Computer Engineering Department

First Year M. Tech Syllabus
(With effect from Academic Year 2024-25)

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Second Year M. Tech Syllabus
(With effect from Academic Year 2024-25)

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M Tech in Computer Engineering | FY M Tech Semester I

FY M Tech Semester I												
Course Code	**Course**	**Teaching Scheme**				**Evaluation Scheme**						
							Theory % Marks			**Practical % Marks**		
		L	**T**	**P**	**Cr**	**Exam**	**Max**	**Min for Pass**		**Max**	**Min for Pass**	
CME2409L01	Algorithm Analysis and Operation Research	3	1	0	4	CCA	50	40	40			
						ESE	50	40				
CME2409L02	Advanced Operating Systems	3	1	0	4	CCA	50	40	40			
						ESE	50	40				
CME2409L03	Artificial Intelligence and Machine Learning	3	1	0	4	CCA	50	40	40			
						ESE	50	40				
CME2409L4A	Data Processing and Information Retrieval	3	1	0	4	CCA	50	40	40			
CME2409L4B	Soft Computing					ESE	50	40				
CME2409L4C	Network Design											
CME2409L4D	Distributed Computing and Middleware Technologies											
CME2409P05	Laboratory Practice I	0	0	4	2	CCA				50	20	
						ESE				50	20	
CME2409L06	Research Methodology	3	0	0	3	CCA	50	20				
CME2409P07	Research Seminar	0	0	2	1	CCA				100	40	
CME2409L08	Non Credit Course 1	2	0	0	0	CCA	100	40		Pass/Fail		
	Total	**17**	**4**	**6**	**22**							
				Hrs								
L	Lecture	**Theory**		**21**								
T	Tutorial	**Pract/Lab**		**6**								
P	Practical	**Total**		**27**								
Cr	Credits											
NC	Non Credit Course (Pass/Fail)											
CCA	Continuous Comprehensive Assessment											
ESE	End Semester Examination											

M Tech in Computer Engineering | FY M Tech Semester II

FY M Tech Semester II											
Course Code	**Course**	**Teaching Scheme**				**Evaluation Scheme**					
		L	**T**	**P**	**Cr**	**Exam**	**Theory % Marks**			**Practical % Marks**	
							Max	**Min for Pass**		**Max**	**Min for Pass**
CME2410L01	Deep Learning and Applications	3	1	0	4	CCA	50	40	40		
						ESE	50	40			
CME2410L02	Social Media Analysis	3	1	0	4	CCA	50	40	40		
						ESE	50	40			
CME2410L03	Advanced Software Engineering	3	1	0	4	CCA	50	40	40		
						ESE	50	40			
CME2410L4A	Network and Cyber Security	3	1	0	4	CCA	50	40	40		
CME2410L4B	Computer Vision										
CME2410L4C	Natural Language Processing					ESE	50	40			
CME2410L4D	Security in IoT										
CME2410P05	Laboratory Practice II	0	0	4	2	CCA				50	20
						ESE				50	20
CME2410P06	Advanced Computing Skill Development	0	0	4	2	CCA	100	40			
CME2410P07	Industry Based Mini Project	0	0	4	2	CCA	100	40			
CME2410L08	Non Credit Course 2	2	0	0	0	CCA	100	40		Pass/Fail	
	Total	**14**	**4**	**12**	**22**						
				Hrs							
L	Lecture	**Theory**		**18**							
T	Tutorial	**Pract/Lab**		**12**							
P	Practical	**Total**		**30**							
Cr	Credits										
NC	Non Credit Course (Pass/Fail)										
CCA	Continuous Comprehensive Assessment										
ESE	End Semester Examination										

M Tech in Computer Engineering | SY M Tech Semester III

SY M Tech Semester III											
Course Code	**Cours**	**Teaching Scheme**				**Evaluation Scheme**					
		L	**T**	**P**	**Cr**	**Exam**	**Theory % Marks**			**Practical % Marks**	
							Max	**Min for Pass**		**Max**	**Min forPass**
CME2411P01	Dissertation Phase I (Synopsis)	0	0	8	4	CCA				100	40
CME2411P02	Dissertation Phase II	0	0	8	4	CCA				50	40
						ESE				50	
CME2411L03	Open Elective: Soft Computing	4	0	0	4	CCA	50	40	40		
						ESE	50	40			
CME2411L04	On Job Training/Internship	0	0	20	10	CCA				100	40
	Total	**4**	**0**	**36**	**22**						
				Hrs							
L	Lecture	**Theory**		**4**							
T	Tutorial	**Pract/Lab**		**36**							
P	Practical	**Total**		**40**							
Cr	Credits										
NC	Non Credit Course (Pass/Fail)										
CCA	Continuous Comprehensive Assessment										
ESE	End Semester Examination										
OJT	On the Job Training/Internship Between Semester II and III and Evaluated in Semester III										
	Open Elective										

M Tech in Computer Engineering | SY M Tech Semester IV

SY M Tech Semester IV										
Course Code	**Course**	**Teaching Scheme**				**Evaluation Scheme**				
							Theory % Marks		**Practical % Marks**	
		L	**T**	**P**	**Cr**	**Exam**	**Max**	**Min for Pass**	**Max**	**Min for Pass**
CME2412P01	Dissertation Phase III	0	0	20	10	CCA			100	40
CME2412P02	Dissertation Phase IV	0	0	24	12	CCA			50	40
						ESE			50	40
	Total	**0**	**0**	**44**	**22**					
				Hrs						
L	Lecture	**Theory**		**0**						
T	Tutorial	**Pract/Lab**		**44**						
P	Practical	**Total**		**44**						
Cr	Credits									
NC	Non Credit Course (Pass/Fail)									
CCA	Continuous Comprehensive Assessment									
MSE	Mid Semester Examination									
ESE	End Semester Examination									
				Hrs	**%**					
	Total Theory Hours			**39**	**28.46**					
	Total Pract/Lab Hours			**98**	**71.53**					
	Total Hours			**137**						
	Total Credits (Cr)			**88**						

M Tech in Computer Engineering | FY M Tech Semester I

Course Code: CME2409L01, Course Title: Algorithm Analysis and Operation Research

Category: Program Core Course

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max	Min marks for Pass		Max %	Min marks for Pass
3	1	0	4	CCA	50	20			
Total Hours				ESE	50	20	40	-	-
39	13	0	Total: 52			40			

Prerequisites: Course Code	
Course Objectives: Purposes of the course are	
• To understand Algorithm Analysis • To introduce students to use quantitative methods and techniques for effective analysis of decisions making • To understand the model formulation and applications that is used in solving business decision problems.	
Course Outcomes: After successful completion of the course units the student will be able to	
CO1	Apply the knowledge of advanced design and analysis techniques for the design and analysis of efficient algorithms
CO2	Apply knowledge to find solutions using multithreaded algorithms and matrix operations
CO3	Analysis of NP-Completeness and Approximation Algorithms to finding near-optimal solutions with polynomial time complexity
CO4	Analyse the characteristics of different types of decision-making environments to solve optimization problems and develop dynamic and adaptive models using game theory
CO5	Evaluate the OR techniques for the optimal distribution of goods or resources from multiple sources to multiple destinations.

Syllabus

Unit I	Advanced Design and Analysis Techniques	8 hrs
Introduction, Dynamic Programming: Rod cutting, Matrix-chain multiplication, Elements of dynamic programming; Greedy Algorithms: An activity-selection problem, Elements of the greedy strategy, Huffman codes; Amortized Analysis: Aggregate analysis, The accounting method, The potential method, Dynamic tables		
Unit II	**Multithreaded Algorithms and Matrix Operations**	**8 hrs**
Multithreaded Algorithms: The basics of dynamic multithreading, Multithreaded matrix multiplication, Multithreaded merge sort; Matrix Operations: Solving systems of linear equations, Inverting matrices, Symmetric positive-definite matrices and least-squares approximation		
Unit III	**NP-Completeness and Approximation Algorithms**	**7 hrs**
NP-Completeness: Polynomial time, Polynomial-time verification, NP-completeness and reducibility, NP-completeness proofs, NP-complete problems; Approximation Algorithms: The vertex-cover problem, The traveling-salesman problem, The set-covering problem, Randomization and linear programming, The subset-sum problem		
Unit IV	**Linear Programming, Duality in Linear Programming and Game Theory**	**8 hrs**
Introduction, Modeling with Linear Programming, Two variable LP model, Graphical LP solutions for both maximization and minimization models with various application examples,		

Duality theory: a fundamental insight. The essence of duality theory, Economic interpretation of duality, Primal dual relationship; Game Theory-Introduction, 2 person zero sum games, Maximi - Minimax principle, Principle of Dominance, Solution for mixed strategy problems, Graphical method for 2 x n and m x 2 games.

Unit V	**The Transportation Problem and Assignment Problem**	**8 hrs**

Finding an initial feasible solution - North West corner method, Least cost method, Vogel's Approximation method, Finding the optimal solution, optimal solution by stepping stone and MODI methods
Assignment Problem: Hungarian method of Assignment problem, Maximization in Assignment problem, unbalanced problem, problems with restrictions, travelling salesman problems.

Tutorials Topics:

1) Assignment on Amortized Analysis: A Dynamically Resized Table-Actual Cost per operation, Aggregate Analysis, Accounting Analysis, Potential Analysis
2) Solving linear equation with matrix.
3) Give NP-Complete proof for travelling salesman (TSP) problem.
4) i) List down the steps to solve the LPP with the help of a graphical method. Solve the following LPP by graphical method.

Max $Z = 100\ x1 + 40\ x2$

Subject to

$5\ x1 + 2\ x2 \leq 1000$
$3\ x1 + 2\ x2 \leq 900$
$x1 + 2\ x2 \leq 500$
$x1, x2 \geq 0$

ii) List down the steps to solve game theory problem using arithmetic method. Find Solution of game theory problem using arithmetic method

Player A\Player B	B1	B2	B3
A1	10	5	-2
A2	13	12	15
A3	16	14	10

5) Discuss Hungarian Method of Solving an Assignment Problem with example.

Text Books

1. Thomas H Cormen, Charles E LeiseArson, Ronald Rivest, Cliffor Stein., Introduction to algorithms, 3rd edition, MIT Press, ISBN 978-0-262-03384-8.
2. Prem Kumar Gupta, D. S. Hira, Operations Research, S. Chand Publishers, New Delhi, 2004, ISBN: 978-81-219-0281-6

Reference Books

1.Horowitz and Sahani, "Fundamentals of Computer Algorithms", University Press, ISBN: 978 81 7371 6126, 81 7371 61262
2. Hamdy A. Taha "Operations Research" Pearson Education, 8th Edition, ISBN: 978-81-317-1104-0

e-Resourses

MOOC Course link :

a. https://onlinecourses.nptel.ac.in/noc20_cs10/preview ,
b. https://onlinecourses.nptel.ac.in/noc22_ma48/preview

Rubrics for Continuous Evaluation

Component	**Level**	**Unit 1**	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**	**Total**	**Process Evaluation**
Continuous Comprehensive Assessment (CCA)	Faculty	10	10	10	10	10	50	Refer CCA Guideline
End Semester Examination (ESE)	Institute	10	10	10	10	10	50	Each Unit Carries 10 marks Question

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	2	2	2
CO2	3	2	2	2	2	2
CO3	3	2	2	2	2	2
CO4	3	2	2	1	2	2
CO5	3	2	2	1	2	2

3: High, 2: Moderate, 1: Low, -: No Mapping,

M Tech in Computer Engineering | FY M Tech Semester I

Course Code: CME2409L02Course Title: Advanced Operating SystemCategory:

Program Core Course

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max	Min marks for Pass		Max %	Min marks for Pass
3	1	0	4	CCA	50	20	40	-	-
39	13	0	Total: 52	ESE	50	20			

Prerequisites: Operating System	
Course Objectives:	
• To understand concept of advanced operating system like Unix and its structure • To learn the concept of Process, Thread, Memory and file management • To understand Distributed Operating System Fundamentals • To acquaint with the concept of message passing • To become aware of Recourse Management concept	
Course Outcomes: After successful completion of the course the student will be able to	
CO1	Recognize and classify advanced operating systems
CO2	Classify and exemplify Process and Memory Management
CO3	Apply distributed Computing system fundamentals to develop applications
CO4	Design Advanced OS based Applications
CO5	Apply obtained knowledge from case studies on real life applications

Syllabus

Unit I	**Introduction:** Introduction to Advanced Operating system – Structure, processes, address spaces and threads, loading programs into processes, files, Architecture of UNIX Operating System, Concepts of Linux Programming- Files and the File system, Processes, Users and Groups, Permissions, Signals, Inter process Communication, low-level kernel, storage management	**7hrs**
Unit II	**Process Management and Memory Management**: Multithreaded Programming-Programming with threads, synchronization, thread safety. Thread implementations-strategies, simple thread implementations, Scheduling Strategy, Tactics Hardware support for virtual memory – forward mapped page tables, hashed page tables	**7hrs**
Unit III	**File Systems**: Basics of File systems, Crash resiliency, Directories and naming, multiple disks, Flash memory, File-Sharing Semantics, File-Caching schemes, File Replication, Fault Tolerance, Automatic Transactions, Design Principles, Case studies: NTFS, WAFL, NFS, CIFS.	**7hrs**
Unit IV	**Distributed Computing systems fundamentals** Introduction to Distributed computing systems, Models, Popularity, Design issues of Distributed operating system, Distributed Shared Memory, General Architecture of DSM systems. Deadlock detection algorithm, distributed file servers. **Study of sample advanced OS** like Chorus, Mach, Amoeba and OSF distributed Environment, Solaris. Case Study: LLM-OS	**9hrs**
Unit V	**Message Passing and Resource Management** Features of a good Message Passing System. Issues in IPC by Message Passing Synchronization, Buffering, Multi-datagram Messages, Encoding and Decoding of Message Data, Process Addressing, Failure handling Features of global scheduling algorithm, Task assignment approach, Load-Balancing and Load approach	**9hrs**

Tutorials: -	
1.Demonstrate functioning of forward mapped Page Table	**2hrs**
2.Differentiate between NTFS, NFS and CIFS file systems	**2hrs**
3. Discuss various Deadlock Detection Algorithms in Distributed System	**2hrs**
4.Discuss various features of Global scheduling algorithm	**2hrs**
5. Mini Project on creation of Logging system and system backup for OS	**5hrs**

Text Books

1. Mukesh Singhal and N. G. Shivaratri, "Advanced Concepts in Operating Systems", McGraw-Hill 1st July 2017
2.A.S. Tanenbaum, "Modern Operating Systems", 5th edition, PHI.

Reference Books

1. Thomas W. Doeppner, "Operating Systems in Depth', Wiley India edition.
2. P.K. Sinha, "Distributed Operating Systems concepts and design", PHI
3.HagitAttiya, Jennifer Welch. Distributed Computing: Fundamentals, Simulations, and Advanced Topics
4. G. Coulouris, J. Dollimore, T. Kindberg, "Distributed Systems concepts and design", 5th edition, 2011 Addison Wesley
5.Linux System Programming Robert Love O'Reilly
6.The Design of the UNIX Operating System Maurice J. Bach. PHI
7.SukumarGhosh, Distributed Systems: An Algorithmic Approach, Second Edition

E-contents:

1. https://nptel.ac.in/courses/106106107
2. https://nptel.ac.in/courses/106105172

Datasets:

1. https://www.kaggle.com/datasets/kartikbhatnagar18/operating-systems-in-use-20092021-time-series
2. https://github.com/topics/malware-dataset

Rubrics for Continuous Evaluation

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Process Evaluation
Continuous Comprehensive Assessment (CCA)	Faculty	10	10	10	10	10	50	Refer CCA Guideline
End Semester Examination (ESE)	Institute	10	10	10	10	10	50	Each Unit Carries 10 marks Question

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	2	3
CO2	3	3	3	1	3	3
CO3	3	3	3	1	3	3
CO4	3	3	3	1	3	3
CO5	3	2	2	1	3	3
CO6	3	3	2	2	3	3

3: High, 2: Moderate, 1: Low, -: No Mapping, *Average should not be zero*

M Tech in Computer Engineering | FY M Tech Semester I

Course Code: CME2409L03, Course Title: Artificial Intelligence and Machine Learning

Category: Program Core Course

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max	Min marks for Pass		Max %	Min marks for Pass
3	1	0	4	CCA	50	20			
Total Hours				ESE	50	20	40	-	-
39	13	0	Total: 52			40			

Prerequisites: Data Structures and Algorithms

Course Objectives: Purposes of the course are

- To give a deep insight of Machine Learning and AI
- To demonstrate ML and AI tools to develop various ML and AI applications
- To explain learning theory and various case studies of Machine learning
- To Apprise the concepts of game playing and intelligent agents in AI
- To explain ML and AI applications and recent advancements

Course Outcomes: After successful completion of the course units the student will be able to

CO1	Understand and relate basic concepts of Artificial Learning
CO2	Evaluate the performance of application using Game playing and intelligent agent
CO3	Choose appropriate AI tool as per the requirement of an application
CO4	Compare between various machine learning algorithms and models and experiment with various case studies of Machine Learning
CO5	Relate and apply learning theory in machine learning applications

Syllabus

Unit I	Introduction to Artificial Intelligence	8 Hrs

Introduction to Artificial Intelligence, Future of AI, Brief Discussion of Major Topics (Expert System, Natural Language Processing, Speech and Pattern Recognition etc.) of AI. Problem definition as a State Space Search, Production System, Control Strategies, Problem Characteristics.

Unit II	Game playing and Intelligent agents	8 Hrs

Game playing, Knowledge representation, Knowledge representation using Predicate logic, Introduction to predicate calculus, Resolution, Use of predicate calculus, Knowledge representation using other logic- Structured representation of knowledge

Architecture for Intelligent Agents, Agent communication, Negotiation and Bargaining, Argumentation among Agents, Trust and Reputation in Multi-agent systems.

Unit III	**AI applications and tools**	**7 Hrs**
Language Models, Information Retrieval and Extraction, Natural Language Processing, Machine Translation, Speech Recognition, Robot: Hardware, Perception, Planning, Moving, Tools used for AI.		
Unit IV	**Introduction to Machine Learning and Case Studies on Advanced Machine Learning Techniques**	**9 Hrs**
What is AI, ML and Deep Learning? Types of learning: Supervised, Unsupervised and semi-supervised, reinforcement learning techniques, Models of Machine learning: Geometric model, Probabilistic Models, Logical Models, Grouping and grading models, Parametric and non-parametric models Case studies: Profiling the online storefronts of counterfeit merchandise, detecting malicious websites in adversarial classification, Credit card fraud detection, Topic models of the underground Internet economy, learning to rate vulnerabilities and predict exploits		
Unit V	**Learning Theory**	**7 Hrs**
1) Features: Feature Extraction, Feature Construction and Transformation, Feature Selection, Dimensionality Reduction: Subset selection, the Curse of dimensionality, Principle Components analysis, Factor analysis, Multidimensional scaling, Linear discriminant analysis, Bias/Variance tradeoff, Union and chernoff/Hoeffding bounds, VC dimension, Probably Approximately Correct (PAC) learning, Concept learning, the hypothesis space, Least general generalization, Internal disjunction, Paths through the hypothesis space, model Evaluation 2) and selection		
3) Tutorial: 4) Case study on Media Manipulation & Disinformation 2 hrs 5) Case study on multi-agent frameworks and their comparison 2 hrs 6) Study of Narrow AI 2 hrs 7) Explore practical applications of Machine learning in daily life 2 hrs 8) Mini Project: students should implement any one Mini project from the problem statements given below 9) 5 hrs 10) Chatbot for Customer Service 11) Object Detection with TensorFlow 12) Fraud Detection System 13) Signature Verification System Using CNN		
TEXT BOOKS: 1. Ethem Alpaydin, "Introduction to Machine Learning", 4th Edition, The MIT Press. 2. Yegnanarayana B, Artificial Neural Networks, Prentice-HallIndia Pvt.Ltd		
REFERENCE BOOKS: 1. Tom M. Mitchell, "Machine Learning", 1 st Edition, Tata McGraw-Hill Education. 2. Mevin P. Murphy, "Machine Learning: A Probabilistic Perspective",The MIT Press. 3. S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, 3rd edition, Pearson Education, 2015. 4. Richard E. Neapolitan, Xia Jiang, Artificial Intelligence - With an Introduction to Machine Learning, Chapman & Hall CRC, 2018. 5. M. Tim Jones, ―Artificial Intelligence: A Systems Approach (Computer Science)‖, Jones and Bartlett Publishers, Inc., First Edition, 2008.		
E-contents: **MOOCs courses link:** 1. https://onlinecourses.nptel.ac.in/noc22_cs56/preview 2. https://onlinecourses.nptel.ac.in/noc23_cs18/preview 3. https://nptel.ac.in/courses/106105077		

Rubrics for Continuous Evaluation

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Process Evaluation
Continuous Comprehensive Assessment (CCA)	Faculty	10	10	10	10	10	50	Refer CCA Guideline
End Semester Examination (ESE)	Institute	10	10	10	10	10	50	Each Unit Carries 10 marks Question

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	1	1	3	1	1
CO2	1	1	2	3	1	1
CO3	1	1	2	3	1	1
CO4	1	1	1	3	1	1
CO5	1	1	2	3	1	1

M Tech in Computer Engineering | FY M Tech Semester I

Course Code: CME2409L4A **Course Title: Data Processing and Information Retrieval**

Category: Program Elective Course

Teaching Scheme				Evaluation Scheme					
					Theory Marks			Practical Marks	
L	T	P	Cr	Exam	Max	Min marks for Pass		Max %	Min marks for Pass
3	1	0	4	CCA	50	20	40	-	-
39	13	0	Total: 52	ESE	50	20			

Prerequisites: Database Management Systems	
Course Objectives: Purposes of the courses are • To study the concept of Data Warehouse and big data • To study concepts of pattern-based data mining for decision making. • To explore concept of text mining, web mining • To understand classification and clustering methods • To provide an insights of Information Retrieval concepts.	
Course Outcomes: After successful completion of the course the student will be able to	
CO1	Design on Data Warehouse, **Implement** OLAP operations using any tool
CO2	**Design** Big Data Model and Implement classification to provide analytical view for any real-life application like traffic system, education sector, health sector etc.
CO3	**Implement** advanced data mining and clustering algorithms and **compare** their performance.
CO4	**Apply** web mining techniques for effective retrieval of data and **evaluate** on standard performance measures
CO5	**Design and Develop** solutions using information retrieval techniques for recommendation systems, Sentiment Analysis, Question Answering Systems etc.

Syllabus

Unit I	**Data Warehouse Basics**	**8 hrs**
Data Warehouse Concept, Data Warehousing architecture, Data Warehouse Models, Data Warehouse Modeling: Data Cube and OLAP- Data Cubes, Schemas, OLAP Operations in the Multidimensional Data Model, Typical OLAP Operations, A Starnet Query Model, A Business Analysis Framework for Data Warehouse Design, Data Warehouse Design Process, Data Lakes		
Unit II	**Data Warehouse, Classification and Big Data**	**8 hrs**
Data Warehouse Usage for Information Processing, From Online Analytical Processing to Multidimensional Data Mining, Efficient Data Cube Computation, Multi-dimensional data handling, retrieval using Tool. Classification, Bayesian Belief Networks, Classification by Backpropagation, SVM, Classification Using Frequent Patterns, Other Classification Methods Big data overview, state of the practice in Analytics- BI Vs Data Science, Current Analytical Architecture, drivers of Big Data, Emerging Big Data Ecosystem, Data Analytic Life Cycle,		

Unit III	Data Mining and Clustering	8 hrs

Data Mining concept, Data: Data, Information and Knowledge; Attribute Types: Nominal, Binary, Ordinal and Numeric attributes, Discrete versus Continuous Attributes, Data Pre-processing, data cleaning, data integration, data reduction, data transformation and Data Discretization, Pattern Mining
Clustering, Probabilistic Model-Based Clustering, Clustering High-Dimensional Data, clustering graph and network data, clustering with constrains, Outlier Analysis, Performance Metrics – Accuracy, Precision, Recall, Sensitivity, Specificity, F1-Score, Cross validation

Unit IV	Web Mining	8 hrs

Text mining: Text Data Analysis and Information Retrieval, Dimensionality Reduction for Text, Feature vector, Bag of words, TF-IDF, Text Mining Approaches, Web mining, web search basics, web crawling and indexes, Search engines, Semantic web mining, Algorithm on mining

Unit V	Information Retrieval	7 hrs

Boolean retrieval, Dictionary and Tolerant retrieval, Index Construction, Types of Indexing, Index compression, Statistical properties of terms in information retrieval: Heaps' law, Zipf's law, Dictionary compression, advances in IR

Tutorial:

1. Consider multi-dimensional data for any domain, create different schema for the same
2. Implement classification with SVM/Backpropagation for dataset applicable any real-life problem. Download dataset from Kaggle or similar platform
3. Implement clustering algorithm for any real-life problem. Use suitable tool for implementation. Download dataset from Kaggle or similar platform
4. Implement any one recent algorithm in IR domain.
5. Evaluate on standard performance parameters in the area for the algorithm implemented in tutorial- 4.

Text Books:

1. Han, Jiawei Kamber, Micheline Pei and Jian, “Data Mining: Concepts and Techniques”, 3rd edition, 2012, Elsevier Publishers, ISBN:9780123814791, 9780123814807.
2. C. Manning, P. Raghavan, and H. Schütze, “Introduction to Information Retrieval”, Cambridge University Press, 2009, -13: 9780521865715

Reference Books:

1. G. K. Gupta , “Introduction to Data mining with case studies", PHI, 3rd edition, 2014,
2. Matthew A. Russell, "Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Google+, GitHub, and More" , Shroff Publishers, 2nd Edition, ISBN: 9780596006068
3. Bing Liu, “Web Data Mining-Exploring Hyperlinks, Contents, and Usage Data”, 2nd edition, 2011, ISBN 978-3-642-19459-7

e-Contents :

1. https://nlp.stanford.edu/IR-book/information-retrieval-book.html
2. NPTEL Course Big Data Computing https://archive.nptel.ac.in/courses/106/104/106104189/
3. NPTEL course on Data Mining https://onlinecourses.nptel.ac.in/noc21_cs06/preview

Rubrics for Continuous Evaluation

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Process Evaluation
Continuous Comprehensive Assessment (CCA)	Faculty	10	10	10	10	10	50	Refer CCA Guideline
End Semester Examination (ESE)	Institute	10	10	10	10	10	50	Each Unit Carries 10 marks Question

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	3	3	3
CO2	3	2	3	3	3	3
CO3	3	2	3	3	3	3
CO4	3	2	3	3	3	3
CO5	2	2	3	3	3	3

3: High, 2: Moderate, 1: Low, 0: No Mapping

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M Tech in Computer Engineering | FY M Tech Semester I

Course Code: CME2409L4B Course Title: Soft Computing

Category: Program Elective Course

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max	Min marks for Pass		Max %	Min marks for Pass
3	1	0	4	CCA	50	20	40	-	-
Total Hours				ESE	50	20			
39	13	0	Total: 52			40			

Prerequisites: Machine learning

Course Objectives: Purposes of the courses are

- To understand the soft computing techniques and algorithms for problem solving
- To be familiar with the various application areas of soft computing
- To develop intelligent systems using the hybrid systems
- To explore and solve problems using genetic Algorithms
- To learn various Bio Inspired optimization Algorithm

Course Outcomes: After successful completion of the course units the student will

CO1: **Compare** soft and hard computing techniques to identify suitable computing techniqueto solve the problem.
CO2: **Implement** fuzzy algorithms for various operations in different domain such ase-Commerce, automotive, home appliances, Structural analysis and Design etc.
CO3: D**esign** Artificial Neural Network for implementation of the solution to real lifeProblems.
CO4: **Apply** Genetic Algorithm to provide effective solutions with optimization for theproblem
CO5: **Create** system with nature-inspired algorithms to provide optimal solution

Syllabus

Unit I	Introduction To Soft Computing	8 hrs
Introduction, historical Development of Soft Computing, characteristics of Soft Computing, Soft Computing Vs Hard Computing, major Areas of Soft Computing, Basic tools of Soft Computing, Applications of Soft Computing.		
Unit II	**Fuzzy Logic and Sets**	**10 hrs**
Introduction to Fuzzy Logic, Fuzzy Membership Functions, Fuzzy Sets and Operations, Properties ofFuzzy Sets, Fuzzy Relations, Fuzzy Propositions, Fuzzy Implications, Fuzzy Inferences, Fuzzy If-		

Then Rule, Fuzzy Algorithms, Fuzzification and Defuzzification, fuzzy computing problems. Fuzzy Logic Controller, Fuzzy rule base and approximate reasoning: truth values and tables in fuzzy logic, fuzzy rule-based system, Fuzzy Decision Making, Fuzzy expert system, case study on fuzzy reasoning.		
Unit III	**Neural Networks**	**7 hrs**
Neural Network Basics, Perceptron, Types of Activation Functions, Architecture of Neural Network, Unsupervised Learning Networks, Neuro-Fuzzy System, case study on neural network for the application		
Unit IV	**Genetic Algorithm**	**7 hrs**
An Introduction to Genetic Algorithms, Genetic Algorithm and Search Space, Operators in Generic Algorithm, Classification of Genetic Algorithm, Holland Classifier System, case study on genetic algorithm.		
Unit V	**Bio-Inspired Optimization Algorithms**	**7 hrs**
Biological Motivation, from natural to artificial, Swarm Intelligence, standard algorithm of AntColony Optimization, Particle Swarm Optimization, cuckoo search algorithm, bat algorithm		

Tutorial:

1. Design fuzzy sets and its basic operations	**2 hrs**
2. Create application using Neural Network	**2hrs**
3. Provide solution for real life problem using Genetic Algorithm	**2 hrs**
4. Create optimization-based application for any domain	**2 hrs**
5. Mini Project – Hybrid system with optimization	**5 hrs**

Text Books :

1. S.N. Sivanandam- “Principles of Soft Computing”, Wiley India- ISBN- 9788126527410
2. Timothy J. Ross, “Fuzzy Logic with Engineering Applications”, Wiley India, ISBN: 978-0- 470-74376-8

Reference Books :

1. Introduction to Artificial Neural Systems - J.M. Zurada, Jaico Publications 1994.
2. Fuzzy Social Choice Theory - Michael B. Gibilisco. Annie M. Gowen Karen E. Albert John N. Mordeson Mark J. Wierman. Terry D. Clark.
3. Russell C. Eberhart , Yuhui Shi , James Kennedy, “ Swarm Intelligence: The Morgan KaufmannSeries in Evolutionary Computation”, 1st Edition, ISBN-13: 978-1558605954

e-Contents :

1. NPTEL Course on Introduction to Soft Computing https://archive.nptel.ac.in/courses/106/105/106105173/
2. NPTEL Course on Introduction to Artificial Neural Networks
3. https://nptel.ac.in/courses/117105084
4. Swayam course on Evolutionary Computation for Single and Multi-Objective Optimization
5. https://onlinecourses.nptel.ac.in/noc21_me43/preview

Rubrics for Continuous Evaluation

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Process Evaluation
Continuous Comprehensive Assessment (CCA)	Faculty	10	10	10	10	10	50	Refer CCA Guideline
End Semester Examination (ESE)	Institute	10	10	10	10	10	50	Each Unit Carries 10 marks Question

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	1	2	2	2
CO2	2	2	2	3	2	3
CO3	3	3	3	3	3	3
CO4	3	2	2	3	3	3
CO5	2	3	2	3	3	3

3: High, 2: Moderate, 1: Low, 0: No Mapping

M Tech in Computer Engineering | FY M Tech Semester I

Course Code: CME2409L4C Course Title: Network Design

Category: Program Core Course

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max	Min marks for Pass		Max %	Min marks for Pass
3	1	0	4	CCA	50	20	40	-	-
Total Hours				ESE	50	20			
39	13	0	Total: 52			40			

Prerequisites: Computer Networks	
Course Description:	
• To develop a comprehensive understanding of advances in computer Networks • To study design issues in networks. • To learn estimation of networking requirements. • To learn Enterprise level network design. • To understand various issues indexing the performance of the network.	
Course Outcomes: After successful completion of the course the student will be able to	
CO1	Apply the knowledge to design computer networks
CO2	Analyze the performance of networks based on chosen metrics
CO3	Design routing schemes for optimized routing in networks
CO4	Illustrate appropriate and advanced techniques to build the computer network
CO5	To implement Quality of Service in next generation networks

Syllabus		
Unit I	**INTRODUCTION:** Overview of network analysis and design process, Network design issues, requirement analysis (user, application, device, network), Routing and forwarding, Routing algorithms, resource allocation, general principles of network design, network characteristics, performance metric in computer networks	**7hrs**
Unit II	**Physical and Logical network design**: Network Topologies, Physical addressing, switching, IP packet format, IP routing method, routing using masks, fragmentation of IP packet, IPv6 vs IPv4, advanced features of IP routers: filtering, IP QoS, NAT, routers	**7hrs**
Unit III	**Queuing Theory** Delay Models in Data Networks, Queuing Models- Little's Theorem, Application of Little's Theorem, and Queuing Systems: M/M/1, M/M/2, M/M/m, M/M/∞, M/M/m/m, M/M/m/q, M/M/1/N, D/D/1, M/G/1 System, M/G/1 Queues with Vacations, Priority Queuing.	**7hrs**
,		
Unit IV	**Modeling Network as Graph** Graph terminology, representation of networks, fundamental graph algorithms, shortest path, link prediction algorithms-Dijkstra's, Bellman's, Floyd's, Incremental shortest path algorithm. **Introduction to Network Testing tool wireshark** Network Testing,What is Wireshark, use cases of wireshark,feature of wireshark	**9hrs**
Unit V	**Methods of Ensuring Quality of Service** Introduction, applications and QoS, QoS mechanisms, Queue management algorithms, feedback, resource reservation, traffic engineering, IP QoS Next generation networks, cyber physical systems, smart mobiles, cards and device networks, smart devices and services **Real-time Experimentation using Wireshark** Capture HTTP Password using wireshark, capture files from HTTP Traffic using Wireshark	**9hrs**
Tutorials:-		
1.Demonstrate with example IP Routing Method and how to use masking for routing		**2hrs**
2.Describe functioning of Dijkstra's algorithm		**2hrs**
3.Descibe Queue management algorithm for implementing QoS		**2hrs**
4. Capture HTTP Password using wireshark		**2hrs**
5.Mini Project on Packet Tracing,IP Spoofing using Wireshark		**5hrs**

Text Books

1. Aaron Kershenbaum, "Telecommunications Network Design Algorithm", McGraw Hill education (India), Edition 2014, ISBN-10: 0070342288
2. James MCCAbe, "N/W analysis, Architecture and Design", Elsevier, 978-0-12-370480-1

Reference Books

1. Pablo Pavon Marino, "Optimization of Computer Networks : Modeling and algorithms – A hands on approach", Wiley Publication, ISBN: 9781119013358
2. Olifer, Victor Olifer, "Computer Networks, Principles, Technologies and Protocols for network design", Wiley India, ISBN: 13: 9788126509171.
3. Wireshark Network Analysis (Second Edition): The Official Wireshark Certified Network Analyst Study Guide 2nd Edition, Kindle Edition by Laura Chappell (Author), Gerald Combs (Foreword) Format: Kindle Edition
4. Practical Packet Analysis by Chris Sanders is a good overview for Wireshark

E-contents :

1. https://nptel.ac.in/courses/108105159
2. https://nptel.ac.in/courses/123105004

Datasets :

1. https://github.com/BNN-UPC/NetworkModelingDatasets
2. https://www.kaggle.com/datasets/ravikumargattu/network-traffic-dataset
3. https://www.kaggle.com/datasets/prmukesh/wireshark-dataset

Rubrics for Continuous Evaluation

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Process Evaluation
Continuous Comprehensive Assessment (CCA)	Faculty	10	10	10	10	10	50	Refer CCA Guideline
End Semester Examination (ESE)	Institute	10	10	10	10	10	50	Each Unit Carries 10 marks Question

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	3	3	3
CO2	3	3	2	1	3	3
CO3	3	3	2	1	3	3
CO4	3	3	3	1	3	3
CO5	3	3	3	1	3	3

3: High, 2: Moderate, 1: Low, -: No Mapping, *Average should not be zero*

M Tech in Computer Engineering | FY M Tech Semester I

Course Code: CME2409L4D Course Title: Distributed Computing and Middleware Technologies

Category: Program Elective Course

Teaching Scheme				Evaluation Scheme					
					Theory Marks			Practical Marks	
L	T	P	Cr	Exam	Max	Min marks for Pass		Max %	Min marks for Pass
3	1	0	4	CCA	50	20			
Total Hours				ESE	50	20	40	-	-
39	13	0	Total: 52			40			

Prerequisites: Operating System	
Course Objectives: Purposes of the course are ➢ To understand the basic concepts of Distributed System and Message Passing. ➢ To compare different Deadlock detection algorithms in DC ➢ To analyze middleware technologies. ➢ To study various middleware designs and patterns.	
Course Outcomes: After successful completion of the course the student will be able to	
CO1	**Apply** fundamental concepts of Distributed Systems and Message passing.
CO2	**Design** the solutions for Synchronization Problems in Distributed computing applications
CO3	**Apply** mutual exclusion and deadlock detection algorithms for large scale distributed applications
CO4	**Implement** distributed application using web services
CO5	**Use and Analyze** Enterprise and Open Telecom Platform (OTP)Middleware for application development

Syllabus

Unit I	**Introduction**	**8 Hrs**
Introduction: Evolution of Distributed Computing Systems, Characterization of Distributed Systems: Issues, Goals, and Types of distributed systems, Distributed System Models, Hardware concepts, Software Concept, Middleware and Distributed System, Middleware organization **Message Passing and Communication** Inter process Communication, Layered Protocols, Inter-process communication (IPC): MPI, Remote Procedure Call (RPC), Remote Object Invocation, Remote Method Invocation (RMI) Message Oriented Communication, Stream Oriented Communication, Group Communication		
Unit II	**Synchronization and Mutual Exclusion**	**8 Hrs**
Synchronization: Clock Synchronization, Logical Clocks, Election Algorithms, **Mutual Exclusion**, Distributed Mutual Exclusion-Classification of mutual Exclusion Algorithm, Requirements of Mutual Exclusion Algorithms, Performance measure, Assertion based Algorithms Lamport's algorithm, Token based Algorithms- Suzuki-Kasami's broadcast based algorithm		
Unit III	**Deadlocks and Distributed Database**	**8Hrs**
Deadlocks: Models of distributed deadlock, Chandy-Misra-Haas deadlock detection for AND model, Chandy-Misra-Haas		

deadlock detection for OR model, Deadlock resolution **Distributed Database:** Concept , Architecture		
Unit IV	**Enterprise Middleware and Open Telecom Platform (OTP) Middleware**	**8 Hrs**
Enterprise Middleware: Concept, EAI, Enterprise Bus (e.g. TIBCO) and Publish-Subscribe Models, Real-time requirements, Security aspects, Business Processes and Middleware Implementations, Message-Oriented Middleware in loosely-coupled systems. **OTP founding ideas**: Basic concepts of the Erlang language, Programming abstractions of the Erlang/OTP platform. server Behaviour and callbacks. The gen_server Behaviour. Erlang Term Storage (ETS) and Disk-based ETS (DETS)		
Unit V	**Web Services**	**7 Hrs**
Web Services: rationale and interoperability. SOAP Web Services: XML messaging, WSDL, general architecture. RESTful Web Services: resource-based approach, JAX-RS APIs. JSON. Service Oriented Architecture. Multi-tier structuring of web applications. Dynamic web content generation		

Tutorial:

1. List various distributed message passing mechanisms and Create a distributed name server (like DNS) RMI.
2. Elaborate the step by step approach to Develop a middleware component for retrieving Stock Market Exchange information.
3. Create a simple web service and write any distributed application to consume the web service
4. Discuss various algorithms used for Clock synchronization in Distributed System
5. Brief about the future trends in Enterprise Application Integration.
   and discuss key strategies in success for any Enterprise Application Integration.

Text Books:

1. Tanenbaum A.S. Maarten V.S.: Distributed Systems Principles and Paradigms, (Pearson Prentice Hall,2007)
2. Cesarini, F., Vinoski, S. (2016). Designing for Scalability with Erlang/OTP: Implementing Robust, Fault-tolerant Systems. Japan: O'Reilly Media, Inc ,2016

Reference Books:

1.Distributed OS by Pradeep K. Sinha (PHI),1998
2.Ajay D. Kshemkalyani, and Mukesh Singhal "Distributed Computing: Principles, Algorithms, and Systems", Cambridge University Press, 2008 (Reprint 2013).
3.Principles of Distributed Database Systems, Ozsu, Pearson Publication,2007.'

NPTEL Links:

https://onlinecourses.nptel.ac.in/noc21_cs87/preview

Rubrics for Continuous Evaluation

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Process Evaluation
Continuous Comprehensive Assessment (CCA)	Faculty	10	10	10	10	10	50	Refer CCA Guideline
End Semester Examination (ESE)	Institute	10	10	10	10	10	50	Each Unit Carries 10 marks Question

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	1	3	2	2
CO2	3	2	2	3	2	2
CO3	3	2	2	3	2	2
CO4	3	2	1	3	2	2
CO5	3	2	2	3	2	2

3: High, 2: Moderate, 1: Low, 0-: No Mapping

M Tech in Computer Engineering | FY M Tech Semester I

Course Code: CME2409P05 **Course Title: Laboratory Practice – I**

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory % Marks			Practical % Marks	
					Max	Min for Pass		Max	Min for Pass
0	0	4	2	CCA	50	20	40	-	-
				ESE	50				
Total Hours									
0	0	52	Total: 52						

Prerequisites: Algorithms, DBMS, Machine Learning, Computer Networks

Course Objectives:

1. To implement multi-threaded algorithms and perform analysis of the algorithm.
2. To apply Operations research knowledge for problem solving.
3. A-1 To create data warehouse for system and use data mining algorithmsB-1 To learn and apply Soft Computing Techniques to create
   C-1 To Provide insight of network testing using wireshark tool
   D-1 To implement mutual exclusion in distributed computing applications
4. A-2 To provide an insights of Information Retrieval concepts
   B-2 To apply Fuzzy, Neural Network, Genetic algorithm for creating hybrid system
   C-2 To Trace the functionality of network under different scenarios like IP spoofing, PacketTracing etc
   D-2 To apply deadlock detection algorithm in distributed environment

Course Outcomes: After successful completion of the course the student will be able to

Course Type	CO	Course Outcome
PCC1	CO1	Implement multi-threaded matrix Multiplication algorithm and perform its analysis.
	CO2	Apply the knowledge of operations research to solve transformation.
	CO3	Apply the knowledge of operations research to solve game theory problems.
PEC 1 A	CO4	Create data warehouse for application and perform OLAP operations
	CO5	Implement clustering/classification algorithm for analyzing data
	CO6	Apply advanced algorithms of Information Retrieval for any software system
PEC 1 B	CO4	Use fuzzy logic in computation and implement various operations with fuzzy concept.
	CO5	Create a small hybrid system with optimization algorithm for any real-life problems.
	CO6	Create solution for real life problems using nature inspired optimization algorithms.

PEC 1 C	CO4	Demonstrate implementation of Link state algorithm
	CO5	Demonstrate functioning of Network using Testing tools
	CO6	Apply network testing tools to judge the performance of the network
PEC 1 D	CO4	Apply Mutual exclusion to implement token-based algorithm
	CO5	CO5 Solve the Distributed deadlock detection problem
	CO6	CO6 Create distributed application using web services

Syllabus

	Introduction	**6 hrs**
Laboratory Proficiency I (LP I) is companion course of theory courses (core and elective) in Semester I. It is recommended that given assignments of each course should be completed by the student. Course/ Laboratory instructor may modify the domain of mini project as per choice of students keeping similar complexity of work. Student has to submit a report/Journal in standard format approved by the Program Coordinator.		
	Guidelines for CCA	**7 hrs**
Continuous assessment of laboratory work is done based on performance of student. Each assignment/ mini project assessment is to be done based on parameters with appropriateweightages as defined by the program coordinator.		
	Guidelines for ESE	**6 hrs**
It is recommended that examination should be conducted as presentation by student based on one ofthe mini projects completed and the content understanding of laboratory work.		
	Suggested List of Assignments	
PCC1: Algorithms Analysis and Operation Research		

Assignment 1

Implement the multi-threaded matrix multiplication.

Compare the three implementations according to the following:

i. Number of threads created
ii. Execution time taken

Assignment 2

The Transportation Problem:

1) Obtain an initial basic feasible solution to the following transportation problem:

	D1	D2	D3	Supply
O1	9	8	5	25
O2	6	8	4	35
O3	7	6	9	40
Demand	30	25	45	

2) Milk in a milk shed area is collected on three routes A, B and C. There are four chilling centers P, Q, R and S where milk is kept before transporting it to a milk plant. Each route is able to supply on an average one thousand liters of milk per day. The supply of milk onroutes A, B and C are 150, 160 and 90 thousand liters respectively. Daily capacity in thousand liters of chilling centers is 140, 120, 90 and 50 respectively. The cost of transporting 1000 liters of milk from each route (source) to each chilling center (destination) differs according to the distance. These costs (in Rs.) are shown in the

following table:

Routes	Chilling Centers			
	P	Q	R	S
A	16	18	21	12
B	17	19	14	13
C	32	11	15	10

The problem is to determine how many thousand liters of milk is to be transported from each route on daily basis in order to minimize the total costof transportation.

Assignment 3

Game Theory: Solve the following pay-off matrix using Game Theory

		Player B				
	Strategies	I	II	III	IV	V
Player A	I	9	3	1	8	0
	II	6	5	4	6	7
	III	2	4	3	3	8
	IV	5	6	2	2	1

PEC 1 A: Data Processing and Information Retrieval

Assignment 1

Create any one of the following systems and create data warehouse. Perform various OLAP operations

a. Health care
b. Movie success prediction system
c. Speech emotion detection system
d. Signature verification system

Assignment 2

Implement any one clustering algorithm and any one classification algorithmon any standard dataset. Dataset available at Kaggle, KDD, data.gov, can be used

Assignment 3

Design and develop text-based IR System using Boolean, vector space or probabilistic method of IR

PEC 1 B: Soft Computing

Assignment 1

Implement various operations on fuzzy sets. Create fuzzy relation by Cartesian product of any two fuzzy sets and perform max-min composition on any two fuzzy relations.

Assignment 2

Create a small hybrid system for any of the below problems.

1. Stock market prediction
2. Object detection system
3. Face recognition system

Assignment 3

Create a small hybrid system with optimization algorithm for any real life problems

PEC 1 C: Network Design	
	Assignment 1 Implement Optimized Floyd Algorithm for the Shortest Path Problem. **Assignment 2** Examine Pre-captured Packets with wireshark tool to demonstrate functioning ofTCP protocol **Assignment 3** Capture and display real-time details of Network Traffic using wireshark Tool
PEC 1 D: Distributed Computing and Middleware Technologies	
	Assignment 1 Implement Token based Algorithm Suzuki-Kasami's broadcast based algorithmfor Mutual exclusion **Assignment 2** Implement Chandy-Misra-Haas Resource Model Algorithm for Deadlock Detection in a Distributed System **Assignment 3** Create, Publish ,and Consume a SOAP based web service for any application.

Rubrics for Continuous Evaluation

Component	Level	Laboratory Practice -I	Total	Passing	Process Evaluation
Continuous Comprehensive Assessment (CCA)	Faculty	1. Design with Advanced Engineering Materials 2. Mechanism Analysis and Synthesis 3. Advanced Mechanics of Solids	50	20	Refer CCA Guideline
ESE	Institute		50	20	External Oral Exam

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO 6
CO1	3	3	3	3	3	3
CO2	3	3	3	3	3	3
CO3	3	3	3	3	3	3
CO4	3	3	3	3	3	3
CO5	3	3	3	3	3	3
CO6	3	3	3	3	3	3

3: High, 2: Moderate, 1: Low, -: No Mapping, Average should not be zero

M Tech in Computer Engineering | FY M Tech Semester I Course

Title: Research Methodology **Course Code: RMD24O9L01**

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory % Marks			Practical % Marks	
					Max	Min for Pass		Max	Min for Pass
3	0	0	3	CCA	100	40			
39	0	0	Total:39						

Prerequisites: Basic understanding of statistics like central tendency, dispersions, Basic computing skills likes Microsoft Excel, Data analysis, critical thinking skills like reasoning etc

Course Objectives: Purposes of Course are:

1. To Provide a comprehensive understanding of research methods, techniques, and theirapplications in engineering and technology.
2. To Enable students to critically analyze and synthesize literature relevant to their researchfield.
3. To Equip students with the skills to design and conduct scientific research effectively usingappropriate methodologies.
4. To Instill ethical standards, promoting integrity accountability and responsibilities in conducting and reporting research

Course Outcomes: After Successful completion of course units, students will

CO1	Apply research process and methodologies relevant to engineering research effectively facilitating foundation of research activities
CO2	Develop ability to conduct a through literature review and find research gaps to critically assesses existing literature, identify unexplored areas to contribute to innovative research
CO3	Design and execute a research study using quantitative and qualitative research methods to yield reliable and valid data ensuring robustness of research findings
CO4	Analyze data using statistical tools and software, interpreting results accurately to make informed decisions based on research results
CO5	Author research findings and present in both written and oral formats effectively to both scientific and lay audiences
CO6	Appraise the ethical standards of research, acknowledging the work of others appropriately and reporting results truthfully

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Syllabus		
Unit I	**Basics of Research**	**7 hrs**
Definition of research, research methodology, concepts and significance of research inengineering, research ethics and responsibilities**,** case studies and real-life examples		
Unit II	**Literature Review Techniques**	**6 hrs**
Sources of Scientific literature, Methods for conducting and organizing literature reviews,Tools for managing references and citations like Mendeley, case studies and real-life examples		
Unit III	**Research Design**	**7 hrs**
Types of research design: Experimental, Correlation, Survey and Case Study, variables, sampling methods and techniques, formulating experimental and observational strategies, case studies and real-life examples		
Unit IV	**Data Collection and Analysis**	**6 hrs**
Techniques for collecting primary and secondary data, quantitative analysis, descriptive and inferential statistics, qualitative analysis, content and thematic analysis, case studies and real- life examples		
Unit V	**Statistical Tools and Software in Research**	**7 hrs**
Usage of Statistical software's like Minitab, MATLAB/Scilab in data analysis andinterpretations, visualizing data and presenting statistical results in graphical, numerical format, case studies and real-life examples		
Unit VI	**Research Reporting and Presentation**	**6 hrs**
Structure and components of research reports and papers, Ethical considerations in publishing,Skills for effective research presentation, case studies and real-life examples		

Tutorials:

All activities should be published in LinkedIn or YouTube and record responses.

1) Write a brief essay on the importance of research in their field of engineering
2) Create a flowchart of the research process for a hypothetical study
3) Group discussion on recent engineering innovations driven by research
4) Analyze a case study on ethical dilemmas in research and propose solutions.
5) Create a literature review by using Mendeley as per APA citations and references
6) Choose a research question and propose a suitable research design
7) Outline experimental protocol for given research question
8) Analyze a dataset using Minitab/Scilab/MATLAB and interpret the results
9) Prepare a check sheet for selection of type of graphs and its effectiveness
10) Review and critique a research paper for ethical compliance

References:

1. Kothari, C. R. (2019). Research methodology: Methods and techniques. New AgeInternational.
2. Kumar, R. (2019). Research methodology: A step by step guide for beginners. SagePublications.
3. Kothari, C. R., & Garg, G. (2019). Research methodology: Methods and techniques.New Age International.
4. Chawla, D., & Sondhi, N. (2021). Research methodology: Concepts and cases. VikasPublishing House.
5. Prasad, R. K. (2020). Research methodology. Kitab Mahal.
6. Tripathi, P. C. (2018). Research methodology in social science. Sarup & Sons.
7. Thomas, G. (2022). Research methodology and scientific writing. Springer.

Research Papers:

1. Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. In Journal of Business Research (Vol. 104, pp. 333–339). Elsevier BV. https://doi.org/10.1016/j.jbusres.2019.07.039
2. Kolstoe, S. E., Durning, J., Yost, J., & Aleksandrova-Yankulovska, S. (2023). Ranking Research Methodology by Risk — a cross-sectional study to determine the opinion of research ethics committee members. In Systematic Reviews (Vol. 12, Issue 1). Springer Science and Business Media LLC. https://doi.org/10.1186/s13643-023-02295-1

NPTEL/SWAYAM

1) Research Methodology - https://www.youtube.com/watch?v=E2gGF1rburw
2) Issues in hypothesis testing part 1- https://www.youtube.com/watch?v=p2M_0e5bxTA
3) Issues in hypothesis testing part 2 - https://www.youtube.com/watch?v=KSwM5qo_yoQ

Rubrics for Continuous Evaluation

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Process Evaluation
Continuous Comprehensive Assessment (CCA)	Faculty	10	10	10	10	10	50	Refer CCA Guideline
End Semester Examination (ESE)	Institute	10	10	10	10	10	50	Each Unit Carry 10 marks Question

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO 5	PO 6
CO1	3	2	3	2	2	3
CO2	3	2	2	3	3	3
CO3	3	2	3	2	3	3
CO4	3	2	2	3	3	3
CO5	2	3	3	3	3	3
CO6	2	3	3	3	3	3

3: High, 2: Moderate, 1: Low, 0/-: No Mapping

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M Tech in Computer Engineering | FY M Tech Semester I

Course Code: CME2409P07, Course Title: Research Seminar

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory % Marks		Practical % Marks		
					Max	Min for Pass	Max	Min for Pass	
0	0	2	1	CCA	-		100	40	
Total Hours									
0	0	26	Total: 26						

Prerequisites: NA	
Course Objectives: Purposes of the course are	
To recognize the research work done by various researchers. To explore and elaborate latest research area demonstrated in the research papers.	
Course Outcomes: After successful completion of the course the student will be able to	
CO1	Analyze the research content demonstrated in the papers referred
CO2	Identify the research gap by performing comparative analysis of work done in the specificresearch area
CO3	Summarize optimized research work in the form of research paper.

Guidelines

The students need to deliver the Research Seminar based on a topic on the latest state-of-the-art work in the specific area of the elective course. The topic has to be approved by the authorities. Thorough literature study based on the broad identified topic has to be carried out. It is advised that the study done in the Seminar leads to the Dissertation work phases to be performed in the Semester III and IV.

The students are expected to submit the duly certified report in the prescribed format, as part of satisfactory completion of the work, certified by the Guide and Head of department.
The students are supposed to publish their work in standard platforms as per guidelines of the BoS in order to validate the study.

The students have to exhibit the continuous progress through regular reporting, presentations and proper documentation of the activities. The continuous assessment of the progress need to be recorded.

Rubrics for Continuous Evaluation

Component	Level	Research Seminar	Total	Process Evaluation
Continuous Comprehensive Assessment (CCA)	Faculty	To findings and technological innovations in the advancement of engineering field and prepare a report	50	Refer CCA Guideline
ESE	Institute	Research Seminar Presentation	50	Oral

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	3	3
CO2	3	3	3	3	3	3
CO3	**3**	**3**	**3**	**3**	**3**	**3**

3: High, 2: Moderate, 1: Low, 0: No Mapping

M Tech in Computer Engineering | FY M Tech Semester I

Course Code: NCC2409L02-B Course Title: Value Education

Category: Non-Credit Course

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory % Marks			Practical % Marks	
					Max	Min for Pass		Max	Min for Pass
2	0	0	0	CCA	100	40	40	-	-
Total Hours									
26	0		Total: 26						

Prerequisites:

Course Objective:

1. Cultivate an understanding of ethical principles and values, promoting integrity,honesty, and responsibility in personal and professional life.
2. Develop empathy and respect towards diverse perspectives, cultures, and beliefs,fostering inclusive and compassionate attitudes.
3. Encourage critical thinking skills to evaluate moral dilemmas and make ethicaldecisions aligned with personal values and societal well-being.

Course Outcomes: After successful completion of the course the student will be able to

CO1	Understand the meaning of values and culture
CO2	Develop as social responsibility, Create a communal harmonious society and practiceunity in diversity
CO3	Identify the power of thoughts and words
CO4	Correlate the relationship between values and human rights

Syllabus

Unit I	**Introduction to Value Education**	**7**
Value Education – Definition, Evolution of value oriented education, Concept of HumanValues – Family Values - Aesthetic Values – Ethical Values – Spiritual Values		
Unit II	**Character Formation: Personal & Personality Development**	**7**
Self-Discipline – Self-Confidence – Self-Initiative – Self-awareness –Empathy –		

Compassion – Forgiveness – Honesty and Courage Leadership qualities – Personality Development		
Unit III	**The Power of Mind**	**6**
Definition, Meaning, Scope of Yoga - Aims and objectives of Yoga - Yoga Education with moderncontext - Different traditions and schools of Yoga - Yoga practices: Controlling Mind – Physical ExercCCA –Meditation – Mudras – Yoga – – Asanas Concept of Mind in the Upanishads – Moralization of Desires – Neutralization of Anger – Five Ways to Check Worry Habit and Eradication – Benefits of Blessings. The Power of Mind – the Power of Positive Thinking		
Unit IV	**Human Rights and Universal Values**	**6**
Concept of Human Rights – Classifications of Human Rights and Relevant Constitutional Provisions: Right to Life, liberty ad Dignity- Right to equality- Right against exploitation- Cultural and Educational Right- Economic Rights- Political Rights- Social Rights - HumanRights of Women and Children – Peace and harmony.		

Reference Books

Text Books

1. Das, M.S. & Gupta, V.K, Social Values among Young adults: A changing Scenario, MD Publications, New Delhi, 1995

2. Vivekananda, Swami, Personality Development, Advaita Ashrama, Kolkata, 2008

3. R. C. Pradhan, Language and Mind in the Upanishads, Language and Mind: The Classical Indian Perspective, ed. K. S. Prasad, Hyderabad Studies in Philosophy no. 5, Decent Books, NewDelhi, 2008

4. Vincent Peale, Norman, Six Attitudes for Winners, Jaico Publishing House, Mumbai, 2009.

5. Dr. Mrinalini Pandey, Disaster Management, Wiley India Pvt. Ltd.

Reference Books

1. Andharia J. Vulnerability in Disaster Discourse, JTCDM, Tata Institute of Social SciencesWorking Paper No. 8, 2008.

2. Govt. of India: Disaster Management Act 2005, Government of India, New Delhi

Web References

1. https://www.hzu.edu.in/bed/Basics-in-Education%20(NCERT).pdf
2. https://nptel.ac.in/content/storage2/courses/109101003/downloads/Lecture-6.pdf
3. 3. https://nptel.ac.in/content/storage2/courses/109104115/PDF/lec38.pdf

Rubrics for Continuous Evaluation

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Total	Passing	Process Evaluation
Continuous Comprehensive Assessment (CCA)	Faculty	25	25	25	25	100	40	Refer CCA Guideline

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	1	2
CO2	3	3	2	3	2	3
CO3	3	1	2	2	3	3
CO4	3	3	3	2	2	2

3: High, 2: Moderate, 1: Low, 0: No

M Tech in Computer Engineering | FY M Tech Semester I

Course Code: NCC2409L02-ACourse Title: Disaster Management
Category: Non-Credit Course

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory % Marks			Practical % Marks	
					Max	Min for Pass		Max	Min for Pass
2	0	0	0	CCA	100	40	40	-	-
Total Hours									
26	0		Total:						

Prerequisites:

Course Objective:

1. Understand disaster risk management.
2. Develop emergency response skills.
3. Enhance disaster resilience.

Course Outcomes: After successful completion of the course the student will be able to

CO1	Learning and understanding the basic knowledge of Disaster Management conceptand different approaches to reduce the impact of disaster
CO2	Understand the types of disaster their origin causes and their management and thedisaster profile of India
CO3	Learning to apply the knowledge of technology for monitoring and management ofthe disaster
CO4	Drill based learning of disaster management

Syllabus

Unit I	**Introduction on Disaster**	**7**
Different Types of Disaster : Natural Disaster: such as Flood, Cyclone, Earthquakes, Landslides etc Man-made Disaster: such as Fire, Industrial Pollution, Nuclear Disaster, Biological Disasters, Accidents (Air, Sea, Rail & Road), Structural failures(Building and Bridge), War & Terrorism etc. Causes, effects and practical examples for all disasters.		
Unit II	**Mitigation and Management techniques of Disaster**	**7**
Basic principles of disasters management and crisis management, Disaster Management		

cycle, Scopes of and criteria of prevention and mitigation of disasters, Aspects of disasterresponse and Recovery, Important criteria of relief Mechanism.		
Unit III	**Geo-informatics in Disaster Management**	**6**
Remote Sensing (RS), Geographical information system (GIS), Global Positioning Service (GPS), Indian Regional Navigation Satellite System (IRNSS): NavIC Indian Tsunami Early Warning System (ITEWS) Use of ICT and mobile technology for Disaster management, Application of Drone.		
Unit IV	**Disaster Management Act**	**6**
Disaster Management Act 2005, Institutional framework under Disaster Management act 2005Roleof National Disaster Management Authority (NDMA) Search and Rescue Operations, (one and two-person method) Demonstration of Earthquake Evacuation Drill Demonstration of Fire Drill		

Reference Books

Text Books

1. Savindra Singh, Jeetendra Singh, Disaster management, Pravalika Publications, Allahabad,2016
2. Alexander David, Introduction in Confronting Catastrophe, Oxford University Press, 2000.
3. Kapur, Anu& others, Disasters in India Studies of grim reality, Rawat Publishers, Jaipur,2005.
4. Mukta Girdhar, Natural Disasters, Amy publication, Dariyaganj, New Delhi, 2019.
5. Dr. Mrinalini Pandey, Disaster Management, Wiley India Pvt. Ltd.

Reference Books

1. Andharia J. Vulnerability in Disaster Discourse, JTCDM, Tata Institute of Social SciencesWorking Paper No. 8, 2008.
2. Govt. of India: Disaster Management Act 2005, Government of India, New Delhi

Web References

1. https://onlinecourses.swayam2.ac.in/cec19_hs20/preview
2. https://nptel.ac.in/courses/124107010
3. https://archive.nptel.ac.in/courses/105/104/105104183/

Rubrics for Continuous Evaluation

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Total	Passing	Process Evaluation
Continuous Comprehensive Assessment (CCA)	Faculty	25	25	25	25	100	40	Refer CCA Guideline

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	1	2
CO2	3	3	2	3	2	3
CO3	3	1	2	2	3	3
CO4	3	3	3	2	2	2

3: High, 2: Moderate, 1: Low, 0: No Mapping

M Tech in Computer Engineering | FY M Tech Semester I

Course Code: NCC2409L02-C

Course Title: Constitution of India and Indian Knowledge System

Category: Non-Credit Course

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory % Marks			Practical % Marks	
					Max	Min for Pass		Max	Min for Pass
2	0	0	0	CCA	100	40	40	-	-
Total Hours									
26	0		Total:						

Prerequisites:

Basic Understanding of Indian History. Basic concepts such as democracy, federalism, andthe separation of powers. Awareness of contemporary political and legal issues in India.
Ability to read and understand complex legal and political texts. Indian Knowledge System

Course Objective:

1. Explore the historical background and evolution of the Constitution of India, examining the factors and events that influenced its development.
2. Comprehensive understanding of the structure, fundamental principles, and values enshrined in the Constitution, including democracy, equality, secularism, and justice.
3. Evaluate the fundamental rights and duties of citizens, the structure and functions of central and state governments, and the significance of key constitutional provisions and amendments in shaping India's governance and society.
4. Understand the rich heritage of ancient India.

Course Outcomes: After successful completion of the course the student will be able to

CO1	Understand the historical context and the making of the Indian Constitution.
CO2	Analyze the Preamble, fundamental rights, duties, and directive principles.
CO3	Describe the structure and functions of the central and state governments and also Interpretkey constitutional provisions and understand the amendment process.
CO4	Appreciate the significance of major constitutional bodies and landmark judgments

Syllabus

Unit I	**Introduction to the Constitution of India**	**7**
Historical Background: Making of the Indian Constitution, Constituent Assembly, influencesfrom other constitutions. *Preamble:* Philosophy, objectives, and interpretation. *Salient Features:* Federal structure, parliamentary system, separation of powers, fundamentalrights and duties.		
Unit II	**Fundamental Rights and Duties**	**7**
Fundamental Rights: Equality, Freedom, Protection from exploitation, Freedom of religion,Cultural and educational rights, Constitutional remedies. *Directive Principles:* Classification, significance, and relation with Fundamental Rights. *Fundamental Duties:* Importance and implementation.		
Unit III	**Structure and Functions of Governments and Constitutional Provisionsand Amendments**	**6**
Union Government: President, Prime Minister and Council of Ministers, Parliament. *State Government:* Governor, Chief Minister and Council of Ministers, State Legislature.*Judiciary:* Supreme Court, High Courts, Subordinate Courts. *Emergency Provisions:* Types, implications. *Special Provisions:* For states and regions, Scheduled and Tribal Areas. *Amendments:* Procedure, major amendments, Basic Structure Doctrine. *Constitutional Bodies:* Election Commission, CAG, UPSC, Finance Commission.		
Unit IV	**Indian Knowledge System**	**6**
IKS Domains: Vedanta, Vedic Literature, Science, Mathematics, Astronomy, Ayurveda, Yoga,Ashtang Yoga, Indian Architecture and Town Planning, Indian Fine Arts, Indian Metallurgy, Agriculture		
Reference Books		
Text Books 1. Introduction to the Constitution of India, by D.D. Basu 2. Indian Polity, by M. Laxmikanth 3. Our Constitution, by Subhash Kashyap **Reference Books** 1. Journals and Articles: Constitutional Law journals, law review articles. **Web References** Government of India, Ministry of Law and Justice, National Portal of India https://iksindia.org/		

Rubrics for Continuous Evaluation

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Total	Passing	Process Evaluation
Continuous Comprehensive Assessment (CCA)	Faculty	25	25	25	25	100	40	Refer CCA Guideline

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	1	2
CO2	3	3	2	3	2	3
CO3	3	1	2	2	3	3
CO4	3	3	3	2	2	2

3: High, 2: Moderate, 1: Low, 0: No Mapping

M Tech in Computer Engineering | FY M Tech Semester II

Course Code: CME2410L01, Course Title: Deep Learning Applications

Category: Program Core Course

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max	Min marks for Pass		Max %	Min marks for Pass
3	1	0	4	CCA	50	20	40	-	-
Total Hours				ESE	50	20			
39	13	0	Total:52			40			

Prerequisites: Machine Learning

- **Course Objectives:** Purposes of the course are
- To understand the core concepts of deep neural networks.
- Comparing different deep learning models.
- To understand the basics of deep reinforcement learning models.
- To analyze Deep Neural Network Architectures.
- To solve real world problem using Reinforcement Learning

Course Outcomes: After successful completion of the course units the student will

CO1	Understand the methods and terminologies involved in deep neural network and Design Simple Deep Neural Network
CO2	Apply suitable CNN for real time application
CO3	Analyze Recurrent and Recursive Neural Network for performance
CO4	Design and Develop Deep learning application using deep generative models.
CO5	Construct and apply reinforcement learning algorithms

Syllabus

Unit I	**Introduction to Neural Network and Deep Neural Network**	**8 hrs**
Neural Networks -Functions in Neural networks, Activation function, Loss function, Function approximation Deep Neural Networks-Shallow neural networks, Training Neural Networks –Backpropagation, Setup and initialization issues, Vanishing and Exploding gradient problem, Gradient Descent Strategies Concept of Transformers and Types, Applications of transformers in Deep Learning		
Unit II	**Convolutional Neural Network**	**8 hrs**
The Basic Structure of a Convolutional Network, Convolution and Pooling as infinitely strong prior, variants of convolution function, structured output, Datatypes, Efficient convolution algorithms, Advanced CNN-Region based CNN, Fast RCNN, You Only Look Once (YOLO), Single shot detector (SSD)		
Unit III	**Sequence Modelling**	**8 hrs**
Recurrent Neural Networks – Modeling the Time Dimension,3D Volumetric Input, why not Markov Models? General Recurrent Neural Networks, Long Short-Term Memory, Domain Specific Applications. Varieties of Recursive Neural Networks, Applications of Recursive Neural Networks		
Unit IV	**Deep Generative Models and Autoencoders**	**8 hrs**
Introduction to deep generative model, Types of GAN, Applications of GAN networks, Training Generative Adversarial Network, Directed Generative Nets, Generative Stochastic Networks, Evaluating Generative Models. Autoencoders, Regularization in auto encoders, Denoising Autoencoders, Sparse auto encoders, Contractive Autoencoders, Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noCCA at input, Ensemble methods, Dropout, Greedy Layer wCCA Pre-		

training, Better activation functions, better weight initialization methods, Batch Normalization.		
Unit V	**Deep Reinforcement Learning**	**7 hrs**
Introduction of deep reinforcement learning, Basic Framework for Reinforcement Learning, Stateless Algorithms, Bootstrapping for Value function learning, Policy gradient Methods		
Tutorial: **1**.Apply Convolutional Neural approach for modelling handwritten images 2.Discuss the classification of the sensor time series sequences using LSTM 3.Use the variational auto encoders for reconstructing MNIST digits 4. Case Study on Reinforcement learning for Robotics and Game Playing 5. Elaborate the process of deep generative model for image generation using text.		
Text Books: 1. Deep Learning- Ian Good felllow, Yoshua Benjio, Aaron Courville, The MIT Press, 2016 2. Neural Networks: A Systematic Introduction, Raúl Rojas, 1996		
Reference Books: 1. Josh Patterson and Adam Gibson," Deep Learning" 2. Pattern Recognition and Machine Learning, Christopher Bishop, 2007 3. Fundamentals of Deep Learning, Nikhil Buduma, O'Reilly Publication ,2017		
SWAYAM/NPTEL/You Tube Links https://onlinecourses.nptel.ac.in/noc21_cs76/preview		

Rubrics for Continuous Evaluation

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Process Evaluation
Continuous Comprehensive Assessment (CCA)	Faculty	10	10	10	10	10	50	Refer CCA Guideline
End Semester Examination (ESE)	Institute	10	10	10	10	10	50	Each Unit Carries 10 marks Question

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	3	1	3
CO2	3	2	2	3	2	3
CO3	3	2	2	3	2	3
CO4	1	2	1	3	2	1
CO5	1	2	2	3	2	1

3: High, 2: Moderate, 1: Low, 0: No Mapping

M Tech in Computer Engineering | FY M Tech Semester II

Course Code: CME2410L02 Course Title: Social Media Analytics

Category: Program Core Course

Prerequisites: DBMS (310241, Data Science and Big data Analytics (310251)	
Course Objectives:	
1. To understand foundations of Social Media Analytics 2. To Visualize and understand the data mining aspects in social networks 3. To solve mining problems by different algorithms 4. To understand behavioural part of web applications for Analysis 5. To analyse the data available on any social media applications	
Course Outcomes: After successful completion of the course the student will be able to	
CO1	Understand the basics of Social Media Analytics.
CO2	Illustrate the significance of Data mining in Social media
CO3	Demonstrate the algorithms used for text mining
CO4	Apply network measures for social media data
CO5	Illustrate Behaviour Analytics techniques used for social media data

Syllabus

Unit I	**Introduction to Social Media Analytics**	**7hrs**
The foundation for analytics, Definition, Social media data sources, Defining social media data, data sources in social media channels, Estimated Data sources and Factual Data Sources, Public and Private data, data gathering in social media analytics, Benefits of social media analytics		
Unit II	**Social Networks and Visualizations**	**7 hrs**
Introduction, Basic Taxonomy of Visualization, Data mining in Social Media: Introduction, Motivations for Data mining in Social Media, Data mining methods for Social Media, Related Efforts The convergence of Visualization, Interaction and Analytics.		
Unit III	**Text Mining in Social Networks**	**8hrs**
Introduction, TEXT Pre-processing, Keyword search, TEXT Classification and clustering Algorithms, ,Hierarchical clustering, k-means clustering, Transfer Learning in heterogeneous Networks, Sampling of online social networks, Comparison of different algorithms used for mining, tools for text mining.		
Unit IV	**Network Measures**	**8hrs**
Centrality: Degree Centrality , Eigenvector Centrality, Katz Centrality , Page Rank, Betweenness Centrality, Closeness Centrality ,Group Centrality ,Transitivity and Reciprocity, Balance and Status, Similarity: Structural Equivalence, Regular Equivalence		
Unit V	**Individual and collective behaviour analytics and Social Media Mining**	**9hrs**
Individual Behavior: Individual Behavior Analysis, Individual Behavior Modeling, Individual Behavior Prediction Collective Behavior: Collective Behavior Analysis, Collective Behavior Modeling, Collective Behavior Prediction, Sample case study Mining Twitter: Overview, Exploring Twitter's API, Exploring Trending Topics,Mining Facebook: Overview, Exploring Facebook's Social Graph API's, Analyzing Social Graph Connections Graph Mining, different ways of misinformation management on Twitter ('X') and Facebook		
Tutorial:-		
1.Do the classification of social media data on Twitter and Facebook		**2 hrs**
2.Demonstrate with example Individual behavior analysis		**2hrs**
3.Demonstrate with example collective behavior analysis		**2hrs**
4.As a case study discuss Facebook's Social Graph API		**2hrs**
5.Mini Project on implementing sentiments analysis on Twitter		**5hrs**
Text Books		
1.Reza Zafarani Mohammad Ali Abbasi Huan Liu, Social Media Mining, Cambridge University Press, ISBN:10: 1107018854		

2.Charu C. Aggarwal, Social Network Data Analytics, Springer, ISBN: 978-1-4419-8461-6

Reference Books

1. Marshall Sponder, Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics, McGraw Hill Education, 978-0-07-176829-0,
2. Matthew A. Russell, Mining the Social Web, O'Reilly, 2nd Edition, ISBN:10: 1449367615 Jiawei Han University of Illinois at Urbana-Champaign Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann, 2nd Edition, ISBN: 13: 978-1-55860-901-3 ISBN: 10: 1-55860- 901-6
3. Bing Liu, Web Data Mining : Exploring Hyperlinks, Contents and Usage Data, Springer, 2nd Edition, ISBN: 978-3-642-19459-7

E-contents :

3. https://nptel.ac.in/courses/106106146
4. https://nptel.ac.in/courses/109103184

Datasets :

1.https://www.kaggle.com/code/shadabhussain/social-media-analytics
2. https://www.kaggle.com/discussions/general/240449
3.https://data.world/datasets/social-media

Rubrics for Continuous Evaluation

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Process Evaluation
Continuous Comprehensive Assessment (CCA)	Faculty	10	10	10	10	10	50	Refer CCA Guideline
End Semester Examination (ESE)	Institute	10	10	10	10	10	50	Each Unit Carries 10 marks Question

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	3	3
CO2	3	3	3	1	3	3
CO3	3	3	3	1	3	3
CO4	3	3	3	1	3	3
CO5	3	3	3	1	3	3

3: High, 2: Moderate, 1: Low, -: No Mapping, *Average should not be zero*****

M Tech in Computer Engineering | FY M Tech Semester II

Course Code: CME2410L03 Course Title: Advanced Software Engineering

Category: Program Core Course

Teaching Scheme				Evaluation Scheme			
L	T	P	Cr	Exam	Theory % Marks		
					Max	Min for Pass	
3	1	0	4	CCA	50	20	40
39	13	0	Total: **52**	ESE	50	20	

Prerequisites: Course Code

Course Objectives: Purposes of the course are

1. Apply software quality assurance and testing activities using modern software tools
2. Organize Agile Software Development, Extreme Programming and Software Development Rhythms.
3. To describe and determine the purpose and importance of project management from the perspectives of planning
4. Design and implementation of secure software.

Course Outcomes: After successful completion of the course units the student will

CO1	Compile and compare the agile methodologies: extreme programming, scrum, and feature driven programming.
CO2	Produce appropriate System Design, object design of reusable Activities
CO3	Apply the process to be followed in the software development life-cycle models
CO4	Identify the appropriate design patterns to solve object-oriented design problems
CO5	Contribute to efficient and Secure delivery of software solutions and implement improvements in the software development processes

Syllabus

Unit I	**Agile Software Development**	7hrs
Agile Methods, XP: Extreme Programming, DSDM, SCRUM, Feature-Driven Development, Modeling Misconceptions, Agile Modeling, Tools of Misconceptions, Updating Agile Models Extreme Programming: Introduction, Core XP Values, The Twelve XP Practices, About Extreme Programming, Planning XP Projects, Test First Coding, Making Pair Programming Work		
Unit II	**Object Oriented Software Engineering**	7 hrs
Overview of System Design, System Design Concepts, System Design activities, Managing System Design, Case study, Object Design- Overview of Object design, Reuse Concepts, Reuse Activities, Managing Reuse		
Unit III	**Software Process Management and Version Control**	**7 hrs**
Process Planning and Project Organizations Work breakdown structures, Planning guidelines, cost and schedule estimating process, iteration planning process, Pragmatic planning, line-of- business organizations, project organizations, evolution of organizations, process automation. Software Version Control -Introduction, Version control types, Software Version Control tools		
Unit IV	**Software Architecture and Design Patterns**	**9 Hrs**
Object-Oriented Paradigm, Data Flow Architectures, Data-Centered Software Architecture, Hierarchical Architecture, Interaction-Oriented Software Architectures, Distributed Architecture, Component-Based Software Architecture, Heterogeneous Architecture, Architecture of User Interfaces, Implicit asynchronous communication software architecture. Solving Design Problems using Design Patterns , Selecting a Design Pattern Design Patterns-1: Creational, Abstract Factory-Builder, Factory Method, Prototype Singleton Design Patterns-2: Structural Patterns: Adapter, Bridge, Composite Decorator, Façade, Flyweight, Proxy		
Unit V	**Software Quality assurance and Testing Methodologies**	**9hrs**

Software quality assurance Framework and Standards SQA Frame work: Introduction to Quality? Software Quality Assurance. Components of Software Quality Assurance. Software Quality Assurance Plan: Steps to develop and implement a Software Quality Assurance Plan.
Introduction to Testing, Automated Testing, Concepts of Test Automation, Introduction to list of tools like Win runner, Load Runner, Jmeter, About Win Runner, Using Win runner, Mapping the GUI.
Threats to Software Security, Sources of Software Insecurity, The Benefits of Detecting Software Security

Tutorial:

1) List the four important attributes, which all software products have. Suggest four attributes, which may be significant.
2) Software engineering methods only became widely used when CASE technology became available to support them. Suggest five types of method support, which can be provided by CASE tools.
3) Justify high cost of system-testing for generic software products, which are sold to a very wide market.
4) Apart from the challenges of legacy systems, heterogeneity and rapid delivery, identify other problems and challenges that software engineering is likely to face in the 21st century.
5) Discuss the professional responsibilities of software engineers to produce maintainable code even if this is not explicitly requested by their employer.
6) Two major international banks with different customer information databases merge and decide that they need to provide access to all customer information from all bank branches. Giving reasons for your answer, suggest the most appropriate strategy for providing access to these systems and briefly discuss how the solution might be implemented.

Reference Books

3. Software Engineering A Practitioner's Approach, Roger S. Pressman, Seventh Edition McGraw Hill International Edition.
4. Software Architecture in Practice, 3rd Edition By Len Bass, Paul Clements, Rick Kazman Published Sep 25, 2012 by Addison-Wesley Professional
5. Applied Software Architecture, Christine Hofmeister, Robert Nord, Deli Soni, Addison-Wesley Professional; 1st edition (November 4, 1999) ,ISBN-10: 0201325713 , ISBN-13: 978- 0201325713
6. Object-Oriented Software Engineering: Conquering Complex and Changing Systems, Bernd Bruegge and Allen H. Dutoit, Pearson Education,2002. ISBN 0-13-489725-0
7. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, Design patterns: Elements of Reusable object-oriented software, Addison-Wesley, 1995
8. Software testing techniques – Boris Beizer, Dreamtech, second edition.

Reference Books

1. Fundamentals of Software Engineering, Rajib Mall, Third Edition, PHI.
2. Software Engineering, Ian Sommerville, Ninth edition, Pearson education
3. Object-oriented Software Engineering: The Professional Developer's Guide, AddisonWesley, George Wilkie, 1993. ISBN-10: 0201627671
4. Software Testing- Yogesh Singh, Camebridge

Rubrics for Continuous Evaluation

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Process Evaluation
Continuous Comprehensive Assessment (CCA)	Faculty	10	10	10	10	10	50	Refer CCA Guideline
End Semester Examination (ESE)	Institute	10	10	10	10	10	50	Each Unit Carries 10 marks Question

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	3	3
CO2	3	3	3	1	3	3
CO3	3	3	3	2	3	3
CO4	3	3	3	1	3	3
CO5	3	3	3	1	3	3

3: High, 2: Moderate, 1: Low, -: No Mapping, *Average should not be zero*

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M Tech in Computer Engineering | FY M Tech Semester II

Course Code: CME2410L4A, Course Title: Network and Cyber Security

Category: Program Elective Course

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max	Min marks for Pass		Max %	Min marks for Pass
3	1	0	4	CCA	50	20	40	-	-
Total Hours				ESE	50	20			
39	13	0	Total: **52**			40			

Prerequisites: -	
Course Objectives: Purposes of the course are	
➢ To give an overview of Network Security and security issues in TCP/IP suite ➢ To illuminate protocol and software vulnerabilities ➢ To explain IP Security and authentication in network security ➢ To give an insight into attacks and tools of network security ➢ To explain cyber security, Cyber Crime, law and Investigation	
Course Outcomes: After successful completion of the course units the student will be able to	
CO1	Illustrate network security and security issues in TCP/IP Suite
CO2	Compare and contrast Network Security Threats and various issues related to it
CO3	Identify suitable IP security and authentication protocol as per the network requirement
CO4	Analyze various networking attacks and tools
CO5	Understand basics of Cyber Security and evaluate the cyber security needs of an organization

Syllabus

Unit I	**Introduction**	**7 Hrs**
Overview of Network Security, Network Security Model, OSI Security Architecture. Security services, attacks, Security Issues in TCP/IP suite- Sniffing, spoofing, buffer overflow, ARP poisoning, ICMP Exploits, IP address spoofing, IP fragment attack, routing exploits, UDP exploits, TCP exploits.		
Unit II	**Network Security Threats and Issues**	**7 Hrs**
. Protocol Vulnerabilities: SYN Flooding, Session Hijacking, ARP Spoofing, Attack on DNS, Wireless LAN: Frame spoofing, Violating MAC; Software Vulnerabilities: Phishing Attack, Buffer Overflow, Cross-site Scripting, SQL Injection; Virus, Worm, Malware, Botnets; Eavesdropping, Password Snooping and IP Masquerade.		
Unit III	**IP Security and authentication**	**7 Hrs**
IP Security-AH and ESP, SSL/TLS, SSH, Web Security- HTTPS, DNS Security, Electronic Mail Security (PGP, S/MIME), Authentication requirements and functions, Hash Functions ,MD5 message Digest algorithm, Secure Hash Algorithm , Authentication protocols- Kerberos, X.509, Lightweight Directory Access Protocol (LDAP) , OAuth2 ,SAML,RADIUS		

Directory Access Protocol (LDAP) , OAuth2 ,SAML,RADIUS

Unit IV	**Attacks and tools**	**8 Hrs**

Intruders, Viruses, Worms, Trojan horses, DoS, Distributed Denial-Of-Service (DDoS),
Ping of death attack, Teardrop attack (aka Nestea), ARP cache poisoning, ARP poisoning commands, ACK scan, TCP port scanning, VLAN hopping, Wireless sniffing, OS fingerprinting ISN Sniffing, Passive OS detection, Honey nets, Honey pots, Ethical hacking process, Ethical hacking issues,
Hacking tools, Tools for MITM attack

Unit V	**Introduction to Cyber Security**	**10 Hrs**

Introduction, Computer Security, Threats, Harm, Vulnerabilities, Controls, Authentication, Access Control and Cryptography. Web attack: Browser Attacks, Web Attacks Targeting Users, Obtaining User or Website Data, Email Attacks. Network Vulnerabilities: Overview of vulnerability scanning, Open Port / Service Identification, Banner /Version Check, Traffic Probe, Vulnerability Probe,
Vulnerability Examples, Network Sniffers and Injection tools
Cyber Crimes, Types of Cybercrime, Cyber Laws, Cyberspace and Criminal Behaviour, Problems Associated with Computer Crime, Introduction to Incident Response, Digital Forensics, Realms of the Cyber world. Internet crime and Act, Recognizing and Defining Computer Crime, Contemporary
Crimes, Computers as Targets, Contaminants and Destruction of Data

Text Books

1. Cryptography and Network Security - Principles and Practice | Eighth Edition | By Pearson,2023
2. William Stallings, Computer Security: Principles and Practices, Pearson 6 Ed, ISBN 978-0-13-335469-0, 2017
3. Nina Godbole, Sunit Belapure, Cyber Security- Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiely India Pvt.Ltd, ISBN- 978-81-265-2179-1, 2011

Reference Books

1. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd, Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt.Ltd, 2005
2. CK Shyamala et el., Cryptography and Security, Wiley India Pvt. Ltd, ISBN-978-81-265-2285-9. 4.
3. Berouz Forouzan, Cryptography and Network Security, TMH, 2 edition, ISBN -978-00-707-0208-0.

e-Contents:

MOOCs courses link :

1. https://onlinecourses.nptel.ac.in/noc23_cs127/preview
2. https://onlinecourses.swayam2.ac.in/nou19_cs08/preview
3. https://onlinecourses.swayam2.ac.in/cec22_cs15/preview

Tutorial :

1) Case study on cyber-attacks in real time environment **2hrs**
2) Study assignment on IDS **2hrs**
3) Demonstrate Linux networking security recovery commands. & Study Tools viz; FTK & The Sleuth Kit **2hrs**
4) Study assignment on Cyber Stalking types & their cases respectively **2hrs**
5) Mini Project: students should implement any one Mini project from the problem statementsgiven below **5hrs**
a. Password Strength Tester
b. Credit Card Encryption and Decryption

Rubrics for Continuous Evaluation

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Process Evaluation
Continuous Comprehensive Assessment (CCA)	Faculty	10	10	10	10	10	50	Refer CCA Guideline
End Semester Examination (ESE)	Institute	10	10	10	10	10	50	Each Unit Carries 10 marks Question

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	1	1	2	1	1
CO2	1	1	1	2	1	1
CO3	1	1	1	1	1	1
CO4	1	1	1	2	1	1
CO5	1	1	1	2	1	2

M Tech in Computer Engineering | FY M Tech Semester II

Course Code: CME2410L4B Course Title: Computer Vision

Category: Program Elective Course

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory % Marks			Practical % Marks	
					Max	Min marks for Pass		Max%	Min for Pass
3	1	0	4	CCA	50	20			
Total Hours					50	20	40	-	-
39	13	0	Total: 52	ESE		40			

Prerequisites: Basic Mathematics**,** Data structures, Image processing, Introduction to machine learning	
Course Objectives:	
6. To provide the computer vision fundamentals 7. To explain mathematical transforms necessary for image processing 8. To explain the image enhancement techniques 9. To review the fundamental concepts of video processing 10. To explain the machine learning models for computer vision	
Course Outcomes: After successful completion of the course the student will be able to	
CO1	Apply the fundamental concepts in computer vision
CO2	Apply mathematical modelling methods for image processing tasks
CO3	Analyse image segmentation and edge detection techniques over real time images
CO4	Analyse the video processing techniques over audio and video frames
CO5	Select a computer vision technique for a real-world problem

Syllabus

Unit I	**Introduction to Computer Vision**	**7 hrs**
Image Formation and Digital Image Representations, Image Enhancement, Image Sampling and Rotation, Image Pre-processing: Image Filtering, Grayscale Conversion ,Noise Reduction, Normalization		
Unit II	**Feature Extraction**	**8 hrs**
Introduction, Feature detection - Lines and corners detection. Identification of basic geometrical structures, Edge Detection ,Object Detection and Recognition , Principal Component Analysis		
Unit III	**Segmentation and Classification**	**8 hrs**
Grouping, super pixels ,Unsupervised and Supervised segmentation methods : Thresholding, Clustering, Support Vector Machine ,Convolutional Neural Networks and image classification		
Unit IV	**Image Compression**	**8 hrs**
Introduction, Need for image compression, Redundancy in images, Classification of image compression schemes, Huffman coding, Arithmetic coding, Predictive coding, Transformed based compression- Discrete Cosine Transform (DCT), Image compression standards, Video Compression Standards.		
Unit V	**Video Processing and Machine Learning for Computer Vision**	**8 hrs**
Basic Steps of Video Processing: Analog video, Digital Video, Time varying Image Formation models: 3D motion models. Video indexing, summarization and retrieval. Audio and Video semantic analysis. Deep Neural Networks Perceptron, Neural Network, Perceptron Training, Gradient Descent, Back propagation, Autoregressive models, Variational Auto encoders (VAEs) ,Normalizing flow models. Deep Learning Architecture for Computer Vision.		
Tutorial: 7) Assignment to Perform analysis on under water imaging		

8) Assignment to perform survey on super resolution and hyper spectral imaging techniques
9) Assignment to perform shadow removal in video images
10) Write an assignment on medical image processing
11) Mini Project based on remote sensing or any other domain

Text Books

1. Computer Vision-A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B.K.P.Horn, McGraw-Hill.2e
2. R. Gonzalez, R.E. Woods, "Digital Image Processing", 3rd Edition, Pearson Education, India,2014

Reference Books

3. M. Tekalp, "Digital Video Processing", Prentice-Hall 2nd edition 2015
4. Forsyth, David A., and Jean Ponce. Computer Vision: a Modern Approach. Upper Saddle River, NJ: Prentice Hall, 2003. ISBN: 0130851981 Engineering Chemistry, Wiley India Pvt. Ltd.
5. Richard Szeliksy "Computer Vision: Algorithms and Applications" (http://szeliski.org/Book/) 2nd edition 2022
6. Deep Learning, Goodfellow and Yoshua Bengio, Aaron Courville, 2016, MIT press. http://www.deeplearningbook.org/

e-contents:

1.NPTELcourse: https://onlinecourses.nptel.ac.in/noc21_ee79/preview
2. NPTELcourse: https://onlinecourses.nptel.ac.in/noc21_cs93/preview
3. NPTELcourse: https://onlinecourses.nptel.ac.in/noc23_ee39/preview

Rubrics for Continuous Evaluation

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Process Evaluation
Continuous Comprehensive Assessment (CCA)	Faculty	10	10	10	10	10	50	Refer CCA Guideline
End Semester Examination (ESE)	Institute	10	10	10	10	10	50	Each Unit Carries 10 marks Question

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	1	1	1	1	1
CO2	2	2	2	3	2	2
CO3	2	2	2	3	2	2
CO4	2	2	2	3	2	2
CO5	2	2	2	3	2	2

3: High, 2: Moderate, 1: Low, 0: No Mapping

M Tech in Computer Engineering | FY M Tech Semester II

Course Code: CME2410L4C, Course Title: Natural Language Processing

Category: Program Elective Course

Teaching Scheme				Evaluation Scheme			
L	T	P	Cr	Exam	Theory % Marks		
					Max	Min for Pass	
3	1	0	4	CCA	50	20	40
39	13	0	Total: **52**	ESE	50	20	

Prerequisites: Theory of Computation, Machine Learning, Discrete Mathematics	
Course Objectives: 1. To be familiar with fundamental concepts and techniques of natural language processing. 2. To acquire the knowledge of various word level analysis in NLP. 3. To develop the various language modeling techniques for NLP. 4. To acquire the knowledge of various parsing and lexical semantics. 5. To use appropriate tools and techniques for processing natural languages and develop knowledge deep learning for NLP.	
Course Outcomes: After successful completion of the course the student will be able to	
CO1	Describe the fundamental concepts and techniques underlying approaches for NLP modules while demonstrating the concepts of morphology, syntax, and semantics in natural language.
CO2	Illustrate various language modeling and parts of speech techniques.
CO3	Illustrate various parsing and lexical semantics.
CO4	Construct and apply the use of NLP tools and techniques for text-based processing of natural languages.
CO5	Develop various approach for speech recognition including feature extraction, acoustic modeling and language modeling using deep learning.

Syllabus		
Unit I	**Foundations of NLP**	**6 hrs**
Generic NLP system, Levels of NLP, Knowledge in language processing, Classical Problems in NLP. Ambiguity in Natural language, Stages in NLP, Challenges of NLP, Applications of NLP, Empirical Laws, Morphology analysis Survey of English Morphology, Inflectional morphology & Derivational morphology, Lemmatization Regular expression, finite automata, finite state transducers (FST) Morphological parsing with FST , Lexicon free FST Porter stemmer		
Unit II	**Language Model and Part-of-Speech**:	**6 hrs**
Text Normalization Minimum Edit Distance N-gram Language Models Simple n-gram models, Estimation parameters and smoothing, Evaluating language models, Word Embeddings/Vector Semantics: Bag-of-words, TFIDF,word2vec,doc2vec,Contextualized representations (BERT),GloVe, Fast Text, ELMO, CoVe, RoBERTa, CBOW, Skip-Gram Smoothing Huge Language Models Perplexity's Relation to Entropy Part-of Speech Tagging HMM for Part-of-Speech Tagging Viterbi algorithm		
Unit III	**Parsing and Lexical Semantics**	**5 hrs**
Introduction to Parsing Linguistic Constituents and Constituency tests - Partial or Shallow Parsing Dependency Parsing Word Senses Relations Between Senses Word Net: A Database of Lexical Relations, Methods for Word Sense Disambiguation.		
Unit IV	**NLP Tools and Techniques**	**4 hrs**
Prominent NLP Libraries: Natural Language Tool Kit (NLTK), spaCy, Text Blob, Gensim etc. Linguistic Resources: Lexical Knowledge Networks, WordNets, Indian Language WordNet (IndoWordnet), VerbNets, PropBank, Treebanks, Universal Dependency Treebanks Lesk Algorithm Walker's algorithm.		
Unit V	**Deep learning architectures for NLP:**	**5 hrs**
RNNs as Language Models - Stacked and Bidirectional RNN architectures LSTM Self Attention Networks: Transformers, Transformers as Language Models. Self-attention - cross- attention-Masked Attention-Positional encoding Masked Language Modeling: Bidirectional Encoder Representations of Transformers (BERT) BERT, GPT-2 GPT 3 **Applications of NLP: Sentiment analysis, Question and Answering**		
Text Books		
1. Dan Jurafsky, James H. Martin "Speech and Language Processing", Draft of 3rd Edition, Prentice Hall 2022 2. UdayKamath, John Liu, James Whitaker "Deep Learning for NLP and Speech Recognition", 1st Edition, Springer 2019.		
Reference Books		
1. Ben Gold, Nelson Morgan, Dan Ellis "Speech and Audio Signal Processing: Processing and Perception of Speech and Music", 2 nd Edition, John Wiley & Sons, 2011. **2.** Manning, Christopher D., and nrichSchütze , "Foundations of Statistical Natural Language Processing", Cambridge, MA: MIT Press **3.** Jacob Benesty, M. M. Sondhi,Yiteng Huang "Springer Handbook of Speech Processing" , 1st Edition, Springer, 2008		
E-contents : 1 https://nptel.ac.in/courses/106101007 2 https://nptel.ac.in/courses/106106211 3 http://web.stanford.edu/class/cs224n/		

Rubrics for Continuous Evaluation

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Process Evaluation
Continuous Comprehensive Assessment (CCA)	Faculty	10	10	10	10	10	50	Refer CCA Guideline
End Semester Examination (ESE)	Institute	10	10	10	10	10	50	Each Unit Carries 10 marks Question

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	2	3	1	1
CO2	2	2	3	2	2	2
CO3	2	2	2	2	2	2
CO4	2	2	3	2	2	2
CO5	2	2	3	3	3	3

3: High, 2: Moderate, 1: Low, 0/-: No Mapping

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M Tech in Computer Engineering | FY M Tech Semester II

Course Code: CME2410L4D **Course Title: Security in IoT**

Category: Program Elective Course

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory % Marks			Practical % Marks	
					Max	Min for Pass		Max	Min for Pass
4	0	0	3	CCA	50	20	40	-	-
Total Hours									
39	0	0	Total: 52	ESE	50	20			

Prerequisites: IoT, Networking and Cyber Security	
Course Objectives:	
1. To explain the basics of IoT 2. To explain IoT technologies 3. To explain the security requirements in IoT 4. To review the IoT security protocols 5. To explain the cloud security for IoT	
Course Outcomes: After successful completion of the course the student will be able to	
CO1	Identify and describe the variety of IoT system architectures, challenges specific to IoT systems
CO2	Illustrate the smart objects and the technologies to connect them to network
CO3	Identify the need of security in IoT applications
CO4	Ability to apply IoT technologies on security
CO5	Ability to identify appropriate security and privacy solutions for real-world applications

Syllabus

Unit I	**Introduction to IoT**	**8 hrs**
Components of IoT Infrastructure, Basic elements of general IoT Architecture, Characteristics of IoT, benefits and challenges of IoT, Applications of IoT, Challenges in Designing IOT Applications		
Unit II	**IoT Enabling Technologies**	**7 hrs**
IoT Development Boards: Arduino, Add-on ESP module, Node MCU, Raspberry Pi; Sensors and Actuators: Temperature Sensor, PIR Sensor, Ultrasonic sensor; Communication Technologies: Bluetooth, ZigBee, WSN, Cellular; Protocols, IoT Cloud Platforms		
Unit III	**Vulnerabilities and Security requirements in IoT**	**8 hrs**
Vulnerabilities, Attacks Specific to IoT, Insufficient Authentication/Authorization, Insecure Access Control, Threats to Access Control Security Requirements in IoT Architecture, Security in Enabling Technologies, Security Concerns in IoT Applications. Security Architecture in the Internet of Things, Introduction to Edge Computing using AI		
Unit IV	**IoT Security**	**8 hrs**
Impact of the Internet of Things (IoT) on Mobile Networks, IoT Networking Protocols, Secure IoT Layers, Back-end Security -Secure Resource Management, Secure IoT Databases, The secure IoT system implementation lifecycle		
Unit V	**Privacy Preservation and Cloud Security in IoT**	**8 hrs**
Introduction to web security, Privacy requirements, Threat analysis, Trust, Identity establishment, Access control, Message integrity, Cloud services and IoT, Cloud IoT security controls, IoT cloud security architecture, cloud enabled IoT computing		
Text Books		

1. Raj Kamal," Internet of Things: Architecture & design Principle", McGraw Hill Education 2017
2. Vijay MadCCAtti, ArshdeepBahga , "Internet of Things: A Hands-On- Approach " Second edition 2014, ISBN: 978 0996025515.

Reference Books

3. "Securing the Internet of Things", Shancang Li, Li Da Xu Syngress,Elsevier, 2017
4. "Security and Privacy in Internet of Things (IoTs)Models, Algorithms, and Implementations", Edited by Fei Hu, CRC Press, 2016

Rubrics for Continuous Evaluation

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Process Evaluation
Continuous Comprehensive Assessment (CCA)	Faculty	10	10	10	10	10	50	Refer CCA Guideline
End Semester Examination (ESE)	Institute	10	10	10	10	10	50	Each Unit Carries 10 marks Question

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3					3
CO2	3			3	2	3
CO3	3				3	3
CO4	3	2		3	3	3
CO5	3	3	3	3	3	3

3: High, 2: Moderate, 1: Low, 0: No Mapping

M Tech in Computer Engineering | FY M Tech Semester II

Course Code: CME2410P05 Course Title: Laboratory Practice II

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory % Marks			Practical % Marks	
					Max	Min for Pass		Max	Min for Pass
0	0	4	2	CCA	50	20	40	-	-
				ESE	50				
Total Hours									
0	0	52	Total: 52						

Prerequisites:

Course Objectives:

Deep Learning

- To use Convolutional neural network for recognition of image data
- Apply recurrent neural network algorithms for audio and video processing.

Computer Vision

- Hands-on programming with images using fundamental algorithms.
- Computer vision techniques to implement real-world applications

Network and Cyber Security

- To explain various attack Cybercrime and forensics
- To give an insights into To learn various vulnerabilities, threats and attacksNLP
- To comprehend the basic ideas and methods of natural language processing (NLP)
- To be familiar with various application of natural Language Processing.IoT

Security

- To introduce the IoT technology and IoT devices
- To introduce the implementation of IoT applications

Course Outcomes: After successful completion of the course the student will be able to

Course Type	CO	Course Outcome
PCC2	CO1	Apply Convolutional Neural Network approach for image processing.
	CO2	Use Recurrent Neural Network for speech data processing.
	CO3	Implement image reconstruction using autoencoders.
PEC 2 A	CO4	Design network security solutions
	CO5	Select appropriate tools to thwart network attacks
	CO6	Design network security solutions
PEC 2 B	CO4	Ability to apply image handling techniques
	CO5	Ability to apply edge detection techniques

	CO6	Apply knowledge of computer vision to real life applications
PEC 2 C	CO4	Implement and evaluate different word embedding techniques in NLP.
	CO5	Develop a semantic language processor that tags semantic content usingWordNet.
	CO6	Design and develop a comprehensive understanding on NLP transformers
PEC 2 D	CO4	Understand IoT software's and components
	CO5	Elaborate the need for Security in IoT.
	CO6	Design and analyze IoT security applications

Syllabus

	Introduction	
Laboratory Proficiency II (LP II) is companion course of theory courses (core and elective) in Semester II. It is recommended that given assignments of each course should be completed by the student. Course/ Laboratory instructor may modify the domain of mini project as per choice of students keeping similar complexity of work. Student has to submit a report/Journal in standard format approved by the Program Coordinator.		
	Guidelines for CCA	
Continuous assessment of laboratory work is done based on performance of student. Each assignment/ mini project assessment is to be done based on parameters with appropriateweightages as defined by the program coordinator.		
	Guidelines for ESE	
It is recommended that examination should be conducted as presentation by student based on one ofthe mini projects completed and the content understanding of laboratory work.		
	Suggested List of Assignments	
	A. PCC4: Deep Learning and Applications	
	Assignment 1 Implement Convolutional Neural Network for traffic sign recognition. **Assignment 2** Implement automatic speech recognition system using Recurrent NeuralNetwork **Assignment 3** Use Autoencoders to implement image/audio compression and reconstruction.	
	PEC 2 A: Network and Cyber Security	
	Assignment 1 Case Study: How To Detect And Prevent Black Hole Attack in Mobile AdHoc Network **Assignment 2** Consider a case study of cybercrime, where the attacker has performed onlinedebit card fraud. Prepare a report and also list the laws to be imposed on attacker **Assignment 3** Configure and demonstrate use of vulnerability assessment tool given below · Wireshark, · Tcpdump · SNORT	
	PEC 2 B: Computer Vision	
	Assignment 1	

	Write a program to perform global and local Thresholding on an input image **Assignment 2** Write a program to perform basic image processing for Edge Detection and LineDetection **Assignment 3** Implement mini project based on computer vision application
PEC 2 C: Natural Language Processing	
	Assignment 1 Implement word embedding approach on any document using i) one hot encoding ii) Bagof words(BOW) iii) TF-IDF. **Assignment 2** Implement a semantic language processor that uses WordNet for semantic tagging. **Assignment 3** Create a transformer architecture model from scratch using the Pytorch library
PEC 2 D: IoT Security	
	Assignment 1 Study the fundamentals of IoT software's and components **Assignment 2** Experiments using Raspberry Pi / Arduino: implement security system with the help ofPIR sensor, buzzer and keypad. **Assignment 3** Implement mini project on IoT network security using appropriate simulator

Rubrics for Continuous Evaluation

Component	**Level**	**Laboratory Practice II**	**Total**	**Passing**	**Process Evaluation**
Continuous Comprehensive Assessment (CCA)	Faculty	1. Dynamics & Vibrations 2. Design & Optimization	50	20	Refer CCA Guideline
ESE	Institute	3. Finite Element Techniques	50	20	External Oral Examination

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	3	3
CO2	3	3	3	3	3	3
CO3	3	3	3	3	3	3
CO4	3	3	3	3	3	3
CO5	3	3	3	3	3	3
CO6	3	3	3	3	3	3

3: High, 2: Moderate, 1: Low

M Tech in Computer Engineering | FY M Tech Semester II

Course Code: CME2410P06 Course Title: Advanced Computing Skill Development

Category: Credit Course

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory % Marks			Practical % Marks	
					Max	Min for Pass		Max	Min for Pass
0	0	4	2	CCA				100	40
Total Hours									
0	0	52	Total: 52						

Prerequisites:	
Course Objectives: Purposes of the course are	
➢ To enhance the abilities to do independent research and analyze complicated situations. ➢ To Nurture an attitude of lifelong learning and ability to adjust to changing demands of technology and the marketplace. ➢ To develop abilities through collaborative projects that involve interdisciplinary collaboration, planning, implementation, and peer reviews.	
Course Outcomes: After successful completion of the course the student will be able to	
CO1	Develop applications using Modern Tools on Recent Trends in IT Sector.
CO2	Conduct top-notch research and encourage advancements in both business and academia.

Guidelines
Skill Development as a Course focuses on enhancing students' practical abilities and competencies needed for professional success. The course includes hands-on training, workshops, and interactive sessions covering areas such as communication, problem-solving, teamwork, and technical skills relevant to specific industries. Students engage in real-world projects and activities that foster personal and professional growth. By the end of the course, participants are expected to have significantly improved their employability and readiness for the job market. Student should take up certification as per the requirement of IT industry to enhance their employability. Alternately online courses from industry partners having collaboration with the department can also be taken up. Certification and/or course selection by the student should be prior approved by guide. Students can undertake courses such as Python Developer, Python Data Scientist, Google Cyber Security Professional Certificate, and Certification in Computer Vision & ImageProcessing etc.

Rubrics for Continuous Evaluation

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Total	Passing	Process Evaluation
Continuous Comprehensive Assessment (CCA)	Faculty	25	25	25	25	100	40	Refer CCA Guideline

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	2	1	2	1	1
CO2	3	3	1	1	3	3

3: High 2: Moderate 1: Low

M Tech in Computer Engineering | FY M Tech Semester II

Course Code: CME2410P07 Course Title: Industry Based Mini Project

Category: Credit Course

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory % Marks			Practical % Marks	
					Max	Min for Pass		Max	Min for Pass
0	0	4	2	CCA				100	40
Total Hours									
0	0	52	Total: 52						

Prerequisites: NA	
Course Objectives: Purposes of the course are	
➢ To educate students for prospective roles in the technology sector by providing hands-on experienceand facilitating association with industry professionals. ➢ To provide practical experience in applying computer science concepts to real-world problems. ➢ To enhance problem-solving, project management, and teamwork skills.	
Course Outcomes: After successful completion of the course the student will be able to	
CO1	Develop innovative solutions to real world complex problems
CO2	Develop professional competencies, including ethics, leadership, and time management.

Guidelines
Industry Based Mini Project involves students working on real-world projects in collaboration with industry partners. This course provides practical experience, allowing students to apply theoretical knowledge to solve industry-specific problems. It includes regular mentoring sessions, project planning, execution, and final presentations. By the end of the course, students gain valuable insights into industry practices, enhance their technical and professional skills, and improve their employability. Students are expected to carry out software project implementation as an industry sponsored project, or an in-house development project in any domain of choice. Industry project through online internship approvedby internal guide is also permitted.

Rubrics for Continuous Evaluation

Component	Level	Industry Based Mini Project	Total	Passing	Process Evaluation
Continuous Comprehensive Assessment (CCA)	Faculty	Mini project Report	50	20	Refer CCA Guideline
ESE	Department	Mini project Presentation	50	20	Refer Guidelines

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	3	3	3	2
CO2	1	1	3	3	2	3

3: High, 2: Moderate, 1: Low

M Tech in Computer Engineering | FY M Tech Semester II

Course Code: NCC2410L01-ACourse Title: Stress Management by Yoga
Category: Non-Credit Course

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory % Marks			Practical % Marks	
					Max	Min for Pass		Max	Min for Pass
2	0	0	0	CCA	100	40	40	-	-
Total Hours									
26	0		Total:						

Prerequisites: Familiarity with Basic Yoga Practices, General Physical Fitness

Course Objective:

1. To provide students with a thorough understanding of stress, its causes, and its effectson mental and physical health.
2. To teach students various yoga practices, including asanas, pranayama, andmeditation, for stress management and overall well-being.
3. To enable students to incorporate the philosophical principles of yoga into their dailyroutines to enhance mental and physical well-being.

Course Outcomes: After successful completion of the course the student will be able to

CO1	Comprehend stress sources and yoga's role.
CO2	Demonstrate mastery in yoga techniques.
CO3	Apply yoga philosophy to stress management.
CO4	Incorporate yoga for long-term well-being.

Syllabus

Unit I	Introduction to Stress and Yoga	7 hrs
Understanding Stress: Types, causes, and impacts *Introduction to Yoga:* Definition, history, and paths (Raja, Karma, Bhakti, Jnana) *Connection between Stress and Yoga:* role of Yoga in stress reduction		
Unit II	**Yoga Practices for Stress Management**	**7 hrs**
Asanas (Postures): Basic stress-relieving asanas (e.g., Shavasana, Balasana)		

Pranayama (Breathing Techniques): Techniques like AnulomVilom, Bhramari, NadiShodhana *Meditation and Relaxation:* Mindfulness meditation, guided imagery, progressive relaxation		
Unit III	**Philosophical Foundations of Yoga**	**6 hrs**
Yoga Philosophy: Eight limbs of yoga *Mind-Body Connection:* Psychosomatic health in yoga *Lifestyle and Diet:* Yogic lifestyle, Sattvic diet		
Unit IV	**Applied Yoga for Stress Management**	**6 hrs**
Yoga Therapy: Personalized yoga routines for stress *Case Studies:* Real-life applications and analysis *Integrating Yoga into Daily Life:* Practical tips for daily practice		

Reference Books

Text Books

1. The Yoga Sutras of Patanjali, by Swami Satchidananda
2. Light on Yoga, by B.K.S. Iyengar
3. The Heart of Yoga, by T.K.V. Desikachar

Reference Books

Journals and Articles: International Journal of Yoga, Journal of Alternative and Complementary Medicine

Web References

Yoga Alliance

International Association of Yoga Therapists National Portal of India

Rubrics for Continuous Evaluation

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Total	Passing	Process Evaluation
Continuous Comprehensive Assessment (CCA)	Faculty	25	25	25	25	100	40	Refer CCA Guideline

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	2	3	1	2
CO2	2	2	2	3	2	3
CO3	2	1	2	2	3	3
CO4	2	3	3	2	2	2

3: High, 2: Moderate, 1: Low, 0: No Mapping

M Tech in Computer Engineering | SY M Tech Semester III

Course Code: CME2411P01, Course Title: Dissertation Phase I (Semester -III)

Category: Dissertation Phase

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory % Marks			Practical % Marks	
					Max	Min for Pass		Max	Min for Pass
0	0	8	4	CCA	-	-	-	100	40
0	0	104	Total: 104	ESE	-				

Prerequisites: Completion of all 4 semesters	
Course Objectives:	
To prepare the synopsis of the dissertation	
Course Outcome: After successful completion of the course the student will be able to	
CO1	Construct the Synopsis on the Dissertation topic considering Statement of Problem,Significance, Objective, Hypothesis and Methodology.
CO2	Demonstrate the Synopsis on the Dissertation topic with Classified Literature Review,Rationale, Research Question, Time Frame, Budget and References.

Syllabus

Unit I	Synopsis Submission	70 hrs

1. Introduction (1 Page): Provide a brief overview of the theories and models relevant toyour topic.
2. Literature Review (2-4 pages): Summarize relevant and related research in classifiedway
3. Statement of the Problem (1 Page): Identify research gaps based on the LiteratureReview and justify the conduct of the study
4. Significance/Rationale (1/2 Page): Explain the importance and contribution of thefindings
5. Objectives: List the objectives (min 4) (1/2 page)
6. Hypotheses/Research Questions: State your expectations from the dissertation (1/2 page)
7. Methodology: Specify whether the project is Experimental, Theoretical/MathematicalModelling, Survey based, or a combination, Design of Experiment (DoE), Describe the strategy and framework proposed, indicate if the approach is quantitative, qualitative, or mixed methods. (1 Page)
8. Time Frame of Dissertation: Provide timeline of the work

9. Budget: Provide Budget (if required)
10. List of References

Unit II	Submission of Synopsis and its Presentation	30hrs
Student is required to present his/her synopsis in front of Committee of the Department		

Rubrics for Continuous Evaluation

Rubrics for CCA (100)		
No	**Component**	**Marks**
1	Complete Submission of Synopsis in hard copy of 5 sets	70
2	Seminar presentation on Synopsis	30
	Total	100

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	2	3	2
CO2	3	3	3	2	3	2

M Tech in Computer Engineering | SY M Tech Semester III

Course Code: CME2411P02, Course Title: Dissertation Phase II (Semester -III)

Category: Dissertation Phase

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory % Marks			Practical % Marks	
					Max	Min for Pass		Max	Min for Pass
0	0	8	4	CCA	-	-	-	50	40
-	0	104	Total: 104	ESE	-			50	

Prerequisites: Submission of Synopsis	
Course Objectives:	
To present the dissertation work	
Course Outcome: After successful completion of the course the student will be able to	
CO1	Construct the Synopsis on the Dissertation topic considering Statement of Problem,Significance, Objective, Hypothesis and Methodology.
CO2	Demonstrate the Synopsis on the Dissertation topic with Classified Literature Review,Rationale, Research Question, Time Frame, Budget and References.

Syllabus

Unit I	Submission of Report	70 hrs

1. Introduction
2. Literature Review
3. Statement of the Problem
4. Significance/Rationale
5. Objectives
6. Hypotheses/Research Questions
7. Methodology
8. Results and Discussions
9. Summary of Objectives Completed (50 % should complete)
10. List of References

Unit II	Submission of Report and its Presentation	30 hrs

Student is required to present his/her work in front of Internal and External Committee of theDepartment

Rubrics for Continuous Evaluation

Component	Level		Total	Process Evaluation
Continuous Comprehensive Assessment (CCA)	Faculty	Complete Submission of Report in hard copy	50	Refer CCA Guideline
End Semester Examination (ESE)	Institute	Presentation on the work in front of Internal and External Committee appointed by Department	50	Each Unit Carry 10 marks Question

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	2	3	2
CO2	3	3	3	2	3	2

3: High, 2: Moderate, 1: Low, 0: No Mapping *********

M Tech in Computer Engineering | FY M Tech Semester I

Course Code: CME2409L4B Course Title: Soft Computing

Category: Open Elective Course

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max	Min marks for Pass		Max %	Min marks for Pass
3	1	0	4	CCA	50	20	40	-	-
Total Hours				ESE	50	20			
39	13	0	Total: 52			40			

Prerequisites: Machine learning

Course Objectives: Purposes of the courses are

- To understand the soft computing techniques and algorithms for problem solving
- To be familiar with the various application areas of soft computing
- To develop intelligent systems using the hybrid systems
- To explore and solve problems using genetic Algorithms
- To learn various Bio Inspired optimization Algorithm

Course Outcomes: After successful completion of the course units the student will

CO1: **Compare** soft and hard computing techniques to identify suitable computing technique to solve the problem.
CO2: **Implement** fuzzy algorithms for various operations in different domain such as e-Commerce, automotive, Home appliances, Structural analysis and Design etc.
CO3: D**esign** Artificial Neural Network for implementation of the solution to real life Problems.
CO4:**Apply** Genetic Algorithm to provide effective solutions with optimization for the problem
CO5: **Create** system with nature-inspired algorithms to provide optimal solution

Syllabus

Unit I	Introduction To Soft Computing	8 hrs
Introduction, historical Development of Soft Computing, characteristics of Soft Computing, Soft Computing Vs Hard Computing, major Areas of Soft Computing, Basic tools of Soft Computing, Applications of Soft Computing.		
Unit II	**Fuzzy Logic and Sets**	**10 hrs**
Introduction to Fuzzy Logic, Fuzzy Membership Functions, Fuzzy Sets and Operations, Properties of Fuzzy Sets, Fuzzy Relations, Fuzzy Propositions, Fuzzy Implications, Fuzzy Inferences, Fuzzy If-		

Then Rule, Fuzzy Algorithms, Fuzzification and Defuzzification, fuzzy computing problems. Fuzzy Logic Controller, Fuzzy rule base and approximate reasoning: truth values and tables in fuzzy logic, fuzzy rule-based system, Fuzzy Decision Making, Fuzzy expert system, case study on fuzzy reasoning.		
Unit III	**Neural Networks**	**7 hrs**
Neural Network Basics, Perceptron, Types of Activation Functions, Architecture of Neural Network, Unsupervised Learning Networks, Neuro-Fuzzy System, case study on neural network for the application		
Unit IV	**Genetic Algorithm**	**7 hrs**
An Introduction to Genetic Algorithms, Genetic Algorithm and Search Space, Operators in Generic Algorithm, Classification of Genetic Algorithm, Holland Classifier System, case study on genetic algorithm.		
Unit V	**Bio-Inspired Optimization Algorithms**	**7 hrs**
Biological Motivation, from natural to artificial, Swarm Intelligence, standard algorithm of Ant Colony Optimization, Particle Swarm Optimization, cuckoo search algorithm, bat algorithm		

Tutorial:

1. Design fuzzy sets and its basic operations **2 hrs**
2. Create application using Neural Network **2hrs**
3. Provide solution for real life problem using Genetic Algorithm **2 hrs**
4. Create optimization based application for any domain **2 hrs**
5. Mini Project – Hybrid system with optimization **5 hrs**

Text Books :

1. S.N. Sivanandam- “Principles of Soft Computing”, Wiley India- ISBN- 9788126527410
2. Timothy J. Ross, “Fuzzy Logic with Engineering Applications”, Wiley India, ISBN: 978-0- 470-74376-8

Reference Books :

1. Introduction to Artificial Neural Systems - J.M. Zurada, Jaico Publications 1994.
2. Fuzzy Social Choice Theory - Michael B. Gibilisco. Annie M. Gowen Karen E. Albert John N. Mordeson Mark J. Wierman. Terry D. Clark.
3. Russell C. Eberhart , Yuhui Shi , James Kennedy, “ Swarm Intelligence: The Morgan Kaufmann Series in Evolutionary Computation”, 1st Edition, ISBN-13: 978-1558605954

e-Contents :

1. NPTEL Course on Introduction to Soft Computing https://archive.nptel.ac.in/courses/106/105/106105173/
2. NPTEL Course on Introduction to Artificial Neural Networks
3. https://nptel.ac.in/courses/117105084
4. Swayam course on Evolutionary Computation for Single and Multi-Objective Optimization
5. https://onlinecourses.nptel.ac.in/noc21_me43/preview

Rubrics for Continuous Evaluation

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Process Evaluation
Continuous Comprehensive Assessment (CCA)	Faculty	10	10	10	10	10	50	Refer CCA Guideline
End Semester Examination (ESE)	Institute	10	10	10	10	10	50	Each Unit Carries 10 marks Question

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	1	2	2	2
CO2	2	2	2	3	2	3
CO3	3	3	3	3	3	3
CO4	3	2	2	3	3	3
CO5	2	3	2	3	3	3

3: High, 2: Moderate, 1: Low, 0: No Mapping

M Tech in Computer Engineering | SY M Tech Semester III

Course Code: CME2411L04, Course Title: On Job Training/Internship(Semester -III)

Category: OJT

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory %Marks			Practical %Marks	
					Max	Min for Pass		Max	Min for Pass
0	0	20	10	CCA	-	-	-	100	40
-	0	60	Total: 60	ESE	-			-	

Prerequisites: NIL	
Course Objectives:	
1. To Investigate Different Industries and Career Paths 2. To Develop a Professional Network 3. To Apply Academic Knowledge in a Professional Setting 4. To Enhance Time Management and Communication Skills 5. To Increase Employment Opportunities	
Course Outcome: After successful completion of the course the student will be able to	
CO1	Understand and Navigate Various Industries and Career Paths
CO2	Build and Utilize a Professional Network for Employability

Syllabus

Unit I	Internship	60hrs
The student is expected to complete an internship in an industry related to the PG program, working at least 6 hours a day for a minimum of 3 weeks. This internship should take place after the end of Semester II and before the commencement of Semester III, after the examinations. The evaluation will be carried out in Semester III. The student must submit a daily report electronically to his/her supervisor. At the end of the internship, the student will submit a comprehensive final report.		
Unit II	**Submission of Report on Internship**	**-hrs**
Student is required to submit report on internship work to his/her supervisor.		

Rubrics for Continuous Evaluation

Rubrics for CCA and ESE(100)		
No	**Component**	**Marks**
1	Progressive Weekly Assessment of Internship work (25 x 3 weeks)	75
2	Complete Submission of Internship Report in hardcopy	25

CO-PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	3	3	-	3	-
CO2	3	3	3	-	3	-

3:High,2:Moderate,1:Low,0:NoMapping

M Tech in Computer Engineering | SY M Tech Semester IV

Course Code: CME2412P01, Course Title: Dissertation Phase III (Semester -IV)

Category: Dissertation Phase

L	T	P	Cr	Exam	Theory % Marks			Practical % Marks	
					Max	Min for Pass		Max	Min for Pass
0	0	20	10	CCA	-	-	-	100	40
0	0	260	Total: 260	ESE	-				

Prerequisites: Completion of DP II	
Course Objectives:	
To prepare the report of the dissertation work	
Course Outcome: After successful completion of the course the student will be able to	
CO1	Construct the Progress Report on the Dissertation topic major focusing on Summary ofObjectives Completed and Findings with discussions.
CO2	Demonstrate the Progress Report on the Dissertation topic with major findings andtheir discussions.

Syllabus

Unit I	Submission of Progress Report	70 hrs

1. Introduction
2. Literature Review
3. Statement of the Problem
4. Significance/Rationale
5. Objectives
6. Hypotheses/Research Questions
7. Methodology
8. Results and Discussions
9. Summary of Objectives Completed (More than 75 % should complete)
10. List of References

Unit II	Submission of Progress Report and its Presentation	30 hrs

Student is required to present his/her synopsis in front of Committee of the Department

Rubrics for Continuous Evaluation

Component	Level	Dissertation Phase III	Total	Process Evaluation
Continuous Comprehensive Assessment (CCA)	Department	Submission of Report in hard copy and Presentation on Dissertation Work	100	Refer CCA Guidelines

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	2	3	2
CO2	3	3	3	2	3	2

3:High,2:Moderate,1:Low, 0:No Mapping

M Tech in Computer Engineering | SY M Tech Semester IV

Course Code: CME2412P01, Course Title: Dissertation Phase IV (Semester -IV)

Category: Dissertation Phase

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory %Marks			Practical %Marks	
					Max	Min for Pass		Max	Min For Pass
0	0	20	10	CCA	-	-	-	100	40
0	0	260	Total: 260	ESE	-				

Prerequisites: Completion of DPII	
Course Objectives:	
To prepare the report of the dissertation work	
Course Outcome: After successful completion of the course the student will be able to	
CO1	Construct the Progress Report on the Dissertation topic major focusing on Summary of Objectives Completed and Findings with discussions.
CO2	Demonstrate the Progress Report on the Dissertation topic with major findings and their discussions.

Syllabus

Unit I	Submission of Progress Report	70hrs

1. Introduction
2. Literature Review
3. Statement of the Problem
4. Significance/Rationale
5. Objectives
6. Hypotheses/Research Questions
7. Methodology
8. Results and Discussions
9. Summary of Objectives Completed (Morethan75%shouldcomplete)
10. List of References

Unit II	**Submission of Progress Report and its Presentation**	**30hrs**
Student is required to present his/her synopsis in front of Committee of the Department		

Rubrics for Continuous Evaluation

Component	**Level**	**Dissertation Phase IV**	**Total**	**Process Evaluation**
Continuous Comprehensive Assessment (CCA)	Faculty	Complete Submission of Final Report in hard copy (4 Sets)	50	Refer CCA Guidelines
ESE	Institute	Presentation on the final work in front of Internal and External Committee appointed by Department.	50	As per performances

CO-PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	3	3	2	3	2
CO2	3	3	3	2	3	2

3: High,2: Moderate,1: Low,0: No Mapping

INSTRUCTIONS FOR DISSERTATION WRITING

It is important that the procedures listed below be carefully followed by all the students of M. Tech.

1. Prepare Three Hard Bound Copies of your manuscript.
2. Limit your Dissertation report to 80 – 120 pages (preferably)
3. The footer must include the following:

Institute Name, M. Tech (Dept. Name) (Specialization) Times New Roman 10 pt. and centrally aligned.

4. Page number as second line of footer, Times New Roman 10 Pt, centrally aligned.
5. Print the manuscript using

a. Letter quality computer printing.

b. The main part of manuscript should be Times New Roman 12 pt. with alignment - justified.

c. Use 1.5 line spacing.

d. Entire report shall be of 5- 7 chapters. 6. Use the paper size **8.5'' × 11'' or A4 (210 × 197 mm).** Please follow the margins given below.

Margin Location	Paper 8.5'' × 11''	Paper A4 (210 × 197 mm)
Top	1"	25.4 mm
Left	1.5"	37 mm
Bottom	1.25"	32 mm
Right	1"	25.4 mm

7. All paragraphs will be 1.5 line spaced with a one blank line between each paragraph. Each paragraph will begin with without any indentation.
8. Section titles should be bold with 14 pt typed in all capital letters and should be left aligned.
9. Sub-Section headings should be aligning at the left with 12 pt, bold and Title Case (the first letter of each word is to be capitalized).
10. Illustrations (charts, drawings, photographs, figures) are to be in the text. Use only illustrations really pertinent to the text. Illustrations must be sharp, clear, **black and white. Illustrations downloaded from internet are not acceptable.**

a. Illustrations should not be more than two per page. One could be ideal

b. Figure No. and Title at bottom with **12 pt**

c. Legends below the title in 10 pt

d. Leave proper margin in all sides

e. Illustrations as far as possible should not be photo copied.

11. Photographs if any should of glossy prints
12. Please use SI system of units only.
13. Please number the pages on the front side, centrally below the footer
14. References should be either in order as they appear in the thesis or in alphabetical order by last name of first author
15. Symbols and notations if any should be included in nomenclature section only
16. Following will be the order of report

i. Cover page and Front page as per the specimen on separate sheet

ii. Certificate from the Institute as per the specimen on separate sheet

iii. Acknowledgements

iv. List of Figures

v. List of Tables

vi. Nomenclature

vii. Contents

viii. Abstract (A brief abstract of the report not more than 150 words. The heading of abstract i.e. word "Abstract" should be bold, Times New Roman, 12 pt and should be typed at the centre. The contents of abstract should be typed on new line without space between heading and contents. Try to include one or two

sentences each on motive, method, key-results and conclusions in Abstract
1 Introduction (2-3 pages) (TNR – 14 Bold)
1.1 Problem statement (TNR – 12)
1.2 Objectives
1.3 Scope
1.4 Methodology
1.5 Organization of Dissertation
2 Literature Review (20-30 pages) Discuss the work done so far by researchers in the domain area and their significant conclusions. No derivations, figures, tables, graphs are expected.
3 This chapter shall be based on your own simulation work (Analytical/ Numerical/FEM/CFD) (15- 20 pages)
4 Experimental Validation - This chapter shall be based on your own experimental work (15-20 pages)
5 Concluding Remarks and Scope for the Future Work (2-3 pages)
References
ANNEXURE (if any) (Put all mathematical derivations, Simulation program as Annexure)
17. All section headings and subheadings should be numbered. For sections use numbers 1, 2, 3, …. and for subheadings 1.1, 1.2, …. etc and section subheadings 2.1.1, 2.1.2, …. etc.
18. References should be given in the body of the text and well spread. No verbatim copy or excessive text from only one or two references. If figures and tables are taken from any reference then indicate source of it. Please follow the following procedure for references
Reference Books
Collier, G. J. and Thome, J. R., Convective boiling and condensation, 3rd ed., Oxford University Press, UK, 1996, pp. 110 – 112.
Papers from Journal or Transactions
Jung, D. S. and Radermacher, R., Transport properties and surface tension of pure and mixed refrigerants, ASHRAE Trans, 1991, 97 (1), pp. 90 – 98. Bansal, P. K., Rupasinghe, A. S. and Jain, A. S., An empirical correction for sizing capillary tubes, Int. Journal of Refrigeration, 1996, 19 (8), pp.497 – 505.
Papers from Conference Proceedings
Colbourne, D. and Ritter, T. J., Quantitative assessment of flammable refrigerants in room air conditioners, Proc. of the Sixteenth International Compressor Engineering Conference and Ninth International Refrigeration and Air Conditioning Conference, Purdue University, West Lafayette, Indiana, USA, 2002, pp. 34 – 40.
Reports, Handbooks etc.
United Nations Environmental Programme, Report of the Refrigeration, Air Conditioning and Heat Pumps, Technical Option Committee, 2002, Assessment - 2002.
Patent
Patent no, Country (in parenthesis), date of application, title, year.
Internet
www.(Site) [Give full length URL]

Continuous Comprehensive Assessment (CCA

1. Model/Software Making and Simulation

A. Methodology

1. Topic Selection:

- Students will choose a specific concept or unit related to the course syllabus (e.g., structural engineering, material properties, axial stresses, etc.).
- Alternatively, a topic can be assigned by the instructor that aligns with key learning outcomes.

2. Research and Design:

- Students conduct preliminary research to gather theoretical knowledge.
- Based on this, students will create a basic blueprint/design for the model. This could be a physical structure, mechanical unit, or software-based simulation.

3. Material Selection/Software Setup:

- Students decide the materials (for physical models) or tools/software (for simulations) to be used, focusing on availability and relevance to the topic.

4. Model Construction/Simulation Development:

- Students will begin the process of constructing the model or setting up the simulation.
- For physical models, ensure proper scaling and material handling.
- For simulations, set up parameters that mimic real-life scenarios, e.g., forces, stresses, or material behavior.

5. Testing and Refining:

- Once the model/simulation is created, it is tested under various conditions (e.g., stress or load application).
- Students must document any adjustments made during this process, justifying why those changes were necessary.

6. Presentation:

- Students present their model or simulation to the class/instructor.
- The presentation should include an explanation of the design, challenges faced, solutions implemented, and the expected real-world application.

7. Report Submission:

- A brief written report detailing the steps taken, design rationale, and results of the testing must be submitted alongside the model.

B. Benefits of Model Making Simulation

1. **Hands-On Learning:**

- Encourages practical understanding of theoretical concepts.
- Bridges the gap between abstract ideas and real-world application.

2. **Critical Thinking & Problem-Solving:**

   - Students learn to troubleshoot issues in design, materials, or simulation setups.

3. **Teamwork and Collaboration:**

   - In group settings, this fosters communication and collaboration among students.

4. **Creativity and Innovation:**

   - Allows students to experiment with new designs, innovative solutions, and modern tools/software.

5. **Enhances Presentation and Communication Skills:**

   - Presenting the model improves verbal and non-verbal communication abilities, essential for professional development.

C. Rubrics (10 Marks)

Criteria	Weightage	Description
Understanding of Concept	3 Marks	Evaluate how well the model/simulation reflects the understanding of the unit/topic. Did the student demonstrate correct theoretical application?
Design and Creativity	2 Marks	Assess the innovation in design and problem-solving. Did the student show creativity and thoughtfulness in the approach?
Functionality & Accuracy	2 Marks	Review if the model/simulation performs the desired function effectively. Is it accurate, realistic, and aligned with real-world scenarios?
Presentation & Explanation	2 Marks	Assess the clarity, depth, and engagement of the presentation. How well did the student explain their design and the rationale behind it?
Report Submission	1 Mark	Evaluate the quality and thoroughness of the report. Does it clearly document the steps, challenges, and results of the simulation/model?

2. Poster Presentation

A. Methodology

1. Topic Selection:

- Students select a topic or unit relevant to the course, focusing on core concepts such as materials, stresses, or structural analysis.
- Alternatively, the instructor assigns topics to ensure coverage of essential learning outcomes.

2. Research and Planning:

- Students conduct in-depth research on the chosen topic to gather theoretical and practical knowledge.
- They outline key points, data, and visuals they intend to use in the poster. This stage includes planning the structure of the poster to ensure clarity and organization.

3. Poster Design:

- Using design tools (e.g., PowerPoint, Canva, or manual drawing), students design the poster.
- The poster should include key sections like Introduction, Core Concepts, Visual Aids (graphs, images, charts), and Conclusion. It should be visually engaging while also being informative.

4. Poster Construction:

- Students create the final version of the poster by assembling researched information, adding visuals, and organizing content logically.
- Attention should be paid to font size, color schemes, and layout to ensure clarity and readability from a distance.

5. Presentation Preparation:

- Students prepare a short verbal explanation (3-5 minutes) to accompany the poster during the presentation.
- The explanation should cover the main points of the poster and address questions from the audience.

6. Presentation:

- Students display their posters in a gallery-style format or individually present them to the instructor and peers.
- During the presentation, students explain the content, highlight important findings, and answer any questions raised by the audience.

7. Report Submission (Optional):

- Students may submit a brief report outlining the methodology followed and the rationale for choosing specific content and design elements.

B. Benefits of Poster Presentation

1. **Visual Learning:**
   - Students learn to condense complex information into clear, digestible visual formats, reinforcing understanding of the topic.
2. **Critical Thinking & Synthesis:**
   - Condensing research into a poster requires students to critically evaluate what is most essential and how to present it effectively.
3. **Communication Skills:**
   - Presenting the poster helps students improve their ability to explain concepts clearly and concisely, enhancing both verbal and non-verbal communication skills.
4. **Creativity and Design Thinking:**
   - Students get an opportunity to apply creativity in the design process, making learning more engaging and multidimensional.
5. **Engagement and Peer Learning:**
   - Gallery-style presentations encourage interaction among peers, facilitating knowledge exchange and feedback.

Rubrics (10 Marks)

Criteria	Weightage	Description
Understanding of Concept	3 Marks	Assess how well the student has understood the key concept of the unit and whether it is correctly reflected in the poster.

Criteria	Weightage	Description
Design and Visual Appeal	2 Marks	Evaluate the creativity and effectiveness of the poster's design, including layout, clarity, and the use of visual aids.
Content Organization	2 Marks	Review the logical flow of information and how well the poster communicates the main idea. Are the points easy to follow?
Presentation & Explanation	2 Marks	Assess the student's ability to clearly explain the poster content during the presentation, along with their engagement with the audience.
Innovation and Creativity	1 Mark	Evaluate the originality of the approach, whether in content presentation or poster design.

3. Group Discussion

A. Methodology

1. Topic Selection:

- The instructor selects a unit-related topic or assigns different topics to groups that are relevant to the course objectives.
- Topics should encourage critical thinking and promote different viewpoints.

2. Group Formation:

- Students are divided into small groups of 4-6 members. Each group is assigned a specific topic for discussion.
- Within the group, students assign roles such as a moderator (optional) to guide the discussion.

3. Preparation:

- Each group is given time to research their topic, gather arguments, facts, and examples.
- Students collaborate to outline their key points and assign different aspects of the discussion to individual members for thorough coverage.

4. Discussion Execution:

- Groups participate in the discussion, presenting their viewpoints, rebuttals, and solutions.
- Discussions are guided by a set of questions or prompts provided by the instructor, and all students are encouraged to participate actively.
- Students listen attentively to their peers and respond constructively, ensuring a balanced and respectful debate.

5. Moderation (Optional):

- The discussion can be moderated by the instructor to ensure equal participation and to intervene if necessary to keep the conversation on track.

6. Conclusion and Summarization:

- At the end of the group discussion, one member from each group summarizes their group's points and findings.
- A collective reflection or feedback session can be organized where students share what they have learned from the discussion.

7. Peer and Self-Assessment:

- Groups can participate in a peer-review process where students assess the contribution of other group members.
- A self-assessment can also be included to reflect on individual participation and learning outcomes.

B. Benefits of Group Discussion

1. **Enhances Critical Thinking:**
   - Group discussions encourage students to think deeply about their topics, consider different perspectives, and form logical arguments.
2. **Develops Communication Skills:**
   - Students practice articulating their ideas clearly and concisely while also learning to listen and respond to others' views.
3. **Fosters Collaboration:**
   - Group discussions require teamwork, promoting a collaborative learning environment where students learn from each other.
4. **Encourages Active Learning:**
   - Students take ownership of their learning by engaging with course material in a more interactive and dynamic way.
5. **Builds Confidence:**
   - Participating in group discussions helps students develop confidence in public speaking and defending their viewpoints.

C. Rubrics (10 Marks)

Criteria	Weightage	Description
Understanding of Topic	3 Marks	Assess how well the student has understood the topic and contributes meaningfully to the discussion with relevant points.
Quality of Arguments	2 Marks	Evaluate the depth and logic of the arguments presented by the student, including the use of examples, data, or reasoning to support their viewpoint.
Active Participation	2 Marks	Review the student's level of engagement during the discussion, including their willingness to contribute and interact with peers.
Listening and Response	2 Marks	Assess the student's ability to listen to others' arguments and provide thoughtful, respectful responses, including rebuttals and counterarguments.
Collaboration & Teamwork	1 Mark	Evaluate how well the student collaborates with the group, respects others' opinions, and helps facilitate a constructive discussion.

4. Article/Literature Review

A. Methodology

1. Topic Selection:

- Students are either assigned a specific unit-related topic or select one that aligns with the key concepts of the course.
- The topic should have sufficient academic or research material available for review.

2. Research and Material Collection:

- Students gather information from credible sources such as academic journals, books, conference papers, and reports.
- Students are encouraged to use resources like SCOPUS, Web of Science, Google Scholar, and library databases to find peer-reviewed articles.

3. Analysis of Literature:

- Students critically evaluate the gathered material, identifying key arguments, methodologies, findings, and gaps in the existing literature.
- The review should cover a range of perspectives on the topic, ensuring that it is not biased or one-sided.

4. Structuring the Review:

- **Introduction**: Define the scope of the review and outline the research question or focus.
- **Main Body**: Summarize the literature, organizing it by themes, methodologies, or chronological order. Discuss key contributions and contrasting views.
- **Analysis and Discussion**: Compare and critique the various perspectives. Identify trends, gaps, and opportunities for further research.
- **Conclusion**: Summarize the findings and propose possible future research directions.

5. Writing the Review:

- Students write the review, maintaining academic integrity, clarity, and proper citation practices (e.g., APA, MLA, or Chicago style).
- Ensure that the language is formal, objective, and devoid of personal bias.

6. Peer Review (Optional):

- Students can exchange reviews with their peers for constructive feedback on content, structure, and clarity before submission.

7. Final Submission:

- Students submit the final review with proper formatting, citations, and a bibliography.

B. Benefits of Article/Literature Review

1. **In-Depth Understanding:**
   - Students gain a deep understanding of the topic by reviewing a variety of scholarly perspectives, methodologies, and findings.
2. **Research Skills Development:**
   - Students learn how to find, analyze, and synthesize information from credible academic sources, honing their research capabilities.
3. **Critical Thinking:**
   - Literature reviews encourage students to critically evaluate the strength of arguments, identify biases, and analyze methodologies in the existing research.
4. **Academic Writing Skills:**
   - Writing a literature review helps students develop skills in structuring academic papers, citing sources, and presenting arguments in a coherent and scholarly manner.
5. **Identifying Gaps in Knowledge:**
   - By reviewing existing literature, students can identify gaps in current knowledge, which could lead to new research questions or projects.

C. Rubrics (10 Marks)

Criteria	Weightage	Description
Comprehensiveness of Review	3 Marks	Evaluate the depth of the literature review, including the variety of sources used and the coverage of different perspectives.
Critical Analysis	3 Marks	Assess the student's ability to critically analyze the literature, compare viewpoints, identify trends, and highlight gaps or contradictions in the research.
Organization and Structure	2 Marks	Review the clarity and logical flow of the review, including proper sectioning (introduction, body, conclusion) and adherence to academic writing conventions.
Use of Sources & Citations	1 Mark	Evaluate the quality and relevance of the sources used, as well as the accuracy of citations and bibliography.
Clarity and Writing Quality	1 Mark	Assess the clarity, coherence, and academic tone of the writing, ensuring it is free from grammatical and typographical errors.

5. Survey based Learning

A. Methodology

1. Topic Selection:

- Students choose or are assigned a topic relevant to the unit. The topic should be something that can be explored by gathering opinions, feedback, or data from a target population (e.g., understanding student perceptions of specific materials or techniques in construction).

2. Objective and Research Questions:

- Clearly define the objective of the survey. What do you aim to learn from conducting the survey? Identify specific research questions that the survey will address.

3. Survey Design:

- **Question Development**: Create questions that are clear, concise, and relevant to the topic. Use a mix of question types: multiple-choice, Likert scale, and open-ended questions to capture both quantitative and qualitative data.
- **Pilot Testing**: Test the survey with a small group to ensure that the questions are understandable and generate useful responses.

4. Target Population:

- Identify the demographic or group that will participate in the survey. Ensure the group is relevant to the unit being studied (e.g., students, professionals in the field, or peers).

5. Data Collection:

- Administer the survey using appropriate methods: paper-based, online forms (Google Forms, SurveyMonkey), or interviews. Ensure the data collection period is sufficient to gather a representative sample.
- Ensure ethical practices are followed, including anonymity and voluntary participation.

6. Data Analysis:

- Once data is collected, students analyze it to identify trends, patterns, and key findings.
- Use statistical tools for quantitative data (e.g., percentages, averages) and thematic analysis for qualitative responses.

7. Report Preparation:

- Students write a report summarizing their findings. The report should include the survey objective, methodology, key results, discussion, and conclusions based on the data collected.
- Visual aids such as graphs, pie charts, or tables can be used to present the findings clearly.

8. Presentation of Results (Optional):

- Students may present their findings in class, explaining the methodology, survey outcomes, and any insights or recommendations derived from the survey.

B. Benefits of Conducting a Survey

1. **Data Collection Skills:**
   - Conducting a survey teaches students how to gather data in a structured manner, improving their research abilities.
2. **Critical Analysis:**
   - Students learn to critically analyze and interpret survey results, distinguishing between significant trends and outliers.
3. **Engagement with Real-world Data:**
   - Surveys allow students to engage with real-world opinions and data, giving them practical insights that supplement theoretical knowledge.
4. **Improvement of Communication:**
   - Survey design and report writing enhance students' ability to ask clear questions and present data effectively, improving both written and verbal communication skills.
5. **Problem Solving:**
   - Analyzing survey results encourages students to think critically about the data, solving problems or identifying gaps based on evidence collected.

C. Rubrics (10 Marks)

Criteria	Weightage	Description
Survey Design and Questioning	3 Marks	Evaluate the quality of the survey design, clarity of the questions, relevance to the unit, and the variety of question types used.
Data Collection & Analysis	3 Marks	Assess the effectiveness of the data collection process and the depth of the data analysis, including identifying trends and key insights from the results.
Presentation of Results	2 Marks	Review how well the data is presented, including the use of visual aids (charts, graphs), and the clarity of the results summary in the report.
Clarity and Structure of Report	1 Mark	Evaluate the organization of the report, ensuring it follows a logical structure with clear objectives, methodology, findings, and conclusions.
Creativity and Originality	1 Mark	Consider the creativity and originality of the survey topic, design, and interpretation of the data, as well as how effectively students connected it to the course.

6. Assignment

A. Methodology

1. Topic Selection:

- The instructor assigns or allows students to choose a topic relevant to the unit being studied. The topic should cover core concepts, theories, or applications (e.g., structural analysis, material properties, or design methods in civil engineering).
- The topic should encourage critical thinking and align with the learning objectives of the unit.

2. Research and Preparation:

- Students conduct research using textbooks, academic papers, lecture notes, and credible online resources.
- They collect information on the topic, organize key points, and begin outlining their assignment. Students should focus on both theoretical and practical aspects, where applicable.

3. Assignment Structure:

- **Introduction**: Briefly introduce the topic and outline the scope of the assignment.
- **Main Body**: Present a detailed explanation of the key concepts, methodologies, or findings related to the unit topic. Use relevant examples, case studies, or diagrams to support the arguments.
- **Conclusion**: Summarize the findings, restate the importance of the topic, and propose future directions for study or application.

4. Writing the Assignment:

- Students write the assignment, ensuring clarity, coherence, and logical flow of ideas. Citations should be used where appropriate to reference sources.
- The length and depth of the assignment should reflect the importance of the topic and be proportional to the allocated marks (e.g., 800-1000 words for a 10-mark assignment).

5. Submission:

- Assignments are submitted on the due date in the required format (e.g., typed, printed, or uploaded on an LMS platform).
- Proper formatting (e.g., font size, margins, and citation style) should be followed as per the instructor's guidelines.

6. Optional Peer Review:

- If time permits, students can engage in peer reviews before submitting their final draft. This allows them to receive feedback on content clarity, structure, and completeness.

B. Benefits of Assignment

1. **Deep Learning:**
    - Assignments encourage students to engage deeply with the unit's subject matter, leading to a better understanding of concepts and theories.
2. **Research Skills Development:**
    - Students develop essential research skills by exploring various sources and identifying the most relevant information for their assignment.
3. **Critical Thinking:**
    - Assignments help students analyze and evaluate information, enhancing their critical thinking and problem-solving abilities.
4. **Time Management:**
    - Completing assignments within a set deadline teaches students how to manage their time effectively.

5. **Academic Writing Skills:**
    - Students improve their ability to communicate ideas in written form, develop structured arguments, and use proper citation methods.
6. **Application of Knowledge:**
    - Assignments provide an opportunity to apply theoretical knowledge to real-world examples, improving students' ability to connect theory with practice.

C. Rubrics (10 Marks)

Criteria	Weightage	Description
Understanding of Concepts	4 Marks	Evaluate how well the student has understood the core concepts of the unit and how effectively they have been explained in the assignment.
Depth of Research	2 Marks	Assess the quality and depth of research, including the variety of sources used and the relevance of examples or case studies provided.
Clarity and Organization	2 Marks	Review the clarity of the writing and logical organization of the assignment, including the structure (introduction, body, conclusion) and the flow of ideas.
Presentation and Formatting	1 Mark	Evaluate the presentation of the assignment, including adherence to formatting guidelines, citation style, and overall neatness and readability.
Originality and Creativity	1 Mark	Assess the originality of the content and creativity in presenting ideas or applying theoretical knowledge to practical examples.

7. Open Book Test

A. Methodology

1. Topic and Scope Definition:

- The instructor selects topics for the open book test that align with the learning outcomes of the unit. Questions should test students' understanding of concepts, their ability to apply knowledge, and their critical thinking skills rather than rote memorization.

2. Test Design:

- **Question Types**: The test should include a mix of question types, such as short answer questions, problem-solving exercises, and case study-based questions. Open-ended questions can be used to evaluate the application of concepts in real-world situations.
- **Level of Difficulty**: Questions should be challenging, requiring students to analyze, evaluate, and synthesize information rather than simply look up facts. The test should encourage students to engage with the material meaningfully.

3. Guidelines for Students:

- Students are allowed to use textbooks, notes, and other reference materials during the test. However, they must rely on their understanding and application of the material.
- Clear instructions regarding time limits, allowed materials, and expectations for citing sources (if needed) should be provided.

4. Test Execution:

- The test can be conducted in a classroom or online environment with a fixed time limit (e.g., 60 minutes).

- Instructors should ensure that students understand that simply copying information from their books will not earn high marks; instead, they must demonstrate comprehension and analysis.

5. Answer Submission:

- Students submit their answers in the required format (e.g., written answers or online submission) by the end of the test period.

6. Post-Test Review (Optional):

- After the test, the instructor may conduct a review session where they discuss common errors, exemplary answers, and any learning gaps.

B. Benefits of Open Book Test

1. **Reduces Memorization Pressure:**
   - Students are not required to memorize information, allowing them to focus on understanding and applying knowledge.
2. **Encourages Critical Thinking:**
   - Open book tests challenge students to think critically, analyze problems, and apply concepts, fostering higher-order cognitive skills.
3. **Prepares Students for Real-World Situations:**
   - In real-world scenarios, professionals often refer to resources and apply their knowledge to solve problems. Open book tests simulate this experience.
4. **Promotes Effective Study Habits:**
   - Students learn how to effectively use resources to find information and enhance their understanding, improving research skills.
5. **Reduces Test Anxiety:**
   - The open book format can reduce stress, making it easier for students to focus on problem-solving rather than recall.
6. **Encourages Deeper Understanding:**
   - Students are more likely to study material deeply since they need to understand it to apply it correctly during the test.

C. Rubrics for Open Book Test (10 Marks)

Criteria	Weightage	Description
Understanding of Concepts	4 Marks	Evaluate how well the student demonstrates a deep understanding of the key concepts, theories, or principles related to the unit.
Application of Knowledge	3 Marks	Assess the student's ability to apply theoretical knowledge to practical situations or problems. Responses should demonstrate thoughtful application of concepts.
Critical Thinking and Analysis	2 Marks	Review the student's ability to analyze information, evaluate alternatives, or provide a reasoned argument based on the material referenced during the test.
Use of Resources	1 Mark	Evaluate how effectively the student uses their notes, textbooks, and other resources during the test. Answers should reflect intelligent reference to material, not just copying.

8. Oral/Viva Voce Examination

A. Methodology

1. Topic Coverage:

- The instructor selects questions that align with key concepts from the unit. These questions can range from basic understanding to in-depth application and analysis of topics covered in the syllabus.
- The questions should test a student's comprehension, ability to explain concepts, and apply theoretical knowledge to practical problems.

2. Structure of the Examination:

- **Question Design**: The instructor prepares a set of questions that may include factual questions, conceptual queries, problem-solving scenarios, and case studies. Questions should encourage students to explain concepts in their own words.
- **Time Allocation**: Each student is given a set amount of time (e.g., 10-15 minutes) to answer the questions. The number of questions depends on the time available and the complexity of the topics.
- **Follow-up Questions**: Based on the student's answers, the examiner can ask follow-up questions to probe deeper into their understanding or clarify their thought process.

3. Examination Procedure:

- The oral examination is conducted individually. The instructor or a panel of examiners asks questions, and students answer them verbally.
- Students should be allowed time to think and structure their responses. They can refer to notes or reference materials if permitted by the examiner.

4. Assessment Criteria:

- The examination should assess the student's knowledge, clarity of thought, communication skills, and ability to justify or explain their answers logically.

5. Feedback (Optional):

- After the examination, students can receive feedback on their performance, highlighting areas of strength and those needing improvement.

B. Benefits of Oral/Viva Voce Examination

1. **Assessment of Conceptual Understanding:**
   - Oral exams are an excellent way to assess a student's deep understanding of concepts. They require the student to explain ideas clearly and concisely.
2. **Improves Communication Skills:**
   - By responding to questions verbally, students enhance their communication skills, including the ability to express complex ideas succinctly.
3. **Encourages Spontaneous Thinking:**
   - Oral exams test students' ability to think on their feet, respond to unexpected questions, and explain concepts without relying on pre-written answers.
4. **Identifies Gaps in Learning:**
   - Oral exams allow examiners to ask follow-up questions to clarify misunderstandings or probe deeper into the student's comprehension of the material.
5. **Reduces Dependence on Written Tests:**
   - Not all students excel in written exams. Oral exams provide an alternative mode of assessment, beneficial for those with stronger verbal communication skills.
6. **Interactive and Dynamic Assessment:**

- Unlike written exams, oral exams are interactive and allow for a dialogue between the examiner and the student, making it a dynamic form of assessment.

C. Rubrics (10 Marks)

Criteria	Weightage	Description
Knowledge and Understanding	4 Marks	Evaluate the depth of the student's knowledge on the unit topics, including their ability to explain core concepts, principles, and theories.
Clarity of Explanation	2 Marks	Assess the student's ability to explain concepts in a clear, organized, and concise manner. Responses should be coherent and logically structured.
Application of Knowledge	2 Marks	Review how well the student can apply theoretical concepts to practical scenarios or real-world examples. Responses should demonstrate critical thinking.
Confidence and Communication	1 Mark	Evaluate the student's confidence in answering questions, their ability to articulate responses clearly, and maintain a positive, calm demeanor.
Problem-Solving and Critical Thinking	1 Mark	Assess the student's ability to solve problems or reason through complex issues during the exam, including responding to follow-up questions effectively.

9 Quiz/MCQ

A. Methodology

1. Topic and Content Coverage:

- The instructor selects multiple-choice questions (MCQs) that cover the key concepts, theories, and applications from the unit. Questions should be designed to assess both basic understanding and higher-order thinking skills such as analysis and application.
- The quiz should include questions from different sections of the unit to ensure a comprehensive assessment of the material.

2. Question Design:

- **Question Types**: The quiz should consist of a balanced mix of fact-based questions (recall), concept-based questions (understanding), and application-based questions (problem-solving).
- **Distractors**: Each question should have 3-5 answer choices, including distractors (incorrect options) that are plausible, requiring students to carefully consider their answers.
- **Difficulty Level**: Include a range of easy, moderate, and difficult questions to differentiate between levels of student understanding.

3. Quiz Format:

- **Number of Questions**: Typically, 10-15 MCQs for a 10-mark quiz is appropriate, depending on the time allotted.
- **Time Limit**: The quiz should be time-bound, ensuring that students must think quickly and demonstrate mastery of the material within a set period (e.g., 15-20 minutes).

4. Test Administration:

- The quiz can be conducted in-class on paper or online using a learning management system (LMS) that automatically grades the MCQs.

- Instructions should be clearly communicated, including how much time is allotted, how to mark answers, and whether there is negative marking for incorrect answers (if applicable).

5. Post-Quiz Review (Optional):

- After the quiz, instructors may review the correct answers with students, explain tricky questions, and clarify any areas of confusion.

B. Benefits of Quiz MCQ Examination

1. **Efficient Assessment:**
   - MCQs allow instructors to quickly assess student understanding of a wide range of topics within a short time frame.
2. **Objective Grading:**
   - MCQs provide an objective way to grade, reducing the potential for bias, and making scoring quick and straightforward.
3. **Broad Coverage:**
   - A well-designed MCQ quiz can cover a broad range of topics, ensuring that students are tested on various parts of the unit.
4. **Encourages Focused Study:**
   - Students prepare for MCQs by studying the key concepts and important details, encouraging them to focus on understanding core material.
5. **Immediate Feedback (in online tests):**
   - In an online format, students can receive immediate feedback on their performance, which helps reinforce learning and identify gaps in knowledge.
6. **Test-Taking Skills:**
   - MCQ quizzes help students develop test-taking strategies, such as eliminating wrong options and managing time effectively during exams.

10. Problem-Based Learning (PBL)

A. Methodology

1. Problem Design:

- The instructor designs a real-world, complex problem or case relevant to the unit's topics. The problem should be open-ended, requiring students to engage deeply with the unit's key concepts and apply their knowledge.
- The problem could be related to the application of theoretical knowledge to practical challenges in civil engineering, structural analysis, materials science, etc.

2. Group Formation:

- Students are divided into small groups (3-5 members), encouraging collaboration. Each group works together to analyze the problem, discuss potential solutions, and divide tasks based on individual strengths.

3. Research and Inquiry:

- Students conduct research, using textbooks, academic papers, and other credible sources to gather information on the problem. This process encourages students to ask questions, hypothesize, and explore different approaches.
- They must apply unit concepts, such as stress analysis, material properties, or construction methods, to propose viable solutions.

4. Problem Solving:

- The group collaborates to develop a solution to the problem. They must present logical, well-structured arguments and provide evidence to support their proposed solution.
- Solutions should be grounded in the theory learned during the unit but also involve critical thinking and innovation.

5. Presentation and Discussion:

- Each group presents their solution to the instructor and peers, using visual aids (e.g., PowerPoint, charts) or detailed reports.
- A Q&A session follows, where the group defends their solution and explains their decision-making process. Other students can ask questions, offering a peer-evaluation aspect.

6. Evaluation and Feedback:

- The instructor evaluates each group based on the quality of the solution, the application of unit concepts, teamwork, and presentation skills.
- Feedback is provided, highlighting strengths and areas for improvement. Peer evaluation can also be incorporated as part of the final grade.

B. Benefits of Problem-Based Learning (PBL)

1. **Deep Learning:**
   - PBL fosters a deep understanding of subject matter as students engage with real-world problems that require applying theoretical knowledge.
2. **Development of Critical Thinking:**
   - Students improve their critical thinking, problem-solving, and decision-making skills by tackling open-ended problems and exploring various solutions.
3. **Improves Collaboration and Teamwork:**
   - PBL encourages teamwork, helping students develop collaboration and communication skills. They learn to work effectively in groups, share responsibilities, and build on each other's ideas.
4. **Encourages Self-Directed Learning:**
   - Students take responsibility for their learning as they research the problem, identify knowledge gaps, and actively seek solutions.
5. **Enhances Problem-Solving Skills:**
   - By working on practical, real-world problems, students enhance their ability to think critically and creatively, applying unit concepts to solve complex issues.
6. **Increased Engagement:**
   - PBL makes learning more engaging and interactive, helping students see the relevance of their studies to real-world challenges in their field of interest.

Rubrics for Problem-Based Learning (10 Marks)

Criteria	Weightage	Description
Understanding of Concepts	3 Marks	Evaluate how well students understand and apply unit concepts to the problem. This includes the accuracy and depth of their theoretical knowledge.
Quality of Solution	3 Marks	Assess the feasibility, creativity, and effectiveness of the proposed solution. The solution should be logical, innovative, and well-supported by evidence.
Collaboration and Teamwork	2 Marks	Review how effectively the group worked together, divided tasks, and communicated ideas. Consider each member's contribution to the overall project.

Criteria	Weightage	Description
Presentation and Communication	1 Mark	Evaluate the clarity, organization, and persuasiveness of the group's presentation. This includes the use of visual aids and the ability to defend their solution.
Problem-Solving Process	1 Mark	Assess how well the group engaged with the problem-solving process, including research, analysis, and the critical evaluation of different solutions.

11. Experiential Learning

A. Methodology

1. Learning Objectives and Activity Design:

- **Identify Objectives**: The instructor clearly defines learning objectives that align with the unit's key concepts and goals. These could be understanding core theories, practical applications, or developing professional skills.
- **Design Experiential Activities**: Activities are designed to provide students with hands-on, real-world experiences. This could include fieldwork, laboratory experiments, industry visits, simulations, or project-based work. For example, in civil engineering, students might visit a construction site or work on a structural analysis project using real data.
- **Connect to Theory**: Ensure that activities are closely tied to theoretical knowledge taught in the unit, providing opportunities for students to apply concepts in practical settings.

2. Execution of the Activity:

- **Preparation**: Before starting the experiential learning activity, the instructor provides background information, instructions, and expectations. Students should understand how the activity links to the unit's learning outcomes.
- **Engagement**: Students actively participate in the learning activity, applying their knowledge in real-world or simulated environments. This may involve conducting experiments, gathering data, observing professional practices, or solving problems in a practical context.
- **Reflection**: After the activity, students reflect on their experiences. They analyze how theoretical concepts were applied in practice, what challenges they encountered, and what they learned from the process.
- **Documentation**: Students submit a report or presentation that documents the experiential learning activity. They must explain the process, the outcomes, and how they applied unit concepts to real-life scenarios.

3. Group or Individual Work:

- Experiential learning activities can be done individually or in groups, depending on the nature of the activity. Group work encourages collaboration and teamwork, while individual work ensures personal accountability and deep reflection.

4. Feedback and Assessment:

- The instructor provides feedback based on students' reports, presentations, and reflections. This feedback helps students understand their performance and encourages further learning.

B. Benefits of Experiential Learning

1. **Practical Application of Knowledge:**

- Students have the opportunity to apply theoretical concepts to real-world situations, helping them understand how abstract ideas work in practice.

2. **Enhanced Engagement:**
   - Experiential learning is highly engaging, making the learning process more dynamic and motivating students to take an active role in their education.
3. **Development of Critical Skills:**
   - Experiential learning fosters skills such as problem-solving, critical thinking, collaboration, and communication, which are essential for professional success.
4. **Bridges the Gap Between Theory and Practice:**
   - Students gain a clearer understanding of how academic knowledge translates to professional environments, helping them prepare for future careers.
5. **Reflection and Deep Learning:**
   - The reflection process allows students to think critically about their experiences, deepening their understanding of the unit's concepts.
6. **Personal and Professional Growth:**
   - Experiential learning promotes personal growth by challenging students to take initiative, manage projects, and work through real-world challenges.

C. Rubrics (10 Marks)

Criteria	Weightage	Description
Application of Theoretical Concepts	4 Marks	Evaluate how well students apply the theoretical knowledge from the unit to practical, real-world situations. This includes accurate and thoughtful use of concepts.
Engagement in the Activity	2 Marks	Assess the level of active participation, enthusiasm, and initiative taken by the student or group during the experiential activity.
Reflection and Analysis	2 Marks	Review the quality of the student's reflection on their experience. Students should demonstrate critical thinking, analysis of challenges, and lessons learned.
Presentation or Documentation	1 Mark	Evaluate the clarity, organization, and professionalism of the student's report or presentation. This includes explaining the activity, outcomes, and conclusions.
Problem-Solving and Adaptability	1 Mark	Assess how well the student navigated challenges or unexpected outcomes during the experiential activity and their ability to adapt to real-world constraints.