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
(Course 2020)

DEPARTMENT OF COMPUTER ENGINEERING

Effective from Academic Year 2022-23

Institute Vision

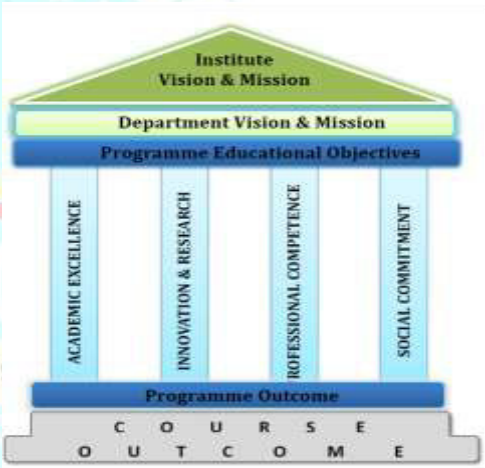
To Serve the Society, Industry and all the Stakeholders through the **Value-Added Quality Education.**

Institute Mission

To serve the needs of society at large by establishing State-of-the-Art Engineering, Management and Research Institute and impart attitude, knowledge and skills with quality education to develop individuals and teams with ability to think and analyze right values and self-reliance.

Quality Policy

We at PCCOE are committed to impart Value Added Quality Education to satisfy the applicable requirements, needs and expectations of the Students and Stakeholders. We shall strive for academic excellence, professional competence and social commitment in fine blend with innovation and research. We shall achieve this by establishing and strengthening state-of- the-art Engineering and Management Institute through continual improvement in effective implementation of Quality Management System.



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LIST OF ABBREVIATIONS USED IN STRUCTURE

Abbreviations	Course Full Name
PCC	**P**rofessional **C**ore **C**ourse
PEC	**P**rofessional **E**lective **C**ourse
OEC[#]	**O**pen **E**lective **C**ourse
PROJ	**Proj**ect, Mini / Minor **Proj**ects, Integrated **Proj**ects
SEM	**Sem**inar
INTR	**Inter**nship
HSMC*	**H**umanities / **S**ocial Science / **M**anagement **C**ourse
AUDIT*	**A**udit **C**ourse
MOOC	**Massive Open Online Courses**
h	**Hours**

Note: * Indicates that these courses are at institute level

The Course offered by the other department(s)

CURRICULUM FRAMEWORK

- The M.Tech. Program is the based on the following type of course: **M.Tech. Computer Engineering**

SR. NO.	TYPE OF COURSE	ABBREVATION
1.	Professional Core Course	PCC
2.	Professional Elective Course	PEC
3.	Open Elective Course	OEC
4.	Project	PROJ
5.	Seminar	SEM
6.	Internship	INTR
7.	Humanities / Social Science / Management Course	HSMC
8.	Audit Course	Audit
9.	Massive Open Online Courses	MOOC

- The Course and Credit Distribution is as under,

SR. No.	TYPE OF COURSE	NO. OF COURSES	TOTAL CREDITS	
			NO.	%
1.	Professional Core Course (PCC)	8	18	26.4
2.	Professional Elective Course (PEC)	6	14	20.5
3.	Open Elective Course (OEC)	2	4	6
4.	Project (PROJ)	3	25	36.6
5.	Seminar (SEM)	1	2	3
6.	Internship (INTR)	1	2	3
7.	Humanities / Social Science / Management Course (HSMC)	1	1	1.5
8.	Audit Course (AUDIT)	2	-	-
9.	Massive Open Online Courses (MOOC)	1	2	3
	TOTAL	**25**	**68**	**100**

COURSE DISTRIBUTION : SEMESTER WISE						
Sr. No.	**TYPE OF COURSE**	**NO. OF COURSES/ SEMESTER**				**TOTAL**
		1	**2**	**3**	**4**	
1.	Professional Core Course (PCC)	5	3	-	-	**8**
2.	Professional Elective Course (PEC)	3	3	-	-	**6**
3.	Open Elective Course (OEC)	1	1	-	-	**2**
4.	Project (PROJ)	-	1	1	1	**3**
5.	Seminar (SEM)	-	-	1	-	**1**
6.	Internship (INTR)	-	-	1	-	**1**
7.	Humanities / Social Science / Management Course (HSMC)	-	1	-	-	**1**
8.	Audit Course (AUDIT)	1	1	-	-	**2**
9.	Massive Open Online Courses (MOOC)	-	-	1*	1	**1**
	TOTAL	**10**	**10**	**3**	**2**	**25**

* MOOCs is optional with Internship

CREDIT DISTRIBUTION : SEMESTER WISE						
1 Lecture hour = 1 Credit 2 Lab Hours = 1 Credit 1 Tutorial Hour = 1 Credit						
Sr. No.	**TYPE OF COURSE**	**NO. OF CREDITS/ SEMESTER**				**TOTAL**
		1	**2**	**3**	**4**	
1.	Professional Core Course (PCC)	11	7	-	-	18
2.	Professional Elective Course (PEC)	7	7	-	-	14
3.	Open Elective Course (OEC)	2	2	-	-	4
4.	Project (PROJ)	-	3	10	12	25
5.	Seminar (SEM)	-	-	2	-	2
6.	Internship (INTR)	-	-	(2)*	-	(2)
7.	Humanities / Social Science / Management Course (HSMC)	-	1	-	-	1
8.	Audit Course (AUDIT)	-	-	-	-	-
9.	Massive Open Online Courses (MOOC)	-	-	(2)*	2	2
	TOTAL	**20**	**20**	**14**	**14**	**68**

* MOOCs is optional with Internship

CURRICULUM STRUCTURE

STRUCTURE FOR 1ST YEAR M. TECH (COMPUTER ENGINEERING)

SEMESTER – I

M Tech Computer Engineering Structure Sem-I			Teaching Scheme				Examination Scheme					
Course Code	**Course Type**	**Course Name**	**L**	**P**	**H**	**CR**	**IE1**	**IE2**	**ETE**	**TW**	**OR**	**Total**
MCE 1401	PCC	Research Methodology & IPR	3	-	3	3	20	30	50	-	-	100
MCE 1402	PCC	Professional Core Course-I: Advanced Software Engineering and Project Management (ASEPM)	3	-	3	3	20	30	50	-	-	100
MCE 1403	PCC	Professional Core Course-II: Advanced Data Structures (ADS)	3	-	3	3	20	30	50	-	-	100
MCE 1404	PEC	Professional Core Lab-I	-	2	2	1	-	-	-	50	50	100
MCE 1501	PEC	Professional Elective-I	3	-	3	3	20	30	50	-	-	100
MCE 1502	PEC	Professional Elective-II	3	-	3	3	20	30	50	-	-	100
MCE 1503	PEC	Professional Elective Lab-I	-	2	2	1	-	-	-	50	50	100
**	OEC	Open Elective-I	2	-	2	2	20	-	30	-	-	50
MCE 1405	PCC	Skill Development Lab – I (Software Skill)	-	2	2	1	-	-	-	50	-	50
M_1961	Audit	Audit Course – I	1	-	1	-	-	-	-	-	-	-
		Total	**18**	**6**	**24**	**20**	**120**	**150**	**280**	**150**	**100**	**800**

Abbr: Course Abbreviation; **L**- Lecture; **P**- Practical; **H**- Hours; **CR**- Credits; **IE1** – Internal Evaluation 1; **IE2** – Internal Evaluation 2; **ETE** – End Term Examination; **TW** – Term Work; **OR** – Oral Exam

** Course code of the selected open elective by student

STRUCTURE FOR 1ST YEAR M. TECH (COMPUTER ENGINEERING)

SEMESTER – II

M Tech Computer Engineering Structure Sem-II			Teaching Scheme				Examination Scheme					
Course Code	**Course Type**	**Course Name**	**L**	**P**	**H**	**CR**	**IE1**	**IE2**	**ETE**	**TW**	**OR**	**Total**
MCE 2406	PCC	Professional Core Course-III : Advanced Algorithms (AA)	3	-	3	3	20	30	50	-	-	100
MCE 2407	PCC	Professional Core Course-IV : Advanced Machine Learning (AML)	3	-	3	3	20	30	50	-	-	100
MCE 2408	PCC	Professional Core Lab-II	-	2	2	1	-	-	-	50	50	100
MCE 2504	PEC	Professional Elective-III	3	-	3	3	20	30	50	-	-	100
MCE 2505	PEC	Professional Elective-IV	3	-	3	3	20	30	50	-	-	100
MCE 2506	PEC	Professional Elective Lab -II	-	2	2	1	-	-	-	50	50	100
**	OEC	Open Elective –II	2	-	2	2	20	-	30	-	-	50
MCE 1912	HSMC	Skill Development Lab – II (Oral & Written Communication)	-	2	2	1	-	-	-	50	-	50
MCE 2701	PROJ	Integrated Mini-Project	-	6	6	3	50	-	-		50	100
M_2962	Audit	Audit Course –II	1	-	1	-	-	-	-	-	-	-
		Total	**15**	**12**	**27**	**20**	**150**	**120**	**230**	**150**	**150**	**800**

Abbr: Course Abbreviation; **L**- Lecture; **P**- Practical; **H**- Hours; **CR**- Credits; **IE1** – Internal Evaluation1; **IE2** – Internal Evaluation 2; **ETE** – End Term Examination; **TW** – Term Work; **OR** – Oral Exam

** Course code of the selected open elective by student

STRUCTURE FOR IIND YEAR M. TECH (COMPUTER ENGINEERING)

SEMESTER-III

M Tech Computer Engineering Structure Sem – III			TEACHING SCHEME				EXAMINATION SCHEME					
Abbr	**Course Type**	**Courses**	**L**	**P**	**H**	**CR**	**IE1**	**IE2**	**ETE**	**TW**	**OR**	**TOTAL**
MCE 3702	PROJ	Dissertation Phase - I Company/ In-house project]	-	20	20	10	100	-	-	-	100	200
MCE 3703	SEM	Seminar	-	04	04	02	-	-	-	50	50	100
MCE 3801	INTR	Internship [Company / In house project]	-	04	04	02	50	-	-	-	50	100
OR												
MCE 3981 **MMD3981**	MOOC	MOOCs / Entrepreneurship	-	04	04	02	50	-	-	-	50	100
		Total	**-**	**28**	**28**	**14**	**150**	**-**	**-**	**50**	**200**	**400**

*Internship**: -It may be in summer/winter vacation or within semester at least for three months, evaluation after fourth semester**

STRUCTURE FOR IIND YEAR M. TECH (COMPUTER ENGINEERING)

SEMESTER-IV

M Tech Computer Engineering Structure Sem – IV			TEACHING SCHEME				EXAMINATION SCHEME					
Abbr	**Course Type**	**Courses**	**L**	**P**	**H**	**CR**	**IE1**	**IE2**	**ETE**	**TW**	**OR**	**TOTAL**
MCE 4704	PROJ	Dissertation Phase – II [Company/ In-house project]	-	24	24	12	200	-	-	-	200	400
MCE 4982	MOOC	MOOCs	-	4	4	2	50	-	-	-	50	100
		Total	**-**	**28**	**28**	**14**	**250**	**-**	**-**	**-**	**250**	**500**

Abbr: Course Abbreviation; **L**- Lecture; **P**- Practical; **H**- Hours; **CR**- Credits; **IE1** – Internal Evaluation 1; **IE2** – Internal Evaluation 2; **ETE** – End Term Examination; **TW** – Term Work; **OR** – Oral Exam

LIST OF ELECTIVE COURSES AND AUDIT COURSES

ELECTIVE COURSES

	Elective-I		**Elective-II**
MCE 1501A	Business Intelligence (BI)	**MCE 1502A**	Data Mining & Analytics (DMA)
MCE 1501B	Advanced Image Processing (AIP)	**MCE 1502B**	Biometric Identification and Liveness Detection (BILD)
MCE 1501C	Cryptography & Cryptanalysis (CC)	**MCE 1502C**	Wireless Sensor Networks & IoT (WSNIoT)

	Elective-III		**Elective-IV**
MCE 2504A	Web and Social Network Data Analysis (WSDA)	**MCE 2505A**	Product Lifecycle Management (PLM)
MCE 2504B	Computer Vision & Video Processing (CVVP)	**MCE 2505B**	User Experience Design (UED)
MCE 2504C	Advanced Computing Intelligence (ACI)	**MCE 2505C**	Software Defined Networks (SDN)

AUDIT COURSES (Common to all Programs)

	SEM-I		**SEM-II**
M_1961A	Constitution of India	**M_2962A**	Team Building &Leadership
M_1961B	Value Education	**M_2962B**	English for Research writing
M_1961C	Stress Management	**M_2962C**	Disaster Management

LIST OF OPEN ELECTIVE COURSES

OFFERED BY HEAT POWER ENGINEERING

	Open Elective – I		Open Elective -II
MMH1601A	Electronic Cooling	**MMH2602A**	Waste Management for Smart Cities
MMH1601B	Green Buildings	**MMH2602B**	Battery Management for Electric Vehicles
MMH1601C	System Modeling & Simulation	**MMH2602C**	Renewable Energy Sources

OFFERED BY DESIGN ENGINEERING

	Open Elective – I		Open Elective -II
MMD1601A	Advanced Materials	**MMD2602A**	Room Acoustics
MMD1601B	Optimization Methods	**MMD2602B**	Design Thinking
MMD1601C	Modelling and Simulation of Dynamic systems	**MMD2602C**	Reliability Engineering

OFFERED BY VLSI & EMBEDDED SYSTEMS

	Open Elective – I		Open Elective -II
MET1601A	Automotive Electronics & Applications	**MET 2602A**	Drone Programming for Beginners
MET1601B	Industrial Drives	**MET 2602B**	Instrumentation and Measurement
MET 1601C	Basics of FPGA and CPLD	**MET 2602C**	Microcontrollers and Microprocessors applications
MET1601D	Robotics	**MET2602D**	Electronics Implementation Platforms

OFFERED BY COMPUTER ENGINEERING

	Open Elective – I		Open Elective -II
MCE1601A	Programming with Python	**MCE2602A**	Image Processing with MATLAB
MCE1601B	Software Engineering Basics	**MCE2602B**	Linux Essentials
MCE1601C	Basics of Machine Learning	**MCE2602C**	Design with UML

OFFERED BY CIVIL- CONSTRCTION MANAGEMENT

	Open Elective – I		Open Elective -II
MCI1601A	Project Management and Finance	**MCI2602A**	Contracts, Tendering & Arbitration
MCI1601B	Green Technology	**MCI2602B**	Total Quality Management
		MCI2602C	Operation Research

OFFERED BY INFORMATION TECHNOLOGY

	Open Elective – I		Open Elective -II
MIT1601A	Business Analytics	**MIT2602A**	Cryptography
MIT1601B	R Programming	**MIT2602B**	Cloud Computing and Security
MIT1601C	Cost Management of Engineering Project	**MIT2602C**	Bitcoin : Fundamentals of Crypto Currencies

Course Syllabus

Semester - I

Program: M.Tech Computer Engineering				Semester : I		
Course : Research Methodology and IPR				Code: MCE1401		
Teaching Scheme			Evaluation Scheme			
Lecture	Credit	Hours	IE1	IE2	ETE	Total
3	3	3	20	30	50	100

Pre-requisite: --

Objectives:

1. To select and define appropriate research problem and parameters with appropriate methodology.
2. To understand statistical techniques for the specific perspective data in an appropriate manner.
3. To make predictions and decisions for the data set using open-source software.
4. To understand the mathematical modeling and its predicting capability.
5. To learn the various steps in research writing and publication process
6. To introduce fundamental aspects of Intellectual property Rights

Outcomes:

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

1. Define a research problem and use appropriate research methodology
2. Examine data using different hypothesis tests and make conclusions about acceptance or rejection of sample data.
3. Analyze numerical data, using standard procedures of probability theory to predict the performance.
4. Develop a mathematical model and analyze the prediction capabilities
5. Write a research paper and research proposal.
6. Write a concept note and prepare to file an IP.

Detailed Syllabus:

Unit	Description	Duration h
1.	**Research Problem and Research Design** Objectives, Motivation, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Criteria of Good Research Definition and Feasibility study of research problem, Sources of research problem, Meaning of Hypothesis, Characteristics of Hypothesis, Errors in selecting a research problem, Concept & need of research design	6
2.	**Applied Statistics** Measures of Variability: Standard Deviation, variance, Quartiles, Interquartile Range Inferential Statistics: Statistical Significance (p values), Pearson's r test, t- test, Chi square test, ANOVA (Analysis of variance)	6
3.	**Probability** Sampling, Types of Sampling, Probability Distribution: Binomial Distribution, Poisson Distribution, Normal Distribution, Case Study: Develop a model for Prediction and Decision Making for the data set using open-source software	6
4.	**Mathematical Modeling and prediction of performance** Types of Modeling, Types of solutions to mathematical models, Steps in Setting up a computer model to predict performance of experimental system, Validation of results, Multi-scale modeling and verifying performance of process system, Nonlinear analysis of system and asymptotic analysis, Sensitivity analysis.	6
5.	**Research Report writing and Publication** Research Report: Dissemination of research findings, outline and structure of research report, different steps and precautions while writing research report, methods and significance of referencing. Publishing Research work: Selection of suitable journal for publishing research work, Open access Vs Subscription Journals, Identifying indexing of selected journals, Impact factor of the journal, structure of research paper, Check for plagiarism of the article, Research paper submission and review process.	6

6.	**Intellectual property Rights** Definition of IPR, Classification of IP, Patentable and non-patentable inventions, statutory exceptions, Persons entitled to apply for patents. Prior Art Search, Patentability Criteria, Patent Filing Procedure, Forms and Fees, Case Study of Patent, Copyright.	**6**
	Total	**36**

Textbooks:

1. C. R. Kothari, Research Methodology: Methods and Techniques, New Age International, 2nd Edition, 1985
2. Ranjit Kumar, Research Methodology: A Step-by-Step Guide for Beginners, 2nd Edition.,2010.
3. Ramakrishna B and Anil Kumar H S., Fundamentals of IPR, Notion Press, 2016
4. Virendra Kumar Ahuja, IPR in India, LexisNexis Butterworths Wadhwa Nagpur, 2017

Reference Books:

1. Stuart Melville and Wayne Goddard, Research methodology: An Introduction for Science & Engineering students
2. S.D. Sharma, Operational Research, Kadar Nath Ram Nath & Co.
3. Wayne Goddard and Stuart Melville, Research Methodology: An Introduction, Juta and Company Ltd, 2004

IE Activities:

1. Write a review paper based on detailed literature survey and cheque for plagiarism.
2. Write a research proposal on your domain specific research problem.
3. Write a concept note and prepare to file an IP.

Program:	M.Tech Computer Engineering	Semester : I
Course :	Advanced Software Engineering and Project Management (ASEPM)	Code :MCE1402

Teaching Scheme			Evaluation Scheme			
Lecture	Credit	Hours	IE1	IE2	ETE	Total
3	3	3	20	30	50	100

Pre-requisite:

1. Basic Principles of Software Engineering
2. Basics of Project planning and management

Objectives:

1. To apply a systematic, disciplined, quantifiable approach to the cost-effective development, operation and maintenance of software systems to the satisfaction of their beneficiaries.
2. To prepare a technologically competent computer by training them in the contemporary software engineering principles and paradigms.
3. To illustrate core project management techniques so as to manage project schedule, expenses and resources with the aid of suitable project management tools.
4. To analyze the various issues in each phase of project management and people management.
5. To provide the students with recent trends and practices in software engineering and supporting tools.
6. To emphasize the importance of software project management skills in order to cater the changing industry needs and constraints across the advancing domains of computing.

Outcomes:

After learning the course the students should be able to:

1. Identify the resources required for a software project and to produce a work plan and resource schedule
2. Decide and justify the use of most appropriate software process model for a given project definition
3. Apply risk management analysis techniques
4. Monitor the progress of a project and to assess the risk of slippage, revising targets counteract drift
5. Use appropriate metrics to manage the software development outcome
6. Understand emerging trends in software engineering and project management.

Detailed Syllabus:

Unit	Description	Duration h
1.	Software Process Framework; Various Software Process Models: Prescriptive, Specialized, Unified, Personal and Team Process models; Software Requirement Engineering- Requirements elicitation, specification, Formal Specifications, Specification Qualities, Classification of Specification Styles , Descriptive Specifications: Logic and Algebraic Specifications , Operational Specifications: DFD, FSM, Petri Nets, validation, change; System Modeling - Context, Interaction, Structural, Behavioral models; Unified Modeling Language.	6
2.	**Software Design Methodologies:** Design Process, Design concepts, Design Models, User interface design, Pattern-based and WebApp design, Software Product Lines, Design modeling using UML [Specification techniques of diagrams in UML].	6
3.	**Agile Development :** Agile methods, Agile development techniques, Extreme Programming, Various Agile Process Models – ASD, SCRUM, DSDM, Crystal, FDD, LSD, AM, AUP.	6
4.	**Software Project Management:** Project Management Spectrum; Project Metrics; Project planning- Estimation and scheduling- PERT, CPM, GERT, Resource loading and Resource Leveling, Types of project Contracts from Project	6

	Management. , Agile Planning, Risk Mitigation and monitoring, , Project Control Techniques, Earned Value Project, Change Management, Quality management, Challenges in software project maintenance - Code Cloning: Detection, Classification, and Refactoring.	
5.	**In Stream Activities In Project Management:** Software Measurement Framework, Ishikawa's Seven tools, Process Assessment and patterns, CMMI – IPPD, Product and Process attributes, Software Quality and configuration management	**6**
6.	**Emerging Trends In Software Engineering And Project :** Agents and Mobile Agents in Software Engineering , Aspect Oriented Programming, Software Process Improvement and maturity models, Distributed Software Engineering, Service-oriented Software Engineering, Real-time Software Engineering	**6**
	Total	**36**

Text Books:

1. Roger S. Pressman, Software Engineering: A practitioners approach , TMH , Seventh Edition, ISBN 978–0–07–337597–7 , ISBN 0–07–337597–7.
2. Ian Sommerville, Software Engineering, Addison-Wesley, Tenth Ed. ISBN-13: 978-0133943030 ISBN-10: 0133943038 .

Reference Books:

1. Linda I. Shafer, Robert T. Futrell, Donald F. Shafer, Quality Software Project Management, Prentice Hall, ISBN 0130912972.
2. Scott Berkun, The Art of Project Management, O'Reilly, First Edition, ISBN 0596007868.
3. Orit Hazzan and Yael Dubinsky, Agile software engineering, Springer –Verlag London, First Edition, ISBN 978-1-84800-199-2
4. Pankaj Jalote, Software Project Management in practice, Addison-Wesley Professional, ISBN 0201737213.
5. Craig Larman, Applying UML and Patterns, Pearson Education, Third Edition.
6. Grady Booch, James Rambaugh, Ivar Jacobson, Unified Modeling Language Users Guide, Addison-Wesley, Second Edition, ISBN 0321267974.

Program: M.Tech Computer Engineering				Semester : I		
Course : Advanced Data Structures (ADS)				Code: MCE1403		
Teaching Scheme			Evaluation Scheme			
Lecture	Credit	Hours	IE1	IE2	ETE	Total
3	3	3	20	30	50	100

Pre-requisite:

1. Data Structures and algorithms
2. Discrete Mathematics

Objectives:

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..

Outcomes:

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

1. Develop logic building skills to solve computing problems
2. Design, and apply linear data structures for solving different real-life problems
3. Select, design, and apply different non-linear data structures for solving different real-life problems
4. Implement different self-balancing search trees for solving real-world problems
5. Demonstrate the selection of appropriate searching techniques for solving real-life problems
6. Illustrate appropriate algorithmic technique for given problems and evaluate algorithms in terms of time and space complexity

Detailed Syllabus:

Unit	Description	Duration h
1.	Linear Data Structures - I: 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. Skip List – Operations and its applications.	6
2.	Linear Data Structures – II **:** 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	6
3.	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.	6
4.	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.	6
5.	Search Trees: Operations and Applications of Optimal Binary Search Tree (OBST), AVL Tree, Red-Black Tree, AA Tree, Splay Tree; K-Dimensional Tree.	6
6.	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.	6

	Total	36

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, 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, University Press, 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 : Business Intelligence - Elective I				Code: MCE1501A		
Teaching Scheme			Evaluation Scheme			
Lecture	Credit	Hours	IE1	IE2	ETE	Total
3	3	3	20	30	50	100

Pre-requisite:

1. Data Mining
2. Machine Learning

Objectives:

1. To get the students acquainted with the fundamentals of Business Intelligence.
2. To illustrate the core concepts and design issues of Decision support system and BI Infrastructure.
3. To emphasize the importance of Data Preprocessing and Data Warehousing techniques for providing solution to the real time BI problems
4. To comprehend and analyze Business and Data Analytics techniques for solving BI problems
5. To get the students acquainted with Pattern Evaluation and Visualization techniques for BI applications.
6. To demonstrate the Modern tools for BI applications

Outcomes:

After learning the course the students should be able to:

1. Differentiate different BAI components such as BI, BA, DSS, and Operational data and Informational data
2. Apply the knowledge of mathematics for data pre-processing techniques to solve BI problems
3. Use Data Warehouse techniques to design BI system.
4. Apply the knowledge of mathematics with Data Mining techniques for analytics to develop DSS
5. Use performance evaluation metrics for pattern evaluation.
6. Use modern analytical tools like WEKA, R, KNIME to develop BI applications

Detailed Syllabus:

Unit	Description	Duration h
1.	**Introduction:** Introduction to data, Information and knowledge, Decision Support System, Theory of Operational data and informational data, Introduction to Business Intelligence, Defining BI Cycle, BI Environment and Architecture, Identify BI opportunities, Benefits of BI. Role of Mathematical model in BI, Factors Responsible for successful BI Project.	6
2.	**Decision Making Concepts:** Concepts of Decision Making, Structure of Decision Support System (DSS), Development of Decision Support System (DSS), Applications of DSS, Role of Business Intelligence in DSS. Determining BI infrastructure requirements, planning for scalability and availability, managing and maintenance of BI systems, managing BI operations for business continuity	6
3.	**Data Preprocessing and Data Warehousing** Data preparation, Preprocessing requirements, data cleaning, data integration, data reduction, data transformation, Data discretization and concept hierarchy generation; Data warehouse Modeling, data warehouse design, Distributed data warehouse.	6
4.	**Business and Data Analytics** Data analytics, business analytics, Data Analytics life cycle, Types of Analytics: Descriptive, Predictive, Prescriptive; Model Planning, Model building, Communicating Results & Findings, Operationalizing; Data Mining techniques for Business Analytics	6
5.	**Pattern Evaluation and Visualization** Metrics for performance evaluation: Accuracy, Error Rate, precision, Recall, F-	6

	measure, Sensitivity, Specificity; Prescriptive Analytical techniques for Optimization, Dashboard, BI metrics on Dashboard, Need of Visualization, Pattern visualization tools and techniques	
6.	**BI Tools and Applications** Tools for Business Intelligence, Role of analytical tools in BI, Case study of Analytical Tools: WEKA/ KNIME/ Rapid Miner/ R; Case Study of BI applications: ERP and Business Intelligence, BI Applications in Marketing, Role of BI in Finance, BI Applications in Banking, BI Applications in Fraud Detection	**6**
	Total	**36**

Text Books:

1. R. Sharda, D. Delen, & E. Turban, Business Intelligence and Analytics. Systems for Decision Support,10th Edition. Pearson/Prentice Hall, 2015. ISBN-13: 978-0-13-305090-5, ISBN-10: 0-13-305090-4;
2. Business Process Automation, Sanjay Mohapatra, PHI.

Reference Books:

1. Introduction to business Intelligence and data warehousing, IBM, PHI.
2. Data mining concepts and techniques, Jawai Han, Michelline Kamber, Jiran Pie, Morgan Kaufmann Publishers 3rd edition.
3. Building the data Warehouse, William H Inmon, Wiley Publication 4th edition.
4. Data Mining for Business Intelligence, WILEY
5. EMC Educational Services, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, Wiley ISBN-13 978 1118876138
6. Ken W. Collier, Agile Analytics: A value driven Approach to Business Intelligence and Data Warehousing, Pearson Education,2012, ISBN-13 978 8131786826

Program: M. Tech Computer Engineering					Semester : I	
Course : Advanced Image Processing - Elective I					Code:MCE1501B	
Teaching Scheme			Evaluation Scheme			
Lecture	Credit	Hours	IE1	IE2	ETE	Total
3	3	3	20	30	50	100

Pre-requisite:

1. Computer Graphics.

Objectives:

1. To discuss advanced topics in Image processing, enhancement and analysis that build on the introduction course.
2. To design and implement solutions for complex image processing problems.
3. To enable to better understand novel, advanced methodology that is discussed in the image processing and image enhancement & analysis literature
4. To assess the performance of image processing algorithms and systems.

Outcomes:

After learning the course the students should be able to:

1. Analyze general terminology of digital image processing.
2. Examine various types of images, intensity transformations and spatial filtering.
3. Develop Fourier transform for image processing in frequency domain.
4. Evaluate the methodologies for image segmentation.
5. Study the feature descriptors
6. Apply image processing algorithms in practical applications.

Detailed Syllabus:

Unit	Description	Duration h
1.	**Digital image fundamentals** Digital Image Processing(DIP), Origin of DIP, Fundamental steps in Digital Image Processing(DIP), Components of digital image processing system, Digitization, Elements of visual perception, Structure of the human eye, Image formation in the eye, Brightness adaptation and discrimination, light, Image sensing and acquisition, Image formation model. Sampling and Quantization	6
2.	**Image Enhancement in spatial domain** Gray level transformations, DIP Operations –Point Operations i.e Histogram processing, enhancement using Arithmetic/logic operations, Basics of spatial filtering, Local operations - Windows Operators, Convolution, Smoothing and sharpening spatial filters, Combining Spatial Enhancement methods.	6
3.	**Frequency Domain** Global operations – Relationship to neighborhood operations, Energy Compaction in transform domain. Two dimensional Discrete Cosine Transform (DCT), Discrete Haar Transform, Haar Wavelet Pyramid, Discrete Sine Transform, Discrete Walsh Transform, Discrete Hadamard Transform	6
4.	**Feature Descriptors** Basics of Feature Descriptor, Color Feature Descriptors: Histograms, Bins, Block Truncation Coding, Sorted Block truncation Coding, Shape Feature Descriptors: Top Hat Transformation, Bottom hat Transformation, Texture Shape Descriptors: GLCM, Texture Patterns, Local Binary Pattern (LBP)	6
5.	Color Spaces: RGB, YCbCr, CIE LUV, Kekre LUV, YUV, HSI, HSV, color space conversions and applications Image Morphology: Erosion, Dialation, Opening, Closing	6

6.	**Advanced Image Processing Algorithms:** Grayscale Image colorization, Image Inpainting, Content based Image Classification, Histogram Equalization Based Contrast Enhancement, Hit and Miss Morphological Algorithm, Image Stitching, PCA based face Recognition	**6**
	Total	**36**

Text Books:

1. R.C.Gonzalas and R.E.Woods: Digital Image Processing, Prentice Hall, 3rd Ed
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. DuttaMajumder, "Digital Image Processing and Analysis", 2nd Edition, Phi learning.
3. William K Pratt, "Digital Image Processing", 4 Edition, Wiley.

Program: M.Tech Computer Engineering				Semester : I		
Course : Cryptography and Cryptanalysis -Elective I				Code:MCE1501C		
Teaching Scheme			Evaluation Scheme			
Lecture	Credit	Hours	IE1	IE2	ETE	Total
3	3	3	20	30	50	100

Pre-requisite:

1. Discrete Math
2. Data Structures

Objectives:

1. To provide an introduction to the fundamental principles of cryptography and its applications on the network security domain.
2. To get familiar with cryptographic techniques for secure (confidential) communication of two parties over an insecure (public) channel;
3. To understand the role of cryptanalysis in the field of cryptography.
4. To communicate professionally about Cryptography and cryptaylysis.

Outcomes:

Students will be able to:

1. Identify computer and network security threats, classify the threats and develop a security model to prevent, detect and recover from the attacks.
2. Design the security solutions for preventing the different security attacks
3. Encrypt and decrypt messages using different ciphers
4. Sign and verify messages using different signature generation and verification algorithms.
5. Discuss different cryptanalysis techniques which can be applied in real time scenarios

Detailed Syllabus:

Unit	Description	Duration h
1	Introduction: Classical Encryption Techniques – Substitution Techniques, Transposition Techniques; Symmetric Cipher Model: Feistel cipher structure, DES, Tripple DES, Block Cipher Design Principles; AES	6
2	Number Theory: Divisibility and the division Algorithm, The Euclidean Algorithm, Modular Arithmetic, Fermat's and Euler's Theorems, The Chinese reminder Theorem	6
3	Public Key Cryptography: RSA – Algorithm & Computational Aspects, Diffie-Hellman Key Exchange; Elgamal Cryptographic System; Elliptic Curve Cryptography	6
4	Key management and distribution: Symmetric key distribution using symmetric & asymmetric encryption, distribution of public keys, X.509 certificates, PKI	6
5	Cryptographic Hash Functions: Applications, SHA, MD5; Message Authentication Codes: requirements, function, security, HMAC; Digital signatures - introduction	6
6	Cryptanalysis, Cryptanalysis on Substitution Cipher (Frequency Analysis), Cryptanalysis on Stream Cipher, Modern Stream Ciphers, Time-Memory Trade-off Attack, Linear Cryptanalysis, Differential Cryptanalysis	6
	Total	**36**

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. 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 : Data Mining and Analytics - Elective II				Code:MCE1502A		
Teaching Scheme			Evaluation Scheme			
Lecture	Credit	Hours	IE1	IE2	ETE	Total
3	3	3	20	30	50	100

Pre-requisite: --

Objectives:

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.

Outcomes:

After learning the course the students should be able to:
1. Apply different preprocessing methods to prepare data in the desired format.
2. Choose appropriate techniques for mining the data.
3. Create frequent patterns using Mining techniques to discover knowledge.
4. Apply different supervised data mining algorithms on a given data to solve real world problems.
5. Use performance measures to evaluate classifiers.
6. Use modern analytical tools like WEKA.

Detailed Syllabus:

Unit	Description	Duration h
1.	Data Mining: Data, Information and Knowledge, Attribute Types, Introduction to Data Preprocessing, Data Cleaning, Data integration, data reduction, transformation and Data Discretization. Data science, Data analytics and machine Learning, Applications, Data Visualisation. Practice Project with Excel/ R/ python/ weka.	6
2.	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. Practice Project with Excel/ R/ python/ weka.	6
3.	Frequent pattern mining: Sequential mining, Structured mining, Correlation mining, associative classification, Association rule mining- Apriori Algorithm, evaluation of candidates rules, Clustering - K-means, overview of methods, Practice Project with Excel/ R/ python/ weka	6
4.	**Classification:** Decision Tree Induction, Attribute Selection Measures, Tree Pruning, Scalability and Decision Tree Induction, Bayes Classification Methods, Baye's Theorem, Naive Bayesian Classification, Rule-Based Classification. Practice Project with Excel/ R/ python/ weka.	6
5.	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,. Practice Project with Excel/ R/ python/ weka	6
6.	Techniques to Improve Classification Accuracy: Introducing Ensemble Methods, Bagging, Boosting and Ada Boost, Random Forests, Improving Classification Accuracy of Class-Imbalanced Data. Practice Project with Excel/ R/ python/ weka	6
	Total	**36**

Text Books:

1.Han, Jiawei Kamber, Micheline Pei and Jian, "Data Mining: Concepts and Techniques", Elsevier Publishers Second Edition, ISBN: 9780123814791, 9780123814807.
2. Matthew A. Russell, "Mining the Social Web,:Data Mining Facebook, Twitter, LinkedIn,

Google+, GitHub, and More" , Shroff Publishers, 2nd Edition

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.

Program:	M.Tech Computer Engineering			Semester : I		
Course :	Biometric Identification and Liveness Detection -Elective II			Code :MCE1502B		
Teaching Scheme			Evaluation Scheme			
Lecture	Credit	Hours	IE1	IE2	ETE	Total
3	3	3	20	30	50	100

Pre-requisite:

Computational Research Methodology & IPR

Objectives:

1. Describe principles of the selected physical and behavioral biometric methods, and know how to deploy them in authentication scenarios
2. Organize and conduct biometric data collection processes, and understand how to use biometric databases in system evaluation
3. Understand the biometrics security issues, and know how to deploy selected liveness detection techniques to make a system spoof-resistant understand the challenges of liveliness detection

Outcomes:

After learning the course the students should be able to:

1.Calculate distributions of within- and between-class matching scores, and calculate various error estimates based on these distributions

2. Analyze differences between a biometric method and a biometric system
3. Deploy statistical methods in biometric system evaluation
4. Itemize the most up-to-date examples of real biometric applications in human authentication

Detailed Syllabus:

Unit	Description	Duration h
1.	Introduction of biometric traits and its aim, Image Processing basics, pattern recognition, statistics, Error types, Identification/verification, Threshold, Score distribution, FAR/FRR, System design issues., Positive/negative identification, Biometric system security, Authentication protocols, Authentication methods.	6
2.	Matching, null and alternative hypothesis h0, h1, Error type I/II, Matching score distribution, FM/FNM, ROC curve, DET curve, FAR/FRR curve., Comparing two systems using ROC curve, Expected overall error, EER, available best error rates, cost function, biometric myths and misrepresentations, negative authentication, trade-offs b/w security and convenience.	6
3.	Selection of suitable biometric, Biometric attributes, Zephyr charts, types of multi biometrics., Verification on multimodel system, normalization strategy, Fusion methods, Multimodel identification, Biometric system security, Biometric system vulnerabilities, circumvention, covert acquisition, quality control, template generation, interoperability, data storage.	6
4.	Signature recognition system, cropping, enhancement, signature parameters, matching and decision, recognition., Discrete Harr wavelet transform,	6
5.	Face detection, feature template, matching. , Fingerprint recognition, Enhancement, Thinning, minutiae, matching, Ear and Iris recognition, why ear, image acquisition, cropping ear and iris, normalization, matching and decision.	6
6.	Liveness Detection: Introduction, Presentation Attacks, Liveness Detection Approaches: Hardware and software based approaches, Passive and active techniques, Challenges	6
	Total	**36**

Text Books:

1. Guide to Biometrics, By: Ruud M. Bolle, Sharath Pankanti, Nalini K. Ratha, Andrew W. Senior, Jonathan H. Connell, Springer 2009

Reference Books:

1. Digital Image Processing using MATLAB, By: Rafael C. Gonzalez, Richard Eugene Woods, 2nd Edition, Tata McGraw-Hill Education 2010
2. Pattern Classification, By: Richard O. Duda, David G.Stork, Peter E. Hart, Wiley 2007
3.Anjos, Andre et.al, Handbook of Biometric Anti-Spoofing: Face Anti-spoofing :Visual Approach,pp.65-82,Springer London, 2014

Program:	M.Tech Computer Engineering			Semester : I		
Course :	Wireless Sensor Network & Internet of Things - Elective II			Code: MCE1502C		
Teaching Scheme			Evaluation Scheme			
Lecture	Credit	Hours	IE1	IE2	ETE	Total
3	3	3	20	30	50	100

Pre-requisite:

1. Computer Network Basics
2. ES & Internet of Things

Objectives:

1. To learn WSN concepts and its technologies.
2. To understand the fundamental concepts of WSN protocols and technologies.
3. To Understand the Architectural Overview of IoT, Reference Architecture and Real World Design Constraints.
4. To Understand the various IoT Protocols
5. To understand the authentication credentials and access control

Outcomes:

After learning the course the students should be able to:

1. Describe basic concepts of WSN.
2. Describe various data link layer and routing protocols and algorithm.
3. Understand constraints and opportunities of wireless and mobile networks for Internet of Things
4. Determine the real-time performance of packet based networks.

Detailed Syllabus:

Unit	Description	Duration h
1.	**Introduction:** Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Mobile Adhoc NETworks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks Sensor Node Hardware and Network Architecture: Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to TinyOS and nesC, Network architecture, Optimization goals and figures of merit, Design principles for WSNs, Service interfaces of WSNs,Gateway concepts.	6
2.	**Deployment and Configuration:** Localization and positioning, Coverage and connectivity, Single-hop and multihop localization, self configuring localization systems, sensor management Network Protocols: Issues in designing MAC protocol for WSNs, Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and Zig Bee, Dissemination protocol for large sensor network. Routing protocols: Issues in designing routing protocols, Classification of routing protocols, Energy-efficient routing, Unicast, Broadcast and multicast, Geographic routing.	6
3.	**Data Storage and Manipulation:** Data centric and content based routing, storage and retrieval in network, compression technologies for WSN, Data aggregation technique. Applications: Detecting unauthorized activity using a sensor network, WSN for Habitat Monitoring.	6
4.	**Introduction to IoT:** IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints-hardware is popular again, Data representation and	6

	visualization, Interaction and remote control.M2M and IoT Technology Fundamentals- Devices and gateways, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics	
5.	**IoT Layer Protocols:** Data Link Layer- Wireless HART,Z-Wave,Bluetooth Low Energy, Zigbee Smart Energy, DASH7 , Network Layer-IPv4,IPv6, 6LoWPAN, Transport Layer -TLS, DTLS , Session Layer- HTTP, CoAP, XMPP, AMQP, MQTT.	**6**
6.	**Security in Internet of Things:** Security Requirements in IoT Architecture ,Security in Enabling Technologies , Insufficient Authentication/Authorization , Insecure Access Control ,Threats to Access Control, Privacy, and Availability - Attacks Specific to IoT. Vulnerabilities ,Secrecy and Secret, Key Capacity, - Authentication/Authorization for Smart Devices , Transport Encryption , Attack & Fault trees,Identity lifecycle , authentication credentials , IoT IAM infrastructure ,Authorization with Publish / Subscribe schemes , access control.	**6**
	Total	**36**

Text Books:

1. Holger Kerl, Andreas Willig, "Protocols and Architectures for Wireless Sensor Network", John Wiley and Sons, 2005 (ISBN: 978-0-470-09511-9)
2. Raghavendra, Cauligi S, Sivalingam, Krishna M., Zanti Taieb, "Wireless Sensor Network", Springer 1st Ed. 2004 (ISBN: 978-4020-7883-5).
3. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.
4. Peter Waher, "Learning Internet of Things", PACKT publishing, Birmingham-Mumbai

Reference Books:

1. Feng Zhao, Leonidas Guibas, " Wireless Sensor Network",Elsevier, 1st Ed. 2004 (ISBN: 13- 978 Internetworking with TCP/IP Principles, Protocols and Architectures – Volume-1 , Fourth Edition – Douglas Comer
2. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer
3. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications
4. Stackowiak, R., Licht, A., Mantha, V., Nagode, L.," Big Data and The Internet of Things Enterprise Information Architecture for A New Age", Apress, 2015.
5. Dr. John Bates , "Thingalytics - Smart Big Data Analytics for the Internet of Things", john Bates, 2015.

Program:	M. Tech. Computer Engineering	Semester : I
Course :	Professional Core Lab 1: Advanced Software Engineering and Project Management (ASEPM) and Advanced Data Structures (ADS)	Code : MCE1404

Teaching Scheme			Evaluation Scheme			
Practical	Hours	Credit	TW	PR	OR	Total
2	2	1	50	-	50	50

MCE1404: Professional Core Lab 1 : Part A:
Advanced Software Engineering and Project Management (ASEPM) Lab

Pre-requisite:

1.Basic Principles of Software Engineering
2.Basics of Project planning and management

Objectives:

1.To apply a systematic, disciplined, quantifiable approach to the cost-effective development, operation and maintenance of software systems to the satisfaction of their beneficiaries.
2.To prepare a technologically competent computer by training them in the contemporary software engineering principles and paradigms.
3.To illustrate core project management techniques so as to manage project schedule, expenses and resources with the aid of suitable project management tools.
4.To analyze the various issues in each phase of project management and people management.
5.To provide the students with recent trends and practices in software engineering and supporting tools.
6.To emphasize the importance of software project management skills in order to cater the changing industry needs and constraints across the advancing domains of computing.

Outcomes:

By the end of the course, students should be able to
1.Identify the resources required for a software project and to produce a work plan and resource schedule
2.Decide and justify the use of most appropriate software process model for a given project definition
3.Apply risk management analysis techniques
4.Monitor the progress of a project and to assess the risk of slippage, revising targets counteract drift
5.Use appropriate metrics to manage the software development outcome
6.Understand emerging trends in software engineering and project management.

Detailed Syllabus:

Assignment No.	Assignment Title	Duration h
1.	Take a Problem statement for software development and Prepare SRS for the same	2
2.	Design the Software Architecture for software to be developed for selected problem Statement using appropriate Architectural Style	2
3.	Prepare detailed design specifications for software to be developed for selected problem Statement using DFD/ UML	2
4.	Prepare the Work breakdown structure for the software to be developed for selected problem Statement and estimate resources required to work on all activities of WBS	2

5.	Prepare detailed Project Plan for the Software Project using Critical Path method.	**2**
6.	Case Studies/ Problems of Project Planning using CPM and PERT	**2**
	Total	**12**

Text Books:

1.Roger S. Pressman, Software Engineering: A practitioners approach , TMH , Seventh Edition, ISBN 978–0–07–337597–7 , ISBN 0–07–337597–7.

2.Ian Sommerville, Software Engineering, Addison-Wesley, Tenth Ed. ISBN-13: 978-0133943030 ISBN-10: 0133943038 .

Reference Books:

1. Linda I. Shafer, Robert T. Futrell, Donald F. Shafer, Quality Software Project Management, Prentice Hall, ISBN 0130912972.

2. Scott Berkun, The Art of Project Management, O'Reilly, First Edition, ISBN 0596007868.

3. Orit Hazzan and Yael Dubinsky, Agile software engineering, Springer -Verlag London, First Edition, ISBN 978-1-84800-199-2

4. Pankaj Jalote, Software Project Management in practice, Addison-Wesley Professional, ISBN 0201737213.

5. Craig Larman, Applying UML and Patterns, Pearson Education, Third Edition.

6. Grady Booch, James Rambaugh, Ivar Jacobson, Unified Modeling Language Users Guide, Addison-Wesley, Second Edition, ISBN 0321267974.

MCE1404: Professional Core Lab 1 : Part B:
Advanced Data Structures (ADS) Lab

Pre-requisite:

1. Data Structures and algorithms

Objectives:

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.

Outcomes:

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

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

Detailed Syllabus:

Assignment No.	Assignment Title	Duration h
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
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.	2
3.	A Dictionary stores keywords and its meanings. Provide facility for adding new keywords, deleting keywords, updating values of any entry. Provide 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.	2
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.	2
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.	2
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.	2

	Total	12

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, 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, University Press, 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 :	**Professional Elective Lab 1 : Elective I and Elective II**				**Code :**	**MCE1503**
Teaching Scheme			**Evaluation Scheme**			
Practical	**Hours**	**Credit**	**TW**	**PR**	**OR**	**Total**
2	**2**	**1**	**50**	**-**	**50**	**50**

MCE1503 : Professional Elective Lab 1 : Part A: Elective I :
Option A : Business Intelligence (BI) Lab

Pre-requisite:

1. Data Mining
2. Machine Learning

Objectives:

1. To illustrate the design issues of Decision support system and BI Infrastructure
2. To comprehend providing solution to real time BI problems with Data Preprocessing and Data Warehousing techniques.
3. To comprehend and apply BI techniques to design and develop Decision Support System.
4. To get the students acquainted with Pattern Evaluation and Visualization techniques for BI applications.
5. To demonstrate the applicability of Modern tools for BI applications

Outcomes:

By the end of the course, students should be able to

1 Students will be able to apply the knowledge of mathematics for data pre-processing techniques to solve BI problems
2. Students will able to use Data Warehouse techniques to design BI system.
3. Students will apply the BI techniques to design and develop Decision Support System.
4.Students will be able to use modern analytical tools like WEKA, R, KNIME to develop BI applications

Detailed Syllabus:

Note: Analytical tool such as KNIME, WEKA, Rapid miner can be used

Assignment No.	Assignment Title	Duration h
1.	Implement an application for share marketing sector which will help customer to suggest whether to Buy or Sell the shares for a particular company/organization. Apply Decision Tree classification algorithm to Share purchase dataset using any suitable analytical tool such as KNIME, WEKA, R.	**4**
2.	Implement an application for share marketing data to identify combination of share purchases and association rules using Apriori algorithm, R language or any suitable tool.	**4**
3.	A Mall has number of items for sale. Build a required Database to develop an application using BI tool for considering one aspect of growth to the business Such as organization of products based on demand and patterns use R Programming or other equivalent latest tools.	**4**
	Total	**12**

Text Books:

1.R. Sharda, D. Delen, & E. Turban, Business Intelligence and Analytics. Systems for Decision Support,10th Edition. Pearson/Prentice Hall, 2015. ISBN-13: 978-0-13-305090-5, ISBN-10: 0-13-305090-4

2 .Business Process Automation, Sanjay Mohapatra, PHI.

Reference Books:

1. Introduction to business Intelligence and data warehousing, IBM, PHI.
2. Data mining concepts and techniques, Jawai Han, Michelline Kamber, Jiran Pie, Morgan Kaufmann Publishers 3rd edition.
3. Building the data Warehouse, William H Inmon, Wiley Publication 4th edition.
4. Data Mining for Business Intelligence, WILEY
5. EMC Educational Services, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, Wiley ISBN-13 978 1118876138
6. Ken W. Collier, Agile Analytics: A value driven Approach to Business Intelligence and Data
7. Warehousing, Pearson Education,2012, ISBN-13 978 8131786826
8. https://www.knime.com/sites/default/files/inline-images/KNIME_quickstart.pdf
9. www.cs.ccsu.edu/~markov/weka-tutorial.pdf

MCE1503 : Professional Elective Lab 1 : Part A: Elective I :
Option B: Advanced Image Processing Lab

Pre-requisite:

1.Computer Graphics

Objectives:

1. To discuss advanced topics in Image processing, enhancement and analysis that build on the introduction course.
2. To design and implement solutions for complex image processing problems.
3. To enable to better understand novel, advanced methodology that is discussed in the image processing and image enhancement & analysis literature
4. To assess the performance of image processing algorithms and systems.

Outcomes:

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

1. Analyze general terminology of digital image processing.
2. Examine various types of images, intensity transformations and spatial filtering.
3. Develop Fourier transform for image processing in frequency domain.
4. Evaluate the methodologies for image segmentation.
5. Study the feature descriptors
6. Apply image processing algorithms in practical applications

Detailed Syllabus:

Assignment No.	Assignment Title	Duration h
1.	Display of images and perform point processing image operations (Any 4 Point processing Operations)	**2**
2.	Resizing of images and perform mask processing operations (Any 6 Mask processing Operations)	**4**
3.	Implementation of DCT based Image Compression	**2**
4.	Application of Image Processing for understanding of applicability of concepts	**4**
	Total	**12**

Text Books:

1. Rafael.C,Gonzalez, Richard E Woods, “Digital Image Processing”,3rdEdition, Pearson India.
2. Jain A.K, “Fundamentals of Digital Image Processing”, 4 Edition, Prentice hall of India.

Reference Books:

1. B.Chanda, D. DuttaMajumder, “Digital Image Processing and Analysis”, 2 nd Edition, Phi learning.
2. William K Pratt, “Digital Image Processing”, 4 Edition, Wiley.

MCE1503 : Professional Elective Lab 1 : Part A: Elective I :
Option C: Cryptography and Cryptanalysis Lab

Pre-requisite:

1.Computer Graphics

Objectives:

1. To discuss advanced topics in Image processing, enhancement and analysis that build on the introduction course.
2. To design and implement solutions for complex image processing problems.
3. To enable to better understand novel, advanced methodology that is discussed in the image processing and image enhancement & analysis literature
4. To assess the performance of image processing algorithms and systems.

Outcomes:

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

1. Design the security solutions for preventing the different security attacks
2. Encrypt and decrypt messages using different ciphers
3. Sign and verify messages using different signature generation and verification algorithms.
4. Discuss different cryptanalysis techniques which can be applied in real time scenarios
5. Write an extensive analysis report on any existing security product or code, investigate the strong and weak points of the product or code

Detailed Syllabus:

Assignment No.	Assignment Title	Duration h
1	Design and develop system to demonstrate secure communication using S-DES algorithm. Analyze and prepare report on different cryptanalytic attacks possible on system.	4
2	Implement public key cryptographic algorithm RSA to encrypt and decrypt massage. Analyze and prepare report on different cryptanalytic attacks possible on system.	2
3	Write a program to exchange keys for secure communication using differ-Hellman key exchange algorithm	2
4	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.	4
	Total	**12**

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. 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.

MCE1503 : Professional Elective Lab 1 : Part B:
Elective II : Option A : Data Mining and Analytics (DMA) Lab

Pre-requisite:

1. Basic Maths

Objectives:

1. Gather sufficient relevant data, conduct data analytics using scientific methods.
2. Demonstrate a sophisticated understanding of the concepts and methods
3. Use advanced techniques to conduct thorough and insightful analysis

Outcomes:

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

1. Apply preprocessing techniques on given data set
2. Apply different data mining techniques on given data to discover knowledge
3. Apply advanced analytic techniques on given data
4. Use advanced techniques to conduct thorough and insightful analysis.
5. Show substantial understanding of the real problems; conduct deep data analytics using appropriate methods; and draw reasonable conclusions
6. Prepare an insightful and well-organized research report/paper for a real-world case study

Detailed Syllabus:

Assignment No.	Assignment Title	Duration h
1.	Consider a dataset (preferably from UCI repository) and apply different data mining technique using WEKA to compare different performance parameter.	3
2.	Consider genes-leukemia.csv from KDnuggets. Make a correct diagnosis following all the steps of data mining.	3
3.	Consider numeric dataset (preferably from UCI repository) and apply association rule mining algorithms and analyze the use of preprocessing techniques.	3
4.	Calculate mean, median, mode, standard deviation and plot histogram, boxplot and scatterplot for any dataset (preferably from UCI repository).	3
	Total	**12**

Text Books:

1. Data Mining: Concepts and Techniques, 3rd Edition, Jiawei Han, MichelineKamber, Jian Pei, ISBN: 978- 0- 12-381479-1
2. Matthew A. Russell, "Mining the Social Web,:Data Mining Facebook, Twitter, LinkedIn, Google+, GitHub, and More" , Shroff Publishers, 2nd Edition

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.

MCE1503 : Professional Elective Lab 1 : Part B:
Elective II : Option B : Biometric Identification and Liveness Detection (BILD) Lab

Pre-requisite:

1. Computational Research Methodology & IPR

Objectives:

1.Describe principles of the selected physical and behavioral biometric methods, and know how to deploy them in authentication scenarios
2. Organize and conduct biometric data collection processes, and understand how to use biometric databases in system evaluation,
3.Understand the biometrics security issues, and know how to deploy selected liveness detection techniques to make a system spoof-resistant
4.Understand the challenges of liveliness detection

Detailed Syllabus:

A research Project to be assigned to each student with selected Biometrics trait (Iris/ Fingerprint/ Palmprint/ Face etc) for one of the approaches as :

Biometric Identification
Biometric Liveness Detection

Assignment No.	Assignment Title	Duration h
1.	Study of the generic process flow of Biometric Identification/ Biometric Liveness detection for selected biometric trait with understanding of performance comparison criteria and Searching and Understanding of the recent published research method for Biometric Identification/ Biometric Liveness detection for selected biometric trait with feasible exploration/modification points	4
2.	Finalization and getting access of the standard testbed for Biometric Identification/ Biometric Liveness detection for selected biometric trait. Preparing the testbed ready for experimentation	2
3.	Implementation of existing method from finalized recent research paper of existing Biometric Identification/ Biometric Liveness detection approach for selected biometric trait	4
4.	Extension/ modification/ Novel method testing of Biometric Identification/ Biometric Liveness detection approach for selected biometric trait and comparison with existing	2
	Total	**12**

Text Books:

1. Guide to Biometrics, By: Ruud M. Bolle, Sharath Pankanti, Nalini K. Ratha, Andrew W. Senior, Jonathan H. Connell, Springer 2009

Reference Books:

1. Digital Image Processing using MATLAB, By: Rafael C. Gonzalez, Richard Eugene Woods, 2nd edition, Tata McGraw-Hill Education 2010
2. Pattern Classification, By: Richard O. Duda, David G.Stork, Peter E. Hart, Wiley 2007
3. Anjos, Andre et.al, Handbook of Biometric Anti-Spoofing: Face Anti-spoofing :Visual Approach,pp.65-82,Springer London, 2014

MCE1503 : Professional Elective Lab 1 : Part B:
Elective II : Option C : Wireless Sensor Networks & IOT(WSNIoT) Lab

Pre-requisite:

1. Computer Network
2. ES & Internet of Things

Objectives:

1. To learn WSN concepts and its technologies.
2. To understand the fundamental concepts of WSN protocols and technologies.
3. To Understand the Architectural Overview of IoT, Reference Architecture and Real World Design Constraints.
4. To Understand the various IoT Protocols .
5. To understand the authentication credentials and access control.

Outcomes:

1. Describe basic concepts of WSN. .
2. Describe various data link layer and routing protocols and algorithm
3. Understand constraints and opportunities of wireless and mobile networks for Internet of Things.
4. Determine the real-time performance of packet based networks.

Detailed Syllabus:

Assignment No.	Assignment Title	Duration h
1.	Create a simple web interface for Raspberry-Pi/Beagle board to control the connected LEDs remotely through the interface.	**4**
2.	Develop a Real time application like smart home with following requirements: When user enters into house the required appliances like fan, light should be switched ON. Appliances should also get controlled remotely by a suitable web interface. The objective of this application is student should construct complete Smart application in group.	**4**
3.	Prepare a Habitat monitoring application using cluster based approach to study functioning of Habitat.	**2**
4.	Develop a Real time application like a smart home with following requirements: If anyone comes at door the camera module automatically captures his image send it to the email account of user or send notification to the user. Door will open only after user's approval.	**2**
	Total	**12**

Text Books:

1. Holger Kerl, Andreas Willig, "Protocols and Architectures for Wireless Sensor Network", John Wiley and Sons, 2005 (ISBN: 978-0-470-09511-9)
2. Raghavendra, Cauligi S, Sivalingam, Krishna M., Zanti Taieb, "Wireless Sensor Network", Springer 1st Ed. 2004 (ISBN: 978-4020-7883-5).

Reference Books:

1. Feng Zhao, Leonidas Guibas, " Wireless Sensor Network",Elsevier, 1st Ed. 2004 (ISBN: 13- 978- Internetworking with TCP/IP Principles, Protocols and Architectures – Volume-1 , Fourth Edition – Douglas Comer
2. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 97 8-3-642-19157-2, Springer

Program:	M. Tech Computer Engineering		Semester :			I
Course :	Skill Development Lab-I (Python Programming)		Code:MCE1405			
Teaching Scheme			Evaluation Scheme			
Practical	Hours	Credit	TW	PR	OR	Total
2	2	1	50	--	50	100

Pre-requisite:

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

Objectives:

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

Outcomes:

After learning the course the students should 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 :

1. Total Six assignments to be conducted out of Eight

Detailed Syllabus:

Skill Development Lab (ANY Six)

Assignment No.	Description	Duration h
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.	**4 (Per assignment)**
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 concpets.	
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.	**4 (Per assignment)**
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.	
	Total	**24**

Text Books:

1. Allen B Downey, ―Think PYTHONǁ, 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 :	Professional Core Course-III: Advanced Algorithm (AA)	Code :MCE2406

Teaching Scheme			Evaluation Scheme			
Lecture	Credit	Hours	IE1	IE2	ETE	Total
3	3	3	20	30	50	100

Pre-requisite:

1.Data structure
2.Design and Analysis of Algorithm

Objectives:

1. To analyze the algorithms using space and time complexity.
2. .To teach problem formulation and problem solving skills.
3. To acquire knowledge of various applied algorithms.
4. To understand selected topics in algorithms that have found applications in areas such as geometric modeling, graphics, robotics, vision, computer animation, etc.

Outcomes:

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

1. Argue the correctness of algorithms using inductive proofs and invariants
2. Prove the correctness and analyze the running time of the basic algorithms for those classic problems in various domains
3. Apply the algorithms and design techniques to solve problems.
4 Demonstrate adequate comprehension of the theory of intractability and prove when certain kinds of problems are intractable.
5. Apply the knowledge of algorithm in various domain

Detailed Syllabus:

Unit	Description	Duration h
1.	**Analysis of Algorithms :** Review of Analysis of Algorithms **Recurrences:** The substitution method for solving recurrences,The recursion-tree method for solving recurrences, The master method for solving recurrences,Proof of the master theorem. **NP-Completeness:**Polynomial time,Polynomial-time verification,NP-completeness and reducibility, NP-completeness proofs, NP-complete problems	6
2.	**Approximation Algorithms:** Introduction, Absolute approximation, Epsilon approximation, Polynomial time Approximation schemes, probabilistically good algorithms. The vertex-cover problem,The traveling-salesman problem,The set-covering problem, Randomization and linear programming,The subset-sum problem	6
3.	**Geometric Algorithms :** Prerequisites – Basic properties of line, intersection of line, line segment, polygon,etc. Line segment properties, detaining segment intersection in time complexity (n log n), Convex full problem – formulation, solving by Graham scan algorithm, Jarvis march algorithm; closest pair of points – problem formulation, solving by divide & conquer method.	6
4.	**Algorithms for Big Data:** streaming/sketching algorithms,algorithms on distributed data,I/O-efficient algorithms,data structures,Intensive Use of SVM for Text Mining and Image Mining Inteligent system : Anytime Algorithms, Desired Properties of Anytime Algorithms, genetic algorithm to adapt intelligent systems, Advanced Indexing Algorithms: Indexing for Very Large High Dimensional Spaces	6
5.	**Online Algorithms:** Euclidean spanning tree problem solved by greedy method, k-server problem, obstacle traversal algorithm, The Network Flow Problem, The Edmonds–Karp algorithm, Dinic's algorithm, Karger's algorithm, Performance Analysis of Local Clustering	6

6.	**Bio Inspired Algorithms:** Advanced Bio Inspired Algorithms like ant colony optimization, honey bee optimization and applications	**6**
	Total	**36**

Text Books:

1.Cormen, Leiserson, Rivest, “Algorithms”, PHI
2.Bressard, “Fundamentals of Algorithms”, PHI
3.Horowitz, Sahni, “Fundamentals of Computer Algorithm”, Galgotia

Reference Books:

1. Aho, Hopcraft, Ullman, “The Design and Analysis of Computer Algorithms”, Addison Wesley
2. Rajiv Motwani and Prabhakar Raghavan, Randomized Algorithms, Cambridge University Press
3. S. Baase, S and A. Van Gelder, "Computer Algorithms: Introduction to Design and Analysis", 3rd edition. Addison Wesley, 2000
4.Artificial Intelligence and Algorithms in Intelligent Systems https://books.google.co.in/books/about/Artificial_Intelligence_and_Algorithms_i.html?id=s5RdDwAAQBAJ&printsec=frontcover&source=kp_read_button&redir_esc=y#v=onepage&q&f=false

Program:	M.Tech Computer Engineering	Semester : II
Course :	Professional Core Course IV: Advanced Machine Learning(AML)	Code :MCE2407

Teaching Scheme			Evaluation Scheme			
Lecture	Credit	Hours	IE1	IE2	ETE	Total
3	3	3	20	30	50	100

Pre-requisite:

1.Data Mining
2.Machine Learning

Objectives:

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

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:

Unit	Description	Duration h
1.	Introduction to Machine Learning; Types of learning: Supervised, Unsupervised and semi-supervised, reinforcement learning techniques; Models of Machine learning: Geometric model, Probabilistic Models, Logical Models, Grouping and grading models, Parametric and non-parametric models, Predictive and descriptive learning	6
2.	Classification : Basic Concepts, Decision Tree Induction, Attribute Selection Measures, Tree Pruning, Rule Extraction from a Decision Tree; Multiclass Classification; Naive Bayesian Classification; Rule-Based Classification; Metrics for Evaluating Classifier Performance	6
3.	Support Vector Machine, Artificial Neural Network and Recurrent Neural Networks: Mathematical foundation, Design and implementation study of neural network systems to solve real world problems	6
4.	Genetic Algorithms, Fuzzy Set Approaches; k-Nearest-Neighbor Classifiers, Case-Based Reasoning, , Holistic learning and multi-perspective learning	6
5.	**Reinforcement learning:** The Reinforcement Learning Problem; History of Reinforcement Learning; Elements of Reinforcement Learning; Example: Tic-Tac-Toe; Transfer learning;	6
6.	Advanced Machine Learning Applications: Beyond machine learning-deep learning and bio inspired adaptive systems; Machine learning and Big data; Natural Language Processing; Healthcare Decision Support System; Computer Vision	6
	Total	**36**

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.Parag Kulkarni, "Reinforcement and Systemic Machine Learning for Decision Making" Wiley-IEEE Press, ISBN: 978-0-470-91999-6.
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

Program:	**M.Tech Computer Engineering**				**Semester : II**	
Course :	**Web and Social Network data Analysis (WSDA)- Elective III**				**Code:MCE2504A**	
Teaching Scheme			**Evaluation Scheme**			
Lecture	**Credit**	**Hours**	**IE1**	**IE2**	**ETE**	**Total**
3	3	3	20	30	50	100

Pre-requisite:

1. Basics of Database Management Systems
2. Basics of Web Technology

Objectives:

1. To revise the basic concepts of Web and Information Retrieval.
2. To understand role of Web Mining concepts in Social Network.
3. To study the basic concepts of Social Network Analysis.
4. To interpret Social networks through mathematical representation.
5 .To analyze relations, descriptive measures and models to overview research questions related to Social Networks.
6. To build various applications based on Social Network platform.

Outcomes:

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

1. Choose and analyze various Information Retrieval Models and in turn will be able to develop Information Retrieval Systems
2. To analyze relevant network data, and some of the associated questions and problems
3. To formulate meaningful research questions concerning Social Network Analysis
4.To Develop the applications based Social Network
5. To Apply Social Network theory to example data sets and to research work.
6. To visualize social network.

Detailed Syllabus:

Unit	**Description**	**Duration h**
1.	**Introduction**: Introduction to Web. Information Retrieval and Web Search.: Basic Concepts of Information Retrieval, Information Retrieval Methods – Boolean Model, Vector Space Model and Statistical Language Model, Relevance Feedback, Evaluation Measures, Text and Web Page Preprocessing , Inverted Index and Its Compression ,Latent Semantic Indexing, Web Search, Meta Search, Web Spamming	**6**
2.	**Web Data Mining:** Concept of Data Mining, Web Mining–Web Content Mining, Web Structure Mining, Web Usage Mining. Web Usage Mining - Data Collection and Preprocessing. Data Modeling for Web Usage Mining, Discovery and Analysis of Web usage Patterns.	**6**
3.	**Social network Analysis:** Social Network Analysis in the Social and Behavioral Sciences: The Social Networks Perspective, Historical and Theoretical Foundations, Fundamental Concepts in Network Analysis, Distinctive Features. Social Network Data: What Are Network Data?, Boundary Specification and Sampling, Types of Networks, Network data, Measurement and Collection.	**6**

4.	**Mathematical Representations of Social Networks:** Notation for Social Network Data: Graph Theoretic Notation, Sociometric Notation, O Algebraic Notation, O Two Sets of Actors Graphs and Matrices: Graphs, Directed Graphs, Signed Graphs and Signed Directed Graphs, Valued Graphs and Valued Directed Graphs, Multigraphs, Hypergraphs, Relations, Matrices.	**6**
5.	**Structural and Locational Properties:** Centrality and Prestige, Non directional Relations, Directional Relations, Cohesive Group and Subgroup, Subgroups Based on Complete Mutuality –Clique, n-cliques with example, Subgroups Based on Nodal Degree- k-plexes, k-cores, Measures of Subgroup Cohesion, Directional Relations -Cliques Based on Reciprocated Ties, Connectivity in Directional Relations, n-cliques in Directional Relations. Measuring Structural Equivalence- Euclidean Distance as a Measure of Structural Equivalence, Correlation as a Measure of Structural Equivalence, Considerations in Measuring Structural Equivalence, Representation of Network Positions.	**6**
6.	**Applications of Social Network Data Analysis:** Sentiment Analysis/ Opinion Mining- Sentiment Classification. Recommendation Systems- Content Based and Collaborative Filtering Techniques, Case studies of – FaceBook, Twitter,LinkedIn.	**6**
	Total	**36**

Text Books:

1. Bing Liu, Web Data Mining Exploring Hyperlinks, Contents, and Usage Data, Springer, Second Edition, ISBN 978-3-642-19459-7.
2. Stanley Wasserman, Katherine Faust, Social Network Analysis: Methods and Applications, Cambridge University Press, ISBN. No. 0-521-38269-6.

Reference Books:

1.Guandong Xu ,Yanchun Zhang and Lin Li,-Web Mining and Social Networking – Techniques and applications, First Edition, Springer, 2011.

2.Dion Goh and Schubert Foo,-Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively, IGI Global Snippet, 2008.

3.Stephen P. Borgatti, Analyzing Social Networks Paperback, ISBN-13: 978-1446247419. ISBN-10:1446247414.

4 .John Scott, Social Network Analysis Paperbac

5. k, ISBN-10: 1446209040, ISBN-13: 978-1446209042.

Program:	M.Tech Computer Engineering	Semester: II
Course :	Computer Vision and Video Processing(CVVP)-Elective III	Code :MCE2504B

Teaching Scheme			Evaluation Scheme			
Lecture	Credit	Hours	IE1	IE2	ETE	Total
3	3	3	20	30	50	100

Pre-requisite:

1.Digital Image Processing
2.Computer Vision

Objectives:

1.Students will be able to comprehend the image formation models,
2.Students will be able to comprehend the extraction of visual frames and audio data from video samples
3.Students will be apply deep learning for computer vision applications
4.Students will be analyze video processing applications

Outcomes:

After learning the course, the students should be able to:
1.Understand the image formation models and image segmentation
2.Apply appropriate filtering and segmentation techniques for image and video processing
3. Explore the deep learning in computer vision
4. Analyze the Video Frames for video processing applications

Detailed Syllabus:

Unit	Description	Duration h
1.	**Image Formation Models :**Image Formation Models: Monocular imaging system, Orthographic & Perspective Projection, Cameras – lenses, projections, sensors, Representation – color spaces	6
2.	**Image models, Transforms and Application Areas:** Contour-texture image model, Segmentation, Photography, Geometrical transforms, Hough transform, Road detection in remote sensing, Mathematical morphology	6
3.	**Image sequence segmentation:** spatial segmentation (frame-by-frame), Temporal segmentation (scene cut detection), Spatio-temporal segmentation,	6
4.	**Introduction to Video Processing:** Principles of color video processing, Video display, Composite versus component video, Progressive and interlaced scan, Sampling of video signals, extraction of video frames and audio data from video.	6
5.	**Deep Learning in Computer Vision**: basics, DCNN Architecture, classification using deep learning	6
6.	**Video Processing Applications:** Content based Video retrieval, Video Visual Content Summarization, Melanoma Skin Cancer Identification, Biometric Livenedss Detection, Haze Removal	6
	Total	**36**

Text Books:

1. González, R.C.; Woods, R.E. Digital image processing. 3rd ed, Harlow: Pearson Prentice Hall. 2008. ISBN 9780131687288.
2. A. Jain, Fundamentals of Digital Image Processing. Information and System Sciences Series, Prentice

Hall, 1989.
3. Yao Wang, Jorn Ostermann, Ya-Qin Zhang, 'Video Processing and Communications', Prentice Hall, 2002

Reference Books:

1. Pratt, W.K. Digital image processing: PIKS scientific inside. 4th ed. New York: John Wiley, 2007. ISBN 9780471767770.
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 :	Advanced Computing Intelligence (ACI) - Elective-III			Code :MCE2504C		
Teaching Scheme			Evaluation Scheme			
Lecture	Credit	Hours	IE1	IE2	ETE	Total
3	3	3	20	30	50	100

Pre-requisite:

1. Advanced Machine Learning
2. Business Intelligence

Objectives:

1. To introduce the different Computational Intelligence Paradigms.
2. To explain the feed-forward neural networks and its learning methods
3. To explain feed-back neural networks and its learning methods.
4. To summarize the Evolutionary Computation and Swarm Intelligent Systems.
5. To interpret different hybrid intelligent systems
6. To discuss the different applications of Computational Intelligence

Outcomes:

After learning the course, the students should be able to

1. Interpret the importance of Computational Intelligence for solving the different problems
2. Select the appropriate type of neural network architecture and learning method.
3. Optimize the solutions by using different optimization techniques.
4. Evaluate the importance of different hybrid intelligent systems.
5. Interpret the importance of Artificial Immune System
6. Formulate the solution to the different real world problems with the use of advanced computing techniques

Detailed Syllabus:

Unit	Description	Duration h
1.	Introduction to Computational Intelligence: Cognitive Computing: Foundation of Cognitive Computing, its uses, AI as the foundation of Cognitive Computing, Elements of Cognitive System, Cognitive Applications, Design Principles of Cognitive System .Introduction to Computational Intelligence, From conventional AI to computational Intelligence	6
2.	Neural Networks- Basic Concepts :Biological Neurons and artificial neuron models, Classification of Artificial Neural Networks, Perceptron Networks and its limitations, Multi-Layer Feed Forward Neural Networks and Error Backpropagation Learning Algorithm, Performance issues in Error Back Propagation algorithm	6
3.	Convolution Neural networks: Architecture, Convolution layer, Pooling Layers, Padding, Stride, Vanishing Gradient Problem, BackPropagation in CNN Data Augumentation, Transfer learning Recurrent Neural Network: Introduction, Architecture, Backpropagation through time, Two issues of standard RNN's (Exploding Gradients, Vanishing Gradients),Long-Short Term Memory	6
4.	Fuzzy Logic and Hybrid Techniques: Fuzzy Set Theory: Fuzzy Sets, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems Hybrid Techniques: Neuro-Fuzzy Systems, Adaptive Neuro-Fuzzy Inference System (ANFIS)	6
5.	Evolutionary Computation and Swarm Intelligent System: Genetic Algorithms (GAs) and Evolutionary Programming: Introduction to GA,	6

	Genetic Algorithms, Procedures of GAs, Working of GAs. Applicability of GAs, Evolutionary Programming, Working of Evolutionary Programming Swarm Intelligent System: Introduction to Swarm Intelligence, Background of Swarm Intelligent systems, Ant Colony System, Working of Ant Colony Optimization, Ant Colony Optimization for TSP, Unit Commitment Problem, Particle Swarm Intelligent System, Artificial Bee Colony System, Cuckoo Search Algorithm.	
6.	Artificial Immune System and Applications of Computational Intelligence: Artificial Immune System: Introduction to natural Immune System, Artificial Immune System Models: Classical View Models, Network Theory Model, Danger Theory Model. Applications of Computation Intelligence: Introduction to Parallelism in Computationally intensive application, Time Series Forecasting by Backpropagation Algorithm, Character recognition, Face Recognition, Travelling Salesman Problem by Evolutionary Algorithm, Signature Classification, Speech Biometrics, Bioinformatics, Biomedical applications.	**6**
	Total	**36**

Text Books:

1. N. P. Padhye, S. P. Simon, "Soft Computing with Matlab Programming ", 1st Edition, OXFORD UNIVERSITY PRESS, 2015, 978-0-19-945542-3
2. Anupam Shukla, Ritu Tiwari, Rahul Kala, "Real Life Applications of Soft Computing", 1st Edition, CRC Press,2010, 1439822891, 9781439822890

Reference Books:

1. Andries P. Engelbrecht, "Computational Intelligence: An Introduction",2nd Edition, PHI, 2007, ISBN: 978-0-470-03561-0
2. Judith Hurwitz, Marcia Kaufman, Adrian Bowles,"Cognitive Computing and Big Data Analytics",1st Edition,1st Edition, John Wiley and Sons, 2015,ISBN: 978-1-118-89662-4
3. J.-S. R. Jang, C.-T. Sun, E. Mizutani, " Neuro-fuzzy and Soft Computing A Computational **Approach to** Learning and Machine Intelligence ",2nd Edition, PHI,2011,ISBN-978-81-203-2243-1

Program: M.Tech Computer Engineering				Semester : II		
Course : Product Lifecycle Management(PLM) -Elective IV				Code :MCE2505A		
Teaching Scheme			Evaluation Scheme			
Lecture	Credit	Hours	IE1	IE2	ETE	Total
3	3	3	20	30	50	100

Pre-requisite:

1.Basic Knowledge of Research Methodology

Objectives:

1. To familiarize the students with the need, benefits and components of PLM.
2. To acquaint students with Product Data Management & PLM strategies.
3. To give insights into new product development program and guidelines for designing and developing a product.
4. To familiarize the students with Virtual Product Development.

Outcomes:

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

1. Gain knowledge about phases of PLM, PLM strategies and methodology for PLM feasibility study and PDM implementation.
2. Illustrate various approaches and techniques for designing and developing products.
3. Apply product engineering guidelines / thumb rules in designing new products
4. Acquire knowledge in applying virtual product development tools

Detailed Syllabus:

Unit	Description	Duration h
1.	**Introduction to Product Lifecycle Management (PLM):** Product Lifecycle Management (PLM), Need for PLM, Product Lifecycle Phases, Opportunities of Globalization, Pre-PLM Environment, PLM Paradigm, Importance & Benefits of PLM, Widespread Impact of PLM, Focus and Application, A PLM Project, Starting the PLM Initiative, PLM Applications. **PLM Strategies:** Industrial strategies, Strategy elements, its identification, selection and implementation, Developing PLM Vision and PLM Strategy , Change management for PLM	6
2.	**Product Design** : Product Design and Development Process, Engineering Design, Organization and Decomposition in Product Design, Typologies of Design Process Models, Reference Model, Product Design in the Context of the Product Development Process, Relation with the Development Process Planning Phase, Relation with the Post design Planning Phase, Methodological Evolution in Product Design, Concurrent Engineering, Characteristic Features of Concurrent Engineering, Concurrent Engineering and Life Cycle Approach, New Product Development (NPD) and Strategies, Product Configuration and Variant Management, The Design for X System, Objective Properties and Design for X Tools, Choice of Design for X Tools and Their Use in the Design Process.	6
3.	**Product Data Management (PDM) :** Product and Product Data, PDM systems and importance, Components of PDM, Reason for implementing a PDM system, financial justification of PDM, barriers to PDM implementation	6
4.	**Virtual Product Development Tools:** For components, machines, and manufacturing plants, 3D CAD systems and realistic rendering techniques, Digital mock-up, Model building, Model analysis, Modeling and simulations in Product Design, Examples/Case studies	6
5.	**Integration of Environmental Aspects in Product Design:** Sustainable Development, Design for Environment, Need for Life Cycle Environmental Strategies, Useful Life Extension Strategies, End-of-Life Strategies, Introduction of	6

	Environmental Strategies into the Design Process, Life Cycle Environmental Strategies and Considerations for Product Design	
6.	**Life Cycle Assessment and Life Cycle Cost Analysis:** Properties, and Framework of Life Cycle Assessment, Phases of LCA in ISO Standards, Fields of Application and Limitations of Life Cycle Assessment, Cost Analysis and the Life Cycle Approach, General Framework for LCCA, Evolution of Models for Product Life Cycle Cost Analysis.	**6**
	Total	**36**

Text Books:

1. John Stark, "Product Lifecycle Management: Paradigm for 21st Century Product Realisation", Springer-Verlag, 2004. ISBN: 1852338105
2. Fabio Giudice, Guido La Rosa, AntoninoRisitano, "Product Design for the environment-A life cycle approach", Taylor & Francis 2006, ISBN: 0849327229

Reference Books:

1. SaaksvuoriAntti, ImmonenAnselmie, "Product Life Cycle Management", Springer, Dreamtech, ISBN: 3540257314
2. Michael Grieve, "Product Lifecycle Management: Driving the next generation of lean thinking", Tata McGraw Hill, 2006, ISBN: 0070636265

Program: M.Tech Computer Engineering				Semester : II		
Course : User Experience Design (UED)-Elective IV				Code :MCE2505B		
Teaching Scheme			Evaluation Scheme			
Lecture	Credit	Hours	IE1	IE2	ETE	Total
3	3	3	20	30	50	100

Pre-requisite:

1. Human Computer Interaction Basics in ASEPM

Objectives:

1. To provide an overview of Information Experience and its evolution.
2. To approach a Design problem beyond Usability and Usefulness.
3. To provide an understanding of how users experience the products and services.
4. To address issues and challenges for achieving a human-centered design process with regard to user experience design.
5. To introduce students to the critical elements of User Interface Design through Design Process, User Research and Research Deliverables.
6. To introduce Effective Usability Testing Principles for great User Experience.

Outcomes:

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

1 Understand and reproduce Elements of User Experience Design in summarizing Information Experience

2. Design and develop online services, from requirement gathering to production and testing with end users from design point of view.
3. Provide a perspective about how user research can be done fast and results can be presented effectively.
4. Develop, Analyze and Evaluate User centered application design.
5. Measure the effectiveness of Information Design through User Interaction and Data Visualization.
6. Apply Usability Testing Principles for testing design prototypes.

Detailed Syllabus:

Unit	Description	Duration h
1.	User Experience Design Overview: What is User Experience Design? Human Information Processing of everyday things, From Product Design to User Experience Design, User Experience and the Web, Cognitive Model, Mental Model	6
2.	Elements of User Experience Design: Core Elements of User Experience, The Five Planes, Working of Core Elements of User Experience: The Strategy Plane, The Scope Plane, The Structure Plane, The Skeleton Plane, The Surface Plane, Applying The Core Elements.	6
3.	Principles of User Experience Design Process: Definition, User Research, Transition: From Defining to Designing, Design Principles	6
4.	User Experience Design Process: Part-I: Definition and Research Understanding the User Needs and Goals, Understanding the Business Goals, Usability and User Research, Creating Personas, Defining Scope and Requirements, Functional Specifications, Content Requirements, Prioritizing requirements	6
5.	User Experience Design Process: Part-II: Design Information Design and Data Visualization, Interaction Design, Information Architecture, Wire framing & Storyboarding, UI Elements and Widgets, Screen Design and Layouts.	6
6.	User Experience Design Process: Part-III: Prototype and Testing Need for testing design, What is Usability Testing, Types of Usability Testing, Usability Testing Process, How to conduct Usability Test, Performance Metrics, Report Findings and	6

	Recommendations.	
	Total	**36**

Text Books:

1. Jesse James Garrett, The Elements of User Experience: User-Centered Design for the Web and Beyond, New Riders, Second Edition, ISBN No. 13: 978-0-321-68368-7
2. Jeffrey Rubin, Handbook of Usability Testing: How to Plan, Design, and Conduct Effective Tests, John Wiley and Sons, Second Edition, ISBN No. 9780470185483.

Reference Books:

1. Rex Hartson, Pardha Pyla, The UX book: process and guidelines for ensuring a quality user experience, Morgan Kaufmann, ISBN No. 9780123852410.
2. Tom Bulls, Bill Albert, Measuring The User Experience: Collecting, Analyzing and Presenting Usability Metrics, Elsevier Science, ISBN No. 9780124157811, 0124157815.
3. Russ Unger, Carolyn Chandler, A Project Guide to UX Design: For user experience designers in the field or in the making (Voices That Matter), New Riders (Pearson Education), Second Edition, ISBN No. 978-0-321-81538-5.
4. Theo Mandel, The Elements of User Interface Design, John Wiley and Sons.

Program: M.Tech Computer Engineering				Semester: II		
Course: Software Defined Networks (SDN)-Elective IV				Code: CE2505C		
Teaching Scheme			Evaluation Scheme			
Lecture	Credit	Hours	IE1	IE2	ETE	Total
3	3	3	20	30	50	100

Pre-requisite:

1. Computer Networks.

Objectives:

1. To enable the Interpretation of the need of Software Defined Networking solutions.
2. Ability of Analysis of different methodologies for sustainable Software Defined Networking solutions.
3. Selection of best practices for design, deploy and troubleshoot of next generation networks.
4. Development of programmability of network elements.

Outcomes:

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

1. Interpret the need of Software Defined Networking solutions.
2. Analyse different methodologies for sustainable Software Defined Networking solutions.
3. Select best practices for design, deploy and troubleshoot of next generation networks.
4. Develop programmability of network elements.
5. Demonstrate virtualization and SDN Controllers using OpenFlow protocol.

Detailed Syllabus:

Unit	Description	Duration h
1.	Introduction to Software Defined Networking (SDN): Challenges of traditional networks, Traditional Switch Architecture - Control, Data and management Planes, Introduction to SDN, Need of SDN, History of SDN, Fundamental characteristics of SDN (Plane Separation, Simplified Device & Centralized control, Network Automation and Virtualization, and Openness), SDN Operation/Architecture,SDN API's (Northbound API's, Southbound API's, East/West API's),ONF,SDN Devices and SDN Applications.	6
2.	OpenFlow: OpenFlow,Overview, The OpenFlow Switch, The OpenFlow Controller, ,OpenFlow Ports, Message Types, Pipeline Processing, Flow Tables, Matching, Instructions, Action Set and List, OpenFlow Protocol, Proactive and Reactive Flow, Timers, OpenFlow Limitations, OpenFlow Advantages and Disadvantages, Open vSwitch Features	6
3.	SDN Controllers: SDN OpenFlow Controllers: Open Source Controllers - NOX, POX, Beacon, Maestro, Floodlight, Ryu and OpenDaylight, Applicability of OpenFlow protocol in SDN Controllers, Mininet, and implementing software-defined network (SDN) based firewall.	6
4.	SDN in Data Center :Data Center Definition, Data Center Demands (Adding, Moving, Deleting Resources, Failure Recovery, Multitenancy, Traffic Engineering & Path Efficiency), Tunneling Technologies for the Data Center, SDN Use Cases in the Data Center, Comparison of Open SDN, Overlays, and APIs, Real-World Data Center Implementations.	6
5.	Network Functions Virtualization (NFV):Definition of NFV, SDN Vs NFV, In-line network functions, Benefits of Network Functions Virtualization, Challenges for Network Functions Virtualization, Leading NFV Vendors, Comparison of NFV and NV.	6
6.	SDN Use Cases: Wide Area Networks, Service Provider and Carrier Networks, Campus Networks, Hospitality Networks, Mobile Networks, Optical Networks, SDN vs P2P/Overlay Networks.	6
	Total	**36**

Text Books:

1.Paul Goransson and Chuck Black - Software Defined Networks: A Comprehensive Approach, ISBN

No:9780124166752
2.SiamakAzodolmolky - Software Defined Networking with Open Flow, ISBN NO:9781849698726
3.Thomas D. Nadeau - SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies, Ken Gray, ISBN NO:10:1-4493-4230-2.

Reference Books:

1. Vivek Tiwari - SDN and OpenFlow for Beginners, ISBN NO:10: 1-940686-00-8
2. Fei Hu, - Network Innovation through OpenFlow and SDN: Principles and Design, ISBN N0: 10: 1466572094
3. Open Networking Foundation (ONF) Documents - https://www.opennetworking.org,

Program:	M. Tech. Computer Engineering	Semester :	II
Course :	Professional Core Lab 2: Advanced Algorithms(AA) and Advanced Machine Learning (AML)	Code :	MCE2408

Teaching Scheme			Evaluation Scheme			
Practical	**Hours**	**Credit**	**TW**	**PR**	**OR**	**Total**
2	**2**	**1**	**50**	**-**	**50**	**50**

MCE2408: Professional Core Lab 2 : Part A
Advanced Algorithms (AA) Lab

Pre-requisite:

1. C++, JAVA, Python

Objectives:

1. To Learn Computational geometry and approximation algorithms with application
2. To analyze the different algorithm with time and space complexity
3. To compare the performance of various advanced algorithm
4. To develop the application using modern tools and technology

Outcomes:

By the end of the course, students should be able to

1.Solve the problem using advanced algorithm

2. Apply the different algorithm design strategy to solve real life problems
3. Keep a sound balance between programming and analytical problem solving.
4. Demonstrate the use of various advanced algorithm in respective domain

Detailed Syllabus:

Note: develop Any three of the following

Assignment No.	Assignment Title	Duration h
1.	Develop algorithmic solution for solving the problem stated in assignment 2, 3 below using set theory, Probability theory and/or required theories, strategy to design Turing machine, multiplexer logic inducing concurrency and perform NP-Hard analysis for the solution feasibility.	**4 (Per assignment)**
2.	Implementations of approximate algorithm for vertex cover problem using JAVA or Python	
3.	Implement Traveling Salesman Problem. Use parallel approach to optimize solution ant colony algorithm for generating good solutions to both symmetric and asymmetric instances of the Traveling Salesman Problem. Use appropriate representation for graph and an appropriate heuristic that defines the distance between any two nodes of the graph.	
4.	Implement a C++ program to find convex hull of a set of points using Jarvis's Algorithm or Wrapping	
5.	Write a program using Text Mining and Image Mining with the help of advance tools	
6.	Develop a speech parsing application using Anytime algorithm	
	Total	**12**

Text Books:

1. Cormen, Leiserson, Rivest, "Algorithms", PHI
2. Sedgewick, R. Bundle of Algorithms in Java. Addison-Wesley 2003. ISBN 0201775786. There is a range of books in this series on algorithms (in C, Java, and C++).

Reference Books:

1. Even, S. Graph Algorithms (ISBN 0-91-489421-8) Computer Science Press 1987. A good treatment of graph algorithms.

MCE2408: Professional Core Lab 2 : Part B
Advanced Machine Learning (AML)Lab

Pre-requisite:

1. Data Mining

Objectives:

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

Outcomes:

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

2. Design and evaluate various machine learning algorithms
3. . 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:

Assignment No.	Assignment Title	Duration h
1.	Implement a fuzzy based model for grading system in education domain. Or Implement Medical diagnostics for detecting diseases using genetic algorithm.	4
2.	Implement Decision Tree algorithms for credit card fraud detection. Or Implement Reinforcement learning model for Tic Tac Toe.	4
3.	Implement an Artificial Neural Network model for stock market prediction Or Implement Twitter Sentiment Prediction using Machine Learning techniques	4
	Total	**12**

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.

Program:	M. Tech. Computer Engineering	Semester:	II
Course:	Professional Elective Lab 2 : Elective III and Elective IV	Code:	MCE2506

Teaching Scheme			Evaluation Scheme			
Practical	Hours	Credit	TW	PR	OR	Total
2	2	1	50	-	50	50

MCE2506 : Program Elective Lab 2 : Part A: Elective III
Option A: Web and Social Network Data Analysis(WSDA) Lab

Pre-requisite: --

Objectives:

1.To revise the basic concepts of Web and Information Retrieval.
2.To understand role of Web Mining concepts in Social Network.
3.To study the basic concepts of Social Network Analysis.
4.To interpret Social networks through mathematical representation.
5.To analyze relations, descriptive measures and models to overview research questions related to Social Networks.
6.To build various applications based on Social Network platform.

Outcomes:

By the end of the course, students should be able to
1.Choose and analyze various Information Retrieval Models and in turn will be able to develop Information Retrieval Systems
2.To analyze relevant network data, and some of the associated questions and problems
3.To formulate meaningful research questions concerning Social Network Analysis
4.To Develop the applications based Social Network
5.To Apply Social Network theory to example data sets and to research work.
6. To visualize social network

Detailed Syllabus:

Assignment No.	Assignment Title	Duration h
1.	Implement a Web Usage Log Mining 1. Learn a classifier for categorizing the visitors of your website 2.Identify common navigation paths, drop-out pages Or Implement web structure mining technique to generate structural summary about any sample web site and/or web page.	4
2.	Implement a Recommender system using contents based/collaborative /hybrid approach. Or Twitter Data Analysis: Use Twitter data for sentiment analysis. The dataset is 3 MB in size and has 31,962 tweets. Identify the tweets which are hate tweets and which are not. Sample Test data set available here https://datahack.analyticsvidhya.com/contest/practice-problem-twitter-sentiment-analysis/	4
3.	Analyze your social network from Facebook. Download network and perform the following activity: • Compute the density and centrality measures of your network;	4

	• Identify the brokers and central nodes in your network; • Visualize the network to identify the brokers in the network; Or Network Analysis • Common Crawl Hyperlink Graph (analyze by country or topical domain) • Linked Data Cloud (analyze by country, topical domain) Analyze Graph Structure of Wikipedia or DBpedia (detect communities)	
	Total	**12**

Text Books:

1.Bing Liu, Web Data Mining Exploring Hyperlinks, Contents, and Usage Data, Springer, Second Edition, ISBN 978-3-642-19459-7.

2.Stanley Wasserman, Katherine Faust, Social Network Analysis: Methods and Applications, Cambridge University Press, ISBN. No. 0-521-38269-6.

Reference Books:

1.Guandong Xu ,Yanchun Zhang and Lin Li,-Web Mining and Social Networking – Techniques and applications, First Edition, Springer, 2011.

2.Dion Goh and Schubert Foo,-Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively, IGI Global Snippet, 2008.

3.Stephen P. Borgatti, Analyzing Social Networks Paperback, ISBN-13: 978-1446247419. ISBN-10:1446247414.

4.John Scott, Social Network Analysis Paperback, ISBN-10: 1446209040, ISBN-13: 978-1446209042.

MCE2506 : Professional Elective Lab 2 : Part A: Elective III :
Option B: Computer Vision and Video Processing(CVVP) Lab

Pre-requisite:

1.Digital Image Processing
2.Computer Vision

Objectives:

1.Students will be able to comprehend the image formation models,
2.Students will be able to comprehend the extraction of visual frames and audio data from video samples
3.Students will be apply deep learning for computer vision applications
4.Students will be analyze video processing applications

Outcomes:

After learning the course, the students should be able to:
1.Understanding of the image formation models and segmentation
2.Application of appropriate filtering and segmentation techniques for image and video processing
3.Knowledge about deep learning in computer vision
4.Knowledge about analysis of video processing applications

Detailed Syllabus:

Assignment No.	Assignment Title	Duration h
1.	Reading Video frames and Applying Image Morphology Operations on extracted frames	2
2.	Reading a video, extracting visual frames , applying point processing on extracted visual frames and creating modified video.	2
3.	Apply deep learning for image classification for an application of choice	4
4.	Real Life case study/mini-project in domain of Computer Vision and Video processing	4
	Total	**12**

Text Books:

1. González, R.C.; Woods, R.E. Digital image processing. 3rd ed, Harlow: Pearson Prentice Hall. 2008. ISBN 9780131687288.
2. A. Jain, Fundamentals of Digital Image Processing. Information and System Sciences Series, Prentice Hall, 1989.
3. Yao Wang, Jorn Ostermann, Ya-Qin Zhang, 'Video Processing and Communications', Prentice Hall, 2002

Reference Books:

1. Pratt, W.K. Digital image processing: PIKS scientific inside. 4th ed. New York: John Wiley, 2007. ISBN 9780471767770.
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.

MCE2506 : Professional Elective Lab 2 : Part A: Elective III :
Option C: Advanced Computing Intelligence(ACI) Lab

Pre-requisite: --

Objectives:

1.To get the insights of open source framework- Tensor flow
2.To experiment with the feed-forward neural networks using open source platform
3.To perform the image classification by using different Networks
4.To analyze the effect of different fuzzy membership functions.
5.To implement the Genetic Algorithm for some application
6.To implement the Evolutionary Computation and Swarm Intelligent Systems.

Detailed Syllabus:

Assignment No.	Assignment Title	Duration h
1.	Introduction to tensorflow with some simple ML examples Or Exercise on Feed forward Neural Network for classification task by using Tensorflow	**2**
2.	Image Classification using CNN using the available networks like AlexNet, ResNet, LeNet, etc. Or Implement and analyze the effect of 3 different available fuzzy membership functions on the output.	**2**
3.	Design and implement a simple genetic algorithm with crossover, mutation, and elitism Or Experiment with any of the AIS algorithm available in open source platform	**2**
4.	Analysis of Time series data using RNN Or Implement Discrete Particle Swarm Optimization, illustrated by the Traveling Salesman Problem	**4**
5.	Experiment on Object and detection using convolution neural networks Or Build feed forward neural networks for face recognition using TensorFlow.	**2**
	Total	**12**

Text Books:

1. Machine Learning with TensorFlow by Nishant Shukla ISBN: 1617293873, 9781617293870
2. Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems by Aurélien Géron

Reference Books:

1. Anupam Shukla, Ritu Tiwari, Rahul Kala, "Real Life Applications of Soft Computing", 1st Edition, CRC Press,2010, 1439822891, 9781439822890
2. Andries P. Engelbrecht, "Computational Intelligence: An Introduction",2nd Edition, PHI, 2007, ISBN: 978-0-470-03561-0
3. Judith Hurwitz, Marcia Kaufman, Adrian Bowles,"Cognitive Computing and Big Data Analytics",1st Edition,1st Edition, John Wiley and Sons, 2015,ISBN: 978-1-118-89662-4

MCE2506 : Professional Elective Lab 2 : Part B: Elective IV :
Option A: Product Lifecycle Management(PLM) Lab

Pre-requisite:

1.Basic Knowledge of Research Methodology

Objectives:

1.To familiarize the students with the need, benefits and components of PLM.
2.To acquaint students with Product Data Management & PLM strategies.
3.To give insights into new product development program / guidelines for designing and developing a product.
4.To familiarize the students with Virtual Product Development.

Outcomes:

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

1. Gain knowledge about phases of PLM, PLM strategies and methodology for PLM feasibility study and PDM implementation.
2. Illustrate various approaches and techniques for designing and developing products.
3. Apply product engineering guidelines / thumb rules in designing new products
4. Acquire knowledge in applying virtual product development tools

Detailed Syllabus:

Generally a product design project to be assigned to each student.
Concepts studied must be applied for a Product Development in one of the following approaches:
New product development
Redesign of an existing product
Design modification of an existing product

Assignment No.	Assignment Title	Duration h
1.	To study and compare the Product Lifecycle Management Strategies	2
2.	To Study the Product Design and Development Process Life Cycle	2
3.	To design and carry out the customer survey for finalization of product specification for selected Product Development Approach Or To generate and select appropriate product concept generation approach and to generate he concept for selected Product Development	4
4.	To design the Product and and plan the feasible prototyping for selected Product Development Or To draft Patent/Copyright for the selected Product Development	4
	Total	**12**

Text Books:

1.John Stark, “Product Lifecycle Management: Paradigm for 21st Century Product Realisation”, Springer-Verlag, 2004. ISBN: 1852338105
2.Fabio Giudice, Guido La Rosa, Antonino Risitano, “Product Design for the environment-A life cycle approach”, Taylor & Francis 2006, ISBN: 0849327229

Reference Books:

1. Saaksvuori Antti, Immonen Anselmie, “Product Life Cycle Management”, Springer, Dreamtech, ISBN: 3540257314
2.Michael Grieve, “Product Lifecycle Management: Driving the next generation of lean thinking”, Tata McGraw Hill, 2006, ISBN: 0070636265

MCE2506 : Professional Elective Lab 2 : Part B: Elective IV :
Option B: User Experience Design(UED) Lab

Pre-requisite:

1. Human Computer Interaction Basics in ASEPM

Objectives:

1. To provide an overview of Information Experience and its evolution.
2. To approach a Design problem beyond Usability and Usefulness.
3. To provide an understanding of how users experience the products and services.
4. To address issues and challenges for achieving a human-centered design process with regard to user experience design.
5. To introduce students to the critical elements of User Interface Design through Design Process, User Research and Research Deliverables.
6. To introduce Effective Usability Testing Principles for great User Experience.

Outcomes:

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

1. Understand and reproduce Elements of User Experience Design in summarizing Information Experience.
2. Design and develop online services, from requirement gathering to production and testing with end users from design point of view.
3. Provide a perspective about how user research can be done fast and results can be presented effectively.
4. Develop, Analyze and Evaluate User centered application design.
5. Measure the effectiveness of Information Design through User Interaction and Data Visualization.
6. Apply Usability Testing Principles for testing design prototypes.

Detailed Syllabus:

Assignment No.	Assignment Title	Duration h
1.	Take a problem statement of designing the User interface and do its feasibility study with requirement analysis	**2**
2.	Identify key Elements to be included in development of User Interface for effective user experience and Design the User Interface Design for the selected Problem Statement	**4**
3.	Implement the user Interface designed for selected problem statement using IDE	**4**
4.	Design the test cases and perform testing of developed user Intercae for selected problem statement	**2**
	Total	**12**

Text Books:

1.Jesse James Garrett, The Elements of User Experience: User-Centered Design for the Web and Beyond, New Riders, Second Edition, ISBN No. 13: 978-0-321-68368-7

2.Jeffrey Rubin, Handbook of Usability Testing: How to Plan, Design, and Conduct Effective Tests, John Wiley and Sons, Second Edition, ISBN No. 9780470185483.

Reference Books:

1.Rex Hartson, Pardha Pyla, The UX book: process and guidelines for ensuring a quality user experience, Morgan Kaufmann, ISBN No. 9780123852410.

2.Tom Bulls, Bill Albert, Measuring The User Experience: Collecting, Analyzing and Presenting Usability Metrics, Elsevier Science, ISBN No. 9780124157811, 0124157815.

3.Russ Unger, Carolyn Chandler, A Project Guide to UX Design: For user experience designers in the field or in the making (Voices That Matter), New Riders (Pearson Education), Second Edition, ISBN No. 978-0-321-81538-5.

4.Theo Mandel, The Elements of User Interface Design, John Wiley and Sons.

MCE2506 : Professional Elective Lab 2 : Part B: Elective IV :
Option C: Software Designed Networks(SDN) Lab

Pre-requisite:

1. Computer Networks

Objectives:

1.To gain conceptual understanding of Software Defined Networking (SDN) & its role in Data Center
2.To gain conceptual understanding of Software Defined Networking (SDN) & its role in Data Center
3.To study open source tools of SDN
4.To Understand the Network Functions Virtualization and SDN

Outcomes:

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

1.Interpret the need of Software Defined Networking solutions
2.Setup network environment to demonstrate SDN
3.Install open source tools of SDN
4.Emulate a Data Center and manage it via a Cloud Network Controller

Detailed Syllabus:

Assignment No.	Assignment Title	Duration h
1.	Set up Mininet network emulation environment using Virtual Box and Mininet. Demonstrate the basic commands in Mininet and emulate different custom network topology (Simple, Linear, and Tree).View flow tables.	4
2.	Study open source POX and Floodlight controller. Install controller and run custom topology using remote controller like POX and floodlight controller. Identify inserted flows by the controllers.	4
3.	Build your own Internet Router using Mininet as an Emulator and POX controller. Write a simple router with a static routing table. The router will receive raw Ethernet frames. It will process the packets just like a real router, and then forward them to the correct outgoing interface. Make sure you receive the Ethernet frame and create the forwarding logic so packets go to the correct interface. Ref:https://github.com/mininet/mininet/wiki/Simple-Router Or Emulate a Data Center and manage it via a Cloud Network Controller: create a multi-rooted tree-like (Clos) topology in Mininet to emulate a data center. Your second task is to implement specific SDN applications on top of the network controller in order to orchestrate multiple network tenants within a data center environment, in the context of network virtualization and management.	4
	Total	**12**

Text Books:

1. Paul Goransson and Chuck Black - Software Defined Networks: A Comprehensive Approach, ISBN No:9780124166752
2. Siamak Azodolmolky - Software Defined Networking with OpenFlow,ISBN NO:9781849698726
3. Thomas D. Nadeau - SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies, Ken Gray, ISBN NO:10:1-4493-4230-2.

Reference Books:

1.VivekTiwari - SDN and OpenFlow for Beginners, ISBN NO:10: 1-940686-00-8
2. Fei Hu, - Network Innovation through OpenFlow and SDN: Principles and Design,ISBN N0: 10: 1466572094
3. Open Networking Foundation (ONF) Documents - https://www.opennetworking.org

Program:	M.Tech Computer Engineering	Semester: II
Course:	Skill Development Lab - II (Soft Skills and English Aptitude)	Code: MCE1912

Teaching Scheme			Evaluation Scheme			
Practical	**Hours**	**Credit**	**TW**	**PR**	**OR**	**Total**
2	2	1	50	--	50	100

Pre-requisite: -

Objectives:

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

Outcomes:

After learning the course, the students should 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:

1 Total Six assignments to be Conducted Out of Eight

Detailed Syllabus:

Skill Development Lab (ANY Six)

Assignment No.	Description	Duration h
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 (Per assignment)**
2.	**Public Speaking:** Any one of the following activities may be conducted : **1. Prepared speech** (Topics are given in advance, students get 10 minutes to prepare the speech and 5 minutes to deliver.) **2. 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.	**2 (Per assignment)**
8.	**Mock interviews:** Guide students and conduct mock interviews	
	Total	**12**

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 :	Integrated Mini-Project			Code :	MCE2701
Teaching Scheme			Evaluation Scheme		
Practical	Hours	Credit	IEI	IE2	OR	Total
6	6	3	--	50	50	100

Pre-requisite:

1. Basics of Software Engineering and Computer Programming Concepts
2. Basics of Programming Language such as C, MATLAB, Python.

Objectives:

1. To understand the ―Product Development Process.
2. To plan for various activities of the major project and channelize the work towards product development.
3. To build, design and implement real time application using available platforms.

Outcomes:

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

1. Understand, plan and execute the mini Project with appreciable research outcomes.
2. Design real time application considering immerging areas in technology
   Prepare good quality technical report based on the mini project.
3. Demonstrate technical ideas and its relevance in recent technology
4. Understand publication and copyright process of research

Guidelines : Total : 36 hours

1. Individual student need to design and demonstrate Mini-project under the guidance of allocated guide.
2. Students can choose domain from computer engineering considering their future implementation in Major Project in second year
3. Mini-Project Report should be submitted as a compliance of term work associated with subject.
4. Paper publication associated with mini-project as research outcome is appreciable.
5. Mini-project work preferably should be completed in laboratory.

Detailed Syllabus:

Integrated Mini-Project

Sr. No.	Activity	Duration h
1.	Week 1, 2 : Mini-project guide allotment, finalization of topic and platform, Planning of the work	6
2.	Week 3, 4: Literature review and specification and Methodology Finalization, Review 1 for finalization of topic and specification.	6
3.	Week 5, 6 : Simulation of Idea on appropriate software tools and finalization of hardware platform	6
4.	Week 7, 8 : understanding platform implementation and related software flow and execute block level design , Review 2 to understand the progress of the project	6
5.	Week 9, 10: Mini Project Report writing and publication or copyright planning and execution.	6
6.	Week 11, 12: Demonstration of Project work and Final Review for submission and term work compliances.	6
	Total	**36**

Course Syllabus

Semester- III

Program:	M. Tech Computer Engineering			Semester :	III	
Course :	Dissertation Phase – I [Company/ In-house project]			Code :	MCE3702	
Teaching Scheme			Evaluation Scheme			
Practical	**Hours**	**Credit**	**IE-I**	**PR**	**OR**	**Total**
20	20	10	100	--	100	200

Pre-requisite:

1. Basics of Software Engineering and Computer Programming Concepts
2. Basics of Programming Language such as C, MATLAB, Python.

Objectives:

1. To understand the ―Product Development Process.
2. To plan for various activities of the major project and channelize the work towards product development.
3. To build, design and implement real time application using available platforms.
4. To inculcate research culture in students for their technical growth.

Outcomes:

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

1. Understand, plan and execute the major Project with appreciable research outcomes.
2. Design real time application considering immerging areas in technology
3. Prepare good quality technical report based on the project.
4. Demonstrate technical ideas and its relevance in recent technology
5. Publish good quality paper in reputed journal and present their work in reputed conferences.

Guidelines:

1. Individual student need to design and demonstrate project under the guidance of allocated guide.
2. Sponsored Project or Project Internship is acceptable considering postgraduate scope.
3. Students can choose project domain and problem statement as per latest research areas, recent technology trends and societal importance.
4. Project Report-1 should be submitted as a compliance of term work associated with subject.
5. At least 2 Paper publications are expected as research outcome of Project Stage-I (Scopus indexed Conference or Journal) and 40% of planned project work should be completed for submission of Dissertation Phase-I
6. Total Duration: 120 hours are contact hours with guides and for reviews , 120 hours are expected to be spend by students to satisfy all project requirements and implementations.

Detailed Syllabus:

Integrated Mini-Project

Sr. No.	Activity	Duration h
1.	Week 1, 2, 3 : Guide allotment, applying for sponsorship and project internship, finalization of topic and platform, Planning of the work.	**30**
2.	Week 4, 5: Literature review, Specification and Methodology Finalization, Review 1 for finalization of topic and specification.	**20**
3.	Week 6, 7, 8 : understanding platform implementation and related software flow and execute block level design , Review 2 to understand the progress of the project	**30**
4.	Week 9, 10 : Simulation of proposed methodology on appropriate software tools and finalization of hardware platform	**20**
5.	Week 11, 12: Project Report writing and publication or copyright planning and execution. Demonstration of Project work and Final Review for submission and term work compliances	**20**
	Total	**120**

Program:	M. Tech Computer Engineering			Semester :	III	
Course :	Seminar			Code :	MCE3703	
Teaching Scheme			Evaluation Scheme			
Practical	**Hours**	**Credit**	**PR**	**TW**	**OR**	**Total**
4	4	2	--	50	50	100

Guidelines:

1. Individual student needs to study recent research topics in the field of Computer Engineering under the guidance of allocated guide.
2. Students can choose topic related to Computer Engineering considering recent trends and its societal importance and at least 5 latest research papers to be studied in seminar.
3. The extensive Literature Survey, Mathematical Modeling of particular method and valuable conclusion is expected from seminar study.
4. Seminar Report should be submitted as a compliance of term work associated with subject.
5. At least 1 review paper publication is expected as research outcome of seminar.
6. Total Duration: 24 Contact Hours and 24 Hours should be spend by students on completion of related activities and requirements.

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Detailed Syllabus:

Seminar Activities

Sr. No.	Activity	Duration h
1.	Week 1, 2, 3 : Guide allotment, finalization of topic, Planning of the work. Review-1 conduction	6
2.	Week 4, 5: Literature review, Specification and Methodology Finalization, of detail topic.	4
3.	Week 6, 7, 8 : Detail Topic Mathematical model, methodology and findings Review-2 conduction	6
4.	Week 9, 10 : Comparison of detail topic with other existing methods	4
5.	Week 11, 12: Seminar Report writing and publication or copyright planning Final Review conduction.	4
	Total	**24**

Program:	M. Tech Computer Engineering			Semester :	III	
Course :	Internship [Company/Inhouse project]			Code :	MCE3801	
Teaching Scheme			Evaluation Scheme			
Practical	**Hours**	**Credit**	**IE1**	**TW**	**OR**	**Total**
4	4	2	50	--	50	100

Guidelines:

1. Individual student need to need to attempt for internship with help of PCCoE T&P cell in the field of Computer Engineering under the guidance of allocated guide.
2. If not get selected for any internships, students can choose extension of mini-project / opportunity of Entrepreneurship opportunity from PCCoE topic related to Computer Engineering considering recent trends and its societal importance.
3. The idea presentation is expected from the students based on their topics .
4. Internship Report should be submitted as a compliance of term work associated with subject.
5. Total Duration : 24 Contact Hours and 24 Hours should be spend by students on completion of related activities and requirements.

Detailed Syllabus:

Internship/ Inhouse/ Entrepreneurship activity

Sr. No.	Activity	Duration h
1.	Week 1, 2, 3 : Guide allotment, Application of internships, finalization of topic, Planning of the work. Review-1 conduction	**6**
2.	Week 4, 5: Internship/ Mini-project/ Entrepreneurship activity implementation as per requirements	**4**
3.	Week 6,7, 8 : Review-2 of Activities	**6**
4.	Week 9, 10 : Interaction of Guides with Industry, Poster Presentation	**4**
5.	Week 11, 12: Internship Report writing and publication or copyright planning Final Review conduction.	**4**
	Total	**30**

Program:	M.Tech Computer Engineering			Semester :	III
Course :	MOOCs			Code :	MCE3981
Teaching Scheme			Evaluation Scheme		
Practical	Hours	Credit	IE1	TW	OR	Total
4	4	2	50	--	50	100

Guidelines :

1. Individual student need to register for MOOC course of their interest or Entrepreneurship related trainings .
2. Week assignments need to be regularly completed as per requirement of course and to be submitted in file to Project Guide, which will be considered for internal assessment of course.
3. The certification of course or training is mandatory.
4. Oral and Presentation of course/ training will be taken at the end of semester by Project Guide
5. Total Duration: 24 Contact Hours and 24 Hours should be spend by students on completion of related activities and requirements.

Program:	M. Tech. (Design Engineering)			Semester : III	
Course :	Entrepreneurship			Code: MMD3981	
Teaching Scheme/week			Evaluation Scheme		
Practical	Hours	Credit	IE2	TW	OR	Total
4	4	2	50	--	50	100

Pre-requisite:

Any Engineering Graduate with Innovation and Design thinking knowledge

Objectives:

1. To acquaint with Entrepreneurial qualities.
2. To apply entrepreneurship in Engineering Courses.
3. To imbibe Entrepreneurial capabilities in engineering students.

Outcomes:

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

1. Motivate students to think about Entrepreneurship alternative to employment.
2. Registering students for Startup / Udyam registration of MSME.

Detailed Syllabus:

Unit	Description	Duration, H
1.	**Introduction to Entrepreneurship and its importance**	04
2.	**Achievement Motivation. Case Studies of Indian Entrepreneurs**	04
3.	**Product Identification, Market Survey**	04
4.	**Whom to contact for what? Financial Management,**	04
5.	**Business Planning**	04
6.	**Project Report preparation**	04
	Total	24

Reference Books:

1. Entrepreneurial Development by Vasant Desai, Himalaya publication
2. Entrepreneurship Development and Small Business Enterprise. Poornima M. Charantimath. Pearson Education India, 2005
3. Dynamics of entrepreneurial development and management : Entrepreneurship, project management, finances, programmes, and problems. by Vasant Desai.
4. Course Material by EDII, Ahmedabad

Experiment List: Project Report preparation for an Enterprise and Udyam Registration.

Course Syllabus

Semester - IV

Program:	M.Tech Computer Engineering			Semester :	IV	
Course :	Dissertation Phase – II [Company/ In-house project]			Code :	MCE4704	
Teaching Scheme			Evaluation Scheme			
Practical	Hours	Credit	IE-I	PR	OR	Total
24	24	12	200	--	200	400

Pre-requisite:

1. Basics of Software Engineering and Computer Programming Concepts
2. Basics of Programming Language such as C, MATLAB, Python.

Objectives:

1. To understand the ―Product Development Process.
2. To plan for various activities of the major project and channelize the work towards product development.
3. To build, design and implement real time application using available platforms.
4. To inculcate research culture in students for their technical growth.

Outcomes:

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

1. Understand, plan and execute the major Project with appreciable research outcomes.
2. Design real time application considering immerging areas in technology
3. Prepare good quality technical report based on the project.
4. Demonstrate technical ideas and its relevance in recent technology
5. Publish good quality paper in reputed journal and present their work in reputed conferences.

Guidelines:

1. Semester III major project is continue to be completed in this section under the guidance of same project guides.
2. Students need to implement the project using suitable hardware and software platforms
3. Final Project Report including all process of project should be submitted as a compliance of term work associated with subject and permission to appear for examination.
4. Total 3 Paper publications are expected as research outcome of Project Stage-I and II (Scopus Indexed Conference or Journal) and 100% of planned project work should be completed for submission of Dissertation Phase-I
5. Total Duration: 144 hours are contact hours with guides and for reviews , 144 hours are expected to be spend by students to satisfy all project requirements and implementations.

Detailed Syllabus:

Integrated Mini-Project

Sr. No.	Activity	Duration h
1.	Week 1, 2 : 60 % Work should be completed.	24
2.	Week 3, 4: Software Simulation and Hardware Implementation should be completed. Review 1 conduction.	24
3.	Week 5, 6 : Paper Publication should be in process or completed during this week, 80% work should be completed.	24
4.	Week 7, 8 : Compliance of 100 % work. Review -2 will be conducted	24
5.	Week 9, 10: Department Reviews will be conducted to check the quality of project and requirements fulfillment to permit project submission.	24
6.	Week 11, 12: Project Report writing and copyright planning and execution. Demonstration of Project work and Final Research Review Committee (RRC) reviews will be conducted for submission and term work compliances	24
	Total	**144**

Program:	M.Tech Computer Engineering			Semester :	IV
Course :	MOOCs			Code :	MCE4982

Teaching Scheme			Evaluation Scheme			
Practical	**Hours**	**Credit**	**IE1**	**TW**	**OR**	**Total**
4	4	2	50	--	50	100

Guidelines:

1. Individual student need to register for MOOC course of their interest or Entrepreneurship related trainings.
2. Week assignments need to be regularly completed as per requirement of course and to be submitted in file to Project Guide, which will be considered for internal assessment of course.
3. The certification of course or training is mandatory.
4. Oral and Presentation of course/ training will be taken at the end of semester by Project Guide
5. Total Duration: 24 Contact Hours and 24 Hours should be spend by students on completion of related activities and requirements.

Program:	M. Tech. (Design Engineering)			Semester : III	
Course :	Entrepreneurship			Code: MMD3981	

Teaching Scheme/week			Evaluation Scheme			
Practical	**Hours**	**Credit**	**IE2**	**TW**	**OR**	**Total**
4	4	2	50	--	50	100

Pre-requisite:

Any Engineering Graduate with Innovation and Design thinking knowledge

Objectives:

4. To acquaint with Entrepreneurial qualities.
5. To apply entrepreneurship in Engineering Courses.
6. To imbibe Entrepreneurial capabilities in engineering students.

Outcomes:

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

3. Motivate students to think about Entrepreneurship alternative to employment.
4. Registering students for Startup / Udyam registration of MSME.

Detailed Syllabus:

Unit	Description	Duration, H
7.	**Introduction to Entrepreneurship and its importance**	**04**
8.	**Achievement Motivation. Case Studies of Indian Entrepreneurs**	**04**
9.	**Product Identification, Market Survey**	**04**
10.	**Whom to contact for what? Financial Management,**	**04**
11.	**Business Planning**	**04**
12.	**Project Report preparation**	**04**
	Total	**24**

Reference Books:

5. Entrepreneurial Development by Vasant Desai, Himalaya publication
6. Entrepreneurship Development and Small Business Enterprise. Poornima M. Charantimath. Pearson Education India, 2005
7. Dynamics of entrepreneurial development and management : Entrepreneurship, project management, finances, programmes, and problems. by Vasant Desai.
8. Course Material by EDII, Ahmedabad

Experiment List: Project Report preparation for an Enterprise and Udyam Registration.

Course Syllabus

Annexure-I

Open Elective Syllabus

LIST OF OPEN ELECTIVE COURSES

OFFERED BY HEAT POWER ENGINEERING

	Open Elective – I		Open Elective -II
MMH1601A	Electronic Cooling	**MMH2602A**	Waste Management for Smart Cities
MMH1601B	Green Buildings	**MMH2602B**	Battery Management for Electric Vehicles
MMH1601C	System Modeling & Simulation	**MMH2602C**	Renewable Energy Sources

OFFERED BY DESIGN ENGINEERING

	Open Elective – I		Open Elective -II
MMD1601A	Advanced Materials	**MMD2602A**	Room Acoustics
MMD1601B	Optimization Methods	**MMD2602B**	Design Thinking
MMD1601C	Modelling and Simulation of Dynamic systems	**MMD2602C**	Reliability Engineering

OFFERED BY VLSI & EMBEDDED SYSTEMS

	Open Elective – I		Open Elective -II
MET1601A	Automotive Electronics & Applications	**MET 2602A**	Drone Programming for Beginners
MET1601B	Industrial Drives	**MET 2602B**	Instrumentation and Measurement
MET 1601C	Basics of FPGA and CPLD	**MET 2602C**	Microcontrollers and Microprocessors applications
MET1601D	Robotics	**MET2602D**	Electronics Implementation Platforms

OFFERED BY COMPUTER ENGINEERING

	Open Elective – I		Open Elective -II
MCE1601A	Programming with Python	**MCE2602A**	Image Processing with MATLAB
MCE1601B	Software Engineering Basics	**MCE2602B**	Linux Essentials
MCE1601C	Basics of Machine learning	**MCE2602C**	Design with UML

OFFERED BY CIVIL- CONSTRCTION MANAGEMENT

	Open Elective – I		Open Elective -II
MCI1601A	Project Management and Finance	**MCI2602A**	Contracts, Tendering & Arbitration
MCI1601B	Green Technology	**MCI2602B**	Total Quality Management
		MCI2602C	Operation Research

OFFERED BY INFORMATION TECHNOLOGY

	Open Elective – I		Open Elective -II
MIT1601A	Business Analytics	**MIT2602A**	Cryptography
MIT1601B	R Programming	**MIT2602B**	Cloud Computing and Security
MIT1601C	Cost Management of Engineering Project	**MIT2602C**	Bitcoin : Fundamentals of Crypto Currencies

Program:	M. Tech. Mechanical (Heat Power Engineering)				Semester: I	
Course:	Electronic Cooling				Code: MMH1601A	
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE 1	IE 2	ETE	Total
2	2	2	20		30	50

Pre-requisite:

Thermodynamics, Fluid Mechanics, Heat Transfer

Objectives:

1. To establish fundamental understanding of heat transfer in electronic equipment.
2. To select a suitable cooling process for electronic components and systems.
3. To increase the capabilities in design and analysis of cooling of electronic packages.
4. To analysis the thermal failure for electronic components and define the solution.

Outcomes:

After learning the course, the students should be able to

1. Understand Heat transfer processes involved in electronics cooling.
2. Analyze thermal failure for electronic components and define the solution.
3. Assign the best cooling method for each individual application.
4. Design cooling system for any electronic device and select Best packaging approach for any design.

Detailed Syllabus:

Unit	Description	Duration h
1.	**Introduction to Electronics Cooling** Introduction, Packaging Trends and Thermal Management, Basics of Heat Transfer, Conduction Heat Transfer, Multi-Dimensional Conduction, Transient Conduction, Natural Convection in Electronic Devices, Forced Convection Heat Transfer, Radiation Heat Transfer, contact and spreading resistances.	06
2.	**Electronics Cooling Methods in Industry** Thermal interface and phase change materials, passive and novel air-cooling approaches, Heat Sinks, Heat Pipes in Electronics Cooling, Thermoelectric Cooling, Liquid Immersion Cooling (Single and Two-phase), Cooling Techniques for High Density Electronics	06
3.	**Packaging of Electronic Equipment** Components of Electronic Systems, Packaging of Electronic Equipment, Conduction Cooling for Chassis and Circuit Boards, Chip/circuit material for augmenting heat transfer.	06
4.	**Control Parameters Measurement and simulation** Temperature & humidity requirement, CFD analysis for Airflow & temperature evaluation, thermography etc	06
	Total	24

Text Books:

1. D. S. Steinberg," Cooling Techniques for Electronic Equipment ", Second Edition, John Wiley & Sons, 1991.
2. F. P. Incropera, "Introduction to Heat Transfer ", Fourth Edition, John Wiley, 2002.
3. S. J. Kim and Sang Woo Lee, "Air cooling Technology for Electronic Equipment", CRC press, London, 1996.
4. F. P. Incropera, "Liquid Cooling of Electronic Devices by Single-Phase Convection", John Wiley& sons, inc, 1999.

Reference Books:

1. J. L. Sloan, "Design and Packaging of Electronic Equipment", Van Nostrand Reinhold Company, 1985.
2. C. Belady, "Standardizing Heat Sink Performance for Forced Convection, Electronics Cooling", Vol. 3, No. 3, September, 1997.
3. C. Biber, Wakefield Engineering, Wakefield, Massachusetts, "Characterization of the Performance of Heat Sinks,", Personal Communication, October 1997.
4. A. B.-Cohen, “Encyclopedia of Thermal Packaging volume 1 to 6”, February 2013, World Scientific Publication

Program:	M. Tech. Mechanical (Heat Power Engineering)			Semester: I			
Course:	Green Buildings			Code: MMH1601B			
Teaching Scheme				Evaluation Scheme			
Lecture	Practical	Tutorial	Credit	IE 1	IE 2	ETE	Total
2	-	-	2	20	-	30	50

Pre -requisite:

Basics of air conditioning

Basics of building construction

Objectives:

1. To develop a multidisciplinary approach to the energy supply and use in new and existing buildings
2. To develop knowledge and understanding of system solutions that provide optimal indoor environment in buildings in an environmentally and cost-effective way
3. To create awareness of different building rating tools

Outcomes:

After learning the course, the students should :

1. Demonstrate understanding of integrated building design process and rating systems for energy efficient buildings
2. Recognize importance of energy and water efficiency as well as waste management strategies
3. Be able to select appropriate site features and evaluate the relationship between energy use and indoor comfort
4. Appreciate the role of material selection in design of green buildings and demonstrate knowledge of government schemes and byelaws for green buildings

Detailed Syllabus:

Unit	Description	Duration, h
1	**Overview and comparison of green building rating systems** What is green building, conventional building practices versus integrated design process, comparison of USGBC LEED, IGBC, GRIHA, EDGE and other green building rating systems, Conducting feasibility studies, reference standards, key definitions, synergies between various credit categories, understanding building forms, site level features, microclimate features	**06**
2.	**Resource Efficiency** Energy efficiency in buildings, Water efficiency – indoor water use, rainwater harvesting, irrigation water use, wastewater systems, strategies for reducing water consumption Waste management – source reduction, reduce – recycle – reuse, strategies for waste management, construction waste management plan	**06**
3	**Health, Wellness and Site features** Introduction to indoor air quality, ASHRAE 62.1 overview and requirements, ventilation rate procedure method, key parameters affecting indoor environment, IAQ management plan Daylight and views, strategies to enhance daylight availability, Overview of WELL standard for buildings, impact of VOCs and hazardous chemicals on human health Erosion and sedimentation control, water efficient landscaping and irrigation practices, microclimate, heat island effect, exterior lighting pollution, Location and transportation, transportation management strategies and planning	**06**
4	**Materials, resources and Government schemes and incentive programs** Low-embodied energy materials, environmental product declarations (EPDs), overview of material categories of IGBC, LEED & GRIHA, life cycle analysis and its application, overview of software tools for LCA Funding and Incentives for green building rating programs, requirements of NBC 2016 related to sustainability, local byelaws, model building code.	**06**
	Total	**24**

Text Books:

1. Shahane, V. S, “Planning and Designing Building”, Poona, Allies Book Stall, 2004.
2. Michael Bauer, Peter Mösle and Michael Schwarz “Green Building – Guidebook for Sustainable Architecture” Springer, 2010.
3. Tom Woolley, Sam Kimmins, Paul Harrison and Rob Harrison “Green Building Handbook” Volume I, Spon Press, 2001.

Reference Books:

1. Mili Majumdar, “Energy-efficient buildings in India” Tata Energy Research Institute, 2002.
2. TERI “Sustainable Building Design Manual- Volume I & II” Tata Energy Research Institute, 2009
3. Reference manuals of green building rating programs (LEED, WELL, IGBC, GRIHA)
4. ASHRAE Standard 62.1, Standard 55, Standard 90.1, and other standards referred by green building programs
5. EDGE App user manual
6. National Building Code of India – 2016
7. ECBC 2017

Program:	M. Tech. Mechanical (Heat Power Engineering)		Semester :	I		
Course :	System Modelling and Simulation		Code :	MMH1601C		
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE 1	IE 2	ETE	Total
2	2	2	20	-	30	50

Pre-requisite:

Objectives:

1. Students able to model any physical system for realtime applications
2. Students able to simulate any physical system for realtime applications

Outcomes:

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

1. Develop mathematical model for practical problem
2. Develop Bond Graph model for system
3. Apply transfer function and State space model techniques
4. Simulate the system using suitable software and Estimate parameters by optimization

Detailed Syllabus:

Unit	Description	Duration
1.	Introduction to Modelling and Simulation, Basic systems, Introduction and Types of Mathematical modelling, Basic building blocks Mechanical, Electrical, Thermal systems.	6
2.	Bond Graph Modelling of Dynamic Systems: Representation, Elements, Single, Two and multiports Causality, Application to basic Mechanical, Electrical and Electromechanical system	6
3.	Dynamic Response and System Transfer Function: Poles, Stability Block diagram/Signal flow diagram/State Space formulation and Frequency response	6
4.	Simulation and Simulation application Parameter Estimation, System Identification and Optimization	6
	Total	**24**

Reference Books:

1. Brown, Forbes T. Engineering System Dynamics. New York, NY: CRC, 2001. ISBN: 9780824706166.

Program: M. Tech. (Heat Power Engineering)				Semester: II		
Course: Waste Management for Smart Cities				Code: MMH2602A		
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credits	IE 1	IE 2	ETE	Total
2	2	2	20	-	30	50

Course Objective:

1. To provides an in-depth understanding of Municipal waste characteristics and management.
2. To make aware about regulations in the area municipal waste management.
3. To equip with the methods of environment risk assessment of waste.
4. To provide an in-depth understanding of Physiochemical and biological treatment of Municipal waste.
5. To be able to design the land-fields for the smart cities.

Course Outcomes:

The learners will be

1. Identify and evaluate the sources; composition; generation rates, methods of separation and collection methods of municipal waste treatment.
2. Evaluate and analysis the risk and methods of handling the hazardous and radioactive waste based on health effects.
3. Evaluate the Physiochemical and biological waste for its treatment and disposal
4. Design the land field for solid and hazardous wastes collection and removal

Detailed Syllabus

Unit	Description	Duration, h
1.	**Municipal Solid Waste Management** Fundamentals Sources; composition, generation rates, collection of waste, separation, transfer and transport of waste, treatment and disposal options. Municipal waste management and handling rules for solid waste, hazardous waste, biomedical waste, fly ash, recycled plastics usage and batteries	6
2.	Hazardous and Radioactive Waste Management Fundamentals Characterization of waste, fate and transport of chemicals, health effects, Fundamentals sources, measures and health effects; nuclear power plants and fuel production; waste generation from nuclear power plants; disposal options	6
3.	Physiochemical Treatment of Solid waste Physicochemical Treatment of Solid and Hazardous Waste Chemical treatment processes for MSW (combustion, stabilization and solidification of hazardous wastes); physicochemical processes for hazardous wastes (soil vapour extraction, air stripping, chemical oxidation); ground water contamination and remediation	6
4.	Biological Treatment of Solid waste and landfill design Biological Treatment of Solid and Hazardous Waste Composting; bioreactors; anaerobic decomposition of solid waste; principles of biodegradation of toxic waste; inhibition; co-metabolism; oxidative and reductive processes; slurry phase bioreactor. Landfill design Landfill design for solid and hazardous wastes; leachate collection and removal; landfill covers; incineration	6

Total	**24**

Text Books / References:

1. John Pichtel Waste Management Practices CRC Press, Taylor and Francis Group 2005.
2. LaGrega, M.D.Buckingham,P.L. and Evans, J.C. Hazardous Waste Management, McGraw Hill International Editions, New York, 1994.
3. Richard J. Watts, Hazardous Wastes - Sources, Pathways, Receptors John Wiley and Sons, New York, 1997.
4. Basics of Solid and Hazardous Waste Mgmt. Tech. by Kanti L.Shah 1999, Prentice Hall.
5. Solid And Hazardous Waste Management 2007 by S.C.Bhatia Atlantic Publishers & Dist.

Program:	M. Tech. Mechanical (Heat Power Engineering)		Semester: II			
Course :	Battery management for Electric Vehicles		Code: MMH2602B			
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE 1	IE 2	ETE	Total
2	2	2	20	--	30	50

Pre-requisite: Basics of Electrical Engineering,

Objectives:

1. To understand the various battery performance parameters and types of batteries used for EV applications
2. To understand the requirements of battery management system
3. To make the learners conversant with Equivalent Circuit Cell Modeling of Battery
4. To make the learners conversant with SOC estimation
5. To make the learners conversant with Battery Pack Balancing and Power Estimation
6. To make the learners aware of thermal issues of Lithium Ion battery and thermal management system

Outcomes:

After learning the course, the learners will be able

1. Demonstrate understanding of battery operation parameters and design requirements of battery management systems
2. To simulate charge discharge characteristics of a battery using equivalent circuit model
3. To estimate SOC and SOH of battery and demonstrate understanding of various methods of battery pack balancing
4. To estimate heat generation inside battery and propose cooling strategy for the battery pack.

Detailed Syllabus

Unit	Description	Duration, h
1.	**Introduction to battery-management systems** Battery terminology and performance parameters, Types of electrochemical cells, Lithium-Ion Cells components, primary functions and components of BMS **BMS design requirements** Primary functions of BMS, sensing voltage, current and temperature of cell and battery pack, estimation of cell SOC and battery pack SOC, Estimation of available energy and power of cell and battery pack	6
2.	**Equivalent Circuit Cell Model (ECM)** Modeling OCV and SOC, Modeling voltage polarization, Warburg impedance, Estimation of Model parameter values: OCV, Columbic Efficiency, total capacity, temperature dependence of OCV, modeling hysteresis, using the ECM to simulate constant voltage/ power charge/ discharge characteristics	5
3.	**State-of-Charge (SOC) Estimation and Battery Pack Balancing** Different approaches to estimating battery cell SOC, Kalman-filter method of SOC estimation: linear Kalman filter , extended Kalman filter Reasons of battery pack unbalancing, criteria for specifying a balancing set point and when to balance a battery pack ,Passive balancing methods for battery packs, Active balancing methods for battery packs: capacitor-based circuits, transformer-based circuits, Estimation of available battery power using a simplified cell model	7
4.	**Battery Thermal Management** Heat Generation inside battery, Thermal issues of Lithium Ion Battery, Operating temperature range, Energy analysis and Thermal modeling of LIB, Cooling strategies in thermal management : Air cooling, liquid cooling, PCM based cooling , effect of parameters like cell arrangement, spacing, fluid velocity etc.	6
	Total	24

Reference Books:

1. Gregory L. Plett, Battery Management Systems, Volume I: Battery Modeling, Artech House, London
2. Gregory L. Plett, Battery Management Systems Volume II, Equivalent-Circuit Methods, Artech House, London
3. Gianfranco Pistoia, Boryann Liaw (eds.), Behaviour of Lithium-Ion Batteries in Electric Vehicles_ Battery Health, Performance, Safety, and Cost, Springer International Publication
4. Reiner_Korthauer, Li-I Batteries Basics and Applications, Springer International Publication

Program:	M. Tech. Mechanical (Heat Power Engineering)	Semester: II
Course:	Renewable Energy Sources	Code: MMH2602C

Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE 1	IE 2	ETE	Total
2	2	2	20	--	30	50

Pre-requisite: Thermodynamics; Fluid Mechanics; Heat Transfer; Elements of Electrical Engineering;

Objectives:

Following concepts to be taught to the students,

1. Demonstrate significance of analysis solar and Wind Resources Sources and design technologies of their utilization
2. Expose them to conceptualize and design renewable energy appliances and equipment
3. Enable them to independently analyze, implement and asses the real-life systems
4. Develop a research insight about renewable technologies so as to motivate all concerned for their enhanced deployment

Course Outcomes:

After learning the course, the learners will be able to

1) Determine the fundamental performance characteristics of solar thermal, photovoltaic and wind energy systems
2) Estimate the potential of solar and wind energy resources
3) Demonstrate understanding of the fundamentals of energy conversion from biomass, geothermal, tidal or wave energy conversion systems
4) Determine the economic feasibility of renewable energy technologies

Detailed Syllabus:

Unit	Description	Duration h
1.	**Solar energy** Potential of Renewable energy sources, Current scenario of worldwide installed capacity, Estimation of solar radiation **Solar thermal collectors** – General description and characteristics of flat plate and concentrating solar collectors, characteristic equation for performance evaluation **Solar Photovoltaic Systems**– Working, Constructional details & performance assessment, Effect of various parameters on output of solar cell, economics	6
2.	**Wind energy** Principles and classification of wind energy conversion systems– Aerodynamics and performance, Site selection considerations, Wind resource / energy potential measurement, wind electric generator components, Operation, maintenance and economics	6
3.	**Energy from biomass -** Sources of biomass, Properties of biomass, Conversion of biomass into fuels – Energy through fermentation – Pyrolysis, gasification and combustion – Aerobic and anaerobic bio-conversion, Biogas plants – Types of plants –operation in dual fuel mode– Properties and Economics	6
4	**Geothermal, Tidal or Wave Energy Conversion** Geothermal energy: hot springs and steam ejection site selection, power plants, and economics. Environmental impacts, Economic and social considerations, Availability, system development and limitations, Wave and tidal energy –Scope and economics, Introduction to integrated energy systems.	6
	Total	24

	Text Books 1. S.P. Sukhatme, Solar Energy – Principles of thermal collection and storage, II edition, Tata McGraw Hill, New Delhi, 1996. 2. Garg H.P., Prakash J., Solar energy Fundamentals and Applications, Tata Mc Graw Hill Publishing Company, New-Delhi, Latest Edition 3. V.V. N. Kishore, Editor, Renewable Energy Engineering and Technology, A knowledge Compendium, The Energy and Resources Institute, New Delhi, 2008
	Reference Books: **1.** J.A.Duffie and W.A.Beckman, Solar engineering of Thermal processes, II edition, **2.** John Wiley, New York, 1991. **3.** D.Y.Goswami, F.Kreith and J.F.Kreider, Principles of Solar Engineering, Taylor and **4.** Francis, Philadelphia, 2000. **5.** D.D.Hall and R.P.Grover, Biomass Regenerable Energy, John Wiley, New York,1987. **6.** Mukund R Patel, Wind and Solar Power Systems, CRC Press, 1999. **7.** J F Manwell, J.G.McGowan, A.L.Rogers, Wind Energy Explained: Theory, Design and Application, John Wiley and Sons, May 2002. **8.** R D Begamudre, Energy Conversion Systems, New Age International (P) Ltd., Publishers, New Delhi ,2000. **9.** Bureau of Energy Efficiency – Volume 1

Program: M. Tech. (Design Engineering)					Semester : I	
Course : Advanced Materials					Code: MMD1601A	
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE1	IE2	ETE	Total
2	2	2	20	--	30	50

Pre-requisite:

Chemistry, Physics, Material Science, Metallurgy

Objectives:

1. To introduce advanced and exotic materials.
2. To familiarize students with structure and properties of materials.
3. To establish significance of material selection in engineering design.
4. To explore new design opportunities.

Outcomes:

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

1. Student will be able to analyze of different materials in advanced engineering application.
2. Student will be able to relate structure and properties of new materials in engineering applications
3. Student will be able to evaluate and select materials for advanced engineering applications.

Detailed Syllabus:

Unit	Description	Duration h
1	Advanced and exotic materials – ceramics and Plastics, Biomaterials, Aerogels, Superconductors, Carbon nano tubes	8
2	Mechanical, electrical, optical and magnetic properties of materials.	8
3	Smart materials, Piezoelectricity, Magnetostriction, smart polymers, Shape memory alloys	6
4	Introduction to nano, Nano-biomimicry, Synthesis of nanomaterials by physical and chemical methods, Synthesis of nanomaterials by biological methods, Characterizations of nanomaterials.	6
	Total	24

Text Books:

1. W.D. Callister Material Science and Engineering: An Introduction, Wiley publication.

Reference Books:

1. Malsch, N.H., "Biomedical Nanotechnology", CRC Press. (2005).
2. L.F. Pease, R.M. Rose and J. Wulff, Electronic Properties (Volume IV: Structure and Properties of Materials)

Program: M. Tech. (Design Engineering)					Semester : I	
Course : Optimization Methods					Code: MMD1601B	
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE 1	IE 2	ETE	Total
2	2	2	20	--	30	50

Pre-requisite: Engineering Mathematics

Objectives:

1. To introduce students to the modeling of constrained decision-making problems and optimization.
2. Provide students with the basic mathematical concepts of optimization.
3. Provide students with the modelling skills necessary to describe and formulate optimization problems.
4. Provide students with the skills necessary to solve and interpret optimization problems in engineering.

Outcomes:

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

1. Formulate mathematical programs in various practical systems
2. Understand basic optimization techniques
3. interpret the results of a model and present the insights (sensitivity, duality)
4. Know the limitations of different solution methodology
5. Use software to solve problems

Detailed Syllabus:

Unit	Description	Duration h
1.	**Classical Optimization Techniques** Introduction to Mathematical Modeling, Single variable optimization and multi variable optimization, with constraints and without constraints	6
2.	**Linear and non-Linear Programming** Simplex Methods, Elimination and iterative methods for one-dimensional minimization .	6
3.	**Simulation Modeling** Introduction, definition and types, limitations, various phases of modeling, Monte Carlo method, applications, advantages and limitations of simulation	6
4.	**Modern Methods of Optimization** Genetic algorithms, Simulated Annealing, Particle Swarm Optimization, Ant Colony Optimization, etc.	6
	Total	24

Text Books:

1. Engineering Optimization: Theory and Practice, Singiresu S. Rao, John Wiley & Sons
2. Practical Optimization Methods with Mathematical Applications, M. Asghar Bhatti, Springer
3. Optimization for engineering design, K. Deb, PHI

Reference Books:

1. Topology Optimization – Theory, Methods and Applications, M. P. Bendse, Q. Sigmund
2. Evolutionary Topology Optimization of Continuum Structures, Methods and Applications, X. Huang, Y.M. Xie, Wiley
3. Structural Optimization, Raphael T. Haftka and Zafer Gurdal, Kluwer Academic Publishers
4. Mathematical Modelling, J N Kapur, New age international publication
5. Optimization concepts and applications in engineering, Belegundu, Chandrupatla, Pearson Education

Program: M. Tech. (Design Engineering)					Semester : I	
Course : Modelling and Simulation of Dynamic systems					Code: MMD1601C	
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE 1	IE 2	ETE	Total
2	2	2	20	--	30	50

Pre-requisite: Engineering Mathematics

Objectives:

1. Students able to model any physical system for realtime applications
2. Students able to simulate any physical system for realtime applications

Outcomes:

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

1. Develop mathematical model for practical problem
2. Develop Bond Graph model for system
3. Apply transfer function and State space model techniques
4. Simulate the system using suitable software and Estimate parameters by optimization

Detailed Syllabus:

Unit	Description	Duration h
1.	Introduction to Modelling and Simulation, Basic systems, Introduction and Types of Mathematical modelling, Basic building blocks Mechanical, Electrical, Thermal systems.	6
2.	Bond Graph Modelling of Dynamic Systems: Representation,Elements, Single,Two and multiports Causality, Application to basic Mechanical,Electrical and Electromechanical system	6
3.	Dynamic Response and System Transfer Function: Poles, Stability Block diagram/Signal flow diagram/State Space formulation and Frequency response	6
4.	Simulation and Simulation application Parameter Estimation, System Identification and Optimization	6
	Total	**24**

Reference Books:

Brown, Forbes T. Engineering System Dynamics. New York, NY: CRC, 2001. ISBN: 9780824706166.

List of Experiments/ Assignments

1. Modelling of any physical systems
2. Simulation using suitable software for any physical system

Program:	M. Tech. (Design Engineering)				Semester : II	
Course :	Room Acoustics				Code : MMD2602A	
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE 1	IE 2	ETE	Total
2	2	2	20	--	30	50

Pre-requisite: Engineering Mathematics, Physics,

Objectives:

The course includes sound fields in rooms with wave theoretical methods, geometrical acoustics methods Acoustical measurement techniques, sound absorption for evaluation of room acoustic quality

Outcomes:

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

Understand Basic principals in acoustics, measurement of sound Power and apply to analyze effectiveness in compliance to noise regulations.

Detailed Syllabus:

Unit	Description	Duration h
1.	**Basics of acoustics –** Terminologies speed of sound, wavelength, frequency, and wave number, acoustic pressure, acoustic intensity and acoustic energy density, spherical wave, **Acoustic measurement** Directivity factor and directivity index, levels and the decibel, combination of sound sources, octave bands, weighted sound levels. Sound power measurement	6.
2.	**Transmission of Sound:** changes in media with normal incidence, changes in media with oblique incidence, sound transmission through a wall, transmission loss for walls - stiffness-controlled region- mass-controlled region - damping-controlled region,	6
3.	**Sound Absorption:** General description of acoustical materials - acoustical tiles, fiberboard, resonator absorption unit absorber, carpets, acoustical plaster, resilient packing composite materials, etc. Their use, selection criteria and construction.	6
4.	**Room acoustics -** surface absorption coefficients, steady-state sound level in a room, Behaviour of sound in an enclosed space. Concept of reverberation and reverberation time effect of energy absorption in the air, noise from an adjacent room, acoustic enclosures, acoustic barriers.	6
	Total	24

Text Books:

Industrial Noise Control, Randell Barron, Marcel Dekker, Inc.

Reference Books:

Mechanical Vibrations & Noise Engineering, A.G.Ambekar, Prentice Hall of India, New-Delhi.

Program: M. Tech. (Design Engineering)					Semester : II	
Course : Design Thinking					Code: MMD2602B	
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE 1	IE 2	ETE	Total
2	2	2	20	--	30	50

Pre-requisite:

Any Engineering Graduate

Objectives:

1. To acquaint with concepts of Design Thinking.
2. To apply design thinking tools in every field of Engineering.

Outcomes:

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

1. Use Design Thinking tools.
2. Create simple Products using design thinking tools

Detailed Syllabus:

Unit	Description	Duration h
1.	Introduction to Design thinking and its importance. Steps in Design Thinking	4
2.	Empathize Phase	4
3.	Define Phase	4
4.	Ideate Phase	4
5.	Prototype Phase	4
6.	Test Phase. One simple Product development using Design thinking tools	4
	Total	24

Reference Books:

1. Design Thinking methodology book by Emrah Yayici , Publisher Emrah Yayici, 2016
2. Designing for Growth: A design thinking toolkit for managers, Tim Ogilvie ,Columbia Business School Publishing

Experiment / Assignments List:

1) Use Design Thinking for simple products such as Bag pack, ladies purse, material handling system or any NPD:- Compulsory assignment in a group of 4 students preferable interdisciplinary.

Program:	M. Tech. (Design Engineering)				Semester :	II
Course :	Reliability Engineering				Code:	MMD2602C
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE 1	IE 2	ETE	Total
2	2	2	20	--	30	50

Pre-requisite: Engineering Mathematics

Objectives:

1. To perform reliability engineering analysis.
2. To compute reliability engineering parameters and estimates for applications in mechanical devices and manufacturing environments.

Outcomes:

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

1. Identify the possible faults in systems and their impacts to the overall system reliability.
2. Develop fault trees for a sub-system and apply various reliability models on fault analysis.
3. Evaluate maintenance schedules and assess the corresponding risk with appropriate techniques and tools.

Detailed Syllabus:

Unit	Description	Duration h
1.	**Fundamental concepts - I** Failure density, failure rate, hazard rate, MTTF, MTBF, pdf, cdf, modes of failure, Areas of reliability, Quality and reliability assurance rules, product liability, probability distributions binomial, normal, Poisson.	6
2.	**System reliability** Series, parallel, mixed configuration, k- out of n structure, complex systems- enumeration method, conditional probability method, cut set and tie set method,	6
3.	**Redundancy** Element redundancy, unit redundancy, standby redundancy- types of stand by redundancy, parallel components single redundancy, multiple redundancy. Markov analysis.	6
4.	**System reliability Analysis** Reliability apportionment, Reliability apportionment techniques – equal apportionment, AGREE, ARINC, feasibility of objectives apportionment.	6
	Total	**24**

Text Books:

1. L.S. Srinath, Concepts of Reliability Engg., Affiliated East-Wast Press (P) Ltd., 1985.
2. E. Balagurusmy, Reliability Engineering, Tata McGraw-Hill Publishing Co. Ltd., 1984.

Reference Books:

1. A.K. Govil, Reliability Engineering, Tata McGraw-Hill Publishing Co. Ltd., 1983.
2. B.S. Dhillion, C. Singh, Engineering Reliability, John Wiley & Sons, 1980.
3. M.L. Shooman, Probabilistic, Reliability, McGraw-Hill Book Co., 1968.
4. P.D.T. Conor, Practical Reliability Engg., John Wiley & Sons, 1985.
5. K.C. Kapur, L.R. Lamberson, Reliability in Engineering Design, John Wiley & Sons, 1977.
6. A. Birolini , Reliability Engineering, Theory and Practice, Third Edition, Springer, 1999

Program:	M. Tech (E&TC)-VLSI and Embedded Systems			Semester:	I		
Course:	Automotive Electronics and its Applications			Code:	MET1601A		
Teaching Scheme				Evaluation Scheme			
Lecture	Hours	Credit		IE1	IE2	ETE	Total
2	2	2		20	--	30	50

Prior Knowledge of Electronics & electrical, instrumentation, control systems, and IC engine operation, **is essential.**

Objectives:

1. To explain the various application of electronics systems and ECU in automotive.
2. To deliver knowledge about principles and applications of sensors and actuators in automotive electronics systems.
3. To explore various control systems in automotive

Outcomes:

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

1. Acquire an overview of automotive components, subsystems, and basics of electronic control in today's automotive industry.
2. Understand the available automotive sensors and actuators in various electronic control systems.
3. Understand components of engine control system in automotive design.
4. Analyze the safety systems in automotive application

Detailed Syllabus:

Unit	Description	Duration h
1.	**Automotive Systems Overview:** Automotive vehicle technology, Present trends in automobiles with emphasis on increasing role of electronics and software, Overview of typical automotive subsystems and components, Body, Chassis, and Powertrain Electronics	6
2.	**Sensors and Actuators:** Basic sensor arrangement, Types of sensors such as oxygen sensors, Crank angle position sensors, Fuel metering/ vehicle speed sensors, Flow sensor, Temperature, EGO, Air mass flow sensors, Throttle position sensor, Solenoids, Stepper Motors, Relays, etc.,	6
3.	**Engine Control System:** Algorithms for engine control including open loop and closed loop control system, Electronic ignition, EGR for exhaust emission control. Look-up tables and maps, Need of maps, Procedure to generate maps, Engine calibration, Torque table, Dynamometer testing	6
4.	**Active and passive safety systems:** Body electronics including lighting control, Remote keyless entry, Immobilizers etc., Electronic instrument clusters and dashboard electronics, Antilock braking system, Electronic stability program, Air bags, Computer vision based ADAS	6
	Total	24

Text Books:

1. William B. Ribbens, "Understanding Automotive Electronics- An Engineering Perspective", 7th edition, Butterworth-Heinemann Publications, 2017.
2. Ronald K. Jurgen, "Automotive Electronics Handbook", Mc-Graw Hill, 1999

Reference Books:

1. Robert Bosch, "Automotive Hand Book", 10th edition, Wiley Publications, 2018
2. Kiencke, Uwe, Nielsen & Lars, "Automotive Control Systems for Engine, Driveline and Vehicle", Second edition, Springer Publication, 2005.
3. Tom H. Denton , "Automobile Electrical and Electronic Systems", 3rd Edition, Elsevier, 2004
4. John F. Kershaw, James D. Halderman, "Automotive Electrical and Electronic Systems", 5th Edition, Pearson Prentice Hall, 2007

Program:	M.Tech (E&TC)-VLSI and Embedded Systems				Semester:	I
Course:	Industrial Drives				Code:	MET1601B
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE 1	IE 2	ETE	Total
2	2	2	20	--	30	50

Pre-requisite:

Electrical Drives, Dynamics of Electrical drives, Control Systems

Objectives:

1. To define electric drive, its parts, advantages and explain choice of electric drive.
2. To explain dynamics and modes of operation of electric drives.
3. To explain selection of motor power ratings and control of dc motor using rectifiers.
4. To explain the control of induction motor, synchronous motor and stepper motor drives.
5. To discuss typical applications electrical drives in the industry

Outcomes:

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

1. Analyze the performance of induction motor drives under different conditions.
2. Control induction motor, synchronous motor and stepper motor drives.
3. Suggest a suitable electrical drive for specific application in the industry
4. To analyze the performance of induction motor drives under different conditions.

Detailed Syllabus:

Unit	Description	Duration h
1.	**Selection of Motor Power Ratings:** Thermal Model of Motor for Heating and Cooling, Classes of Motor Duty, Determination of Motor Rating. **Direct Current Motor Drives:** Controlled Rectifier Fed dc Drives, Single and three Phase Half and Fully Controlled Rectifier Control of dc Separately Excited Motor, Rectifier Control of dc Series Motor, Supply Harmonics, Power Factor and Ripple in Motor Current, Chopper Control of Separately Excited dc Motor, Chopper Control of Series Motor.	6
2.	**Induction Motor Drives:** Analysis and Performance of Three Phase Induction Motors, Analysis of Induction Motor Fed from Non-Sinusoidal Voltage Supply, Starting, Braking, Transient Analysis. Speed Control Techniques-Stator Voltage Control, Variable Voltage Frequency Control from Voltage Sources.	6
3.	Voltage Source Inverter (VSI) Control, Cyclo-converter Control, Closed Loop Speed Control and Converter Rating for VSI and Cyclo-converter Induction Motor Drives, Variable Frequency Control from a Current Source, Current Source (CSI) Control, current regulated voltage source inverter control, speed control of single phase induction motors.	6
4.	**Synchronous Motor Drives:** Operation from fixed frequency supply-starting, synchronous motor. Self-controlled synchronous motor drive employing load commutated thruster inverter, Permanent Magnet ac (PMAC) Motor Drives, Sinusoidal PMAC Motor Drives, Brushless dc Motor Drives. **Stepper Motor Drives:** Variable Reluctance, Permanent Magnet, Important Features of Stepper Motors, Torque Versus Stepping Rate Characteristics, Drive Circuits for Stepper Motor. **Industrial Drives:** Textile Mills, Steel Rolling Mills, Cranes and Hoists, Machine Tools.	6
	Total	**24**

Text Books:

1. Gopal K Dubey , Fundamentals of the electrical drives Narosa publication
2. N. Mohan T.M. udeland & W.P.Robbins , Power Electronics converter application J.Wiley & sons
3. Vedam Suryavanshi**,** Electrical Drives Concept and application
4. B.K. Bose, Advanced power Electronics & A.C. Drives
5. S.K.Pillar, Analysis of thyristor power conditioned motors

Reference Books:

1. N.K De,P.K. Sen , Electric Drives PHI Learning 1 st Edition, 2009
2. Gobal K.Dubey, Fundamentals of Electrical Drives- Alpha Science Int. Ltd.,
3. Shepherd Hullay & Liag, Power Electronics & Motor Control -, Cambridge Univ. Press
4. Gopal K Dubey, Power Semiconductor controlled Drives, - Prentice Hall pub.
5. R. Krishnan, Electric Motor Drives–Modelling, Analysis and Control, - Pearson Education, 2003
6. P.C. Sen , Thyristorised DC Drives -, Krieger pub.
7. S.B.Dewan, G.R.Slemon & A.Stranghan; Power Semi conductor controlled Drives - John-Willey pub.

Program:	M.Tech (E&TC)-VLSI and Embedded Systems			Semester :	I	
Course :	Basic of FPGA and CPLD			Code :	MET1601C	
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE1	IE2	ETE	Total
2	2	2	20	--	30	50

Pre-requisite: Fundamentals of digital electronics, Knowledge of one hardware description language

Objectives:

1. To make students familiar with programmable logic devices and its architectures.
2. To understand the architecture and features of FPGA and CPLD .
3. To make the students familiar with the design process and how the design is mapped to the existing hardware in FPGA and CPLD.

Outcomes:

After learning the course the students should be able to:

1. To understand the depth of CPLD and FPGA architectures.
2. To design a system using FPGAs.
3. To demonstrate an understanding of interfacing of different external devices with FPGA/CPLD.
4. To apply the complete design flow of FPGA and CPLD for the specific application.

Detailed Syllabus:

Unit	Description	Duration H
1.	**Introduction:** Introduction to Hardware Description language, Need of Programmable logic devices, PLA PAL, CPLD, FPGA: General Architecture, features CPLD Architecture: overview, specification and applications, Features of XC9500 series of CPLD family.	**6**
2.	**FPGA Architecture:** Xilinx Logic Cell Array, Configurable Logic Block, I/O Block, Programmable Interconnects, Programming methods, Advanced features of Xilinx 4000 series Technology Trends: Device capacity, Utilization and Gate Density, Programming methods, General Design Flow, General Design Guidelines.	**6**
3.	**Interfacing with FPGA/CPLD:** The purpose of interfacing, interfacing of external devices such as WiFi Module, Bluetooth Module, GPS Module, Zigbee Module, Different types of display devices with FPGA/CPLD	**6**
4.	**Case Studies-FPGA/CPLD:** Xilinx Virtex-6, Spartan-6, Z-board Advanced features in FPGA based on Case studies. **Logical Design by FPGA/CPLD:** Complete design of any combinational circuit by gates, Boolean Algebra, Design of sequential circuits	**6**
	Total	**24**

Text Books:

1. P.K.Chan& S. Mourad, Digital Design Using Field Programmable Gate Array, Prentice Hall (Pte), 1994
2. Ronald Sass and Andrew G. Schmidt, "Embedded systems design with platform FPGAs: Principles and practices", Morgan Kaufmann, 2010.
3. Design manuals of Altera, Xilinx and Actel.

Reference Books:

1. S. Trimberger, Edr. Field Programmable Gate Array Technology, Kluwer Academic Publications, 1994.
2. Ronald J Tocci, Neal S. Widmer, Gregory L. Moss, "Digital Systems: Principles & Applications", 10th Edition, Pearson, 2009
3. J. Old Field, R. Dorf, Field Programmable Gate Arrays, John Wiley & Sons, Newyork, Reprint 2008.
4. S. Brown, R. Francis, J. Rose, Z. Vransic, Field Programmable Gate Array, BSP, 2007.
5. S. Brown and J. Rose, "Architecture of FPGAs and CPLDs: A Tutorial", IEEE Design & Test of Computers, Vol. 13, No. 2, pp. 42-57, 1996.
6. Stephen Brown Zvonko Vranesic – Fundamentals of Digital Logic with VHDL design, McGraw Hill – 2000

Program: M.Tech (E&TC)-VLSI and Embedded Systems					Semester : I	
Course : Robotics					Code : MET1601D	
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE1	IE2	ETE	Total
2	2	2	20	--	30	50

Prior Knowledge of 1. Sensors and actuators 2. Programming language 'C', MATLAB

Objectives: To impart knowledge on
1. Electromechanical elements of robots
2. Control system for robot automation
3. Existing robots designed for various applications

Outcomes: After learning the course the students should be able to:
1. Understand kinematics, statistics and dynamic of robots
2. Apply concepts of industrial automation and communication for selection of robots
3. Select sensing and actuating elements for designing robots as per applications requirements
4. Integrate and design control system and information system for various applications.

Detailed Syllabus:

Unit	Description	Duration h
1.	**Introduction to robotics:** Evolution of Robotics, Elements of robots; Kinematics of serial and parallel robots; Velocity and static analysis of robots; Dynamics of robots; Motion planning and control; Flexible manipulators; Wheeled mobile robots, classification of Robots	5
2.	**Advanced concepts in robotics:** Introduction to Cloud and Fog robotics; Basic concepts of industrial automation and communication protocols for PLC, DCS, SCADA systems; Introduction to Internet of Things, Protocols and real time applications.	5
3.	Sensing Elements **for robots:** Classification of Sensors, Encoders and Dead Reckoning Infrared Sensors, Ground-based RF Systems, Active Beacons, Ultrasonic Transponder Trilateration, Accelerometers, Gyroscopes, Laser Range Finder, Vision-based Sensors, Color-tracking Sensors, safety and motion sensors, Force/ Torque Sensors , Tactile Sensors, DC Motors, Controlling a DC Motor, Pulse Width Modulation, Stepper Motors, Servo Motor.	7
4.	Control System of Robots: Automatic-Feedback Control System, Control Elements, Control System Design, A Robot's System Dynamics, Sensory Feedback, Control Algorithms and Performances, Space Control, Introduction to Information System of Robots.	7
	Total	24

Text Books:

1. John J C, Introduction to Robotics: Mechanics and Control , Addison-Wesley (1989).
2. Appin Knowledge Solutions, Robotics (2007)
3. Ming Xie, Fundamentals of Robotics - Linking Perception to Action (2003)

Reference Books:

1. Thomas Bräunl, Embedded Robotics - Thomas Braunl (2006)
2. Bruno S and Sciavicco L, Robotics: Modelling, Planning and Control, Springer (2009).
3. Fu K S, Ralph G and Lee C S G, Robotics: Control Sensing. Vision, and Intelligence , Tata McGraw-Hill (1987).
4. Mukhopadhyay S, Sen S and Deb A K, Industrial Instrumentation, Control and Automation, Jaico (1999).
5. Rajkumar B and Dastjerdi A V, Internet of Things: Principles and Paradigms , Morgan Kaufmann (2016).

Program:	M.Tech (E&TC)-VLSI and Embedded Systems			Semester:	II
Course:	Drone Programming for Beginners			Code:	MET2602A

Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE 1	IE 2	ETE	Total
2	2	2	20	--	30	50

Pre-requisite: Basic understanding of physics (Force, Velocity, Acceleration, etc), Understanding of sensors and actuators, Control systems, Modelling Basics –MATLB & SIMULINK, Programming in python

Objectives:

1. To understand the physics behind drones
2. To create the mathematical model of quadcopter drone from simple mathematics & Experimental data
3. To implement model into Simulink & check it against real life performance

Outcomes:

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

1. Identify & select different accessories of Drones as per applications
2. Establish the mathematical model & the Physics behind Quadcopter drone
3. Design Simulink model simulating the complete dynamics of quadcopter drone.

Detailed Syllabus:

Unit	Description	Duration H
1.	**Introduction to drones:** Unmanned Aerial Systems (UAS), Basics of drones, Introduction to Drones programming and Development Tools, Current rules and regulations governing owning and operating a UAS, concerns surrounding UAS safety, security and privacy issues	6
2.	**Drone accessories and Applications:** Sensors, Motors, Propellers, Battery, Concept of propulsion, Forces working on a Flight, Principal axes and rotation of aerial systems, Stable, unstable and neutral systems, Control drone (roll, pitch and yaw), Application of drones.	6
3.	**Drone control system development in Simulink:** Control system architecture, Quadcopter with actuator & propellers functionality block, Sensing & estimation functionality block, controller functionality block, Motor mixing algorithm (RPYT) functionality block	6
4.	**Modelling, Simulation & Flight control design:** Dynamic quadcopter system Model, flight control design, 3D visualization, testing & Tuning the model, Flight operations, Applicable software for data collection, processing, and analysis	6
	Total	24

Text books:

1. John Baichtal ,Building your own drones, a beginner's guide to drones, UAVS, and ROVs
2. Muhammad Usman , Quadcopter modelling and control with Matlab/Simulink implementation
3. Ryan Gordon , Model based design of a quadcopter
4. K.S.Fu, R.C.Gonzalez, C.G.Lee , Robotics control, sensing, vision and intelligence

Reference Books:

1. - R.K.Mittal , I.J.Nagrath,Robotics and control
2. Ben Rupert , Drones (The ultimate guide), , CreateSpace Independent Publishing Platform
3. Agam Kumar Tyagi Matlab and Simulink for engineers, , Oxford University Press, 2012

Program:	M. Tech (E&TC)-VLSI and Embedded Systems	Semester:	II
Course :	Instrumentation and Measurements	Code:	MET2602B

Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE1	IE2	ETE	Total
2	2	2	20	--	30	50

Pre-requisite: Basics of sensors and Actuators, Basic of Electronics, Analog and Digital Systems

Objectives:

To impart knowledge on the following Topics -

1. Basic functional elements of instrumentation
2. Fundamentals of electrical and electronic instruments
3. Comparison between various measurement techniques
4. Various storage and display devices
5. Various transducers and the data acquisition systems

Outcomes:

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

1. Analyse different measuring parameters of any electronics/mechatronics system
2. Design and evaluate characteristics of different types of mechatronics/ electrical/ electronic system
3. Understand different types of wave/spectrum analyzer.
4. Interface various system components and analyse its data using data acquisition system.

Detailed Syllabus:

Unit	Description	Duration h
1.	Basics of Measurements: Accuracy, Precision, resolution, reliability, repeatability, validity, Errors and their analysis, Standards of measurement. Bridge Measurement: DC bridges- wheatstone bridge, AC bridges – Kelvin, Hay, Maxwell, Schering and Wien bridges, Wagner ground Connection. Electronic Instruments for Measuring Basic Parameters: Amplified DC meter, AC Voltmeter, True- RMS responding Voltmeter, Electronic multi-meter, Digital voltmeter, Vector Voltmeter.	6
2.	Oscilloscopes: Cathode Ray Tube, Vertical and Horizontal Deflection Systems, Delay lines, Probes and Transducers, Specification of an Oscilloscope. Oscilloscope measurement Techniques, Special Oscilloscopes – Storage Oscilloscope, Sampling Oscilloscope. Signal Generators: Sine wave generator, Frequency – Synthesized Signal Generator, Sweep frequency Generator. Pulse and square wave generators. Function Generators.	6
3.	Signal Analysis: Wave Analyzer, Spectrum Analyzer. Frequency Counters: Simple Frequency Counter; Measurement errors; extending frequency range of counters Transducers: Types, Strain Gages, Displacement Transducers	6
4.	Digital Data Acquisition System: Interfacing transducers to Electronics Control and Measuring System. Instrumentation Amplifier, Isolation Amplifier. An Introduction to Computer-Controlled Test Systems.IEEE-488 GPIB Bus	6
	Total	24

Text Books:

1. Albert D.Helstrick and William D.Cooper, Pearson Education , Modern Electronics Instrumentation & Measurement Techniques, . Selected portion from Ch.1, 5-13.
2. by Joshph J.Carr ,Elements of Electronics Instrumentation and Measurement-3rd Edition.Pearson Education. Selected portion from Ch.1,2,4,7,8,9,13,14,18,23 and 25.

Reference Books:

1. Electronics Instruments and Instrumentation Technology – Anand, PHI
2. Doebelin, E.O., Measurement systems, McGraw Hill, Fourth edition, Singapore, 1990.

M.Tech (E&TC)-VLSI and Embedded Systems				Semester :		I
Course : Microcontrollers and Microprocessors applications				**Code :**		**MET2602C**
Teaching Scheme			**Evaluation Scheme**			
Lecture	**Hours**	**Credit**	**IE1**	**IE2**	**ETE**	**Total**
2	2	2	20	--	30	50

Prior Knowledge of Digital Electronics **is essential.**

Objectives:

1. To understand architecture and features of typical Microcontroller.
2. To understand need of microcontrollers in real life applications.
3. To learn interfacing of real-world peripheral devices
4. To study various hardware and software tools for developing applications.
5. To learn the architecture and programmer's model of advanced processor and microcontroller
6. To acquaint the learner with application instruction set and logic to build assembly language programs.

Outcomes:

After learning the course the students should be able to:

1. Learn importance of microcontroller and microprocessor in designing embedded application
2. To apply the programming skills to develop real-life embedded application.
3. Learn use of hardware and software tools.
4. Develop interfacing to real world devices

Detailed Syllabus:

Unit	Description	Duration h
1.	**Introduction to single chip Microcontrollers:** Intel MCS-51 family features, 8051/8031-architecture, 8051 assembly language programming, addressing modes, Programming interrupts, timers and serial communication	6
2.	**Microcontrollers and system design:** Assembly vs High-Level language programming, System Development Environment: assembler, compiler and integrated development environment, Debugging and Simulation, system design with 8051.	6
3.	**System level interfacing design;** Advanced Microprocessor Architectures- 286, 486, Pentium; Introduction to RISC processors; ARM microcontrollers; Embedded system design methodologies, embedded controller design for communication, digital control.	6
4.	**Microcontroller & Processors Applications:** Interfacing with display devices, Sensors, actuators, and memory devices. Case Study on real time embedded system.	6
	Total	24

Text Books:

1. Barry B Brey, The intel microprocessor: architecture, programming and interfacing, Prentice hall of India, New Delhi, 2003.ISBN-0138027455, 4th Edition
2. Mohammad Ali Mazidi and Janice Gillispie Maszidi "The 8051 Microcontroller and Embedded Systems" Pearson education, 2003, ISBN- 9788131710265, 2nd Edition

Reference Books:

1. Chris H. Pappas, William H. Murray, ―80386 Microprocessor Handbooks‖, McGraw-Hill Osborne Media, ISBN-10: 0078812429, 13: 978-0078812422.
3. Walter A. Triebel, ―The 80386Dx Microprocessor: Hardware‖, Software, and Interfacing, Pearson Education, ISBN: 0137877307, 9780137877300.
4. Mohammad Rafiquzzaman, ―Microprocessors: Theory and Applications: Intel and Motorola", Prentice Hall, ISBN: -10:0966498011, 13:978:0966498011.
5. K. Bhurchandi, A. Ray, ―Advanced Microprocessors and Peripherals, McGraw Hill Education, Third Edition, ISBN: 978-1-25-900613-5

Program:	M. Tech(VLSI & Embedded Systems)				Semester:I	
Course:	Electronics Implementation Platform				Code: MET2602D	
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE1	IE2	ETE	Total
2	2	2	20	--	30	50

Pre-requisite: Knowledge of C language, Python, electronic circuits.

Objectives:

1. Explain about the Arduino, Raspberry Pi, PLDs and all other associated platforms
2. Understand of the importance of micro controllers and computers in science and technology.
3. Discuss basic programming and structures required for basic operation of the platform,
4. Describe how to recognize functions, operations and syntax of Python, C and C++

Outcomes:

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

1. Apply logical thinking and problem-solving skills with Arduino platform.
2. Acquire knowledge about Raspberry pi for implementation of applications
3. Understand Digital Signal processing implantation basics
4. Understanding rapid prototyping using PLDs.

Detailed Syllabus:

Unit	Description	Duration H
1.	Arduino: A open-sourceHardware, Working, Interfacing, Coding basics and small applications and Debugging.	6
2.	Raspberry pi : Working, Interfacing, Coding basics and small applications and Debugging.	6
3.	DSP processor for Real time Video and Inage Processing. : Working, Interfacing, Coding basics and small applications and Debugging.	6
4.	Programmable Logic devices: FPGA: Working, Interfacing, Coding basics and small applications and Debugging.	6
	Total	**24**

Text Books:

1. Ryan Turner,Arduino Programming: The Ultimate Beginner's & Intermediate Guide to Learn Arduino Programming Step by Step, 2019
2. Derek Molloy Exploring Raspberry Pi: Interfacing to the Real World with Embedded Linux 1st Edition,2006
3. Avtar Singh , Digital Signal Processing Implementations : Using DSP Microprocessors (with examples from TMS320C54XX),2003
4. Roger Woods, John McAllister, Ying Yi, Gaye Lightbody, FPGA- based Implementation of Signal Processing Systems, Second Edition, 2017

Reference Books:

1. Mark TorvaldsARDUINO - ARDUINO PROGRAMMING - ARDUINO FOR BEGINNERS, Second Edition June 7, 2018
2. Eben Upton Raspberry Pi User Guide 4th Edition 2019
3. Sen M. Kuo ,Real-Time Digital Signal Processing, : Implementations, Application and Experiments with the TMS320C55X, 2001
4. Cem Unsalan, Bora Tar ,Digital System Design with FPGA: Implementation Using Verilog andx VHDL , 2017

Program: M.Tech (Computer Engineering)				Semester : I		
Course : Programming with Python				Code : MCE1601A		
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE 1	IE 2	ETE	Total
2	2	2	20	--	30	50

Pre-requisite: . Basics of Programming

Objectives:

1.To acquire knowledge in Python and R programming
2.To develop Python programs with conditionals and loops and data structures
3.Acquire skills to apply data analysis methods to a problem

Outcomes:

After learning the course the students should be able to:
1.Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python
2.Interpret Object oriented programming in Python
3.Apply a solution clearly and accurately in a program using Python.

Detailed Syllabus:

Unit	Description	Duration h
1.	**Introduction to Python Programming:** Python Introduction, Installing and setting Python environment in Windows and Linux, basics of Python interpreter, Execution of python program, Editor for Python code, syntax, variable, Data types. Flow control if if else, for, while, range() function, continue, pass, break. Strings: Sequence operations, String Methods.	6
2.	**Lists:** Basic Operations, List slices,list methods,list and strings **Dictionaries:** looping and dictionaries, dictionaries & lists. **Tuples and Files :** reading and writing Functions: Definition, Call, Arguments ,Input output file handling.	6
3.	**Object Oriented Programming** features in Python: Classes, Objects, Inheritance,Errors and Exceptions: try, except and else statements, Exception Objects, Regular expressions.	6
4.	**Numpy and Matplotlib** :Array operations, Numpy Side Effects, 2D Numpy Arrays , Numpy Basic Statistics. Matplotlib: Introduction, Simple plots, Line API, Legend API, Figures, Subplots. **Pandas:** Look Ups, Selections and Indexing, Filling Methods, Series operation, Handling NaN values, Mapping, Data Frames, Reading Files, Plotting, Joins, Correlation, Histograms, Rolling calculation.	6
	Total	24

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

Program: M.Tech (Computer Engineering)				Semester : I		
Course : Software Engineering Basics				Code : MCE1601B		
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE 1	IE 2	ETE	Total
2	2	2	20	--	30	50

Pre-requisite:- None

Objectives:

1. To learn and understand the principles of Software Engineering
2. To be acquainted with methods of capturing, specifying, visualizing and analyzing software requirements.
3. To apply Design and Testing principles to S/W project development.
4. To understand project management through life cycle of the project.
5. To understand software quality attributes.

Outcomes:

After learning the course the students should be able to:

1. Decide on a process model for a developing a software project
2. Classify software applications and Identify unique features of various domains
3. Design test cases of a software system.
4. Understand basics of IT Project management.
5. Plan, schedule and execute a project considering the risk management.
6. Apply quality attributes in software development life cycle.

Detailed Syllabus:

Unit	Description	Duration h
1.	**Introduction to Software Engineering and Software Process Models:** Software Engineering Fundamentals: Nature of Software, Software Engineering Principles, The Software Process, Software Myths. Process Models :A Generic Process Model, Prescriptive Process Models: The Waterfall, Incremental Process(RAD), Evolutionary Process, Unified Process, Concurrent. Advanced Process Models & Tools: Agile software development: Agile methods, Plan-driven and agile development.	6
2.	**Software Requirements Engineering and Analysis:** Requirements Engineering: User and system requirements, Functional and non-functional requirements, Types & Metrics, A spiral view of the requirements engineering process. Software Requirements Specification (SRS): The software requirements Specification document, The structure of SRS, Ways of writing a SRS, Requirements elicitation & Analysis: Process, Requirements validation, Requirements management.	6
3.	**Design Engineering:** Design Process & quality, Design Concepts, The design Model, Pattern-based Software Design. Architectural Design :Design Decisions, Views, Patterns, Application Architectures, Modeling Component level Design: component, Designing class based components, conducting component-level design, User Interface Design: The golden rules, Interface Design steps & Analysis, Design Evaluation	6
4.	**Project Risk Management:** Risk Analysis & Management: Reactive versus Proactive Risk Strategies, Software Risks, Risk Identification, Risk Projection, Risk Refinement, Risk Mitigation, Risks Monitoring and Management, The RMMM plan for case study project	6
	Total	**24**

Text Books:

1. Roger Pressman, ―Software Engineering: A Practitioner‘s Approach‖, McGraw Hill, ISBN 0–07–337597

2. Ian Sommerville, ― Software Engineering‖, Addison and Wesley, ISBN 0-13-703515-2

Reference Books:

1. Carlo Ghezzi, ―Fundamentals of Software Engineering", Prentice Hall India, ISBN-10: 0133056996
2. Rajib Mall, ―Fundamentals of Software Engineering‖, Prentice Hall India, ISBN-13: 978- 8120348981
3. Pankaj Jalote, ―An Integrated Approach to Software Engineering‖, Springer, ISBN 13: 9788173192715.
4. S K Chang, ―Handbook of Software Engineering and Knowledge Engineering‖, World Scientific, Vol I, II,

ISBN: 978-981-02-4973-1
5. Tom Halt, ―Handbook of Software Engineering‖, Clanye International, ISBN10: 1632402939
6.Christine Bresnahan, Richard Blum –Linux command line and Shell Scripting Bible -Weilly , ISBN-978-0-470-25128-7

Program:	M.Tech (Computer Engineering)			Semester :	I	
Course :	Basics of Machine Learning			Code :	MCE1601C	
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE1	IE2	ETE	Total
2	2	2	20	--	30	50

Pre-requisite:

1.Linear Algebra, Statistics, Probability and Calculus

2. Basic Programming Skills

Objectives:

1. To master the concepts of supervised and unsupervised learning, recommendation engine, and time series modeling
2. To gain practical knowledge over principles, algorithms, and applications of Machine Learning through a hands-on approach and to validate Machine Learning models and decode various accuracy metrics. Improve the final models using another set of optimization algorithms, which include Boosting & Bagging techniques
3. To acquire thorough knowledge of the statistical and heuristic aspects of Machine Learning and To comprehend the theoretical concepts and how they relate to the practical aspects of Machine Learning.
4. 4.To implement models such as support vector machines, kernel SVM, naive Bayes, decision tree classifier, random forest classifier, logistic regression, K-means clustering

Outcomes:

After learning the course the students should be able to:

1. Understand machine learning techniques and computing environment that are suitable for the applications under consideration.
2. Solve problems associated with batch learning and online learning, and the big data characteristics such as high dimensionality, dynamically growing data and in particular scalability issues.
3. Develop scaling up machine learning techniques and associated computing techniques and technologies for various applications.
4. Implement various ways of selecting suitable model parameters for different machine learning techniques.

Detailed Syllabus:

Unit	Description	Duration h
1.	**Foundations for Machine Learning [ML]:** ML Techniques overview: Supervised; Unsupervised, Reinforcement Learning,Validation Techniques (Cross-Validations)**;**Feature Reduction/Dimensionality reduction;Principal components analysis (Eigen values, Eigen vectors, Orthogonality)	6
2.	**Clustering:** Distance measures;Different clustering methods (Distance, Density, Hierarchical); Iterative distance-based clustering; Dealing with continuous, categorical values in K-Means; Constructing a hierarchical cluster; K-Medoids, k-Mode and density-based clustering; Measures of quality of clustering	6
3.	**Classification: Naïve Bayes Classifier** Model Assumptions; Probability estimation; Required data processing; M-estimates;, Feature selection: Mutual information;Classifier **K-Nearest Neighbors:** K-Nearest Neighbor algorithm; Aspects to consider while designing K-Nearest Neighbor Support Vector Machines;SVM for classification and regression problems.	6
4.	**Association Rule mining:** The applications of Association Rule Mining: Market Basket, Recommendation Engines, etc. ; A mathematical model for association analysis; Large item sets; Association Rules; Apriori: Constructs large item sets with mini sup by iterations; Interestingness of discovered association rules; Application examples; Association analysis vs. classification ; FP-trees **Research Aspects: Application of ML in various domains-**Research Paper Publication in Quality Indexed International Journals/ Conferences;Practical Implementation of Industry Projects/Applications**;** IPR	6

	Total	24
Text Books: 1. T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e, 2008. 2. Christopher Bishop. Pattern Recognition and Machine Learning. 2e.		
Reference Books: 1. Ethem Alpaydin, Introduction to Machine Learning		

Program:	M.Tech (Computer Engineering)			Semester :		II
Course :	Image Processing with MATLAB			Code :		MCE2602A
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE 1	IE 2	ETE	Total
2	2	2	20	--	30	50

Pre-requisite: Programming Basics

Objectives:

1. Develop an overview of the field of image processing.
2. Cover the basic theory and algorithms that are widely used in digital image processing.
3. Develop hands-on experience in using computers to process images.
4. Familiarize with MATLAB Image Processing Toolbox Course

Outcomes:

After learning the course the students should be able to:

1: Understand the need for image transforms different types of image transforms and their properties.

2: Learn different techniques employed for the enhancement of images.

3: Understand the need for image compression and to learn the spatial and frequency domain techniques of image compression.

4: Learn different feature extraction techniques for image analysis and recognition.

5: Develop any image processing application.

Detailed Syllabus:

Unit	Description	Duration h
2.	**Introduction:** What is image processing? What are the fundamental issues? , What is the role of perception? Image sampling and quantization, Basic relationship between pixels, MATLAB orientations. **Image Transformations** Discrete Fourier transform, Properties of 2D DFT, FFT, Convolution, Correlation, Discrete cosine transform, Discrete Wavelet transform.	6
2.	**Image Enhancement Techniques** Spatial Domain Techniques: Basic gray level transformations, Histogram processing, Image subtraction, Image averaging, Spatial filtering, Smoothing filters, Sharpening filters. Frequency Domain Techniques: Frequency domain filtering, Image smoothing and Image sharpening using frequency domain filters.	6
3.	**Color image processing:** Color fundamentals, Color models, Color transformation, Smoothing and Sharpening **Image Compression:** Fundamentals, Encoder-Decoder model, Types of redundancies, Lossy and Lossless compression, Huffman coding, Arithmetic coding, Golomb coding, LZW coding, Block transform coding, Run-length coding, JPEG Lossless predictive coding, Lossy predictive coding, Wavelet coding.	6
4.	**Morphological Image processing:** Basics, Erosion, Dilation, Opening, Closing, Hit-or-Miss transform, Boundary Detection, Hole filling, Connected components, Convex hull, Thinning, Thickening, Skeletons, Pruning. **Image Segmentation and Representation:** Point, Line and Edge detection, Edge linking and Boundary detection, Thresholding, Basic global tresholding, Otsu's method, Region based segmentation, Use of motion in segmentation	6

	Total	24

Text Books:

1. R. C.Gonzalez, R.E.Woods," Digital Image processing", Pearson edition, Inc3/e,2008.
2. A.K.Jain," Fundamentals of Digital Image Processing", PHI,1995

Reference Books:

1. J.C. Russ," The Image Processing Handbook", (5/e), CRC, 2006
2. R.C.Gonzalez & R.E. Woods; "Digital Image Processing with MATLAB", Prentice Hall, 2003
3.W. K. Pratt, *Digital Image Processing,* John Wiley & Sons, 2006.
4.S. Ahmed, *Image Processing,* McGraw -Hill, 1994.
5.S. J. Solari, *Digital Video and Audio Compression,* McGraw-Hill, 1997

Program: M.Tech (Computer Engineering)				Semester : II		
Course : Linux Essentials				Code : MCE2602B		
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE 1	IE 2	ETE	Total
2	2	2	20	--	30	50

Pre-requisite:

Objectives:

1.To acquire knowledge of basic Linux OS, commands, and terminologies
2.To develop programs using Shell scripting
3. To acquire skills related to Linux file system

Outcomes:

After learning the course the students should be able to:
1. Use common and simple Linux commands
2. Demonstrate programming ability using Unix Shell
3. Develop collaboratively using GIT and write research-papers using LaTex
4.Apply a solution clearly and accurately in Linux environment

Detailed Syllabus:

Unit	Description	Duration h
3.	**Introduction to Linux:**Linux introduction; Understanding philosophy of Linux; Understanding Software Licensing and Linux Distributions; Architecture of Linux OS; Installation of Linux OS (direct and using virtual machine); Using common Linux programs: Linux desktop environment, working with different productivity software; Understanding and managing hardware: CPU, Disk issues, Device drivers, Display etc.;	6
2.	**Basic Commands and Shell Scripting:** Introduction to Linux commands, concept of shell, shell variables,getcwd() and pwd; Introduction to shell programming features: Variables declaration & scope,test, return value of a program, if-else and useful examples, for and while loop, switch case; Shell functions, pipe and redirection, wildcards, escape characters; Awk script: Environment andworkflow, syntax, variables, operators, regular expressions, arrays, control flows, loops,functions, output redirections	6
3.	**Linux File System and Networking:** File System - Manipulating Files: creating, deleting, copying, moving, renamingetc; Using absolute and relative path; Manipulating Directories: Creating, Deleting and Managing; Basic File and Directory commands; Understanding Linux file system; Networking - Understanding network features; Configuring a network connection; Testing a network connection;	6
4.	**Essential System Administration** **Users and Group Management:** Users and Group management: Creation, Updating, Deletion of user and group; Commands –shadow, useradd, usermod, userdel, groupadd, groupmod, groupdeletc; Managing ownership and permission. **Process and PackageManagement:** Understanding package management,package management commands like rpm, yum, apt; Understanding Process hierarchy and identifying running processes; Log files. **Or** **Introduction to GIT and LaTEX:** LaTEX:Basic syntax, compiling and creating documents; Document structure including sections and paragraphs; Adding Images, Table ofcontents, Source code, graphs; Adding references, and Bibliography; Installation and Hands-on of LaTEX. GIT: Creating a project using GIT locally, add, commit; Branch and Merge; Cloning a remote repo, working with a remote repo; Working on a project in a distributed	6

	fashion; Hands-on of GIT.	
	Total	**24**

Text Books:

1. Christine Bresnahan, Richard Blum ―Linux Essentials, Sybex, ISBN 9781119092063

2. Sumitava Das, Unix Concepts and Applications, Tata-McGraw Hill, ISBN 0-07-063546-3

Reference Books:

1.Christine Bresnahan, Richard Blum –Linux command line and Shell Scripting Bible -Weilly , ISBN-978-0-470-25128-7

Program:	M.Tech (Computer Engineering)			Semester :	II	
Course :	Design with UML			Code :	MCE2602C	
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE1	IE2	ETE	Total
2	2	2	20	--	30	50

Pre-requisite:

.Basic understanding of computer programming and related programming paradigms.

Objectives:

5. To introduce the concept of Object-oriented design
6. To understand and differentiate Unified Process from other approaches
7. To design static and dynamic UML diagrams

Outcomes:

After learning the course the students should be able to:

1. Understand Basic features and elements of the object-oriented approach
2. Identify, analyze, and model structural and behavioral concepts of the system.
3. Apply the concepts of architectural design for deploying the code for software.

Detailed Syllabus:

Unit	Description	Duration h
4.	Introduction to UML: Importance of modeling, principles of modeling, object-oriented modeling, conceptual model of the UML, Architecture, Software Development Life Cycle	**6**
2.	Basic Structural Modeling: Classes, Relationships, common Mechanisms, and diagrams. Advanced Structural Modeling: Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages. Class & Object Diagrams	**6**
3.	Basic and Advanced Behavioral Modeling: Interactions, Interaction diagrams. Use cases, Use case Diagrams, Activity Diagrams. Advanced Behavioral Modeling Events and signals, state machines, processes and Threads, time and space, state chart diagrams.	**6**
4.	Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams. Common modeling techniques	**6**
	Total	**24**

Text Books:

1. Grady Booch, - The unified modeling language user guide. Pearson Education India, ISBN: 0-201-57168
2. James Rumbaugh. Micheal Blaha- Object-Oriented Modeling and Design with UML: Pearson Education India, ISBN-13: 978-0130159205

Reference Books:

2. Charles Ritcher - Designing Flexible Object-Oriented systems with UML. New Riders Publishing.
3. Jackson, Burd Thomson - Object Oriented Analysis & Design. Thomson Course Technology.
4. Mike O'Docherty - Object-Oriented Analysis and Design: using UML. Wiley Publication
5. Joseph Schmuilers - Teach Yourself UML in 24 Hours. Sams publishing.

Program:	M. Tech. (Civil) Construction Management				Semester : I	
Course :	Project Management and Finance				Code : MCI1601A	
Teaching Scheme				Evaluation Scheme		
Lecture	Hours	Credit	IE1	IE2	ETE	Total
2	2	2	20	--	30	50

Pre-requisite: Basics of Management, Basics of Finance

Objectives:

After Completing this course, student will have adequate background to understand and solve the problem involving:

1. Outline the principles followed in carrying out a project.
2. To demonstrate knowledge and understanding of engineering and management principles.
3. To function effectively as an individual, and as a member or leader in diverse teams.
4. To understand the concepts of finance and accounts carried out in project management.

Outcomes:

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

1. Study the current market trends and choose projects.
2. Prepare project feasibility reports.
3. Ability to implement the project effectively meeting government norms and conditions.
4. Ability to understand the role and responsibility of the Professional Engineer.
5. Ability to choose projects which benefit the society and organization.

Detailed Syllabus:

Unit	Description	Duration h
1	**Introduction to Management** What is Management? It's Need ,Importance & Purpose, Evolution of Managements thought, Different Schools/ approaches to Management: Behavioral, Quantitative, Systems, Contingency Approach	6
2.	**Project Implementation, Monitoring and Control** Project representation: Role of project managers, relevance with objective of organization, preliminary manipulations, Basic Scheduling concepts: Resource levelling, Resource allocation, Setting a base line, Project management information system: Importance of contracts in projects: Team work in Project Management: Formation of Effective terms.	6
3.	**Organizing** Organizing as a Management process, Principles of Organization, Different Structures of organizations such as line, Line & Staff, Functional, Matrix or project Organization: Characteristics, Features, their Merits and Limitation, Ownerships of Organization: Sole Proprietorship, Partnership, Private Ltd., Public Ltd., Introduction to Organizational climate, Decision Making, Group Decision Making, Staffing: What is Staffing? Steps involved in Staffing, Recruitment, Staffing, Performance Appraisal Development	6
4.	**Financial Statements and Their Analysis** Understanding of Financial Statements and Their Analysis, Like Balance Sheet, Profit & Loss Account ,Ratio Analysis, Fund Flow Analysis, Statement of Changes In Financial Position.	6
	Total	**24**

Text Books: (Font Type: Times New Roman, Size: 10)

1. Project Management Institute A Guide to the Project Management Body of Knowledge PMBOK Guide (Sixth Edition), Sept 2017.
2. James C.Van Horne, Fundamentals of Financial Management, Person Education 2004.
3. Khanna, R.B.,Project Management, PHI 2011.

Reference Books:(Font Type: Times New Roman, Size: 10)

1. Kuster J., Huber, E., Lippmann, R., Schmid, A., Schneider, E., Witschi, U., Wust, R. Project Management Handbook, 2015.
2. Prasanna Chandra, Financial Management, Tata McGraw-Hill, 2008.
3. Carl S. Warren, James M. Reeve, Jonathan Duchac.
4. Financial and Managerial Accounting, 2016
5. Paneer Selvam, R., and Senthilkumar, P., Project Management, PHI, 2011.

Program:	M. Tech. Civil (Construction Management)			Semester : I		
Course :	Green Technology			Code : MCI1601B		
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE1	IE2	ETE	Total
2	2	2	20	--	30	50

Pre-requisite:

1. Environmental study, Types of pollution

Objectives: After Completing this course, student will have adequate background to:-

1. evaluate Global warming and its effect
2. demonstrate knowledge in the reduction of global warming.
3. apply control measures of carbon emission and accumulation.
4. apply high tech measures for Reducing Carbon Emissions.

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

1. analyse effects of Global warming
2. Implement the concept of reduction of global warming
3. apply remedial action for the carbon emission and accumulation.
4. apply high tech measures for Reducing Carbon Emissions.

Detailed Syllabus:

Unit	Description	Duration h
1.	**Global Warming and its effect:-** Introduction and physical definition of global warming, the New Carbon Problem: Accumulation, Long Half-Life, Heating Potential, Carbon Emission Factors, Carbon Absorption in Nature, The Global Emission Situation and its effect in India, The Kyoto and Other Protocols and its view in India, Effect of climate change and its impact. **Planning for the Future to reduce global warming:-** Steps taken to Control Carbon Emissions universally, Use of Promotional and Punitive Mechanisms for Reducing Carbon in Atmosphere, The General Approach in Planning for the Future, Developing Countrywide Adaptive Measures for Safety of Local People, Developing Mitigative Measures for Global Reduction of Carbon, India's National Action Plan on Climate Change (NAPCC) till date, National Mission for a Green India, The MRV Debate.	6
2.	**Opportunities in Control of Carbon Emissions and Accumulation:-** Essential Steps for Control of Carbon Emissions and Accumulation, Procedure to develop own Priorities and Business Opportunities in India for control of carbon emissions and accumulation, Needs a Mix of Green and Traditional Power Sources in India, A Logical Approach for Carbon Reduction, Need in India —More Forests, Less Deforestation and payment rates procedure for controlling carbon emissions and its Promotional Mechanisms at India**.** **Green Technologies for Energy Production:-** Various Technologies Available for Energy Production, Cost Comparison of a Few Typical Systems for Power Generation, Sources of Energy Production Already in Use, Alternative Methods Ready for Use, Green Technologies Needing some Prior R&D Work.	6
3.	**Green Technologies for Personal and Citywide Application :-** Measures to be taken for Green city, Carbon Emission Reduction at Personal Level, Carbon Emission Reduction at Local Authority and Citywide Level, Carbon Emissions from Imports. **Green Technologies for Specific Applications:-** Promotion of 'Green' Buildings, Guidelines, The Energy Conservation Building Code (ECBC), Green Hotels and Hospitals, Green Technologies for Transport, Green Roads, Ports and Harbors, Industries, Carbon, Carbon Emissions from a Few Selected Industries in India, The Changing Scenario in Cities, Need for Wider	6

	Application to Town Planning and Area Re-Development Projects ,'Green' Infrastructure for Municipal Services, Bringing up Indian Villages, Green Services for Crematoria, Spreading Message to all Stakeholders.	
4.	**Some High-tech Measures for Reducing Carbon Emissions :-** Use of Solar Power with Satellite-Based Systems ,Use of Carbon Capture and Storage (Sequestration) ,Microorganisms, A Quick SWOT Analysis. **Recommended Plan of Action :-** India's National Action Plan Take Us to a Low-Carbon Path, The Missions Help Develop Awareness, Few case studies on Projects undertaken by Various Countries, Adaptive Measures Essential for Indian People to Cope with Climate Change	**6**
	Total	**24**

Text Books:

1. Green Technologies, Soli J. Arceivala, Mc Graw Hill Education.

Reference Books:

1. Green Technologies and Environmental Sustainability edited by Ritu Singh, Sanjeev Kumar
2. http://cpcbenvis.nic.in/greentechnology.html

Program:	M. Tech. Civil (Construction Management)			Semester : II		
Course :	Contracts, Tendering & Arbitration			Code : MCI2602A		
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE1	IE2	ETE	Total
2	2	2	20	--	30	50

Pre-requisite:

Objectives:

1. To equipped with knowledge of contracts system.
2. To study principles and specifications for making tender documents
3. To learn basic principles of Arbitration in the context of various construction aspects.

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

1. Adopting the ethical knowledge for making construction contracts & Tenders.
2. Prepare Tendering documents as per conditions of contract.
3. Exhibit concept of Arbitration to resolution of disputes in construction projects.

Detailed Syllabus:

Unit	Description	Duration h
1.	**Construction Contracts :** Indian Contract Act (1872) :Definition of the contract as per the ACT. Valid, Voidable,Void contracts, Objectives of the act. Introduction: To law, Indian legal system, Laws governing structure & Working of Construction Organization Firms, Laws of Tort.	6
2.	**Construction Contract Documents:** Evaluation of contract documents, need for documents, present stage of national and international contract documents, types of construction contracts, roles and functions of parties to the contract. Contract Formation.	6
3.	**Stages in Contracting:** Preparation of tender documents estimating, pre - qualification, bid evaluation, award of contract, project financing and contract payments, contracts close out and completion.	6
4.	**Arbitration:** The Arbitration and Conciliation Act, 1996,Dispute Resolution, Introduced to the various ADR techniques, Comparison of Actions and Laws-Agreements , subject matter-Violations-Appointment of Arbitrators-Conditions of Arbitrations-Powers and duties of Arbitrator.	6
	Total	24

Text Books:

1. Civil Engineering Contracts and Estimates - B.S.Patil – Universities Press- 2006 Edition,reprinted in 2009.
2. The Indian Contract Act (9 of 1872), 1872- Bare Act- 2006 edition, Professional Book Publishers.
3. The Arbitration and Conciliation Act,(1996), 1996 (26 of 1996)- 2006 Edition, Professional Book Publisher.

Reference Books:

1. Law of contract Part I and Part II, Dr. R.K. Bangia- 2005 Edition, Allahabad Law Agency.
2. Arbitration, Conciliation and Alternative Dispute Resolution Systems- Dr. S.R. Myneni- 2004 Edition, reprinted in 2005- Asia Law House Publishers.
3. The Workmen‘s Compensation Act, 1923 (8 of 1923) Bare Act- 2005- Professional Book Publishers.
4. Standard General Conditions for Domestic Contracts- 2001 Ministry Of Statistics and Program Implementation, Government of India.

5. FIDIC Document (1999).
6. Dispute Resolution Board foundation manual-www.drbf.org. 30 Edition

Program:	**M. Tech. Civil (Construction Management)**	**Semester : II**
Course :	**Total Quality Management**	**Code : MCI2602B**

Teaching Scheme			**Evaluation Scheme**			
Lecture	**Hours**	**Credit**	**IE1**	**IE2**	**ETE**	**Total**
2	2	2	20	--	30	50

Pre-requisite: TQM & MIS at UG Level , Awareness of Quality Construction Aspects

Objectives:

1. To **understand** the need of QM in construction and **apply** necessary tools to achieve
2. To **apply** necessary trainings for the effective utilization of resources
3. To **apply** effectively the eight principles of ISO for quality processes
4. To **apply** Six Sigma tool for TQM in project execution

Outcomes: After learning the course, the engineers should be able to:

1. Explain and apply the TQM philosophy
2. To use effectively QC tools.
3. Apply ISO principles for effective Quality process
4. Apply Six Sigma effectively for quality improvement

Detailed Syllabus:

Unit	**Description**	**Duration h**
1	**Concepts of Quality** A) Definition of quality as given by Deming, Juran, Crosby, difference between Quality control, Quality Assurance (QA/QC). Total quality control (TQC) and Total Quality Management (TQM), Need for TQM in construction industry. Organization necessary for implementation of quality, Quality manual-Contents, data required, preparation, responsibility matrix, monitoring for quality- PDCA Cycle.	**6**
2	**Quality Control Tools** Histogram, Pareto diagram, Fish-bone diagram, Quality control chart-Testing required for quality control. Statistical Quality Control-Necessity, Benchmarking.	**5**
3	**Study of ISO 9004- Quality System Standards.** Purpose of ISO Standards. Difference between ISO 9001 and ISO 9004. Certification process for ISO 9001. Certification bodies involved. Eight Principles of ISO-Basic meaning, applying these principles for an effective quality process in the organization. Management support and commitment necessary for achieving implementation for quality system standards. **Development** of quality circles, quality inspection team, inspection reports, monitoring and control, 360‘ feedback for quality.	**7**
4	**A) Six Sigma** Definition of six sigma, evolution – Historical aspects, probability distribution Six sigma ratings, Six sigma training, six sigma as an effective tool in TQM. **B) Application of Six Sigma** Numerical	**6**
	Total	**24**

Text Books:

1. Quality Control and Total Quality Management by P. L. Jain- Tata McGraw Hill Publ. Company Ltd
2. Total Engineering Quality Management – Sunil Sharma – Macmillan India Ltd.
3. Total Project Management – The Indian Context – P. K. Joy Macmillan India Ltd.

Reference Books:

1. International Standards Organization – ISO 9001 and ISO 9004
2. Mantri Handbook – A to Z of Construction – Mantri Publications
3. Juran‘s Quality Handbook – Joseph M. Juran, A. Blanton. Godfrey – Mcgraw Hill International Edition (1998)

4. Management Information Systems – Gordon B. Davis, Margrethe H. Olson – Tata McGraw Hill Publ. Co.

Program:	**M. Tech. (Civil Engineering)**				**Semester : II**	
Course :	**Operations Research**				**Code : MCI2602C**	
Teaching Scheme			**Evaluation Scheme**			
Lecture	**Hours**	**Credit**	**IE1**	**IE2**	**ETE**	**Total**
2	2	2	20	-	30	50

Pre-requisite: Applied Mathematics Including Calculus and Linear Algebra, Calculus-Based Probability/Statistics

Objectives: This course aims at enabling students,

1. To familiarize with concepts and techniques of Linear and Nonlinear Programming Problems.
2. To derive feasible and optimal solution for Transportation and Assignment Problem.
3. To apply various methods to select and execute various optimal strategies using decision theory.
4. To construct network diagrams with single and three time estimates of activities involved in the project.

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

1. Model and solve Linear and Nonlinear Programming Problems.
2. Model & Solve profit maximization Transportation and Assignment Problem.
3. Apply various methods to select and execute various optimal strategies using decision theory.
4. Calculate Project schedule and expected completion time for the project.

Detailed Syllabus:

Unit	**Description**	**Duration h**
1.	**Introduction to Operations Research** Introduction, operations research approach to problem solving, Models and Modelling in operations research, Advantages, Methods for solving operations research models, Methodology of operations research, Advantages. **Linear Programming** Introduction, Structure of Linear programming Model, Advantages, Limitations, Assumptions and Applications of Linear programming, Guidelines for Model Formulation, Solving Linear programming problems using Graphical Method and Simplex Method	**6**
2.	**Transportation and Assignment Problems** Mathematical Models of Transportation Problem, The Transportation Algorithm, Methods for Finding Initial Solution, Test for Optimality. Mathematical Models of Assignment Problem, Solution Methods of Assignment Problem.	**6**
3.	**Decision Theory and Games Theory** Steps of Decision-Making Process, Types of Decision-Making Environment, Decision Making Under Uncertainty, Games Theory: Introduction, Two Person Zero Sum Games, Pure Strategies (Minimax and Maximin Principles): Games with Saddle Point, Mixed Strategies: Games without Saddle Point, The Rules of Dominance, Solution Methods of Games without Saddle Point.	**6**
4.	**Project Management** Introduction, Basic Difference between PERT and CPM, Phases of Project Management, PERT/CPM Network Components and Precedence Relationships, Critical Path Analysis. Project scheduling with uncertain activity times, Estimation of project completion time.	**6**
	Total	**24**

Text Books:

1. J K Sharma, "Operations Research: Theory and Applications" , Trinity Press 5th Edition ISBN No. 9789350593363.
2. Frederick S. Hillier, Gerald Lieberman, "Introduction to Operations Research, McGraw Hill", 6th Edition ISBN No. 0071139893.

Reference Books:

3. Gerald Lieberman, "Operations Research: An Introduction", PHI, 9th Edition, ISBN No. 978-9332518223.
4. Gupta Prem Kumar and Hira D.S, "Problems in Operations Research", S. Chand, ISBN No.978-8121909686.
5. Wayne L. Winston, "Operations Research Applications and Algorithms", Cengage Learning, 4th Edition, ISBN No. 978-8131501900.
6. P Sankara Iyer, "Operations Research", Sigma Series, TMH, 1st Edition, ISBN No.978-0070669024.

Program:	M. Tech. (Information Technology)			Semester :	I	
Course :	Business Analytics			Code :	MEIT1601A	
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE 1	IE 2	ETE	Total
2	2	2	20	-	30	50

Pre-requisite: 1. Machine Learning; 2. Data Science

Objectives:

1. Understand the different basic concept / fundamentals of business statistics
2. Understand the concept of Probability and its usage in various business applications.
3. Understand the practical application of Descriptive and Inferential Statistics concepts and their uses for Business Analytics.
4. Evaluate different data analytics tools.

Outcomes:

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

1. Gaining Knowledge of basic concept / fundamentals of business analytics.
2. Evaluating basic concepts of probability and perform probability theoretical distributions.
3. To perform practical application by taking managerial decision and evaluating the Concept of Business Analytics.
4. Evaluate different tools.

Detailed Syllabus:

Unit	Description	Duration
1.	**Introduction** What is business analytics?, Business Analytics process: problem framing, Data modeling, model building, Deployment, Different types of business analytics, application of business analytics, current trends, roles within data analytics team.	**6**
2.	**Analytics Techniques** Optimization techniques: Linear Programming, Goal Programming, Integer Programming, Non –linear programming, Predictive modeling :- regression, multiple linear regression for predictive analysis, logistic regression, linear discriminant analysis, Data Mining: Introduction to supervised and unsupervised learning, clustering	**6**
3.	**Probability Theory & Distribution** Probability: Theory of Probability, Addition and Multiplication Law, Baye's Theorem Probability Theoretical Distributions: Concept and application of Binomial; Poisson and Normal distributions. Concept of Business Analytics- Meaning types and application of Business Analytics, Use of Spread Sheet to analyze data-Descriptive analytics and Predictive analytics	**6**
4.	**Data analytics tools** Data Visualization using Tableau/Python/R/SQL. Case study.	**6**
	Total	**24**

Text Books:

1. R.N. Prasad ,Seema Acharya, "Fundamentals of business analytics", Wiley

Reference Books:

1. James Evans, Business Analytics, 2nd Edition, Pearson

Program:	M. Tech. (Information Technology)			Semester :	I	
Course :	R Programming			Code :	MEIT1601B	
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE 1	IE 2	ETE	Total
2	2	2	20	-	30	50

Pre-requisite:
1. Knowledge of Statistics in Mathematics
2. Prior Knowledge of any programming

Objectives:
1. To use R and R Studio Environment
2. To understand different data types and control structures in R
3. To interface R with other languages.
4. To understand the use of R for Big Data analytics.

Outcomes:
After learning the course, the students should be able to:
1. Understand the basics in R programming in terms of constructs, control statements, string functions.
2. Apply the use of R for Big Data analytics.
3. Learn to apply R programming for Text processing.
4. Able to appreciate and apply the R programming from a statistical perspective.

Detailed Syllabus:

Unit	Description	Duration h
1.	**Getting Started with R Programming** Introduction to the R-Studio, user-interface, Basic commands, Data Structures in R, Reading data into R, Subsetting	6
2.	**Matrices, Arrays And Lists** Creating matrices ,Matrix operations ,Applying Functions to Matrix Rows and Columns, Adding and deleting rows and columns, Vector/Matrix Distinction, Avoiding Dimension Reduction, Higher Dimensional arrays, Lists, Creating lists, General list operations,– Accessing list components and values, Applying functions to lists, Recursive lists	6
3.	**Data Frames** Creating Data Frames, Matrix-like operations in frames, Merging Data Frames, Applying functions to Data frames, Factors and Tables: factors and levels, Common functions used with factors, Working with tables, Other factors and table related functions, Control statements: Arithmetic and Boolean operators and values, Default values for arguments, Returning Boolean values, Environment and Scope issues: Writing Upstairs - Recursion ,Replacement functions, Tools for composing function code, Math and Simulations in R	6
4.	**Interfacing** Interfacing R to other languages, Parallel R, Basic Statistics, Linear Model, Generalized Linear models, Non-linear models, Time Series and Auto-correlation – Clustering	6
	Total	24

Text Books:

1. Mark Gardener, Beginning R – The Statistical Programming Language, Wiley, 2013
2. Norman Matloff , The Art of R Programming: A Tour of Statistical Software Design, No Starch Press, 2011

Reference Books:

1. Jared P. Lander, R for Everyone: Advanced Analytics and Graphics, Addison-Wesley Data & Analytics Series, 2013
2. Robert Knell, Introductory R: A Beginner's Guide to Data Visualization, Statistical Analysis and Programming in R, Amazon Digital South Asia Services Inc, 2013.

Program:	M. Tech. (Information Technology)			Semester :	I	
Course :	Cost Management of Engineering Project			Code :	MEIT1601C	
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE 1	IE 2	ETE	Total
2	2	2	20	-	30	50

Pre-requisite:
1. Software Engineering, 2. Project Management

Objectives:
1. To provide the parties concerned with a most favorable financial outcome to the project.
2. Identifying "best value" project option selection and developing realistic budgets.

Outcomes:
After learning the course, the students should be able to:
1. Prepare favorable financial outcome to the project.

Detailed Syllabus:

Unit	Description	Duration h
1.	**Introduction and Purpose of Project Cost Management** Client, Engineering consultant supporting Client in Development Phase, Engineering (Managing) Contractor carrying out EPCM role for project implementation, Consultant acting as PMC for Client, Material Suppliers, Construction / Service Contractors, External Finance Provider	**6**
2.	**Core Project Cost Management Issues** Project Concept & Feasibility, Project Development & Definition, Project Implementation, Project Commissioning & Financial Close out	**6**
3.	**Estimating and Project Financing** Estimate Categories, Estimate Quality, Project Schedule influence on estimated cost, Estimate Scope, Study / Development Estimates, Estimates for provision of advanced funding, Estimate quality required for project authorization, Estimating techniques, Location factors, Escalation ,Currency fluctuations, Contingency, Cash flow Project Financing: Internal financing, Financing of project development works, External financing, Banks & Venture Funds, Government grants and loans, Contractors, Suppliers, Customers	**6**
4.	**Vulnerable Projects** Mega-projects (Projects with value >€2Bn), Retrofit projects (Modifications and extensions to existing facilities), New Technology projects, Sub-surface works, Projects in emerging markets (e.g. E Europe, Asia), Projects in remote locations, Projects requiring significant regulatory validation (e.g. Pharmaceutical, Nuclear), Contaminated Demolition, Fast Track Projects	**6**
	Total	**24**

Text Books:

1. Kenneth K. Humphreys, Lloyd M. English, "Project and cost engineer's handbook", third edition, Ace International, Marcel Dekkar Inc., New York Basel.

Reference Books:

1. Kenneth K. Humphreys, Lloyd M. English, "Project and cost engineer's handbook", third edition, Ace International, Marcel Dekkar Inc., New York Basel.

Program:	M. Tech. (Information Technology)			Semester :	II
Course :	Cryptography			Code :	MEIT2602A

Teaching Scheme			Evaluation Scheme			
Lecture	**Hours**	**Credit**	**IE 1**	**IE 2**	**ETE**	**Total**
2	**2**	**2**	**20**	**-**	**30**	**50**

Pre-requisite:
1. Basic Mathematics
2. Basic Computer Network.

1. To understand computer, network and information security.
2. To study operating system security and malwares.
3. To study security issues in internet protocols.
4. To study network defense tools.

Outcomes:
After learning the course, the students should be able to:
1. Understand modern concepts related to cryptography and cryptanalysis
2. Analyze and use methods for cryptography and reflect about limits and applicability of these methods
3. Learn details and design philosophy of modern symmetric and public key systems
4. Learn uses and limitations of the various categories of cryptographic algorithms

Detailed Syllabus:

Unit	Description	Duration h
1.	**Introduction:** Computer Security Concepts, Terminology, OSI Security Architecture, Elements Of Information Security, Security Policy, Types of Security attacks , Security Goals and services, Modular Arithmetic, GCD, Euclidean Algorithm, Fermat's Little Theorem, Euler Totient Function, Extended Euclidean Algorithm, Chinese Remainder Theorem.	**6**
2.	**Classical Encryption Techniques:** Symmetric Cipher Model, Encryption Methods, Classical Encryption Techniques, Substitution Ciphers, Transposition Ciphers, one-time pad, Cryptanalysis, Block Ciphers, Stream Ciphers	**6**
3.	**Private-key Encryption:** Block Cipher Principles, Data Encryption Standard (DES), Triple DES, Advanced Encryption Standard (AES), RC5, International Data Encryption Algorithm (IDEA), Differential and Linear cryptanalysis	**6**
4.	**Public-key cryptosystems:** Public-Key Cryptography, Key Management, Key Distribution, RSA, Timing Attack, Diffie Hellman Key Exchange, Elliptic Curve Arithmetic, Elliptic Curve Cryptography [ECC]	**6**
	Total	**24**

Text Books:
1. William Stallings, Computer Security: Principles and Practices, Pearson 6th Ed, ISBN: 978-0-13-335469-0
2. V. K. Pachghare, "Cryptography and Information Security", PHI Learning 3rd edition
3. Jonathan Katz, Yehuda Lindell, "Introduction to Modern Cryptography", CRC press

Reference Books:
1. Oded Goldreich, Foundations of Cryptography Basic Tools, Cambridge University Press.
2. Nina Godbole, Information Systems Security, Wiley India Pvt. Ltd, ISBN -978-81-265-1692-6

Program:	M. Tech. (Information Technology)			Semester :	II	
Course :	Cloud Computing and Security			Code :	MEIT2602B	
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE 1	IE 2	ETE	Total
2	2	2	20	-	30	50

Pre-requisite:
1. Operating Systems
2. Fundamentals of Computer Networks.

Objectives:
1. To become familiar with Cloud Computing and its ecosystem.
2. To learn basics of virtualization and its importance.
3. To give technical overview of Cloud Programming and Services.
4. To understand security issues in cloud computing.

Outcomes:
After learning the course, the students should be able to:
1. To understand the need of Cloud based solutions.
2. To understand Security Mechanisms and issues in various Cloud Applications
3. To explore effective techniques to program Cloud Systems.
4. To understand current challenges and trade-offs in Cloud Computing..

Detailed Syllabus:

Unit	Description	Duration h
1.	**Fundamentals of cloud computing:** Origins and Influences, Basic Concepts and Terminology, Goals and Benefits, Risks and Challenges, Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models, Federated Cloud/Intercloud, Types of Clouds. Cloud-Enabling Technology: Broadband Networks and Internet Architecture, Data Center Technology, Virtualization Technology, Web Technology, Multitenant Technology, Service Technology.	**6**
2.	**Virtualization and common standards in cloud computing:** Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Types of Hypervisors, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation. Common Standards: The Open Cloud Consortium, Open Virtualization Format, Standards for Application Developers: Browsers (Ajax), Data (XML, JSON), Solution Stacks (LAMP and LAPP),Syndication (Atom, Atom Publishing Protocol, and RSS), Standards for Security	**6**
3.	**Cloud programming, environments and applications: :** Features of Cloud and Grid Platforms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments, Understanding Core OpenStack Ecosystem. Applications: Moving application to cloud, Microsoft Cloud Services, Google Cloud Applications, Amazon Cloud Services, Cloud Applications (Social Networking, E-mail, Office Services, Google Apps, Customer Relationship Management).	**6**
4.	**Cloud security and issues:** Basic Terms and Concepts, Threat Agents, Cloud Security Threats and Attacks, Additional Considerations, Cloud Security Mechanisms: Encryption, Hashing, Digital Signature, Public Key Infrastructure (PKI), Identity and Access Management (IAM), Single Sign-On (SSO), Hardened Virtual Server Images. Cloud Issues: Stability, Partner Quality, Longevity, Business Continuity, Service-Level Agreements, Agreeing on the Service of Clouds, Solving Problems, Quality of Service, Regulatory Issues and Accountability.	**6**
	Total	**24**

Text Books:

1. Jack J. Dongarra, Kai Hwang, Geoffrey C. Fox, Distributed and Cloud Computing: From Parallel Processing to the Internet of Things, Elsevier, ISBN :9789381269237, 9381269238, 1st Edition.
2. Thomas Erl, Zaigham Mahmood and Ricardo Puttini, Cloud Computing: Concepts, Technology & Architecture, Pearson, ISBN :978 9332535923, 9332535922, 1 st Edition.

Reference Books:

1. Srinivasan, J. Suresh, Cloud Computing: A practical approach for learning and implementation, Pearson, ISBN :9788131776513.
2. Brian J.S. Chee and Curtis Franklin, Jr., Cloud Computing: Technologies and Strategies of the Ubiquitous Data Center, CRC Press, ISBN :9781439806128.
3. Kris Jamsa, Cloud Computing: Saas, Paas, Iaas, Virtualization, Business Models, Mobile, Security, and More, Jones and Bartlett, ISBN :9789380853772.
4. John W. Ritting house, James F. Ransome, Cloud Computing Implementation, Management, and Security, CRC Press, ISBN : 978 1439806807, 1439806802.
5. Karl Matthias, Sean P. Kane, Docker: Up and Running, OReilly, ISBN:9781491917572, 1491917571.

Program:	M. Tech. (Information Technology)			Semester :	II	
Course :	Bitcoin : Fundamentals of Crypto Currencies			Code :	MEIT2602C	
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE 1	IE 2	ETE	Total
2	2	2	20	-	30	50

Pre-requisite:

1. Basic of Cryptography
2. Basic of Information and Cyber security.

Objectives:

1. To understand the basic concepts behind Cryptography and Crypto currency.
2. To understand the different Consensus approaches for Bit coin.
3. To understand the concepts of blockchain technology.
4. To understand the Mechanics of bit coin.

Outcomes:

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

1. Apply Cryptography concepts to Currency (real time) problem solving.
2. Learn and apply different consensus mechanisms for real time projects based on digital currency.
3. Analyze block chain model come from a different case studies.

Detailed Syllabus:

Unit	Description	Duration h
1.	**Basics** Fundamentals of Crypto currencies : Nodes, Transaction , Wallets, Coin Mining ,Basics of Trading Exchanges ,Market Tradability Crypto Trading Strategies, Blockchain: Nodes, P2P , Ledger ,Consensus Methods Genesis Block	**6**
2.	**How to Store and Use Bit coins** How to Store and Use Bit coins, Hot and Cold Storage, Splitting and Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Market	**6**
3.	**Cryptography:** Cryptographic Hash Functions: Hashing and SHA 256, Digital Signatures, Public Keys , Private Keys, A Simple Crypto currency	**6**
4.	**Mechanics of Bit coin** Bit coin Transactions, Bit coin Scripts, Applications of Bit coin Scripts, Bit coin Blocks, The Bit coin Network, How Bit coin Achieves Decentralization, Centralization vs. Decentralization, Distributed Consensus : Consensus without Identity, The Block chain Incentives, Miners and Mining :Proof of Work ,Limitations & Improvements.	**6**
	Total	**24**

Text Books:

1. Martin Quest, "Block chain Dynamics: A Quick Beginner's Guide on Understanding the Foundations of Bit coin and Other Crypto currencies", Create Space Independent Publishing Platform, 15-May-2018
2. Daniel Drescher, "Block chain Basics", A Non -Technical Introduction in 25 Steps.

Reference Books:

1. Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, "Beginning Block chain A Beginner's Guide to Building Block chain Solutions", 2018
2. 2. Chris Dannen , "Introducing Ethereum and Solidity", Foundations of Crypto currency and Block chain Programming for Beginners

Course Syllabus

Annexure-II

Audit Courses

List of Audit Courses

	SEM-I		SEM-II
M_1961A	Constitution of India	**M_2962A**	Team Building & Leadership
M_1961B	Value Education	**M_2962B**	English for Research writing
M_1961C	Stress Management	**M_2962C**	Disaster Management

Program:	M.Tech. Computer Engineering			Semester :	I and II	
Course :	Audit Courses (Semester I and II)			Code :	M_1961 M_2962	
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE1	IE2	ETE	Total
1	1	--	--	--	--	--

Guidelines:

1. **The audit courses are common to all M.Tech Courses.**
2. **Students can select any audit course from list of audit courses for semester I and II**
3. **These are non-credit courses but mandatory to comply the submission of the semester.**

Program:	M.Tech Computer Engineering			Semester :	I	
Course :	Constitutions of India			Code :	M_1961A	
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE1	IE2	ETE	Total
1	1	-	--	--	--	--

Objectives:

1.To understand the constitution and the centre-state relations and functioning
2.To understand the rules and regulations under which public and private sector work
3.To understand E-governance through computers and knowledge of cyber laws

Outcomes:

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

1.Work cohesively without violating the rules and regulations of the constitution
2.Understanding and application of E-governance for suitable projects

Detailed Syllabus:

Unit	Description	Duration h
1.	Introduction to Constitution of India; Salient Features of the Constitution; Fundamental Rights and Fundamental Duties; Directive Principles of State Policy Role of Public Sector Undertakings in economic development; Need for Reformed Engineering Serving at the Union and State level	6
2.	E-Governance and Role of engineers in E-Governance; Finance Commission and Centre-State Relations;Role of I.T. professionals in Judiciary; Cyber laws in India	6
	Total	**12**

Text Books:

1. Brij Kishore Sharma: An Introduction to the Constitution of India, Eighth Edition. PHI Learning, 2011
2. C.S.Prabhu: E-Governance, Concepts and Case Studies

Reference Books:

1. Dr J N Pandey : Constitutional Law of India
2. https://www.meity.gov.in/divisions/national-e-governance-plan
3. https://www.meity.gov.in/DeitY_e-book/e-gov_policy/download/Policy%20Document.pdf
4. http://www.iibf.org.in/documents/cyber-laws-chapter-in-legal-aspects-book.pdf

Program:	M.Tech. Computer Engineering				Semester :	I
Course :	Value Education				Code :	M_1961B
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE1	IE2	ETE	Total
1	1	-	--	--	--	--

Objectives:

1.To identify and develop Attitude and Core Faith values
2.To expose students to Family Relations
3.To enable student to understand Creative Thinking and Problem solving
4.To enable students to understand Humanistic Education.

Outcomes:

After learning the course the students should be able to:

1.Change in awareness levels, knowledge and understanding of student
2.Change in attitudes / behaviour of students with regards to their education improved teamwork, institutional leadership and other life skills
3.Improvement in social health and attitude.

Detailed Syllabus:

Unit	Description	Duration h
1.	Why Human Relations are so important? Understanding Behavior, Human Relations, and Performance, Personality, Stress, Learning, and Perception, Attitudes, Self-Concept, Natural acceptance of human values, and Ethics, Dealing with Conflict, Leading and Trust	6
2.	Justice in Humankind, Nurturing and Exploitation, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics	6
	Total	12

Text Books:

1."A Foundation Course in Human Values and Professional Ethics" R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi and Teacher's Manual, R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi

Reference Books:

1."Human Relations in Organizations Applications and Skill Building" Robart Lussier, eighth edition, McGraw-Hill (2014).
2.Atkinson and Hilgard's, "Introduction to psychology" Nolen-Hoeksema, S., Fredrickson, B. L., Loftus, G. R., & Lutz, C., Cengage Learning EME.

Program:	M.Tech. Computer Engineering			Semester :	I	
Course :	Stress Management			Code :	M_1961C	
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE1	IE2	ETE	Total
1	1	-	--	--	--	--

Objectives:

1. To overcome stress
2. To achieve overall health of body and mind
3. To learn to achieve the highest goal happily
4. To become a person with stable mind, pleasing personality and determination

Outcomes:

Students will be able to:

1. Develop healthy mind in a healthy body thus improving social health also
2. Improve efficiency

Detailed Syllabus:

Unit	Description	Duration h
1	Definitions of Eight parts of Yog. (Ashtanga) Yam and Niyam. Do`s and Don't's in life.	6
2.	Pranayam Regularization of breathing techniques and its effects- Types of pranayama Approach to day to day work and duties, wisdom	6
	Total	12

Text Books:

1.'Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal, Nagpur

Reference Books:

1."Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

2.A Handbook of Practical Wisdom Leadership, Organization and Integral Business Practice By Wendelin Küpers, David J. Pauleen · 2016

3. A Foundation Course in Human Values and Professional Ethics Presenting a Universal Approach to Value Education - Through Self-exploration

Program: M. Tech . Computer Engineering					Semester:	II
Course: Team Building & Leadership					Code: M_2962A	
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE1	IE2	ETE	Total
1	1	-	--	--	--	--

Objectives:

1.Develop and strengthen interpersonal skills
2.Become familiar with and discuss different leadership models.
3.Familiarize students with the characteristics of team building.

Outcomes:

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

1.Use leadership and teamwork knowledge to develop projects.
2.To develop the capacity to work collaboratively in a team

Detailed Syllabus:

Unit	Description	Duration h
1	**Leadership:** Will and motivation, Personal leadership, self-knowledge, and self-control, using power responsibly and respectfully: the leader as a team-builder, Ability to plan future actions and transmit that vision to others. Taking the initiative and stimulate others. What the word "leader" means, Types of leadership, Traditional, legal, and legitimate leader. Categories: autocratic, democratic, charismatic, paternalistic, authentic, spiritual, dictatorial, etc	6
2	**Team work** Why is teamwork important? The evolution from group to team: development stages. Advantages and disadvantages of teamwork. How to determine roles in a team. Traditional vs. virtuoso teams, forming effective and balanced teams, Strengthening teams within the organization. Creating a friendly and collaborative environment. Strategies to develop the team's mission, vision, values, and objectives. Shared objectives vs. personal motivation. Distinguishing purpose and tasks in the team. Encouraging participation. Creating team identity, creating high-performing teams.	6
	Total	**12**

Text Books

1. Stephen Covey, The Seven Habits of Highly Effective People, Free Press, 1989.
2. Ronald A. Heifetz, Leadership without Easy Answers, Belknap Press, 1994.
3. Michael E. Porter, Competitive Strategy, Free Press, 1980.

Reference Books:

1.John Kotter, Leading Change: Why Transformation Efforts Fail,
2.Ikujiro Nonaka, The Knowledge-Creating Company
3.Michael West, The Secrets of Successful Team Management, Chap. 2, "Self-Management," pgs. 32-61

Program:	M.Tech. Computer Engineering	Semester :	II
Course :	English For Research Paper Writing	Code :	M_2962B

Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE1	IE2	ETE	Total
1	1	-	--	--	--	--

Objectives:

1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title
4. Ensure the good quality of paper at very first-time submission

Outcomes:

After learning the course the students should be able to:

1. Develop healthy mind in a healthy body thus improving social health also
2. Improve efficiency

Detailed Syllabus:

Unit	Description	Duration h
1	Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness, Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.	6
2	key skills are needed when writing a Title, Abstract, Introduction, Review of the Literature, Methods, Results, Discussion, Conclusions useful phrases, how to ensure paper is as good as it could possibly be the first- time submission	6
	Total	12

Text Books:

1. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press

Reference Books:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book .
3. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

Program:	M.Tech. Computer Engineering			Semester :	II	
Course :	Disaster Management			Code :	M_2962C	
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE1	IE2	ETE	Total
1	1	-	--	--	--	--

Objectives:

1. To orient engineers about various natural and manmade disasters.
2. To teach the concept of Disaster management and measures to be taken at different stages of disaster management.
3. To provide insight about global, national and regional level scenario of disaster management.

Outcomes:

After learning the course the students should be able to:

1. Learn different disasters and measures to reduce the risk due to these disasters.
2. Learn institutional frame work for disaster management at national as well as global level.

Detailed Syllabus:

Unit	Description	Duration h
1	**Introduction** – Hazard and Disaster. Concepts of Hazard, Vulnerability, Risks. Different Types of Disaster : A) Natural Disaster: such as Flood, Cyclone, Earthquakes, Landslides etc B) Man-made Disaster: such as Fire, Industrial Pollution, Nuclear Disaster, Biological Disasters, Accidents (Air, Sea, Rail & Road), Structural failures(Building and Bridge), War & Terrorism etc. Slow Disasters (famine, draught, epidemics) and Rapid Onset Disasters(Air Crash, tidal waves, Tsunami) Causes, effects and practical examples for all disasters.	6
2	**Natural disasters**- Earthquakes, Tsunami, Floods, Drought, Landslides, Cyclones and Volcanic eruptions. Their case studies. Coastal disasters. Coastal regulation Zone. **Disaster Prevention and Mitigation**. Refugee operations during disasters, Human Resettlement and Rehabilitation issues during and after disasters, Inter-sectoral coordination during disasters, Models in Disasters. **Disaster Management** : Role of Government, International and NGO Bodies. Role of IT in Disaster Preparedness Role of Engineers on Disaster Management.	6
	Total	**12**

Reference Books:

1. Pandey, M., 2014. Disaster Management, Wiley India Pvt. Ltd., 240p.
2. Tushar Bhattacharya, Disaster Science and Management, McGraw Hill Education (India) Pvt. Ltd
3. Jagbir Singh, Disaster, Management: Future Challenges and Opportunities, K W Publishers Pvt. Ltd.
4. J.P. Singhal, Disaster Management, Laxmi Publications
5. C. K. Rajan, Navale Pandharinath, Earth and Atmospheric Disaster Management : Nature and Manmade, B S Publication
6. Shailesh Shukla, Shamna Hussain, Biodiversity, Environment and Disaster Management, Unique Publications

Text Books:

1. Disaster Administration and Management, Text & Case studies- SL Goel-Deep and Deep Publications
2. Disaster Management- G.K Ghosh-A.P.H. Publishing Corporation
3. Disaster management – S.K.Singh, S.C. Kundu, Shobha Singh A – 119, William Publications, New Delhi.
4. Disaster Management – Vinod K Sharma- IIPA, New Delhi,1995
5. Encyclopedia of Disaster Management- Goel S.L. - Deep and Deep Publications, New Delhi, 2006.

VISION AND MISSION OF COMPUTER DEPARTMENT

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- To be a Premier Hub in Computer Engineering in Education and Research

Mission

- To build technologically competent and ethically strong individuals for serving the needs of industry and society by providing state-of-the-art resources, opportunities for Learning and Research in Computer Engineering

Programme Outcomes:

1. An ability to independently carry out research /investigation and development work to solve practical problems
2. An ability to write and present a substantial technical report/document
3. Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program

Programme Specific Outcomes:

1. Innovative Solutions: Student will be able to apply Software Development Life Cycle concepts and problem solving skills to provide innovative computing solutions for addressing various problems in thrust areas like agriculture, healthcare, transport etc.
2. Development to sustain in Competitive Environment: Student will be able to work on various domains to design and develop procedures, systems and tools using state of the art technologies which can be sustained in competitive environment.

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