

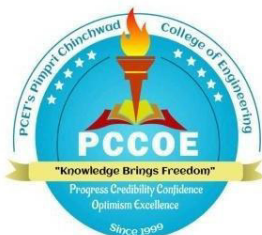
Pimpri Chinchwad Education Trust's

PIMPRI CHINCHWAD COLLEGE OF ENGINEERING

SECTOR NO. 26, PRADHIKARAN, NIGDI, PUNE 411044

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

DEPARTMENT OF COMPUTER ENGINEERING



**Curriculum Structure of
M. Tech. Computer Engineering
and
Syllabus of M. Tech. Computer Engineering Courses**

(Approved by BoS Computer Engineering)

(Course 2020)



Effective from Academic Year 2023-24

(Updated with minor changes)

Institute Vision

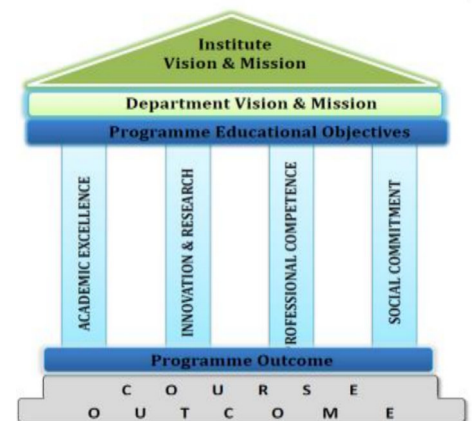
To be one of the top 100 Engineering Institutes of India in coming five years by offering exemplarily Ethical, Sustainable and Value Added Quality Education through a matching ecosystem for building successful careers.

Institute Mission

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

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.






Pimpri Chinchwad Education Trust's
Pimpri Chinchwad College of
Engineering




Course Approval Summary

A) Board of study - Department of Computer Engineering


Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS
1	Research Methodology & IPR	MCE1401	11	 Chairman BoS, Computer Engineering PCET's, Pimpri Chinchwad College of Engineering Sector No. 26, Pradhikaran, Nigdi, Pune-44
2	Professional Core Course-I: Advanced Software Engineering and Project Management (ASEPM)	MCE1402	13	
3	Professional Core Course-II: Advanced Data Structures (ADS)	MCE1403	15	
4	Professional Core Lab-I	MCE1404	28	
5	Business Intelligence - Elective I	MCE1501A	17	
6	Advanced Image Processing - Elective I	MCE1501B	19	
7	Cryptography and Cryptanalysis -Elective I	MCE1501C	21	
8	Data Mining and Analytics - Elective II	MCE1502A	22	
9	Biometric Identification and Liveness Detection -Elective II	MCE1502B	24	
10	Wireless Sensor Network & Internet of Things - Elective II	MCE1502C	26	
11	Professional Elective Lab-I	MCE1503	32	
12	Professional Core Course-III : Advanced Algorithms (AA)	MCE2406	42	
13	Professional Core Course-IV : Advanced Machine Learning (AML)	MCE2407	44	
14	Professional Core Lab-II	MCE2408	58	
15	Web and Social Network data Analysis (WSDA)- Elective III	MCE2504A	46	
16	Computer Vision and Video Processing(CVVP)- Elective III	MCE2504B	48	
17	Advanced Computing Intelligence (ACI) - Elective-III	MCE2504C	50	
18	Product Lifecycle Management(PLM) - Elective IV	MCE2505A	52	
19	User Experience Design (UED)-Elective IV	MCE2505B	54	
20	Software Defined Networks (SDN)-Elective IV	MCE2505C	56	
21	Professional Elective Lab -II	MCE2506	60	

22	Dissertation Phase - I	MCE3702	71	
23	Seminar	MCE3703	72	
24	Internship	MCE3801	73	
25	MOOCs/ Entrepreneurship	MCE3981	74	
26	Dissertation Phase – II	MCE4704	77	
27	MOOCs	MCE4982	78	

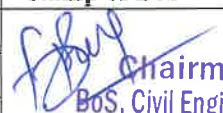
B) Board of study – Department of Mechanical Engineering

Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS
1	Battery Management for Electric Vehicles	MMC1601A	81	 Chairman BoS, Mechanical Engineering PCE's, Pimpri Chinchwad College of Engineering Sector No. 26, Pradhikaran, Nigdi, Pune-44
2	Green Technology	MMC1601B	82	
3	System Modeling & Simulation	MMC1601C	84	
4	Waste Management for Smart Cities	MMC2602A	85	
5	Electronic Cooling	MMC2602B	86	
6	Renewable Energy Sources	MMC2602C	87	
7	Advanced Materials	MMD1601A	89	
8	Optimization Methods	MMD1601B	90	
9	Modelling and Simulation of Dynamic systems	MMD1601C	91	
10	Room Acoustics	MMD2602A	92	
11	Design Thinking	MMD2602B	93	
12	Reliability Engineering	MMD2602C	94	


C) Board of study - Department of Electronics and Telecommunication Engineering

Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS
1	Automotive Electronics & Applications	MET1601A	95	 Chairman BoS, Electronics & Telecommunication Engineering PCE's, Pimpri Chinchwad College of Engineering Sector No. 26, Pradhikaran, Nigdi, Pune-44
2	Industrial Drives	MET1601B	96	
3	Basics of FPGA and CPLD	MET1601C	98	
4	Drone Programming for Beginners	MET2602A	99	
5	Instrumentation and Measurement	MET2602B	100	
6	Microcontrollers and Microprocessors applications	MET2602C	101	

D) Board of study - Department of Civil Engineering

Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS
1	Project Management and Finance	MCI1601A	112	 Chairman BoS, Civil Engineering PCET's, Pimpri Chinchwad College of Engineering Sector No. 26, Pradhikaran, Nigdi, Pune-44
2	Green Technology	MCI1601B	114	
3	Contracts, Tendering & Arbitration	MCI2602A	116	
4	Total Quality Management	MCI2602B	117	
5	Operation Research	MCI2602C	118	

E) Board of study - Department of Information Technology

Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS
1	R programming	MDS1601A	119	 Chairman BoS, Information Technology PCET's, Pimpri Chinchwad College of Engineering Sector No. 26, Pradhikaran, Nigdi, Pune-44
2	Business Analytics	MDS1601B	120	
3	Python for Data Science	MDS2602A	121	
4	Introduction to Neural Networks	MDS2602B	123	

Approved by Academic Council:

Chairman, Academic Council
Pimpri Chinchwad College of Engineering


Chairman
Academic Council
PCET's, Pimpri Chinchwad College of Engineering
Sector No. 26, Pradhikaran, Nigdi, Pune-44

CONTENTS

Sr.No	Title	Page No
1	List of Abbreviations used in Curriculum Structure	1
2	Curriculum Framework	2
3	Curriculum Structure	4
4	List of Elective Courses and Audit Courses	8
5	List of Open Elective	9
6	Course Syllabus of Semester - I	10
7	Course Syllabus of Semester - II	41
8	Course Syllabus of Semester - III	70
9	Course Syllabus of Semester - IV	76
10	Annexure – I: Open Electives (All Branches)	79
11	Annexure – II : Audit Courses (Common to all)	124
12	Vision and Mission of Department	133

LIST OF ABBREVIATIONS USED IN STRUCTURE

Abbreviations	Course Full Name
PCC	Professional Core Course
PEC	Professional Elective Course
OEC[#]	Open Elective Course
PROJ	Project, Mini / Minor Projects, Integrated Projects
SEM	Seminar
INTR	Internship
HSMC*	Humanities / Social Science / Management Course
AUDIT*	Audit Course
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 (2020-2021; 2021-2022)

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

SR. NO.	TYPE OF COURSE	ABBREVIATION
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	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		-	-	100	-	100
OR												
MCE 3981	MOOC	MOOCs/ Entrepreneurship	-	04	04	02		-	-	100		100
		Total	-	28	28	14		-	-	250	150	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		-	-	100		100
		Total	-	28	28	14	200	-	-	100	200	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 COMPUTATIONAL MECHANICS

	Open Elective – I		Open Elective -II
MMC1601A	Battery Management for Electric Vehicles	MMC2602A	Waste Management for Smart Cities
MMC1601B	Green Technology	MMC2602B	Electronic Cooling
MMC1601C	System Modeling & Simulation	MMC2602C	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

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- CONSTRUCTION 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 ARTIFICIAL INTELLIGENCE & DATA SCIENCE

	Open Elective – I		Open Elective -II
MDS1601A	R programming	MDS2602A	Python for Data Science
MDS1601B	Business Analytics	MDS2602B	Introduction to Neural Networks

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:						
<ol style="list-style-type: none"> To select and define appropriate research problems and parameters with appropriate methodology. To understand statistical techniques for the specific perspective data in an appropriate manner. To make predictions and decisions for the data set using open-source software. To understand mathematical modeling and its predicting capability. To learn the various steps in research writing and publication process To introduce fundamental aspects of Intellectual property Rights 						
Outcomes:						
After learning the course the students should be able to:						
<ol style="list-style-type: none"> Define a research problem and use appropriate research methodology Examine data using different hypothesis tests and make conclusions about acceptance or rejection of sample data. Analyze numerical data, using standard procedures of probability theory to predict the performance. Develop a mathematical model and analyze the prediction capabilities Write a research paper and research proposal. Write a concept note and prepare to file an IP. 						
Detailed Syllabus:						
Unit	Description					Duration h
1.	Introduction to Research Meaning of Research, Objectives, Motivation, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Criteria of Good Research					7
2.	Research Problem and Research Design 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					8
3.	Applied Statistics and Probability Sampling, Types of Sampling, Measures of Variability: Standard Deviation, variance, Quartiles, Interquartile Range, Statistical Significance (p values), Inferential Statistics: Pearson's r test, t-test, Chi square test, ANOVA (Analysis of variance), Probability Distribution: Binomial Distribution, Poisson Distribution, Normal Distribution					7
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.					8
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					7

	journals, Impact factor of the journal, structure of research paper, Check for plagiarism of the article, Research paper submission and review process.	
6.	Intellectual property Rights Innovation process, Importance of Innovations in Research, Concept note 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.	8
	Total	45
Text Books:		
<ol style="list-style-type: none"> 1. Research Methodology: Methods and Trends, by Dr. C. R. Kothari 2. Research Methodology: An Introduction by Wayne Goddard and Stuart Melville 3. Research Methodology: A Step by Step Guide for Beginners, by Ranjit Kumar, 2nd Edition 4. Fundamentals of IPR by Ramkrishna B and Anil Kumar H S. , Notion Press 5. IPR in India by Virendra Kumar Ahuja, LexisNexis Butterworths Wadhwa Nagpur 		
Reference Books:		
<ol style="list-style-type: none"> 1. Research methodology: an Introduction for Science & Engineering students, by Stuart Melville and Wayne Goddard 2. Operational Research by Dr. S.D. Sharma, Kedar Nath Ram Nath & Co. 		

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:						
<ol style="list-style-type: none"> 1. Basic Principles of Software Engineering 2. Basics of Project planning and management 						
Objectives:						
<ol style="list-style-type: none"> 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:						
<ol style="list-style-type: none"> 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.					7
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].					8
3.	Agile Development : Agile methods, Agile development techniques, Extreme Programming, Various Agile Process Models – ASD, SCRUM, DSDM, Crystal, FDD, LSD, AM, AUP.					7
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 Management. , Agile Planning, Risk Mitigation and monitoring, , Project Control					8

	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	7
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	8
	Total	45
Text Books:		
<ol style="list-style-type: none"> 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:		
<ol style="list-style-type: none"> 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 Rumbaugh, 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.					7
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					8
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.					7
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.					8
5.	Search Trees: Operations and Applications of Optimal Binary Search Tree (OBST), AVL Tree, Red-Black Tree, AA Tree, Splay Tree; K-Dimensional Tree.					7
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.					8

	Total	45
Text Books: <ol style="list-style-type: none"> 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: <ol style="list-style-type: none"> 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.					7
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					8
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.					7
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					8
5.	Pattern Evaluation and Visualization Metrics for performance evaluation: Accuracy, Error Rate, precision, Recall, F-measure, Sensitivity, Specificity; Prescriptive Analytical techniques for Optimization, Dashboard, BI metrics on					7

	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	8
	Total	45
Text Books: <ol style="list-style-type: none"> 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: <ol style="list-style-type: none"> 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					7
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.					8
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					7
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)					8
5.	Color Spaces: RGB, YCbCr, CIE LUV, Kekre LUV, YUV, HSI, HSV, color space conversions and applications Image Morphology: Erosion, Dialation, Opening, Closing					7
6.	Advanced Image Processing Algorithms: Grayscale Image colorization, Image Inpainting, Content based Image Classification,					8

	Histogram Equalization Based Contrast Enhancement, Hit and Miss Morphological Algorithm, Image Stitching, PCA based face Recognition	
	Total	45
Text Books:		
<ol style="list-style-type: none"> 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:		
<ol style="list-style-type: none"> 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 cryptanalysis.						
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, Triple DES, Block Cipher Design Principles; AES					7
2	Number Theory: Divisibility and the division Algorithm, The Euclidean Algorithm, Modular Arithmetic, Fermat’s and Euler’s Theorems, The Chinese remainder Theorem					8
3	Public Key Cryptography: RSA – Algorithm & Computational Aspects, Diffie-Hellman Key Exchange; Elgamal Cryptographic System; Elliptic Curve Cryptography					7
4	Key management and distribution: Symmetric key distribution using symmetric & asymmetric encryption, distribution of public keys, X.509 certificates, PKI					8
5	Cryptographic Hash Functions: Applications, SHA, MD5; Message Authentication Codes: requirements, function, security, HMAC; Digital signatures - introduction					7
6	Cryptanalysis, Cryptanalysis on Substitution Cipher (Frequency Analysis), Cryptanalysis on Stream Cipher, Modern Stream Ciphers, Time-Memory Trade-off Attack, Linear Cryptanalysis, Differential Cryptanalysis					8
	Total					45
Text Books: 1. William Stallings, “Cryptography and Network security -Principles and Practices”, Pearson publication sixth Edition. 2. Atul Kahate, “Cryptography and Network security ”, McGrawHill publication						
Reference Books: 1. William Stallings, Lawrie Brown “Computer security -Principles and Practices”, Pearson publication. 2. John F. Dooley, History of Cryptography & Cryptanalysis-Codes, Ciphers & Algorithms, Springer 3. W. Mao, “Modern Cryptography – Theory and Practice”, Pearson Education. 4. A. Forouzan, "Cryptography & Network Security", Tata Mc Graw Hill.						

Program :	M. Tech Computer Engineering			Semester: I		
Course :	Data Mining and Analytics - Elective II			Code :		
Teaching Scheme			Evaluation Scheme			
Lecture	Credit	Hours	IE1	IE2	ETE	Total
3	3	3	20	30	50	100
Pre-requisite:-						
Course Objectives:						
This course aims at enabling students,						
<ol style="list-style-type: none"> 1. To gather sufficient relevant data, conduct data analytics using scientific methods. 2. To demonstrate a sophisticated understanding of the concepts and methods 3. To use advanced techniques to conduct thorough and insightful analysis 4. To demonstrate various algorithms with python/R/weka/Excel to solve real life problems. 						
Course Outcomes:						
After learning the course the students should be able to:						
<ol style="list-style-type: none"> 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
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.					7
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.					8
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					7
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.					8
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					7

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	8
	Total	45
Text Books:		
<ol style="list-style-type: none"> 1. Han, Jiawei Kamber, Micheline Pei and Jian, "Data Mining: Concepts and Techniques", Elsevier Publishers Second Edition, ISBN: 9780123814791, 9780123814807. 2. Ian.H.Witten, Eibe Frank, Mark A.Hall, Christopher J.Pal, "Data Mining, Practical Machine Learning Tools and Techniques", Fourth Edition, Morgan kaufmann, 2017.ISBN : 978-0-12 804291-5. 		
Reference Books:		
<ol style="list-style-type: none"> 1. Maksim Tsvetovat, Alexander Kouznetsov, "Social Network Analysis for Startups: Finding connections on the social web", Shroff Publishers , ISBN: 10: 1449306462 		

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: <ol style="list-style-type: none"> 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: <ol style="list-style-type: none"> 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.					7
2.	Matching, null and alternative hypothesis h_0 , h_1 , 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.					8
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.					7
4.	Signature recognition system, cropping, enhancement, signature parameters, matching and decision, recognition., Discrete Harr wavelet transform,					8
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.					7
6.	Liveness Detection: Introduction, Presentation Attacks, Liveness Detection Approaches: Hardware and software based approaches, Passive and active techniques, Challenges					8
	Total					45
Text Books: <ol style="list-style-type: none"> 1. Guide to Biometrics, By: Ruud M. Bolle, Sharath Pankanti, Nalini K. Ratha, Andrew W. Senior, Jonathan H. Connell, Springer 2009 						
Reference Books: <ol style="list-style-type: none"> 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.					7
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.					8
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.					7
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					8

	architectural views. Real-World Design Constraints- Introduction, Technical Design constraints-hardware is popular again, Data representation and 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.	7
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.	8
	Total	45
<p>Text Books:</p> <ol style="list-style-type: none"> 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 		
<p>Reference Books:</p> <ol style="list-style-type: none"> 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
<u>MCE1404: Professional Core Lab 1 : Part A:</u> <u>Advanced Software Engineering and Project Management (ASEPM) Lab</u>						
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. Apply software development life cycle concept and prepare SRS. 2. Design the Software Architecture for software to be developed using appropriate architectural styles 3. Apply design specifications for the software to be developed and estimate the resource requirements. 4. Prepare a detailed Project Plan for the Software Project using CPM and PERT.						
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					3
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					3

5.	Prepare detailed Project Plan for the Software Project using Critical Path method.	3
6.	Case Studies/ Problems of Project Planning using CPM and PERT	2
	Total	15

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 Rumbaugh, 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. Develop advanced applications using linear data structures.		
2. Implement advanced tree algorithms for problem-solving.		
3. Evaluate various graph algorithms to solve real life problems.		
4. Select appropriate algorithmic techniques for problem solving.		
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.	3
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.	3
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.	3

	Total	15
--	--------------	----

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:

- A. Aho, J. Hopcroft, J. Ulman, — Data Structures and Algorithms, Pearson Education, 1998, ISBN-0-201-43578-0.
1. Michael J Folk, — File Structures an Object Oriented Approach with C++, Pearson Education, ISBN:81-7758-373-5.
2. Sartaj Sahani, — Data Structures, Algorithms and Applications in C++, Second Edition, University Press, ISBN:81-7371522 X.
3. 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
<u>MCE1503 : Professional Elective Lab 1 : Part A: Elective I : Option A : Business Intelligence (BI) Lab</u>						
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.					5
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.					5
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.					5
	Total					15
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)	3
2.	Resizing of images and perform mask processing operations (Any 6 Mask processing Operations)	4
3.	Implementation of DCT based Image Compression	3
4.	Application of Image Processing for understanding of applicability of concepts	5
	Total	15

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 message. Analyze and prepare report on different cryptanalytic attacks possible on system.	4
3	Write a program to exchange keys for secure communication using differ-Hellman key exchange algorithm	3
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		15

Text Books:

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

Reference Books:

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

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.	4
3.	Consider numeric dataset (preferably from UCI repository) and apply association rule mining algorithms and analyze the use of preprocessing techniques.	4
4.	Calculate mean, median, mode, standard deviation and plot histogram, boxplot and scatterplot for any dataset (preferably from UCI repository).	4
Total		15

Text Books:

1. Data Mining: Concepts and Techniques, 3rd Edition, Jiawei Han, Micheline Kamber, 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
3. Maksim Tsvetov, Alexander Kouznetsov, "Social Network Analysis for Startups: Finding connections the social web", Shroff Publishers , ISBN: 10: 1449306462

Reference Books:

1. W. Mao, "Modern Cryptography – Theory and Practice", Pearson Education.
2. Charles P. Pfleeger, Shari Lawrence Pfleeger – Security in computing – Prentice Hall of India
3. Douglas Stinson, "Cryptography Theory and Practice", 2nd Edition, Chapman & Hall/CRC.
4. B. A. Forouzan, "Cryptography & Network Security", Tata Mc Graw Hill.

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 liveness 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	3
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	4
	Total	15

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.	4
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.	3
Total		15

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:						
<ol style="list-style-type: none"> 1. Data Structure and Problem Solving 2. Object Oriented Programming Concepts 						
Objectives:						
<ol style="list-style-type: none"> 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:						
<p>After learning the course the students should be able to:</p> <ol style="list-style-type: none"> 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 :						
<ol style="list-style-type: none"> 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 $3^3 + 7^3 + 1^3 = 371$. Write a program to find all Armstrong number in the range of 0 to N					
5.	Write a program to create Shape class with draw method. Define two child					

	class Circle and Square and override draw method. Use OOPs Polymorphism and Inheritance concepts.	
6.	The celebrity problem is the problem of finding the celebrity among n people. A celebrity is someone who does not know anyone (including themselves) but is known by everyone. Write a Python program to solve the celebrity problem.	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	30
Text Books:		
1. Allen B Downey, —Think PYTHON , O’Rielly, ISBN: 13:978-93-5023-863-9, 4th Indian Reprint 2015 2. Peng, Roger D and Elizabeth Matsui, —The Art of Data Science." A Guide for Anyone Who Works with Data. Skybrude Consulting 200 (2015): 162		
Reference Books:		
1. Zed A. Shaw, Learn Python the Hard Way 2. Narsimha Karumanchi, Data Structures and Algorithmic Thinking with Python		

Course Syllabus

Semester - II

Program: M.Tech Computer Engineering			Semester: II			
Course: 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. Apply the master theorem for solving recurrences and analyze various NP complete problems. 2. Apply the various approximation algorithms to solve the problems. 3. Apply the Geometric algorithms for solving various problems. 4. Apply the advanced algorithms for big data operations. 5. Apply the various Online algorithms for solving different problems. 6. Analyze the various advanced Bio Inspired algorithms.						
Detailed Syllabus:						
Unit	Description					Duration hr
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					7
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					8
3.	Geometric Algorithms: Prerequisites – Basic properties of line, intersection of line, line segment, polygon, etc. Line segment properties, detecting segment intersection in time complexity ($n \log n$), Convex hull problem – formulation, solving by Graham scan algorithm, Jarvis march algorithm; closest pair of points – problem formulation, solving by divide & conquer method.					7
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 Intelligent system : Anytime Algorithms, Desired Properties of Anytime Algorithms, genetic algorithm to adapt intelligent systems, Advanced Indexing Algorithms: Indexing for Very Large High Dimensional Spaces					8
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					7
6.	Bio Inspired Algorithms: Advanced Bio Inspired Algorithms like ant colony optimization, honey bee optimization and applications					8

Total	45
--------------	-----------

TextBooks:

- 1.Cormen, Leiserson, Rivest, “Algorithms” ,PHI
- 2.Bressard, “Fundamentals of Algorithms”, PHI
- 3.Horowitz,Sahni,“FundamentalsofComputerAlgorithm”,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					7
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					8
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					7
4.	Genetic Algorithms, Fuzzy Set Approaches; k-Nearest-Neighbor Classifiers, Case-Based Reasoning, , Holistic learning and multi-perspective learning					8
5.	Reinforcement learning: The Reinforcement Learning Problem; History of Reinforcement Learning; Elements of Reinforcement Learning; Example: Tic-Tac-Toe; <u>Transfer learning</u> ;					7
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					8
	Total					45
Text Books: 1. Peter Flach, Machine Learning: The Art and Science of Algorithms that make sense of data, Cambridge University Press, 1st Edition, 2012, ISBN No.: 978-1-316-50611-0 2.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					7
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.					8
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.					7
4.	Mathematical Representations of Social Networks: Notation for Social Network Data: Graph Theoretic Notation, Sociometric Notation, O Algebraic Notation, O Two Sets of Actors					8

	Graphs and Matrices: Graphs, Directed Graphs, Signed Graphs and Signed Directed Graphs, Valued Graphs and Valued Directed Graphs, Multigraphs, Hypergraphs, Relations, Matrices.	
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.	7
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.	8
	Total	45
Text Books:		
<ol style="list-style-type: none"> 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:		
<ol style="list-style-type: none"> 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.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:						
Unit	Description					Duration h
1.	Image Formation Models : Image Formation Models: Monocular imaging system, Orthographic & Perspective Projection, Cameras – lenses, projections, sensors, Representation – color spaces					7
2.	Image models, Transforms and Application Areas: Contour-texture image model, Segmentation, Photography, Geometrical transforms, Hough transform, Road detection in remote sensing, Mathematical morphology					8
3.	Image sequence segmentation: spatial segmentation (frame-by-frame), Temporal segmentation (scene cut detection), Spatio-temporal segmentation,					7
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.					8
5.	Deep Learning in Computer Vision: basics, DCNN Architecture, classification using deep learning					7
6.	Video Processing Applications: Content based Video retrieval, Video Visual Content Summarization, Melanoma Skin Cancer Identification, Biometric Liveness Detection, Haze Removal					8
	Total					45
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					7
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					8
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					7
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)					8
5.	Evolutionary Computation and Swarm Intelligent System: Genetic Algorithms (GAs) and Evolutionary Programming: Introduction to GA,					7

	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.	8
	Total	45
Text Books:		
<ol style="list-style-type: none"> 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:		
<ol style="list-style-type: none"> 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					7
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.					8
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					7
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					8
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 Environmental Strategies into the Design Process, Life Cycle Environmental					7

	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.	8
	Total	45
Text Books:		
<ol style="list-style-type: none"> 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:		
<ol style="list-style-type: none"> 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 core concepts of User Experience Design, including cognitive and mental models, to enhance design effectiveness. 2. Apply the five planes of User Experience Design to create structured and user-focused experiences. 3. Conduct user research to identify needs, define goals, and establish design requirements. 4. Design and evaluate user-centered solutions using interaction design, information architecture, and wireframing techniques. 5. Use information design and data visualization to enhance user interaction and simplify complex information. 6. Perform usability testing to evaluate prototypes, measure performance, and recommend improvements. 1.						
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					7
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.					8
3.	Principles of User Experience Design Process: Definition, User Research, Transition: From Defining to Designing, Design Principles					7
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					8

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.	7
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 recommendations.	8
Total		45
Text Books:		
<ol style="list-style-type: none"> 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:		
<ol style="list-style-type: none"> 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.					7
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					8
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.					7
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.					8
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.					7
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.					8
	Total					45
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 NO: 10: 1466572094
3. Open Networking Foundation (ONF) Documents - <https://www.opennetworking.org>,

Program: M.Tech. Computer Engineering			Semester: II			
Course: ProfessionalCoreLab2:AdvancedAlgorithms(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
<u>MCE2408: Professional Core Lab2:Part A</u> <u>Advanced Algorithms (AA) Lab</u>						
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 an application using advanced algorithms in various domains.						
Outcomes: By the end of the course students should be able to 1. Perform the analysis of algorithms using recurrence relations. 2. Apply approximation algorithms for solving given problems. 3. Apply parallel approach to optimize the solutions for given real life problems. 4. Apply the various advanced algorithms to solve the problems.						
Assignment No.	Assignment Title					Duration Hours
1.	Develop algorithmic solution for solving the problem stated in assignment 2, 3 below using Probability theory or required theories, strategy to design Turing machine, multiplexer logic inducing concurrency and perform NP-Hard analysis for the solution feasibility.					2
2.	Implementations of approximate algorithm for vertex cover problem using JAVA or Python					2
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.					2
4.	Implement a C++ program to find convex hull of a set of points using Jarvis's Algorithm or Wrapping					2
5.	Write a program using Text Mining and Image Mining with the help of advance tools					2
6.	Develop a speech parsing application using Anytime algorithm					3
Total					15	
Text Books: 1. Cormen,Leiserson,Rivest,“Algorithms”,PHI 2. Sedgewick,R.BundleofAlgorithmsinJava. Addison-Wesley2003.ISBN0201775786.Thereisarange of books in this series on algorithms (in C, Java, and C++).						
Reference Books: 1. Even,S.GraphAlgorithms(ISBN0-91-489421-8)ComputerSciencePress1987.Agoodtreatmentof 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.	5
2.	Implement Decision Tree algorithms for credit card fraud detection. Or Implement Reinforcement learning model for Tic Tac Toe.	5
3.	Implement an Artificial Neural Network model for stock market prediction Or Implement Twitter Sentiment Prediction using Machine Learning techniques	5
Total		15

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
<u>MCE2506 : Program Elective Lab 2 : Part A: Elective III</u> <u>Option A: Web and Social Network Data Analysis(WSDA) Lab</u>						
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.					5
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/					5
3.	Analyze your social network from Facebook. Download network and perform the following activity: <ul style="list-style-type: none"> • Compute the density and centrality measures of your network; • Identify the brokers and central nodes in your network; 					5

	<ul style="list-style-type: none"> • Visualize the network to identify the brokers in the network; <p>Or</p> <p>Network Analysis</p> <ul style="list-style-type: none"> • Common Crawl Hyperlink Graph (analyze by country or topical domain) • Linked Data Cloud (analyze by country, topical domain) <p>Analyze Graph Structure of Wikipedia or DBpedia (detect communities)</p>	
	Total	15
Text Books:		
<ol style="list-style-type: none"> 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:		
<ol style="list-style-type: none"> 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	3
2.	Reading a video, extracting visual frames , applying point processing on extracted visual frames and creating modified video.	4
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		15

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	3
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.	3
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	3
4.	Analysis of Time series data using RNN Or Implement Discrete Particle Swarm Optimization, illustrated by the Traveling Salesman Problem	3
5.	Experiment on Object and detection using convolution neural networks Or Build feed forward neural networks for face recognition using TensorFlow.	3
Total		15

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	4
2.	To Study the Product Design and Development Process Life Cycle	4
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 the 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	3
	Total	15

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	3
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	4
Total		15

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.	5
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.	5
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.	5
Total		15

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 NO: 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:						
<ol style="list-style-type: none"> To facilitate holistic growth To make the students aware about the significance of Soft Skills and English Aptitude To develop the ability of effective communication through individual and group activities To expose students to right attitude and behavioral aspects and build the same through various activities 						
Outcomes:						
<p>After learning the course, the students should be able to:</p> <ol style="list-style-type: none"> Express effectively through verbal/oral communication skills Prepare for group discussions/meetings/interviews and presentations 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.					4 (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.	4 (Per assignment)
8.	Mock interviews: Guide students and conduct mock interviews	
	Total	30
Text Books:		
<ol style="list-style-type: none"> 1. Barun Mitra, Personality Development and Soft Skills 2. Stephen Lucas, The Art of Public Speaking 		
Reference Books:		
<ol style="list-style-type: none"> 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	IE1	IE2	OR	Total
6	6	3	--	50	50	100
Pre-requisite:						
<ol style="list-style-type: none"> Basics of Software Engineering and Computer Programming Concepts Basics of Programming Language such as C, MATLAB, Python. 						
Objectives:						
<ol style="list-style-type: none"> To understand the —Product Development Process. To plan for various activities of the major project and channelize the work towards product development. To build, design and implement real time application using available platforms. 						
Outcomes:						
After learning the course, the students should be able to:						
<ol style="list-style-type: none"> Understand, plan and execute the mini Project with appreciable research outcomes. Design real time application considering immerging areas in technology Prepare good quality technical report based on the mini project. Demonstrate technical ideas and its relevance in recent technology Understand publication and copyright process of research 						
Guidelines : Total : 36 hours						
<ol style="list-style-type: none"> Individual student need to design and demonstrate Mini-project under the guidance of allocated guide. Students can choose domain from computer engineering considering their future implementation in Major Project in second year Mini-Project Report should be submitted as a compliance of term work associated with subject. Paper publication associated with mini-project as research outcome is appreciable. 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					7
2.	Week 3, 4: Literature review and specification and Methodology Finalization, Review 1 for finalization of topic and specification.					8
3.	Week 5, 6 : Simulation of Idea on appropriate software tools and finalization of hardware platform					7
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					8
5.	Week 9, 10: Mini Project Report writing and publication or copyright planning and execution.					7
6.	Week 11, 12: Demonstration of Project work and Final Review for submission and term work compliances.					8
	Total					45

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	Hour	Credit	TW	PR	OR	Total
20	20	10	100	-	100	200
Pre-Requisites:						
<ol style="list-style-type: none"> Basics of Software Engineering and Computer Programming Concepts Basics of Programming Language such as C, MATLAB, Python. 						
Course Objectives:						
<ol style="list-style-type: none"> To understand the —Product Development Process. To plan for various activities of the major project and channelize the work towards product development. To build, design and implement real time application using available platforms. To inculcate research culture in students for their technical growth. 						
Course Outcomes:						
After learning the course, the students should be able to:						
<ol style="list-style-type: none"> Understand, plan and execute the major project with appreciable research outcomes. Design real time application considering immerging areas in technology. Prepare good quality technical report based on the project design. Demonstrate technical ideas and its relevance in recent technology Publish good quality paper based on studied literature in reputed journal and present their work in reputed conferences. 						
Guidelines						
<ol style="list-style-type: none"> Individual student needs to design and demonstrate project under the guidance of allocated guide. Sponsored Project or Project Internship is acceptable considering postgraduate scope. Students can choose project domain and problem statement as per latest research areas, recent technology trends and societal importance. Project Report-1 should be submitted as a compliance of term work associated with subject. Paper publications, IPR (Copyright/ Patent) 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 Total Duration: 120 hours are contact hours with guides and for reviews, and additional 30 hours students will utilize to learn supporting concepts for project. Total 150 (120 +30) hours are expected to be spend by students to satisfy all project requirements and implementations. 						
Detailed Syllabus:						
Dissertation Phase – I [Company/ In-house Project]						
Sr. No.	Activity					Duration (Hours)
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	Hour	Credit	TW	PR	OR	Total
4	4	2	50	-	50	100
Pre-Requisites:						
1. Research Methodology Concepts						
Course Objectives:						
1. To apply the knowledge and skills for understanding realistic problems.						
2. To review the existing literatures published in reputed journals / conference proceedings						
3. To identify research gaps by observing the experimental results keenly.						
4. To prepare technical reports of high quality.						
Course Outcomes:						
After learning the course, the students should be able to:						
1. Identify a real-life problem based on societal/real life problems.						
2. Understand various solution approaches and algorithms, proposed by the existing literature for solving the identified problem.						
3. Analyze the solutions proposed by existing literatures and verify the results.						
4. Identify the shortcomings of various solution approaches by observing results.						
5. Articulate the critical analysis of various approaches in own language.						
6. Prepare good quality technical reports based on the selected problem statement.						
Guidelines						
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 Modelling 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 additional 06 hours students will utilize to learn supporting concepts for seminar. Total 30 (24 +06) hours are expected to be spend by students to satisfy all seminar requirements and implementations.						
Detailed Syllabus:						
Seminar Activities						
Sr. No.	Activity					Duration (Hours)
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	-	100	-	100
Guidelines:						
<ol style="list-style-type: none"> 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					6
3.	Week 6,7, 8 : Review-2 of Activities					6
4.	Week 9, 10 : Interaction of Guides with Industry, Poster Presentation					6
5.	Week 11, 12: Internship Report writing and publication or copyright planning Final Review conduction.					6
	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	-	100	-	100
Guidelines :						
<ol style="list-style-type: none"> 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	-	100		100
Pre-requisite: Any Engineering Graduate with Innovation and Design thinking knowledge						
Objectives: <ol style="list-style-type: none"> To acquaint with Entrepreneurial qualities. To apply entrepreneurship in Engineering Courses. To imbibe Entrepreneurial capabilities in engineering students. 						
Outcomes: After learning the course, the students should be able to: <ol style="list-style-type: none"> Motivate students to think about Entrepreneurship alternative to employment. Registering students for Startup / Udyam registration of MSME. 						
Detailed Syllabus:						
Unit	Description					Duration, H
1.	Introduction to Entrepreneurship and its importance					05
2.	Achievement Motivation. Case Studies of Indian Entrepreneurs					05
3.	Product Identification, Market Survey					05
4.	Whom to contact for what? Financial Management,					05
5.	Business Planning					05
6.	Project Report preparation					05
	Total					30
Reference Books: <ol style="list-style-type: none"> Entrepreneurial Development by Vasant Desai, Himalaya publication Entrepreneurship Development and Small Business Enterprise. Poornima M. Charantimath. Pearson Education India, 2005 Dynamics of entrepreneurial development and management : Entrepreneurship, project management, finances, programmes, and problems. by Vasant Desai. 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	Hour	Credit	TW	PR	OR	Total
24	24	12	200	-	200	400
Pre-Requisites:						
<ol style="list-style-type: none"> Basics of Software Engineering and Computer Programming Concepts Basics of Programming Language such as C, MATLAB, Python. 						
Course Objectives:						
<ol style="list-style-type: none"> To understand the —Product Development Process. To plan for various activities of the major project and channelize the work towards product development. To build, design and implement real time application using available platforms. To inculcate research culture in students for their technical growth. 						
Course Outcomes:						
After learning the course, the students should be able to:						
<ol style="list-style-type: none"> Understand, plan and execute the major project with appreciable research outcomes. Develop real time application considering immerging areas in technology. Prepare good quality technical report based on the project implementation and derived results. Demonstrate technical ideas and its relevance in recent technology. Publish good quality paper based on derived resultsin reputed journal and present their work in reputed conferences. 						
Guidelines						
<ol style="list-style-type: none"> Semester III major project is continued to be completed in this semester under the guidance of same project guide. Students need to implement the project using suitable hardware and software platforms. 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. Paper publications, IPR (Copyright/ Patent) 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-II Total Duration: 144 hours are contact hours with guides and forreviews,additional 36 hours students will utilize to learn supporting concepts for project. Total 180 (144 +36) hours are expected to be spend by students to satisfy all project requirements and implementations. 						
Detailed Syllabus:						
Dissertation Phase – II [Company/ In-house Project]						
Sr. No.	Activity					Duration (Hours)
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 fulfilment 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

		Total			180	
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	-	100	-	100
Guidelines:						
<ol style="list-style-type: none"> 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. 						

Course Syllabus

Annexure-I

Open Elective Syllabus

LIST OF OPEN ELECTIVE COURSES

OFFERED BY COMPUTATIONAL MECHANICS

	Open Elective – I		Open Elective -II
MMC1601A	Battery Management for Electric Vehicles	MMC2602A	Waste Management for Smart Cities
MMC1601B	Green Technology	MMC2602B	Electronic Cooling
MMC1601C	System Modeling & Simulation	MMC2602C	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

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- CONSTRUCTION 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 ARTIFICIAL INTELLIGENCE & DATA SCIENCE

	Open Elective – I		Open Elective -II
MDS1601A	R programming	MDS2602A	Python for Data Science
MDS1601B	Business Analytics	MDS2602B	Introduction to Neural Networks

Program:	M. Tech. Computational Mechanics (Mechanical Engineering)			Semester: I		
Course :	Battery Management for Electric Vehicles (Open Elective-I)			Code: MMC1601A		
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE 1	IE 2	ETE	Total
2	2	2	20	--	30	50
Prior knowledge of:						
a. Basics of Electrical Engineering,						
Course 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					7
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					8
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.					8
Total						30
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, 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. Computational Mechanics (Mechanical Engineering)			Semester : I		
Course :	Green Technology (Open Elective-I)			Code : MMC1601B		
Teaching Scheme				Evaluation Scheme		
Lecture	Hours	Credit	IE1	IE2	ETE	Total
2	2	2	20	--	30	50
Prior knowledge of:						
a. Environmental study, b. Types of pollution.....are essential						
Course 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.					7
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.					8
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 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.					7
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					8
	Total					30

Assignments :

1. Assignment based on Global Warming and its effect and reduction measures.
2. Assignment based on Control of Carbon Emissions and Accumulation
3. Assignment based on Applications of green technologies.
4. Assignment based on High-tech measure for carbon emission reduction/ action plan

Text Books:

1. Soli J. Arceivala, Green Technologies, First edition, Mc Graw Hill Education, 2017.

Reference Books

1. Ritu Singh, Sanjeev Kumar, Green Technologies and Environmental Sustainability. First edition, 2017.
2. <http://cpcbenviis.nic.in/greentechnology.html>

Program:	M. Tech. Computational Mechanics (Mechanical Engineering)			Semester : I		
Course :	System Modeling and Simulation (Open Elective-I)			Code : MMC1601C		
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE 1	IE 2	ETE	Total
2	2	2	20	-	30	50
Prior knowledge of:						
Course Objectives:						
<ol style="list-style-type: none"> 1. Students able to model any physical system for real-time applications 2. Students able to simulate any physical system for real-time applications 						
Course Outcomes:						
After learning the course, the students should be able to:						
<ol style="list-style-type: none"> 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.					7
2.	Bond Graph Modelling of Dynamic Systems: Representation, Elements, Single, Two and multiports Causality, Application to basic Mechanical, Electrical and Electromechanical system					8
3.	Dynamic Response and System Transfer Function: Poles, Stability Block diagram/Signal flow diagram/State Space formulation and Frequency response					7
4.	Simulation and Simulation application Parameter Estimation, System Identification and Optimization					8
	Total					30
Text Book						
<ol style="list-style-type: none"> 1. Frank L. Severance, System modeling and simulation an introduction, Wiley, 2009. 2. Mathematical Modeling and Simulation: Introduction for Scientists and Engineers, Kai Veltn, Wiley 2009. 3. Introduction to Simulink® with Engineering Applications, Steven T. Karris, Orchard Publications, 2006. 						
Reference Books:						
<ol style="list-style-type: none"> 1. Brown, Forbes T. Engineering System Dynamics. New York, NY: CRC, 2001. ISBN: 9780824706166. 2. Simulation Modeling and Analysis with Expertfit Software, Averill Law, McGraw-Hill Science, 2007. 						

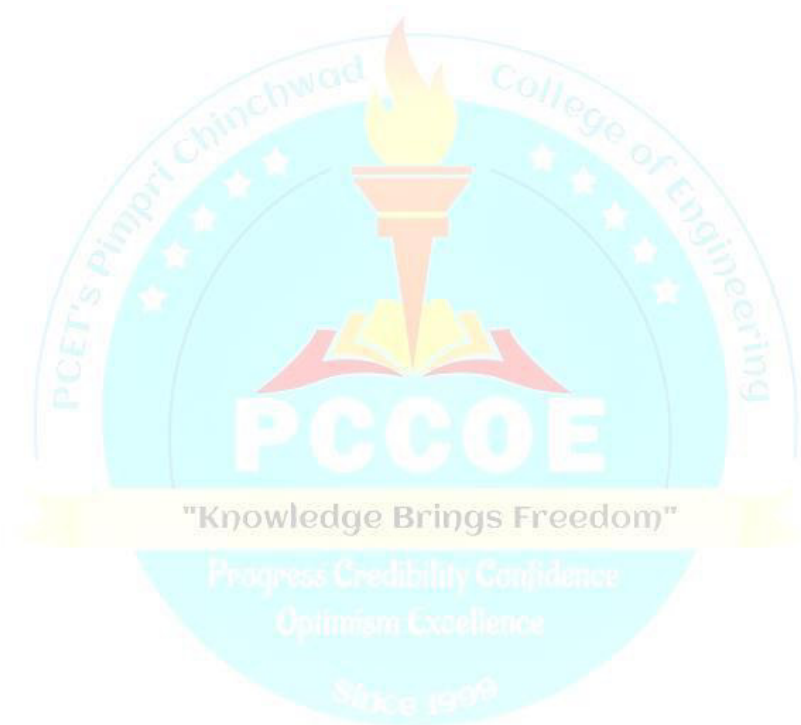
Program:	M. Tech. Computational Mechanics (Mechanical Engineering)			Semester: II		
Course:	Waste Management for Smart Cities (Open Elective-II)			Code: MMC2602A		
Teaching Scheme				Evaluation Scheme		
Lecture	Hours	Credit	IE 1	IE 2	ETE	Total
2	2	2	20	-	30	50
Course Objective:						
<ol style="list-style-type: none"> 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						
<ol style="list-style-type: none"> 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					7
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					8
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					7
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					8
Total					30	
Text Books:						
<ol style="list-style-type: none"> 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. 						
References:						
<ol style="list-style-type: none"> 1. Richard J. Watts, Hazardous Wastes - Sources, Pathways, Receptors John Wiley and Sons, New York, 1997. 2. Basics of Solid and Hazardous Waste Mgmt. Tech. by Kanti L.Shah 1999, Prentice Hall. 3. Solid And Hazardous Waste Management 2007 by S.C.Bhatia Atlantic Publishers & Dist. 						

Program:	M. Tech. Computational Mechanics (Mechanical Engineering)			Semester: II		
Course:	Electronic Cooling (Open Elective-II)			Code: MMC2602B		
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE 1	IE 2	ETE	Total
2	2	2	20	--	30	50
Prior knowledge of:						
<ul style="list-style-type: none"> a. Thermodynamics b. Fluid Mechanics c. Heat Transfer 						
are essential						
Course Objectives:						
<ul style="list-style-type: none"> 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. 						
Course Outcomes:						
After learning the course, the students should be able to						
<ul style="list-style-type: none"> 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.					7
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					8
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.					7
4.	Control Parameters Measurement and simulation Temperature & humidity requirement, CFD analysis for Airflow & temperature evaluation, thermography etc					8
	Total					30
Text Books:						
<ul style="list-style-type: none"> 1. D. S. Steinberg, "Cooling Techniques for Electronic Equipment ", Second Edition, John Wiley & Sons, 1991. 2. S. J. Kim and Sang Woo Lee, "Air cooling Technology for Electronic Equipment", CRC press, London, 1996. 3. F. P. Incropera, "Liquid Cooling of Electronic Devices by Single-Phase Convection", John Wiley & sons, inc, 1999. 						
Reference Books:						
<ul style="list-style-type: none"> 1. J. L. Sloan, "Design and Packaging of Electronic Equipment", Van Nostrand Reinhold Company, 1985. 2. F. P. Incropera, "Introduction to Heat Transfer ", Fourth Edition, John Wiley, 2002. 3. C. Belady, "Standardizing Heat Sink Performance for Forced Convection, Electronics Cooling", Vol. 3, No. 3, September, 1997. 4. C. Biber, Wakefield Engineering, Wakefield, Massachusetts, "Characterization of the Performance of Heat Sinks,", Personal Communication, October 1997. 5. A. B.-Cohen, -Encyclopedia of Thermal Packaging volume 1 to 6l, February 2013, World Scientific Publication 						

Program:	M. Tech. Computational Mechanics (Mechanical Engineering)			Semester: II		
Course:	Renewable Energy Sources (Open Elective-II)			Code: MMC2602C		
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE 1	IE 2	ETE	Total
2	2	2	20	--	30	50
Prior knowledge of:						
a. Thermodynamics b. Fluid Mechanics c. Heat Transfer d. Elements of Electrical Engineering.....are essential						
Course 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					7
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					8
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					7
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.					8
	Total					30
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, John Wiley, New York, 1991.
2. D.Y.Goswami, F.Kreith and J.F.Kreider, Principles of Solar Engineering, Taylor and Francis, Philadelphia, 2000.
3. J F Manwell, J.G.McGowan, A.L.Rogers, Wind Energy Explained: Theory, Design and Application, John Wiley and Sons, May 2002.
4. R D Begamudre, Energy Conversion Systems, New Age International (P) Ltd., Publishers, New Delhi, 2000.
5. 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: <ol style="list-style-type: none"> To introduce advanced and exotic materials. To familiarize students with structure and properties of materials. To establish significance of material selection in engineering design. To explore new design opportunities. 						
Outcomes: After learning the course, the students should be able to: <ol style="list-style-type: none"> Student will be able to analyze of different materials in advanced engineering application. Student will be able to relate structure and properties of new materials in engineering applications 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					7
2	Mechanical, electrical, optical and magnetic properties of materials.					8
3	Smart materials, Piezoelectricity, Magnetostriction, smart polymers, Shape memory alloys					7
4	Introduction to nano, Nano-biomimicry, Synthesis of nanomaterials by physical and chemical methods, Synthesis of nanomaterials by biological methods, Characterizations of nanomaterials.					8
	Total					30
Text Books: 1. W.D. Callister Material Science and Engineering: An Introduction, Wiley publication.						
Reference Books: <ol style="list-style-type: none"> Malsch, N.H., “Biomedical Nanotechnology”, CRC Press. (2005). 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:						
<ol style="list-style-type: none"> To introduce students to the modeling of constrained decision-making problems and optimization. Provide students with the basic mathematical concepts of optimization. Provide students with the modelling skills necessary to describe and formulate optimization problems. 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:						
<ol style="list-style-type: none"> Formulate mathematical programs in various practical systems Understand basic optimization techniques interpret the results of a model and present the insights (sensitivity, duality) Know the limitations of different solution methodology 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					7
2.	Linear and non-Linear Programming Simplex Methods, Elimination and iterative methods for one-dimensional minimization .					8
3.	Simulation Modeling Introduction, definition and types, limitations, various phases of modeling, Monte Carlo method, applications, advantages and limitations of simulation					7
4.	Modern Methods of Optimization Genetic algorithms, Simulated Annealing, Particle Swarm Optimization, Ant Colony Optimization, etc.					8
	Total					30
Text Books:						
<ol style="list-style-type: none"> Engineering Optimization: Theory and Practice, Singiresu S. Rao, John Wiley & Sons Practical Optimization Methods with Mathematical Applications, M. Asghar Bhatti, Springer Optimization for engineering design, K. Deb, PHI 						
Reference Books:						
<ol style="list-style-type: none"> Topology Optimization – Theory, Methods and Applications, M. P. Bendse, Q. Sigmund Evolutionary Topology Optimization of Continuum Structures, Methods and Applications, X. Huang, Y.M. Xie, Wiley Structural Optimization, Raphael T. Haftka and Zafer Gurdal, Kluwer Academic Publishers Mathematical Modelling, J N Kapur, New age international publication 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:						
<ol style="list-style-type: none"> 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:						
<ol style="list-style-type: none"> 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.					7
2.	Bond Graph Modelling of Dynamic Systems: Representation, Elements, Single, Two and multiports Causality, Application to basic Mechanical, Electrical and Electromechanical system					8
3.	Dynamic Response and System Transfer Function: Poles, Stability Block diagram/Signal flow diagram/State Space formulation and Frequency response					7
4.	Simulation and Simulation application Parameter Estimation, System Identification and Optimization					8
	Total					30
Text Book						
<ol style="list-style-type: none"> 1. Frank L. Severance, System modeling and simulation an introduction, Wiley, 2009. 2. Mathematical Modeling and Simulation: Introduction for Scientists and Engineers, Kai Veltn, Wiley 2009. 3. Introduction to Simulink® with Engineering Applications, Steven T. Karris, Orchard Publications, 2006. 						
Reference Books:						
<ol style="list-style-type: none"> 1. Brown, Forbes T. Engineering System Dynamics. New York, NY: CRC, 2001. ISBN: 9780824706166. 2. Simulation Modeling and Analysis with Expertfit Software, Averill Law, McGraw-Hill Science, 2007. 						

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					7
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,					8
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.					7
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.					8
	Total					30
Text Books: 1. Industrial Noise Control, Randell Barron, Marcel Dekker, Inc. 2. Room Acoustics By Heinrich Kuttruff, ISBN 9780367870997, 6th Edition 2019						
Reference Books: 1. 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					5
2.	Empathize Phase					5
3.	Define Phase					5
4.	Ideate Phase					5
5.	Prototype Phase					5
6.	Test Phase. One simple Product development using Design thinking tools					5
	Total					30
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						

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:						
<ol style="list-style-type: none"> To perform reliability engineering analysis. 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:						
<ol style="list-style-type: none"> Identify the possible faults in systems and their impacts to the overall system reliability. Develop fault trees for a sub-system and apply various reliability models on fault analysis. 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.					7
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,					8
3.	Redundancy Element redundancy, unit redundancy, standby redundancy- types of stand by redundancy, parallel components single redundancy, multiple redundancy. Markov analysis.					7
4.	System reliability Analysis Reliability apportionment, Reliability apportionment techniques – equal apportionment, AGREE, ARINC, feasibility of objectives apportionment.					8
	Total					30
Text Books:						
<ol style="list-style-type: none"> L.S. Srinath, Concepts of Reliability Engg., Affiliated East-West Press (P) Ltd., 1985. E. Balagurusamy, Reliability Engineering, Tata McGraw-Hill Publishing Co. Ltd., 1984. 						
Reference Books:						
<ol style="list-style-type: none"> A.K. Govil, Reliability Engineering, Tata McGraw-Hill Publishing Co. Ltd., 1983. B.S. Dhillon, C. Singh, Engineering Reliability, John Wiley & Sons, 1980. M.L. Shooman, Probabilistic, Reliability, McGraw-Hill Book Co., 1968. P.D.T. Conor, Practical Reliability Engg., John Wiley & Sons, 1985. K.C. Kapur, L.R. Lamberson, Reliability in Engineering Design, John Wiley & Sons, 1977. A. Birolini , Reliability Engineering, Theory and Practice, Third Edition, Springer, 1999 						

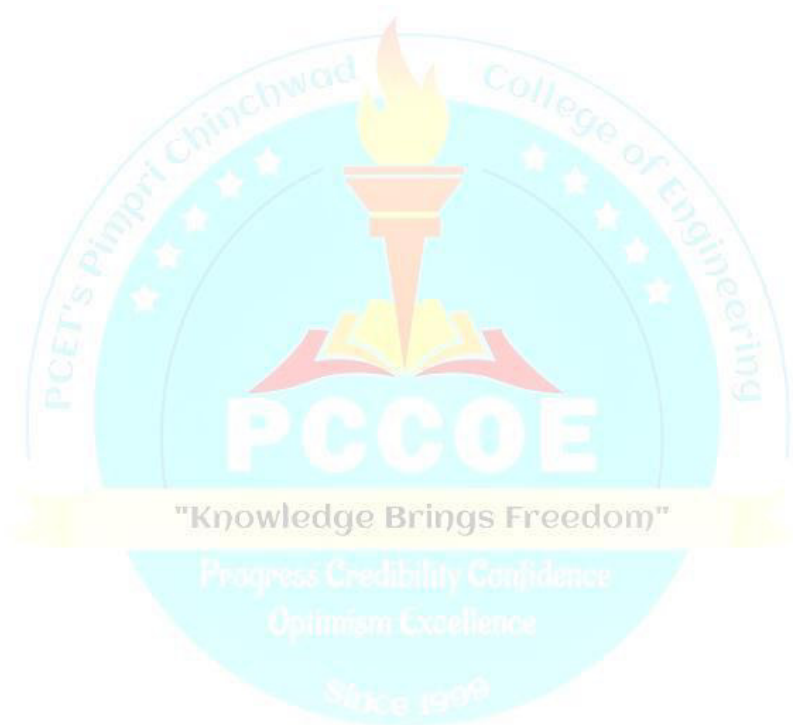
Program: M. Tech (E&TC)-VLSI and Embedded Systems				Semester: I		
Course: Automotive Electronics and Applications				Code: MET1601A		
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE1	IE2	ETE	Total
2	2	2	20	--	30	50
Pre-requisite: Knowledge of electronics & electrical, instrumentation, control systems, and IC engine operation, etc.						
Objectives:						
<ol style="list-style-type: none"> To learn and understand the various application of electronics systems and ECU in automotive. To learn and understand principles and applications of sensors and actuators in automotive electronics systems. To learn and understand various control systems in automotive 						
Outcomes:						
After learning the course, the students should be able to:						
<ol style="list-style-type: none"> Acquire an overview of automotive components, subsystems, and basics of electronic control in today's automotive industry. Use and apply available automotive sensors and actuators in various electronic control systems while designing automotive system design. Apply knowledge of modern technologies in automotive design. 						
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					7
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.,					8
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					7
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					8
Total					30	
Text Books:						
<ol style="list-style-type: none"> William B. Ribbens, "Understanding Automotive Electronics- An Engineering Perspective", Seventh edition, Butterworth-Heinemann Publications. Ronald K. Jurgen, "Automotive Electronics Handbook", Mc-Graw Hill. 						
Reference Books:						
<ol style="list-style-type: none"> Robert Bosch," Automotive Hand Book", Fifth edition, SAE Publications Kiencke, Uwe, Nielsen & Lars, "Automotive Control Systems for Engine, Driveline and Vehicle", Second edition, Springer Publication. Automotive Electronics by Tom H. Denton Automotive Electrical and Electronic Systems by John F. Kershaw, James D. Halderman / Pearson Education 						

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: <ol style="list-style-type: none"> To define electric drive, its parts, advantages and explain choice of electric drive. To explain dynamics and modes of operation of electric drives. To explain selection of motor power ratings and control of dc motor using rectifiers. To analyze the performance of induction motor drives under different conditions. To explain the control of induction motor, synchronous motor and stepper motor drives. To discuss typical applications electrical drives in the industry 						
Outcomes: After learning the course, the students should be able to: <ol style="list-style-type: none"> Explain the advantages and choice of electric drive. Explain dynamics and different modes of operation of electric drives. Suggest a motor for a drive and control of dc motor using controlled rectifiers. Analyze the performance of induction motor drives under different conditions. Control induction motor, synchronous motor and stepper motor drives. Suggest a suitable electrical drive for specific application in the industry 						
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 Phase Fully Controlled Rectifier Control of dc Separately Excited Motor, Single Phase Half Controlled Rectifier Control of dc Separately Excited Motor, Three Phase Fully Controlled Rectifier Control of dc Separately Excited Motor, Three Phase Half Controlled Rectifier Control of dc Separately Excited Motor, Multi quadrant Operation of dc Separately Excited Motor Fed from Fully Controlled Rectifier, 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.					7
2.	Induction Motor Drives: Analysis and Performance of Three Phase Induction Motors, Operation with Unbalanced Source Voltage and Single Phasing, Operation with Unbalanced Rotor Impedances, 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.					8
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.					7
4.	Synchronous Motor Drives: Operation from fixed frequency supply-starting, synchronous motor. Self-controlled synchronous motor drive employing load commutated thruster inverter, Starting Large Synchronous Machines, 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.					8
	Total					30
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. Gopal 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-Wiley 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:						
<ol style="list-style-type: none"> To make students familiar with programmable logic devices and its architectures. To understand the architecture and features of FPGA and CPLD . 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:						
<ol style="list-style-type: none"> To understand the depth of CPLD and FPGA architectures. To design a system using FPGAs. To demonstrate an understanding of interfacing of different external devices with FPGA/CPLD. To apply the complete design flow of FPGA and CPLD for the specific application. 						
Detailed Syllabus:						
Unit	Description					Duration h
2.	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.					7
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.					8
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					7
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					8
	Total					30
Text Books:						
<ol style="list-style-type: none"> P.K.Chan & S. Mourad, Digital Design Using Field Programmable Gate Array, Prentice Hall (Pte), 1994 Ronald Sass and Andrew G. Schmidt, "Embedded systems design with platform FPGAs: Principles and practices", Morgan Kaufmann, 2010. Design manuals of Altera, Xilinx and Actel. 						
Reference Books:						
<ol style="list-style-type: none"> S. Trimberger, Edr. Field Programmable Gate Array Technology, Kluwer Academic Publications, 1994. Ronald J Tocci, Neal S. Widmer, Gregory L. Moss, "Digital Systems: Principles & Applications", 10thEdition, Pearson, 2009 J. Old Field, R. Dorf, Field Programmable Gate Arrays, John Wiley & Sons, Newyork, Reprint 2008. S. Brown, R. Francis, J. Rose, Z. Vransic, Field Programmable Gate Array, BSP, 2007. 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. Stephen Brown Zvonko Vranesic – Fundamentals of Digital Logic with VHDL design, McGraw Hill – 2000 						

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 –MATLAB & SIMULINK, Programming in python						
Objectives:						
<ol style="list-style-type: none"> To understand the physics behind drones To create the mathematical model of quadcopter drone from simple mathematics & Experimental data To implement model into Simulink & check it against real life performance 						
Outcomes:						
After learning the course, the students should be able to:						
<ol style="list-style-type: none"> Identify & select different accessories of Drones as per applications Establish the mathematical model & the Physics behind Quadcopter drone 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					7
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.					8
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					7
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					8
	Total					30
Text books:						
<ol style="list-style-type: none"> Building your own drones, a beginner's guide to drones, UAVs, and ROVs- John Baichtal Quadcopter modelling and control with Matlab/Simulink implementation by Muhammad Usman Model based design of a quadcopter by Ryan Gordon Robotics control, sensing, vision and intelligence – K.S.Fu, R.C.Gonzalez, C.G.Lee 						
Reference Books:						
<ol style="list-style-type: none"> Robotics and control- R.K.Mittal , I.J.Nagrath Drones (The ultimate guide), Ben Rupert, CreateSpace Independent Publishing Platform Matlab and Simulink for engineers, Agam Kumar Tyagi, Oxford University Press, 2012 						

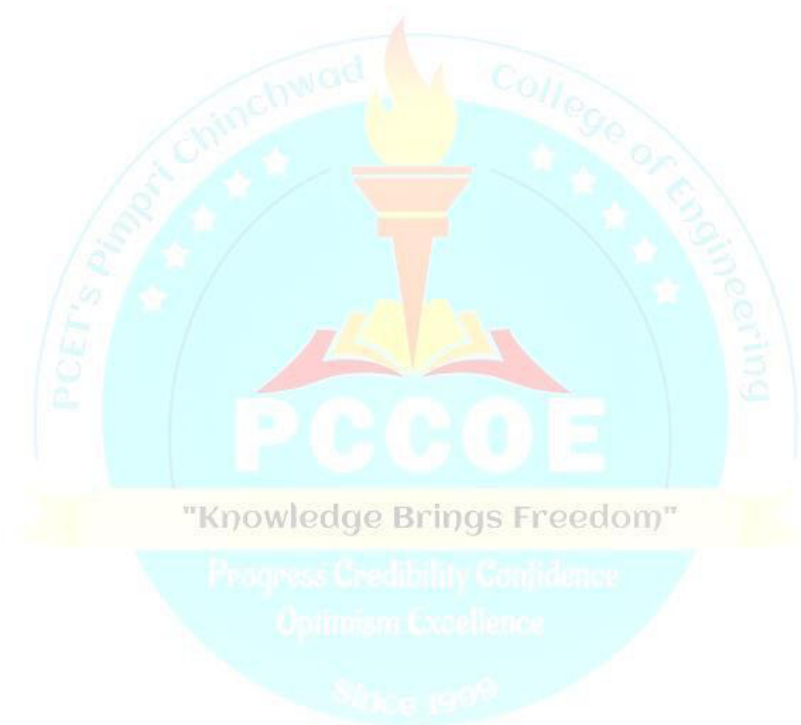
Program: M. Tech (E&TC)-VLSI and Embedded Systems				Semester: II		
Course : Instrumentation and Measurements				Code: MET2602B		
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE1	IE2	ETE	Total
2	2	2	20	--	30	50
Pre-requisite: Basics of sensors and Actuators, Basic of Electronics, Analog and Digital Systems						
Objectives: To impart knowledge on the following Topics - <ol style="list-style-type: none"> 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: <ol style="list-style-type: none"> 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.					7
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.					8
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					7
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					8
	Total					30
Text Books: <ol style="list-style-type: none"> 1. Modern Electronics Instrumentation & Measurement Techniques, by Albert D.Helstrick and William D.Cooper, Pearson Education. Selected portion from Ch.1, 5-13. 2. Elements of Electronics Instrumentation and Measurement-3rd Edition by Joshph J.Carr.Pearson Education. Selected portion from Ch.1,2,4,7,8,9,13,14,18,23 and 25. 						
Reference Books: <ol style="list-style-type: none"> 1. Electronics Instruments and Instrumentation Technology – Anand, PHI 2. Doebelin, E.O., Measurement systems, McGraw Hill, Fourth edition, Singapore, 1990. 						

Program: M.Tech (E&TC)-VLSI and Embedded Systems			Semester : II			
Course : Microcontrollers and Microprocessor Applications			Code : MET2602C			
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE 1	IE 2	ETE	Total
2	2	2	20	--	30	50
Pre-requisite: Digital Electronics						
Objectives:						
<ol style="list-style-type: none"> 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:						
<ol style="list-style-type: none"> 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
3.	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					7
4.	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.					8
5.	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.					7
4.	Microcontroller & Processors Applications: Interfacing with display devices, Sensors, actuators, and memory devices. Case Study on real time embedded system.					8
Total					30	
Text Books:						
<ol style="list-style-type: none"> 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:						
<ol style="list-style-type: none"> 1. Chris H. Pappas, William H. Murray, —80386 Microprocessor HandbooksI, McGraw-Hill Osborne Media, ISBN-10: 0078812429, 13: 978-0078812422. 3. Walter A. Triebel, —The 80386Dx Microprocessor: HardwareI, 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. 2. K. Bhurchandi, A. Ray, —Advanced Microprocessors and Peripherals, McGraw Hill Education, Third Edition, ISBN: 978-1-25-900613-5 						

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.					7
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.					8
3.	Object Oriented Programming features in Python: Classes, Objects, Inheritance,Errors and Exceptions: try, except and else statements, Exception Objects, Regular expressions.					7
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.					8
	Total					30
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						

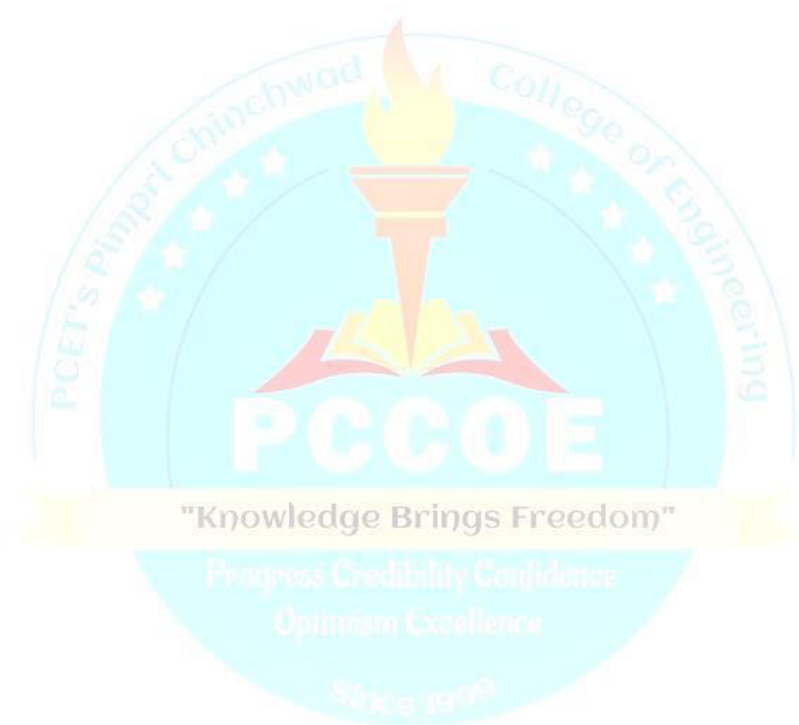
Program: M.Tech (Computer Engineering)			Semester : I			
Course : Software Engineering Basics			Code : MCE1601B			
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE 1	IE 2	ETE	Total
2	2	2	20	--	30	50
Pre-requisite:- None						
Objectives:						
<ol style="list-style-type: none"> To learn and understand the principles of Software Engineering To be acquainted with methods of capturing, specifying, visualizing and analyzing software requirements. To apply Design and Testing principles to S/W project development. To understand project management through life cycle of the project. To understand software quality attributes. 						
Outcomes:						
After learning the course the students should be able to:						
<ol style="list-style-type: none"> Decide on a process model for a developing a software project Classify software applications and Identify unique features of various domains Design test cases of a software system. Understand basics of IT Project management. Plan, schedule and execute a project considering the risk management. 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.					7
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.					8
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					7
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					8
	Total					30
Text Books:						
1. Roger Pressman, —Software Engineering: A Practitioner’s Approachl, McGraw Hill, ISBN 0–07–337597						
2. Ian Sommerville, — Software Engineeringl, 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 Engineeringl, Prentice Hall India, ISBN-13: 978- 8120348981						
3. Pankaj Jalote, —An Integrated Approach to Software Engineeringl, Springer, ISBN 13: 9788173192715.						
4. S K Chang, —Handbook of Software Engineering and Knowledge Engineeringl, 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)					7
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					8
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.					7
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					8

	Total	30
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		



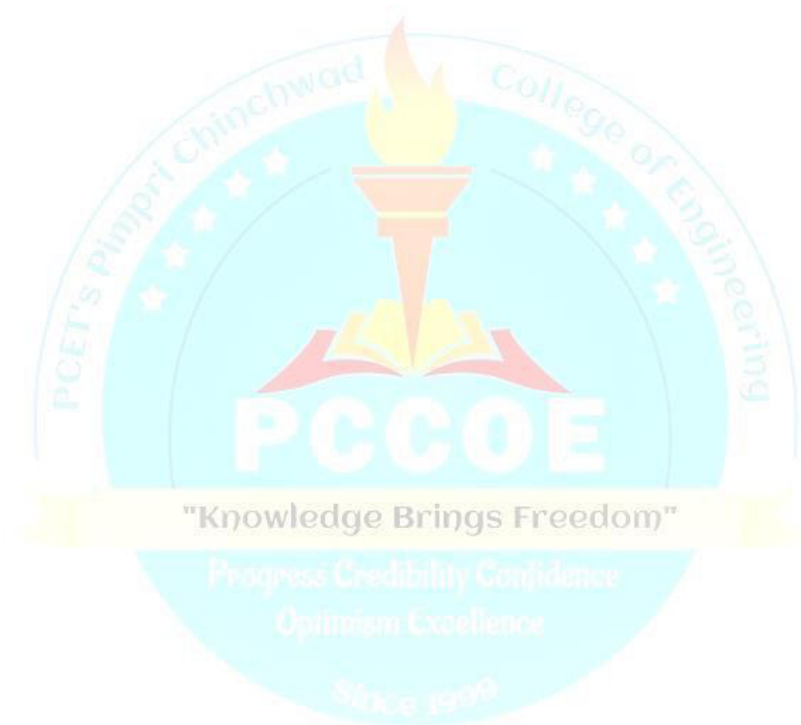
Program: M.Tech (Computer Engineering)			Semester : II			
Course : Image Processing with MATLAB			Code : MCE2602A			
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE 1	IE 2	ETE	Total
2	2	2	20	--	30	50
Pre-requisite: Programming Basics						
Objectives: 1. Develop an overview of the field 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.					7
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.					8
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.					7
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					8
	Total					30

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

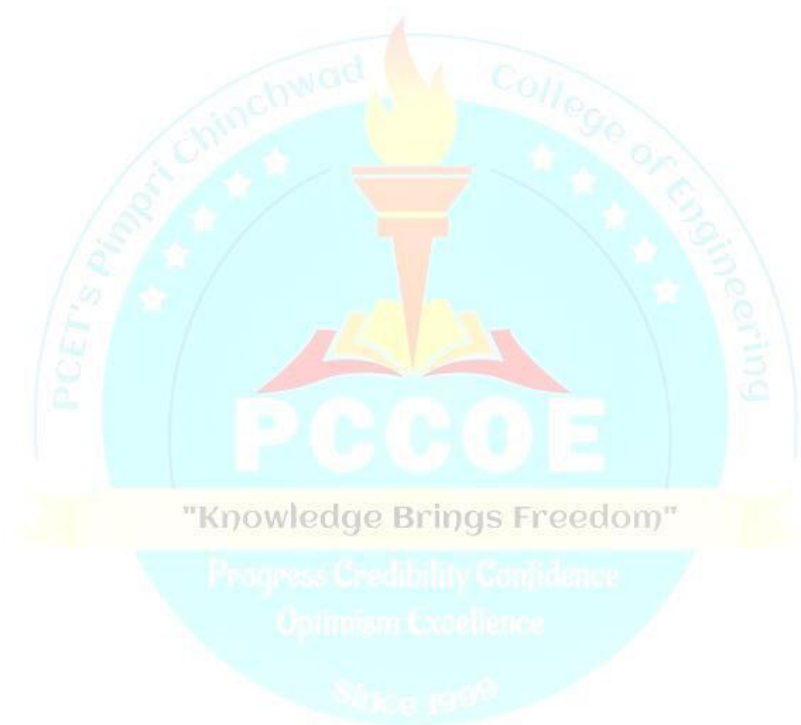
Reference Books:

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:						
<ol style="list-style-type: none"> 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:						
<ol style="list-style-type: none"> 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.;					7
2.	Basic Commands and Shell Scripting: Introduction to Linux commands, concept of shell, shell variables,getwd() 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 and workflow, syntax, variables, operators, regular expressions, arrays, control flows, loops,functions, output redirections					8
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;					7
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, groupdelete; 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 fashion; Hands-on of GIT.					8

	Total	30
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					7
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					8
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.					7
4.	Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams. Common modeling techniques					8
	Total					30
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: <ol style="list-style-type: none"> 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: <ol style="list-style-type: none"> 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					7
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.					8
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					7
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.					8
	Total					30
Text Books: (Font Type: Times New Roman, Size: 10) <ol style="list-style-type: none"> 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) <ol style="list-style-type: none"> 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.	<p>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.</p> <p>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.</p>					7
2.	<p>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.</p> <p>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.</p>					8
3.	<p>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.</p> <p>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 Application to Town Planning and Area Re-Development Projects 'Green'</p>					7

	Infrastructure for Municipal Services, Bringing up Indian Villages, Green Services for Crematoria, Spreading Message to all Stakeholders.	
4.	<p>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.</p> <p>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</p>	8
	Total	30
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://cpcbenviis.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.					7
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.					8
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.					7
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.					8
	Total					30
Text Books:						
1. Civil Engineering Contracts and Estimates - B.S.Patil – Universities Press- 2006 Edition,reprnted 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.drbbf.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:							
<ol style="list-style-type: none"> 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:							
<ol style="list-style-type: none"> 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.					7	
2	Quality Control Tools Histogram, Pareto diagram, Fish-bone diagram, Quality control chart-Testing required for quality control. Statistical Quality Control-Necessity, Benchmarking.					8	
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					8	
	Total					30	
Text Books:							
<ol style="list-style-type: none"> 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:							
<ol style="list-style-type: none"> 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 (Construction Management)		Semester :		II
Course :				Operation Research		Code : MCI2602C
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE1	IE2	ETE	Total
2	2	2	20	--	30	50
Pre-requisite: Statistical Mathematics						
Objectives:						
Outcomes: After learning the course, the engineers should be able to:						
1. Acquire a sound knowledge of principles of Operation Research and its applications.						
2. Apply forecasting methods / principles of scheduling, sequencing, maintenance planning for OR.						
3. Select and apply appropriate methods / techniques in Civil Engineering management situations for project planning / management and finance through critical thinking.						
Detailed Syllabus:						
Unit	Description					Duration h
1.	Use of Operations Research in Engineering and Managerial Decision making process. Introduction to Optimization Techniques and their application in Engineering Planning, Design and Construction. Various models; Objective function and constraints.					7
2.	Linear programming: Formulation of Linear optimization models, Civil engineering applications. Simplex method, special cases in simplex method, Method of Big M, Two phase method, duality, sensitivity analysis.					8
3.	a) Transportation Model and its variants, b) Assignment Model and its variants. c) Decision theory.					7
4.	(a) Queuing Theory, Simulation. (b) Sequencing model – n jobs through 2, 3 and M machines. (c) Replacement models. (d) Games Theory.					8
	Total					30
Text Books:						
1. Operations Research by Hamdy A.Taha						
2. Engineering Optimization Theory & Practice – S.S. Rao., Wiley.						
3. Engineering Optimization—Methods and Applications—Ravindran,Wiley						
4. Operations Research by J.K.Sharma						
5. Quantitative Techniques in Management by N.D.Vohra						
Reference Books:						
1. Principles of Construction Management by R.Pilcher						
2. Operations Management by E.S.Buffa						
3. Principles of Operations Management by H.M.Wagner						
4. Principles of Operation Research – Wagner, Prentice Hall.						
5. Operation Research – Hira and Gupta, S.Chand						
6. Operations Research: Principles and Practice-Ravindrav,Philip&Solberg,Wiley,India						

Program:		M. Tech. (Artificial Intelligence and Data Science)			Semester : I	
Course :		R Programming			Code :MDS1601A	
Teaching Scheme				Evaluation Scheme		
Lecture	Hours	Credit	IE1	IE2	ETE	Total
2	2	2	20	-	30	50
Pre-requisite:						
<ol style="list-style-type: none"> 1. Knowledge of Statistics in Mathematics 2. Prior Knowledge of any programming 						
Objectives:						
<ol style="list-style-type: none"> 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:						
<ol style="list-style-type: none"> 1. Explain 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 (Hrs.)
1.	Getting Started with R Programming Introduction to the R-Studio, user-interface, Basic commands, Data Structures in R, Reading data into R Subsetting					7
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					8
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					8
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					7
	Total					30
Text Books:						
<ol style="list-style-type: none"> 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:						
<ol style="list-style-type: none"> 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. (Artificial Intelligence and Data Science)		Semester :	I		
Course :	Business Analytics		Code :	MDS1601B		
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE1	IE2	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 (Hrs.)
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.					8
2.	Analytics Techniques Optimization techniques: Linear Programming, Goal Programming, Integer Programming, Non –linear programming, Predictive modelling :- regression, multiple linear regression for predictive analysis, logistic regression, linear discriminate analysis, Data Mining: Introduction to supervised and unsupervised learning, clustering					8
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					8
4.	Data analytics tools Data Visualization using Tableau/Python/R/SQL. Case study.					6
	Total					30
Text Books: • R.N. Prasad , Seema Acharya, “Fundamentals of business analytics”, Wiley						
Reference Books: 1. James Evans, Business Analytics, 2 nd Edition, Pearson						

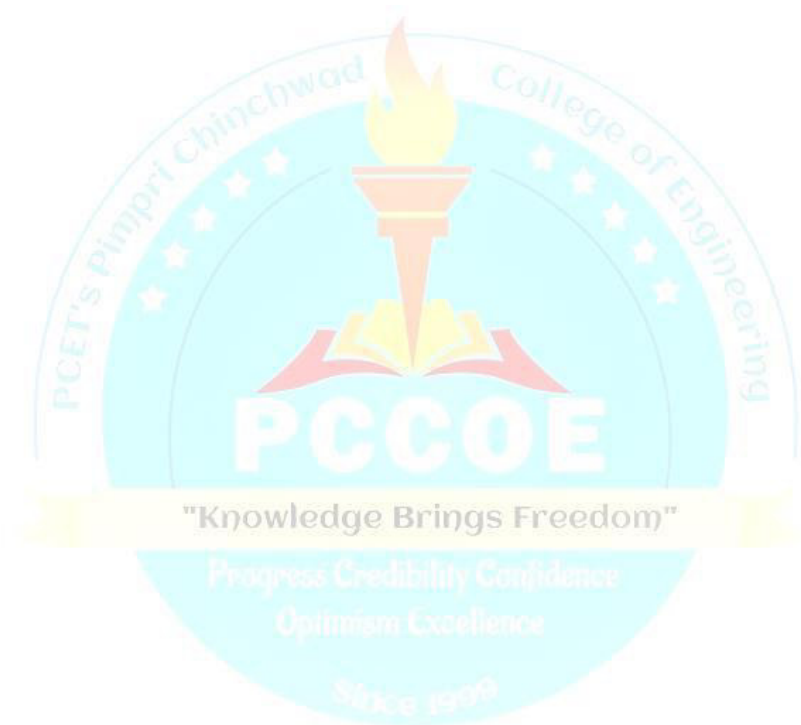
Program:	M. Tech. (Artificial Intelligence and Data Science)		Semester :	II		
Course :	Python for Data Science		Code :	MDS2602A		
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE1	IE2	ETE	Total
2	2	2	20	-	30	50
Pre-requisite: 1. Python basics ; 2.Statistical and numerical methods						
Objectives:						
<ol style="list-style-type: none"> 1. Apply various Python data structures to effectively manage various types of data. 2. Explore various steps of data science pipeline with role of Python 3. Design applications applying various operations for data cleansing and transformation. 4. Use various data visualization tools for effective interpretations and insights of data. 						
Outcomes:						
After learning the course, the students should be able to:						
<ol style="list-style-type: none"> 1. Gain an in-depth understanding of data science processes and the basics of statistics. 2. Explain the essential concepts of Python programming. 3. Perform high-level mathematical computations. 4. Perform data analysis and manipulation. 						
Detailed Syllabus:						
Unit	Description					Duration (Hrs.)
1.	Overview of Python and Data Structures Basics of Python including data types, variables, expressions, objects and functions. Python data structures including String, Array, List, Tuple, Set, Dictionary and operations them					6
2.	Data Science and Python Discovering the match between data science and python: Outlining the core competencies of a data scientist, Linking data science, big data, and AI , Understanding the role of programming, Creating the Data Science Pipeline, Preparing the data, Performing exploratory data analysis, Learning from data, Visualizing, Obtaining insights and data products, Understanding Python's Role in Data Science Introducing Python's Capabilities and Wonders: Why Python?, Grasping Python's Core Philosophy, Contributing to data science, Discovering present and future development goals, Working with Python, Getting a taste of the language, Understanding the need for indentation, Working at the command line or in the IDE, Performing Rapid Prototyping and Experimentation, Considering Speed of Execution, Visualizing Power, Using the Python Ecosystem for Data Science, Accessing scientific tools using SciPy, Performing fundamental scientific computing using NumPy, Performing data analysis using pandas, Implementing machine learning using Scikit-learn, Going for deep learning with Keras and TensorFlow, Plotting the data using matplotlib, Creating graphs with NetworkX, Parsing HTML documents using Beautiful Soup.					9
3.	Data Visualization Visualizing Information: Starting with a Graph, Defining the plot, Drawing multiple lines and plots, Saving your work to disk, Setting the Axis, Ticks, Grids, Getting the axes, Formatting the axes, Adding grids, Defining the Line Appearance, Working with line style, Using colors, Adding markers, Using Labels, Annotations, and Legends, Adding labels, Annotating the chart, Creating a legend.					7
4.	Data Wrangling Wrangling Data: Playing with Scikit-learn, Understanding classes in Scikit-learn, Defining applications for data science, Performing the Hashing Trick, Using hash functions, Demonstrating the hashing trick, Working with deterministic selection, Considering Timing and Performance, Benchmarkin, with,timeit, Working with the memory profiler, Running in Parallel on Multiple Cores, Performing multicore parallelism, Demonstrating multiprocessing.					8
	Total					30

Text Book

1. Python for data science for dummies 2nd Edition, John Paul Mueller, Luca Massaron, Wiley
2. Programming through Python, M. T. Savaliya, **R. K. Maurya**, G. M. Magar, STAREDU Solutions
3. Pandas for everyone :Python Data Analysis, Daniel Y. Chen, Pearson

Reference Book

1. Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools Davy Cielen, Arno D.B. Meysman, Mohamed Ali



Program:	M. Tech. (Artificial Intelligence & Data Science)		Semester : II			
Course :	Introduction to Neural Networks		Code : MDS2602B			
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	IE1	IE2	ETE	Total
2	2	2	20	-	30	50
Prerequisite:						
1. Linear Algebra 2. Mathematics						
Objectives:						
1. The main objective of this course is to provide the student with a basic understanding of neural networks fundamentals 2. Program the related algorithms and Design the required and related systems						
Outcomes:						
After learning the course, the students should be able to:						
1. Demonstrate ANN structure and activation Functions 2. Define foundations and learning mechanisms and state-space concepts 3. Identify structure and learning of perceptions 4. Explain Feed forward, multi-layer feed forward networks and Back propagation algorithms 5. Analyze Radial Basis Function Networks, Regularization and RBF networks 6. Explain the Self Organizing Map						
Detailed Syllabus:						
Unit	Description					Duration Hrs
1.	Introduction to Neural Networks: Introduction and ANN Structure, Biological neurons and artificial neurons. Model of an ANN. Activation functions used in ANNs. Typical classes of network architectures.					6
2.	Mathematical Foundation Mathematical Foundations and Learning mechanisms. Re-visiting vector and matrix algebra, State-space concepts, Concepts of optimization, and Error-correction learning. Memory-based learning, Hebbian learning. Competitive learning.					8
3.	Perceptrons Single-layer perceptrons, Structure and learning of perceptrons, Pattern classifier, introduction and Bayes' classifiers, Perceptron as a pattern classifier, Perceptron convergence. Limitations of a perceptrons.					7
4.	Feed Forward and Backpropagation NN: Feed forward ANN, Structures of Multi-layer feed forward networks. Back propagation algorithm, Back propagation - training and convergence, Functional approximation with back propagation. Practical and design issues of back propagation learning					9
Total						30
Text Books:						
1. Introduction to Artificial Neural Systems, Jacek Zurada, West Publishing Company 2. Simon Haykin, "Neural Networks: A comprehensive foundation", Second Edition, Pearson Education Asia. 3. Satish Kumar, "Neural Networks: A classroom approach", Tata McGraw Hill, 2004						
Reference Books:						
1. Neural Networks: A Systematic Introduction, Raúl Rojas, 1996 2. Pattern Recognition and Machine Learning, Christopher Bishop, 2007						
MOOC Courses-						
3. 1. Deep Learning Part-I, Swayam Prof.Mitesh M. Khapra 4. 2. Neural Networks and Deep Learning, Coursera, Andrew Ng 5. 3. Deep Learning for Computer Vision, Prof. Vineeth N Balasubramanian						



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:						
<ol style="list-style-type: none"> 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 2. https://www.meity.gov.in/DeitY_e-book/e-gov_policy/download/Policy%20Document.pdf 3. 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:						
<ol style="list-style-type: none"> 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:						
<ol style="list-style-type: none"> 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:						
<ol style="list-style-type: none"> 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:						
<ol style="list-style-type: none"> 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:						
<ol style="list-style-type: none"> 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:						
<ol style="list-style-type: none"> 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:						
<ol style="list-style-type: none"> 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: <ol style="list-style-type: none"> 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
<i>"Knowledge Brings Freedom"</i>						
Text Books:						
<ol style="list-style-type: none"> 1. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press 						
Reference Books:						
<ol style="list-style-type: none"> 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:						
<ol style="list-style-type: none"> 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:						
<ol style="list-style-type: none"> 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:						
<ol style="list-style-type: none"> 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:						
<ol style="list-style-type: none"> 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

Vision

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

Mission

M1: To develop technologically competent and self-sustained professionals through contemporary curriculum.

M2: To nurture innovative thinking and collaborative research, making a positive impact on society.

M3: To provide state-of-the art computing environment and learning opportunities through Center of Excellence.

M4: To foster leadership skills and ethics with holistic development.

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.

Higher Study Scope: PhD. Research Centre at PCCOE

Computer
Engineering.

E&TC
Engineering.

Mechanical
Engineering.

Features of PhD Research Centers

- Experienced Research Guides
- Separate Research Laboratories, Library, licensed software, recent hardware and other Facilities
- Good support for Publications.
- Justified and clear evaluation systems
- Defined rules and regulations for evaluation and submission.
- Effective Course work conductions
- Well structure infra-facilities



“There are no secrets to success. It is the result of preparation, hard work, learning from failure.”

– Colin Powell



**Pimpri Chinchwad College of
Engineering (PCCoE),**

Pradhikaran, Nigdi, Pune – 411 044