Subject Code	15M3NCI231	**Semester : ODD**	**Session Month July-December 2024**	
Subject Name	**E-Commerce and Social Web**			
Credits	**3**	**Contact Hours**	**3-0-0**	
Faculty (Names)	**Coordinator(s)**	Dr. Kapil Madan		
	Teacher(s)	Dr. Kapil Madan		
Module No.	**Subtitle of the Module**	**Topics in the module**		**No. of Lectures for the module**
1.	Introduction and overview of e-Commerce	Definition and models of e-commerce and examples. Selection of an E-commerce type and business model. Business models based on (1) Transaction Parties (2) Transaction Types. Case Studies of the Indian context.		3
2.	Introduction to Social Web	Social Web overview, data-types, format, Text cleaning, tagging and storage, Social media techniques, tools and platforms, data-visualization of data, research, applications and challenges in social Web.		3
3.	Introduction to Social Commerce	Introduction to Social Commerce, Supporting Theories and Concepts for Social Commerce, Tools and Platforms for Social Commerce		3
4.	Social Network Analysis for Startups	Analyzing Social web, Nodes, Edges and Network measures, Centrality, Power and Bottlenecks, Concept of Cliques, Clusters and Components, Viral marketing, Graph data in real world, Business use of Social web, Privacy in Social web		4
5.	Social Shopping	Social Media Marketing, Social Shopping: Concepts, Benefits, and Models, Customer Engagement and Metrics		4
6.	Programming using API and RSS feeds	Introduction to OAuth protocol, Programming and Crawling Social media using Twitter 4j Facebook API, YouTube API, LinkedIn API, and News Service APIs		5
7.	Twitter and Facebook Data Analytics for Viral Marketing	Topic-based Clusters in Egocentric Networks on Facebook, Changes in Tie Strength Through Site Use on Facebook, Patterns of Responses to Resource Requests on Facebook, Exploring requests for help on Facebook, Analysis of User-Generated Content on Facebook, Predicting Clicks on Ads, Predicting the quality of new contributors to the Facebook crowdsourcing system		8
8.	Creating Suggestions and Recommendations	Perform web-market segmentation, making recommendations: collaborative filtering and content-based filtering approaches, creating suggestions and building recommendation engines, understanding recommendation engines based on users, items, and content, Finding recommendations about friends,articles, and news stories, Creating recommendations for sites similar to Netflix		5

9.	Developing Server side solutions using advanced java technology	Quick Review of Java Servlet Technology, Servlet Lifecycle, HTTP Servlet Basics, HttpSession, HttpRequest-Response, Retrieving and sending information, Servlet Session Tracking, Handling Cookies, Invoking Java Code with JSP Scripting Elements, JSP page Directive, Including Files in JSP Pages, Using JavaBeans in JSP Documents , Integrating Servlets and JSP (MVC) Architecture.	7
		Total number of Lectures	42

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Michael P Papazoglou and Pieter M.A. Ribbers, " e-Business- Organizational and technical foundation" , John Wiley and Sons, 2006.
2.	Efraim Turban , David King, Dennis Viehland, Jae Lee, "Electronic Commerce A Managerial Perspective 2006", 4ed, Pearson Education International edition, 2006.
3.	Stephen Chen, "Strategic management of e-business", second edition, John Wiley and Sons,2005.
4.	RS Prasad, "Cyber crime: An Introduction", ICFAI Books, ICFAI University, 2004.
5.	RS Prasad, "Cyber crime: Combat Strategies", ICFAI Books, ICFAI University, 2004.
6.	RS Prasad, "CRM Present and Future", ICFAI Books, ICFAI University, 2005.
7.	Elaine Lawrence et al, "Internet commerce – Digital models for Business", John Wiley andSons, 2003.
8.	Abhijit Choudhury and Jean-Pierre Kuilboer, "E-business and E-Commerece Infrastructure – Technologies supporting E-Business Initiative", McGraw Hill, 2002.
9.	Henry Chan et al, E-Commerece – fundamentals and applications", John Wiley and Sons,2001.
10.	Programming Collective Intelligence: Building Smart Web 2.0 Applications by Toby Segaran
11.	Algorithms of the Intelligent Web Haralambos Marmanis, Dmitry Babenko
12.	Recommender Systems: An Introduction Dietmar Jannach (Author), Markus Zanker (Author), Alexander Felfernig (Author), Gerhard Friedrich
13.	Recommender Systems Handbook Francesco Ricci (Editor), Lior Rokach
14.	Recommendation Systems in Software Engineering Martin P. Robillard (Editor), Walid Maalej (Editor), Robert J Walker (Editor), Thomas Zimmermann

Machine Learning and Data Mining Lab (17M15CS112)
Detailed Syllabus

Course Code	17M15CS112	**Semester:** Odd 2024	**Semester: I Session** 2024 -2025 Month from: July – December 2024
Course Name	Machine Learning and Data Mining Lab		
Credits	1	**Contact Hours**	**2**

Faculty (Names)	**Coordinator(s)**	Dr. Amit Mishra
	Teacher(s) (Alphabetically)	Dr. Anita Sahoo, Dr. Amit Mishra

COURSE OUTCOMES: Students will be able to		**COGNITIVE LEVELS**
C173.1	Perform data preprocessing, data sampling and visualization.	Understanding (Level-2)
C173.2	Apply Linear regression, Logistic regression, kNN, k Means, SVM and ID3 on different datasets.	Apply (Level-3)
C173.3	Implement Apriori algorithm and Eclat algorithm in R.	Apply (Level-3)
C173.4	Apply neural networks such as ANN, BPN and CNN to different datasets.	Apply (Level-3)
C173.5	Evaluate and analyze different machine learning models on the basis of their performances.	Evaluate (Level-5)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Python for data sampling and Visualization	a. To write a program for writing the pixel values of an image b. Write programs for Data Sampling (given dataset).	1
2.	Python for text processing	Use IPython (a web version provided by Jupyter notebook) to write a word count program. Your program should read a text document (download from https://raw.githubusercontent.com/python/cpython/master/	1
3.	Classification-1	Implement kNN algorithm using Python. Consider the iris dataset and report the accuracy of classification. [May take help from : https://machinelearningmastery.com/tutorial-to-implement-k-nearest-neighbors-in-python-from-scratch/]	2
4.	Clustering	Clustering: Implement kMeans Algorithm	2
5.	Classification-2	Classify the wine dataset of UCI Repository by ID3.	2
6.	Data Mining-1	Implement Logistic Regression on a sample dataset	2
7.	Data Mining-2	Implement apriori and Eclat algorithm for association rule mining in R	3
8.	SVM-1	Apply Support Vector Machine on the dataset of question the Parkinson dataset given in https://archive.ics.uci.edu/ml/datasets/Parkinson+Dataset+with+replicated+acoustic+features+.	2
9.	Comparison of Classification algorithms	Compare the classification of Iris dataset by different algorithms namely kNN, ID3 and SVM. Report accuracy and other performance measures.Implement neural networks for Classification of *four* character patterns	5

10.	ANN	Apply Multi Layer Percepron for supervised learning (problem statement to be given individually)	4
11.	BPN	Use back propagation for supervised learning . For the data based on 1990 census data from California.Evaluate the accuracy of a model's predictions using RMSE.	4
12.	CNN	Implement CNN using TensorFlow for classifying MNIST images	4

Evaluation Criteria

Components	**Maximum Marks**
Lab Test1	20
Lab Test2	20
D2D	50
Attendance	10
Total	100

PBL- Students in a group of 4-5 will be designing an efficient solution to a given problem / case-studies using appropriate Machine Learning and Data mining Technique studies in the course.

Recommended Reading material:

Text Books:

1.	Jiawei, Han, and Kamber Micheline. *Data mining: concepts and techniques*. Morgan kaufmann, 2006.
2.	Chakrabarti, Soumen, Richard E. Neapolitan, Dorian Pyle, Mamdouh Refaat, Markus Schneider, Toby J. Teorey, Ian H. Witten et al. *Data mining: know it all*. Morgan Kaufmann, 2008.
3.	Trueblood, Robert P., and John N. Lovett. *Data mining and statistical analysis using SQL*. Vol. 1. Berkeley, CA: Apress, 2001.
4.	Kimball, Ralph, and Margy Ross. The data warehouse toolkit: the complete guide to dimensional modeling. John Wiley & Sons, 2011.
5.	Pujari, Arun K. Data mining techniques. Universities press, 2001.

Reference Books:

1.	Mining, What Is Data. *Introduction to data mining*. New Jersey: Pearson Education, Inc, 2006.
2.	Chakrabarti, Soumen. *Mining the Web: Discovering knowledge from hypertext data*. Morgan Kaufmann, 2002.
3.	Berson, Alex, and Stephen J. Smith. *Data warehousing, data mining, and OLAP*. McGraw-Hill, Inc., 1997.
4.	Inmon, William H. Building the data warehouse. John wiley & sons, 2005.
5.	Anahory, Sam, and Dennis Murray. Data warehousing in the real world: a practical guide for building decision support systems. Addison-Wesley Longman Publishing Co., Inc., 1997.
6.	Dunham, Margaret H. *Data mining: Introductory and advanced topics*. Pearson Education India, 2006.
7.	Subasi, Abdulhamit. Practical machine learning for data analysis using python. Academic Press, 2020.
8.	Putatunda, Sayan. *Practical Machine Learning for Streaming Data with Python*. Berkeley, CA: Apress, 2021.

Detailed Syllabus
Lab-wise Breakup

NOTE: All the entries (…) must be in Times New Roman 11.

Course Code	17M15CS113	**Semester** **Odd 2024**	**Semester** ... **Session** 2024-25 **Month from** July to Dec, 2024
Course Name	**Cloud Technology Lab**		
Credits	1	**Contact Hours**	2 Hours

Faculty (Names)	**Coordinator(s)**	Dr Prakash Kumar
	Teacher(s) (Alphabetically)	Dr. Prakash Kumar Mr. Prashant Kaushik

COURSE OUTCOMES		**COGNITIVE LEVELS**
C171.1	Demonstrate the architecture and layers of Cloud Service Models, Deployment models etc.	Understand (level 2)
C171.2	Provisioning of Data Centers, Virtual Machines (VMs) and cloudlet allocations on CloudSim using various scheduling algorithms.	Apply (level 3)
C171.3	Analyze various Scheduling techniques and resource allocations, compare their performances on different Cloud Platforms, like, CloudSim, Amazon Web Services (AWS).	Analyze (level 4)
C171.4	Evaluate the various Cloud Services provisioning and their performances using AWS platforms, Containers and Dockers.	Evaluate (level 5)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	CloudSim installations, VM creation and usage	Understand the Cloud Service Models, Deployment Models, Various Cloud Layers, Data Centers, Virtualization Technology, Virtual Machines (VMs), Virtual Machine Monitors (VMMs).	CO1
2.		Provisioning of Data Centers, Virtual Machines (VMs) on CloudSim. Allocate different Cloudlets to VMs and Data Centers using different scheduling algorithms.	CO2
3.	Analyze various Scheduling algorithms in different scenarios on cloudsim, AWS	Create different Data Centers and allocate the VMs to them and analyze the outcomes	CO3
4.		Analyze various Scheduling techniques and resource allocations supported by Cloud Platforms, e.g. CloudSim and AWS., Their performance evaluations on different Cloud Platforms, like, CloudSim and Amazon Web Services (AWS).	CO3
5.	Evaluate Cloud Service provision on AWS, Containers and Dockers.	Evaluate the various Cloud Services provisioning and their performance evaluations using AWS like EC2, RDS, Simple Storage Service, Containers and Dockers.	CO4
***n*.**	…	…	…

Evaluation Criteria

Components	**Maximum Marks**
Lab Test# 1	20
Lab Test# 2	20
D2D work	60 (D2D: 30 marks, PBL: 20 marks, Attendance: 10 marks)
Total	**100**

Project Based Learning: A group of maximum 2 students are to be formed. Each group shall choose a Cloud based project. The project shall be designed and/or modeled based on Cloud Platform like AWS, Google cloud, Eucalyptus, CloudSim, iFogSim or any other Cloud Platform, preferably open source platforms and tools. The project shall function and run as per the objective of the project. Live demonstration of the project shall be shown during their presentation. The project evaluation shall be done based on the quality, innovation, relevance and creativity involved.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	K. Hwang, Geoffrey C. Fox, Jack J. Dongarra, "Distributed and Cloud Computing- From Parallel Processing to the Internet of Things", Morgan Kauffman Publishers, Elsevier.
2	George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" O'REILLY publication.
3	"Virtualization Overview", White paper, VM Ware.
4.	Rodrigo N. Calheiros, Rajiv Ranjan, Anton Beloglazov, Cesar A. F. De Rose, and Rajkumar Buyya, CloudSim: A Toolkit for Modeling and Simulation of Cloud Computing Environments and Evaluation of Resource Provisioning Algorithms, Software: Practice and Experience, Volume 41, Number 1, Pages: 23-50, ISSN: 0038-0644, Wiley Press, New York, USA, January 2011.
5.	Tom Guérout, Thierry Monteil, Georges Da Costa, Rodrigo Neves Calheiros, Rajkumar Buyya, Mihai Alexandru, Energy-aware Simulation with DVFS, Simulation Modelling Practice and Theory, Volume 39, No. 1, Pages: 76-91, ISSN: 1569-190X, Elsevier Science, Amsterdam, The Netherlands, November 2013.
6.	Rajkumar Buyya, Rajiv Ranjan and Rodrigo N. Calheiros, Modeling and Simulation of Scalable Cloud Computing Environments and the CloudSim Toolkit: Challenges and Opportunities, Proceedings of the 7th High Performance Computing and Simulation Conference (HPCS 2009, ISBN: 978-1-4244-4907-1, IEEE Press, New York, USA), Leipzig, Germany, June 21 - 24, 2009. - **Keynote Paper.**
7.	https://www.docker.com
***m*.**	…

COs	PO 1	PO 2	PO 3	PSO1	PSO2
C171.1	2	2	2	1	1
C171.2	2	2	2	1	2
C171.3	2	1	1	1	1
C171.4	1	1	2	2	2
AVG.	2	2	2	1	2

1. CO-PO and CO-PSO Mapping (M. Tech- CSE) I sem:

COs	PO 1	PO 2	PO 3	PSO1	PSO2
C171.1	2 Basics of Cloud services demonstrated	2 Basic principles and architectures of Cloud model is demonstrated	2 Various Cloud Service types and deployment models are demonstrated	1 Role of Virtualization Technology in Cloud Model is demonstrated	1 Data Center, Virtual Machine creation and usage is demonstrated
C171.2	2 Provisioning of Data Center and VMs on CloudSim platform	2 Allocation of Virtual Machines to Data Centers and Hosts	2 Applying various scheduling algorithms for VM provisioning and cloudlet allocations	1 Allocate Cloudlets to VM and Data Centers	2 Applying various scheduling algorithms for Cloudlet allocations on VMs
C171.3	2 Creating VMs and Instances on Amazon Web Services (AWS)	1 Analysing the behaviour of scheduling techniques	1 Analysis of instances on AWS, Elastic Compute Cloud (EC2) etc.	1 Analysis of Simple Storage Service (S3)	1 Analysis of other AWS Services, viz, Relational Database Service (RDS).
C171.4	1 Evaluation of AWS, Elastic Compute Cloud (EC2) features	1 Evaluation of AWS storages and their features, namely, Simple Storage Service (S3), Relations Database Services (RDS)	2 Performance evaluations of instances on AWS, EC2, storage and other services.	2 Performance Evaluation of Containers and their benefits over Virtual Machines.	2 Performance Evaluation of Dockers and their applications.
AVG.	2	2	2	1	2

Detailed Syllabus

Lecture-wise Breakup

Subject Code	23M12CS113	**Semester Odd (specify Odd/Even)**	**Semester Odd Session 2024-2025 Month from July 24 to December 24**
Subject Name	Software Quality and Testing		
Credits	**3**	**Contact Hours**	**3-0-0**

Faculty (Names)	**Coordinator(s)**	Dr. Indu Chawla
	Teacher(s) (Alphabetically)	Dr. Indu Chawla

COURSE OUTCOMES		**COGNITIVE LEVELS**
1.	Describe software quality management processes in the context of Software Development and Engineering.	Understand Level (Level 2)
2.	Utilize quality standards, factors, metrics and models for quality improvement.	Apply Level (Level 3)
3.	Infer the defects and manipulate them for improvement in quality for given Software.	Apply Level (Level 3)
4.	Examine the different testing processes for appropriate testing strategy.	Analyze Level (Level 4)

S.N.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Overview and Challenges	Overview of Software quality in the context of software development, quality frameworks, perspectives and expectations. Software errors: causes and classification	3
2.	Software quality models and factors	Software quality models: generalized, product specific, their comparison and interactions, Software quality factors: Product operations, revision and transition.	4
3.	Software quality Metrics	Software quality Metrics such as product quality metrics, in process quality metrics, metrics for software maintenance	4
4.	Software quality standards	Scope of quality management standards, SPI, CMMI and six sigma certifications	3
5.	Quality Assurance	Quality assurance techniques and comparisons, Defect prevention and process improvement.	6

6	Quantifiable Quality improvement	Quality assurance monitoring and measurement, immediate follow up actions and feedback.	4
7.	Software testing	Test activities, management and automation, Input domain partitioning and Boundary testing, Control flow, data Dependency and Interaction testing	6
8.	Software testing	Goals of Testing Software, Model-Driven Test Design, Test Automation, Input Space Partitioning, Graph Coverage, Logic Coverage, Syntax-based Testing	6
9.	Coverage and usage testing	Coverage and usage testing based on checklists, partitions, Finite state machines and Markov Chains	6
Total number of Lectures			**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 Assignment/Quiz/Mini-project (15 Marks) Attendance (10 Marks)
Total	**100**

Project based learning: Each Students in group of 3 to 4 will study about implications of software quality and testing in open source projects. They will present a detailed report or demonstrate the solution proposed. This detailed study using Software quality and testing techniques will help their employability into IT sector.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books

1.	Daniel Galin, Software Quality: Concepts and Practice, Wiley, 2018
2.	Paul Ammann and Jeff Offutt, Introduction to Software Testing, Cambridge University Press, 2016

Reference Books

1.	Kamna Malik, Praveen Choudhary, Software Quality- A practitioner's approach, Tata Mc Graw Hill, 2009
2.	Jeff Tian, Software Quality Engineering: Testing, Quality Assurance, and Quantifiable Improvement, Wiley India Pvt Ltd, 2005
3.	Gillies, Alan C., Software quality : theory and management, Cengage Learning, 2014
4.	Software Quality Journal-https://www.springer.com/journal/11219
5.	International Conference on Software Engineering- https://dl.acm.org/conference/icse

Detailed Syllabus
Lecture-wise Breakup

Course Code	23M12CS114	**Semester Even (specify Odd/Even)**	**Semester** 1st **Session** 2024-25 **Month from** July 2024 to Dec 2024
Course Name	Computer Vision		
Credits	3	**Contact Hours**	3-0-0

Faculty (Names)	**Coordinator(s)**	Dr. Ankit Vidyarthi
	Teacher(s) (Alphabetically)	Dr. Ankit Vidyarthi

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Understand the fundamental concepts of Computer Vision	Understand Level (Level 2)
CO2	Understand basic concepts, terminology, theories, models and methods in the field of computer vision	Understand Level (Level 2)
CO3	Determine known principles of human visual system	Apply Level (Level 3)
CO4	Illustrate methods related to multi-scale representation, edge detectionand detection of other primitives, stereo, motion and object recognition	Analyzing Level (Level 4)
CO5	Predicting a design of a computer vision system for a specific problem	Evaluate Level (Level 5)

COs	**PO1:** An ability to independently carry out research/ investigation and development work to solve practical problems	**PO2:** An ability to write and present a substantial technical report/document	**PO3:** Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program	**PSO 1:** Students should be able to develop and implement the solution of real-life computing problems using contemporary technologies	**PSO2:** Students should be able to apply ethical principles and commit to professional and social responsibilities
CO1	**1** Covers definitions, vision components introduction, and their use		**2** Covers general terminologies used to understand the vision systems	**3** Basic fundamentals help to build the vision pipeline for problem representation	
CO2	**2** Vision problems require an understanding of models and their working to solve practical problems	**2** Suitable model prediction for specific projects and its demonstration to society	**3** To solve a specific problem having multiple methods and identification of the best among all	**3** Solving the problems using the hybridization of the vision systems with existing algorithms	
CO3			**1** Human visual perspective to solve specific problems		
CO4	**2** Covers image representation using the frequency bands	**2** Representation of the images to understand the hidden pattern		**3** Covers a wide range of algorithms for object representation and template matching	**2** various problems of the society handled using the multi-scale representation
CO5	**3** Design of a vision system for a specific problem		**2** Building new algorithms and procedures for vision problems	**3** New design and algorithms for specific problems	
AVG.	**2**	**2**	**2**	**2**	**2**

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction	Introduction of Computer Vision, Monocular imaging system, Orthographic& Perspective Projection, Cameramodel and Camera calibration, Binocular imaging systems	4
2.	Image Processing and Feature representation	Image representations (continuous and discrete), Edge detection, Image filtering, Thinking in frequency, Image pyramids and applications	6
3.	Feature Detection and Matching	Edge detection, Interest points and corners, Local image features, Feature matching and hough transform, Model fitting and RANSAC	8
4.	Motion Estimation	Regularization theory, Opticalcomputation, StereoVision, Motionestimation,Structure from motion, Feature Tracking and Optical Flow	10
5.	Shape Representation and Segmentation	Deformable curves and surfaces, Snakes and active contours, Level set representations, Fourier and wavelet descriptors, Medialrepresentations,Multi-resolution analysis	8
6.	Object recognition	Hough transforms and other simple object recognition methods, Shapecorrespondence and shape matching, Principal Component analysis, Shape priors for recognition, Mixture of Gaussians and advanced feature encoding	6
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1 Examination	20
T2 Examination	20
End Semester Examination	35
TA	25 (Attendance (10), Tutorial/Quiz/Class-Test/ (5), Mini Project(10))
Total	**100**

Project Based Learning: Students in a group of 2 will take some real world problem and apply AI logics to solve the healthcare problem in a meaning way. Students can able to understand the core logic about data handling and processing.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

	Text Books
1.	Forsyth DA, Ponce J. Computer vision: a modern approach. prentice hall professional technical reference; 2002
2	Lakshmanan V, Görner M, Gillard R. Practical machine learning for computer vision. " O'Reilly Media, Inc."; 2021
	Reference Books
3.	Szeliski, R..*Computer vision: algorithms and applications*. Springer Nature, (2022)
4.	Chen K, Schönlieb CB, Tai XC, Younes L, editors. Handbook of Mathematical Models and Algorithms in Computer Vision and Imaging: Mathematical Imaging and Vision. Springer; 2023
5.	Chowdhary CL, Reddy GT, Parameshachari BD. Computer Vision and Recognition Systems: Research Innovations and Trends. CRC Press; 2022

Detailed Syllabus
Lab-wise Breakup

Course Code	**17M15CS111**	**Semester** ODD	**Semester I Session** 2024 -2025 **Month from** July to Dec 2024
Course Name	Advanced Algorithms Lab		
Credits	1	**Contact Hours**	2

Faculty (Names)	**Coordinator(s)**	Manish Kumar Thakur
	Teacher(s) (Alphabetically)	Manish Kumar Thakur

COURSE OUTCOMES		**COGNITIVE LEVELS**
C170.1	Implement algorithms and use appropriate advanced data structures for solving computing problems.	Level 3: Apply
C170.2	Design algorithms using divide-and-conquer, greedy and dynamic programming strategies, and further recite algorithms that employ these strategies.	Level 3: Apply Level 5: Evaluate
C170.3	Illustrate the mathematical foundation of network flows and some important flow algorithms.	Level 2: Understand Level 3: Apply
C170.4	Implement randomized algorithms to solve various problems, and validate their correctness and complexity.	Level 3: Apply Level 4: Analyze
C170.5	Understand P, NP, polynomial reduction, NP-hardness, and NP-Completeness.	Level 2: Understand Level 4: Analyze
C170.6	Comprehend and select algorithm design approaches in a problem specific manner.	Level 6: Create

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Fundamentals of data structures and algorithmic problem solving	Searching, Sorting, time complexity, Heaps, Arrays, Linked List, Trees, Fibonacci heaps, splay trees, dynamic trees.	CO1
2.	Divide and Conquer Technique	Solving Matrix multiplication problem and subset- sum problem using divide-and-conquer approach	CO2
3.	Greedy Algorithms	Greedy Approximation algorithms- Set Cover Problem, K Centers Problem, Fractional and 0/1 Knapsack, Coinage problem; Bin packing; Job scheduling, Graph coloring; and Text compression using Huffman coding and Shannon-Fanon coding.	CO2
4.	Dynamic Programming Technique	Fundamentals of Dynamic programming based solution approach, Printing Shortest Common Super sequence, Dynamic Programming on Trees, Maximum sum rectangle in a 2D matrix.	CO2
5.	Graph Algorithms	Solve and analyze Graph problems, Algorithms. All Pair Shortest Problem, Subset-sum problem. Minimum Spanning Trees (Prim's and Kruskal algorithms); Shortest Path using Dijkstra's algorithm, K-clique problem, Graph Coloring problem.	CO1, CO2
6.	Flows in Network	Network flows - max flow and min-cost flow/circulation, Edmonds-Karp algorithm	CO3

7.	Tractable and Non- Tractable Problems	One Way of Coping with NP-Hardness. Randomized Rounding. Vertex Cover and Travelling Salesman Problem.	CO4, CO5
8.	Mini-Project	Mini-Project	CO6

Evaluation Criteria

Components	**Maximum Marks**
Lab Test# 1	20
Lab Test# 2	20
D2D work	60
Total	**100**

Project based learning: Students in group of 3 to 4 students are required to develop mini-project based on the concepts taught in this course like Greedy algorithms, dynamic programming, network flow, etc. The solution approach for the identified problem statements should include the usages of advanced data structures including string data structures. The problem statements may be a puzzle-based games, graph-based problems, string-based problems, etc. The developed mini project will enhance the algorithmic thinking and problem-solving approaches of students which are highly desirable to excel in software industries.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein , Introduction to Algorithms, MIT Press, 3rd Edition, 2009
2.	Hochbaum “Approximation Algorithms for NP-Hard Problems”, 1996.
3.	Ahuja, Magnanti and Orlin, “Network Flows: Theory, Algorithms and Applications”, 1993.
4.	Horowitz and Sahni, Fundamentals of Computer Algorithms, Computer Science Press, 1978
5.	Study material on //fileserver2