herbert Schildt, TMH.
- Object-Oriented Programming in C++, E Balagurusam

COURSE OUTCOMES

After completion of the course, students would be able to:

CO1. Describe various fundamental of object-oriented design for programming practices.

CO2. Apply fundamental Object-Oriented Programming principles such as encapsulation, inheritance, and polymorphism in real problem.

CO3. Develop robust and scalable software systems and applications.

CO4. Create modular, maintainable, and extensible code that adheres to industry best practices.

CO5. Evaluate Object-Oriented solutions and make informed design decisions

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Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	3												
CO2			2				3						1	
CO3					2				2			2	2	
CO4					1								1	
CO5					2							1	3	1

1 - Slightly; 2 - Moderately; 3 – Substantially

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

COMPUTER SYSTEM AND ORGANIZATION
15251203

COURSE OBJECTIVES

- To provide the fundamental knowledge of a computer system and its processing units.
- To provide the details of input & output operations, memory management and performance measurement of the computer system.
- To understand how computer represents and manipulate data.

Unit I

Introduction: Von-Neumann Model, Harvard Architecture, Various Subsystems, CPU, Memory, I/O, System Bus, CPU and Memory Registers, Program Counter, Accumulator, Register Transfer and Micro Operations: Register Transfer Language, Tree-State Bus Buffers, Bus and Memory Transfers, Arithmetic Micro-Operation, Logic Micro-Operation, Shift Micro- Operation.

Unit- II

Computer Arithmetic: Addition and Subtraction with Signed-Magnitude, Multiplication Algorithm, Division Algorithm, Division Algorithms, Floating-Point Arithmetic Operations.

Central Processing Unit (CPU): General Purpose Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer (RISC).Hardwired and Micro programmed Control.

Unit -III

Input-Output Organization: Peripheral Devices, I/O Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, DMA (DMA Controller, DMA Transfer), Input-Output Processor (IOP), Data Transfer- Serial/Parallel, Simplex/ Half Duplex/ Full Duplex.

Unit -IV

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, AssociativeMemory, Cache Memory- Organization and Mappings, Replacement policies, Memory Management Hardware. **Introduction to Pipelining:** Concept of pipelining, Performance of pipelined processors, Pipeline speedup & efficiency, Non-pipelined vs pipelined execution, Pipeline Hazards

Unit-V

Introduction to Modern Processors: Intel: i-series, Apple: M-Series, ARM Cortex-A, AMD etc. Tensor Cores, Neural Processing Unit (NPU), AI Accelerators, Warp/Wavefront Execution, CUDA Cores, Matrix Multiplication Engine, Inference Engine, Unified Shader Architecture.

RECOMMENDED BOOKS

- Computer System Architecture, Morris Mano, PHI.
- Microprocessor Architecture, Programming and Applications with the 8085, Gaonkar,
- Computer Organization, Carl Hamacher, THM.
- Computer Architecture and Organization, J P Hayes, Mc-Graw Hills, New Delhi.

COURSE OUTCOMES

After completion of the course students would be able to:

CO1. Explain the fundamental computer architectures and internal CPU operations.
CO2. Evaluate CPU organization, instruction design, addressing modes, and control unit implementation.
CO3. Describe input/output structures and analyze data transfer techniques including interrupts, DMA, and I/O processing.
CO4. Evaluate cache design, replacement strategies, memory management hardware, and pipelined execution performance.
CO5. Analyze modern processor and advanced architectures including AI accelerators, NPUs, Tensor Cores, and GPU execution models.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3			3							3	3	
CO2	3	3					3					2	3	3
CO3	3	2	2		3				2			3	3	3
CO4	3	3		3	2							3	3	3
CO5	3	3		3	3							2	3	3

1 - Slightly; 2 - Moderately; 3 – Substantially

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

OPERATING SYSTEMS
15251204

COURSE OBJECTIVES

- Provide basic knowledge of computer operating system structures and functioning.
- Compare several different approaches to memory management, file management and process management.
- Understand various problems related to concurrent operations and their solutions.

Unit- I

Basics of operating systems: Generations, Types, Structure, Services, System Calls, System Boot, System Programs, Protection and Security, User mode vs kernel mode.
Process management: Process Concepts, Process States, Process Control Block, Scheduling-Criteria, Scheduling Algorithms and their Evaluation, Threads, Threading Issues.

Unit-II

Process synchronization: Background, Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors.
Deadlock: System Model, Deadlock Characterization, Deadlock Prevention, Detection and Avoidance, Recovery form Deadlock.

Unit-III

Memory management: Main Memory, Swapping, Contiguous Memory Allocation, Paging, Structure of Page Table, Segmentation, Virtual Memory, Demand Paging, Page Replacement Algorithms, Allocation of Frames, Thrashing.

Unit-IV

Storage management: Mass-Storage Structure, Disk Structure, Disk Attachment, Disk Scheduling, RAID Structure.
File system interface: File Concept, Access Methods, Directory Structure, File System Structure, Allocation Methods, and Free-Space Management.
System Protection: Goals, Principles, Domain of Protection, Access Matrix, Access Control

Unit-V

Emerging topics: Overview of Real-Time Operating Systems (RTOS), Brief introduction to mobile and cloud operating systems, Virtualization (Hypervisors, Type-1 & Type-2), Containerization Basics (Docker Concept)

RECOMMENDED BOOKS

- Operating System Concepts, Silberschatz, Ninth Edition, Willey Publication.
- Operating Systems, Internals and Design Principles, Stallings, Seventh Edition, Pearson Publication.
- OPERATING SYSTEMS, Dr. Sukomal Pal, AICTE
- Modern Operating Systems, Tanenbaum, Fourth Edition. Pearson Publication.

COURSE OUTCOMES

After the successful completion of this course, the student will be able to:

CO1. **Explain** the fundamental concepts, structure, and services of operating systems.
CO2. **Analyze** the mechanisms of process management, synchronization, and deadlock handling.
CO3. **Apply** memory management techniques to solve allocation and paging problems.
CO4. **Evaluate** the performance of CPU scheduling, disk scheduling, and page replacement algorithms.
CO5. **Design** solutions for issues related to system protection, security, and resource management.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	1	1	-	-	-	1	-	2	3	1
CO2	3	3	2	2	1	-	-	-	1	1	-	2	3	2
CO3	3	3	3	2	1	-	-	-	1	1	-	2	3	2
CO4	2	3	2	3	2	1	-	-	1	1	-	2	2	3
CO5	2	3	3	2	2	2	1	1	2	1	1	3	2	3

1 - Slightly; 2 - Moderately; 3 – Substantially

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

BASIC ELECTRICAL & ELECTRONICS ENGINEERING
15251205

Course Objectives:

- Impart foundational knowledge in Electrical and Electronics Engineering.
- Enable students to analyze electric circuits, understand electrical machines, and implement digital systems.
- Explore emerging applications in industrial automation, smart grids, and renewable systems.

Unit I

D.C. Circuits Analysis: Voltage and Current Sources: Dependent and independent source. Source conversion. Kirchhoff's Law, Mesh and Nodal analysis. Network theorems: Superposition theorem, Thevenin's theorem & Norton's theorem and their applications.

Unit II

Single-phase AC Circuits: Generation of sinusoidal AC voltage, definitions: Average value, R.M.S. value, Form factor and Peak factor of AC quantity, Concept of Phasor, analysis of R-L, R-C, R-L-C Series and Parallel circuit, Power and importance of Power factor, Resonance in AC circuits.

Unit III

Transformer & Electrical Machines: Magnetic Circuits and Electromagnetism, Transformers: Construction, principle, types, losses & efficiency, OC & SC test DC Machines: Motor and Generator working Principles, Characteristics, Introduction to Induction Motors and Synchronous Machines.

Unit IV

Digital Electronics, Devices & Circuits: Number Systems, Logic Gates and Truth Tables, Diodes, Transistors (BJT), Multiplexers, Demultiplexers.

Unit V

Emerging Trends and Applications: Introduction to Smart Grids, Smart Meters, and Renewable Systems. Types of earthing, Sensors and Basic IoT Applications.

Recommended Books:

1. Basic Electrical and Electronics Engineering, D.P. Kothari and I.J. Nagrath, 2nd Edition, McGraw-Hill Education, 2020.
2. Basic Electrical and Electronics Engineering, S.K. Bhattacharya, 2nd Edition, Pearson Education, 2017.
3. Basic Electrical Engineering, V.N. Mittle and Arvind Mittal, 2nd Edition, McGraw-Hill Education, 2005.

4. Basic Electrical Engineering, A.E. Fitzgerald, David E. Higginbotham, and Arvin Grabel, 5th Edition, McGraw-Hill Education, 1981.
5. Principles of Electrical Engineering and Electronics, V.K. Mehta and Rohit Mehta, Revised Edition, S. Chand Publishing, 2019.

Course Outcomes (COs):

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

CO1. **Apply** fundamental laws and network theorems to analyze DC circuits
CO2. **Analyze** single-phase series & parallel AC circuits for calculation of power, power factor, and resonance conditions.
CO3. **Explain** the working principles, construction, and operational characteristics of transformers, DC machines, and induction motors.
CO4. **Design** basic digital logic circuits using logic gates, flip-flops, and counters
CO5. **Discuss** the concepts of smart meter, smart grids, earthing, and IoT systems to emerging industrial applications in automation and renewable energy systems.

Course Articulation Matrix

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	*PSO1	*PSO2
CO1	3	3	2	2	1	-	-	-	-	-	-	1		
CO2	3	3	2	2	1	-	-	-	-	-	-	1		
CO3	3	2	3	2	2	1	-	-	-	-	-	2		
CO4	3	3	3	2	1	-	-	1	2	2	-	1		
CO5	3	2	3	2	3	2	2	2	-	1	1	2		

1 - Slightly; 2 - Moderately; 3 – Substantially

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

COMPUTER GRAPHICS & MODELLING LAB

15251206

List of Experiments

1. Installation and Introduction to OpenGL basics, graphic functions, commands for compiling and executing an OpenGL Program.
2. Write a Program to create an output window, to plot a point with given coordinates and other basic demonstrations.
3. Write a Program to implement DDA Line Drawing Algorithm.
4. Write a Program to implement Bresenham's Line Algorithm.
5. Write a Program to implement Mid-Point Circle Algorithm.
6. Performance evaluation of Z-Buffer vs. Painter's Algorithm using runtime measurements.
7. Write a Program to implement following 2D transformations: Translation, Scaling and Rotation of a line and polygon around origin.
8. Write a Program to implement Bezier curve & B-spline.
9. Write a Program to implement Flood Filling Algorithm & Boundary Filling Algorithm using polygon.
10. Write a program to design a short 2D/3D educational or social-awareness animation (e.g., road safety, hand-washing steps, disaster safety, sign-language gesture animation).
11. Write a program to visualize a real-world social dataset (such as pollution levels, rainfall intensity, or traffic density) using animated color gradients and interpret how the visualization supports societal awareness.

COURSE OUTCOMES

After completion of the course students will be able to:

CO1. Develop the ability to implement and manipulate algorithms for drawing geometric shapes, transformations, and color models.

CO2. Implement and apply 2D and 3D transformations (translation, rotation, scaling, reflection, etc.) on graphical objects.

CO3. Develop the ability to design and implement a complete graphical application with user interaction and dynamic graphics.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	3	1	1	1	1	1		1	3	1
CO2	3	2	2	1	3				1	1	1	1	3	1
CO3	2	2	3	1	3	2	1	1	2	3	2	2	2	3

1 - Slightly; 2 - Moderately; 3 – Substantially

1 - Slightly; 2 - Moderately; 3 - Substantially

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

OBJECT ORIENTED PROGRAMMING & METHODOLOGY
15251207/29251202

List of Experiments

1. Write a program to swap two integers without using third variable. The swapping must be done in a function of a particular class.

2. Write a program that uses a class where the member functions are defined outside a class.

3. Design a class to represent a bank account. Which includes account number, name of the depositor, type of the account, balance amount in the account. Define Methods, to assign initial values, to Deposit an amount, to Withdraw amount after checking balance, to display name and balance.

4. Write a program to find the greater of two given numbers in two different classes using friend function.

5. Create an inheritance hierarchy of Rodent, Mouse, Gerbil, Hamster etc. In the base class provide methods that are common to all Rodents and override these in the derived classes to perform different behaviors, depending on the specific type of Rodent. Create an array of Rodent, fill it with different specific types of Rodents and call your base class methods.

6. Create two classes: Polar and Cartesian, to represent Polar and Cartesian coordinates of a point. Demonstrate how to convert Polar coordinates to Cartesian coordinates by writing the conversion code in source class.

7. Write a Program to Demonstrate Anomaly in Multi-path (Diamond) Inheritance and Its Solution

8. Write a Program Abstract Class Shape with Cone and Sphere

9. Create LIST Class with Stack and Queue Using Pure Virtual Functions

10. Write a program to demonstrate working of various file handling operations in C++

COURSE OUTCOMES

After completion of the course students would be able to:

CO1. Demonstrate the use of various OOPs concepts with the help of programs.

CO2. Formulate solutions to problems demonstrating usage of control structures, modularity, I/O and other standard language constructs.

CO3. Enumerate Implement appropriate object orient programming concepts for solving real world problems.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1		1											1
CO2		1	2				1						1	
CO3		1			1									2

1 - Slightly; 2 - Moderately; 3 – Substantially

BASIC ELECTRICAL & ELECTRONICS ENGINEERING
15251208

LIST OF EXPERIMENT

1. To verify Kirchhoff's Current Law & Kirchhoff's Voltage Law.
2. To verify Superposition Theorem
3. To determine resistance & inductance of a choke coil.
4. To determine active & reactive power in a single phase A.C circuit.
5. To determine voltage ratio & current ratio of a single phase transformer.
6. To determine the polarity of a single phase transformer.
7. To perform open circuit & short circuit test on a single phase transformer.
8. To study multimeter & measure various electrical quantities
9. To study of constructional details of DC machine.
10. To determine the V-I characteristics of diode in forward bias & reverse bias condition.
11. To determine phase and line quantities in three phase star and delta connection
12. To study of effect of open and short circuits in simple circuits
13. To plot Transistor CB characteristics (Input and Output)
14. To plot Transistor CE characteristics (Input and Output)
15. **Study the output characteristics of a solar PV panel under varying conditions**
16. **Develop a simple IoT system to monitor temperature and humidity using sensors.**

Course Outcomes:

After the completion of the lab, the student will be able to –

CO1 **Demonstrate** the ability to operate lab equipment and instruments relevant to the electrical engineering field

CO2 **Collect** experimental data accurately and effectively in ethical manner

CO3 **Integrate** theoretical knowledge from coursework into practical applications and experiments

CO4 **Communicate** experimental results effectively through oral presentations and written documentation

CO5 **Demonstrate** responsibility and professionalism in the completion of lab tasks and assignments

CO6 **Show** willingness to learn new techniques, tools, or methods to enhance practical engineering skills

Course Articulation Matrix

COs / POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO 1	3	2	2	3	3	3	3	2	-	-	-	2		
CO 2	2	3	2	3	2	3	2	3	-	2	-	2		
CO 3	3	3	3	3	2	2	2	2	2	3	2	3		
CO 4	1	2	2	3	-	2	2	3	3	3	2	2		
CO 5	-	-	1	2	-	3	3	3	3	3	2	3		
CO 6	2	2	2	2	3	3	3	2	3	3	2	3		

1 - Slightly; 2 - Moderately; 3 – Substantially

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

MICRO PROJECT-II
15251210

Course Objective:

- Understand and apply basic programming constructs, file handling, and simple data structures to solve small-scale computational problems.
- Develop practical applications integrating fundamental concepts of algorithms, database operations, and introductory networking.
- Build interactive CLI/GUI/Web interfaces using beginner-friendly tools to enhance user experience and problem-solving.

List of Projects

1. Simple Calculator (with History Log)

Addition, subtraction, multiplication, division and stores past calculations in a file

2. Password Strength Checker

Checks password quality using regex rules.

3. Basic To-Do List (CLI)

Add, delete, view simple tasks (stored in a text file).

4. Student Grade Calculator

Based on marks → grade/percentage.

5. Electricity Bill Calculator

Uses slabs and conditions.

6. Number Guessing Game

Random number + attempts counter.

7. Currency Converter (Hardcoded Rates)

Simple menu-driven program.

8. String Analyzer Tool

Counts vowels, words, characters.

9. Marks/Attendance Percentage Calculator

Takes multiple inputs, shows summary.

10. Mini Banking Menu (Without DB)

Deposit, withdraw, balance using variables.

11. Library Management (File-Based)

Add, search, delete books; store in text file.

12. Contact Book (Array/List Based)

Add, search, update contacts.

13. Shopping List Manager

Simple item list + remove items.

14. Student Record System (File-Based)

Add student info and retrieve records.

15. Simple Inventory Tracker

Products stored in file; stock updates.

16. Railway/Bus Reservation Prototype (Simple)

Shows seats as array, books a seat.

17. Basic Billing System for Shop

Calculates total & prints bill to text file.

18. Hostel Attendance Tracker

List of students → mark present/absent.

19. Quiz System (File-Based Questions)

Reads Q/A from file; calculates score.

20. Employee Payroll Calculator

Basic salary, allowances, net pay.

21. Maze Solver (DFS/BFS optional)

User enters maze layout → find path.

22. Banking System Simulation (File Handling)

Account creation + deposit/withdraw logs.

23. CLI Chat Simulator (Very Simple Sockets or Simulation)

Even without networking: simulate chat between two users (turn-based).

24. Real-Time Voting System (Simple Data Structures)

Add votes → count votes dynamically.

25. Online Quiz System (With Very Simple SQL)

26. Blogging System (File-Based)

Create, edit, delete blog posts.

27. Basic Weather App (Public API Optional)

28. Portfolio Website (HTML/CSS Only)

Very simple personal profile site.

29. Smart Home Simulation Console App

Turn appliances ON/OFF, store status in memory or file.

30. Mini Inventory Store with Bill Generation

Manage items + generate printed bill.

Recommended Books:

- Head First Programming, David Griffiths, Paul Barry, O'Reilly Media.
- Let Us C, Yashavant Kanetkar, BPB Publications.
- Data Structures Using C, Reema Thareja, Oxford University Press.
- Head First HTML and CSS, Elisabeth Robson & Eric Freeman, O'Reilly Media

Course Outcomes:

Upon successful completion, students will be able to:

CO1: Apply fundamental programming concepts, including variables, control structures, functions, arrays, strings, and file handling, to design and implement simple computational applications.

CO2: Use file handling or very simple database operations to store, retrieve, and update information.

CO3: Develop functional CLI/GUI/Web-based mini projects using beginner-friendly tools and demonstrate problem-solving ability through proper documentation, testing, and execution of applications.

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	2	2	-	-	1	1	-	1	2	1
CO2	3	2	2	1	3	3	-	-	1	1	2	1	3	2
CO3	2	2	3	1	3	1	-	1	3	3	2	3	3	2

1 - Slightly; 2 - Moderately; 3 – Substantially

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Sustainability & Environmental Science

15251211

Course Objective:

To equip students with a comprehensive understanding of environmental science, pollution control, sustainability, and global frameworks, enabling them to analyze environmental challenges and contribute to sustainable solutions through informed decision-making and responsible practices.

Unit I:

Introduction to Environmental Science: definition, importance and its components. Ecosystem and its components. Water cycle, carbon cycle, food chain, energy flow in ecosystem. Current state of environment in India and world; Underlying reasons (root causes) of modern environmental degradation (social, psychological, cultural). Introduction to Environmental pollution: air, water, noise, soil, thermal and radioactive.

Unit II:

Environmental Pollution and Management: air, water, noise, soil, thermal and radioactive. Causes, impacts, pollution control techniques and mitigation strategies. Solid waste management: Principles of waste management, different components of waste management system and introduction to management of hazardous waste like e-waste, plastic waste. Global environmental Issues: Climate change, global warming, ozone layer depletion, urban heat island

Unit III:

Environmental policies and laws in India: Environmental Protection Act, Water Act, Air Act. **Overview of global environmental policies and frameworks:** Kyoto protocol, Montreal protocol, COP summits. Introduction to clean development mechanism, carbon credit, carbon trading. Environmental audit.

Unit IV:

Sustainability concepts: definition, importance, pillars of sustainability (economic, environmental, and social). Sustainable development. Overview of UN Sustainable Development Goals (SDGs) and their global relevance. Concept of circular economy, resource efficiency, energy conservation, green buildings and sustainable manufacturing.

Unit V:

Sustainable Energy solutions: New energy sources: need of new sources, different types of new energy sources, application of hydrogen energy, ocean energy sources, and tidal energy conversion. Concept, origin and power plant of geothermal energy. Renewable energy sources

like water, wind etc. Overview of sustainable materials and construction practices. Introduction to sustainable transportation systems and sustainable water infrastructure.

Recommended Books:

1. D. K. Asthana, Meera Asthana, A Text Book of Environmental Studies, S Chand & Co., New Delhi.

2. S. K. Dhameja, Environmental Engineering & Management, S K Kataria & Sons, New Delhi

3. C. S. Rao, Environmental Pollution Control Engineering, C.S. Rao, New Age International Publishers

4. A. K. Gupta, Environmental Sustainability and Green Technologies, PHI Learning.

Course Outcomes:

Upon completion of the course, a student will be able to

CO1. **Explain** the fundamental concepts of environmental science, including ecosystems and the causes of environmental degradation.

CO2. Analyze the sources, causes, and impacts of air, water, and solid waste pollution and propose appropriate mitigation strategies.

CO3. Evaluate the effectiveness of environmental policies and global frameworks in addressing environmental challenges.

CO4. Explain the concepts of sustainability and sustainable development goals.

CO5. Apply various solutions for achieving sustainable development.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1													
CO2													
CO3													
CO4													
CO5													

1 - Slightly; 2 - Moderately; 3 – Substantially

Department of Computer Science and Engineering
Scheme of Evaluation
B. Tech. IV Semester *(Computer Science and Engineering)* *(for batch admitted in academic session 2024-25)*

S. No.	Course Code	Category Code	Course Name	Maximum Marks Allotted						Total Marks	Contact Hours per week			Total Credits	Mode of Learning	Mode of Major Exam.	Duration of Major Exam.
				Theory Block				Practical Block									
				Continuous Evaluation			Major Evaluation	Continuous Evaluation	Major Evaluation		L	T	P				
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment		Lab Work & Sessional									
1.	15242201	DC	**Data Science**	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
2.	15242202	DC	Design and Analysis of Algorithms	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
3.	15242203	DC	Automata Theory	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
4.	15242204	DC	Networking with TCP/IP	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
5.	15242205	DC	Discrete Structure	25	25	20	30	-	-	100	3	-	-	3	Face to Face	MCQ	2 Hrs
6.	15242206	DLC	**Data Science Lab**	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
7.	15242207	DLC	Design and Analysis of Algorithms Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
8.	15242208	DLC	Competitive Programming	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
9.	15242209	SP	**Semester Proficiency**[$]	-	-	-	-	50	-	50	-	-	2	1	Face to Face	SO	-
10.	15242210	PBL	**Macro Project-II**[#]	-	-	-	-	70	30	100	-	-	2	1	Experiential	SO	-
11.	NECXXXX X	NEC	**Novel Engaging Course (Activity Based Learning)**	-	-	-	-	50	-	50	-	1	-	1	Interactive	SO	-
12.	SIP2XXXX	SIP	**Skill Internship Program**	-	-	-	-	60	-	60	-	-	-	2**	Experiential	SO	-
Total				**125**	**125**	**100**	**150**	**440**	**120**	**1060**	**13**	**5**	**10**	**23**	-	-	-
13.	15242211	MAC	Project Management, Economics & Financing	`	-	-	-	100	-	100	-	2	-	GRADE	Blended	SO	-
14.	15242212	MWS	Mandatory Workshop on Intellectual Property Rights at Department Level											**GRADE**	Interactive	MCQ	-

Summer Semester of six-eight week duration will be conducted for makeup of previous semester examination.

Additional Course for Honours or Minor Degree: Permitted to opt for maximum two additional courses for the award of Honours or Minor Degree

[$]Semester Proficiency– includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in the semester courses

MCQ: Multiple Choice Question **AO:** Assignment + Oral **PP:** Pen Paper **SO:** Submission + Oral **OB:** Open Book

[#] Macro Project-II will be presented and evaluated through an interdisciplinary project evaluation committee.

[**] These credits will be transferred from Skill Internship Project.

PC	BSC	ESC	DC	DE	SPC	OC	DLC	NEC	SP	SIP	SLP	PDC	PBL	MAC	MWS
1	0	0	5	0	0	0	3	1	1	1	0	0	1	1	2

Mode of Learning								Mode of Examination								Total Credits
Theory		Lab				NEC	SIP	Theory				Lab		NEC	SIP	
Face to Face	Online	Face to Face	Blended	Experiential	Experimental	Interactive	Experiential	PP	AO	MCQ	OB	SO	AO	SO	SO	
15		1	1		3	1	2			15		2	3	1	2	23
65.1		4.4	4.4		13	4.4	8.7			65.1		8.7	13.1	4.4	8.7	Credits %

List of courses to be opted for Honors or Minor specialization in V Semester

Minor Specialization*(to be opted by students of Other Department)*
Introduction to Database Systems
Object Oriented System Development Using UML, Java And Patterns

***Honors**(to be opted by students of Parent Department)*	
Track1	**Course**
Information Security	Foundations of Cryptography, IIIT Bangalore
	Cryptography and Network Security
IoT	Introduction To Internet Of Things
	Wireless Ad Hoc and Sensor Networks
High Performance Computing	Parallel Computer Architecture
	Advanced Computer Architecture

***Course run through SWAYAM/NPTEL/MOOC Learning Based Platform**

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

(Deemed to be University)

(Declared Under Distinct Category by Ministry of Education, Government of India)

NAAC Accredited with A++ Grade

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DATA SCIENCE

15242201

COURSE OBJECTIVES

- To provide the fundamental knowledge of Data Sciences, along with essential Python programming skills..
- Apply data manipulation, statistical analysis, and visualization techniques using Python libraries like NumPy and pandas.
- Develop, implement, and evaluate machine learning models while using statistical methods to derive insights and validate results.

Unit – I:

Introduction to Data Science: Introduction, Definition, applications of Data Science, Impact of Data Science, Data Analytics Life Cycle, role of Data Scientist.

Basics of Python: Essential Python libraries, Python Introduction- Features, Identifiers, Reserved words, Indentation, Comments, Built-in Data types and their Methods: Strings, List, Tuples, Dictionary, Set, Type Conversion- Operators. Decision Making: Looping-Loop Control statement, Math and Random number functions. User defined functions.

Vectorized Computation: The NumPy ndarray- Creating ndarrays- Data Types for ndarrays- Arithmetic with NumPy Arrays- Basic Indexing and Slicin

Unit-II

Data Analysis (with Pandas): Series, DataFrame, Essential Functionality: Dropping Entries, Indexing, Selection, and Filtering- Function Application and Mapping- Sorting and Ranking. Summarizing and Computing Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis. Unique Values, Value Counts, and Membership. Reading and Writing Data in Text Format.

Unit-III

Exploratory Data Analysis and Visualisation: Handling Missing Data, Data Transformation: Removing Duplicates, Transforming Data Using a Function or Mapping, Replacing Values, Detecting and Filtering Outliers, Functions in pandas. Plotting with pandas: Line Plots, Bar Plots, Histograms and Density Plots, Scatter or Point Plots.

Unit-IV

Introduction to Machine Learning: Types of Learning, Linear Regression- Simple Linear Regression, Implementation, plotting and fitting regression line, Logistic Regression, K-Nearest Neighbors (KNN), K-Means Clustering.

Unit-V

Hypothesis Testing: Mean and Variance Tests, p-value, Errors, Z-Test, t-Test, Paired t-Test, and F-Test, Analysis of Variance (ANOVA) and Contingency Table Analysis, Model Evaluation Metric

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RECOMMENDED BOOKS

1. Cathy O'Neil and Rachel Schutt , "Doing Data Science", O'Reilly, 2015.
2. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", EMC 2013
3. Artificial Intelligence: A Modern Approach by Stuart J. Russell and Peter Norvig, Prentice Hall.
4. Pattern Recognition and Machine Learning, Christopher M. Bishop
5. James, Gareth, et al. An introduction to statistical learning. Vol. 112. New York: springer, 2013.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1: Analyze Data Science concepts and apply Python programming for data tasks, including data manipulation with NumPy.

CO2: Analysis of the data for applying various statistical modeling approaches.

CO3: Develop expertise in managing missing data and assessing the impact of visualizations on data insight communication.

CO4: Design and implement machine learning algorithms and assess model performance.

CO5: Develop statistical tests and **evaluate** machine learning models.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	3	2	-	-	1	2	1	1	3	2
CO2	3	3	2	2	3	2	-	1	1	2	2	1	3	3
CO3	2	2	2	1	3	2	-	1	1	3	3	2	3	2
CO4	3	3	3	2	3	3	-	1	1	2	3	2	3	3
CO5	3	3	2	2	3	3	1	1	1	2	2	2	3	3

(1 - Slightly; 2 - Moderately; 3 – Substantially)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DESIGN AND ANALYSIS OF ALGORITHMS

15242202

Course Objectives

- To develop the ability to analyze algorithm efficiency
- To learn and apply major algorithm design paradigms
- To understand computational complexity concepts

Unit-1

Introduction to Computational Model: RAM model, Algorithms and its importance, Recurrences and Asymptotic Notations, Growth of function, Mathematical Analysis of Non-Recursive and Recursive Algorithm, Review of Sorting & Searching Algorithms, Basic Tree and Graph Concept: Binary Search Trees, Height Balanced Tree, B-Trees and Traversal Techniques

Unit-2

Divide and Conquer Method: Introduction and its Examples such as Finding the maximum and minimum, Binary Search, Merge Sort, Quick Sort and Stassen's Matrix Multiplication.

Unit-3

Greedy Method: Introduction, Characteristics, greedy activity selection. Minimum Cost Spanning Trees: Prim's and Kruskal's Algorithm, knapsack Problem, Single Source Shortest Path: Dijkstra's single source shortest path algorithm, Huffman Coding.

Unit-4:

Dynamic Programming and Backtracking: Introduction, The principle of Optimality, Examples of Dynamic Programming Methods such 0/1 Knapsack, Travelling salesman problem, Floyds All Pairs Shortest Path, Longest Common Subsequence and Reliability Design. NP Completeness: Introduction, Class P and NP, Polynomial Reduction, NP-Hard and NP-Complete problem.

Backtracking Concept and its Examples like 4-Queen's Problem, Knapsack problem Hamiltonian Circuit Problem, etc.

Unit-5:

Randomized Algorithms: Las Vegas and Monte Carlo algorithms, Randomized Quicksort, Randomized Search, Randomized Hashing,

Approximation Algorithms: Approximation ratio & performance guarantees, Greedy approximation

REFERENCE BOOKS: -

- Fundamentals of Computer Algorithms, Horowitz & Sahani, Universities press
- Introduction to Algorithms, Coreman Thomas, Leiserson CE, Rivest RL, PHI.
- Design & Analysis of Computer Algorithms, Ullman, Pearson.
- Algorithm Design, Michael T Goodrich, Robarto Tamassia, Wiley India

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COURSE OUTCOMES:

After Completion of this course, the students would be able to:

CO1 **analyze** the time and space complexity of algorithms using recurrence relations, asymptotic notations, and apply these concepts to basic sorting, searching, tree, and graph operations.

CO2: **Apply** the divide-and-conquer strategy to design and evaluate algorithms for problems such as searching, sorting, maximum–minimum finding, and matrix multiplication.

CO3: **Implement and analyze** greedy algorithms for optimization problems including activity selection, minimum spanning trees, shortest paths, knapsack, and Huffman coding.

CO4: **Use** dynamic programming principles to solve complex optimization problems such as knapsack, TSP, all-pairs shortest paths, LCS, and reliability design.

CO5: **Apply** randomized and approximation algorithm technique to design efficient solutions for computationally hard problems and evaluate their performance guarantees.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	1	2	1	1	1	1	2	2	2
CO2	3	3	3	3	3	1	1	1	1	1	1	2	2	2
CO3	3	3	3	3	3	2	1	1	1	1	1	1	2	2
CO4	3	3	2	3	2	1	1	1	1	1	1	1	2	2
CO5	3	3	3	3	2	1	1	1	1	1	1	2	2	2

(1 - Slightly; 2 - Moderately; 3 - Substantially

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

AUTOMATA THEORY

15242203

COURSE OBJECTIVE

- **Understand** the fundamental concepts of formal languages, automata, mathematical proofs for computation and algorithms and grammars.
- **Analyze** different types of automata and their capabilities in recognizing languages.
- **Design** finite automata, pushdown automata, and Turing machines for solving computational problems.

Unit-I

Introduction to Automata Theory: Automata, Computability and Complexity, Alphabet, Symbol, String, and Formal Languages, Examples of automata machines, Finite Automata as a language acceptor and translator, Moore machines and Mealy machines, Composite Machine, Conversion from Mealy to Moore and vice versa.

Unit-II

Types of Finite Automata: Non Deterministic Finite Automata (NDFA), Deterministic finite automata(DFA), conversion of NDFA to DFA, minimization of automata machines, regular expression, Arden's theorem. Pumping lemma, applications, Union, Concatenation, Closure properties of regular languages, 2 way DFA.

Unit-III

Grammars: Types of grammar, context sensitive grammar, context free grammar, regular grammar. Derivation trees, Rightmost and Leftmost derivations of Strings, ambiguity in grammar, simplification of context free grammar, killing null and unit productions, conversion of grammar to automata machine and vice versa, Chomsky hierarchy of grammar. Chomsky Normal Form (CNF) and Greibach Normal Form (GNF).

Unit-IV

Push down Automata: Definition, Model, Acceptance of CFL, Acceptance by Final State and Acceptance by Empty stack, Example of PDA, deterministic and non-deterministic PDA, conversion of PDA into context free grammar and vice versa, CFG equivalent to PDA.

Turing Machine: Techniques for construction. Universal Turing machine Multitape, Multihead and Multidimensional Turing machine, N-P complete problems. Decidability and Recursively Enumerable Languages, Halting problem of Turing machine, The post correspondence problem (PCB),

Unit-V

Application of automata machines in Switching Circuits, Digital circuit design, verify the behavior of complex digital circuits, Study and insights into the relationship between classical and quantum computing models, Application of automata machines in speech recognition and robotics.

RECOMMENDED BOOKS

- Introduction to Automata Theory Language & Computation, Hopcroft& Ullman, Narosa Publication.
- Element of the Theory Computation, Lewis &Christors,Pearson.
- Theory of Computation, Chandrasekhar &Mishra,PHI.
- Theory of Computation, Wood, Harper &Row.
- Introduction to Computing Theory, Daniel I-A Cohen,Wiley.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1. Describe the fundamental concepts of finite automata.

CO2. Explain Finite State Machine, basic grammar concepts and context-free language principles.

CO3. Design Automata machines and their relation to CFLs.

CO4. Analyze decidable and undecidable problems using standard theoretical methods.

CO5. Apply automata theory, languages and computation in engineering application.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1		1	2				2	1	2		
CO2	3		1	3	2		3	2	2		2		1	2
CO3	3	3	2		1	3		1	2	3		2	2	2
CO4	3	2	1	2	1	2	2		2	3		2	1	2
CO5	3	2		1	2	2		3		2		1	2	1

Slightly; 2 - Moderately; 3 – Substantially

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Networking with TCP/IP

15242204

COURSE OBJECTIVES

- To understand TCP/IP Internetworking and Addressing.
- To understand framing, Routing, Address resolution and Error reporting mechanism used in the Internet
- To understand the working of Application layer protocols
- To Troubleshoot networking issues

Unit-1

TCP/IP model, Addressing- Physical, logical and port addressing, IPv4 addresses: Classful addressing, Classless addressing. Special addresses, DHCP and NAT. Subnetting and Supernetting.

Unit-2

IP Datagram- format, options, fragmentations, checksum, IPsec. Address Resolution Protocol (ARP), Reverse address resolution protocol (RARP). Internet Control message protocol (ICMP).

Unit-3

TCP: TCP Reliable data transfer, Connection Establishment & Release, TCP Frame, Header Checksum, Sliding Window Concept for error control, congestion control and TCP timers. UDP: Format, Pseudo header, Encapsulation, Checksum, Multiplexing & Demultiplexing. Stream Control Transmission Protocol.

Unit-4

Routing Protocols- RIP, OSPF and BGP, Application Layer: DNS, FTP, TFTP, Mail Transfer protocols, TELNET, HTTP.

IPv6 Protocol, ICMPv6, IPv6 addressing, Voice over IP, RTP, SNMP, Internet security and Firewall: Internet Security, IP security, Firewall Implementation.

Unit- 5

Study of network packet analyzer tools: Wireshark, CISCO packet Tracer etc. Scanner Tools: Nmap, Nessus etc.

Internet of Things (IoT) Networking**,** 5G and Next-Generation Mobile Networks, Edge and Fog Computing in Networking, Zero Trust Network Architecture

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RECOMMENDED BOOKS

- Data and Computer Communication - W. Stalling, Pearson
- Internetworking with TCP/IP - Vol. - I - D.E. Comer, PHI
- Data Communication & Networking -B.A. Forouzan
- ISDN and Broad band ISDN with Frame Relay & ATM - W. Stalling
- LANs - Keiser

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1. Illustrate the architecture of the TCP/IP model and demonstrate addressing schemes used in network communication.

CO2. Identify and explain the role of core Internet layer protocols including IP, ARP, ICMP, and IPsec.

CO3. Analyze the features of TCP, UDP, and SCTP transport protocols and their mechanisms for reliable communication.

CO4. Explain the operation of routing and application layer protocols in data communication.

CO5. Simulate and evaluate network topologies and security protocols using modern network analysis tools.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		1	2	1				1		1	2	1
CO2	3	3			2							1	2	1
CO3	3	3	2	2	2							2	2	1
CO4	3	3	2	2	2		1			1		2	2	2
CO5	3	3	3	3	3	1	2	1	2	2	2	3	2	3

1 - Slightly; 2 - Moderately; 3 – Substantially

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DISCRETE STRUCTURE

15242205

COURSE OBJECTIVES

- To gain knowledge of basic algebra and discrete numeric functions.
- To learn functions and its relation
- To familiarize with propositional logic
- To know about the graph theory and its application in computer
- To be familiar with generating function

UNIT: 1

Functions and Relations:

Sets, Subsets, Power sets, Complement, Union and Intersection, De Morgan's law, Cartesian products, Relations, Relational Matrices, Properties of relations, Equivalence relation, Functions, Injection, Surjection and Bijective Mapping, Composition of functions, Permutations, Characteristic functions and Mathematical Induction.

UNIT: 2

Partial Order Relations and Lattice:

Partial order set, Hasse diagrams, Upper bounds, Lower bounds, Maximal and Minimal element, first and last element, Lattices, Sub-lattices, Lattice homomorphism, Lattice isomorphism, Complete lattice, complemented lattice, and Distribution Lattice.

UNIT: 3

Group and Field:

Group axioms, Abelian group, and its properties, Subgroup, Co-sets, Left and Right Co-sets, Normal subgroup, semi group, Lagrange's Theorem, fields, minimal polynomials, reducible polynomials, primitive polynomial, polynomial roots, applications.

UNIT: 4

Graph Theory

Finite graphs, incidence and degree, isomorphism, sub graphs and union of graphs, connectedness, walk, paths and circuits, Eulerian and Hamiltonian graphs. Trees: properties of trees, pendant vertices in tree, Center of tree, spanning trees and cut vertices, binary tree, matrix representation of

graph, incidence and adjacency matrix and their properties, applications of graphs in computer science.

UNIT: 5

Discrete Numeric Functions:

Introduction to discrete numeric functions and generating functions, introduction to recurrence relations, solution of combinatorial problem using generating functions, linear recurrence relations with constant coefficients, homogeneous solutions, particular solutions, and total solutions, solution of linear recurrence relations using method of generating functions.

Course Outcomes

After completing this course, the students will be able to:

CO's	Description of CO's
CO1	Acquire Knowledge of set theory
CO2	Analyze the concept of Lattices
CO3	Apply the concept of Group Theory
CO4	Derive the Inferences from Graph Theory
CO5	Illustrate the Discrete numeric function and recursive relation

Recommended Books:

1. J.P Tremblay and Manohar: Discrete Mathematical Structures with Application to Computer science, McGraw-Hill, 1st Edition 2017.
2. Narsingh Deo: Graph Theory, PHI Learning, 2014.
3. C.L Liu: Discrete Mathematics.4th Edition 2012.
4. Rosen: Discrete Mathematics and its Applications, McGraw Higher Ed, 7th Edition 2008.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DATA SCIENCE LAB

15242206

List of Experiments

1. Perform Creation, indexing, slicing, concatenation and repetition operations on Python built-in data types: Strings, List, Tuples, Dictionary, Set
2. Solve problems using decision and looping statements.
3. Apply Python built-in data types: Strings, List, Tuples, Dictionary, Set and their methods to solve any given problem
4. Handle numerical operations using math and random number functions.
5. Manipulation of NumPy arrays- Indexing, Slicing, Reshaping, Joining and Splitting.
6. Computation on NumPy arrays using Universal Functions and Mathematical methods.
7. Import a CSV file and perform various Statistical and Comparison operations on rows/columns.
8. Create Pandas Series and DataFrame from various inputs.
9. Import any CSV file to Pandas DataFrame and perform the following:
    1. Visualize the first and last 10 records
    2. Get the shape, index and column details
    3. Select/Delete the records(rows)/columns based on conditions.
    4. Perform ranking and sorting operations.
    5. Do required statistical operations on the given columns.
    6. Find the count and uniqueness of the given categorical values.
    7. Rename single/multiple columns.
10. Import any CSV file to Pandas DataFrame and perform the following:
    1. Handle missing data by detecting and dropping/ filling missing values.
    2. Transform data using different methods.
    3. Detect and filter outliers.
    4. Perform Vectorized String operations on Pandas Series.
    5. Visualize data using Line Plots, Bar Plots, Histograms, Density Plots and Scatter Plots.
11. Use the scikit-learn package in python to implement the regression model and its related methods.

Course Outcomes (COs):

CO1: Apply fundamental Python programming constructs such as data types, control structures, and functions to design ethical and efficient solutions for real-life problems.

CO2: Analyze and process structured and unstructured data using Python libraries like NumPy and Pandas to derive meaningful insights while considering societal relevance and responsible data handling.

CO3: Develop real world data science applications using Python.

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3			2	2		2		2	2		3	2
CO2	3	3		2	2	2		2		2	2		3	3
CO3	3	2	3	2	2	2			3	3	2	2	3	3

(1 - Slightly; 2 - Moderately; 3 - Substantially)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DESIGN AND ANALYSIS OF ALGORITHMS LAB

15242207

List of Experiments

1. WAP to implement the following using array as data structure and analyze its time Complexity.

a. Insertion sort b. Selection sort c. Bubble sort d. Quick sort e. Bucket sort f. Radix sort g. Heap sort h. Merge sort

2. WAP to implement Linear and Binary Search and analyze its time complexity.

3. WAP to implement Matrix Chain Multiplication and analyze its time complexity.

4. WAP to implement Longest Common Subsequence Problem and analyze its time Complexity.

5. WAP to implement Optimal Binary Search Tree Problem and analyze its time complexity.

6. WAP to implement Huffman Coding and analyze its time complexity.

7. WAP to implement Dijkstra's Algorithm and analyze its time complexity.

8. WAP to implement Bellman Ford Algorithm and analyze its time complexity.

9. WAP to implement DFS and BFS and analyze their time complexities.

10. WAP to Implement 0/1 knapsack using dynamic programming.

11. Implement greedy-based approximation algorithms for problems such as Vertex Cover or Knapsack and compute their approximation ratios and performance guarantees.

12. Implement Las Vegas and Monte Carlo algorithms such as Randomized Quicksort, Randomized Search, and Randomized Hashing, and analyze their expected time complexities.

COURSE OUTCOMES:

CO1: **Implement and compare** various algorithmic techniques (sorting, searching, graph traversal, greedy, and dynamic programming) using appropriate data structures.

CO2: **Analyze and evaluate** the time and space complexities of algorithms through experimental execution and theoretical assessment.

CO3: Implement Las Vegas and Monte Carlo algorithms such as Randomized Quicksort, Randomized Search, and Randomized Hashing, and analyze their expected time complexities.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	3	3	2	1	1	1	1	1	2	2	1
CO2	2	2	2	3	3		1	1	1	1	1	2	1	2
CO3	2	3	2	3	3	2	1	1	1	1	1	1	2	2

(1 - Slightly; 2 - Moderately; 3 - Substantially)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

COMPETITIVE PROGRAMMING

15242208

Course Objectives:

- To build strong foundational skills in programming logic, time–space complexity, and problem-solving techniques used in competitive programming.
- To enable students to apply data structures, algorithms, graphs, dynamic programming, and number theory concepts for solving medium to advanced-level coding problems.
- To prepare students for national and global coding contests by developing speed, accuracy, debugging skills, and consistent practice on online judge platforms.

UNIT 1:

Basics of C++/Python, input–output, loops, conditionals, functions. Introduction to time–space complexity and constraints. Arrays, strings, frequency maps, simple logic problems. Basics of STL (vector, set, map, pair). Practice: 40–50 beginner problems on LeetCode/CodeChef.

UNIT 2:

Core Data Structures & Techniques: Stacks, queues, linked lists, heaps, hash maps. Two-pointer, sliding window, prefix sums, hashing. Binary search and sorting-based logic patterns. Practice on GFG DS Track & LeetCode/CodeChef Data Structures. Target: 30–40 DS-based problems.

UNIT 3:

Graphs & Dynamic Programming, Graph basics: BFS, DFS, components, cycles. Shortest paths: Dijkstra, Bellman-Ford, MST algorithms. Recursion, memoization, DP introduction. DP topics: knapsack, LIS, LCS, grid DP.Practice: 30-40 graph & DP problems on LeetCode/CodeChef.

UNIT 4:

Advanced Algorithms & Number Theory, Sieve, modular arithmetic, combinatorics, modular inverse. Fast exponentiation, prime factorization. Greedy strategies and optimization techniques. Bit manipulation & bitmask DP. Practice: 30–40 advanced-level problems across platforms.

UNIT 5:

Contest Practice & Deployment Registration on LeetCode, CodeChef, GFG, HackerRank. Weekly contests, mock tests, debugging strategies. Editorial writing and clean coding practices. Mini-project: CP notebook/GitHub repository. Target: 30–40 problems + 6 mock contests.

Course Outcomes (COs):

Upon successful completion of this course, students will be able to:

CO1: Solve beginner-level CP problems using programming fundamentals.
CO2:Apply appropriate data structures and algorithmic techniques for intermediate problems.
CO3: Use graph algorithms and dynamic programming to solve complex problems.
CO4:Implement advanced number theory, greedy methods, and optimization in contest environments.
CO5: Participate effectively in coding contests and maintain consistent problem-solving practice.

Reference Books

1. "Competitive Programming 4" by Steven Halim & Felix Halim (2018).
2. "Guide to Competitive Programming" by Antti Laaksonen (Springer, 2017).
3. "Programming Challenges: The Competitive Programmer's Handbook" by Laaksonen (Revised Edition 2016).
4. Elements of Programming Interviews in C++" by Adnan Aziz et al. (2016).

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1													
CO2													
CO3													
CO4													
CO5													

1 - Slightly; 2 - Moderately; 3 – Substantially

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

MACRO PROJECT-II

15242210

COURSE OBJECTIVES:

- To strengthen students' capability to design and develop full-scale software systems using intermediate-to-advanced programming, database, and networking concepts.
- To introduce students to multi-tier application development, including GUI/web interfaces, backend services, and AI-driven modules.
- To cultivate teamwork, documentation, testing practices, and deployment skills consistent with professional software development standards.

UNIT 1: ADVANCED PROGRAMMING & SOFTWARE DESIGN

Experiments

1. Modular programming and multi-file project setup
2. Implementing advanced DS (trees, graphs, hashing)
3. Applying software design principles—cohesion, coupling, modularity
4. Implementation of basic design patterns (MVC, Singleton, Factory)

Projects

1. Graph-Based Campus Navigation Tool
2. Hash-Map Based Student Lookup System
3. Modular Inventory Tracking Tool
4. Event Scheduler using Min-Heap
5. Course Prerequisite Checker
6. Event Scheduler using Min-Heap
7. Role-Based Access Control (RBAC) System
8. Path-Finder Engine
9. Mini Search Engine using Inverted Index

UNIT 2: DATABASE SYSTEMS & FULL-STACK BACKEND DEVELOPMENT

Experiments

1. Designing normalized relational schemas (1NF–BCNF)

2. SQL implementation—joins, triggers, views, stored procedures
3. NoSQL basic CRUD operations (MongoDB / similar)
4. Transaction management & ACID demonstration

Projects

1. Library Database + Query Engine
2. College Course Registration System
3. Banking Mini-Backend with Transaction Logs
4. Hostel/Room Allocation with Constraints Handling
5. E-Commerce Product Catalog with Cart & Orders
6. Student Grievance Management System
7. Hospital Appointment Scheduling System
8. Employee Payroll Management System

UNIT 3: NETWORK PROGRAMMING, API DEVELOPMENT & INTRODUCTION TO AI SERVICES

Experiments

1. TCP/UDP socket programming
2. REST API creation (Flask/Django/FastAPI)
3. WebSockets for real-time communication
4. Intro to AI services:
    - Using NLP models for classification/sentiment analysis
    - Simple ML model integration (pretrained)
    - API-based AI inference (OpenAI/Gemini/HuggingFace-lite)

Projects

1. Real-Time Chat Application using Sockets
2. Weather & News App using Public APIs
3. AI-Powered Email Classifier (spam/ham) using NLP API
4. Client-Server File Transfer Tool
5. Mini Recommendation Engine (rule-based or ML API powered)
6. Multiplayer Game Backend
7. Voice Command Recognition Tool
8. Network Intrusion Detection Mini-System
9. Real-Time Stock Price Monitor

UNIT 4: GUI / WEB DEVELOPMENT + AI-ENABLED FEATURES

Experiments

1. Tkinter / PyQt or Java Swing for GUI
2. Event-driven programming
3. Basic dashboard and visualizations
4. Integrating AI components into UI (e.g., embedding ML predictions)

Projects

1. GUI-Based DB Query Interface
2. Student Performance Dashboard
3. AI-Augmented To-Do Manager (priority prediction)
4. Python/Java Image Classifier GUI (pretrained model)
5. Web-Based Mini-LMS with Quiz Auto-Grading
6. Smart Resume Analyzer GUI
7. Face Recognition Attendance System
8. Medical Symptoms Checker GUI
9. Smart Image Caption Generator
10. Expense Analyzer Web App
11. Voice-Assisted Notes App

UNIT 5: MACRO PROJECT INTEGRATION

Experiments

1. Requirement gathering + Writing SRS (Software Engineering alignment)
2. UML diagrams, architectural design, and documentation
3. Git workflow: branching, merging, collaborative development
4. Testing (unit, integration, system, black-box & white-box)
5. Deployment basics (local server / lightweight containers)

Projects:

1. Online Examination System with Proctoring Assistance **(AI + DB + Web)**
2. E-Commerce Platform with Recommendation Module
3. Smart Attendance System (AI face recognition)
4. Hospital Management & Scheduling System
5. Campus Navigation + Event Notification Platform
6. Secure Chat App with Spam Detection Module
7. College Fest/Event Management Portal with Chatbot
8. Cab Booking System with Route Optimization
9. Cloud-Based File Storage with Auto-Tagging (AI)
10. Hostel/Room Allotment using constraints + dashboard

11. Personal Finance Manager with AI Expense Categorization
12. Social Media Mini-Platform with Content Moderation

RECOMMENDED BOOKS:

- Clean Code: A Handbook of Agile Software Craftsmanship, Robert C. Martin, Prentice Hall.
- Software Engineering: A Practitioner's Approach, Roger S. Pressman & Bruce R. Maxim, McGraw-Hill Education.
- Python Crash Course: A Hands-On, Project-Based Introduction to Programming, Eric Matthes.
- Database System Concepts, Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill Education
- Computer Networks, Andrew S. Tanenbaum, David J. Wetherall, Pearson.
- Artificial Intelligence: A Modern Approach, Stuart Russell & Peter Norvig, Pearson.

COURSE OUTCOMES:

Upon successful completion of this course, students will be able to:

CO1: Design and implement intermediate to advanced multi-tier applications integrating programming constructs, data structures, databases, APIs, and networking concepts.

CO2: Apply software engineering principles to build applications with proper architecture, documentation, testing, version control, and AI-enhanced functional components.

CO3: Collaborate effectively to plan, design, build, test, and deploy real-world software systems, demonstrating professional communication, teamwork, and project management skills.

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3	1	-	-	2	2	2	3	3	2
CO2	2	3	2	3	3	1	-	2	1	1	2	3	3	3
CO3	1	1	2	2	3	-	-	2	3	3	3	2	2	1

1 - Slightly; 2 - Moderately; 3 – Substantially

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Project Management, Economics & Financing

15242211

Course Objectives:

To provide knowledge about project attributes and planning essentials, develop project networks, make rational decisions for project completion, utilize resources effectively, and understand the basics of project finances and management.

Unit I:

Project Planning: Introduction to Project Management, Difference between Project and Production, Attributes of a Project: Time, Cost, Quality and Safety. Stakeholders of a Project, Project life cycle. Project Planning: Types of Project Plans and feasibility.

Unit II:

Project Network logic: Project Networking and work flows, Activity duration and methods of estimating activity duration – One time estimate three time estimates, Duration estimation procedure. Use of Bar Charts, Mile stone charts and networks, Network representation schemes: Activity on Arrow and Activity on Node Networks (A-o-A & A-o-N), Logic behind developing project network and simple network calculations, Critical paths and floats.

Unit III:

Decision making through networks: CPM, PERT & PDM: Use of network in Decision Making: Importance of critical path, Monitoring the progress and updating the project plan. Use of floats in Resource smoothening, Introduction to Precedence Diagramming Method (PDM), Different lag and lead relations in terms of SS(Start to Start), SF(Start to Finish), Finish to Start(FS), and Finish to Finish(FF) and composite relations.

Unit IV:

Project Cost Control: Breakeven analysis in planning stage, Direct and indirect cost, slope of direct cost curve, Total project cost and optimum duration, contracting the network for cost optimization. Escalation & Variation in prices.

Unit V:

Projects Financing: Introduction to project financing; Role of governments in financing projects, Funder and Concessionaire: Economic multiplier effects of Projects; Means of financing-public finance and private finance, Granting authority: World Bank Group, IMF,ADB, Micro and Small Enterprises Funding Scheme (MSME), Elementary understanding of Procurement of infrastructure

projects through Public Private Partnership (PPP) route, Build Operate Transfer (BOT), Build Operate Own & Transfer (BOOT); Stakeholders' perspectives, Lifecycle of PPP projects, Micro & Macro economics concepts and its application in Project Financing.

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

CO 1: Know the attributes of project and its different phases.
CO 2: Develop the project network based on work breakdown structure and estimation of activity durations.
CO 3: Analyze the project network and make decide the various alternates.
CO 4: Evaluate the optimum cost of project for assigned deadlines.
CO 5: Understand the different options to arrange the finances to complete it within stipulated time.

Text-Books:

1. Project Management Scheduling PERT and CPM by Dr. B.C. Punmia, K.K. Khandelawal

2. PERT & CPM Principles and Applications by L.S. Srinath, Affiliated EWP Pvt. Ltd.

3. Project Planning and Control by Albert Lester, Fourth Edition Elsevier Butterworth-Heinemann.

Reference Books:

1. A Management Guide to PERT/CPM With GERT/PDM/DCPM and Other networks by Jerome D. Wiest, Ferdinand K. Levy, Prentice Hall.

2. Project Management with CPM and PERT by Joseph J . Moder, Cecil R . Phillips, Van Nostrand Reinhold Company.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1													
CO2													
CO3													
CO4													
CO5													

1 - Slightly; 2 - Moderately; 3 – Substantially

Professional certification platforms and relating certifications with specific domain/areas of certification

Domain		*Cyber Security*				
S. No.	**Certification Name**	**Company/Organization**	**Source/Link**	**Paid/Free**	**Level**	**Key Focus**
1	Introduction to Cybersecurity	NASSCOM / FutureSkills Prir	https://www.futureskillsprime.in/course/cisco-netacad-introduction-to-cyber-security/	Free	Beginner	The Course explores the broader topics of Cybersecurity, helping the learner understand trends, threats, and acquire advanced cyber security training.
2	Cybersecurity Essentials	NASSCOM / FutureSkills Prir	https://www.futureskillsprime.in/course/cyber-security-essentials/	Free	Beginner	This course provides general introduction to basics to fight the cybercrime
3	Algorand Blockchain Application Developer	NASSCOM / FutureSkills Prir	https://www.futureskillsprime.in/course/blockchain-application-developer/	Free	Beginner	This course provides software developers with the core knowledge and skills to build decentralized applications and gain practical expertise on the Algorand blockchain platform.
4	Online Communication & Data Security	NASSCOM / FutureSkills Prir	https://www.futureskillsprime.in/course/online-communication-data-security-by-wadhwani-foundation/	Free	Beginner	In this course you will dive into the digital world with confidence, mastering online communication
5	CompTIA Security+	CompTIA	https://www.udemy.com/course/securityplus/?utm_source=bing&utm_medium=udemyads&utm_campaign=BG-Search_Keyword_Beta_Prof_la.EN_cc.India&campaigntype=Search&portfolio=Bing-India&language=EN&product=Course&test=&audience=Keyword&topic=CompTIA_Security+&priority=Beta&utm_content=deal4584&utm_term=_.ag_1326013411671036_.ad__.kw_CompTIA+Security%2B+Class_.de_c_.dm__.pl__.ti_kwd-82876969000281%3Aloc-90_.li_149831_.pd__&matchtype=p&msclkid=624be2fc15771f47e0a08ad595eb3afb&couponCode=CP130525	Paid	Beginner	Network security, risk management
6	Certified Ethical Hacker (CEH)	EC-Council	https://www.eccouncil.org/train-certify/certified-ethical-hacker-ceh/	Paid	Intermediate	Ethical hacking, penetration testing
7	Cisco Certified CyberOps Associate	Cisco	https://www.cisco.com/site/us/en/learn/training-certifications/certifications/cybersecurity/associate/index.html	Paid	Beginner	Security monitoring, incident response
8	Google Cybersecurity Certificate	Google	https://grow.google/certificates/cybersecurity/	Paid	Beginner	Security fundamentals, SIEM tools
9	Certified Information Systems Security Professional (CISSP)	ISC²	https://www.isc2.org/certifications/cissp	Paid	Advanced	Security architecture, risk management
10	Offensive Security Certified Professional (OSCP)	Offensive Security	https://www.offsec.com/products/oscp-plus/	Paid	Advanced	Penetration testing, exploit development

11	IBM Cybersecurity Analyst Professional Certificate	IBM	https://www.coursera.org/professional-certificates/ibm-cybersecurity-analyst?utm_source=IBM&utm_medium=institutions&utm_campaign=IBMBadge	Free	Beginner	Security operations, threat intelligence
12	Certified in Cybersecurity (CC)	ISC²	https://www.isc2.org/landing/1mcc	Free	Beginner	Cybersecurity fundamentals, risk management
13	Introduction to IT & Cybersecurity	Cybrary	https://www.cybrary.it/course/introduction-to-it-and-cybersecuri	Free	Beginner	Short intro course, good for exploring roles in cybersecurity
14	AWS Security Fundamentals	AWS (Amazon web services)	https://explore.skillbuilder.aws/learn/courses/48/aws-security-fu	Enrollment is Free but certification can be free using free certification vouchers through programs like AWS Educate's Emerging Talent Community (ETC).	Beginner	Fundamental AWS cloud security concepts, including AWS access control, data encryption methods
15	Authentication and Authorization with AWS Id	AWS (Amazon web services)	https://explore.skillbuilder.aws/learn/courses/85/authentication-	Enrollment is Free but certification can be free using free certification vouchers through programs like AWS Educate's Emerging Talent Community (ETC).	Beginner	This is an introductory course to authentication and authorization with AWS Identity and Access Management (IAM).
16	Getting Started with Amazon Detective	AWS (Amazon web services)	https://explore.skillbuilder.aws/learn/courses/14077/getting-start	Enrollment is Free but certification can be free using free certification vouchers through programs like AWS Educate's Emerging Talent Community (ETC).	Beginner	Using Amazon Detective, you can quickly analyze, investigate, and identify the root cause of potential security issues or suspicious activities.
17	Introduction to Ethical Hacking	Great Learning	https://www.mygreatlearning.com/academy/learn-for-free/cours	Free	certificate available after completion	
18	Cybersecurity – Foundation	Infosys Springboard	https://infyspringboard.onwingspan.com/web/en/login?ref=%2Fapp%2Ftoc%2Flex_auth_013099680234938382823_shared%2Foverview%23iss%3Dhttps:%2F%2Finfyspringboard.onwingspan.com%2Fauth%2Frealms%2Finfyspringboard	Free	Beginner level, ~6–8 hours, certificate available	
19	Cybersecurity: An Introduction	Infosys Springboard	infyspringboard.onwingspan.com/web/en/login?ref=%2Fapp%2Ftoc%2Flex_auth_01355293011311001679_shared%2Foverview%23iss%3Dhttps:%2F%2Finfyspringboard.onwingspan.com%2Fauth%2Frealms%2Finfyspringboard	Free	Basic course, no prerequisites, ideal for students	
20	Cyber Security and Awareness	TCS iON	https://www.tcsion.com/iDH/India/Catalog/search_text/cyber/order_by/relevance/pageNo/1	Free	For beginners, covers basic concepts and safe practices	
Domain		***Machine learning***				
1	Machine Learning Crash Course	Google	https://developers.google.com/machine-learning/crash-course	Free	Beginner	~15 hours, beginner-friendly, includes coding exercises
2	Machine Learning with Python	IBM	https://www.coursera.org/learn/machine-learning-with-python	Free (Audit) and certificate (P	Beginner	Intermediate level, hands-on, 30 hours
3	IBM Introduction to Machine Learning Specia	IBM	https://www.coursera.org/specializations/ibm-intro-machine-lear	Free (Audit) and certificate (P	Intermediate level	Understand the potential applications of machine learning
4	Certificate Program in Artificial Intelligence &	NASSCOM / FutureSkills Prir	https://www.futureskillsprime.in/course/certificate-program-in-ar	Free (after registration)	Beginner	Govt-approved platform, great for Indian students

5	Machine Learning - Linear Regression	NASSCOM / FutureSkills Pri	https://www.futureskillsprime.in/course/machine-learning-linear-	Free (after registration)	Beginner	This course will unlock new opportunities and job positions like Data Analyst, Data Scientist, Data Engineer, Product Analyst, Machine Learning Engineer, Decision Scientist.
6	Introduction on Generative AI – Artificial intel	NASSCOM / FutureSkills Pri	https://www.futureskillsprime.in/course/fundamentals-in-generat	Free (after registration)	Beginner	Learn the fundamentals and technicalities of Generative AI models.
7	An Introduction to world of AI with Machine L	NASSCOM / FutureSkills Pri	https://www.futureskillsprime.in/course/an-introduction-to-world	Free (after registration)	Beginner	Learn the AI models with machine learning
8	Machine Learning: What it is and Why it Matt	TCS	https://learning.tcsionhub.in/courses/machine-learning-what-it-is	Free	Beginner	Basic intro course, ~4 hours
9	Artificial Intelligence & Machine Learning Basi	Infosys	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_au	Free	Beginner	Beginner friendly, includes quizzes and assignments
10	Applied Machine Learning	Infosys	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_au	Free	Beginner	Intermediate level with real-world cases
11	Intro to Machine Learning	AWS	https://www.aws.training/Details/Course?id=33885	Free	Beginner	~2 hours, AWS-centric, basic ML concepts
12	Machine Learning for Beginners	Microsoft	https://learn.microsoft.com/en-us/shows/machine-learning-for-b	Free	Beginner	Beginner course, includes GitHub code notebooks
Domain		***Data science***				
1	Data Science Foundations	IBM	https://www.coursera.org/specializations/data-science-foundatio	Free (Audit)	Beginner	Beginner level, no coding required, ~12 hours
2	Data Science Methodology	IBM	https://www.coursera.org/learn/data-science-methodology	Free (Audit)	Beginner	No prerequisites, part of IBM DS professional cert
3	Introduction to Data Science	Microsoft	https://www.edx.org/learn/data-science/ibm-introduction-to-data	Free (Audit) and certificate (P	Beginner	Requires Python basics, ~6 weeks
4	Data Science for Beginners	Microsoft	https://github.com/microsoft/Data-Science-For-Beginners	Free (assessment) but no cert	Beginner	Beginner friendly, 10 lesson modules with projects
5	Foundations: Data, Data, Everywhere	Google	https://www.coursera.org/learn/foundations-data	Free (Audit)	Beginner	Beginner course, 1st in Google Data Analytics Cert
6	Introduction to Data Science	Infosys	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_au	Free	Beginner	Introductory, includes quizzes and projects
7	Data Science Orientation	IBM	https://cognitiveclass.ai/courses/data-science-hands-open-source	Free	Beginner	Offered via Cognitive Class, IBM platform
8	Big Data Fundamentals	NASSCOM / FutureSkills Pri	https://futureskillsprime.in/course/big-data-fundamentals	Free (after registration)	Beginner	Govt-approved, suitable for beginners
9	Data Science for Beginners	NASSCOM / FutureSkills Pri	https://www.futureskillsprime.in/course/data-science-for-beginne	Free (after registration)	Beginner	Aligned to Competency Standards developed by SSC nasscom in collaboration with Industry and approved by Government of India
10	RDBMS for Data Science	NASSCOM / FutureSkills Pri	https://www.futureskillsprime.in/course/rdbms-for-data-science-l	Free (after registration)	Beginner	Introudction to the basics of RDBMS and Data sceince
11	Python for Data Science	NASSCOM / FutureSkills Pri	https://www.futureskillsprime.in/course/python-for-data-science-	Free (after registration)	Beginner	Applications of Data science using Python a hands on approach
Domain		***Cloud computing***				
1	AWS Cloud Practitioner Essentials	Amazon Web Services (AWS	https://www.aws.training/SessionSearch?pageNumber=1&course	Free (Enrollment) but exam c	Beginner	Beginner level, ~6 hours, covers AWS basics
2	Google Cloud Digital Leader Training	Google Cloud	https://cloud.google.com/learn/certification?hl=en#why-get-goog	Free (Enrollment) but exam c	Beginner	Foundational course for GCP, self-paced
3	Microsoft Azure Fundamentals (AZ-900) Learn	Microsoft	https://learn.microsoft.com/en-us/training/paths/azure-fundame	Free	Beginner	Covers Azure basics, 9 modules
4	Cloud Computing Basics (Cloud 101)	IBM	https://www.coursera.org/learn/cloud-computing-basics	Free (Audit)	Beginner	Beginner-friendly, ~12 hours
5	Introduction to Cloud Computing	IBM via Cognitive Class	https://cognitiveclass.ai/courses/introduction-to-cloud	Free	Beginner	Self-paced, beginner-level course
6	Fundamentals of Cloud Computing	Infosys	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_au	Free	Beginner	Covers SaaS, PaaS, IaaS concepts
7	Cloud Infrastructure and Services	Infosys	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_au	Free	Beginner	Intermediate level

8	Introduction of Cloud Computing	NASSCOM / FutureSkills Pri	https://www.futureskillsprime.in/course/introduction-of-cloud-co	Free (after registration)	Beginner	Learn the fundamentals of cloud security, including data encryption, access controls, and compliance, to protect cloud infrastructure and ensure secure cloud computing.
9	Cloud Computing Concepts	University of Illinois (Course	https://www.coursera.org/learn/cloud-computing	Free (Audit)	Beginner	Intermediate course, ~30 hours
10	Google Cloud Computing Foundations with Ku	NASSCOM / FutureSkills Pri	https://www.futureskillsprime.in/pathways/kubernetes-in/	Free (after registration)	Advanced	learn about Kubernetes and its key features. You will also learn about the advantages and disadvantages of Kubernetes.
11	Certificate program in Cloud Computing Engin	NASSCOM / FutureSkills Pri	https://www.futureskillsprime.in/course/certificate-program-in-cl	Free (after registration)	Beginner	learn about Azure and its application.
Domain		***Networking***				
1	Networking Basics	NASSCOM / FutureSkills Pri	https://www.futureskillsprime.in/course/networking-basics/	Free (after registration)	Beginner	Learn about the basics of networking.
2	Networking Essentials	Cisco Networking Academy	https://www.netacad.com/courses/networking-essentials?course	Free	Beginner	Beginner-friendly, teaches basic networking with Packet Tracer
3	Networking Basics	Cisco Networking Academy	https://www.netacad.com/courses/networking-basics?courseLang	Free	Beginner	Covers foundational networking concepts
4	The Bits and Bytes of Computer Networking	Google (Coursera)	https://www.coursera.org/learn/computer-networking	Free (Audit)	Beginner	Beginner-level, 6 modules, ~30 hours
5	Introduction to Networking	IBM (Cognitive Class)	https://cognitiveclass.ai/courses/introduction-to-networking	Free	Beginner	Self-paced, beginner course
6	Network Fundamentals	Infosys Springboard	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_au	Free	Beginner	Includes basics of network architecture and devices
7	Networking Essentials	TCS iON	https://learning.tcsionhub.in/courses/networking-essentials/	Free	Beginner	Beginner course, online self-paced
8	Basics of Computer Networking	Great Learning	https://www.mygreatlearning.com/academy/learn-for-free/cours	Free	Beginner	Short course, basic concepts explained
Domain		***Programming***				
1	Python Fundamentals	NASSCOM / FutureSkills Pri	https://www.futureskillsprime.in/course/python-fundamentals-2/	Free (after registration)	Beginner	Acquire the requisite skills in python to be able to work with ML applications. Learn from the fundamentals to the advanced concepts.
2	Python Basics	NASSCOM / FutureSkills Pri	https://www.futureskillsprime.in/course/python-basics/	Free (after registration)	Beginner	This course offers you informative web links, hands-on exercises, and quizzes to strengthen your understanding of Python.
3	Operating Systems & Shell Scripting	NASSCOM / FutureSkills Pri	https://www.futureskillsprime.in/course/operating-systems-and-s	Free (after registration)	Beginner	This course offers you informative web links, hands-on exercises, and quizzes to introduce basic concepts of Operating System, Shell Scripting and Regular Expressions to manipulate and work with text files.
4	Software Programmer - Python	NASSCOM / FutureSkills Pri	https://www.futureskillsprime.in/course/software-programmer-p	Free (after registration)	Beginner	Python course covers basic/advanced concepts like data types, control structures, functions, OOP, file handling, web scraping, data analysis & more
5	JAVA programmimg	Shiksha online	https://www.shiksha.com/college/coding-ninjas-pitampura-delhi-	Free (after registration)	Beginner	Mastery in Code: Navigating the World of Java Programming, Crafting Dynamic Applications, and Unleashing the Power of Object-Oriented Excellence.

6	Duke - Java Programming: Solving Problems w	Shiksha online	https://www.shiksha.com/online-courses/java-programming-solvi	Free (after registration)	Beginner	Explore a Career as a Software Engineer. Learn the basics of programming and software development
7	Get started with Java on Azure	Shiksha online	https://www.shiksha.com/online-courses/java-programming-solvi	Free (after registration)	Beginner	Azure overview
8	Kotlin for Java Developers	Shiksha online	https://www.shiksha.com/online-courses/java-programming-solvi	Free (after registration)	Beginner	Basics of Java

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Department of CSE

Scheme of Evaluation

M. Tech. II Semester *(CSE)*

(for batch admitted in academic session 2025-26)

S. No.	Course Code	Category Code	Course Name	Maximum Marks Allotted								Total Marks	Contact Hours per week			Total Credits	Mode of Learning	Mode of Exam.	Duration of Exam.
				Theory Block				Practical Block		MOOCs									
				Continuous Evaluation			Major Evaluation	Continuous Evaluation	Major Evaluation	Assignment	Exam		L	T	P				
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment													
1.	62251201	DC	Algorithm Design Techniques & Analysis	25	25	20	30	-	-	-	-	100	3	-	-	3	Face to Face	PP	2 Hrs.
2.	62251202	DC	Digital Watermarking & Steganalysis	25	25	20	30	-	-	-	-	100	2	1	-	3	Face to Face	PP	2 Hrs.
3.	62251203	DC	Natural Language Processing	25	25	20	30	-	-	-	-	100	2	1	-	3	Face to Face	PP	2 Hrs.
4.		DE	**Departmental Elective[*] (DE-2)**	-	-	-	-	-	-	25	75	100	3	-	-	3	Online	MCQ	3 Hrs
5.		SC	**Specialization Course (SC-2)**	25	25	20	30	-	-	-	-	100	2	1	-	3	Face to Face	PP	2 Hrs.
6.	62251204	DLC	**Lab-II[#]**	-	-	-	-	70	30	-	-	100	-	-	4	2	Experiential	SO	-
7.	62251205	DLC	**Seminar/Presentation[$]**	-	-	-	-	70	30	-	-	100	-	-	4	2	Mentoring	SO	-
8.	622512XX	NEC	**Classified Novel Engaging Course (Activity Based Learning)**	-	-	-	-	-	50	-	-	50	-	1	-	1	Interactive	SO	-
Total				**100**	**100**	**80**	**120**	**140**	**110**	**25**	**75**	**750**	**12**	**04**	**08**	**20**	-	-	-

MCQ: Multiple Choice Question **PP:** Pen Paper **SO:** Submission + Oral **OB:** Open Book

[*] This course will run through SWAYAM / NPTEL /MOOC based learning platform (with credit transfer facility). The course can be related & relevant to other domain as well.

[#] During lab, students have to perform practical/assignments/minor projects related to the courses of respective semester using recent technologies / languages / tools etc.

[$] Seminar/Presentation through SWAYAM / NPTEL (Registration in a course will be compulsory for students but assessment will be based on internal seminar presentation).

DE-2[*] *(through SWAYAM / NPTEL /MOOC)*		
S. No.	**Course Code**	**Course Name**
1.	62251206	Cloud Computing
2.	62251207	Social Networks

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Department of CSE

Mode of Learning								Mode of Examination				Total Credits
Theory		Lab					CNEC	Theory			Lab	
Face to Face	Online	Face to Face	Blended	Experiential	Experimental	Mentoring	Interactive	PP	MCQ	OB	SO	
12	3	-		2		2	1	12	3		5	20
60	15	-		10		10	5	60	15		25	Credits %

Classified Novel Engaging Course (Activity Based Learning)

M. Tech. II Semester *(CSE)*

Classified Novel Engaging Course		
1.	Artificial Intelligence & Neural Networks	62251210
2.	Data Science using Python	62251211

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

ALGORITHM DESIGN TECHNIQUES & ANALYSIS
62251201

COURSE OBJECTIVE:

- To introduce the topic of algorithms as a precise mathematical concept.
- To demonstrate the familiarity with major algorithm design paradigms and methods of analysis.
- To design efficient algorithms for common computer engineering problems.
- To enhance the skills using well-known algorithms and data structures for solving real-life problems.

UNIT I

Introduction: What is an algorithm, Functions and Relations, Vectors and Matrices, Linear Inequalities and Linear Equations, Asymptotic Notations and Basic Efficiency Classes, Master's Theorem, Mathematical Analysis of Recursive and Non-recursive Algorithms, Empirical Analysis of Algorithms. Brute Force and Exhaustive Search- Sequential Search and Brute-Force, String Matching, Closest-Pair and Convex-Hull Problems.

UNIT II

Decrease-and-Conquer: Topological Sorting, Fake-Coin Problem, Russian Peasant Multiplication, Josephus Problem, Computing a Median and the Selection Problem, Game of Nim. **Transform-and-Conquer:** 2-3 Trees, B-Trees, B+ Trees, **Various Algorithms:** Krushkal & Prim's Algorithm, Huffman Encoding, Job Scheduling Algorithm, Kirchoff's Law, Travelling Salesman Problem

UNIT III

Space and Time Trade-Offs: Sorting by Counting, Input Enhancement in String Matching, Boyer-Moore Algorithm, Open Hashing (Separate Chaining), Closed Hashing (Open Addressing), Problem Solving using Dynamic Programming – Calculating the Binomial Coefficient, Making Change Problem, Assembly Line Scheduling, Knapsack problem, Matrix chain multiplication

UNIT IV

Iterative Improvement: Simplex Method, Maximum-Flow Problem, MaximumMatching in Bipartite Graphs, Stable Marriage Problem.

Limitations of Algorithm

Power: Lower-Bound Arguments, Trivial Lower Bounds, Information-Theoretic Arguments, Adversary Arguments, Problem Reduction, Decision Trees, Decision Trees for Sorting, Decision Trees for Searching a Sorted Array.

UNIT V

Introduction to P, NP, NP-Hard and NP-Complete, P and NP Problems - Partition problem, Bin-packing problem, NP-Complete Problems, Travelling Salesman problem, Hamiltonian problem, Approximation algorithms.

Recommended Books:

1. Introduction to Design and Analysis of Computer Algorithms, 3rd Edition, Anany Levitin, Pearson Education
2. Fundamentals of Computer Algorithms, Horowitz & Sahani, Universities press.
3. Introduction to Algorithms, Coremen Thomas, Leiserson CE, Rivest RL, PHI.
4. Design & Analysis of Computer Algorithms, Ullmann, Pearson.
5. Algorithm Design, Michael T Goodrich, Robarto Tamassia, Wiley India.

COURSE OUTCOMES

After completion of this course, the students would be able to:
CO1: Recall fundamental algorithm concepts and mathematical foundations.
CO2: Explain algorithm design strategies with examples.
CO3: Apply techniques like dynamic programming to solve problems.
CO4: Analyze complexity and trade-offs of algorithms.
CO5: Evaluate algorithm limitations and classify problems (P, NP, NP-Hard).

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	---	---	---	---	---	---	---	---	---	1	3	2
CO2	2	3	1	---	2	---	---	---	1	1	---	2	3	2
CO3	3	3	3	2	3	---	---	---	1	1	2	2	3	3
CO4	3	3	2	3	3	---	---	---	---	---	1	3	3	2
CO5	2	3	2	3	2	---	---	---	---	---	---	2	3	3

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DIGITAL WATERMARKING & STEGANALYSIS
62251202

COURSE OBJECTIVES

- To provide the importance of digital watermarking and Steganography
- To discuss the properties of watermarking and steganography systems
- To discuss the different models of watermarking and steganography
- To understand the various evaluation metrics
- To examine various applications of watermarking and steganography

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UNIT-I

INTRODUCTION: Information Hiding, Steganography, and Watermarking. History of Watermarking. History of Steganography, Importance of Digital Watermarking. Importance of Steganography, Applications and Properties.

UNIT-II

WATERMARKING: Evaluating watermarking systems. Notation, Communications, Communication-based models, Geometric models, Mapping messages into message vectors, Error correction coding, Detecting multi-symbol watermarks, Attacks.

UNIT-III

MODELS OF WATERMARKING: Notation, Communications, Components of Communications Systems, Classes of Transmission Channels, Secure Transmission, Communication-Based Models of Watermarking, Basic Model, Watermarking as Communications with Side Information at the Transmitter, Watermarking as Multiplexed Communications, Geometric Models of Watermarking, Distributions and Regions in Media Space, Marking Spaces, Modeling Watermark Detection by Correlation, Robust Watermarking Approaches.

UNIT-IV

STEGANOGRAPHY & STEGANALYSIS: Steganographic Communication, The Channel, The Building Blocks, Notation and Terminology, Information – Theoretic Foundations of Steganography, Cachin's Definition of Steganographic Security, Practical Steganographic Methods, Statistics Preserving Steganography, Model-Based Steganography, Steganalysis Scenarios, Detection, Forensic Steganalysis, The Influence of the Cover Work on Steganalysis, Some Significant Steganalysis Algorithms, LSB Embedding, and the Histogram Attack.

UNIT-V

APPLICATIONS: Applications of Watermarking, Broadcast Monitoring, Copyrights, Proof of Ownership, Transaction Tracking, Content Authentication, Copy Control, Device Control, Legacy Enhancement. Applications of Steganography, Steganography for Dissidents, Steganography for Criminals.

RECOMMENDED BOOKS

- Ingemar J. Cox, Mathew L. Miller, Jefrey A. Bloom, Jesica Fridrich, Ton Kalker, "Digital Watermarking and Steganography", Morgan Kaufmann Publishers, New York, 2008.
- Ingemar J. Cox, Mathew L. Miller, Jefrey A. Bloom, "Digital Watermarking", Morgan Kaufmann Publishers, New York, 2003.
- Ingemar Cox, Mathew Miller, Jefrey Blom, Jesica Fridrich and Ton Kalker, "Digital Watermarking and Steganography", Morgan Kaufmann Publishers, Nov 2007.
- Juergen Seits, "Digital Watermarking for Digital Media", IDEA Group Publisher, New York, 2005.
- Jesica Fridrich, "Steganography in Digital Media: Principles, Algorithms, and Applications", Cambridge University press, 2010.
- Michael Arnold, Martin Schmucker, Stephen D. Wolthusen, "Techniques and Applications of Digital Watermarking and Content Protection", Artech House, London, 2003.
- Peter Wayner, "Disappearing Cryptography – Information Hiding: Steganography & Watermarking", Morgan Kaufmann Publishers, New York, 2002.
- Stefan Katzenbelser and Fabien A. P. Peticolas, "Information hiding techniques for Steganography and Digital Watermarking", ARTECH House Publishers, January 2004.

COURSE OUTCOMES

After the completion of this course, students would be able to:

CO1. Describe watermarking and steganography fundamental concepts and principles

CO2. Explain & Detect different watermarking attacks.

CO3. Identify and assess the different models of watermarking.

CO4. Carry out system security for various threat environments using steganography techniques.

CO5. Explain the various applications of watermarking and steganography.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	3												
CO2			2				3						1	
CO3					2				2			2	2	
CO4					1								1	
CO5					2							1	3	1

1 - Slightly; 2 - Moderately; 3 – Substantially

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

NATURAL LANGUAGE PROCESSING
62251203

COURSE OBJECTIVES

- Develop a comprehensive understanding of fundamental concepts and techniques in Natural Language Processing.
- Introduce advanced machine learning and deep learning approaches for NLP tasks.
- Prepare students for designing and implementing NLP solutions for real-world applications.

Unit-I

Introduction to Natural Language Processing: Foundations of NLP, levels of linguistic analysis (phonology, morphology, syntax, semantics, pragmatics), challenges in NLP, applications of NLP, brief history and evolution of NLP, ethics in NLP.

Unit-II

Text Processing and Language Modeling: Text preprocessing techniques, tokenization, stemming, lemmatization, part-of-speech tagging, named entity recognition, n-gram models, statistical language models, neural language models, transformers and attention mechanisms.

Unit-III

Syntactic and Semantic Analysis: Constituency and dependency parsing, context-free grammars, probabilistic context-free grammars, semantic role labeling, word sense disambiguation, lexical semantics, distributional semantics, word embeddings (Word2Vec, GloVe, FastText).

Unit-IV

Machine Learning for NLP: Supervised learning algorithms for text classification and sequence labeling, unsupervised learning for topic modeling and clustering, deep learning architectures for NLP (RNNs, LSTMs, GRUs, CNNs), transfer learning and fine-tuning in NLP, evaluation metrics for NLP tasks.

Unit-V

Advanced NLP Applications: Machine translation (statistical and neural approaches), sentiment analysis and opinion mining, text summarization, question answering systems, dialogue systems and chatbots, information retrieval and extraction, multi-modal NLP (text-to-speech, speech recognition, image captioning), recent advancements in NLP (e.g., GPT, BERT, XLNet).

RECOMMENDED BOOKS

- Daniel Jurafsky, James H. Martin, "Speech and Language Processing", Prentice Hall.
- Christopher D. Manning, Hinrich Schütze, "Foundations of Statistical Natural Language Processing", MIT Press.
- Yoav Goldberg, "Neural Network Methods for Natural Language Processing", Morgan & Claypool Publishers.
- Emily M. Bender, Alex Lascarides, "Linguistic Fundamentals for Natural Language Processing: 100 Essentials from Morphology and Syntax", Morgan & Claypool Publishers.
- Jacob Eisenstein, "Introduction to Natural Language Processing", MIT Press.

COURSE OUTCOMES

After completion of the course students would be able to:

CO1. Explain the fundamental concepts of Natural Language Processing, including linguistic levels of analysis and challenges in NLP.
CO2. Apply various text processing techniques and implement language models for NLP tasks.
CO3. Analyse and **implement** syntactic and semantic analysis methods in natural language.
CO4. Design and **develop** machine learning and deep learning models for various NLP applications.
CO5. Evaluate and **implement** advanced NLP applications, addressing real-world problems and ethical considerations.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	1			1	2		2	3	2
CO2	3	3	3	3	3				2	2		2	3	3
CO3	3	3	3	3	3	1			2	2	1	2	3	3
CO4	3	3	3	3	3	2	1	1	2	2	2	2	3	3
CO5	3	3	3	3	3	3	2	2	3	3	2	3	3	3

1 - Slightly; 2 - Moderately; 3 - Substantially

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DEEP LEARNING
62251208

COURSE OBJECTIVES

- Introduce major deep neural network frameworks and issues in basic neural networks.
- To solve real world applications using Deep learning

Unit-I

Introduction to machine learning, scope and limitations, Types of machine learning, Linearity vs non linearity, Neural Networks Basics – layers in Neural networks – Activation function, Loss function - Function approximation - Classification and Clustering problems - Deep networks basics - Shallow neural networks,

Unit-II

Multilayer network, Gradient descent, backpropagation, weight initialization, training, testing, underfitting and overfitting, batch normalization, dropout, L1 and L2 regularization, unstable gradient problem tuning hyper parameters, momentum, Mini-batch Gradient Descent – Exponential Weighted Averages – Gradient Descent with Momentum – RMSProp and Adam Optimization – Hyperparameter tuning.

Unit-III

Foundations of Convolutional Neural Networks – CNN operations – Architecture – Simple Convolution Network – Deep Convolutional Models – ResNet, AlexNet, InceptionNet and others. data augmentation, Transfer Learning, Transfer Learning Models, Generative Adversarial Network.

Unit-IV

Recurrent neural network, long short-term memory, gated recurrent unit, translation, Auto encoders beam search and width, Bleu score, attention model.

Unit-V

Reinforcement Learning, RL-framework, MDP, Bellman equations, Value Iteration and Policy Iteration, Actor-critic model, Q-learning, SARSA

RECOMMENDED BOOKS

- Ian Goodfellow Yoshua Bengio Aaron Courville, Deep Learning, MIT Press, 2017.
- Michael Nielsen, Neural Networks and Deep Learning, Determination Press, first Edition, 2013
- Deep Learning Foundations and Concepts, Christopher M. Bishop, Hugh Bishop

COURSE OUTCOMES

After completing the course, the student will be able to:

CO1. **Understand** the fundamental concepts and types of machine learning, including linearity and non-linearity.
CO2: **Apply** principles of neural networks, including multilayer networks, gradient descent, and backpropagation, to solve real-world problems.
CO3: **Analyze and design** convolutional neural networks (CNNs) for image recognition.
CO4: **Evaluate** the use of recurrent neural networks (RNNs), LSTMs, and GRUs for sequence modeling tasks, and implement attention mechanisms for improved performance.
CO5**: Create** solutions using reinforcement learning algorithms, including Q-learning and SARSA.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	1	-	-	-	1	-	1	1	2	1
CO2	2	3	2	2	2	-	-	-	1	-	1	1	3	3
CO3	2	3	3	2	2	-	-	-	1	-	1	1	3	2
CO4	1	3	3	2	2	-	-	-	1	-	1	1	3	3
CO5	1	3	3	2	2	-	-	-	1	-	1	1	3	3

1 - Slightly; 2 - Moderately; 3 – Substantially

Department of CSE

Name of Faculty Mentor	**Dr. Rahul Dubey (CSE)**
Course Title	**Data Science using Python**
Objectives of Course	• To develop skills in data manipulation and analysis using libraries like NumPy and pandas. • To enable students to create effective data visualizations using Matplotlib and Seaborn. • To equip students with techniques for exploratory data analysis. • To familiarize students with integrating Python and SQL for database management. • To introduce foundational concepts of machine learning, including supervised and unsupervised learning. • To guide students in building, evaluating, and applying predictive models using Scikit-learn.
Content	The course will cover various topics, including Introduction to Python for Data Science and an overview of Python and its applications in data science. Setting up the environment (Anaconda, Jupyter Notebook). Python basics: variables, data types, loops, and control structures and functions. Data Manipulation and anlysis using NumPy for numerical computations. Data manipulation using pandas Data cleaning and preprocessing techniques. Data Visualization using Matplotlib. Advanced visualization with Seaborn. Exploratory data analysis. Working with Databases Introduction to SQL integration in Python. Reading and writing data to/from databases. Introduction to Machine Learning Overview of supervised and unsupervised learning. Building predictive models with Scikit-learn. Evaluating model performance. Solving real-world problems using data science techniques.
Contact hrs	30
Outcomes of Course (As per OBE)	CO1: Demonstrate proficiency in Python programming and its applications in data science. CO2: Manipulate and analyze data effectively using NumPy and pandas libraries. CO3: Create insightful visualizations and conduct exploratory data analysis using Matplotlib and Seaborn. CO4: Integrate Python with SQL for database operations and manage data workflows. CO5: Build and evaluate predictive machine learning models using Scikit-learn to solve real-world problems.

Name of Faculty Mentor	**Dr. Dheeraj Dixit**
Course Title	**Artificial Intelligence & Neural Networks**
Objectives of Course	• Identify problems where AI is required and the different methods available • Compare and contrast different AI techniques • Define and explain learning algorithms • Learn knowledge representation techniques and their importance in AI • Familiarize with neural networks, their architectures, learning laws, and activation functions
Content	• Introduction to AI, its history, tasks, and techniques • Agent-based approaches, search techniques, constraint satisfaction problems • Knowledge representation techniques like logic, semantic networks • Introduction to neural networks, learning laws, and activation functions • Neural network models and architectures like single/multi-layer perceptron's
Contact hrs	15 hrs.
Outcomes of Course **(As per OBE)**	After completing the course, students will have the following abilities: • CO1. Identify the AI-based problems • CO2. Apply techniques to solve the AI problems • CO3. Define learning and explain various learning techniques • CO4. Discuss the concepts and architectures of Neural Networks

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Department of CSE

Scheme of Evaluation

M. Tech. IV Semester *(CSE)*

(for batch admitted in academic session 2024-25)

S. No.	Course Code	Category Code	Course Name	Maximum Marks Allotted						Total Marks	Contact Hours per week			Total Credits	Mode of Learning	Mode of Exam.	Duration of Exam.
				Theory Block				Practical Block									
				Continuous Evaluation			Major Evaluation	Continuous Evaluation	Major Evaluation		L	T	P				
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment		Lab Work & Sessional									
1.	62242201	DLC	Dissertation	-	-	-	-	350	150	500	-	-	32	16	Interactive	SO	-
Total				-	-	-	-	**350**	**150**	**500**	-	-	**32**	**16**	-	-	-