Pimpri Chinchwad Education Trust's

PIMPRI CHINCHWAD COLLEGE OF ENGINEERING

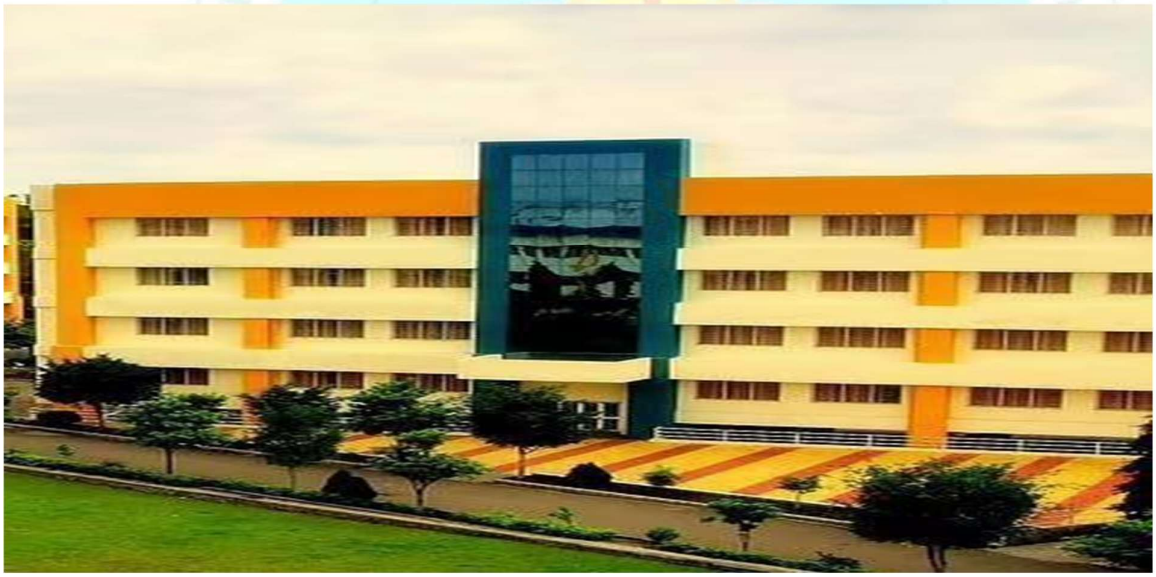
SECTOR NO. 26, PRADHIKARAN, NIGDI, PUNE 411044

(An Autonomous Institute Approved by AICTE and Affiliated to SPPU, Pune)

Curriculum Structure and Syllabus

of

M. Tech. Computer Engineering
(Regulations 2024)



Effective from Academic Year 2024-25

Institute Vision

To be one of the top 100 Engineering Institutes of India in coming five years by offering exemplarily Ethical, Sustainable and Value Added Quality Education through a matching ecosystem for building successful careers.

Institute Mission

1. Serving the needs of the society at large through establishment of a state-of-art Engineering Institute.
2. Imparting right Attitude, Skills, Knowledge for self-sustenance through Quality Education.
3. Creating globally competent and Sensible engineers, researchers and entrepreneurs with an ability to think and act independently in demanding situations.

EOMS Policy

"We at PCCOE are committed to offer exemplarily Ethical, Sustainable and Value Added Quality Education to satisfy the applicable requirements, needs and expectations of the Students and Stakeholders.

We shall strive for technical development of students by creating globally competent and sensible engineers, researchers and entrepreneurs through Quality Education.

We are committed for Institute's social responsibilities and managing Intellectual property.

We shall achieve this by establishing and strengthening state-of-the-art Engineering Institute through continual improvement in effective implementation of Educational Organizations Management Systems (EOMS)."

Course Approval Summary

Board of Studies - Department of Computer Engineering

Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS chairman
1	Advanced Software Engineering and Project Management	MCE21PC01	14	
2	Advanced Data Structures	MCE21PC02	16	
3	Program Elective Course 1(Data Mining & Analytics)	MCE21PE01	18	
4	Program Elective Course 1 (Cryptography & Cryptanalysis)	MCE21PE02	20	
5	Program Elective Course 2(Advanced Image Processing)	MCE21PE03	22	
6	Program Elective Course 2(Natural Language Processing)	MCE21PE04	24	
7	Advanced Data Structures Laboratory	MCE21PC03	26	
8	Program Elective Lab 1	MCE21PE05	28	
9	Program Elective Lab 2	MCE21PE06	30	
10	Skill Development Lab -1	MCE21VS01	32	
11	Research Methodology	MCE22EL01	35	
12	Program Elective Course 3 (Advanced Machine Learning)	MCE22PE01	37	
13	Program Elective Course 3 (Blockchain Technology)	MCE22PE02	39	
14	Program Elective Course 4(Computer Vision & Video Processing)	MCE22PE03	41	
15	Program Elective Course 4(Prompt Engineering)	MCE22PE04	43	
16	Program Elective Lab 3	MCE22PE05	45	
17	Program Elective Lab 4	MCE22PE06	47	
18	Skill Development Lab -2	MCE22VS01	50	
19	Research Internship	MCE22EL02	52	
20	Review paper Writing	MCE22EL03	54	
21	Dissertation-Phase - I	MCE23EL01	56	

	[Company/Research project]			
22	MOOC -1	MCE23EL02	58	
23	MOOC -2	MCE23EL03	59	
24	Dissertation- Phase -II [Company / Research project]	MCE24EL01	61	
25	Seminar	MCE24EL02	62	

Approved by Academic Council:

Chairman, Academic Council
Pimpri Chinchwad College of Engineering

INDEX

LIST OF ABBREVIATIONS

Sr. No.	Abbreviation	Type of Course
1	PCC	Programme Core Course
2	PEC	Programme Elective Course
3	RM	Research Methodology
4	Project	Project
5	INT	Internship
6	MOOC	Massive Open Online Courses
7	L	Lecture
8	P	Practical
9	T	Tutorial
10	H	Hours
11	Cr	Credits
12	FA	Formative Assessment
13	SA	Summative Assessment
14	TW	Term Work
15	OR	Oral
16	PR	Practical

COURSE WISE CREDIT DISTRIBUTION

Sr. No.	Type of Course	No. of Courses	Total Credits	
			No.	%
1	Programme Core Course (PCC)	3	8	10
2	Programme Elective Course (PEC)	8	20	25
3	Vocational and Skill Enhancement Course (VSEC)	2	4	5
4	Experiential Learning Courses (ELC)	8	48	60
Total		**21**	**80**	**100**

SEMESTER-WISE COURSE DISTRIBUTION

Sr. No.	Type of Course	No. of Courses / Semester				Total
		1	2	3	4	
1	Programme Core Course (PCC)	3	-	-	-	3
2	Programme Elective Course (PEC)	4	4	-	-	8
3	Vocational and Skill Enhancement Course (VSEC)	1	1	-	-	2
4	Experiential Learning Courses (ELC)	-	3	3	2	8
Total		**8**	**8**	**3**	**2**	**21**

SEMESTER-WISE CREDIT DISTRIBUTION

Credit Distribution: Semester Wise						
Sr. No.	**Type of Course**	**No. of Credits / Semester**				**Total**
		1	**2**	**3**	**4**	
1	Programme Core Course (PCC)	8	-	-	-	8
2	Programme Elective Course (PEC)	10	10	-	-	20
3	Vocational and Skill Enhancement Course (VSEC)	2	2	-	-	4
4	Experiential Learning Courses (ELC)	-	8	20	20	48
Total		**20**	**20**	**20**	**20**	**80**

Curriculum Structure
M.Tech. Computer Engineering

CURRICULUM STRUCTURE

M.Tech. (Computer Engineering) Semester – I

M.Tech Computer Engineering (Regulations 2024) (With effect from Academic Year 2024-25) Semester I																
Course Code	**Course Name**	**Credit Scheme**				**Teaching Scheme (Hours/Week)**			**Evaluation Scheme and Marks**							
									FA							
		L	**P**	**T**	**Total**	**L**	**P**	**T**	**FA1**	**FA2**	**SA**	**TW**	**PR**	**OR**	**Total**
MCE21PC01	Advanced Software Engineering and Project Management	3	-	-	3	3	-	-	20	20	60	-	-	-	100
MCE21PC02	Advanced Data Structures	3	-	-	3	3	-	-	20	20	60	-	-	-	100
--	Program Elective Course -1	3	-	-	3	3	-	-	20	20	60	-	-	-	100
--	Program Elective Course -2	3	-	-	3	3	-	-	20	20	60	-	-	-	100
MCE21PC03	Advanced Data Structures Laboratory	-	2	-	2	-	4	-	-	-	-	50	-	50	100
MCE21PE05	Program Elective Course-1 Laboratory	-	2	-	2	-	4	-	-	-	-	50	-	50	100
MCE21PE06	Program Elective Course-2 Laboratory	-	2	-	2	-	4	-	-	-	-	50	-	50	100
MCE21VS01	Skill Development Laboratory- 1	-	2	-	2	-	4	-	-	-	-	100	-	-	100
Total		**12**	**08**	**-**	**20**	**12**	**16**	**-**	**80**	**80**	**240**	**250**	**-**	**150**	**800**

L-Lecture, **P**-Practical, **T**-Tutorial,**FA**–Formative Assessment, **SA**-Summative Assessment, **TW**-Term Work, **OR**-Oral, **PR**-Practical

Semester – I

List of courses – Professional Elective Course – 1

Course Code	Course Name	
MCE21PE01	Data Mining & Analytics	Choose any one
MCE21PE02	Cryptography & Cryptanalysis	

List of courses – Professional Elective Course – 2

Course Code	Course Name	
MCE21PE03	Advanced Image Processing	Choose any one
MCE21PE04	Natural Language Processing	

CURRICULUM STRUCTURE

M.Tech. (Computer Engineering) Semester – II

M.Tech Computer Engineering (Regulations 2024) (With effect from Academic Year 2024-25)															
Semester II															
Course Code	Course Name	Credit Scheme				Teaching Scheme (Hours/Week)			Evaluation Scheme and Marks						
									FA		SA	TW	PR	OR	Total
		L	P	T	Total	L	P	T	FA1	FA2					
MCE22EL01	Research Methodology	2	-	-	2	2	-	-	10	10	30	-	-	-	50
--	Program Elective Course-3	3	-	-	3	3	-	-	20	20	60	-	-	-	100
--	Program Elective Course -4	3	-	-	3	3	-	-	20	20	60	-	-	-	100
MCE22PE05	Program Elective Course-3 Laboratory	-	2	-	2	-	4	-	-	-	-	50	-	50	100
MCE22PE06	Program Elective Course-4 Laboratory	-	2	-	2	-	4	-	-	-	-	50	-	50	100
MCE22VS01	Skill Development Lab -2	-	2	-	2	-	4	-	-	-	-	100	-	-	100
MCE22EL02	Research Internship	-	4	-	4	-	8	-	-	-	-	150	-	-	150
MCE22EL03	Review paper Writing	-	2	-	2	-	4	-	-	-	-	100	-	-	100
Total		**8**	**12**	**-**	**20**	**8**	**24**	**-**	**50**	**50**	**150**	**450**	**-**	**100**	**800**

L-Lecture, **P**-Practical, **T**-Tutorial, **FA**–Formative Assessment, **SA**-Summative Assessment, **TW**-Term Work, **OR**-Oral, **PR**-Practical

Semester – II

List of courses – Professional Elective Course – 3

Course Code	Course Name	
MCE22PE01	Advanced Machine Learning	Choose any one
MCE22PE02	Blockchain Technology	

List of courses – Professional Elective Course – 4

Course Code	Course Name	
MCE22PE03	Computer Vision & Video Processing	Choose any one
MCE22PE04	Prompt Engineering	

CURRICULUM STRUCTURE

M.Tech. (Computer Engineering) Semester – III

M.Tech Computer Engineering (Regulations 2024) (With effect from Academic Year 2024-25)																
Semester III																
Course Code	**Course Name**	**Credit Scheme**				**Teaching Scheme (Hours/Week)**			**Evaluation Scheme and Marks**							
									FA							
		L	**P**	**T**	**Total**	**L**	**P**	**T**	**FA1**	**FA2**	**SA**	**TW**	**PR**	**OR**	**Total**
MCE23EL01	Dissertation-Phase - I [Company/Research project]	-	16	-	16	-	32	-	-	-	-	200	-	200	400
MCE23EL02	MOOC -1	2	-	-	2	2	-	-	-	-	-	50	-	-	50
MCE23EL03	MOOC -2	2	-	-	2	2	-	-	-	-	-	50	-	-	50
Total		**4**	**16**	**-**	**20**	**4**	**32**	**-**	**-**	**-**	**-**	**300**	**-**	**200**	**500**

L-Lecture, **P**-Practical, **T**-Tutorial,**FA**–Formative Assessment, **SA**-Summative Assessment, **TW**-Term Work, **OR**-Oral, **PR**-Practical

CURRICULUM STRUCTURE

M.Tech. (Computer Engineering) Semester – IV

M.Tech Computer Engineering (Regulations 2024) (With effect from Academic Year 2024-25)															
Semester IV															
Course Code	Course Name	Credit Scheme				Teaching Scheme (Hours/Week)			Evaluation Scheme and Marks						
									FA		SA	TW	PR	OR	Total
		L	P	T	Total	L	P	T	FA1	FA2					
MCE24EL01	Dissertation- Phase -II [Company / Research project]	-	16	-	16	-	32	-	-	-	-	200	-	200	400
MCE24EL02	Seminar	-	04	-	04		08	-	-	-	-	100	-	100	200
Total		**-**	**20**	**-**	**20**	**-**	**40**	**-**	**-**	**-**	**-**	**300**	**-**	**300**	**600**

L-Lecture, **P**-Practical, **T**-Tutorial, **FA**–Formative Assessment, **SA**-Summative Assessment, **TW**-Term Work, **OR**-Oral, **PR**-Practical

Course Syllabus
Semester-I

Program:	M. Tech Computer Engineering					Semester: I	
Course:	Advanced Software Engineering and Project Management					Code :	MCE21PC01
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
				FA		SA	Total
	Lecture	Practical	Tutorial	FA1	FA2		
3	3	-	-	20	20	60	100

Prior knowledge of

Basic course in Software Engineering

is essential.

Course Objectives:

This course aims at enabling students,

1. To learn and understand the principles of Software Engineering, process model, Agile process
2. To develop requirement model after the software requirements were understood
3. To apply Design and User Interface design principles to S/W project development.
4. To use project and risk management throughout the development of the project.

Course Outcomes:

After learning the course, the students should be able to:

1. Categorizing software requirements by using different modeling techniques.
2. Apply Design principles for software project development.
3. Develop user interface prototype by using different patterns.
4. Articulate the management techniques required to plan, organize, monitor, and control software projects.
5. Understand the risk involved in the software project development.

Detailed Syllabus:

Unit	Description	Duration [Hrs]
I	Software Engineering: Definition, Software Process, Process Models: Overview, Agile Development: OverviewRequirement Analysis, Scenario based modeling, UML model that supplement the use case, data modeling concepts, class based modeling, Requirement modeling for WebApps. Case Study: Safe Home	10
II	The Design Process, Design Concept, Design Model, Software Architecture, Architectural Styles, Architectural Design, What is Component, Design class based components, Conducting component level design, Component level design for webApps, Case Study: Safe Home	9
III	User Interface design: The Golden Rules, User Interface Analysis and design, Interface Analysis, Interface design steps, WebApp Interface design, Design patterns, Patterns based software design, Architectural/Component level design UI design/WebApp Design patterns. Case Study: Safe Home	8
IV	Project Management Concepts: The management spectrum, People, the product, the process, the project, the W5HH principle, Process and Project Metrics: Metrics in the process and project domain, Software measurements, Metrics for software quality, Integrating metrics with the software process, The project planning process, software scope and feasibility, resources, software project estimation, Project scheduling, defining the task set for software project, scheduling, Case Study: Safe Home	9

V	Risk Management: Reactive vs proactive, software risks, Risk identification- projection- refinement, Risk mitigation, monitoring and management, The RMMM plan, Software maintenance and supportability, Reengineering, software reengineering, Reverse engineering, restructuring , forward engineering, Software Process Improvement: What is SPI?, the SPI process, The CMMI, mThe other SPI framework. Emerging trends in software engineering.	9
	Total	**45**

Text Books:

1. Roger Pressman and Bruce Maxim Software Engineering A Practitioner's Approach, 9th Edition, ISBN-10: 1259872971 | ISBN-13: 9781259872976 By© 2020

Reference Books:

1. Ian Sommerville, Software Engineering, Tenth Edition, Pearson, ISBN-13: 9780137503148, 2021

Program :	M. Tech Computer Engineering					Semester: I	
Course :	Advanced Data Structures					Code :	MCE21PC02
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
				FA		SA	Total
	Lecture	Practical	Tutorial	FA1	FA2		
3	3	-	-	20	20	60	100

Prior knowledge of
Basic Data Structures and Algorithms
is essential.

Course Objectives:

This course aims at enabling students,

1. To get acquainted with various advanced data structures of computer science.
2. To analyze the performance of various data structures and implementation details of data structures.
3. To select, design, and implement appropriate data structures to solve given problems.

Course Outcomes:

After learning the course, the students should be able to:

1. Apply the linear data structures for solving various problems.
2. Apply the concept of trees for problem solving
3. Solve real life problems using graph data structures.
4. Apply the concepts of advanced search trees for problem solving.
5. 5. Analyze various algorithmic techniques for solving problems

Detailed Syllabus:

Unit	Description	Duration [Hrs]
I	**Linear Data Structures:** Static and dynamic Memory Allocation, Matrix, Linked list – Operations and applications on Singly Linked List, Doubly Linked List, Singly Circular Linked List and Doubly Circular Linked List. Stack- Operations and its applications. Queue- Operations and its applications, Priority Queue, Double-ended Queue. Hashing - Hash Table, Hash Functions, Collision resolution strategies- open addressing and chaining, Hash table overflow- open addressing and chaining, extensible hashing, closed addressing and separate chaining	9
II	**Nonlinear Data Structures - Trees:** Basic terminology, General tree and its representation. Properties, operations and applications of Binary Tree. binary tree traversals(recursive and non-recursive)- inorder, preorder, post order, depth first search and breadth first search. Binary Search Tree (BST), Threaded BST, Huffman Tree. Multiway search trees – B-Tree and B+ Tree.	9
III	**Nonlinear Data Structures – Graphs:** Basic Concepts, Storage representation, Adjacency matrix, adjacency list. Traversal – BFS and DFS, Minimum Spanning Tree – Prim's and Kruskal's Algorithm, Shortest Path Algorithms – Dijkstra's Algorithm, Floyd-Warshall Algorithm; Bi-connected and strongly connected components; Network Flow Algorithms – Maximum flow/minimum cut, Traveling Salesman Problem.	9
IV	**Search Trees:** Operations and Applications of Optimal Binary Search Tree (OBST), AVL Tree, Red-Black Tree, AA Tree, Splay Tree; K-Dimensional Tree.	9

V	**Basic algorithmic techniques:** Greedy algorithms- Knapsack problem, Job selection problem etc.; Divide & conquer – Quick Sort, Merge Sort etc.; Dynamic programming: Bellman Ford algorithm, Longest Subsequence problem etc. Backtracking – N-Queen Problem, Subset Sum problem etc.	9
	Total	**45**

Text Books:

1. Peter Brass, ― Advanced Data Structures, Cambridge University Press, ISBN: 978-1-107-43982-5.
2. Horowitz and Sahani, ―Fundamentals of Data Structures in C++, University Press, ISBN 10: 0716782928, ISBN 13: 9780716782926.
3. Goodrich, Tamassia, Goldwasser, Data Structures and Algorithms in C++, Wiley publication, ISBN978-81-265-1260-7
4. 4. Cormen, Thomas H - Introduction to algorithms MIT Press, cop. 2009. ISBN: 978-0-262-0338-4-8

Reference Books:

1. A. Aho, J. Hopcroft, J. Ulman, ― Data Structures and Algorithms, Pearson Education, 1998, ISBN0- 201-43578-0.
2. Michael J Folk, ― File Structures an Object Oriented Approach with C++, Pearson Education, ISBN: 81-7758-373-5.
3. Sartaj Sahani, ― Data Structures, Algorithms and Applications in C++, Second Edition, University Press, ISBN:81-7371522 X
4. 4. Samet, Hanan - Foundations of multidimensional and metric data structures, Elsevier : Morgan Kaufmann, cop. 2006. ISBN: 978-0-12-369446-1

Program :	M. Tech Computer Engineering					Semester: I	
Course :	Data Mining and Analytics – (PEC-1)					Code :	MCE21PE01
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
				FA		SA	Total
	Lecture	Practical	Tutorial	FA1	FA2		
3	3	-	-	20	20	60	100

Prior knowledge of
Mathematics
is essential.

Course Objectives:
This course aims at enabling students,

1. To gather sufficient relevant data, conduct data analytics using scientific methods.
2. To demonstrate a sophisticated understanding of frequent pattern mining.
3. To use supervised and unsupervised techniques to conduct thorough and insightful performance analysis
4. To demonstrate various algorithms with python/R/weka/Excel to solve real life problems.

Course Outcomes:
After learning the course, the students should be able to:

1. Apply different preprocessing methods to prepare data in the desired format.
2. Create frequent patterns using Mining techniques to discover knowledge.
3. Apply different supervised data mining algorithms on a given data set to solve real world problems.
4. Evaluate classification models using different performance metrics.
5. Apply different clustering algorithms to solve real world problems.

Detailed Syllabus:

Unit	Description	Duration [Hrs]
I	**Data Mining**: Data, Information and Knowledge, Attribute Types, Introduction to Data Preprocessing, Data Cleaning, Data integration, data reduction, transformation and Data Discretization. Measuring the Central Tendency: Basics of Mean, Median, and Mode, Measuring the Dispersion of Data, Variance and Standard Deviation. Measuring Data Similarity and Dissimilarity, Data Matrix versus Dissimilarity Matrix, Proximity Measures for Nominal Attributes and Binary Attributes, Dissimilarity of Numeric Data, Correlation among attributes **Case Study** ; Practice on Excel/ R/Weka/Python	9
II	Market Basket Analysis, Frequent Itemsets, Closed Itemsets, and Association Rules Mining Frequent Patterns, Associations, and Correlations Frequent pattern mining: , associative classification, Association rule mining- Apriori Algorithm, Improving the efficiency of Apriori, Various measures support, Confidence, Lift, Evaluation of candidates rules. **Case Study** ; Practice on Excel/ R/Weka/Python	9
III	**Classification**: Rule-Based Classification -Decision Tree Induction, Attribute Selection Measures, Tree Pruning, Decision Tree Induction, Bayes Classification Methods, Baye's Theorem, Naive Bayesian Classification, Ensemble Methods, Bagging, Boosting and Ada Boost, Random Forests, Improving Classification Accuracy of Class-Imbalanced Data. **Case Study** ; Practice on Excel/ R/Weka/Python.	9

IV	**Model Evaluation and Selection**: Metrics for Evaluating Classifier Performance, Holdout Method and Random Sub sampling, Cross-Validation, Bootstrap, Model Selection Using Statistical Tests of Significance, Comparing Classifiers Based on Cost–Benefit and ROC Curves, **Case Study** ; Practice on Excel/ R/Weka/Python	9
V	**Clustering**: Partitioning Methods: k-Means, k-Medoids, Hierarchical Methods: Agglomerative versus Divisive Hierarchical Clustering, Distance Measures in Algorithmic Methods, DBSCAN: Density-Based Clustering, Text clustering. **Evaluation of Clustering:** Assessing Clustering Tendency, Determining the Number of Clusters, Measuring Clustering Quality **Case Study** ; Practice on Excel/ R/Weka/Python	9
	Total	**45**

Text Books:

1. Han, JiaweiKamber, Micheline Pei and Jian, “Data Mining: Concepts and Techniques”, Elsevier Publishers, Fourth Edition, 2022, ISBN: 978-0128117606, 10:9780128117606.

Reference Books:

1. Ian.H.Witten, Eibe Frank, Mark A.Hall, Christopher J.Pal, "Data Mining, Practical Machine Learning Tools and Techniques", Fourth Edition, Morgan kaufmann, 2017.ISBN : 978-0-12 804291-5
2. Mohammed J. Zaki and Wagner Meira, "Data Mining and Machine Learning: Fundamental Concepts and Algorithms", Second Edition, Cambridge University Press, March 2020

e-sources:

1. https://nptel.ac.in/courses/106105174
2. https://www.coursera.org/learn/data-mining-project
3. https://www.google.co.in/books/edition/Data_Mining/1SylCgAAQBAJ?hl=en&gbpv=1&printsec=frontcover(last accessed : 25th April 2024)

Program:	M. Tech Computer Engineering					Semester: I	
Course :	Cryptography and Cryptanalysis (PEC-1)					Code :	MCE21PE02
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
				FA		SA	Total
	Lecture	Practical	Tutorial	FA1	FA2		
3	3	-	-	20	20	60	100

Prior knowledge of
Mathematics
is essential.

Course Objectives:

This course aims at enabling students,

1. To provide an introduction to the principles of cryptography
2. To make students familiar with cryptographic techniques for secure (confidential) communication of two parties over an insecure (public) channel
3. To make students understand the role of cryptanalysis in the field of cryptography.

Course Outcomes:

After learning the course, the students should be able to:

1. Use asymmetric encryption technique to provide confidentiality to the message in transit
2. Use symmetric encryption technique to provide confidentiality to the message in transit
3. Analyze the advantages and disadvantages of using different key management and
4. distribution techniques
5. Use different signature generation and verification algorithms to sign and verify messages
6. Discuss different cryptanalysis techniques which can be applied in real time scenarios

Detailed Syllabus:

Unit	Description	Duration [Hrs]
I	Introduction: Classical Encryption Techniques – Substitution Techniques, Transposition Techniques; Symmetric Cipher Model: Feistel cipher structure, DES, Tripple DES, Block Cipher Design Principles; AES	9
II	Public Key Cryptography: RSA – Algorithm & Computational Aspects, Diffie-Hellman Key Exchange; Elgamal Cryptographic System; Elliptic Curve Cryptography	9
III	Key management and distribution: Symmetric key distribution using symmetric & asymmetric encryption, distribution of public keys, X.509 certificates, PKI	9
IV	Cryptographic Hash Functions: Applications, SHA, MD5; Message Authentication Codes: requirements, function, security, HMAC; Digital signatures – introduction	9
V	Cryptanalysis, Cryptanalysis on Substitution Cipher (Frequency Analysis), Cryptanalysis on Stream Cipher, Modern Stream Ciphers, Time-Memory Trade-off Attack, Linear Cryptanalysis, Differential Cryptanalysis	9
	Total	**45**

Text Books:

Text Books:

1. William Stallings, “Crpyptography and Network security -Principles and Practices”, Pearson publication sixth Edition.
2. Atul Kahate, “Crpyptography and Network security ”, McGrawHill publication

Reference Books:

1. Ian.H.Witten, Eibe Frank, Mark A.Hall, Christopher J.Pal, "Data Mining, Practical Machine Learning Tools and Techniques", Fourth Edition, Morgan kaufmann, 2017.ISBN : 978-0-12 804291-5
2. Mohammed J. Zaki and Wagner Meira, "Data Mining and Machine Learning: Fundamental Concepts and Algorithms", Second Edition, Cambridge University Press, March 2020

e-sources:

1. William Stallings, Lawrie Brown “Computer security -Principles and Practices”, Pearson publication.
2. John F. Dooley, History of Cryptography & Cryptanalysis-Codes, Ciphers & Algorithms, Springer
3. W. Mao, “Modern Cryptography – Theory and Practice”, Pearson Education.
   A. Forouzan, "Cryptography & Network Security", Tata Mc Graw Hill

Program :	M. Tech Computer Engineering					Semester: I	
Course :	Advanced Image Processing - (PEC-2)					Code:	MCE21PE03
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
3	3	-	-	20	20	60	100

Prior knowledge of
Computer Graphics
is essential.

Course Objectives:

This course aims at enabling students,

1. To get acquaintance of the Image processing methods and the applications
2. To design solutions for complex image processing problems

Course Outcomes:

After learning the course, the students should be able to:

1. Comprehend the digital image processing fundamentals
2. Use the image enhancement methods for appropriate applications
3. Analyze the different image segmentation methods
4. Apply the feature descriptors to extract features from the images
5. Examine the object detection methods for suitable applications

Detailed Syllabus:

Unit	Description	Duration [Hrs]
I	**Digital Image Fundamentals** Digital Image Processing(DIP) - Origin, Fundamental steps, Components, Digitization, Elements of visual perception, Image formation model, Brightness adaptation and discrimination, Image sensing and acquisition, Sampling and Quantization	9
II	**Image Enhancement in Spatial domain and Frequency domain** **Spatial Domain** Gray level transformations, Basics of spatial filtering, Convolution, Smoothing and Sharpening spatial filters, Contrast enhancement methods, Combining Spatial Enhancement methods. **Frequency Domain** Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT), Discrete Cosine Transform (DCT) Case Studies on Image Enhancement	9
III	**Image Segmentation** Introduction, Segmentation techniques – Thresholding, Region-based, Edge-based, Watershed, Graph-based, Clustering-based, Active Contours, Superpixel segmentation Case Studies on Image Segmentation	9
IV	**Feature Descriptors** Introduction, Types of Feature Descriptors, Canny Edge Detector, Hough Transform, Scale-Invariant Feature Transform (SIFT), Speeded-Up Robust Features (SURF), Histogram of Oriented Gradients (HOG) Case Studies on Feature Descriptors	9

V	**Object Detection** Introduction, Object Detection Methods - Haar-Cascade, Support Vector Machine (SVM), Decision Trees, Random Forest, Deep Learning based methods Case studies on Object Detection	9
	Total	**45**

Text Books:

1. R.C.Gonzalas and R.E.Woods: Digital Image Processing, Prentice Hall, 3rd Ed, ISBN 13: 9780131687288,July 18.
2. Jain A.K, "Fundamentals of Digital Image Processing", 4 Edition, Prentice hall of India.

Reference Books:

1. S.Sridhar, Digital Image Processing, Oxford University Press.
2. B.Chanda, D. Dutta Majumder, "Digital Image Processing and Analysis", 2nd Edition, Phi learning.
3. William K Pratt, "Digital Image Processing", 4th Edition, Wiley.

Program:	M. Tech Computer Engineering					Semester: I	
Course :	Natural Language Processing- (PEC-2)					Code :	MCE21PE04
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
				FA			
	Lecture	Practical	Tutorial	FA1	FA2	SA	Total
3	3	-	-	20	20	60	100

Prior knowledge of
Discrete Mathematics, Theory of Computation
is essential.

Course Objectives:
This course aims at enabling students,
1. To explore the fundamentals of Natural Language Processing (NLP).
2. To acquire the knowledge of various text processing techniques in NLP.
3. To use different NLP libraries to process the text data.
4. To develop syntactical and semantic analysis models in NLP.
5. To identify and develop real world applications of NLP.

Course Outcomes:
After learning the course, the students should be able to:
1. Devise the fundamentals of Natural Language Processing (NLP).
2. Demonstrate the use of word level processing techniques in handling different types of text data.
3. Apply morphological, Syntactic and Semantic analysis techniques to understand the text data.
4. Design NLP models for text-based processing of natural languages.
5. Evaluate various NLP models to design real world Applications.

Detailed Syllabus:

Unit	Description	Duration [Hrs]
I	**Fundamentals of Natural Language Processing** Fundamentals of NLP, Programming languages Vs Natural Languages, Challenges inNLP, Stages of NLP, Ambiguity, ontology in nlp, Approaches of NLP: Rule based,Data Based, Knowledge Based approaches, NLP APIs, NLP Libraries, corpora andcorpora analysis	9
II	**Word Processing** Importance of word-level processing in NLP, Tokenization Techniques: white-spacetokenization, word tokenization, sentence tokenization, Punctuation-based, Treebank,Tweet, MWEStemming vs. Lemmatization, Techniques and algorithms: Porter Stemmer, SnowballStemmer, WordNet Lemmatizer, Stop Words Removal, Detect and correct spellingerrors, Part-of-Speech (POS) Tagging	9
III	**Syntax and Semantic Analysis** Morphological Analysis: Morphology, Types of Morphemes, Morphological parsingwith Finite State Transducers (FST) **Syntactic Analysis:** Syntactic Representations of Natural Language, ParsingAlgorithms, CKY (Cocke-Kasami-Younger) algorithm, Probabilistic context-freegrammars, and Statistical parsing **Semantic Analysis**: Lexical Semantic, Relations among lexemes & their senses –Homonymy,Polysemy, Synonymy, Hyponymy, WordNet, Word Sense Disambiguation (WSD), Dictionary based approach, Latent Semantic Analysis	9

IV	**NLP Modeling** Probabilistic language modeling, Markov models, Log-Linear Models, Graph-basedModels: context free grammar. N-gram models: Simple n-gram models, unigram, bigram, Metrics for Language Modelings Word Embeddings/ Vector Semantics: Bag-of-words, TFIDF, word2vec, doc2vec, Contextualized representations (BERT, GPT)	9
V	**Applications of NLP and Research Trends** Text Classification, Information Retrieval and Extraction, Machine Translation,TextGeneration, Recommendation system, Recent advancements in NLP research, Emerging trends and challenges in NLP domain	9
	Total	**45**

Text Books:

1. Jurafsky, David, and James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing", Computational Linguistics and Speech Recognition‖, 2/e, PEARSON Publication, 2013, 978-9332518414
2. Manning, Christopher D., and nrich Schütze , "Foundations of Statistical Natural Language Processing", Cambridge, MA: MIT Press, 1999, 978-0262133609

Reference Books:

1. Steven Bird, Ewan Klein, Edward Loper, "Natural Language Processing with Python – Analyzing Text with the Natural Language Toolkit", O'Reilly Publication
2. Dipanjan Sarkar , "Text Analytics with Python: A Practical Real-World Approach to Gaining Actionable Insights from your Data", Apress Publication ISBN: 9781484223871
3. Alexander Clark, Chris Fox, and Shalom Lappin, "The Handbook of Computational Linguistics and Natural Language Processing", Wiley Blackwell Publications
4. Jacob Eisenstein, "Natural Language Processing", MIT Press
5. Jacob Eisenstein, "An Introduction to Information Retrieval", Cambridge University Press

e-sources:

1. https://nptel.ac.in/courses/106101007
2. https://nptel.ac.in/courses/106106211
3. https://onlinecourses.nptel.ac.in/noc24_cs39/preview

Program:	M. Tech Computer Engineering						Semester: I
Course:	Advanced Data Structures Laboratory						Code:MCE21PC03
Credits	Teaching Scheme (Hrs. /Week)			Evaluation Scheme and Marks			
	Theory	Practical	Tutorial	TW	OR	PR	Total
2	-	4	-	50	50	-	100

Prior knowledge of
Basic Data Structures and Algorithms
is essential.

Course Objectives:

This course aims at enabling students,

1. To get acquainted with various advanced data structures of computer science.
2. To analyze the performance of various data structures and implementation details of data structures.
3. To select, design and implement appropriate data structures to solve given problems.

Course Outcomes:

After completion of this course, the students will be able to,

1. Students will be able to compare various advanced data structures.
2. Students will be able to make appropriate choices of data structure to solve computing problems.
3. Students will be able to apply appropriate advanced data structure and efficient algorithms to approach the problems of various domains.
4. Students will be able to select, design and implement appropriate data structures to solve given problems.

Detailed Syllabus

Expt. No.	Suggested List of Experiments
1.	Implement a Telephone book using a skip list. Provide functions for inserting new details, deleting data related to a phone number and searching a given phone number. (note: Decide the level of element in the list Randomly with some upper limit)
2.	Implement hashing and handle collisions using chaining with / without replacement for maintaining and searching records of bank account details of customers. Provide functionalities for operations: Insert, Find, and Delete.
3.	A Dictionary stores keywords and its meanings. Provide facility for adding new keywords, deleting keywords, updating values of any entry. Provide a facility to display whole data sorted in ascending/ Descending order. Also find how many maximum comparisons may require for finding any keyword. Use Binary Search Tree for implementation.
4.	Implement the AVL tree for maintaining book-records of a library. Provide functionalities to insert, delete and search data in the tree. You should implement single and double rotation and ensure that the tree maintains AVL property at the time of insertion and deletion. For checking whether the tree is really balanced, provide a separate function.
5.	You have a business with several offices; you want to lease phone lines to connect them up with each other; and the phone company charges different amounts of money to connect different pairs of cities. You want a set of lines that connects all your offices with a minimum total cost. Solve the problem by suggesting appropriate data structures.
6.	Given length of wall w and shelves of two lengths m and n, find the number of each type of shelf to be used and the remaining empty space in the optimal solution so that the empty space is minimum. The larger of the two shelves is cheaper so it is preferred.

Text Books:

1. Peter Brass, ― Advanced Data Structures, Cambridge University Press, ISBN: 978-1-107-43982-5.

2. Horowitz and Sahani, ―Fundamentals of Data Structures in C++, University Press, ISBN 10: 0716782928ISBN 13: 9780716782926.
3. Goodrich, Tamassia, Goldwasser, ―Data Structures and Algorithms in C++, Wiley publication, ISBN-978-81-265-1260-7
4. Cormen, Thomas H - Introduction to algorithms MIT Press, cop. 2009. ISBN: 978-0-262-0338-4-8

Reference Books:

1. A. Aho, J. Hopcroft, J. Ulman, ― Data Structures and Algorithms, Pearson Education, 1998, ISBN-0-201-43578-0.
2. Michael J Folk, ― File Structures an Object Oriented Approach with C++, Pearson Education, ISBN:81-7758-373-5.
3. Sartaj Sahani, ― Data Structures, Algorithms and Applications in C++, Second Edition, UniversityPress, ISBN:81-7371522 X.
4. Samet, Hanan - Foundations of multidimensional and metric data structures, Elsevier : Morgan Kaufmann, cop. 2006. ISBN: 978-0-12-369446-1

Program:	M. Tech Computer Engineering					Semester: I	
Course:	Program Elective Course-1 Laboratory					Code:	MCE21PE05
Credits	Teaching Scheme (Hrs. /Week)			Evaluation Scheme and Marks			
	Theory	Practical	Tutorial	TW	OR	PR	Total
2	-	4	-	50	50	-	100

Program Elective Lab 1
Data Mining and Analytics Lab

Prior knowledge of
Engineering Mathematics
is essential.

Course Objectives:
This course aims at enabling students,

1. To gather sufficient relevant data, conduct data analytics using scientific methods.
2. To demonstrate a sophisticated understanding of the concepts and methods
3. To use advanced techniques to conduct thorough and insightful analysis
4. To demonstrate various algorithms with python/R/weka/Excel to solve real life problems

Course Outcomes:
After completion of this course, the students will be able to,

1. Analyse the literature for any relevant application
2. Apply various Data mining techniques to solve real world applications.
3. Summarise the findings in the form of report/ Paper.

Guidelines:

1. Students have to individually implement and demonstrate a Mini Project using the concepts learnt in the Professional elective Course Data Mining and Analytics.
2. A report comprising of following points need to be submitted
   a. Problem Definition
   b. Existing literature on various techniques
   c. Architecture
   d. Results
   e. Conclusion

Plagiarism: It is essential for the student to follow ethical practices while coding and report writing.

Detailed Syllabus

Expt. No.	Suggested List of Experiments
1	Mini Project: Select any suitable data set with high dimensions (such as Bostan dataset, breast cancer dataset) from any repository of data such as SK-Learn, UCI library, Kaggle dataset library etc. for any relevant application like Marketing, Agriculture, Finance, Banking , Medical Perform following 1.Preprocessing 2.Supervised learning 3.Unsupervised learning 4.Analyze frequent patterns 5.Evaluate models using performance measures Use tools like WEKA or Python/R.

References:

1. Han, Jiawei Kamber, Micheline Pei and Jian, “Data Mining: Concepts and Techniques”, Elsevier Publishers, Fourth Edition, 2022, ISBN: 978-0128117606, 10:9780128117606
2. Ian.H.Witten, Eibe Frank, Mark A.Hall, Christopher J.Pal, "Data Mining, Practical Machine Learning Tools and Techniques", Fourth Edition, Morgan kaufmann, 2017.ISBN : 978-0-12 804291-5

3. Mohammed J. Zaki and Wagner Meira, "Data Mining and Machine Learning: Fundamental Concepts and Algorithms", Second Edition, Cambridge University Press, March 2020

OR

Program Elective Lab 1
Cryptography and Cryptanalysis Lab

Course Objectives:

This course aims at enabling students,

1. To provide an introduction to the principles of cryptography
2. To make students familiar with cryptographic techniques for secure (confidential) communication of two parties over an insecure (public) channel
3. To make students understand the role of cryptanalysis in the field of cryptography.

Course Outcomes: After learning the course, the students should be able to:

1. Use asymmetric encryption technique to provide confidentiality to the message in transit
2. Use symmetric encryption technique to provide confidentiality to the message in transit
3. Use different key management and distribution techniques
4. Write an extensive research and analysis report on any existing security product or code, investigate the strong and weak points of the product or code

Detailed Syllabus

Expt. No.	Suggested List of Experiments
1.	Design and develop a system to demonstrate secure communication using the S-AES algorithm. Analyze and prepare a report on different cryptanalytic attacks possible on the system.
2.	Design and develop a system to demonstrate secure communication using the S-DES algorithm. Analyze and prepare a report on different cryptanalytic attacks possible on the system.
3.	Implement public key cryptographic algorithm RSA to encrypt and decrypt massage. Analyze and prepare a report on different cryptanalytic attacks possible on the system.
4.	Write a program to exchange keys for secure communication using differ-Hellman key exchange algorithm
5.	Analyze & document drawbacks of any public key or secret key cryptography algorithm, suggest the modification in the existing algorithm and prepare the detailed research report commenting on the comparison among modified algorithm and existing algorithm. Implement a system with proposed modifications

Text Books:

1. William Stallings, “Cryptography and Network security -Principles and Practices”, Pearson publication sixth Edition.
2. Atul Kahate, “Cryptography and Network security”, McGrawHill publication

Reference Books:

1. William Stallings, Lawrie Brown “Computer security -Principles and Practices”, Pearson publication.
2. John F. Dooley, History of Cryptography & Cryptanalysis-Codes, Ciphers & Algorithms, Springer
3. W. Mao, “Modern Cryptography – Theory and Practice”, Pearson Education.
4. A. Forouzan, "Cryptography & Network Security", Tata Mc Graw Hill

Program:	M. Tech Computer Engineering					Semester: I	
Course:	Program Elective Course-2 Laboratory					Code:	MCE21PE06
	Teaching Scheme (Hrs. /Week)			Evaluation Scheme and Marks			
Credits	Theory	Practical	Tutorial	TW	OR	PR	Total
2	-	4	-	50	50	-	100

Program Elective Lab 2
Advanced Image Processing Lab

Prior knowledge of
Computer Graphics
is essential.

Course Objectives:
This course aims at enabling students,
1. To discuss the Image processing methods and the applications
2. To design solutions for complex image processing problems.

Course Outcomes:
After learning the course, the students should be able to:
1. Develop hybrid image enhancement method for suitable application
2. Demonstrate the image segmentation methods
3. Demonstrate the different feature descriptors
4. Demonstrate the object detection method for suitable application

Guideline : The Course Facilitator can discuss the applications for the assignment topics mentioned below:

Detailed Syllabus

Expt. No.	Suggested List of Experiments
1.	Hybrid image enhancement method
2.	Image Segmentation method
3.	Feature Descriptor technique
4.	Object Detection method

Text Books:
1. Rafael.C, Gonzalez, Richard E Woods, "Digital Image Processing",3rd Edition, Pearson India.
2. Jain A.K, "Fundamentals of Digital Image Processing", 4th Edition, Prentice hall of India.

Reference Books:
1. B.Chanda, D. Dutta Majumder, "Digital Image Processing and Analysis", 2nd Edition, Phi learnin
2. William K Pratt, "Digital Image Processing", 4th Edition, Wiley.

OR

Program Elective Lab 2
Natural Language Processing Lab

Prior knowledge of
Discrete Mathematics, Theory of Computation, Python
is essential

Course Objectives:
This course aims at enabling students,
1. To explore the fundamentals of Natural Language Processing (NLP).
2. To acquire the knowledge of various text processing techniques in NLP.
3. To develop syntactical and semantic analysis models in NLP.
4. To learn implementation of various real world applications of NLP.

Course Outcomes:
After learning the course, the students should be able to:
1. Use different NLP libraries to process the text data.
2. Implement syntactical analysis algorithm to understand the text data syntactically.

3. Apply NLP models for text-based processing of natural languages.
4. Develop real world NLP applications

Guidelines for Students:

- The laboratory assignments are to be submitted by students in the form of a journal.
- Journal consists of a prologue, certificate, table of contents and handwritten write-up of each assignment.
- Program codes with sample output of all performed assignments are to be submitted as softcopy.

Guidelines for Laboratory/Term Work Assessment:

- Continuous assessment of laboratory work is done based on overall performance and Laboratory performance of students.
- Each Laboratory assignment assessment should assign grade/marks based on parameters with appropriate weightage.
- Suggested parameters for overall assessment as well as each Laboratory assignment assessment include- timely completion, performance, innovation, efficiency, punctuality and neatness.

Guidelines for Laboratory Conduction

- Assignments on all concepts are mandatory.
- Mini-project can be completed in groups of 2 to 3 students.
- Use of open-source tools is to be encouraged.

Detailed Syllabus

Expt. No.	Suggested List of Assignments
1.	Apply various tokenization, stemming and lemmatization on a given text. Compare the results in terms of word variations and semantic coherence.
2.	Implement POS tagging using existing libraries like NLTK or SpaCy.
3.	Implement parsing algorithms such as CKY algorithm for syntactic analysis.
4.	Implement word embedding techniques such as Bag-of-words, TFIDF, word2vec, doc2vec, GPT, BERT.
5.	Mini Project to implement application of NLP.

Text Books:

1. Jurafsky, David, and James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing", Computational Linguistics and Speech Recognition‖, 2/e, PEARSON Publication, 2013, 978-9332518414
2. Manning, Christopher D., and nrich Schütze , "Foundations of Statistical Natural Language Processing", Cambridge, MA: MIT Press, 1999, 978-0262133609

Reference Books:

1. Steven Bird, Ewan Klein, Edward Loper, "Natural Language Processing with Python – Analyzing Text with the Natural Language Toolkit", O'Reilly Publication
2. Dipanjan Sarkar , "Text Analytics with Python: A Practical Real-World Approach to Gaining Actionable Insights from your Data", Apress Publication ISBN: 9781484223871
3. Alexander Clark, Chris Fox, and Shalom Lappin, "The Handbook of Computational Linguistics and Natural Language Processing", Wiley Blackwell Publications
4. Jacob Eisenstein, "Natural Language Processing", MIT Press
5. Jacob Eisenstein, "An Introduction to Information Retrieval", Cambridge University Press.

e-sources:

1. https://nptel.ac.in/courses/106101007
2. https://nptel.ac.in/courses/106106211
3. https://onlinecourses.nptel.ac.in/noc24_cs39/preview
4. https://www.coursera.org/learn/probabilistic-models-in-nlp
5. https://www.coursera.org/learn/attention-models-in-nlp?specialization=natural-language-processing

Program:	M. Tech Computer Engineering					Semester: I	
Course:	Skill Development Lab-I (Programming with Python)					Code: MCE21VS01	
Credits	Teaching Scheme (Hrs. /Week)			Evaluation Scheme and Marks			
	Theory	Practical	Tutorial	TW	OR	PR	Total
2	-	4	-	100	-	-	100

Prior knowledge of

1. Data Structure and Problem Solving,
2. Object Oriented Programming Concepts

is essential.

Course Objectives:

This course aims at enabling students,

1. To acquire programming skills in core Python.
2. To acquire Object Oriented Skills in Python
3. To develop the ability draw graphs/plots in Python
4. To develop the ability to do data analysis in Python

Course Outcomes:

After completion of this course, the students will be able to,

1. To develop proficiency in creating based applications using the Python Programming Language.
2. To be able to understand the various data structures available in Python programming language and apply them in solving computational problems.
3. To be able to do data analysis using open source library Pandas and Numpy.
4. To be able to draw various kinds of plots using Matplotlib library.

Guidelines:

Total six assignments mandatory from which any five from assignment 1 to 7.

Detailed Syllabus

Expt. No.	Suggested List of Experiments
1.	Write a Python program which iterates the integers from 1 to a given number and print "Fizz" for multiples of three, print "Buzz" for multiples of five, print "FizzBuzz" for multiples of both three and five using itertools module.
2.	Write a program to compute the number of characters, words and lines in a file.
3.	Write a function called convert to days() that takes no parameters. Have your function prompt the user to input numbers of hours, minutes, and seconds. Write a helper function called get days() that uses these values and converts them to days in float form (fractions of a day are allowed). get days() should return the number of days. Use this helper function within the convert to days() function to display the numbers of days to the user. The built-in function round() takes two arguments: a number and an integer indicating the desired precision (i.e., the desired number of digits beyond the decimal point). Use this function to round the number of days four digits after the decimal point.
4.	An Armstrong number of three digits is an integer such that the sum of the cubes of its digits is equal to the number itself. For example, 371 is an Armstrong number since 33 + 73 + 13 = 371. Write a program to find all Armstrong number in the range of 0 to N
5.	Write a program to create Shape class with draw method. Define two child class Circle and Square and override draw method. Use OOPs Polymorphism and Inheritance concepts.
6.	The celebrity problem is the problem of finding the celebrity among n people. A celebrity is someone who does not know anyone (including themselves) but is known by everyone. Write a Python program to solve the celebrity problem

7.	Consider appropriate dataset in CSV format and solve following questions using pandas a. Print first 5 records b. Apply data cleaning concepts. c. Print last 10 records d. Apply data analysis operations e. Print analysis in graphical format using Matplotlib library
8.	**Mini Project** Students can select any relevant topic and data set. Following points should be followed in Mini Project. 1. Data analysis using pandas, numpy or any other relevant library. 2. Proper user interface. 3. Graphical report generation using matplotlib or any other relevant library

Text Books:

1. Allen B Downey, ―Think PYTHON, O'Rielly, ISBN: 13:978-93-5023-863-9, 4th Indian Reprint 2015
2. Peng, Roger D and Elizabeth Matsui, ―The Art of Data Science." A Guide for Anyone Who Works with Data. Skybrude Consulting 200 (2015): 162

Reference Books:

1. Zed A. Shaw, Learn Python the Hard Way
2. Narsimha Karumanchi, Data Structures and Algorithmic Thinking with Python

Course Syllabus
Semester-II

Program:	M. Tech Computer Engineering					Semester: II	
Course:	Research Methodology					Code: MCE22EL01	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
				FA		SA	Total
	Lecture	Practical	Tutorial	FA1	FA2		
2	2	-	-	10	10	30	50

Prior knowledge of

–

is essential.

Course Objectives:

This course aims at enabling students

1. To get insights into the scientific method of doing research and report writing
2. To understand the know-how of research paper publication into conferences and journals
3. To identify the IPR and startup potential of the idea and understand the process of it

Course Outcomes:

After learning the course, the students should be able to:

1. Understand basic concepts of research and its methodologies.
2. Identify appropriate research problems and write their objectives and expected outcomes
3. Write the research reports and research papers by following relevant ethics
4. Disseminate the research outcomes through Publication, intellectual property rights (IPRs), or startup ventures

Detailed Syllabus:

Unit	Description	Duration [Hrs]
I	**Introduction**- Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process.	8
II	**Defining Research Problem-** Sources of the research problem, Literature Review, writing research objectives and expected outcomes, Meaning of Hypothesis, Characteristics of Hypothesis, Null and alternate hypothesis with examples	7
III	**Scientific writing**: Dissemination of research findings, outline and structure of research report, Structure and components of conference and journal articles, ethics and scientific conduct, ethics in life science studies, plagiarism.	7
IV	**Research Publication and IPR**- Conference Paper, Journal papers, Publishing in journals (Scopus/SCI/SCIE/WoS/UGC care, etc.), Terminology- h-index, i10 index, impact factor, cite score, citations, quartiles (Q1, Q2, Q3, Q4). **IPR**- Copyrights, Trademark, Patent- Design and Utility Patent, Procedure till patent gets granted, Patent Licencing and commercialization **Startup**- product registration, Angel investors, Venture Capital	8
	Total	**30**

Text Books:

1. C. R. Kothari ,Research Methodology: Methods and Trends,
2. Research Methodology: An Introduction by Wayne Goddard and Stuart Melville
3. Research Methodology: A Step-by-Step Guide for Beginners, by Ranjit Kumar, 2nd Edition
4. Fundamentals of IPR by Ramkrishna B and Anil Kumar H S. , Notion Press 5. IPR in India by Virendra Kumar Ahuja, LexisNexis Butterworths Wadhwa Nagpur

Reference Books:

1. Research methodology: an Introduction for Science & Engineering students, by Stuart Melville and Wayne Goddard
2. C.G. Thomas, Research methodology and scientific writing, Ane books, Delhi, 2015.

e-sources:

1. NPTEL course on Research Methodology By Prof. Soumitro Banerjee, IISER Kolkata- https://onlinecourses.nptel.ac.in/noc22_ge08/preview
2. Coursera course on Research Methodologies by Athanasia Lampraki https://www.coursera.org/learn/research-methodologies

Program:	M. Tech Computer Engineering					Semester: II	
Course:	Advanced Machine Learning : (PEC-3)					Code:MCE22PE01	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
				FA		SA	Total
	Lecture	Practical	Tutorial	FA1	FA2		
3	3	-	-	20	20	60	100

Prior knowledge of

-

is essential.

Course Objectives:

This course aims at enabling students

1. To understand nature of problems solved with machine learning
2. To apply classification algorithms for suitable machine learning problems
3. To understand reinforcement learning method and its applications
4. To apply advanced machine learning methods for suitable applications

Course Outcomes:

After learning the course, students will be able to:

1. Design and evaluate various machine learning algorithms
2. Use machine learning methods for data analysis in various scientific fields
3. Choose and apply appropriate Machine Learning techniques for analysis, forecasting and categorization of data
4. Apply neural network model to solve complex problems.
5. Apply generative models to generate new data samples that resemble a given dataset.

Detailed Syllabus:

Unit	Description	Duration [Hrs]
I	Introduction to Machine Learning; Types of learning: Supervised, Unsupervised and semi-supervised, reinforcement learning techniques; Predictive and descriptive learning, Models of Machine learning: Geometric model, Probabilistic Models, Logical Models, Grouping and grading models, Parametric and non-parametric models, Overfitting and underfitting	9
II	Classification : Basic Concepts, Decision Tree Induction, Attribute Selection Measures, Tree Pruning, Rule Extraction from a Decision Tree; Multiclass Classification; Naive Bayesian Classification; Support Vector Machine, k-Nearest-Neighbor Classifiers, Metrics for Evaluating Classifier Performance	9
III	Genetic Algorithms, Fuzzy Set Approaches; Case Based Reasoning, Holistic learning and multi-perspective learning, Elements of Reinforcement Learning; Example: Tic-TacToe	9
IV	Neural Network: Beyond machine learning-deep learning and bio inspired adaptive systems; Artificial Neural Network, Recurrent Neural Networks, Convolutional Neural Network (CNN)- Mathematical foundation, Design and implementation	9
V	Introduction to Generative Adversarial Networks (GANs) and Variational Autoencoders (VAEs); Data Augmentation and Transfer Learning, Generative AI, Explainable AI, Application of Machine learning in Indian Knowledge System (IKS)	9
	Total	**45**

Text Books:

1. Peter Flach, Machine Learning: The Art and Science of Algorithms that make sense of data, Cambridge University Press, 1st Edition, 2012, ISBN No.: 978-1-316-50611-0
2. 2.Parag Kulkarni, "Reinforcement and Systemic Machine Learning for Decision Making" Wiley-IEEE Press, ISBN: 978-0-470-91999-6.
3. 3.Han, Jiawei Kamber, Micheline Pei and Jian, "Data Mining: Concepts and Techniques" Elsevier Publishers Third Edition, ISBN: 9780123814791, 9780123814807.

Reference Books:

1 Ethem Alpaydin, Introduction to Machine Learning, PHI, 2nd edition, 2013, 978-0-262-01243-0 Kevin

2 Murphy, Machine Learning: a Probabilistic Approach, MIT Press, 1st Edition, 2012, ISBN No.: 978-0262- 0616-4

3 Tom Mitchell, Machine Learning, McGraw Hill, 1997, 0-07-042807-7

e-sources:

1 https://www.knime.com/sites/default/files/inline-images/KNIME_quickstart.pdf

2 www.cs.ccsu.edu/~markov/weka-tutorial.pdf

Program:	M. Tech Computer Engineering					Semester: II	
Course:	Blockchain Technology- (PEC-3)					Code: MCE22PE02	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
				FA			
	Lecture	Practical	Tutorial	FA1	FA2	SA	Total
3	3	-	-	20	20	60	100

Prior knowledge of

Data Structure, Cryptography Techniques, Programming Concepts

is essential.

Course Objectives:

This course aims at enabling students,

1. To provide conceptual understanding of working of Blockchain Technology.
2. To familiarize various types of Blockchain.
3. To familiarize different platforms of Blockchain such as Ethereum, Hyperledger, Bitcoin etc.
4. To impart knowledge of smart contracts for development of Blockchain based systems.

Course Outcomes:

After learning the course, the students should be able to:

1. Understand the foundational principles and working mechanisms of blockchain technology.
2. Classify different blockchain types and consensus mechanisms
3. Develop smart contracts on Ethereum for real-world applications.
4. Develop consortium blockchain solutions using tools like Hyperledger Fabric and Sawtooth
5. Develop blockchain based solutions for real world problems.

Detailed Syllabus

Unit	Description	Duration [Hrs]
I	**Fundamentals of Blockchain**: Introduction, Origin of Blockchain, key Blockchain concepts, Components of Blockchain- Node, Nonce, Hash, mining, Wallet, Ledger, Block in a Blockchain, Blockchain layers, Pros & Cons of Blockchain.	9
II	**Consensus Mechanisms and Blockchain Types**: Different consensus mechanisms, Public Blockchain & Private Blockchain : Public Blockchain, Blockchain Layers, Popular public Blockchain. Ethereum Blockchain, Private Blockchain & Permissioned Blockchain, PAXOS,RAFT, PBFT Consensus algorithm	9
III	**Smart Contracts**: Introduction to smart contracts, Characteristics of smart contracts, Types of smart contracts, Smart contracts in Ethereum, Smart contracts in Industry(healthcare, Supply chin etc). Smart contracts in Private Blockchain.	9
IV	C**onsortium Blockchain**: Key characteristics of consortium Blockchain, Need of consortium Blockchain, Challenges of Consortium Blockchain, Introduction to Hyperledger : Fabric, sawtooth , Tools, Hyperledger fabric, Overview of Ripple	9
V	**Applications of Blockchain:** Blockchain in Banking & Finance- Challenges, Know your customer (KYC), Cross border payments, Trade finance. Blockchain in Education – Challenges in Educational System, Identity & Student Records, Blockchain in Healthcare- Challenges in Healthcare, Heath Records Management	9
	Total	**45**

Text Books:

1. Chandramouli Subramanian, Asha George, Abhilash K A, Meena Karthikeyan, " Blockchain Technology", University Press (Indis) Pvt. Ltd. 2021, ISBN: 9789389211634
2. Bashir, Imran, "Mastering Blockchain : Distributed ledger technology, decentralization, and smart contracts explained", 2nd Edition, Birmingham : Packet Publishing, 2018, ISBN 9781788838672 178883867X 1788839048 9781788839044

Reference Books:

1. Melanie Swan, "Block Chain: Blueprint for a New Economy", O'Reilly, 2015
2. Ritesh Modi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Block Chain", Packt Publishing
3. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O'Dowd, Venkatraman Ramakrishna, "Hands-On Block Chain with Hyperledger: Building Decentralized Applications with Hyperledger Fabric and Composer", Import, 2018
4. Daniel Drescher, "Block Chain Basics", Apress; 1st edition, 2017

e-sources:

1. NPTEL Course "Introduction to Block Chain Technology & Applications"
2. https://nptel.ac.in/courses/106/104/106104220/
3. NPTEL Course on "Blockchain Architecture & Use Cases" https://nptel.ac.in/courses/106/105/106105184/

Program:	M. Tech Computer Engineering					Semester: II	
Course:	Computer Vision and Video Processing(PEC-4)					Code: MCE22PE03	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
				FA		SA	Total
	Lecture	Practical	Tutorial	FA1	FA2		
3	3	-	-	20	20	60	100

Prior knowledge of

1.Digital Image Processing

2.Deep Learning

is essential.

Course Objectives:

This course aims at enabling students,

1. To get acquainted with the image formation models, segmentation and application areas
2. To gain knowledge about the motion estimation and the video processing methods
3. To design solutions for complex problem scenarios in computer vision

Course Outcomes:

After learning the course, the students should be able to:

1.Summarize the image formation models

2.Analyze the image sequence segmentation methods

3. Use the image models and transforms for suitable applications

4.Examine the different motion estimation algorithms

5. Analyze the video processing methods

Detailed Syllabus:

Unit	Description	Duration [Hrs]
I	**Image Formation Models :**Image Formation Models: Monocular imaging system, Orthographic & Perspective Projection, Cameras – lenses, projections, sensors, Representation – color spaces, Camera model and Camera calibration, Binocular imaging systems, Sources, Shadows and Shading.	9
II	**Image sequence segmentation:** Spatial segmentation (frame-by-frame), Temporal segmentation (scene cut detection), Spatio-temporal segmentation, Spectral analysis of image sequences: Fourier, DCT and wavelet-domain analysis	9
III	**Image models, Transforms and Application Areas:** Contour-texture image model, Mathematical morphology, Segmentation, Object interaction, Geometrical transforms, Image registration, Hough transform, Road detection in remote sensing, biomedical and industrial applications	9
IV	**Motion estimation:** Optical flow, Pixel based motion estimation, Block matching algorithm, Deformable block matching algorithm, Mesh based motion estimation, Global motion estimation, Region based motion estimation, Multi resolution motion estimation, Feature based Motion Estimation, Direct motion Estimation	9
V	**Video Processing:** Basics, Enhancement, Segmentation, Object Tracking – Mean-shift and Deep learning based approaches, Video surveillance, Video annotation, Face Tracking For Use in a Perceptual User Interface	9
	Total	**45**

Text Books:

1. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Publisher Prentice Hall Edition 2nd Edition, 2018.
2. González, R.C.; Woods, R.E. Digital image processing. 3rd ed, Harlow: Pearson Prentice Hall. 2016, ISBN 9780131687288, July 2018.

Reference Books:

1. Digital Image Processing and Computer Vision, R. J. Schalkoff, John Wiley & Sons Australia Edition, 2008.
2. David A. Forsyth and Jean Ponce: Computer vision: A modern approach, Prentice Hall, 2002.
3. A. Bovik (Ed.), The Essential Guide to Video Processing. Academic Press, 2009.

Program:	M. Tech Computer Engineering					Semester: II	
Course:	Prompt Engineering-(PEC-4)					Code: MCE22PE04	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
3	3	-	-	20	20	60	100

Prior knowledge of
--
is essential.

Course Objectives:

This course aims at enabling students,

1. Define prompt engineering and its role in interacting with LLMs.
2. Explain the fundamental concepts of NLP and generative models relevant to prompt engineering.
3. Identify different prompt types (few-shot, zero-shot) and their applications.
4. Apply various prompt engineering techniques (e.g., Chain-of-Thought, Crowdsourcing) to achieve specific tasks.
5. Evaluate and refine prompts for accuracy, bias mitigation, and factual consistency.

Course Outcomes:

After learning the course, the students should be able to:

1. Understand the role in interacting with LLM
2. Explore the fundamental concepts of NLP and generative models
3. Explore the different prompt types and their Applications
4. Apply various prompt engineering techniques
5. Evaluate ethical consideration of Prompt Engineering

Detailed Syllabus:

Unit	Description	Duration [Hrs]
I	**Introduction to Prompt Engineering** Large Language Model , Working of LLM, Prompt Engineering, importance of Prompt Engineering, Types of prompts: security threats, system failures, performance bottlenecks, Benefits and limitations of Prompt Engineering, Benefits and limitations of Prompt Engineering, Case studies highlighting the impact of prompts on computing systems Real-world applications across various domains	9
II	**Foundations of NLP and Generative Models** Overview of NLP tasks and applications, Preprocessing techniques for text data, Basic NLP tools and libraries (NLTK, SpaCy), Text Representation and Feature Engineering - Bag-of-Words model, Word embeddings (Word2Vec, GloVe), Deep learning-based text representations (BERT, Transformer). Generative Models - Overview of generative modeling, Probabilistic generative models, Autoencoders and variational inference.	9
III	**Prompt Types and Techniques** Zero-shot vs. Few-shot learning with prompts, Task-specific prompt design strategies, Advanced techniques like Chain-of-Thought prompting, Introduction to prompt engineering tools and resources, Prompt Detection Techniques- Anomaly detection methods, Threshold-based approaches, Machine learning techniques for prompt detection	9

IV	**Prompt Development and Evaluation** Exercises - case studies in crafting prompts for various tasks (e.g., text generation, question answering), Techniques for evaluating prompt effectiveness and factual accuracy, Refining and iterating on prompts based on results, bias detection and mitigation in prompts	9
V	**Current trends and case studies of Prompt Engineering** Emerging trends and advancements in prompt engineering Ethical considerations and potential societal impacts Discussion on the future of human-AI collaboration through prompts, Case Studies: Analysis of real-world prompt events, Design and implementation of prompt-resistant solutions, Evaluation of prompt engineering techniques in practice,	9
	Total	**45**

Text Books:

1. Richard H. Thaler and Cass R. Sunstein,Nudge: Improving Decisions About Health, Wealth, and Happiness
2. Robert B. Cialdini ,Influence: The Psychology of Persuasion

Reference Books:

1. Don Norman, The Design of Everyday Things.
2. Nir Eyal, Hooked: How to Build Habit-Forming Products,
3. Peter C. Brown, Henry L. Roediger III, and Mark A. McDaniel "Make It Stick: The Science of Successful Learning.
4. Dan Ariely, Predictably Irrational: The Hidden Forces That Shape Our Decisions"
5. Stephen Wendel "Designing for Behavior Change: Applying Psychology and Behavioral Economics"
6. Jeff Johnson, Designing with the Mind in Mind: Simple Guide to Understanding User Interface Design Rules
7. B.J. Fogg "Persuasive Technology: Using Computers to Change What We Think and Do"
8. Daniel Kahneman "Thinking, Fast and Slow"

e-sources:

1. Google AI Blog: http://research.google/blog/ -
2. Hugging Face Blog: https://huggingface.co/blog -
3. Papers with Code - Prompt Engineering: https://paperswithcode.com/task/prompt-engineering -

Program:	M. Tech Computer Engineering						Semester: II
Course:	Program Elective Course-3 Laboratory						Code: MCE22PE05
Credits	Teaching Scheme (Hrs. /Week)			Evaluation Scheme and Marks			
	Theory	Practical	Tutorial	TW	OR	PR	Total
2	-	4	-	50	50	-	100

Program Elective Lab 3
Advanced Machine Learning Lab

Prior knowledge of
Machine Learning
is essential.

Course Objectives:

This course aims at enabling students,

1. To understand nature of problems solved with machine learning
2. To apply advanced machine learning methods for suitable applications

Course Outcomes:

After learning the course, the students should be able to:

1. Design and evaluate various machine learning algorithms.
2. Use machine learning methods for data analysis in various scientific fields.
3. Choose and apply appropriate Machine Learning techniques for analysis, forecasting and categorization of data.
4. Understand reinforcement learning and its applications.

Detailed Syllabus

Expt. No.	Suggested List of Experiments
1.	Implement a fuzzy based model for grading system in education domain. OR Implement Medical diagnostics for detecting diseases using genetic algorithm.
2.	Implement Decision Tree algorithms for credit card fraud detection. OR Implement Reinforcement learning model for Tic Tac Toe.
3.	Implement an Artificial Neural Network model for stock market prediction OR Implement Twitter Sentiment Prediction using Machine Learning Techniques
4.	Implement Reinforcement Learning model for Traffic Light Control System.

Text Books

1. Kevin Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 1st Edition, 2012, ISBN No.: 978-0262- 0616-4
2. Ian.H. Witten, Eibe Frank, "Data Mining: Practical Machine Learning Tools and Techniques",2nd Edition
3. Stephen Marsland, "Machine Learning: An Algorithmic Perspective" ,1st Edition.
4. Peter Flach, "Machine Learning: The Art and Science of Algorithms that make sense of data", Cambridge University Press, 1st Edition, 2012, ISBN No.: 978-1-316-50611-0
5. Han, Jiawei Kamber, Micheline Pei and Jian, "Data Mining: Concepts and Techniques" Elsevier Publishers Third Edition, ISBN: 9780123814791, 9780123814807.

Reference Books:

1. Ethem Alpaydin, "Introduction to Machine Learning", PHI, 2nd edition, 2013, 978-0-262-01243-0 Kevin
2. Tom Mitchell, "Machine Learning", McGraw Hill, 1997, 0-07-042807-7 3. Parag Kulkarni, "Reinforcement and Systemic Machine Learning for Decision Making" Wiley-IEEE Press, ISBN: 978-0-470-91999-6.

OR

Program Elective Lab 3
Blockchain Technology Lab

Prior knowledge of
-
is essential.

Course Objectives:

This course aims at enabling students,

1. To develop skills to implement smart contracts on local Blockchain environments.
2. To make the students learn to develop smart contracts across various test networks.
3. To develop skills for designing and building DApps using Ethereum or Hyperledger technologies.

Course Outcomes:

After completion of this course, the students will be able to,

1. Develop and test smart contract on local Blockchain
2. Develop and test smart contracts on Ethereum test networks.
3. Develop and test a DApp using Ethereum/Hyperledger.

Detailed Syllabus

Expt. No.	Suggested List of Experiments
1.	Write a smart contract using Solidity for bank Transactions such as get balance, deposit and withdrawal etc.
2.	Study of Geth and Ganache Tools to Create a private Block chain, Creation of Account and Mining using geth.
3.	Create and Configure Genesis block.
4.	Introduction to Truffle, establishing local Blockchain using Truffle
5.	Using the Blockchain Concepts in Theory course and assignments covered above, Students should develop an application. Create a Blockchain on Testnet for storing any critical information. Document the findings and analysis in the analysis report preferably in IEEE Research Paper format Note: ● Instructors should maintain the progress report of the mini project throughout the semester from the project group and assign marks as a part of the term work. ● Oral examination will be on the Solution Proposed in Mini Project and BlockChain concepts used in the laboratory assignments.

ext Books:

1. Artemis Caro, "Blockchain: The Beginners Guide to Understanding the Technology Behind Bitcoin & Cryptocurrency", Kevin Wolhuter, 2021, ISBN: 1922590061, 9781922590060
2. Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly Media, Inc.2017, ISBN: 9781491954386

Reference Books:

1. Mark Watney, Blockchain for Beginners: The Complete Step by Step Guide to Understanding Blockchain Technology", CreateSpace Independent Publishing Platform, 2017, ISBN: 1548766887, 9781548766887.
2. Alwyn Bishop, "Blockchain Technology Explained", CreateSpace Independent Publishing Platform, 2018, ISBN: 9781986273800.

Program:	M. Tech Computer Engineering						Semester: II
Course:	Program Elective Course-4 Laboratory						Code: MCE22PE06
Credits	Teaching Scheme (Hrs. /Week)			Evaluation Scheme and Marks			
	Theory	Practical	Tutorial	TW	OR	PR	Total
2	-	4	-	50	50	-	100

Program Elective Lab 4
Computer Vision and Video Processing Lab

Prior knowledge of
Digital Image Processing, Deep Learning
is essential

Course Objectives:
This course aims at enabling students,
1. Familiarize the computer vision, video processing methods and applications
2. To design solutions for the real time scenarios in computer vision and video processing

Course Outcomes:
After learning the course, the students should be able to:
1. Develop an application based on computer vision methods
2. Develop an application based on video processing methods

Detailed Syllabus

Expt. No	Suggested topics for the Mini Project are as follows
1.	Mini Project on biomedical/industrial application/remote sensing
2.	Mini Project on Video surveillance/enhancement/annotation

Text Books:
1. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Publisher Prentice Hall Edition 2nd Edition, 2018.
2. González, R.C.; Woods, R.E. Digital image processing. 3rd ed, Harlow: Pearson Prentice Hall. 2016, ISBN 9780131687288,July 2018.

Reference Books:
1. Digital Image Processing and Computer Vision,R. J. Schalkoff, John Wiley & Sons Australia Edition, 2008
2. David A. Forsyth and Jean Ponce: Computer vision: A modern approach, Prentice Hall, 2002.
3. A. Bovik (Ed.),The Essential Guide to Video Processing. Academic Press, 2009.
4. 4.Introductory Techniques for 3D Computer Vision, E. Trucco, A. Verri, Prentice Hall Edition 2013.

OR

Program Elective Lab 4
Prompt Engineering Lab

Prior knowledge of
Basic Computer Fundamentals
is essential.

Course Objectives:
This course aims at enabling students,
1. To provide a comprehensive understanding of the principles, methodologies, and techniques involved in prompt engineering.
2. To equip students with the skills necessary for effective prompt detection, analysis, and response in various domains.
3. To foster critical thinking and problem-solving abilities required for designing prompt-resistant systems and architectures.

4. To explore advanced topics and emerging trends in prompt engineering, preparing students for research and innovation in the field.

Course Outcome:

After learning the course, the students should be able to:

1. Analyze different types of prompts, including security threats, performance bottlenecks, and system failures.
2. Design and implement prompt detection mechanisms using both rule-based and machine learning approaches.
3. Apply prompt engineering principles to real-world scenarios across various domains such as cybersecurity, cloud computing, and IoT.
4. Evaluate the performance and effectiveness of prompt response mechanisms through simulation and experimentation**.**

Detailed Syllabus

Expt. No.	Suggested List of Experiments
1.	**Title:** Introduction to Prompt Engineering **Tasks:** 1. Overview of prompt engineering concepts and applications 2. Introduction to popular prompting techniques: template-based, text-based, and parameter-based 3. Hands-on exercises using platforms like Hugging Face Transformers or OpenAI Codex to generate prompts and analyze outputs
2.	**Title:** Text-to-Text Transfer Learning **Tasks:** 1. Understanding the principles of text-to-text transfer learning 2. Hands-on training with pre-trained language models like GPT, BERT, T5 3. Fine-tuning pre-trained models for specific prompt engineering tasks such as text summarization, translation, and question answering
3.	**Title:** Prompt Design and Evaluation **Tasks:** 1. Techniques for designing effective prompts for AI systems 2. Evaluation metrics for assessing prompt effectiveness, including fluency, relevance, and diversity 3. Conducting experiments to compare the performance of different prompts on specific tasks using standard benchmarks and datasets
4.	**Title:** Advanced Prompting Techniques **Tasks:** 1. Advanced methods for prompt engineering, including zero-shot learning, few-shot learning, and prompt programming 2. Hands-on exercises on designing prompts for complex tasks such as code generation, image captioning, and logical reasoning 3. Discussion on recent research trends and applications in prompt engineering
5.	**Title:** Prompt Engineering for Specific Applications Tasks: 1. Application-focused lab session, where students choose a specific domain or task (e.g., healthcare, finance, conversational AI) to apply prompt engineering techniques 2. Hands-on project work to design, implement, and evaluate prompts tailored to the chosen application Presentation and discussion of project results, lessons learned, and future directions in prompt engineering

Reference Books:

1. Koren, Israel, and C. Mani Krishna. Fault-tolerant systems. Morgan Kaufmann, 2020.
2. Bryant, Randal E., and David Richard O'Hallaron. Computer systems: a programmer's perspective. Prentice Hall, 2011.
3. Saltzer, Jerome H., and M. Frans Kaashoek. Principles of computer system design: an introduction. Morgan Kaufmann, 2009.
4. Hennessy, John L., and David A. Patterson. Computer architecture: a quantitative approach. Elsevier, 2011.
5. Cachin, Christian, Rachid Guerraoui, and Luís Rodrigues. Introduction to reliable and secure distributed programming. Springer Science & Business Media, 2011.
6. Adkins, Heather, Betsy Beyer, Paul Blankinship, Piotr Lewandowski, Ana Oprea, and Adam Stubblefield. Building secure and reliable systems: best practices for designing, implementing, and maintaining systems. O'Reilly Media, 2020.

Program:	M. Tech Computer Engineering						Semester: II
Course:	Skill Development Lab -2 (Soft Skills and Aptitude)						Code: MCE22VS01
Credits	Teaching Scheme (Hrs. /Week)			Evaluation Scheme and Marks			
	Theory	Practical	Tutorial	TW	OR	PR	Total
2	-	4	-	100	-	-	100

Prior knowledge of
--
is essential.

Course Objectives:

This course aims at enabling students,

1. To facilitate holistic growth
2. To make the students aware about the significance of Soft Skills and English Aptitude
3. To develop the ability of effective communication through individual and group activities
4. To expose students to right attitude and behavioral aspects and build the same through various activities

Course Outcomes:

After completion of this course, the students will be able to,

1. Express effectively through verbal/oral communication skills
2. Prepare for group discussions/meetings/interviews and presentations
3. Operate effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, inter personal relationships, conflict management and leadership activities

Guidelines:

Total Six assignments to be Conducted Out of Eight

Detailed Syllabus

Expt. No.	Suggested List of Experiments
1.	**Group Discussion:** Make students aware of proper and globally accepted ethical way to handle work, colleagues and clients. Develop group communication skills. Learn to speak up one's opinion in a forum. Cultivate the habit of presenting solution driven analytical arguments making them contributors in any team.
2.	**Public Speaking**: Any one of the following activities may be conducted: Prepared speech (Topics are given in advance, students get 10 minutes to prepare the speech and 5 minutes to deliver.) Extempore speech (Students deliver speeches spontaneously for 5 minutes each on a given topic)
3.	**Writing An Article on Any Social Issue**: Build writing skills, improve language and gain knowledge about how to write an article/ report
4.	**Reading and Listening skills**: The batch can be divided into pairs. Each pair will be given a article by the facilitator. Each pair would come on the stage and read aloud the article one by one. After reading by each pair, the other students would be asked questions and needful corrections in the article. The facilitator can evaluate the students for reading and listening skills.
5.	**Debate On Current Affairs/ Social Relevance Topics**: Cultivate the habit to present forceful arguments while respecting the opponents perspective and enhance verbal skills.
6.	**Telephonic etiquettes:** To teach students the skills to communicate effectively over the phone. Students will be divided into pairs. Each pair will be given different situations, such as phone call to enquire about job vacancy, scheduling a meeting with team members, phone call for requesting of urgent leave from higher authorities. Students will be given 10 min to prepare. Assessment will be done on the basis of performance during the telephone call.

7.	**Email etiquettes:** To provide students with an in-depth understanding of writing formal emails
8.	**Mock interviews:** Guide students and conduct mock interviews

Text Books:

1. Barun Mitra, Personality Development and Soft Skills
2. Stephen Lucas, The Art of Public Speaking

Reference Books:

1. Marcia Weaver, Empowering Employees Through Basic Skills
2. Gerald Ratigan, Aced: Superior Interview Skills to Gain an Unfair Advantage to Land Your DREAM JOB!

Program:	M. Tech. Computer Engineering					Semester: II	
Course:	Research Internship					Code:MCE22EL02	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
4	-	8	-	150	-	-	150

Prior knowledge of:

Basics of programming language such as Java, MATLAB, Python etc

is essential

Course Objectives:

This course will enable students

1. To provide the opportunities to learn, understand and sharpen the research acumen, as well as the communication/ technical/managerial skills required for conducting research.
2. To enhance their problem-solving and critical-thinking abilities.
3. To provide an opportunity to the students to carry out research in a real work environment with supervisor guidance over a specific period.
4. To familiarize students with research methods, analytical tools and techniques along with their appropriate usage.

Course Outcomes:

After learning the course, the students will be able to:

1. Develop the ability to learn the concept of Literature Review, Technical Reading, critical evaluation, Attributions and Citations.
2. Identify and apply the algorithm or mechanism to solve the research problem.
3. Adapt Ethics in Engineering Research.
4. Prepare a technical report based on the results obtained.

Guidelines:

1. Individual student needs to attempt for research internship under the guidance of allocated supervisor.
2. Student can do research internship in the industry or in the institute under guidance of allocated supervisor.
3. Student doing research internship in the industry can work on the problem statement provided by the industry.
   For student doing internship in the institute, supervisor will assign a research task (problem statement or part of funding proposal).
4. Student is supposed to provide a feasible solution to the assigned problem statement.
5. Student will synthesize research findings by drafting a research report.
6. Three reviews will be scheduled to assess progress of the research work. Review-I: Student will present current state of the art of the literature for the assigned research task.
   Review-II: Explanation of the partial results obtained through implementation of the proposed algorithm is expected.
   Review-III: Demonstration and explanation of the complete solution of the assigned research task is expected.
7. Student should try to publish the results in the reputed journal or register a patent.
8. Student is supposed to submit research internship report as a compliance of term work associated with subject.

Detailed Syllabus

Sr. No.	Suggested List of Experiments
1	Week 1, 2, 3: Guide allotment, Application of internships, finalization of topic, Planning of the work. Review-1 conduction

2	Week 4, 5: Internship/ Mini-project/ Entrepreneurship activity implementation as per requirements
3	Week 6,7, 8: Review-2 of Activities
4	Week 9, 10: Interaction of Guides with Industry, Poster Presentation
5	Week 11, 12: Internship Report writing and publication or copyright planning: Final Review-3 conduction.

Program	M.Tech. Computer Engineering					Semester:II	
Course	Review Paper Writing					Code:MCE22EL03	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
2	-	4	-	100	-	-	100

Prior knowledge of:

Basics of Technical writing

is essential

Course Objectives:

This course will enable students

1. To provide an opportunity to the students to carry out research review of specific topic
2. To familiarize students with publication support tools

Course Outcomes:

After learning the course, the students will be able to:

1. Develop the ability to learn the concept of Literature Review, Technical Reading, critical evaluation, Attributions and Citations.
2. Use publications tools such as writing tools, plagiarism tools and AI writing tools
3. Understand Publication Ethics and their impact in research.
4. Prepare a technical review paper with appropriate statistics and conclusions.

Guidelines:

1. Individual student need to find the specific area of research under the guidance of allocated supervisor.
2. Student need to collect at least 25 papers in specified area.
3. They have to prepare Literature review on the basis of papers collected.
4. Student is supposed to appropriate writing tools such as Latex for preparation of material.
5. Student need to learn tools for good English writing such as Grammarly.
6. Students need to use plagiarism and AI writing checking tools for their document.
7. Three reviews will be scheduled to assess progress of the research work.
8. Student must publish the good review paper in conference/ journal.
9. One MOOCs course related to Research Review Writing is compulsory

Detailed Syllabus

Sr. No.	Activity
1.	Guide allotment and selection of research area
2.	Finalize research review topic and scope of research Review-1 (Will be conducted in Week 3-4)
3.	Conducting critical literature review: Selection of appropriate research papers, Critical reading and thinking, Comparative analysis of the papers, Finding a research Gap
4.	Review-2 (Will be conducted in Week 6-7): Expectation: Discussion on the Area of research selected for review
5.	Write a research review paper. Software for paper formatting like LaTeX/MS Office etc. can be used Citing styles and tools such as Google scholar, Mendleyetc Reference Management Software like Zotero/Mendeley
6.	Evaluation of MOOCs course attended related to research review writing
7.	Final Review-3 (Will be conducted in Week 9-11): Expectations: Paper Publication

Course Syllabus
Semester-III

Program:	M. Tech Computer Engineering					Semester: III	
Course:	Dissertation- Phase - I [Company/ Research project]					Code: MCE23EL01	
Credits	Teaching Scheme (Hrs. /Week)			Evaluation Scheme and Marks			
	Theory	Practical	Tutorial	TW	OR	PR	Total
16	-	32	-	200	200	-	400

Prior knowledge of
Software Engineering, Computer Programming and Research Methodology
is essential.

Course Objectives:
This course will enable students to
1. To plan for various activities of the major project and channelize the work towards publication
2. To build, design and implement real time application using available platforms.
3. To adapt research culture for further career growth.

Course Outcomes:
After completion of this course, the students will be able to,
1. Identify a research topic considering the real-world/societal problems.
2. Analyze the literature for the selected problem to identify gaps in the existing solutions.
3. Propose a solution model for the selected problem with the help of cutting-edge technologies.
4. Execute block level design for the proposed model.
5. Develop part of the proposed solution using appropriate hardware platforms and software tools.
6. Prepare and publish good quality technical reports and present it effectively.

Guidelines:

The M Tech Dissertation serves as a culmination of academic learning and practical application of Computer Engineering. The primary objective of this dissertation is to demonstrate the ability to independently research and solve either a real-world challenge or to advance the existing theoretical framework by proposing a novel algorithm. Through this dissertation, students are expected to showcase their analytical, problem-solving, and technical ability of a higher degree which is difficult for an undergraduate student.
Dissertation work may be in-house research, sponsored or multidisciplinary. It can be carried out inside or outside the institute, in any relevant industry/organization or research institution or labs/organization.

Responsibilities of Students:

- The Dissertation should be carried out individually by each student.
- Each student should identify the area or topics in recent trends and developments in consultation with the institute guide or industry or any research organization.
- All students should meet their respective project guide regularly (at least once in a week) and report the progress of the dissertation work.
- Students should maintain the record of all the meetings, remarks given by guide/reviewers and progress of the work in the project diary. The project diary must be presented during each review presentation to the reviewers.
- A student should conduct the research ethically, adhere to the academic integrity standards, and cite sources whenever using any existing results
- For final examination, students should complete the Dissertation Report in all aspects
- Each student should prepare the report, get it approved by his/her guide and submit the duly signed copy within deadline.
- It is expected that all students should prepare a research article/paper, funding proposal, patent and copyright on their respective dissertation work and submit the same in reputed journals/ conferences in collaboration with his/her guide.

Guide Allocation:

- At the start of the semester, each student will be allocated with a project guide, who is a faculty in

the department.

- In case of a sponsored project (with a reputed industry or any research organization) external guide should be from sponsored company/Industry along with the internal guide from the program.

Deliverables:

- Dissertation Synopsis
- Review-1, Review-2 and Review-3 reports
- Dissertation Phase I report
- Draft of the Research Article

Assessment Criteria:

- There will be three reviews through the Dissertation Phase I (Added as annexures)
- The review committee will approve the project title. Discussion/ presentation may be arranged covering topics listed in the synopsis.
- The project guide and/or review panel will evaluate the timely progress of the projects.
- Assessment will be done based on the published assessment rubrics, attached in Annexure I
- During reviews, students are required to demonstrate the progress done after the last review.
- The suggestions or corrections given by the review panel committee should be recorded in the project dairy, incorporated and demonstrated in the consecutive reviews.
- Final term work will be calculated based on the performance in reviews.
- Dissertation Phase -I final exam will be conducted in front of an external examiner

Detailed Syllabus

Activity. No.	Suggested List of Activities
1.	Guide allocation, Applying for sponsorship and project internship, Topic Finalization and Project Planning:
2.	Literature Review Review 1 for finalization of topic and specification.
3.	Solution Design and Platform Selection Review 2 to understand the progress of the project
4.	Implementation (40% implementation expected)
5.	Preparation of research article, dissertation phase I report and presentation Final review for submission and term work compliance

Program:	M. Tech Computer Engineering					Semester: III	
Course:	MOOCs -1					Code: MCE23EL02	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
2	2	-	-	50	-	-	50

Prior knowledge of

--

is essential.

Course Objectives:

This course aims at enabling students,

1. To imbibe self learning.
2. To prepare students for modern tools and techniques.

Course Outcomes:

After learning the course, the students should be able to:

1. To apply the technical knowledge in multi-disciplinary project.
2. To explore modern tools and techniques.

Guidelines for Students:

Individual student can register for MOOC course which include the multi-disciplinary knowledge, tools and techniques to develop and apply it in project.

Selection of Course:

1. The selected course should be from NPTEL/ Cousera/ Udemy/any foreign university approved course.
2. The selected course should not be from courses offered in the programme curriculum.
3. Students must take prior approval from Mentor/Project Guide and PG coordinator/MOOC coordinator through the prescribed form given in Annexure-A.
4. Students must submit proof of course registration done along with Annexure-A.
5. Certification and grade report is mandatory for the course to be selected
6. Students must complete all assessments related to the selected course as prescribed by the course.

Duration of Course:

Selected MOOC course should be of 6/8/10 weeks (minimum 30 hours).

Assessment of Course:

At the end of course submission, the MOOC report of 10-15 pages in hardcopy is mandatory along with certificate of completion.

Evaluation guideline and rubric for progressive :

Student will be evaluated progressively for a total 50 marks(i.e 40 marks progressive and 10 marks completion of certificate)

Sr. No.	Rubric	Marks
1	Presentation of Topic selected	**10**
2	Score of assignments	**30**
	Total	**40**

The 10 marks will be based on certificate completion.

Web-references:

1. https://swayam.gov.in/nc_details/NPTEL
2. **https://onlinecourses.nptel.ac.in/**

Annexure A: MOOC Course Approval Form

Program:	M. Tech Computer Engineering						Semester: III
Course:	MOOCs -II						Code:MCE23EL03
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
2	2	-	-	50	-	-	50

Prior knowledge of

--

is essential.

Course Objectives:

This course aims at enabling students,

1. To imbibe self learning.
2. To inculcate research and innovation culture among students.

Course Outcomes:

After learning the course, the students should be able to:

1. Analyze the new state-of-art for lifelong learning.
2. Develop innovative solutions, and formulate strategic business plans.

Guidelines for Students:

Individual student can register for MOOC course within the categories of Innovation and Entrepreneurship / Science and Research Methods/ Business and Management.

Selection of Course:

1. The selected course should be from NPTEL/ Cousera/ Udemy/any foreign university approved course.
2. The selected course should not be from courses offered in the programme curriculum.
3. Students must take prior approval from Mentor/Project Guide and PG coordinator/MOOC coordinator through the prescribed form given in Annexure-A.
4. Students must submit proof of course registration done along with Annexure-A.
5. Certification and grade report is mandatory for the course to be selected
6. Students must complete all assessments related to the selected course as prescribed by the course.

Duration of Course:

Selected MOOC course should be of 6/8/10 weeks (minimum 30 hours).

Assessment of Course:

At the end of course submission, the MOOC report of 10-15 pages in hardcopy is mandatory along with certificate of completion.

Evaluation guideline and rubric for progressive :

Student will be evaluated progressively for a total 50 marks(i.e 40 marks progressive and 10 marks completion of certificate)

Sr. No.	Rubric	Marks
1	Presentation of Topic selected	**10**
2	Score of assignments	**30**
	Total	**40**

1. **The 10 marks will be based on certificate completion.**

Web-references:

1. https://swayam.gov.in/nc_details/NPTEL
2. **https://onlinecourses.nptel.ac.in/**

Annexure A: MOOC Course Approval Form

Course Syllabus
Semester-IV

Program:	M. Tech Computer Engineering						Semester: IV
Course:	Dissertation- Phase - II [Company/ Research project]						Code: MCE24EL01
Credits	Teaching Scheme (Hrs. /Week)			Evaluation Scheme and Marks			
	Theory	Practical	Tutorial	TW	OR	PR	Total
16	-	32	-	200	200	-	400

Prior knowledge of
Research methodology, Programming languages, and Dissertation phase 1
is essential.

Course Objectives:

This course will enable students to

1. Perform research independently.
2. Provide a complete end-to-end solution for a real-world problems.
3. Articulate his/her research findings in an effective manner.
4. Prepare the draft of a research article in a standard format.

Course Outcomes:

After completion of this course, the students will be able to,

1. Develop an application based on the proposed solution model considering the legal, ethical and compliance issues.
2. Test the developed application for correctness
3. Articulate research findings in an effective and confident manner
4. Prepare a Dissertation report based on the developed application
5. Prepare a good quality research article in standard formats based on their research findings

Ideally the dissertation phase 2 is the continuation of the dissertation phase 1. Students should continue with their dissertation phase 1 and complete the implementation in phase 2. It is also expected that once the implementation is done, analysis

Guidelines:

Guidelines are the same as Dissertation Phase I except the deliverables part.

Deliverables:

- Review 1, Review 2 and Review 3 Reports
- Dissertation Phase 2 Report
- Research Article

Detailed Syllabus

Expt. No.	Suggested List of Experiments
1.	Coding and Implementation: Review -1 will be conducted
2.	Implementation and integration of all modules
3.	Testing and Validation: Review -2 will be conducted
4.	Fine Tuning the Application as per test results: Review 3 will be conducted.
5.	Demonstration of Project work and Final Research Review Committee (RRC) reviews will be conducted for submission and term work compliances

Program:	M. Tech Computer Engineering						Semester: IV
Course:	Seminar						Code: MCE24EL02
Credits	Teaching Scheme (Hrs. /Week)			Evaluation Scheme and Marks			
	Theory	Practical	Tutorial	TW	OR	PR	Total
04	-	08	-	100	100	-	200

Prior knowledge of
Research Methodology
is essential.

Course Objectives:
This course aims at enabling students,

1. To apply the knowledge and skills for understanding realistic problems.
2. To review the existing literatures published in reputed journals / conference proceedings
3. To identify research gaps by observing the experimental results keenly.
4. To prepare technical reports of high quality.

Course Outcomes:
After completion of this course, the students will be able to,

1. Identify a real-life problem based on societal/real life problems.
2. Understand various solution approaches and algorithms, proposed by the existing literature for solving the identified problem.
3. Analyze the solutions proposed by existing literatures and verify the results.
4. Identify the shortcomings of various solution approaches by observing results.
5. Articulate the critical analysis of various approaches in own language.
6. Prepare good quality technical reports based on the selected problem statement.

Guidelines:

Guide Allocation:
At the start of the semester, each student will be allocated a faculty member as seminar guide.
Responsibility of the students:

- The Seminar should be carried out individually by each student.
- A student should identify the area or topics in recent trends and developments in consultation with the guide
- A student should report to his/her respective guide regularly (at least once in a week) and report the progress of the seminar work.
- A student should follow the timelines and deadlines and inform the supervisor in case of any difficulty/delay.
- Students should maintain the record of all the meetings, remarks given by guide/reviewers and progress of the work in the project diary. The project diary must be presented during each review presentation to the reviewers.
- A student should conduct the research ethically, adhere to the academic integrity standards, and cite sources whenever using any existing results
- A student should Incorporate constructive feedback to improve the quality and rigor of the research
- For final examination, students should complete the Seminar Report in all aspects including formatting and citation.
- Each student should prepare the report, get it approved by his/her guide and submit the duly signed copy within deadline.
- A student should invest time and effort in preparing for seminar presentations and the oral defense of the seminar

Deliverables:

- Seminar Report
- One -page report of Review-1, and Review-2

Assessment Guidelines:

- There will be two reviews throughout the semesters. The rubrics for those reviews are attached in Annexure

Detailed Syllabus

Activity No.	Suggested Activity
I	Topic Identification and Proposal Development: Week 1: • Meet with seminar guide to discuss project guidelines and expectations. • Identify potential seminar topics based on personal interest and faculty expertise. • Conduct preliminary literature review to understand existing work in selected topic areas. Week 2: • Refine the seminar topic and formulate specific seminar objectives. • Develop a concise proposal outlining Seminar scope, methodology, and expected outcomes. • Submit the proposal to the seminar coordinator after approval from the guide • Review 1 will be conducted
II	**Literature Review and Planning:** Week 3: • Begin an in-depth literature review on the chosen topic to identify key concepts, methodologies, and gaps in existing solutions . • Develop a structured literature review document summarizing relevant studies and findings. Week 4: • Discuss literature findings with the project guide to refine semianr objectives and methodology. • Plan the implementation phase based on insights gained from the literature review. • Week 5: • Finalize the literature review and update the research plan accordingly. • Prepare a detailed timeline with specific milestones for implementation and result verification. • Prepare a rough literature review draft based on the key findings.
III	**Implementation and Result Verification:** Week 6-7: • Implement one existing solutions or develop experimental setups based on the planned methodology. • Start collecting data and conducting experiments as per the timeline. Week 8: • Continuously monitor and analyze experimental results to verify findings and address any technical challenges. • Discuss progress and results with the project guide for feedback and guidance. Week 9: • Complete data collection and experiments required for achieving project objectives. • Begin data analysis and interpretation to draw meaningful conclusions. • Fine tune the rough draft in proper format to finalize the research paper
IV	**Report Preparation and Presentation:** Week 10:

	• Organize and structure research findings into a comprehensive report format. • Draft sections of the seminar report including introduction, methodology, results, and discussion. Week 11: • Review and revise the seminar report based on feedback from the project guide and seminar coordinator. • Review and revise the draft of literature review paper based on guide's feedback. Prepare presentation slides summarizing key findings and conclusions. Week 12: • Finalize the seminar report and presentation slides. Review 2 will be conducted

Annexure-I

	Pimpri Chinchwad Education Trust's **Pimpri Chinchwad College of Engineering**

Annexure A: MOOC Course Approval Form

1. Student email address:

2. Semester in which NPTEL course opted:

NPTEL Course Details:

Sr. No.	Name of Course	Course Duration	Offering Institute	Substituting Course

The NPTEL courses opted by the student have been checked and found OK/ Not OK.

---------- ----------

Mentor/ Project Guide PG Coordinator/MOOC Coordinator

Undertaking by the student:

I, _____, ROLL NO._____ will abide by the guidelines of the department for undertaking NPTEL courses and report the marks/grade/credits obtained would be duly communicated to my Mentor and MOOC Co-ordinator. The approval of the Mentor/Project Guide and PG coordinator/MOOC Co-ordinator would be binding on me.

Signature of the student with Date:

Attachment: Proof of Course Registration

	Pimpri Chinchwad Education Trust's **Pimpri Chinchwad College of Engineering**

Annexure D-1: Rubric Table for Review I Assessment of Dissertation Phase I

Performance Indicators (PI) **(Five Performance levels will be considered in this assessment.** 1. Excellent, 2. Very Good, 3. Good, 4. Fair, 5. Poor)	**Maximum Marks**
1. Problem Identification, Novelty, Innovation and Relevance of the topic- Societal relevance, industry or research relevance, possible topic leading to patenting and multidisciplinary.	10
2. Literature Survey: Quality of references searched in order of increasing merit - Conference papers (National), Conference papers (International), International Journal Papers, Surveys. It is expected that a student will perform a literature review of at least 50 papers.	20
3. Objectives: All the objectives of the proposed work are well defined. Objectives are measurable and attainable.	5
4. Project planning: Timely presentation of work plan, Clarity, provision of margin for activities etc.	5
5. Quality of documentation, presentation, and question-answer: Appropriate slides, content on slides is well organized, results are shown in tabular and graphical formats, interpretation of results is well explained, Communication manners	10
Total Marks	**50**

Annexure D-2: Rubric Table for Review II Assessment of Dissertation Phase I

Performance Indicators (PI) **(Five Performance levels will be considered in this assessment)** (1. Excellent, 2. Very Good, 3. Good, 4. Fair, 5. Poor)	**Maximum Marks**
1. Requirement Analysis: Research gaps from the existing literature identified in a clear way such that the design can be done on the same. Requirements are identified and a clear understanding of requirements	10
2. Modeling and Design: Quality and correctness in modeling/algorithm design; Design documentation	20
3. Selection of appropriate hardware and software platform for project development	5
4. Punctuality and Professionalism: Student contacted the guide weekly once and communicated all the progress time to time.	5
5. Content of Presentation, Demonstration and Question-Answer: Appropriate slides, content on slides is well organized, results are shown in tabular and graphical formats, interpretation of results is well explained, Communication manners	10
Total Marks	**50**

Annexure D-3: Rubric Table for Review III Assessment of Dissertation Phase I

Performance Indicators (PI) **(Five Performance levels will be considered in this assessment)** (1. Excellent, 2. Very Good, 3. Good, 4. Fair, 5. Poor)	**Maximum Marks**
1. Incorporation of Suggestions of earlier review: Changes are made as per the suggestion received in the earlier review	10
2. Coding and Implementation (40% expected): Workability of the project, obtaining the results, success in the outcome.	30
3. Testing and Validations: Appropriate quality of testing and validations with all test cases	20
4. **Punctuality and Professionalism:** Punctual, ethical, sustainable work done and clear communication with guide at every stage.	10
5. Content of Presentation, Demonstration and Question-Answer: Appropriate slides, content on slides is well organized, results are shown in tabular and graphical formats, interpretation of results is well explained	10
6. Research Article Preparation: Review paper drafted with formatting and references; the same is approved by guide	**10**
7. Documentation and Quality of the report: Systematic Organization, Technical Content, Depth, apparent efforts put in the preparation of the report i.e. data collection, expression in own language, etc.	**10**
Total Marks	**100**

nnexure D-4: Rubric Table for Review I Assessment of Dissertation Phase II

Performance Indicators (PI) **(Five Performance levels will be considered in this assessment)** (1. Excellent, 2. Very Good, 3. Good, 4. Fair, 5. Poor)	**Maximum Marks**
1. Incorporation of Suggestions of dissertation phase-I: Changes are made as per the suggestion received in the dissertation phase 1 review	10
2. Coding and Implementation (60% expected): Workability of the project, obtaining the results, and success in the outcome.	20
3. Testing and Validations: Appropriate quality of testing and validations with all test cases	10
4. Content of Presentation, Demonstration, and Question-Answer: Appropriate slides, content on slides is well organized, results are shown in tabular and graphical formats, interpretation of results is well explained	10
5. Punctuality and Professionalism: Punctual, ethical, sustainable work done and clear communication with guide at every stage.	10
Total Marks	**60**

Annexure D-5: Rubric Table for Review II Assessment of Dissertation Phase II

Performance Indicators (PI) **(Five Performance levels will be considered in this assessment)** (1. Excellent, 2. Very Good, 3. Good, 4. Fair, 5. Poor)	**Maximum Marks**
1. Incorporation of Suggestions of earlier review : Changes are made as per the suggestion received in the earlier review	10
2. Coding and Implementation (90% expected): Workability of the project, obtaining the results, and success in the outcome.	20
3. Testing and Validations: Appropriate quality of testing and validations with all test cases	10
4. Content of Presentation, Demonstration, and Question-Answer: Appropriate slides, content on slides is well organized, results are shown in tabular and graphical formats, interpretation of results is well explained	10
5. Punctuality and Professionalism: Punctual, ethical, sustainable work done and clear communication with guide at every stage.	10
Total Marks	**60**

Annexure D-6: Rubric Table for Review III Assessment of Dissertation Phase II

Performance Indicators (PI) **(Five Performance levels will be considered in this assessment)** (1. Excellent, 2. Very Good, 3. Good, 4. Fair, 5. Poor)	**Maximum Marks**
1. Incorporation of Suggestions of earlier review : Changes are made as per the suggestion received in the earlier review	10
2. Coding and Implementation (100% expected): The final project should be ready, and it should provide expected results as well	10
3. Testing and Validations: Appropriate quality of testing and validations with all test cases	10
4. Documentation and quality of the report: Systematic Organization, Technical Content, Depth, apparent efforts put in the preparation of the report i.e. data collection, expression in own language, etc.	10
5. Content of Presentation, Demonstration, and Question-Answer: Appropriate slides, content on slides is well organized, results are shown in tabular and graphical formats, interpretation of results is well explained	10
6. Punctuality and Professionalism: Punctual, ethical, sustainable work done and clear communication with guide at every stage.	10
7. Paper Publication / IPR/ Project Competition / Consultancy/ Product Development:	20
Total Marks	**80**

	Pimpri Chinchwad Education Trust's **Pimpri Chinchwad College of Engineering**
Annexure S-1: Rubric Table for Assessment of Seminar	

Rubrics for Review 1 at guide level for 20 Marks:

Relevance of the topic - Is it solving a real life/ social problem?	Scope, Feasibility, and objectives for the topic	Total
10	10	20

		Excellent	Very Good	Fair	Poor
Sr. No.	**Marks/ Range**	**8-10**	**6-7**	**4-5**	**1-3**
1	**Relevance of the topic - Is it solving a real life/ social problem?**	Selection of realistic problems of societal, industry, or research relevance with a clear and concise definition of the problem statement leading to M Tech project	Selection of realistic problem of societal, industry, or research relevance, multidisciplinary project but problem definition is not clearly mentioned	Selection of not that much realistic problem and not concise problem definition	Not of relevance and problem definition is not clearly specified or this may not lead to a M Tech project topic
2	**Scope, Feasibility, and objectives for the topic**	Clear definition of objectives, feasibility, and scope of the topic along with the identification of base paper along with algorithmic techniques.	Objectives, feasibility, and scope are specified, base paper identified but unable to identify algorithmic techniques	Objectives, feasibility, and scope are fairly specified, but base paper, algorithms /techniques are not identified	Objectives, feasibility, and scope, are not clearly specified

Rubrics For Review 2 with Panel Members for 80 marks:

Literature Survey	Status of base model implementation (100% expected) followed by model testing and evaluation.	Presentation Skills	Documentation and Report writing	Regularity and Attitude	Technical Understanding	Total
20	20	10	10	10	10	80

		Excellent	Very Good	Fair	Poor
Sr. No.	Marks/ Range	16-20	11-15	6-10	1-5
1	Literature Survey	More than 50 literatures/ research articles studied and all selected literatures are of high quality	More than 50 literatures/ research articles studied but all selected literatures are not of high quality	25 to 50 literatures/ research articles studied and all selected literatures are of high quality	Less than 25 articles are studied
2	Status of base model implementation (100% expected) followed by model testing and evaluation.	Implemented 81% - 100% of base model.	Implemented 71% - 80% of base model.	Implemented 61% - 70% of base model.	Implemented 51% - 60% of base model.

		Excellent	Very Good	Fair	Poor
Sr. No.	Marks/ Range	8-10	6-7	4-5	1-3
3	Presentation Skills	Excellent in effective technical expression using tools like PPT along with	Very good in Effective technical expression using tools like PPT along with	Good in Effective technical expression using tools like PPT along with good communicationski	Average in Effective technical expression using tools like PPT along with poor

		excellent Communication skills and attitude.	very good attitude but poor communication skills /	lls but poor attitude.	communication skills and poor attitude.
4	**Documentation and Report writing**	Excellent documentation of evidences and on time submission of reports free from technical and linguistic errors	Good documentation of evidence and on time submission of reports with good quality.	Documentation of evidences done but some things are missed and delay in report submission	Improper documentation of evidences and late reporting.
5	**Regularity & Attitude**	All activities are done as per calendar. Met guide on his/her own without reminder	Activities done fairly as per the calendar, however multiple reminders from guide is required for that	Not followed the activity calendar properly. Multiple reminders from guide.	Not at all followed the activity calendar. Each task needs multiple interventions from the guide.
6	**Technical Understanding**	Properly justified the reason for techniques/algorithms used along with the sufficient comparison with other alternative techniques available	Properly justified the reason for techniques/algorithms used along with the less number of comparison with other alternative techniques available	Justified reason for techniques/algorithm used but never explained comparison with other similar techniques.	Ambigiousexplaination for justifying the techniques used

Vision and Mission
of
Computer Department

Department Vision

To be a premier Computer Engineering program by achieving excellence in Academics and Research for creating globally competent and ethical professionals.

Department Mission

- M1: To develop technologically competent and self-sustained professionals through contemporary curriculum.
- M2: To nurture innovative thinking and collaborative research, making a positive impact on society.
- M3: To provide state-of-the art computing environment and learning opportunities through Center of Excellence.
- M4: To foster leadership skills and ethics with holistic development.