COURSE STRUCTURE
MECHANICAL ENGINEERING
B. TECH I SEMESTER

S. No	Course Code	Course Category	Course Title	Hours per week			Total Contact Hours	Credits
				Lecture	Tutorial	Practical		
1	20ME1T01	BSC	Linear Algebra and Differential Equations	3	-	-	3	3
2	20ME1T02	BSC	Engineering Physics	3	-	-	3	3
3	20ME1T03	HSMC	English	3	-	-	3	3
4	20ME1T04	ESC	Basic Electrical & Electronics Engineering	3	-	-	3	3
5	20ME1T05	ESC	Engineering Graphics	1	-	4	5	3
6	20ME1L06	HSMC	English Communication Skills Lab	-	-	3	3	1.5
7	20ME1L07	BSC	Engineering Physics Lab	-	-	3	3	1.5
8	20ME1L08	ESC	Basic Electrical & Electronics Engineering Lab	-	-	3	3	1.5
Total number of credits								**19.5**

B. TECH II SEMESTER

S. No	Course Code	Course Category	Course Title	Hours per week			Total Contact Hours	Credits
				Lecture	Tutorial	Practical		
1	20ME2T01	BSC	Transform Techniques	3	-	-	3	3
2	20ME2T02	BSC	Engineering Chemistry	3	-	-	3	3
3	20ME2T03	ESC	Engineering Mechanics	3	-	-	3	3
4	20ME2T04	ESC	Thermodynamics	3	-	-	3	3
5	20ME2T05	ESC	Problem Solving Through C	3	-	-	3	3
6	20ME2L06	BSC	Engineering Chemistry Lab	-	-	3	3	1.5
7	20ME2L07	ESC	Engineering & IT Workshop	-	-	3	3	1.5
8	20ME2L08	ESC	Problem Solving through C Lab	-	-	3	3	1.5
9	20ME2M09	MC	Environmental Science	2	-	-	2	-
Total number of credits								**19.5**

B. TECH III SEMESTER

S. No	Course Code	Course Category	Course Title	Hours per week			Total Contact Hours	Credits
				Lecture	Tutorial	Practical		
1	20ME3T01	BSC	Numerical Methods and Vector Calculus	3	-	-	3	3
2	20ME3T02	PCC	Material Science & Metallurgy	3	-	-	3	3
3	20ME3T03	PCC	Production Technology	3	-	-	3	3
4	20ME3T04	PCC	Mechanics of Solids	3	-	-	3	3
5	20ME3T05	PCC	Fluid Mechanics and Hydraulic Machines	3	-	-	3	3
6	20ME3L06	PCC	Production Technology Lab	-	-	3	3	1.5
7	20ME3L07	PCC	Fluid Mechanics and Hydraulic Machines Lab	-	-	3	3	1.5
8	20ME3L08	PCC	Mechanics of Solids & Metallurgy Lab	-	-	3	3	1.5
9	20ME3S09	SC	Computer aided drafting and modeling Lab	0	-	4	4	2
Total number of credits								**21.5**

B. TECH IV SEMESTER

S. No	Course Code	Course Category	Course Title	Hours per week			Total Contact Hours	Credits
				Lecture	Tutorial	Practical		
1	20ME4T01	BSC	Complex Variables and Statistical Methods	3	-	-	3	3
2	20ME4T02	PCC	Design of Machine Elements	3	-	-	3	3
3	20ME4T03	PCC	Internal Combustion Engines & Air Compressors	3	-	-	3	3
4	20ME4T04	PCC	Kinematics of Machinery	3	-	-	3	3
5	20ME4T05	HSMC	Managerial Economics & Financial Analysis	3	-	-	3	3
6	20ME4L06	PCC	Proficiency Through Reading & Writing Lab	-	-	3	3	1.5
7	20ME4L07	PCC	Computer Aided Machine Drawing Lab	-	-	3	3	1.5
8	20ME4L08	PCC	Thermal Engineering Lab	-	-	3	3	1.5
9	20ME4S09	SC	Programming through MATLAB	0	-	4	4	2
10	20ME3M10	MC	Constitution of India	2	-	-	2	-
Total number of credits								**21.5**
Honors/Minor courses				**4**	**0**	**0**	**-**	**4**

B.TECH V SEMESTER

S. No	Course Code	Course Category	Course Title	Hours per week			Total Contact Hours	Credits
				Lecture	Tutorial	Practical		
1	20ME5T01	PCC	Dynamics of Machines	3	-	-	3	3
2	20ME5T02	PCC	Turbo machines	3	-	-	3	3
3	20ME5T03	PCC	Metal Cutting &Machine Tools	3	-	-	3	3
4		**OEC**	**Open Elective-I**	3	-	-	3	3
5	**Professional Elective -I**			3	-	-	3	3
	20ME5T06	PEC	Experimental Stress Analysis					
	20ME5T07		Design for Manufacturing					
	20ME5T08		Refrigeration & Air Conditioning					
6	20ME5L09	PCC	Theory of Machines Lab	-	-	3	3	1.5
7	20ME5L10	PCC	Machine Tools & Computer Aided Manufacturing Lab	-	-	3	3	1.5
8	20ME5S11	SC	Simulation of Mechanical Systems Lab	-	-	4	4	2
9	20ME5M12	MC	Essence of Indian Traditional knowledge	2	-	-	2	-
10	20ME5I13	I	Summer Internship	-	-	-	-	1.5
Total number of credits								**21.5**
Honors/Minor courses				**4**	**-**	**-**	**4**	**4**

B. TECH VI SEMESTER

S. No	Course Code	Course Category	Course Title	Hours per week			Total Contact Hours	Credits
				Lecture	Tutorial	Practical		
1	20ME6T01	PCC	Design of Transmission Elements	3	-	-	3	3
2	20ME6T02	PCC	Heat Transfer	3	-	-	3	3
3	20ME6T03	PCC	Metrology and Measurements	3	-	-	3	3
4	**Professional Elective -II**			3	-	-	3	3
	20ME6T04	PEC	Finite Element Methods					
	20ME6T05		Computational Fluid Dynamics					
	20ME6T06		Production Planning & Control					
5		**OEC**	**Open Elective-II**	3	-	-	3	3
6	20ME6L09	PCC	Metrology & Instrumentation Lab	-	-	3	3	1.5
7	20ME6L10	PCC	Heat Transfer Lab	-	-	3	3	1.5
8	20ME6L11	PCC	CAE & CFD Lab	-	-	3	3	1.5
9	20ME6S12	SC	Soft skills	-	-	4	4	2
10	20ME6M13	MC	Disaster Management	2	-	-	2	-
11	20ME6P14	P	Community Service Project	-	-	-	-	4
Total number of credits								**25.5**
Honors/Minor courses				**4**	**-**	**-**	**4**	**4**

B. TECH VII SEMESTER

S. No	Course Code	Course Category	Course Title	Hours per week			Total Contact Hours	Credits
				Lecture	Tutorial	Practical		
1	**Professional Elective –III/MOOCS**			3	-	-	3	3
	20ME7T01	PEC	Advanced Materials					
	20ME7T02		Power Plant Engineering					
	20ME7T03		Advanced Optimization Techniques					
2	**Professional Elective –IV/ MOOCS**			3	-	-	3	3
	20ME7T04	PEC	Management Science					
	20ME7T05		Additive Manufacturing					
	20ME7T06		Advanced Machining Processes					
3	**Professional Elective -V / MOOCS**			3	-	-	3	3
	20ME7T07	PEC	Mechanical Vibrations					
	20ME7T08		Automobile Engineering					
	20ME7T09		Non Destructive Evaluation					
4		OEC	**Open Elective-III**	3	-	-	3	3
5		OEC	**Open Elective-IV**	3	-	-	3	3
6	20ME7T14	HSMC	Universal Human Values 2: Understanding Harmony	3	-	-	3	3
7	20ME7S15	SC	Python Programming Lab	1	-	2	3	2
8	20ME7I16	I	Industrial Internship	-	-	-	-	3
Total number of credits								**23**
Honors/Minor courses				**4**	**-**	**-**	**4**	**4**

B. TECH VIII SEMESTER

S. No	Course Code	Course Category	Course Title	Hours per week			Total Contact Hours	Credits
				Lecture	Tutorial	Practical		
1	20ME8P01	P	Project (Project work/internship)	-	-	-	-	8
	INTERNSHIP (6 MONTHS)							
Total number of credits								**8**

OPEN ELECTIVE –I:

S. No.	Course Code	Course Name	L	T	P	C	Offered by
1	20CE5T04	Architecture and Town Planning	3	0	0	3	CE
2	20CE5T05	Elements of Civil Engineering	3	0	0	3	CE
3	20EE5T04	Basics of Control Systems	3	0	0	3	EEE
4	20EE5T05	Special Electrical Machines	3	0	0	3	EEE
5	20ME5T04	Design Thinking & Product Innovation	3	0	0	3	ME
6	20ME5T05	Nanotechnology	3	0	0	3	ME
7	20EC5T04	Linear System Analysis	3	0	0	3	ECE
8	20EC5T05	Digital Logic Design	3	0	0	3	ECE
9	20EC5T06	Solid State Devices	3	0	0	3	ECE
10	20CS5T07	Introduction to Artificial Intelligence	3	0	0	3	CSE
11	20CS5T08	Operating System	3	0	0	3	CSE
12	20CS5T09	Software Engineering	3	0	0	3	CSE
13	20IT5T07	Computer Networks	3	0	0	3	IT
14	20IT5T08	Computer Graphics	3	0	0	3	IT
15	20HS5T01	Quantitative Aptitude and Reasoning	3	0	0	3	BED
16	20MB5T01	Principles of Management	3	0	0	3	DMS
17	20MB5T02	Technology Management	3	0	0	3	DMS
18	20AD5T07	Foundations of Data Science	3	0	0	3	AIDS
19	20AM5T07	Introduction to Machine Learning	3	0	0	3	AIML

OPEN ELECTIVE –II:

S. No.	Course Code	Course Name	L	T	P	C	Offered by
1	20CE6T08	Remote Sensing and GIS	3	0	0	3	CE
2	20CE6T09	Environmental Impact Assessment	3	0	0	3	CE
3	20EE6T08	Renewable Energy Sources	3	0	0	3	EEE
4	20EE6T09	Energy Audit, Conservation and Management	3	0	0	3	EEE
5	20ME6T07	Industrial Robotics	3	0	0	3	ME
6	20ME6T08	3D Printing	3	0	0	3	ME

7	20EC6T07	Electronic Circuits and Networks	3	0	0	3	ECE
8	20EC6T08	Principles of Communications	3	0	0	3	ECE
9	20EC6T09	Microcontrollers & its Applications	3	0	0	3	ECE
10	20CS6T07	Introduction to Machine Learning	3	0	0	3	CSE
11	20CS6T08	Information Security	3	0	0	3	CSE
12	20CS6T09	Agile Technologies	3	0	0	3	CSE
13	20IT6T07	Fundamentals of Machine Learning	3	0	0	3	IT
14	20IT6T08	Database Management Systems	3	0	0	3	IT
15	20HS6T01	Operations Research	3	0	0	3	BED
16	20MB6T01	Organizational Behaviour	3	0	0	3	DMS
17	20MB6T02	Project Management	3	0	0	3	DMS
18	20AD6T07	Visual Analytics	3	0	0	3	AIDS
19	20AM6T07	Big data Analytics	3	0	0	3	AIML

OPEN ELECTIVE –III:

S. No.	Course code	Course Name	L	T	P	C	Offered by
1	20CE7T13	Construction Technology and Management	3	0	0	3	CE
2	20CE7T14	Green Buildings	3	0	0	3	CE
3	20EE7T13	Concept of Power System Engineering	3	0	0	3	EEE
4	20EE7T14	Instrumentation	3	0	0	3	EEE
5	20ME7T10	Green Engineering Systems	3	0	0	3	ME
6	20ME7T11	Hybrid Electric Vehicles	3	0	0	3	ME
7	20EC7T10	Data Communications	3	0	0	3	ECE
8	20EC7T11	Mechatronics	3	0	0	3	ECE
9	20EC7T12	Bio Medical Instrumentation	3	0	0	3	ECE
10	20CS7T10	Artificial Neural Networks	3	0	0	3	CSE
11	20CS7T11	Cyber Security	3	0	0	3	CSE
12	20CS7T12	Software Testing Methodologies	3	0	0	3	CSE
13	20IT7T10	Internet of Things	3	0	0	3	IT
14	20IT7T11	Computer Vision	3	0	0	3	IT
15	20HS7T01	Fuzzy sets	3	0	0	3	BED

16	20MB7T01	Digital Media management	3	0	0	3	DMS
17	20MB7T02	Entrepreneurship Development	3	0	0	3	DMS
18	20AD7T10	Data Analysis and Visualization with Python	3	0	0	3	AIDS
19	20AM7T10	NOSQL Databases	3	0	0	3	AIML

OPEN ELECTIVE –IV:

S. No.	Course Code	Course Name	L	T	P	C	Offered by
1	20CE7T15	Waste water treatment	3	0	0	3	CE
2	20CE7T16	Repair and Rehabilitation of Concrete Structures	3	0	0	3	CE
3	20EE7T15	Power Quality	3	0	0	3	EEE
4	20EE7T16	Electric Vehicles	3	0	0	3	EEE
5	20ME7T12	Micro-Electro- Mechanical Systems	3	0	0	3	ME
6	20ME7T13	Solar Energy Systems	3	0	0	3	ME
7	20EC7T13	Introduction to Embedded Systems	3	0	0	3	ECE
8	20EC7T14	Internet of Things	3	0	0	3	ECE
9	20EC7T15	Analog and Digital IC applications	3	0	0	3	ECE
10	20CS7T13	Data Analytics	3	0	0	3	CSE
11	20CS7T14	Block Chain Technology	3	0	0	3	CSE
12	20CS7T15	Software Project Management	3	0	0	3	CSE
13	20IT7T13	Cloud Computing	3	0	0	3	IT
14	20IT7T14	Business Intelligence	3	0	0	3	IT
15	20HS7T02	Polymer Chemistry	3	0	0	3	BED
16	20MB7T03	Total Engineering Quality Management	3	0	0	3	DMS
17	20MB7T04	Stress Management	3	0	0	3	DMS
18	20AD7T11	Natural Language Processing	3	0	0	3	AIDS
19	20AM7T11	Deep Learning	3	0	0	3	AIML

HONORS/MINOR COURSES OFFERED BY THE DEPARTMENT

Honors/ Minor Course Fulfillments:

- The 20 additional credits need to be acquired, 16 credits can be earned by undergoing specified courses, with each carrying 4 credits.
- The remaining 4 credits must be acquired through two online MOOCs (SWAYAM /NPTEL), which shall be domain specific, each with 2 credits and with a minimum duration of 8/12weeks as recommended by the Board of Studies.
- Minor Engineering subjects are offered to other branches by ME Department (except for ME Students).
- Honors engineering subjects are offered to ME Students.
- The head of the department will float the list of allowed MOOC electives in each academic year, based on the list floated by MOOCs (SWAYAM/NPTEL).

HONORS COURSES

S.No.	Course code	Course Name	L	T	P	C
		Pool-1				
1	20MEHN01	Advanced Mechanics of Solids	4	0	0	4
2	20MEHN02	Fracture Mechanics	4	0	0	4
3	20MEHN03	Advanced Machine Design	4	0	0	4
4	20MEHN04	Tribology	4	0	0	4
		Pool-2				
5	20MEHN05	Measurements in Heat Transfer	4	0	0	4
6	20MEHN06	Advanced Mechanics of Fluids	4	0	0	4
7	20MEHN07	Energy Storage Systems	4	0	0	4
8	20MEHN08	Advanced Thermodynamics	4	0	0	4
		Pool-3				
9	20MEHN09	Metrology and Computer Aided Inspection	4	0	0	4
10	20MEHN10	Lean Manufacturing	4	0	0	4
11	20MEHN11	Flexible Manufacturing Systems	4	0	0	4
12	20MEHN12	Robotics & Control	4	0	0	4
		Pool-4				
13	20MEHN13	Quality Engineering in Manufacturing	4	0	0	4
14	20MEHN14	Precision Engineering	4	0	0	4
15	20MEHN15	Automation in Manufacturing	4	0	0	4
16	20MEHN16	Materials Characterization Techniques	4	0	0	4

MINOR COURSES

S.No.	Course code	Course Name	L	T	P	C	Offered by
1	20MEMN01	Engineering Mechanics	3	1	0	4	MECH
2	20MEMN02	Thermal Engineering	3	1	0	4	MECH
3	20MEMN03	Production Technology	3	1	0	4	MECH
4	20MEMN04	Fundamentals of Engineering Design	3	1	0	4	MECH
5	20MEMN05	Production Planning and control	3	1	0	4	MECH
6	20MEMN06	Materials Technology	3	1	0	4	MECH
7	20MEMN07	Basics of Mechanical Engineering	3	1	0	4	MECH
8	20MEMN08	Automobile Engineering	3	1	0	4	MECH

B.TECH I SEMESTER		**BSC**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
20ME1T01	**LINEAR ALGEBRA AND DIFFERENTIAL EQUATIONS**					

Pre-requisite: Basic knowledge about matrices, differentiation and integration

Course Objective: Objective of the course is to impart

- Basic understanding of mathematical methods to solve simultaneous linear systems
- Understanding of formation and solutions of ordinary differential equations
- Knowing the mathematical methods to solve applications of differential equations

Course Outcomes:

At the end of the course, student will be able to

CO1: Apply the knowledge to solve a system of homogeneous and non homogeneous linear equations

CO2: Illustrate the methods of computing eigen values and eigen vectors

CO3: Able to analyze the real life situations, formulate the differential equations and then applying the methods

CO4: Determine the solutions of linear differential equations

CO5: Optimize functions of several variables and able to find extreme values of constrained functions

SYLLABUS

UNIT-I: Linear systems of equations:

Rank of a matrix, Echelon form, Normal form, PAQ is in normal form, linear dependence and independence of vectors, Consistency of linear system of equations, System of linear homogeneous equations, Gauss-elimination and Gauss -Jordan methods.

UNIT-II: Eigen values & Eigen vectors:

Eigen values, Eigen vectors, Properties of Eigen values (without proofs), Cayley-Hamilton theorem (without proof), finding inverse and powers of a matrix using C-H theorem, Reduction to diagonal form, reduction of quadratic form to canonical form using orthogonal reduction, nature of quadratic forms.

UNIT-III: Ordinary Differential Equations of first order:

Linear equations, Bernoulli's equation, Exact differential equations. Equations reducible to exact equations, **Applications:** Orthogonal Trajectories, Newton's Law of cooling, Rate of decay &growth., R-L series circuits.

UNIT-IV: Linear Differential Equations higher order:

Definitions, Complete solution (without proof), Operator D, Rules to find complementary function, Inverse operator, Rules to find the particular integral(nonhomogeneous term of the form e^{ax} , sin(ax+b), cos(ax+b), polynomials in x^m, e^{ax} V(x), any other function), Method of variation of parameters.

UNIT-V: Partial Differentiation:

Functions of two variables, Partial derivatives, Homogeneous functions, Euler's theorem, Total derivative, Jacobian and functional dependence, Taylor's theorem for functions of two variables. **Applications:** Maxima and Minima of functions of two variables, Lagrange's method of undetermined multipliers.

Text Books:

1. B. S. GREWAL, Higher Engineering Mathematics, Khanna Publishers, 43rd Edition, 2014.
2. B. V. RAMANA, Higher Engineering Mathematics, Tata MC Graw Hill, 1st Edition, 2007.

Reference Books:

1. ERWIN KREYSZIG, Advanced Engineering Mathematics, John Wiley & Sons, 10th Edition, 2015.
2. N. P. BALI & Dr. MANISH GOYAL, A Text book of Engineering Mathematics, Lakshmi Publications, 9th Edition, 2014.

B.TECH I SEMESTER **BSC**

L	T	P	C
3	0	0	3

20ME1T02 ENGINEERING PHYSICS

Pre-requisite: Knowledge of basic concepts of waves, Optics, Electricity and Magnetism

Course Objective: Objective of the course is to impart

- *Knowledge* of fundamentals of Physics which helps them in the study of advanced topics of Engineering.
- *Develop* analytical capability and understand various Engineering concepts.

Course Outcomes:

At the end of the course, student will be able to

CO1: *Impart* knowledge of Physical Optics phenomenon Polarization and identify these phenomenon in natural processes

CO2: *Gain* knowledge of applications of lasers and optical fibers in various fields .

CO3: *Classify* magnetic and dielectric materials and their Engineering applications.

CO4: *Impart* knowledge of architectural acoustics and Study of Ultrasonics.

CO5: *Classify* crystal systems and analyze the crystalline structure using various X-ray diffraction techniques .

SYLLABUS

UNIT-I: Wave Optics:

Interference: Introduction-Principle of Superposition – Coherent Sources – Interference in thin films (reflection geometry) – Colors in thin films-Newton's rings-Determination of wave length nd refractive index.

Diffraction: C Introduction- Fresnel and Fraunhofer diffraction - Fraunhofer Diffraction due to Single slit, Double slit, N –slits(Qualitative) - Diffraction Grating – Resolving Power of Grating(Qualitative).

Polarizations: Introduction- Types of polarization-polarization by reflection, refraction and Double refraction-Nicol's prism –Half and Quarter wave plates.

UNIT-II: Lasers and Fiber Optics:

Lasers:: Introduction – Characteristics of laser – Spontaneous and Stimulated emissions of radiation – Einstein's coefficients – Population inversion – Lasing action - Pumping Schemes – Ruby laser – He-Ne laser - Applications of lasers.

Fiber optics: Introduction –Principle of optical fiber-Construction- - Acceptance Angle - Numerical Aperture -Classification of optical fibers based on refractive index profile and modes .

UNIT-III: Magnetic and Dielectric Materials:

Magnetic Materials: Introduction – Magnetic dipole moment – Magnetization – Magnetic susceptibility and permeability – Origin of permanent magnetic moment – Bohr magneton – Classification of magnetic materials: Dia, para ferro, anti ferro&ferri – Domain concept of Ferromagnetism(Qualitative) - Hysteresis – soft and hard magnetic materials .

Dielectric Materials: Introduction - Dielectic polarization – Dielectric Polarizability, Susceptibility and Dielectric constant-types of polarizations: Electronic and Ionic (Quantitative), Orientational polarizations (qualitative) – Lorentz Internal field – Claussius-Mossoti equation.

UNIT-IV: Acoustics and Ultrasonics:

Acoustics: Introduction – requirements of acoustically good auditorium– Reverberation – Reverberation time– Sabine's formula - Absorption coefficient and its determination – Factors affecting acoustics of buildings and their remedial measures.

Ultrasonics: Introduction - Properties - Production by magnetostriction and piezoelectric methods – Detection - Non Destructive Testing – pulse echo system through transmission and reflection modes - Applications.

UNIT-V: Crystallography and X-ray diffraction:

Crystallography: Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattices – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC.

X-ray diffraction: Miller indices – separation between successive (hkl) planes- Bragg's law - X-ray Diffractometer – crystal structure determination by Laue's and powder methods – powder pattern of bulk, nano materials of ZnO and calculation of lattice cell by Scherrer's formula.

Text books:

1. Engineering Physics – Dr. M.N. Avadhanulu& Dr. P.G. Kshirsagar, S. Chand and Company
2. Engineering physics – D.K. Battacharya and PoonamTandon, Oxford University press.
3. Engineering Physics by P.K.Palanisamy SciTech publications.

Reference Books:

1. Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley &Sons
2. Engineering Physics – M.R.Srinivasan, New Age Publications
3. Engineering Physics – D K Pandey, S. Chaturvedi, Cengage Learning
4. Engineering Physics - Sanjay D. Jain, D. Sahasrambudhe and Girish, University Press

B.TECH I SEMESTER	**HSMC**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

20ME1T03 ENGLISH

Pre-requisite:

Course Objective:

- Facilitate effective listening skills for better comprehension of academic lectures and English spoken by nativespeakers
- Focus on appropriate reading strategies for comprehension of various academic texts and authenticmaterials
- Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oralpresentations
- Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
- Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

Course Outcomes: At the end of the course, student will be able to

CO1	understand social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information
CO2	ask and answer general questions on familiar topics
CO3	employ suitable strategies to master the art of letter writing and email writing
CO4	recognize paragraph structure and be able to match beginnings/endings/headings with paragraphs
CO5	form sentences using proper grammatical structures and correct wordforms

SYLLABUS

UNIT-I	A Drawer full of happiness (Detailed Study) Deliverance (Non-detailed Study)
UNIT-II	Nehru’s letter to his daughter Indira on her birthday(Detailed Study)

	Bosom Friend (Non-detailed Study)
UNIT-III	Stephen Hawking-Positivity ‘Benchmark’ (Detailed Study) Shakespeare’s Sister(Non-detailed Study)
UNIT-IV	Liking a Tree, Unbowed: WangariMaathai-biography (Detailed Study) Telephone Conversation(Non-detailed Study)
UNIT-V	Stay Hungry-Stay foolish (Detailed Study) Still I Rise(Non-detailed Study)

Text Books

1. “Infotech English”, Maruthi Publications. (Detailed)
2. “The Individual Society”, Pearson Publications.(Non-detailed)

Reference Books

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition,2018.
3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) MacmillanEducational.
4. Hewings, Martin. Cambridge Academic English (B2). CUP,2012.

B.TECH I SEMESTER

ESC	L	T	P	C
	3	0	0	3

20ME1T04 BASIC ELECTRICAL & ELECTRONICS ENGINEERING

Pre-requisite: Fundamental in Engineering Mathematics and Physics

Course Objective: Impart a basic knowledge of electrical quantities such as current, voltage, power, energy and frequency to understand the impact of technology in a global and societal context.

1. Provide working knowledge for the analysis of basic DC and AC circuits used in electrical and electronic devices.
2. To explain the working principle, construction, applications of DC machines, AC machines
3. Know the fundamental of Electrical Engineering.
4. Understand .the concepts of diodes and transistors

Course Outcomes: At the end of the course, student will be able to

CO1: Analyze various electrical networks.

CO2: Understand operation of DC generators, single-phase transformer and acquire proper knowledge and working of 3-phase alternator and 3-phase induction motors

CO3: Understand operation of Sources of Energy & power transmission and distribution using single line diagrams.

CO4: Analyze operation of half wave, full wave bridge rectifiers and OP-AMPs.

CO5: Understanding operations of CE amplifier and basic concept of feedback amplifier.

SYLLABUS

UNIT-I: Electrical Circuits:

Basic definitions - Types of network elements - Ohm's Law - Kirchhoff's Laws – Resistive networks, Inductive networks -Capacitive networks – Series - Parallel circuits - Star-delta and delta-star transformations.

UNIT-II: Electrical Machines:

Principle of operation of DC generator – EMF equation - Principle of operation of DC motor- Principle of operation of single phase transformers – EMF equation – Losses – OC & SC tests. Principle of operation of 3-Phase induction motor – Slip-torque characteristics. Principle of operation of alternators – Principle of operation of Synchronous motor - Speed-torque characteristics. Selection of electrical machines for various mechanical applications.

UNIT-III: Electrical Power Generation, Transmission and Distribution:

Sources of Energy – conventional & non-conventional, Introduction and layout of Thermal, hydel power plants**,** Introduction and layout of nuclear power plants, layout of solar power plants, power transmission and distribution using single line diagrams.

UNIT-IV: Diodes:

Introduction to semi-conductor physics, PN junction diode, Zener diode, half wave, full wave and bridge rectifier using diodes, Zener diode as a voltage regulator.

UNIT-V: Transistors:

PNP and NPN junction transistor, transistor as an amplifier- Transistor amplifier - Frequency response of CE amplifier - Concepts of feedback amplifier.

Text Book(s)

1. Electrical Technology by Surinder Pal Bali, Pearson Publications.
2. Electronic Devices and Circuits, R.L. Boylestad and Louis Nashelsky, 9th edition, PEI/PHI 2006.

References

1. Electrical Circuit Theory and Technology by John Bird, Routledge Taylor &Francis Group
2. Basic Electrical Engineering by M.S.Naidu and S.Kamakshiah,TMH Publications
3. Fundamentals of Electrical Engineering by Rajendra Prasad, PHI Publications,2nd edition

4. Basic Electrical Engineering by Nagsarkar, Sukhija, Oxford Publications,2nd edition
5. Industrial Electronics by G.K. Mittal, PHI

B.TECH - I SEMESTER	**ESC**	**L**	**T**	**P**	**C**
		1	**0**	**4**	**3**

20ME1T05 ENGINEERING GRAPHICS

Objective:

1. To introduce the students to use orthographic projections, projections of points & simple lines.
2. To make the students draw the projections of the lines inclined to both the planes.
3. To make the students draw the projections of the plane inclined to both the planes.
4. To make the students draw the projections of the various types of solids in different positions inclined to one of the planes.
5. To represent the object in 3D view through isometric views. The student will be able to represent and convert the isometric view to orthographic view and vice versa.

Course Outcomes:

At the end of the course, the student will be able to

1. Understand the concepts of projections and draw projections for simple entities such as points and lines.
2. Draw orthographic projections of planes and simple solids.
3. Understand the concept of sections and sectional views.
4. Develop the surfaces for various simple solids and understand the concept of intersection of two solids.
5. Analyze the 2D drawings and convert to 3D isometric views.
6. Learn computer aided drafting with AutoCAD and draw simple 2D part drawings and orthographic views using the software.

SYLLABUS

UNIT I

Orthographic Projections: Reference plane, importance of reference lines, projections of points in various quadrants, projections of lines, line parallel to both the planes, line parallel to one plane and inclined to other plane.

Projections of straight lines inclined to both the planes, determination of true lengths, angle of inclination and traces.

UNIT II

Projections of planes: regular planes perpendicular/parallel to one reference plane and inclined to the other reference plane; inclined to both the reference planes.

Projections of Solids – Prisms, Pyramids, Cones and Cylinders-Simple positions

UNIT III

Projections of Solids – Prisms, Pyramids, Cones and Cylinders with the axis inclined to one plane.

Sections of Solids: Sections and sectional views of Right regular solids-Prisms, Pyramids, Cones and Cylinder.

UNIT IV

Interpenetration of right regular solids: Intersection of Cylinder Vs Cylinder, Cylinder Vs Prism, Cylinder Vs Cone, Prism Vs Cone.

Development of Surfaces: Development of Surfaces of right regular solids-Prisms, Pyramids, Cones and Cylinder

UNIT V

Conversion of orthographic views to isometric view for Simple Solids such as prism, pyramid, cylinder and cone; Conversion of isometric view to orthographic views.

Computer Aided Drafting: Introduction to AutoCAD, Geometric commands, Modify commands, Annotation, Layers, display control and Properties tool bars. Creation of simple 2D part drawings and orthographic views.

Text books:

1. Engineering Drawing by N.D. Butt, Chariot Publications
2. Engineering Drawing by K.L.Narayana& P. Kannaiah, Scitech Publishers

Reference books:

1. Engineering Graphics for Degree by K.C. John, PHI Publishers
2. Engineering Graphics by PI Varghese, McGraw Hill Publishers
3. Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, NewAge
4. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers

B.TECH I SEMESTER **HSMC**

L	T	P	C
0	0	3	1.5

20ME1L06 ENGLISH COMMUNICATION SKILLS LAB

Course Objectives:

- Facilitate effective usage of functional English through role plays
- Focus on vocabulary enhancement
- Foster various nuances of phonetics and accent neutralization

Course Outcomes: At the end of the course, student will be able to

CO1: Acquire basic proficiency in English by learning functional aspects of English language

CO2: Learn the methods of enhancing vocabulary

CO3: Acquaint himself/herself with nuances of Phonetics

LIST OF EXPERIMENTS

1 Greetings and Introductions
2 Requesting Permission & Giving Directions
3 Inviting/Complaining/Congratulating
4 Root Words
5 Phonetics-Sounds and Symbols
6 Pronunciation Rules

References:

1. Strengthen Your Steps, Maruti Publications
2. Interact, Orient Blackswan
3. Word Power Made Easy, Pocket Books

		L	T	P	C
B.TECH I SEMESTER	**BSC**	**0**	**0**	**3**	**1.5**

20ME1L07 ENGINEERING PHYSICS LAB

Pre-requisite: Fundamental understanding of usage of an instrument with proper care.

Course Objective: Objective of the course is to impart

- Training Engineering graduates to handle instruments and their usage methods to improve the accuracy of measurements.

At the end of the course, student will be able to

CO1: **Outcomes**: The student is exposed to different methods of chemical analysis and use of some commonly employed instruments. They thus acquire some experimental skills.

CO2: Implement the basic principles of Mechanics to measure different physical parameters.

CO3: Enhance the knowledge of Usage of electronic devices in various applications

LIST OF EXPERIMENTS

1. Newton's rings –Determination of radius of curvature of Plano Convex Lens.
2. Determination of wavelength of spectral lines -Diffraction Grating
3. Determination of thickness of a spacer using wedge film and parallel interference fringes.
4. Determination of wavelength of laser source using diffraction grating
5. Determination of Numerical Aperture and bending loss of a given Optical Fiber.
6. Determination of dispersive power of prism.
7. Determination of Rigidity modulus of a material- Torsional Pendulum.
8. Determination of Acceleration due to Gravity and Radius of Gyration- Compound Pendulum.
9. Determination of Young's modulus by method of single cantilever oscillations
10. Verification of laws of vibrations in stretched strings – Sonometer.
11. Estimation of Planck's Constant using Photo electric Effect

12. Study of I /V Characteristics of Semiconductor diode.
13. I/V characteristics of Zener diode.

    Magnetic field along the axis of a current carrying coil – Stewart and Gee's apparatus

15. Energy Band gap of a Semiconductor using p - n junction diode

Reference Books

1. A Text book of Practical Physics, Balasubramanian S, Srinivasan M.N, S Chand Publishers, 2017.

B.TECH	**ISEMESTER**	**ESC**	**L**	**T**	**P**	**C**
			0	**0**	**3**	**1.5**

20ME1L08 BASIC ELECTRICAL & ELECTRONICS ENGINEERING LAB

Course Objectives: To understand the operation of electrical machines & electronic devices

Course Outcomes:

CO 1 Compute the efficiency of DC shunt machine without actual loading of the machine

CO 2 Estimate the efficiency and regulation at different load conditions and power factors for single phase transformer with OC and SC tests.

CO 3 Analyze the performance characteristics and to determine efficiency of DC shunt motor & 3-Phase induction motor.

CO 4 Control the speed of dc shunt motor using Armature voltage and Field flux control methods.

CO 5 Draw the characteristics of PN junction diode & transistor

CO 6 Determine the ripple factor of half wave & full wave rectifiers.

LIST OF EXPERIMENTS

1. Swinburne's test on D.C. Shunt machine (Predetermination of efficiency of a given D.C. Shunt machine working as motor and
2. OC and SC tests on single phase transformer (Predetermination of efficiency and regulation at given power factors).
3. Brake test on 3-phase Induction motor (Determination of performance characteristics).
4. Speed control of D.C. Shunt motor by
   a) Armature Voltage control b) Field flux control method
5. Brake test on D.C. Shunt Motor.
6. PN junction Diode characteristics A. Forward bias, B. Reverse bias. (Cut in voltage & Resistance calculations)
7. Transistor CE Characteristics (Input and Output).
8. Full wave Rectifier with and without filters.
9. CE Amplifiers.
10. RC Phase Shift Oscillator.
11. Class A Power Amplifier.

B.TECH II SEMESTER **BSC**

L	T	P	C
3	0	0	3

20ME2T01 TRANSFORM TECHNIQUES

Pre-requisite: Linear Algebra and Differential Equations

Course Objective: Objective of the course is to impart

- Learning the techniques of Laplace transforms to solve ordinary differential equations
- knowledge of Fourier series & Fourier transforms for piecewise continuous functions
- knowledge of solving boundary valued problems

Course Outcomes: At the end of the course, student will be able to

CO1: Able to analyze a class of integrals in terms of beta and gamma functions

CO2: Provide the techniques of Laplace transformations and able to solve problems related to digital signal processing

CO3: Analyze the general periodic functions in the form of an infinite convergent sine and cosine series

CO4: Illustrate the methods to solve the boundary value problems

CO5: Determine a solution of a discrete system using Z- transforms

SYLLABUS

UNIT-I: Special functions:

Beta function, Properties & problems, Gamma function, properties & problems, Relation between Beta and Gamma functions, Evaluation of improper integrals

UNIT-II: Laplace Transforms (all properties without proofs):

Definition, Transforms of elementary functions, properties of Laplace transforms, Transforms of periodic functions, Transforms of derivatives and integrals, Multiplication by t^n, Division by t, Evaluation of improper integrals.

Inverse Laplace transforms–Method of partial fractions, other methods of finding inverse transforms, Convolution theorem (without proof).

Application: Application to differential equations

UNIT-III: Fourier Series &Fourier Transforms:

Euler's formulae (without proof), Conditions of Fourier expansion, Functions having points of discontinuity, Change of inerval, Even and odd functions, Half-range series.

Fourier Integral theorem (without proof), Fourier cosine & sine integral, complex form of Fourier integral, Fourier transform, Fourier sine & cosine transforms, properties of Fourier transforms (without proof), Convolution theorem(without proof), finite & infinite Fourier sine & cosine transforms.

UNIT-IV: Partial Differential Equations:

Formation of partial differential equations by eliminating arbitrary constants and arbitrary functions, solutions of first order linear (Lagrange) equation and nonlinear (standard type) equations. Method of separation of Variables, Applications: One-dimensional wave and heat equations, two-dimensional heat equation.

UNIT-V: Z-Transforms: (all properties without proofs)

Introduction, definition, some standard z-transforms, linearity property, damping rule, some standard results, shifting U_n to the right, multiplication by n, initial and final value theorems, Inverse z-transforms, convolution theorem, evaluation of inverse z-transforms by partial fractions, applications to difference equations.

Text Books:

1. B. S. GREWAL, Higher Engineering Mathematics, Khanna Publishers, 43rd Edition, 2014.

2. B. V. RAMANA, Higher Engineering Mathematics, Tata MC Graw Hill, 1st Edition, 2007.

Reference Books:

3. ERWIN KREYSZIG, Advanced Engineering Mathematics, John Wiley & Sons, 10th Edition, 2015.

4. N. P. BALI & Dr. MANISH GOYAL, A Text book of Engineering Mathematics, Lakshmi Publications, 9th Edition, 2014.

B.TECH II SEMESTER	**BSC**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

20ME2T02 ENGINEERING CHEMISTRY

Pre-requisite: Knowledge of basic concepts of Chemistry for Engineering students will help them as professional engineers later in design and material selection, as well as utilizing the available resources.

Course Objective: Objective of the course is to impart

- ***Importance*** of usage of plastics in house hold appliances and composites (FRP)in aerospace and automotive industries.
- ***Outline*** the basics for the construction of electrochemical cells, batteries and fuelcells. Understand the mechanism of corrosion and how it can be prevented.
- ***Express***the increases in demand as wide variety of advanced materials are introduced; which have excellent engineering properties.
- ***Classify and discuss*** the materials used in major industries like steel industry, metallurgical industries and construction industries and electrical equipment manufacturing industries. Lubricationis also ***summarized***.
- ***Relate*** the need of fuels as a source of energy to any industry, particularly industries like thermal power stations , steel industry ,fertilizer industry etc., and hence introduced.
- ***Explain*** the importance and usage of water as basic material in almost all the industries;
- ***Interpret*** drawbacks of steam boilers and also how portable water is supplied for drinking purposes.

Course Outcomes:

At the end of the course, student will be able to

CO1: ***Analyze*** the different types of composite plastic materials and ***interpret*** the mechanism of conduction in conducting polymers.

CO2: ***Utilize*** the theory of construction of electrodes, batteries and fuel cells in redesigning new engineering products and c***ategorize*** the reasons for corrosion and study methods to control corrosion.

CO3: ***synthesize*** nanomaterials for modern advances of engineering technology.

Summarize the techniques that detect and measure changes of state of reaction.

Illustrate the commonly used industrial materials.

CO4: ***Differentiate*** petroleum, petrol, synthetic petrol and have knowledge how they are produced.

Study alternate fuels and ***analyse*** flue gases.

CO5: ***Analyze*** the suitable methods for purification and treatment of hard water and brackish water.

SYLLABUS

UNIT-I: Polymer Technology:

Polymerisation: Introduction, methods of polymerization (addition and Condensation), Physical and mechanical properties.

Plastics: Compounding, fabrication(compression, injection, blown film and extrusion), preparation, properties and applications (PVC, polycarbonates and Bakelite),mention some examples of plastic materials used in electronic gadgets.

Elastomers: Natural rubber-Drawbacks-vulcanization, preparation, properties and applications (BunaS, Thiokol and polyurethanes).

Composite materials: Fiber reinforced plastics – GFRP and Aramid FRP

Conducting polymers: Intrinsic and extrinsic conducting polymers

Biodegradable polymers: preparation and applications

UNIT-II: Electro chemical Cells And Corrosion:

PartI:*ELECTRO CHEMICAL CELLS:* Single electrode potential, electrochemical series and uses of series, standard hydrogen electrode, calomel electrode, batteries (Dry cell, Li ion battery and zinc aircells), fuelcells(H_2-O_2,CH_3OH-O_2,phosphoric acid and molten carbonate).

PartII: *Corrosion:* Definition, theories of corrosion (chemical and electrochemical), galvanic corrosion, differential aeration corrosion, stress corrosion, galvanic series, factors influencing rate of corrosion, corrosion control (cathodic protection),Protective coatings (cathode ic coatings, anodic coatings, electroplating and electroless plating)

UNIT-III: Chemistry Of Materials:

Part- A: *Nanomaterials:-*Introduction, sol-gel method, characterization by (Brunauer Emmet Teller [BET]), (scanning electron microscopy [SEM]) and (transmission electron microscopy [TEM]) with example ($TiO2$), applications of graphene and fullerenes, carbon nanotubes (types, preparation and applications)

Part-B: *Refractoriness:-*Definition, classification, properties (refractoriness, refractoriness underload, porosity and thermal spalling), failure of refractories.

Lubricants:-Definition, mechanism of lubricants, properties (definition and importance).

Cement: - Constituents, manufacturing, parameters to characterize the clinker formation: lime saturation factor (LSF), silica ratio(SR) and alumina ratio(AR), deterioration of cement.

UNIT-IV: Fuels:

Introduction, calorific value, higher calorific value, lower calorific values, problems using Dulong's formula, proximate and ultimate analysis of coal sample and their significance, numerical problems, petroleum (refining-cracking), synthetic petrol (Fischer Tropsch and Bergius), petrol knocking, dieselknocking,octaneandcetaneratings,anti-knockingagents,Introductiontoalternativefuels(Bio-diesel,ethanol, methanol, natural gas, liquefied petroleum gas, compressed natural gas).

UNIT-V: Water Technology:

Hardness of water, determination of hardness by complex metric method, boiler troubles (priming and foaming, scale formation, boiler corrosion, Causticem brittlement), internal treatments, softening of hard water (zeolite process and related sums, ion exchange process), potable water and its specifications, break point chlorination-desalination (reverse osmosis and electrodialysis).

Standard Books:

1. P. C. Jainand M.Jain "**Engineering Chemistry**",15/e, Dhanpat Rai & Sons, Delhi,(Latest edition).
2. Shikha Agarwal, "**Engineering Chemistry**", Cambridge University Press, New Delhi, (2019).
3. S.S. Dara, "**ATextbook of Engineering Chemistry**", S.Chand & Co,(2010).
4. Shashi Chawla, "Engineering Chemistry", Dhanpat Rai Publicating Co. (Latest edition).

Reference:

1. K.Sesha Maheshwaramma and Mridula Chugh, "**Engineering Chemistry**", Pearson India Edn.
2. O.G.Palana, "**Engineering Chemistry**", Tata Mc Graw Hill Education Private Limited, 2009). CNR Rao and JM Honig (Eds)
3. "**Preparation and characterization of materials**" Academic press, New York (latestedition) B. S. Murthy, P. Shankar and others,
4. "**Textbook of Nano science and Nanotechnology**", University press (latestedition)

B.TECH II SEMESTER	**ESC**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

20ME2T03 ENGINEERING MECHANICS

Objectives: The students completing this course are expected to understand the concepts of forces and its resolution in different planes, resultant of force system, forces acting on a body, their free body diagrams using graphical methods. They are required to understand the concepts of centre of gravity and moments of inertia and their application, Analysis of frames and trusses, different types of motion, friction and application of work - energy method.

Course outcomes:

1. The student should be able to draw free body diagrams for FBDs for particles and rigid bodies in plane and space and problems to solve the unknown forces, orientations and geometric parameters.
2. The student should be able to determine centroid for lines, areas and center of gravity for volumes and their composites.
3. The student should be able to determine area and mass movement of inertia for composite sections
4. The student should be able to analyze motion of particles and rigid bodies and apply the principles of motion, work energy and impulse – momentum.

SYLLABUS

UNIT – I

Objectives: The students are to be exposed to application of free body diagrams. Solution to problems using graphical methods and law of triangle of forces.

Introduction to Engg. Mechanics – Basic Concepts.

Systems of Forces: Coplanar Concurrent Forces – Components in Space – Resultant – Moment of Force and its Application – Couples and Resultant of Force Systems.

Equilibrium of Systems of Forces: Free Body Diagrams, Equations of Equilibrium of Coplanar Systems, Spatial Systems for concurrent forces. Lamis Theorm, Graphical method for the equilibrium of coplanar forces, Converse of the law of Triangle of forces, converse of the law of polygon of forces condition of equilibrium.

UNIT II

Objectives: The students are to be exposed to the concepts of force and friction, direction and its application.

Friction: Introduction**,** limiting friction and impending motion, coulomb's laws of dry friction, coefficient of friction, cone of friction, Wedges.

Analysis of plane trusses-Method of Joints, Method of Sections.

UNIT – III

Objectives: The students are to be exposed to concepts of centre of gravity.

Centroid: Centroids of simple figures (from basic principles) – Centroids of Composite Figures

Centre of Gravity: Centre of gravity of simple body (from basic principles), centre of gravity of composite bodies, Pappus theorems.

UNIT – IV

Objectives: The students are to be exposed to concepts of moment of inertia and polar moment of inertia including transfer methods and their applications.

Area moments of Inertia: Definition – Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia.

Mass Moment of Inertia: Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia, mass moment of inertia of composite bodies.

UNIT – V

Objectives: The students are to be exposed to rigid motion kinematics and kinetics

Kinematics: Rectilinear and Curvilinear motions – Velocity and Acceleration

– Motion of Rigid Body – Types and their Analysis in Planar Motion.

Kinetics: Analysis as a Particle and Analysis as a Rigid Body in Translation– Central Force Motion – Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies.

Work – Energy Method: Equations for Translation, Work-Energy Applications to Particle Motion, Connected System-Fixed Axis Rotation and Plane Motion. Impulse momentum method.

TEXT BOOKS:

1. Engineering Mechanics - S.Timoshenko &D.H.Young., 4thEdn - , McGraw Hill publications.
2. Engineering Mechanics- S S Bhavikati –New Age International Publishers

REFERENCES:

3. Engineering Mechanics, statics and dynamics – I.H.Shames, – Pearson Publ.
4. Engineering Mechanics, Fedinand . L. Singer, Harper –Collins.
5. Engineering Mechanics statics and dynamics , A Nelson , McGraw Hill publications
6. Engineering Mechanics- A KTayal
7. Engineering Mechanics , R.K.Bansal, Laxmi Publications
8. Engg. Mechanics- KL Kumar-Tata McGraw Hill publications

B.TECH II SEMESTER	**ESC**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

20ME2T04 THERMODYNAMICS

Course objectives:

1. To introduce the basic laws of thermodynamics
2. To make them understand the applications of laws of thermodynamics
3. To introduce the concepts of entropy, Availability and Irreversibility
4. To make them understand the properties of Steam and use of Steam Tables
5. To introduce air standard cycles and their applications.

Course outcomes: at the end of the course, the student will be able

1. understand the basic laws of thermodynamics
2. apply the laws of thermodynamics
3. understand the concept of entropy, Availability and Irreversibility
4. understand the properties of Steam and use of Steam Tables
5. understand the use of standard cycles and their applications.

SYLLABUS

Unit I

Introduction: Basic Concepts: Macroscopic and microscopic view points, definitions of thermodynamic terms, quasi – static process, point and path function, forms of energy, ideal gas and real gas, Zeroth law of thermodynamics.

First law of Thermodynamics: Joule's experiment-first law of thermodynamics, corollaries-perpetual motion machines of first kind, first law applied to non-flow and flow process-limitations of first law of thermodynamics**.**

Unit II

Second Law of Thermodynamics: Kelvin - Planck statement and Clausius statement and their equivalence, corollaries - perpetual motion machines of second kind - reversibility and irreversibility, cause of irreversibility - Carnot cycle, heat engine, heat pump and refrigerator, Carnot theorem, Carnot efficiency.

Unit III

Entropy: Clausius inequality - Concept of Entropy- entropy equation for different processes and systems

Availability and Irreversibility: Definition of exergy and energy, expressions for availability and irreversibility. Availability in steady flow, non-flow processes and irreversibility.

Unit IV

Properties of Steam and use of Steam Tables: Pure Substances, P-V-T surfaces, T-s and h-s diagram, Mollier chart, dryness fraction, property tables, analysis of steam undergoing various thermodynamic processes using Mollier chart– steam calorimetry.

Unit V

Air Standard Cycles: Otto, Diesel and dual cycles, P-V and T -S diagrams - description and efficiencies, mean effective pressures. Comparison of Otto, Diesel and dual cycles

Refrigeration cycle: Rankine cycle, Brayton cycle.

Text Book(s)

1. P.K.Nag, Engineering Thermodynamics, 5/e, Tata McGraw Hill,2013.
2. Yunus A. Cengel, Michaela A. Boles, Thermodynamics, 7/e, Tata McGraw Hill,2011.

References

1. J.B.Jones and G.A.Hawkins, Introduction to Thermodynamics, 2/e, John Wiley & Sons,2012.
2. Moran, Michael J. and Howard N. Shapiro, Fundamentals of Engineering Thermodynamics, 3/e, Wiley,2015
3. Claus Borgnakke Richard E. Sonntag, Fundamentals of Thermodynamics, 7/e, Wiley,2009 R.K. Rajput, S.Chand& Co., Thermal Engineering, 6/e, Laxmi publications,2010

B.TECH II SEMESTER **ESC**

L	T	P	C
3	0	0	3

20ME2T05 PROBLEM SOLVING THROUGH C

Pre-requisite:

Course Objective:

- To learn about the computer systems, computing environments, developing of a computer program and Structure of a C Program
- To gain knowledge of the operators, selection, control statements and repetition in C. To learn about the design concepts of arrays, strings, enumerated structure and union types and their usage. To assimilate about pointers, dynamic memory allocation and know the significance of Preprocessor. To assimilate about File I/O and significance of functions

Course Outcomes: At the end of the course, student will be able to

CO1: Understand the basic concepts of programming

CO2: Understand and Apply loop construct for a given problem

CO3: Demonstrate the use pointers

CO4: Understand the use of functions and develop modular reusable code

CO5: Understand File I/O operations

SYLLABUS

UNIT-I:

INTRODUCTION TO COMPUTERS: Functional Components of computer, computer software, categories of memory, types of programming languages, Development of algorithms, flow charts, software development process, Computer Numbering system

BASICS OF C PROGRAMMING: Introduction to programming paradigms, Structure of C program, Data Types, C Tokens, Operators: Precedence and Associativity, Expressions Input/output statements, Assignment statements

UNIT-II:

Decision making statements: if, if else, nester if. Multi way decision making statements: else if, Switch statement. **Loop statements**: while, do while, for, Compilation process.

UNIT-III:

Introduction to Arrays: Declaration, Initialization, One dimensional array, Example Programs on one dimensional array, Selection sort, linear and binary search, two dimensional arrays, Matrix Operations, Multi-dimensional Arrays

Strings: Declaration, String operations: length, compare, concatenate, copy, String handling functions.

UNIT-IV:

FUNCTIONS: Introduction to functions: Function prototype, function definition, function call, Built-in functions, Recursion, Storage classes, Passing Arrays & Strings to the functions, Preprocessor directives

POINTERS: Pointers, Pointer operators, Pointer arithmetic, Arrays and pointers, Array of pointers, Parameter passing: Pass by value, Pass by reference, Dynamic Memory Allocation

UNIT-V:

STRUCTURES AND UNIONS: Structure, Nested structures, Pointer and Structures, Array of structures, Example Program using structures and pointers, Self-referential structures, Unions.

FILE PROCESSING: Files, Types of file processing: Sequential access, Random access, Sequential access file, Random access file, Command line arguments

Text Books:

1. Krnighan. B.W and Ritche, D.M, "The C Programming Language", Second Edition, Pearson Education, 2006
2. ReemaThareja, "Programming in C", Oxford University Press, Second Edition, 2016.

References:

1. Pradepdey, Manas Ghosh, "Fundamentals of Computing and programming in C", First Edition, Oxford University Press, 2009.
2. Paul Deitel and Harvey Deitel, "C How to Program", Seventh Edition,

Pearson Publication.
3. E Balagursamy, "Programming in C, Sixth Edition, Tata McGraw Hill.
4. Ajay Mittal, "Programming in C A practical Approach", Pearson education

B.TECH II SEMESTER	**BSC**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

20ME2L06 ENGINEERING CHEMISTRY LAB

Pre-requisite: Acquire some experimental skills.

Course Objective: Objective of the course is to impart

- The experiments introduce volumetric analysis; redox titrations with different indicators; EDTA titrations.
- A few instrumental methods of chemical analysis.

Course Outcomes:

At the end of the course, student will be able to

CO1: The student is exposed to different methods of chemical analysis and use of some commonly employed instruments. They thus acquire some experimental skills.

LIST OF EXPERIMENTS

1 Determination of HCl using standard Na2CO3 solution.

2 Determination of alkalinity of a sample containing Na2CO3 and NaOH.

3 Determination of Mn+2 using standard oxalic acid solution.

4 Determination of ferrous iron using standard K2Cr2O7 solution.

5 Determination of Cu+2 using standard hypo solution.

6 Determination of temporary and permanent hardness of water using standard EDTA solution.

7 Determination of Fe+3 by a colorimetric method.

8 Determination of the concentration of acetic acid using sodium hydroxide (pH-metry method).

9 Determination of iso-electric point of amino acids using pH-metry method/conductometric method

10 Determination of the concentration of strong acid vs strong base (by

conductometric method).

11 Determination of strong acid vs strong base (by potentiometric method).

12 Determination of Mg+2 present in an antacid.

13 Determination of CaCO3 present in an egg shell.

14 Estimation of Vitamin C.

15 Determination of phosphoric content in soft drinks.

16 Adsorption of acetic acid by charcoal.

17 Preparation of nylon-6, 6 and Bakelite (demonstration only).

B.TECH II SEMESTER	ESC	L	T	P	C
		0	0	3	1.5

20ME2L07: ENGINEERING & IT WORKSHOP

Course Objective: To impart hands-on practice on basic engineering trades and skills.

Trade:

1. **Carpentry**
   a. T-Lap Joint
   b. Cross Lap Joint
   c. Dovetail Joint
   d. Mortise and Tenon Joint
2. **Fitting**
   a. Vee Fit
   b. Square Fit
   c. Half Round Fit
   d. Dovetail Fit
3. **House Wiring**
   a. Parallel / Series Connection of three bulbs
   b. Stair Case wiring
   c. Florescent Lamp Fitting
   d. Measurement of Earth Resistance
4. **TinSmithy**
   a. Taper Tray
   b. Square Box without lid
   c. Open Scoop
   d. Funnel
5. **Product prototyping using 3D Printing**
6. **IT Workshop**
   Task 1: Identification of the peripherals of a computer - Prepare a report containing the block diagram of the computer along with the configuration of each component and its functionality. Describe about various I/O Devices and its usage.

   Task 2: Practicing disassembling and assembling components of a PC

Note: At least two exercises to be done from each trade.

B.TECH II SEMESTER	**ESC**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

20ME2L08 **PROBLEM SOLVING THROUGH C LAB**

Course Objectives:

- Apply the principles of C language in problem solving.
- To design flowcharts, algorithms and knowing how to debug programs.
- To design & develop of C programs using arrays, strings pointers &functions.
- To review the file operations, pre processor commands.

Course Outcomes:

- Demonstrate Knowledge on various concepts of a C language.
- Able to draw flowcharts and write algorithms.
- Able design and development of C problem solving skills.
- Able to design and develop modular programming skills.
- Able to trace and debug a program

Exercise 1:

1. Write a C program to print a block F using hash (#), where the F has a height of six characters and width of five and four characters.
2. Write a C program to compute the perimeter and area of a rectangle with a height of 7 inches and width of 5inches.
3. Write a C program to display multiple variables.

Exercise 2:

1. Write a C program to calculate the distance between the two points.
2. Write a C program that accepts 4 integers p, q, r, s from the user where r and s are positive and p is even. If q is greater than r and s is greater than p and if the sum of r and s is greater than the sum of p and q print "Correct values", otherwise print "Wrong values".

Exercise 3:

1. Write a C program to convert a string to a long integer.
2. Write a program in C which is a Menu-Driven Program to compute

the area of the various geometrical shape.

3. Write a C program to calculate the factorial of a given number.

Exercise 4:

1. Write a program in C to display the n terms of even natural number and their sum.
2. Write a program in C to display the n terms of harmonic series and their sum. 1 + 1/2 + 1/3 + 1/4 + 1/5 ... 1/n terms.
3. Write a C program to check whether a given number is an Armstrong number or not.

Exercise 5:

1. Write a program in C to print all unique elements in an array.
2. Write a program in C to separate odd and even integers in separate arrays.
3. Write a program in C to sort elements of array in ascending order.

Exercise 6:

1. Write a program in C for multiplication of two square Matrices.
2. Write a program in C to find transpose of a given matrix.

Exercise 7:

1. Write a program in C to search an element in a row wise and column wise sorted matrix.
2. Write a program in C to print individual characters of string in reverse order.

Exercise 8:

1. Write a program in C to compare two strings without using string library functions.
2. Write a program in C to copy one string to another string.

Exercise 9:

1. Write a C Program to Store Information Using Structures with Dynamically Memory Allocation
2. Write a program in C to demonstrate how to handle the pointers in the program.

Exercise 10:

1. Write a program in C to demonstrate the use of & (address of) and *(value at address) operator.
2. Write a program in C to add two numbers using pointers.

Exercise 11:

1. Write a program in C to add numbers using call by reference.
2. Write a program in C to find the largest element using Dynamic Memory Allocation.

Exercise 12:

1. Write a program in C to swap elements using call by reference.
2. Write a program in C to count the number of vowels and consonants in a string using a pointer.

Exercise 13:

1. Write a program in C to show how a function returning pointer.
2. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using malloc( )function.

Exercise 14:

1. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using calloc( ) function. Understand the difference between the above two programs
2. Write a program in C to convert decimal number to binary number using the function.

Exercise 15:

1. Write a program in C to check whether a number is a prime number or not using function.
2. Write a program in C to get the largest element of an array using the function.

Exercise 16:

1. Write a program in C to append multiple lines at the end of a text file.
2. Write a program in C to copy a file in another name
3. Write a program in C to remove a file from the disk.

B.TECH II SEMESTER

MC	L	T	P	C
	2	-	-	-

20ME2M09 ENVIRONMENTAL SCIENCE

Course objective:

To understand the importance of Environment and the importance of biodiversity

Course outcomes:

- The importance of environment, Natural resources and current global environmental challenges for the sustenance of the life on planet earth.
- The concepts of the ecosystem and its function in the environment.
- 3.The biodiversity of India and the threats to biodiversity, and conservation practices to protect the biodiversity
- The various attributes of the pollution and their impacts and measures to reduce or control the pollution along with waste management practices.
- The environmental legislations of India and Social issues and the possible means
- Environmental assessment and the stages involved in EIA.

SYLLABUS

UNIT-I: MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

Introduction- Scope of Environmental Studies- Importance of Environmental Studies- Need for public awareness, Environmental ethics- Contemporary Environmentalists- Environmental Global moves: Stockholm conference, Earth summit

Concept of an ecosystem - Structure of an ecosystem- function of an ecosystem- Food chains, food webs- ecological pyramids- Energy flow in the ecosystem- Ecological succession- Nutrient cycling- 1^oproduction& 2^oproduction- Major ecosystems: Forest ecosystem- Grassland ecosystem, Desert ecosystem- Aquatic ecosystem: pond, Lake Ecosystem- Streams, river ecosystem, Oceans

UNIT-II: NATURAL RESOURCES AND CONSERVATION

Introduction and classification of natural resources-Forest resources**:** Use and over-exploitation- Deforestation-Timber extraction-Mining- Conservation-Water resources**:** Use and over utilization of surface and ground water,-Floods, drought, Dams and associated problems- Water conservation, rain water harvesting, water shed management-Energy resources**:** renewable energy sources –solar-wind-hydro-tidal- Ocean thermal-geo thermal-bio mass-bio gas-bio fuels- Hydrogen.- Non-renewable energy sources-coal-petroleum-natural gas-Nuclear energy

UNIT-III: **BIODIVERSITY AND ITS CONSERVATION**

Definition, classification- Value of biodiversity-Threats to biodiversity: habitat loss, man-wildlife conflicts- Endangered and endemic species of India-Conservation of biodiversity- Biodiversity at national and local levels, Hot-sports of biodiversity

UNIT-IV: ENVIRONMENTAL PROBLEMS

Global warming, Climate change- Acid rain, Ozone depletion- Air pollution-Water pollution- Soil pollution- Noise pollution, Nuclear hazards- Solid Waste Management: Causes, Consequences and Control methods- Solid Waste Management- Population growth and explosion, effects, control measures- Pollution case studies- Role of an individual in prevention of pollution

UNIT-V: ENVIRONMENTALLEGISLATION&MANAGEMENT

Sustainable development- Air (Prevention and Control of Pollution) Act-Drawbacks- Water (Prevention and control of Pollution) Act- Drawbacks-Wildlife Protection Act- Drawbacks- Forest Conservation Act- Drawbacks-Environmental Protection Act- Drawbacks- Environmental Impact Assessment and its significance- Preparation of Environmental Management Plan and Environmental Impact Statement- Ecotourism

TEXT BOOKS:

1. Environmental Studies, Anubha Kaushik, C P Kaushik, New Age Publications, New Delhi

2. Environmental Studies, K. V. S. G. Murali Krishna, VGS Publishers, Vijayawada

3. Environmental Studies, R. Rajagopalan, 2nd Edition, 2011, Oxford University Press.

4. Environmental Studies, P. N. Palanisamy, P. Manikandan, A. Geetha, and K. Manjula Rani; Pearson Education, Chennai

REFERENCES:

1. Text Book of Environmental Studies, Deeshita Dave & P. UdayaBhaskar, Cengage Learning.

2. A Textbook of Environmental Studies, Shaashi Chawla, TMH, New Delhi

3. Environmental Studies, Benny Joseph, Tata McGraw Hill Co, New Delhi

4. Perspectives in Environment Studies, AnubhaKaushik, C P Kaushik, New Delhi.

B.TECH III SEMESTER **BSC**

L	T	P	C
3	0	0	3

20ME3T01 **NUMERICAL METHODS AND VECTOR CALCULUS**

Pre-requisite: Linear Algebra and Differential Equations & Transformation Techniques

Course Objective: Objective of the course is to impart

- understand the basic numerical methods to solve simultaneous linear equations
- knowledge of numerical methods to solve ordinary differential equations
- the types of integration over the lines, surfaces & volumes

Course Outcomes:

At the end of the course, student will be able to

CO1: Determine the solution of transcendental equations by different numerical methods

CO2: Provide the interpolation techniques which analyze the data of an unknown function

CO3: Illustrate the numerical methods to determine solutions for a class of ordinary differential equations involving irregularly shaped boundaries

CO4: Evaluate areas and volumes using double & triple integrals

CO5: Apply the concepts of calculus to scalar and vector fields and establish the relation between line, surface and volume integrals.

SYLLABUS

UNIT-I: Numerical Solution of Equations:

Solution of Algebraic and transcendental equations: Bisection method, Method of false position and Newton-Raphson method. Iterative methods of solution of linear simultaneous equations: Jacobi's and Gauss-Seidel iteration methods.

UNIT-II: Interpolation:

Forward and backward, relation between these operators, Differences of a polynomial, Interpolation with unequal intervals: Lagrange's interpolation formula, Newton's forward & backward interpolation formulae & problems.

UNIT-III: Numerical Integration & Numerical Solutions of ordinary differential equations with initial conditions:

Numerical Integration: Trapezoidal rule, Simpson's 1/3rd and 3/8th rules.

Numerical Solution of ODE: Picard's method, Taylor's series method, Euler's method, Modified Euler's method, Runge-Kutta method of 4^{th} order.

UNIT-IV: Multiple Integrals:

Double integrals in Cartesian & polar coordinates, Change of order of integration, Triple integrals, Change of variables (Cartesian to Polar, Rectangular coordinates to Cylindrical & Rectangular coordinates to Spherical polar coordinate systems). **Applications:** Area enclosed by plane curves, Volume of solids.

UNIT-V: Vector Differentiation & Vector Integration:

Introduction, Scalar and Vector point functions, Del applied to scalar point functions-Gradient, directional derivatives, Del applied to vector point functions-Div& Curl, physical interpretation of div & curl, Del applied twice to point functions, Del applied to products of point functions (Identities without proofs).Line integral, Green's theorem in the plane (without proof), Surface integrals, Stoke's theorem (without proof), Volume integral, Gauss Divergence theorem (without proof).

Text Books:

B. S. GREWAL, Higher Engineering Mathematics, Khanna Publishers, 43rd Edition, 2014.

B. V. RAMANA, Higher Engineering Mathematics, Tata MC Graw Hill, 1st Edition, 2007.

Reference Books:

ERWIN KREYSZIG, Advanced Engineering Mathematics, John Wiley & Sons, 10th Edition, 2015.

N. P. BALI &Dr. MANISH GOYAL, A Text book of Engineering Mathematics, Lakshmi Publications, 9th Edition, 2014.

B.TECH III SEMESTER **PCC**

L	T	P	C
3	0	0	3

20ME3M02 MATERIAL SCIENCE & METALLURGY

SYLLABUS

UNIT – I

Structure of Metals and Constitution of alloys: Bonds in Solids, Crystal structure of metals, grains and grain boundaries, determination of grain size and effect of grain size on the mechanical properties of metal / alloys. Necessity of alloying, types of solid solutions, Hume Rothery's rules.

UNIT –II

Equilibrium Diagrams: Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, eutectic systems, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of important binary phase diagrams of Pb-Sn, Fe-Fe3C, Cu-Ni and Al-Cu.

UNIT –III

Cast Irons and Steels: Extraction of Iron, Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheroidal graphite cast iron, applications of cast irons. Classification of steels, structure and properties of plain carbon steels, Low alloy steels, Had field manganese steels, Maraging steels, tool and die steels.

UNIT – IV

Heat treatment of Alloys: Effect of alloying elements on Fe-Fe3C system, Annealing, normalizing, hardening, TTT diagrams, tempering, hardenability, surface - hardening methods, Age hardening treatment, Cryogenic treatment of alloys.

UNIT – VNon-ferrous Metals and Alloys: Structure and properties of Copper and its alloys, Aluminum and its alloys, Titanium and its alloys.

Ceramic Materials:

Crystalline ceramics, glasses, cermets, abrasive materials, nanomaterials– definition, properties and applications.

Composite Materials:

Classification of composites, methods to manufacture the composites, particle reinforced materials, fiber reinforced materials, metal ceramic mixtures, metal matrix composites and C – C composites.

Text Books:

1. Donald R. Askeland and WendelinJ.Wright, Essential of Materials Science and Engineering –Global Engineering Publisher, 4th edition, 2019.
2. Sidney H.Avner, Introduction to Physical Metallurgy- McGraw Hill Publishers, 2ndedition and 2017.

References:

1. Dr. V.D.Kodgire, Material Science and Metallurgy – Everest Publishers, 31st edition and2011.
2. Callister& Balasubramanian, Materials Science and engineering, Wiley Publications, 9thedition and 2015.
3. Traugott Fischer – Material Science for Engineering students –Elsevier Publisher and 2009.
4. V. Rahghavan, PHI Publisher - Material science and Engineering, 6th edition, and2015.
5. Yip-Wah Chung- Introduction to Material Science and Engineering, CRC Press, 1st edition and 2006
6. A V K Suryanarayana - Material Science and Metallurgy, B S Publications 1st edition and2014.
7. U. C. Jindal Material Science and Metallurgy – Pearson Publications, 1st edition and2011.
8. Vijendra Singh - Physical Metallurgy, Standard Publishers, 1st edition, and2005.

B.TECH III SEMESTER

	L	T	P	C
PCC	3	0	0	3

20ME3T03 PRODUCTION TECHNOLOGY

SYLLABUS

UNIT – I

CASTING: Steps involved in making a casting. Patterns – Types of patterns – Materials used for patterns, pattern allowances, Gating ratio and design of Gating systems. Risers – Types, function and design, casting design considerations. Gases in metals. Solidifications. General defects in castings. Basic principles and applications of Centrifugal casting, Die casting and Investment casting-advantages, disadvantages and applications.

UNIT – II

WELDING: Classification of welding processes, types of welded joints and their characteristics, Gas welding, Different types of flames and uses, Oxy – Acetylene Gas cutting. Basic principles of Arc welding, Manual metal arc welding, Submerged arc welding, Inert Gas welding- TIG & MIG welding- advantages, disadvantages and applications. Welding defects – causes and remedies – destructive and non-destructive testing of welds. Introduction to brazing & soldering.

UNIT – III

METAL FORMING: Hot working and Cold working, Strain hardening and Annealing. Bulk forming processes: Forging - Smith forging, Drop Forging, Roll forging, Forging hammers, Rotary forging, forging defects; Rolling – fundamentals, types of rolling mills and products, Forces in rolling and power requirements. Extrusion and its characteristics. Types of extrusion, Impact extrusion, Hydrostatic extrusion; Wire drawing and Tube drawing. Introduction to powder metallurgy – compaction and sintering, advantages and applications.

UNIT – IV

SHEET METAL FORMING: - Blanking and piercing, Forces and power requirement in these operations, Deep drawing, Stretch forming, Bending, Spring back and its remedies, Coining, Spinning, Types of presses and press tools. High energy rate forming processes: Principles of explosive forming, electromagnetic forming, Electrohydraulic forming, rubber pad forming, advantages and limitations.

UNIT – V

Plastics and Polymers: Introduction, Types of plastics and Composites based on plastics.

Processing of Plastics:

Thermoplastics: Blow and Injection molding**,**

Thermosets: Liquid Molding Process, Reaction injection molding, Resin transfer molding

Text Books:

1. P.N. Rao, Manufacturing Technology -Vol I- 1st edition, Tata McGraw Hill Education and 2013

2. Mikell P. Groover. Fundamentals of Modern Manufacturing Materials, Processes, and Systems -John Wiley publications, 4th edition and 2010.

References:

1. A.Ghosh& A.K.Malik – Manufacturing Science - East West Press Pvt. Ltd, 2nd edition and 2010.

2. Allyn and Bacon - Process and materials of manufacture- PHI publisher, 4th Edition, 1990.

3. R.K. Jain - Production Technology, Khanna Publisher 1st edition and 2015.

4. P C Sharma- Production Technology - S. Chand, 1st edition and 2006.

5. H.S. Shaun - Manufacturing Processes- Pearson publication, 1st edition and 2012.

6. J.P. Kaushish - Manufacturing Processes- PHI publication, 1st edition and 2010.

		L	T	P	C
B.TECH III SEMESTER	**PCC**	**3**	**0**	**0**	**3**

20ME3T04 MECHANICS OF SOLIDS

SYLLABUS

UNIT – I

STRESSES & STRAINS : Elasticity and plasticity – Types of stresses & strains–Hooke's law – stress-straindiagramformildsteel–Workingstress–Factorofsafety–Lateralstrain,Poisson'sratio & volumetric strain, Relation between elastic constants – Bars of varying section – composite bars – Temperature stresses- Compound Stresses - Principal planes and principal stresses - Mohr's circle, Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

UNIT – II

SHEAR FORCE AND BENDING MOMENT: Definition of beam – Types of beams and loads – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, u.d.l, uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT – III

FLEXURALSTRESSES: Theory of simple bending–Assumptions–Derivation of bending equation: M/ I = f/y = E/R, Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections – Design of simple beam sections.

SHEAR STRESSES: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T angle sections.

UNIT – IV

DEFLECTION OF BEAMS : Differential equations of the deflection curve, Slope and deflection using double integration method, Macaulay's method and Moment area method for simply supported, cantilever and overhanging beams. Statically Indeterminate Beams and solution methods.

TORSION: Introduction-Derivation of torsion equation- Torsion of Circular shafts- Pure Shear- Transmission of power by circular shafts, Shafts in series, Shafts in parallel.

UNIT – V

THIN CYLINDERS: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in dia, and volume of thin cylinders – Riveted boiler shells – Thin spherical shells.

THICK CYLINDERS: –lame's equation – cylinders subjected to inside & outside pressures – compound cylinders.

COLUMNS: Buckling and Stability, Columns with Pinned ends, Columns with other support Conditions, Limitations of Euler's Formula, Rankine's Formula.

Text Books:

1. GH Ryder, Strength of materials, 3/e, Mc Millan publishers India Ltd.,1983.
2. Popov, Mechanics of Solids, 2/e, New Pearson Education,2015.

References:

1. U.C Jindal, Strength of Materials, Pearson Education,2012.
2. Junnarkar S. B, Mechanics of Structures, Vol-III Charotar,1974.
3. SS Rattan, Strength of materials, 3/e, Tata McGraw-Hill,2016.
4. Andrew Pytel, Ferdinand Leon Singer, Strength of Materials, 4/e, Harper & Row,2007.

B.TECH III SEMESTER PCC

L	T	P	C
3	0	0	3

20ME3T05 FLUID MECHANICS AND HYDRAULIC MACHINES

SYLLABUS

UNIT – I

FLUID STATICS: Definition of fluid, continuum, dimensions and units, properties of fluids – specific gravity, viscosity and its significance, compressibility, surface tension, capillarity, vapor pressure and manometry, Pascal's law, hydrostatic law.

BUOYANCY AND FLOATATION: Meta center, stability of floating body. Submerged bodies. Calculation of metacenter height. Stability analysis and applications.

FLUID KINEMATICS: Methods of Analysis- System and control volume, Classification of flows-steady and unsteady, uniform and non-uniform, laminar and turbulent, rotational and irrotational, viscous and inviscid, internal and external flows, Continuity equation. Kinematics-stream tube, stream function, circulation and vorticity, stream function and potential function, condition for irrotational flow.

UNIT-II

FLUID DYNAMICS: Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its applications- force on pipe bend, Measurement of flow - Venturimeter, Orificemeter and pitot tube, stagnation properties.

CLOSED CONDUIT FLOW: Reynolds's experiment – Darcy-Weisbach equation – minor losses in pipes – pipes in series and pipes in parallel – total energy line – hydraulic gradient line.

UNIT-III

BOUNDARY LAYER THEORY: concept of boundary layer, displacement, momentum and energy thickness, separation of boundary layer.

DIMENSIONAL ANALYSIS: Fundamental and derived dimensions, Rayleigh method, Buckingham theorem, dimensionless groups, application of dimensional groups, model testing and similitude, types of similarity- geometric, kinematic and dynamic.

UNIT-IV : IMPACT OF JETS: Impulse momentum equation, Hydrodynamic force of jet striking stationary and moving-vanes, flat and curved vanes, centrally and tangentially, series of vanes, radial vanes, velocity triangles, work done and efficiency

HYDRAULIC TURBINES: Classification of hydraulic turbines- Impulse and Reaction turbines, Pelton, Francis and Kaplan turbines, working principles, draft tube– theory and its functions, Unit and specific quantities, performance curves.

UNIT-V

ROTODYNAMIC PUMPS: Classification – mixed, axial, construction, principle and application.

CENTRIFUGAL PUMPS- Classification, working principle, work done by impeller, specific speed, performance characteristic curves, Cavitation & NPSH.

POSITIVE DISPLACEMENT PUMPS: Working - gear pump, vane pump, rotary piston pump,

RECIPROCATING PUMP - Working, Slip, Indicator diagrams, Air vessels.

TEXT BOOKS

1 Dr. P.N. Modi & Dr.S.M. Seth, Hydraulics & Fluid Mechanics Including Hydraulics Machines, Rajsons Publ, 21stEd.,2017.

2 R. K. Bansal, Fluid Mechanics and Hydraulic Machines, Laxmi Publ.,10th Ed.,2018.

REFERENCES BOOKS

1 R.K. Rajput, Fluid Mechanics and Hydraulic Machines, S. Chand Publ., 6thEd.,2015.

2 D. Ramadurgaiah, Fluid Mechanics and Machinery, New-age International, 1st Ed.,2002.

3 T.R. Banga& S.C. Sharma, Fluid Mechanics & Hydraulic Machines, Khanna Publ.,16th Ed.,2016.

4 V.M. Domkundwar&A.V. Domkundwar, Fluid Mechanics and Hydraulic Machines, DhanpatRai& Co.2014.

B.TECH III SEMESTER

PCC	L	T	P	C
	0	0	3	1.5

20ME3L06 PRODUCTION TECHNOLOGY LAB

LIST OF EXPERIMENTS

(Minimum of 12 Exercises need to be performed)

I. METAL CASTING:

1. Pattern Design and making - for one casting drawing.
2. Sand properties testing - for strength and permeability.
3. Mould preparation, Melting and Casting.

II WELDING:

1. Gas welding
2. Gas cutting
3. Manual metal arc welding - Lap & Butt Joints
4. TIG/MIG Welding
5. Resistance Spot Welding
6. Brazing and soldering

III METAL FORMING:

1. Blanking & Piercing operations.
2. Perform V-bending operation using hydraulic press.

IV PROCESSING OF PLASTICS

1. Injection Moulding
2. Blow Moulding

B.TECH III SEMESTER

PCC	L	T	P	C
	0	0	3	1.5

20ME3L07 FLUID MECHANICS AND HYDRAULIC MACHINES LAB

LIST OF EXPERIMENTS

1. Experimental Verification of Bernoulli's Theorem.
2. Calibration of Venturimeter.
3. Calibration of Orific emeter.
4. Determination of friction factor for a given pipeline.
5. Determination of loss of head due to sudden contraction in a pipeline.
6. Turbine flow meter.
7. Impact of jets on Vanes.
8. Performance Test on Pelton Wheel.
9. Performance Test on Francis Turbine.
10. Performance Test on Single Stage Centrifugal Pump.
11. Performance Test on Multi Stage Centrifugal Pump.
12. Performance Test on Reciprocating Pump.

B.TECH III SEMESTER

PCC	L	T	P	C
	0	0	3	1.5

20ME3L08 MECHANICS OF SOLIDS & METALLURGY LAB

LIST OF EXPERIMENTS

NOTE: Any 6 experiments from each section A and B.

(A) MECHNICS OF SOLIDSLAB:

1. Direct tension test
2. Bending test on
   a) Simple supported beam
   b) Cantilever beam
3. Torsion test
4. Hardness tests
   a) Brinells hardness test
   b) Rockwell hardness test
5. Test on springs
6. Compression test on cube
7. Impact test
8. Punch shear test

(B) METALLURGYLAB:

1. Preparation and study of the Micro Structure of pure metals like Iron, Cu and Al.
2. Preparation and study of the Microstructure of Mild steels, low carbon steels, high – C steels.
3. Study of the Micro Structures of Cast Irons.
4. Study of the Micro Structures of Non-Ferrous alloys.
5. Study of the Micro structures of Heat treated steels.
6. Hardenability of steels by Jominy End Quench Test.
7. To find out the hardness of various treated and untreated steels.

B.TECH III SEMESTER

SC	L	T	P	C
	0	0	4	2

20ME3S09 **COMPUTER AIDED DRAFTING AND MODELING LAB (Skill Oriented Course)**

SYLLABUS

UNIT-1

Definition of Design, Steps in conventional design. CAD, Geometric Definition of Design, Steps in conventional design. CAD, Geometric modeling, types of geometric models: 2D, 2.5D, 3D.

Techniques to create geometric models: wireframe, surface and solid modeling techniques.

UNIT-2

Menus and toolbars in AutoCAD, Coordinate systems to specify a point in AutoCAD, Drawing Basic Geometric Shapes (entities) in AutoCAD, Using Modify Commands

UNIT-3

Sectional views: types, cutting plane line, section lines, Hatching and Gradients, Dimensioning: elements, types, systems, Dimension edit

Tolerance: Limits, fits, tolerances, Fits, and its types, Bill of materials (BoM)

UNIT-4

Concept of Projections: Orthographic, Isometric, Oblique, and Perspective projections, First angle projection and third angle projection, Examples of converting isometric view into orthographic views, Layers for various features of part drawings, Isometric Drawings: in a 2D plane

Isometric Drawings: in 3D plane (3D wireframe modeling, Plotting and Publishing)

Surface modeling: Plane surface, Tabulated surface, Ruled surface, Revolved surface, Lofted surface, Sweep

2.5D Solid modeling using Extrude, Sweep, Revolve, Loft

UNIT-5 3D Solid Modeling- Primitives, Boolean Operations. Constructive Solid Geometry/Primitive instancing (CSG), 3D Solid Modeling exercise using CSG, Advanced Drafting, Mechanical Features

B.TECH IV SEMESTER	BSC	L	T	P	C
		3	0	0	3

20ME4T01: COMPLEX VARIABLES AND STATISTICAL METHODS

Pre-requisite: Basic knowledge about Calculus and Probability

Course Objective: Objective of the course is to impart

- basic understanding of complex variable theory
- description of sampling distribution of means, proportions & variances
- testing the hypothesis concerning means, proportions & variances

Course Outcomes:

S. No.	At the end of the course, student will be able to
CO 1:	Determine analytic and non-analytic functions
CO 2:	Analyze the analytic function into a power series which is useful in the study of communication systems.
CO 3:	Understand random variables and probability distributions
CO 4:	Apply different distributions to compute confidence intervals
CO 5:	Test the hypothesis concerning means and proportions

SYLLABUS

UNIT-I: Analytic Functions:

Introduction, Complex function, Limit and continuity of a complex function, Derivative of f(z), Analytic functions, Harmonic functions & orthogonal system, finding analytic functions by Milne-Thomson method. Applications to flow problems.

UNIT-II: Complex Integration and Residues: (all theorems without proofs)

Complex integration, Cauchy's theorem and Cauchy's integral formula, Series of complex terms, Taylor's series and Laurent's series. Zeros and singularities of an analytic function, Residues and Cauchy-Residue theorem. Evaluation of real definite integrals using contour integration about unit circle.

UNIT-III: Random variables and distributions:

Introduction-Discrete & Continuous Random variable - Distribution functions.

Binomial, Poisson distributions. Continuous distribution: Normal distributions, Normal approximation to Binomial distribution.

UNIT-IV: Sampling Theory:

Introduction - Population and samples- Sampling distribution of means (s known)- Central limit theorem- t-distribution- Sampling distribution of means (s unknown)- Sampling distribution of variances - Point estimation- Maximum error of estimate - Interval estimation.

UNIT-V: Tests of Hypothesis:

Introduction –Hypothesis-Null and Alternative Hypothesis- Type I and Type II errors – Level of significance - One tail and two-tail tests- Tests concerning one mean and proportion, two means- Proportions and their differences.

Text Books:

1. **B. S. GREWAL,** Higher Engineering Mathematics, Khanna Publishers, 43rd Edition, 2014.
2. **Richards A Johnson, Irvin Miller and Johnson E Freund**. Probability and Statistics for Engineering, 9th Edition, PHI.

Reference Books:

3. **N. P. BALI & Dr. MANISH GOYAL,** A Text book of Engineering Mathematics, Lakshmi Publications, 9th Edition, 2014.
4. **Jay l. Devore,** Probability and Statistics for Engineering and the Sciences, 8thedition, Cengage Publshers.

B.TECH IV SEMESTER **PCC**

L	T	P	C
3	0	0	3

20ME4T02 DESIGN OF MACHINE ELEMENTS

SYLLABUS

Unit I

Mechanical Engineering Design: Design process, design considerations, codes and standards of designation of materials, selection of materials, preferred numbers.

Design for Static Loads: Modes of failure, Factor of safety, design of components subjected to axial, bending, torsional and impact loads. Design for Theories of failure for static loads.

Unit II

Design for Dynamic Loads: Stress concentration, Types of fluctuating stresses, Endurance limit, Notch sensitivity, fatigue strength under axial, bending and torsion, fatigue design for infinite life. Fatigue theories of failure, Soderberg, Goodman and modified Goodman criterion for fatigue failure. Fatigue design under combined stresses.

Unit III

Design of Bolted Joints: Threaded fasteners, preload of bolts, various stresses induced in the bolts. Torque requirement for bolt tightening, eccentrically loaded bolted joints, gasketed joints.

Riveted Joints: Design of lap, butt and eccentrically loaded joints, failure and efficiency of riveted joints.

Welded Joints: Strength of lap and butt welds, eccentrically loaded welded joints. Joint is subjected to bending and torsion.

Unit IV

Design of Cotters and Knuckle Joints: cotter joints-spigot and socket, sleeve and cotter, jib and cotter joints-knuckle joints.

Power Transmission Shafts: Design of shafts subjected to bending, torsion and axial loading. Shafts subjected to fluctuating loads using shock factors. Shaft design on torsional rigidity basis.

Unit V

Keys: Function, types, design of sunk, saddle, Kennedy and Woodruff keys.

Couplings: Design of rigid, flange and bushed pin couplings, universal coupling.

Springs: Design of helical compression, tension, torsion springs. Design against fluctuating loads, concentric springs and leaf springs.

Text Book(s)

1. V.B.Bhandari, Design of Machine Elements, Tata McGraw Hill, 3/e, 2010.
2. J.E. Shigley, Mechanical Engineering Design, Tata McGraw Hill, 2/e, 1986.

References

1. R.L. Norton, Machine Design an Integrated approach, 2/e, Pearson Education,2004.
2. R.K. Jain, Machine Design, Khanna Publications,1978.
3. M.F.SpottsandT.E.Shoup, Design of Machine Elements, 3/e, Prentice Hall (Pearson Education),2013.
4. Data book

Note: Design data book is permitted.

B.TECH IV SEMESTER	**PCC**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

20ME4T03 **INTERNAL COMBUSTION ENGINES & AIR COMPRESSORS**

SYLLABUS

UNIT – I

I.C. Engines: Classification - Working principles, Valve and Port Timing Diagrams, - Engine systems, Fuel, Carburetor, Fuel Injection System, Ignition, Cooling and Lubrication, principle of Wankle engine, Principles of supercharging and turbo charging.

Actual Cycles and their Analysis: Introduction, Comparison of Air Standard and Actual Cycles, Time Loss Factor, Heat Loss Factor, Exhaust Blow down-Loss due to Gas exchange process, Volumetric Efficiency. Loss due to Rubbing Friction, Actual and Fuel-Air Cycles of CI Engines.

UNIT – II

Combustion in S.I. Engines: Normal Combustion and abnormal combustion – Importance of flame speed and effect of engine variables – Types of Abnormal combustion, pre-ignition and knocking (explanation of) – Fuel requirements and fuel rating, antiknock additives – combustion chamber – requirements, types.

Combustion in C.I. Engines: Four stages of combustion – Delay period and its importance – Effect of engine variables – Diesel Knock– open and divided combustion chambers and nozzles used – fuel requirements and fuel rating.

UNIT – III

Measurement, Testing and Performance: Parameters of performance - measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – Determination of frictional losses and indicated power – Performance test – Heat balance sheet and chart.

UNIT – IV

Compressors: Classification – positive displacement and roto dynamic machinery – Power producing and power is absorbing machines, fan, blower and compressor.

Reciprocating Compressor: Principle of operation, work required Isothermal efficiency, volumetric efficiency and effect of clearance, multi stage compression, under cooling, minimum work condition for two stage compression.

UNIT V

Rotary (Positive displacement type): Roots Blower, vane sealed compressor, Lysholm compressor – Mechanical details and principle of working – efficiency considerations.

Dynamic Compressors: Centrifugal compressors: Mechanical details and principle of operation – velocity and pressure variation. Slip factor, power input factor, pressure coefficient and adiabatic coefficient.

Axial Flow Compressors: Mechanical details and principle of operation and degree of reaction, work done factor - isentropic efficiency– Polytropic efficiency.

Text Books:

1. V. Ganesan, Internal Combustion Engines, Tata McGraw Hill, 4th Ed.,2017.

2. John B. Heywood, Internal Combustion Engine Fundamentals, McGraw-Hill, 2nd Ed.,2018.

References:

1. R.K. Rajput, Thermal Engineering, Lakshmi Publications, 8th Ed., 2010

2. M.L. Mathur& R.P. Sharma, Internal Combustion Engines, Dhanpath Rai & Sons Publications.

3. R.S. Khurmi & J.S. Gupta, Thermal Engineering, S. Chand Publications, 15th Ed.,2015.

B.TECH IV SEMESTER **PCC**

L	T	P	C
3	0	0	3

20ME4T04 KINEMATICS OF MACHINERY

UNIT – I

MECHANISMS : Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematic pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully constrained and incompletely constrained. Grublers criterion, Grashoff's law, Degrees of freedom, Kutzbach criterion for planar mechanisms, Mechanism and machines – classification of machines – kinematic chain – inversion of mechanism– inversion of mechanism – inversions of quadric cycle, chain – single and double slider crank chains.

UNIT – II

LOWER PAIR MECHANISM: Exact and approximate copiers and generated types – Peaucellier, Hart and Scott Russel – Grasshopper – Watt T. Chebicheff and Robert Mechanisms and straight line motion, Pantograph. Conditions for correct steering – Davis Steering gear, Ackermans steering gear – velocity ratio; Hooke's Joint: Single and double – Universal coupling– application–problems.

UNIT – III

KINEMATICS: Velocity and acceleration – Motion of a link in machine – Determination of Velocity and acceleration diagrams – Graphical method – Application of relative velocity method four bar chain. Velocity and acceleration analysis of for a given mechanism, Kleins construction, Coriolis acceleration, determination of Coriolis component of acceleration.

Plane motion of body: Instantaneous centre of rotation, centroids and axodes – relative motion between two bodies – Three centres in line theorem – Graphical determination of instantaneous centre, diagrams for simple mechanisms and determination of angular velocity of points and links.

UNIT – IV

CAMS: Definitions of cam and followers – their uses – Types of followers and cams – Terminology –Types of follower motion: Uniform velocity, Simple harmonic motion and uniform acceleration and retardation. Maximum velocity and maximum acceleration during outward and return strokes in the above 3 cases. Analysis of motion of followers: Roller follower – circular cam with straight, concave and convex flanks.

Power Transmissions: Introduction, Belt and rope drives, selection of belt drive- types of belt drives, V-belts, materials used for belt and rope drives, velocity ratio of belt drives, slip of belt, creep of belt, tensions for flat belt drive, angle of contact, centrifugal tension, maximum tension of belt, Chains- length, angular speed ratio, classification of chains.

UNIT – V

GEARS: Higher pairs, friction wheels and toothed gears–types – law of gearing, condition for constant velocity ratio for transmission of motion, Form of teeth: cycloidal and involute profiles. Velocity of sliding – phenomena of interferences – Methods of interference. Condition for minimum number of teeth to avoid interference, expressions for arc of contact and path of contact – Introduction to Helical, Bevel and worm gearing.

GEAR TRAINS: Introduction to gear Trains, Train value, Types – Simple and reverted wheel train – Epicyclic gear Train. Methods of finding train value or velocity ratio – Epicyclic gear trains. Selection of gear box-Differential gear for an automobile.

Text Books:

1. A.Ghosh & A.K.Malik , Theory of Mechanisms and machines, 4/e, East West Press Pvt. Ltd,2011

2. S.S.Rattan , Theory of Machines, 4/e, Tata Mc-Graw Hill, 2014

3. J.J Uicker, G.R.Pennock&J.E.Shigley, Theory of machines and Mechanisms –3/e Oxford publishers,2009.

References:

1. J.E.Shigley, Theory of Machines and Mechanisms, 4/e, Oxford, 2014

2. P.L.Ballaney, Theory of Machines & Mechanisms, 25/e, Khanna Publishers,Delhi, 2003

3. Ashok G. Ambekar, Mechanism and Machine Theory 1/e PHI Publishers,2007.

4. Bevan (Author), The Theory of Machines, 3/e Paperback,2009

5. J.S. Rao, Kinematics of Machinery through Hyper Works, 18 volume, Springer Publ,2001

6. Vickers, Theory of machines and Machinery, 4/e, Oxford 2014

B.TECH IV SEMESTER		**HSMC**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
20ME4T05	**MANAGERIAL ECONOMICS & FINANCIAL ANALYSIS**					

Course Objectives:

- The Learning objectives of this paper are to understand the concept and nature of Managerial Economics and its relationship with other disciplines and also to understand the Concept of Demand and Demand forecasting
- To familiarize about the Production function, Input Output relationship, Cost-Output relationship and Cost-Volume-Profit Analysis
- To understand the nature of markets, Methods of Pricing in the different market structures and to know the different forms of Business organization and the concept of Business Cycles
- To learn different Accounting Systems, preparation of Financial Statement and uses of different tools for performance evaluation
- Finally, it is also to understand the concept of Capital, Capital Budgeting and the techniques used to evaluate Capital Budgeting proposals

Course Outcomes:

CO1: The Learner is equipped with the knowledge of estimating the Demand and demand elasticity's for a product

CO2: The knowledge of understanding of the Input-Output-Cost relationships and estimation of the least cost combination of inputs

CO3: The pupil is also ready to understand the nature of different markets and Price Output determination under various market conditions and also to have the knowledge of different Business Units

CO4: The Learner is able to prepare Financial Statements and the usage of various Accounting tools for Analysis

CO5: The Learner can able to evaluate various investment project proposals with the help of capital budgeting techniques for decision making

SYLLABUS

UNIT I

Introduction to Managerial Economics and demand Analysis: Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other subjects –Concept of Demand, Types of Demand, Determinants of Demand-Demand schedule, Demand curve, Law of Demand and its limitations- Elasticity of

Demand, Types of Elasticity of Demand and Measurement Demand forecasting and Methods of forecasting, Concept of Supply and Law of Supply.

UNIT II

Theories of Production and Cost Analyses: Theories of Production function- Law of Variable proportions-Isoquants and Isocosts and choice of least cost factor combination-Concepts of Returns to scale and Economies of scale-Different cost concepts: opportunity costs, explicit and implicit costs-Fixed costs, Variable Costs and Total costs –Cost –Volume-Profit analysis-Determination of Breakeven point(problems)-Managerial significance and limitations of Breakeven point.

UNIT III

Introduction to Markets, Theories of the Firm & Pricing Policies: Market Structures: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly – Features – Price and Output Determination – Managerial Theories of firm: Marris and Williamson's models – other Methods of Pricing: Average cost pricing, Limit Pricing, Market Skimming Pricing, Internet Pricing: (Flat Rate Pricing, Usage sensitive pricing) and Priority Pricing, Business Cycles : Meaning and Features – Phases of a Business Cycle. Features and Evaluation of Sole Trader, Partnership, Joint Stock Company – State/Public Enterprises and their forms.

UNIT IV

Introduction to Accounting & Financing Analysis: Introduction to Double Entry System, Journal, Ledger, Trail Balance and Preparation of Final Accounts with adjustments – Preparation of Financial Statements-Analysis and Interpretation of Financial Statements-Ratio Analysis – Preparation of Funds flow and cash flow analysis (Problems)

UNIT V

Capital and Capital Budgeting: Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Time value of money- Methods of appraising Project profitability: Traditional Methods(payback period, accounting rate of return) and modern methods(Discounted cash flow method, Net Present Value method, Internal Rate of Return Method and Profitability Index)

Text Books:

1) A R Aryasri, Managerial Economics and Financial Analysis, The McGraw – Hill companies.

Reference Books:

1) Varshney R.L, K.L Maheswari, Managerial Economics, S. Chand & Company Ltd.

2) JL Pappas and EF Brigham, Managerial Economics, Holt, R & W; New edition edition

3) N.P Srinivasn and M. SakthivelMurugan, Accounting for Management, S. Chand & Company Ltd.

4) MaheswariS.N,AnIntroduction to Accountancy, Vikas Publishing House Pvt Ltd

5) I.M Pandey, Financial Management , Vikas Publishing House Pvt Ltd

6) V. Maheswari, Managerial Economics, S. Chand & Company Ltd.

B.TECH IV SEMESTER **PCC**

L	T	P	C
0	0	3	1.5

20ME4L06 **PROFICIENCY THROUGH READING AND WRITING LAB**

Unit I Vocabulary Building

1.1 The concept of word formation

1.2. Root words from foreign languages and their use in English

1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives

1.4 Synonyms, antonyms, and standard abbreviations

Unit II Writing Skills

2.1 Organizing principles of paragraphs in documents

2.2 Creative writing

2.3 Essay writing

Unit III Identifying Common Errors in Writing

3.1 Subject-verb agreement

3.2 Noun-pronoun agreement

3.3 Misplaced modifiers

3.4 Articles

3.5 Prepositions

3.6 Redundancies

3.7 Clichés

Unit IV Comprehension

4.1 Scanning

4.2 Skimming

4.3 Identifying the main ideas

Unit V Reading for Pleasure

5.1 Review of an autobiography/biography

5.2 Review of a novel

5.3 Review of a self help book

Suggested Readings:

1. Practical English Usage. Michael Swan. OUP. 1995.
2. Remedial English Grammar. F.T. Wood. Macmillan.2007.
3. On Writing Well. William Zinsser. Harper Resource Book. 2001.
4. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
5. Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.

B.TECH IV SEMESTER	PCC	L	T	P	C
		0	0	3	1.5

20ME4T07 COMPUTER AIDED MACHINE DRAWING

The following contents are to be done by any 2D CAD software package

Conventional representation of materials and components:

Detachable joints: Drawing of thread profiles, hexagonal and square-headed bolts and nuts, bolted joint, bolted joint with washer and locknut, stud joint, screw joint.

Riveted joints: Drawing of rivet, lap joint, butt joint with single strap, single riveted, double riveted double strap joints.

Welded joints: Lap joint and T joint with fillet, butt joint with conventions.

Keys: Taper key, sunk taper key, round key, saddle key, feather key, woodruff key. Shaft coupling, bushed pin-type flange coupling, universal coupling, Oldhams' coupling.

The following contents to be done by any 3D CAD software package Sectional views

Creating solid models of complex machine parts and create sectional views.

Assembly drawings: (Any four of the following using solid model software)

Lathetoolpost,toolheadofshapingmachine,tailstock,machinevice,gatevalve,car burettor,piston,

connectingrod,eccentric,screwjack,plumberblock,axlebearing,pipevice,clampi ngdevice,Geneva cam, universal coupling.

Manufacturing drawing:

Representation of limits, fits and tolerances for mating parts. Use any four parts of above assembly drawings and prepare manufacturing drawing with dimensional and geometric tolerances.

Text Books:

1. K.L.Narayana, P.Kannaiah, A text book on Machine Drawing, SciTech Publications,2014

Reference Books:

1. Cecil Jensen, Jay Helsel and Donald D.Voisinet, Computer Aided Engineering Drawing, Tata Mcgraw-Hill, NY,2000.

2. James Barclay, Brain Griffiths, Engineering Drawing for Manufacture, Kogan Page Science, 2003.
3. N.D.Bhatt, Machine Drawing, Charotar, 50/e,2014.
4. K.L.Narayana, Production Drawing, NewAge International Publishers, 3/e,2014

B.TECH IV SEMESTER	PCC	L	T	P	C
		0	0	3	1.5

20ME4T08 THERMAL ENGINEERING LAB

LIST OF EXPERIMENTS

1. I.C. Engines valve / Port timing diagrams.
2. I.C. Engines performance test and Exhaust emission measurements (4 - stroke diesel engine).
3. I.C. Engines performance test and Exhaust emission measurements (2- stroke petrol engine).
4. Evaluation of engine friction by conducting Morse test on 4-stroke multi cylinder petrol engine.
5. Determination of FP by retardation and motoring test on IC engine.
6. I.C. Engines heat balance at different loads and show the heat distribution curve.
7. Performance test on variable compression ratio engines.
8. Performance test on reciprocating air compressor unit.
9. Performance Test on Refrigeration Tutor.
10. Economical speed test of an IC engine.
11. Disassembly/assembly of Engines.
12. Study of boilers, mountings and accessories.

B.TECH IV SEMESTER	SC	L	T	P	C
		0	0	4	2

20ME4S09 **PROGRAMMING THROUGH MATLAB (Skill Oriented Course)**

The Structure of this Skill Course is divided into three modules under Matlab environment. With these additional skills, The student can get through knowledge in Matlab. By its nature, the presentation on MATLAB and its Toolboxes in this course cover all the background and details necessary for a complete understanding of MATLAB. The limited objective of the presentation here is to give enough information to enable the reader to apply MATLAB to the analysis and design problems covered in this course For further details, the readers are referred to extensive documentation, in both printed and online format, provided by the Math Works Inc

Objectives:

- Introduction to MATLAB family of programs
- Brief introduction to MATLAB base program in an interactive "hands on" tutorial style
- At the end of the day, our most important goal is that you gain useful computational skills that are applicable to your field of study. Advances in computing have revolutionized science and engineering in the past couple decades. hope will enable you to harness this computational power and help you accomplish great things in your career

Module 1

1 Introduction to MATLAB
2 Visualization and Programming
3 Solving Equations, Curve Fitting, and Numerical Techniques
4 Advanced Programming (iterations, Fibonacci series calendars and clocks, Google page rank, Game of life, Sudoku)
5 Various Functions and Toolboxes

Module 2

1 Introduction to Simulink

2 Analysis of Linear and Non linear Systems

3 Plotting of Specific Functional systems with Simulink

4 Basic Functional Units in Communication Systems

5 Control Systems analysis in time and frequency

Module 3

1 Optimum Statistical Parameters

2 Curve Fitting And Regression

3 Basic Neural Networks for computations

4 Vibrations and Dynamics

5 Kinematics Simulators

B.TECH IV SEMESTER

	L	T	P	C
MC	2	0	0	-

20ME4M10 CONSTITUTION OF INDIA

Course Objectives:

- To Enable the student to understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and election commission of India.
- To understand the central and state relation financial and administrative

Course Outcomes:

At the end of the course, the student will be able to have a clear knowledge on the following:

CO1: Understand historical background of the constitution making, importance for building a democratic India, features and principles of Indian Constitution.

CO2: Understand the functioning of three wings of the government ie., executive, legislative and judiciary.

CO3: Understand the roles and powers of State Government and its Administration and value of the fundamental rights and duties for becoming good citizen of India.

CO4: Understand and analyze the decentralization of power between Union, State and Local self-Government and local administration.

CO5: Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission, UPSC, Welfare commissions for sustaining democracy.

SYLLABUS

UNIT I

Introduction to Indian Constitution: Constitution meaning of the term, Indian Constitution -Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

UNIT II

Union Government and its Administration Structure of the Indian Union: Federalism, CentreState relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, LokSabha, Rajya Sabha, The

Supreme Court and High Court: Powers and Functions;

UNIT III

State Government and its Administration Governor, Role and Position, CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

UNIT IV

A.Local Administration, District's Administration Head, Role and Importance, Municipalities, Mayor and role of Elected Representative, CEO of Municipal Corporation PachayatiRaj: Functions PRI: ZilaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Block level Organizational Hierarchy(Different departments),

Village level, Role of Elected and Appointed officials, Importance of grass root democracy

UNIT V

Election Commission: Election Commission, Role of Chief Election Commissioner and Election Commissionerate State Election Commission:, Functions of Commissions for the welfare of SC/ST/OBC and women

References:

1) Durga Das Basu, Introduction to the Constitution of India, Prentice Hall of India Pvt. Ltd.

2) Subash Kashyap, Indian Constitution, National Book Trust

3) J.A. Siwach, Dynamics of Indian Government & Politics

4) D.C. Gupta, Indian Government and Politics

5) H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)

6) J.C. Johari, Indian Government and Politics Hans

7) J. Raj Indian Government and Politics

8) M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd.. New Delhi

9) Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012

E-sources:

1) nptel.ac.in/courses/109104074/8

2) nptel.ac.in/courses/109104045/

3) nptel.ac.in/courses/101104065/

4) www.hss.iitb.ac.in/en/lecture-details

5)www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution

B.TECH V SEMESTER	PCC	L	T	P	C
		3	0	0	3

20ME5T01 DYNAMICS OF MACHINES

Pre-requisite: Kinematics of Machinery

Course Objective: The Students will acquire the knowledge

1. To analyze stabilization of sea vehicles, aircrafts and automobile vehicles.
2. To solve frictional losses, torque transmission of mechanical systems.
3. To analyze dynamic forces of slider crank mechanism and design of flywheel.
4. To understand the methods of balancing reciprocating and rotary masses.
5. To understand the concept of vibrations and its significance on engineering design.

Course Outcomes: At the end of the course, student will be able to

CO1: Understand the stabilization of sea vehicles, aircrafts and automobile vehicles

CO2: Solve frictional losses, torque transmission of mechanical systems.

CO3: Analyze dynamic forces of slider crank mechanism and design of flywheel

CO4: Understand the methods of balancing reciprocating and rotary masses.

CO5: Illustrate the concept of vibrations and its significance on engineering design

SYLLABUS

UNIT-I: PRECESSION:

Gyroscopes, effect of precession motion on the stability of moving vehicles such as motorcar, motor cycle, aero planes and ships, static and dynamic force analysis of planar mechanisms,(Demonstration of models in video show).

UNIT-II:

FRICTION: Inclined plane, friction of screw and nuts, pivot and collar, uniform pressure, uniform wear, friction circle and friction axis: lubricated surfaces, boundary friction, and film lubrication.

CLUTCHES: Friction clutches- single disc or plate clutch, multiple disc clutch, cone clutch, centrifugal clutch.

BRAKES AND DYNAMOMETERS: Simple block brakes, internal expanding brake, band brake of vehicle.

General description and operation of dynamometers: Prony, Rope brake, Epicyclic, Bevis Gibson and belt transmission.

UNIT-III:

TURNING MOMENT DIAGRAMS: Dynamic force analysis of slider crank mechanism, inertia torque, angular velocity and acceleration of connecting rod, crank effort and turning moment diagrams – fluctuation of energy – fly wheels and their design.

GOVERNERS: Watt, porter and proell governors, spring loaded governors – Hartnell and Hartung with auxiliary springs. Sensitiveness, isochronism and hunting.

UNIT-IV: BALANCING:

Balancing of rotating masses single and multiple – single and different planes, use analytical and graphical methods. Primary, secondary, and higher balancing of reciprocating masses. analytical and graphical methods, unbalanced forces and couples –examination of "V" multi cylinder in line and radial engines for primary and secondary balancing, locomotive balancing, hammer blow, swaying couple, variation of tractive effort.

UNIT-V: VIBRATIONS:

Free Vibration of spring mass system –Natural frequency-types of damping – damped free vibration, Simple problems on forced damped vibration, vibration isolation and transmissibility transverse loads, vibrations of beams with concentrated and distributed loads. Dunkerly's methods, Raleigh's method, whirling of shafts, critical speeds, torsional vibrations, two and three rotor systems.

Text Books:

1. S.S Rattan, Theory of Machines, Mc. Graw Hill.
2. Ashok G. Ambedkar, Mechanism and machine theory, PHI Publications.

Reference Books:

1. JS Rao and RV Dukkipati, Mechanism and Machine Theory, New Age .
2. Shigley, Theory of Machines, MGH.
3. Thomas Bevan, Theory of Machines, CBS Publishers.

B.TECH V SEMESTER	**PCC**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

20ME5T02 TURBO MACHINES

Pre-requisite: Internal Combustion Engines & Air Compressors

Course Objective:

1. To provide the knowledge of basic principles, governing equations and applications of turbo machine.
2. To provide the students with opportunities to apply basic thermo-fluid dynamics flow equations to Turbo machines.
3. To explain construction and working principle and evaluate the performance characteristics of Turbo Machines.

Course Outcomes: At the end of the course, student will be able to

CO1: Recognize typical designs of turbomachines and differentiate from positive displacement machines.
CO2: Explain the working principles of turbomachines and apply it to various types of machines.
CO3: Perform the preliminary design of turbomachines (pumps, compressors, turbines) on 1-D basis.
CO4: Determine the off-design behavior of turbines and compressors and relate it to changes in the velocity triangles.
CO5: Recognize relations between choices made early in the turbo machinery design process and the final components and operability.

SYLLABUS

UNIT-I: Basic Concepts:

Rankine cycle - schematic layout, thermodynamic analysis, concept of mean temperature of heat addition, methods to improve cycle performance – regeneration & reheating.

UNIT-II: Boilers:

Classification – working principles– mountings and accessories-working principles, boiler horse power, equivalent evaporation, efficiency and heat balance – draught, classification – Chimney height calculations, condition for maximum discharge, efficiency of chimney – artificial draught, induced and forced.

UNIT-III: Steam Nozzles:

Function of a nozzle – applications - types, flow through nozzles, Area- velocity relationship, Performance characteristics of Nozzles, condition for maximum discharge, critical pressure ratio, Super saturated flow, its effects, degree of super saturation and degree of under cooling - Wilson line.

Steam Turbines: Classification – impulse turbine; mechanical details – velocity diagram – effect of friction- blade or diagram efficiency – condition for maximum efficiency. De-Laval turbine - methods to reduce rotor speed-compounding, condition for maximum efficiency.

UNIT-IV:

Reaction Turbine: Mechanical details – principle of operation, thermodynamic analysis of a stage, degree of reaction –velocity diagram – Parson's reaction turbine – condition for maximum efficiency - calculation of blade height.

Steam Condensers: classification of condensers – working principle of different types – vacuum efficiency and condenser efficiency

UNIT-V:

Gas Turbines: Simple gas turbine plant-closed and open cycle gas turbines, Brayton cycle, Efficiency, work ratio and optimum pressure ratio for simple gas turbine cycle, actual cycle, methods for performance improvement- regeneration, Inter-cooling and reheating.

Jet propulsion: Turbo-jet engines, thrust, thrust power, efficiencies, Turbo-prop engines, Ramjet and pulse jet engines, Rocket engines..

Text books:

1. Thermodynamics and Heat Engines/R.Yadav, Volume -II /Central Publishing House
2. Gas Turbines /V.Ganesan /TMH
3. Heat Engineering /V.P Vasandani and D.S Kumar/Metropolitan Book Company, New Delhi

Reference Books:

1. Gas Turbines and Propulsive Systems /P.Khajuria & S.P.Dubey /Dhanpatrai

2. Gas Turbines / Cohen, Rogers and SaravanaMuttoo / Addison Wesley – Longman
3. Thermal Engineering-R.S Khurmi, &J S Gupta/S.Chand.
4. Thermal Engineering-P.L.Bellaney/ Khanna publishers
5. Thermal Engineering-M.L.Marthur& Mehta/Jain bros. Publishers
6. Thermal Engineering / RK Rajput/ Lakshmi Publications

Note: Use of steam tables and Mollier chart is allowed.

B.TECH V SEMESTER	**PCC**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

20ME5T03 METAL CUTTING &MACHINE TOOLS

Pre-requisite: Production Technology

Course Objective: The Students will acquire the knowledge

1. To apply the elementary theory of metal cutting and principles in material removal processes
2. To understand the working principles and operations that can be performed on lathe machines.
3. To identify the working principles and operations that can be performed on shaper, slotter, planner machines and drilling machines calculate the material removal rates.
4. To understand the working principles and operations that can be performed for producing various features using milling machine tool and select appropriate machining processes for finishing operation with the desired quality
5. To apply appropriate jigs and fixtures on machine tools and write simple CNC programs and conduct CNC machining

Course Outcomes: At the end of the course, student will be able to

CO1	Students can understand the fundamental knowledge and principles in material removal processes.
CO2	Students apply the fundamentals and principles of metal cutting to practical applications through multiple labs using lathes, milling machines, grinding machines, and drill presses.
CO3	To demonstrate the fundamentals of machining processes and machine tools.
CO4	To develop knowledge and importance of metal cutting parameters.
CO5	To develop fundamental knowledge on tool materials, cutting fluids and tool wear mechanisms.

SYLLABUS

UNIT-I: FUNDAMENTAL OF MACHINING:

Classification of machining processes, cutting conditions, cutting parameters, geometry of single point cutting tool, tool angles, types of chips, mechanics of orthogonal cutting –Merchant's force diagram, cutting forces, cutting speeds, feed, depth of cut, tool life, tool wear, machinability, economics of machining, coolants, tool materials and properties.

UNIT-II: LATHE MACHINES:

Engine lathe – principle of working, specification of lathe – types of lathe – work holders tool holders – box tools taper turning, thread turning – for lathes and attachments, constructional features of speed gear box and feed gear box. Turret and capstan lathes – collet chucks – other work holders – tool holding devices – box and tool layout. Principal features of automatic lathes – classification – single spindle and multi-spindle automatic lathes – tool layout and cam design for automats.

UNIT-III:

SHAPING, SLOTTING AND PLANNING MACHINES: Principles of working – principal parts – specifications, operations performed, machining time calculations.

DRILLING & BORING MACHINES: Principles of working, specifications, types, operations performed – tool holding devices – twist drill – Boring Machines – fine Boring Machines – jig boring machine, deep hole Drilling Machine.

UNIT-IV: MILLING MACHINES:

Introduction – principle of working – specifications – milling methods – classification of Milling Machines – principle features of horizontal, vertical and universal Milling Machine, machining operations, types of cutters – geometry of milling cutters – methods of indexing, accessories to milling machines – cutting speed and feed – machining time calculations.

UNIT-V: FINISHING PROCESSES:

Introduction – theory of grinding – classification of grinding machines: cylindrical and surface grinding machines- tool and cutter grinding machines- different types of abrasives- bonds, specification and selection of a grinding wheel-lapping, Honing & Broaching operations- comparison to grinding.

Text Book(s)

1. Manufacturing Engineering and Technology -Kalpakjian S & Steven R Schmid/Pearson Publications 7th Edition
2. Manufacturing Technology Vol-II/P.N Rao/Tata McGraw Hill

References

1. Metal cutting and machine tools /Geoffrey Boothroyd, Winston A.Knight/ Taylor & Francis.
2. Production Engineering/K.C Jain & A.K Chitaley/PHI Publishers
3. Technology of machine tools/S.F.Krar, A.R. Gill, Peter SMID/ TMH
4. Fundamentals of modern manufacturing – Mikell P Groover – John Wiley & sons -5th edition.

B.TECH V SEMESTER	**PEC**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

20ME5T06 **EXPERIMENTAL STRESS ANALYSIS**
(PROFESSIONAL ELECTIVE -I)

Pre-requisite: Mechanics of Solids

Course Objective:

1. Recognize the various techniques available to measure the stress and Strains using different sources.
2. Realize the working of recording instruments and data logging methods
3. Distinguish the principles of photo elasticity in two dimensional stress Analyses.
4. Objective of the course is to measure strain through various experimental methods like strain gauges, photo elasticity techniques, brittle coatings, moiré methods and birefrigerent coatings.
5. To understand the relation between the mechanics theory and experimental stress analysis to learn usage of the experimental techniques on the practical problem.

Course Outcomes: At the end of the course, student will be able to

CO1: Understand the overall concepts of stress/strain analysis by experimental means.

CO2: Familiar with the theory and practice of common experimental stress analysis Methods including moire methods, photo elasticity

CO3: Acquire the knowledge on Brittle and bi-refrigent coatings and working of strain gauges.

CO4: Student should be able to choose the appropriate method for measuring strain of strain & stress.

CO5: Analyze the results obtained from coating techniques and corroborated with theoretical results.

SYLLABUS

UNIT-I: Introduction:

Stress, strain, Plane stress and plane strain conditions, Compatibility conditions. Problems using plane stress and plane strain conditions, stress functions, Mohr's circle for stress strain, Three-dimensional stress strain relations.

UNIT-II: Strain Measurement and Recordings:

Various types of strain gauges, Electrical Resistance strain gauges, semiconductor strain gauges, strain gauge circuits. Introduction, static recording and data logging, dynamic recording at very low frequencies, dynamic recording at intermediate frequencies, dynamic recording at high frequencies, dynamic recording at very high frequencies, telemetry systems.

UNIT-III:

Photo elasticity: Photo elasticity – Polariscope – Plane and circularly polarized light, Bright and dark field setups, Photo elastic materials – Isochromatic fringes – Isoclinic

Three dimensional Photo elasticity: Introduction, locking in model deformation, materials for three-dimensional photo elasticity, machining cementing and slicing three-dimensional models, slicing the model and interpretation of the resulting fringe patterns, effective stresses, the shear difference method in three dimensions, applications of the Frozen-stress method, the scattered light method.

UNIT-IV: Brittle coatings:

Introduction, coating stresses, failure theories, brittle coating crack patterns, crack detection, ceramic based brittle coatings, resin based brittle coatings, test procedures for brittle coatings analysis, calibration procedures, analysis of brittle coating data. Moire Methods: Introduction, mechanism of formation of Moire fringes, the geometrical approach to Moire-Fringe analysis, the displacement field approach to Moire-Fringe analysis, out of plane displacement measurements, out of plane slope measurements, sharpening and multiplication of Moire-Fringes, experimental procedure and techniques.

UNIT-V:

Birefringent Coatings Introduction, Coating stresses and strains, coating sensitivity, coating materials, application of coatings, effects of coating thickness, Fringe-order determinations in coatings, stress separation methods.

Text Books:

1. Theory of Elasticity by Timoshenke and GoodierJr
2. Experimental stress analysis by Dally and Riley,McGraw-Hill

References:

1. A treatise on Mathematical theory of Elasticity by LOVE .A.H
2. Photo Elasticity by Frocht Experimental stress analysis, Video course by K.Ramesh / NPTEL

B.TECH V SEMESTER	PEC	L	T	P	C
		3	0	0	3

20ME5T07 **DESIGN FOR MANUFACTURING (PROFESSIONAL ELECTIVE -I)**

Pre-requisite: Manufacturing Technology

Course Objective: The students will acquire the knowledge:

1. To understand the basic concepts of design for manual assembly
2. To interpret basic design procedure of machining processes
3. To understand design considerations metal casting, extrusion and sheet metal work
4. To interpret the design considerations of various metal joining process.
5. To interpret the basic design concepts involved in the assembly automation

Course Outcomes: At the end of the course, student will be able to

CO1: Understand the basic concepts of design for manual assembly

CO2: Identify basic design procedure of various machining processes.

CO3: Illustrate the design considerations metal casting, extrusion and sheet metal work .

CO4: Interpret the design considerations of various metal joining process.

CO5: Understand the basic design concepts involved in the assembly automation.

SYLLABUS

UNIT-I: Introduction:

Introduction: Design philosophy-steps in design process-general design rules for manufacturability-basic principles of designing for economical production-creativity in design.

Materials: Selection of materials for design-developments in material technology-criteria for material selection-material selection interrelationship with process selection-process selection charts.

UNIT-II: Machining processes:

Overview of various machining processes-general design rules for machining dimensional tolerance and surface roughness-Design for machining – ease – redesigning of components for machining ease with suitable examples. General design recommendations for machined parts.

UNIT-III:

Metal casting: Appraisal of various casting processes, selection of casting process,-general design considerations for casting-casting tolerance-use of solidification, simulation in casting design-product design rules for sand casting.

Metal joining: Appraisal of various welding processes, factors in design of weldments – general design guidelines-pre and post treatment of welds-effects of thermal stresses in weld joints-design of brazed joints.

UNIT-IV:

Forging: Design factors for forging – closed die forging design – parting lines of dies – drop forging die design – general design recommendations.

Extrusion & Sheet metal work: Design guide lines extruded sections-design principles for punching, blanking, bending, deep drawing-Keeler Goodman forging line diagram – component design for blanking.

UNIT-V: **Plastics:**

Visco elastic and creep behavior in plastics-design guidelines for plastic components-design considerations for injection moulding – design guidelines for machining and joining of plastics.

Text Books:

1. George E Dieter and Linda Schmidt, Engineering Design, 4th Edition, McGraw Hill (2015)
2. A.K.Chitale and R.C.Gupta, Product Design and Manufacturing, 5th Edition, PHI Learning (2011)
3. David M Anderson, Design for Manufacturability, CRC Press (2013)

References:

1. James G Bralla, Design For Manufacturability Handbook, 2nd Edition, McGraw Hill (2004)
2. Dr.P.C.Sharma, Production Technology, S.Chand& Company (2009)

B.TECH V SEMESTER		**PEC**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**

20ME5T08 **REFRIGERATION AND AIR-CONDITIONING (PROFESSIONAL ELECTIVE -I)**

Pre-requisite: Thermodynamics

Course Objective:

1. Learning the fundamental principles and different methods of refrigeration and air conditioning.
2. Study various refrigeration cycles and evaluate performance using Mollier charts and/ or refrigerant property tables.
3. Comparative study of different refrigerants with respect to properties, applications and environmental issues.
4. Understand the basic air conditioning processes on psychometric charts, calculate cooling load for its applications in comfort and industrial air conditioning.
5. Study of the various equipment-operating principles, operating and safety controls employed in refrigeration air conditioning systems.

Course Outcomes: At the end of the course, student will be able to

CO1: Illustrate the fundamental principles and applications of refrigeration and air conditioning system

CO2: Obtain cooling capacity and coefficient of performance by conducting test on vapour compression refrigeration systems

CO3: Present the properties, applications and environmental issues of different refrigerants

CO4: Calculate cooling load for air conditioning systems used for various

CO5: Operate and analyze the refrigeration and air conditioning systems.

SYLLABUS

UNIT-I: Introduction to Refrigeration:

Necessity and applications – unit of refrigeration and C.O.P. – Mechanical refrigeration – types of ideal cycles of refrigeration. Air refrigeration: bell Coleman cycle - open and dense air systems – refrigeration systems used in air crafts and problems.

UNIT-II: Vapour Compression Refrigeration:

Working principle and essential components of the plant – simple vapour compression refrigeration cycle – COP – representation of cycle on T-S and p-h charts – effect of sub cooling and super heating – cycle analysis – actual cycle influence of various parameters on system performance – use of p-h charts – numerical problems. VCR System Components: Compressors – general classification – comparison – advantages and disadvantages. Condensers – classification – working principles evaporators – classification – working principles expansion devices – types – working principles.

UNIT-III:

Refrigerants – Desirable properties – classification - refrigerants used – nomenclature – ozone depletion – global warming Vapour Absorption System: Calculation of maximum COP – description and working of NH3 – water system and Li Br –water (Two shell & Four shell) System, principle of operation three fluid absorption system, salient features. Steam Jet Refrigeration System: Working principle and basic components, principle and operation of (i) thermoelectric refrigerator (ii) vortex tube

UNIT-IV: Introduction to Air Conditioning:

Psychometric properties & processes – characterization of sensible and latent heat loads — need for ventilation, consideration of infiltration – load concepts of RSHF, GSHF- problems, concept of ESHF and ADP temperature. Requirements of human comfort and concept of effective temperature- comfort chart –comfort air conditioning – requirements of industrial air conditioning, air conditioning load calculations.

UNIT-V: Air Conditioning Systems:

Classification of equipment, cooling, heating humidification and dehumidification, filters, grills and registers fans and blowers. Heat pump – heat sources.

Text Books:

1. A Course in Refrigeration and Air conditioning / SC Arora Domkundwar/ Dhanpatrai
2. Refrigeration and Air Conditioning / CP Arora / TMH.

References:

1. Refrigeration and Air Conditioning / Manohar Prasad / New Age.
2. Principles of Refrigeration /Dossat / Pearson Education.
3. Basic Refrigeration and Air-Conditioning / Ananthanarayanan / TMH

B.TECH V SEMESTER	PPC	L	T	P	C
		0	0	3	1.5

20ME5L09 THEORY OF MACHINES LAB

Pre-requisite: Acquire some experimental skills.

Course Objective:

The Students will acquire the knowledge to analyze gyroscope, frequency of free and forced vibration and study static and dynamic balancing.

Course Outcomes: At the end of the course, student will be able to

CO1:	Examine the motion of a motorized gyroscope when the couple is applied along its spin axis.
CO2:	Find the frequency of undamped and damped free vibration of an equivalent spring mass system.
CO3:	Find the position of sleeve against controlling force and speed of a Hartnell governor and to plot the characteristic curve of radius of rotation
CO4:	Interpret the static and dynamic balancing using rigid blocks
CO5:	Interpret the moment of inertia of a flywheel and Determine whirling speed of shaft theoretically and experimentally

LIST OF EXPERIMENTS

1	To determine whirling speed of shaft theoretically and experimentally.
2	To determine the position of sleeve against controlling force and speed of a Hartnell Governor and to plot the characteristic curve of radius of rotation.
3	To analyse the motion of a motorized gyroscope when the couple is applied along its spin axis
4	To determine the frequency of undamped free vibration of an equivalent spring mass system.
5	To determine the frequency of damped force vibration of a spring mass system

6	To study the static and dynamic balancing using rigid blocks.
7	To find the moment of inertia of a flywheel
8	To plot follower displacement vs cam rotation for various Cam Follower systems.
9	To plot slider displacement, velocity and acceleration against crank rotation for single slider, crank mechanism/Four bar mechanism.
10	To find coefficient of friction between belt and pulley.
11	To study simple and compound screw jack and determine the mechanical advantage, velocity ratio and efficiency
12	To study various types of gears- Spur, Helical, Worm and Bevel Gears.

NOTE: Any 10 experiments mentioned above.

B.TECH V SEMESTER	**PCC**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

20ME5L10 **MACHINE TOOLS & COMPUTER AIDED MANUFACTURING LAB**

Pre-requisite: Acquire some experimental skills.

Course Objective: The Students will acquire the knowledge to understand the parts of various machine tools and operate them. They are required to understand the different shapes of products that can be produced on machine tools.

Course Outcomes:

At the end of the course, student will be able to

CO1:	Make use of Lathe machine tool to produce step turning, taper turning, knurling and threading features on the given workpiece.
CO2:	Understand the working of Milling machine tool to produce grooves.
CO3:	Utilize Drilling machine tool to produce features of cylindrical holes on flat and round surfaces and perform tapping operation
CO4:	Make use of Shaper and Planer machine tools to produce features of slots and pockets on flat surfaces to the desired quality.
CO5:	Utilize Grinding machine tool to produce finished surfaces and grind cutting tools

LIST OF EXPERIMENTS

1	Introduction to general purpose machine
2	Step turning and taper turning on lathe machine
3	Thread cutting and knurling on lathe.
4	Drilling and Tapping
5	Shaping and Planning
6	Slotting
7	Milling
8	Cylindrical & Surface Grinding

9 Grinding of Tool angles

NOTE: Any 5 varieties of jobs on the above said machines

COMPUTER AIDED MANUFACTURING LAB

Pre-requisite: Acquire some Software Knowledge.

Course Objective: The Students will acquire the knowledge

1. To model of simple machine parts and assemblies from the part drawings using standard CAM packages.
2. To generate CNC Turning codes for different operations using standard CAM packages.
3. To generate CNC Milling codes for different operations using standard CAM packages.
4. To learn various fields of engineering where these tools can be effectively used to improve the output of a product.
5. To impart knowledge on how these tools are used in Industries by solving some real time problems using 3-D printing equipment.

Course Outcomes:

At the end of the course, student will be able to

CO1:	Understand the concepts of simple machine parts and assemblies from the part drawings using standard CAM packages.
CO2:	Understand the concepts of CNC Turning codes for different operations using standard CAM packages.
CO3:	Solve CNC Milling codes for different operations using standard CAM packages.
CO4:	Analyze the concepts of CNC programming for various operations of milling.
CO5:	Interpret the study of tools that are used in Industries by solving some real time problems using 3- D printing equipment.

LIST OF EXPERIMENTS

CNC-LATHE PROGRAMMING

1	Plain Turning And Facing Operation Without Canned Cycle & With Canned Cycle
2	Step Turning Operation Without Canned Cycle & With Canned Cycle
3	Pattern Repeated Cycle Without Canned Cycle & With Canned Cycle
4	Thread Cutting Without Canned Cycle & With Canned Cycle
5	Box Turning Cycle
6	Multiple Turning Cycle
7	Taper Turning Cycle
8	Multiple Grooving Cycle
9	Multiple Threading Cycle

CNC-MILLING PROGRAMMING

1	Linear And Circular Interpolation
2	Circular Pocketing
3	Rectangular Pocketing
4	Peck Drilling
5	Mirroring

NOTE: Any 5 experiments from above said list of experiments.

		L	T	P	C
B.TECH V SEMESTER	**SC**	**0**	**0**	**4**	**2**

20ME5S11 **SIMULATION OF MECHANICAL SYSTEMS LAB (Skill Oriented Course)**

Pre-requisite: Acquire some MAT LAB Knowledge.

Course Objective: To understand the simulation of various mechanical components using advanced MATLAB tool SIMULINK.

Course Outcomes: At the end of the course, student will be able to

CO1: Analyze the concept of spring mass damper systems.

CO2: Understand the concept of friction in mechanical components both translation and rotational.

CO3: Understand the concept of linkage and steering mechanisms.

CO4: Analyze the mode shapes and natural frequency in various spring mass damper systems.

LIST OF EXPERIMENTS

1 Mass-Spring-Damper with controller

2 Double Mass-Spring- Damper

3 Simple Mechanical System

4 Mechanical System with Translational Friction

5 Mechanical System with Translational Hard stop

6 Mechanical Rotational System with stick-slip motion

7 Linkage Mechanism

8 Steering Mechanism

9 Determination of deflection and stresses in 2D and 3D trusses and beams.

10 Determination of deflections component and principal and Von-mises stresses in plane stress, plane strain and axi-symmetric components.

11 Determination of stresses in 3D and shell structures (at least one

	example in each case)
12	Estimation of natural frequencies and mode shapes, Harmonic response of 2D beam.

NOTE: Any 10 experiments from above mentioned list of experiments.

B. TECH V SEMESTER

	L	T	P	C
MC	2	-	-	-

20ME6M12 ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

Course Objectives:

- The course aims at imparting basic principles of thought process, reasoning and inferencing.
- Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature.
- Holistic life style of Yogic-science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions.
- The course focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health care system

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1: Understand the significance of Indian Traditional Knowledge
CO2: Classify the Indian Traditional Knowledge
CO3: Compare Modern Science with Indian Traditional Knowledge system.
CO4: Analyze the role of Government in protecting the Traditional Knowledge
CO5: Understand the impact of Philosophical tradition on Indian Knowledge System.

SYLLABUS

Unit I

Introduction to Traditional Knowledge: Define Traditional Knowledge- Nature and Characteristics- Scope and Importance- kinds of Traditional Knowledge- The historical impact of social change on Traditional Knowledge Systems- Value of Traditional knowledge in Global Economy.

Unit II

Basic structure of Indian Knowledge System: Astadash Vidya- 4 Ved - 4 Upaved (Ayurved, Dhanurved, Gandharva Ved & Sthapthya Adi),6vedanga (Shisha, Kalppa, Nirukha,Vykaran, Jyothisha & Chand),4upanga (Dharmashastra, Meemamsa, purana & Tharka Shastra).

Unit III

Modern Science and Indian Knowledge System: Indigenous Knowledge, Characteristics- Yoga and Holistic Health care-cases studies.

Unit IV

Protection of Traditional Knowledge: The need for protecting traditional knowledge - Significance of Traditional knowledge Protection-Role of government to harness Traditional Knowledge.

Unit V

Impact of Traditions: Philosophical Tradition (Sarvadarshan) Nyaya, Vyshepec, Sankhya, Yog, Meemamsa, Vedantha, Chavanka, Jain &Boudh - Indian Artistic Tradition - Chitrakala, Moorthikala, Vasthukala , Sthapthya, Sangeetha, Nruthya Yevam Sahithya.

Text Books

1. Traditional Knowledge System in India, by AmitJha, 2009.

2. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, Pratibha Prakashan 2012.

References

1. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, BharatiyaVidya

2. Swami Jitatmanand, Holistic Science and Vedant, BharatiyaVidyaBhavan

3. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata.

4. Pramod Chandra, India Arts, Howard Univ. Press, 1983.

5. Krishna Chaitanya, Arts of India, Abhinav Publications, 1987.

Web Resources:

1. https://www.wipo.int/wipo_magazine/en/2017/01/article_0004.html

2. http://iks.iitgn.ac.in/wp-content/uploads/2016/01/Indian-Knowledge-Systems-Kapil-Kapoor.pdf

3.https://www.wipo.int/edocs/mdocs/tk/en/wipo_grtkf_ic_21/wipo_grtkf_ic_21_ref_facilitators_tex t.pdf

		L	T	P	C
B.TECH V SEMESTER	**I**	**0**	**0**	**0**	**1.5**

20ME5I13 SUMMER INTERNSHIP

Pre-requisite: Knowledge on mechanical subjects.

Course Objective:

The main objective of this course is to make the student employable through an advanced training program or Industrial exposure.

Course Outcomes:

At the end of the course, student will be able to

CO1: Apply the academic knowledge either in Industry or any training program.

CO2: Understand administrative functions and ethical principles of the organisation.

CO3: Analyze and develop the concepts by practical observation.

CO4: Improve the report writing skills.

Note: The duration of internship is minimum of 8 weeks

		L	T	P	C
B.TECH VI SEMESTER	**PCC**	**3**	**0**	**0**	**3**

20ME6T01 DESIGN OF TRANSMISSION ELEMENTS

Pre-requisite: Mechanics of Solids, Design of Machine Elements

Course Objective:

The Students will acquire the knowledge

1. Understand to select the suitable bearing based on the application of the loads and predict the life of the bearing
2. Design of engine parts and Design of curved beams with various cross sections and crane hooks
3. Design power transmission elements such as belts and pulleys and power screws
4. Design of the machine tool elements such as levers and brackets and also rope drives.

Course Outcomes: At the end of the course, student will be able to

CO1: Select the suitable bearing based on the application of the loads and predict the life of the bearing.

CO2: Design the IC Engines parts.

CO3: Design the power transmission elements such as gears, belts,pulleys, and power screws.

CO4: Design the spur & helical gears for different engineering applications.

CO5: Design the machine tool elements such as levers and brackets and also rope drives.

SYLLABUS

UNIT-I: BEARINGS:

Classification of bearings- applications, types of journal bearings – lubrication – bearing modulus – full and partial bearings – clearance ratio – heat dissipation of bearings, bearing materials – journal bearing design – ball and roller bearings – static loading of ball & roller bearings, bearing life.

UNIT-II: ENGINE PARTS:

Connecting Rod: Thrust in connecting rod – stress due to whipping action on connecting rod ends – cranks and crank shafts, strength and proportions of over hung and center cranks – crank pins, crank shafts. Pistons, forces acting on piston – construction design and proportions of piston, cylinder, cylinder liners,

Design of curved beams: introduction, stresses in curved beams, expression for radius of neutral axis for rectangular, circular, trapezoidal and t-section, design of crane hooks, c –clamps.

UNIT-III:

POWER TRANSMISSIONS SYSTEMS, PULLEYS: Transmission of power by belt and rope drives , transmission efficiencies, belts – flat and v types – ropes - pulleys for belt and rope drives, materials, chain drives

DESIGN OF POWER SCREWS: Design of screw, square ACME, buttress screws, design of nut, compound screw, differential screw, ball screw- possible failures.

UNIT-IV: SPUR & HELICAL GEAR DRIVES:

Spur gears- helical gears – load concentration factor – dynamic load factor, surface compressive strength – bending strength – design analysis of spur gears – estimation of centre distance, module and face width, check for plastic deformation, check for dynamic and wear considerations.

UNIT-V: MACHINE TOOL ELEMENTS:

Levers and brackets: design of levers – hand levers-foot lever – cranked lever – lever of a lever loaded safety valve- rocker arm straight – angular- design of a crank pin – brackets- hangers- wall boxes.

Wire Ropes: Construction, Designation, Stresses in wire ropes, rope sheaves and drums

Text Books:

1. Machine Design/V.Bandari/TMH Publishers
2. Machine Design/ NC Pandya & CS Shaw/ Charotar publishers
3. Design data book.

Reference Books:

1. Machine Design: An integrated Approach / R.L. Norton / Pearson Education
2. Mech. Engg. Design / JE Shigley/Tata McGraw Hill education
3. Design of machine elements- spots/Pearson Publications
4. Machine Design-Norton/Pearson Publications

Note: Design data book is permitted for examination.

B.TECH VI SEMESTER	**PCC**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

20ME6T02 HEAT TRANSFER

Pre-requisite: Engineering Thermodynamics

Course Objective: The Students will acquire the knowledge

1. To learn the different modes of heat transfer and conduction heat transfer through various solid bodies
2. To learn the one dimensional steady state heat conduction heat transfer and one dimensional transient heat conduction
3. To learn the basic concepts of convective heat transfer and forced convection heat transfer of external flows and internal flows
4. To learn the free convection heat transfer concepts and heat transfer Processes in heat exchangers
5. To learn the concepts of film wise condensation, drop wise condensation and radiation heat transfer

Course Outcomes: At the end of the course, student will be able to

CO1: Find heat transfer rate for 1D, steady state composite systems with heat generation and performance of pins.

CO2: Understand the concepts transient heat conduction and basic laws involved in the convection heat transfer

CO3: Apply the empirical equations for forced convection and free convection problems

CO4: Examine the rate of heat transfer with phase change and in the heat exchangers

CO5: Illustrate the concepts of radiation heat transfer

SYLLABUS

UNIT-I: Introduction:

Basic modes of heat transfer- rate equations- generalized heat conduction equation - steady state heat conduction solution for plain and composite slabs - cylinders - critical thickness of insulation- heat conduction through fins of uniform cross section- fin effectiveness and efficiency. Unsteady State Heat Transfer Conduction- Transient heat conduction- lumped system analysis and use of Heisler charts.

UNIT-II: Convection:

Basic concepts of convection–heat transfer coefficients - types of convection – forced convection and free convection. Forced convection in external flow– concepts of hydrodynamic and thermal boundary layer- use of empirical correlations for flow over plates and cylinders. Fluid friction – heat transfer analogy, approximate solution to laminar boundary layer equation for external flow. Internal flow – Use of empirical relations for convective heat transfer in horizontal pipe flow.

UNIT-III: Radiation:

Radiation heat transfer – thermal radiation – laws of radiation - Black and Gray bodies – shape factor-radiation exchange between surfaces - Radiation shields - Greenhouse effect.

UNIT-IV: Heat Exchangers:

Types of heat exchangers- parallel flow- counter flow- cross flow heat exchangers- overall heat transfer coefficient- LMTD and NTU methods- fouling in heat exchangers.

UNIT-V: Boiling and Condensation:

Different regimes of boiling- nucleate, transition and film boiling – condensation – film wise and drop wise condensation. Mass Transfer: Conservation laws and constitutive equations - Fick's law of diffusion, isothermal equi-mass - Equimolal diffusion- - diffusion of gases and liquids- mass transfer coefficient.

Text books:

1. P.K. Nag, Heat Transfer, 3/e, Tata McGraw-Hill, 2011.
2. F. P. Incropera and D.P. Dewitt, Fundamentals of Heat and Mass Transfer, 6/e, John Wiley, 2007.

Reference Books:

1. J.P.Holman, Heat Transfer, 9/e, Tata McGraw-Hill,2008.
2. Cengel. A.Yunus, Heat Transfer- A Practical Approach, 4/e, Tata McGraw-Hill, 2007.
3. S.P. Sukhatme, A Textbook of Heat Transfer, Universities Press, 2005
4. Lienhard and Lienhard, A Heat and Mass Transfer, Cambridge Press, 2011.

B.TECH VI SEMESTER	**PCC**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

20ME6T03 METROLOGY AND MEASUREMENTS

Pre-requisite: Engineering Graphics, Fundamentals of Measuring Units.

Course Objective:

1. To impart the principles of measurement of dimensional and geometric parameters of mechanical elements.
2. To introduce working of various temperature, pressure, flow and strain measuring instruments.

Course Outcomes: At the end of the course, student will be able to

CO1	Determine tolerances and allowances to realize interchangeable manufacture. evaluate the surface roughness parameters.
CO2	Design of limit gauges.
CO3	Distinguish between line standards and end standards.
CO4	Apply the principles of interferometry in measurement of flatness and straightness.
CO5	Elaborate the basic principles of measurement systems. choose the appropriate instrument to measure the physical parameters like pressure, temperature, force, torque, displacement, speed and strain.

SYLLABUS

UNIT-I:

Systems of limits and fits: Introduction, normal size, tolerance limits, deviations, allowance, fits and their types – unilateral and bilateral tolerance system, hole and shaft basis systems – Interchangeability, deterministic & statistical tolerance, selective assembly. International Standard system, limits and fits.

Limit Gauges: Taylor's principle – Design of go and No go gauges, plug, ring, snap, gap, taper, profile and position gauges.

UNIT-II:

Linear Measurement: Length standard, line and end standard, slip gauges – calibration of the slip gauges, Dial indicator, micrometers. Measurement of Angles and Tapers: Different methods – Bevel protractor – angle slip gauges

– spirit levels – sine bar – Sine plate, rollers and spheres used to determine the tapers.

Optical Measuring Instruments: Tool maker's microscope and its uses – collimators, optical projector – optical flats and their uses. Interference of light, Michaleson's interferometer, NPL flatness interferometer and NPL gauge interferometer.

UNIT-III:

Flat Surface Measurement: Measurement of flat surfaces – instruments used – straight edges – surface plates – auto collimator.

Surface Roughness Measurement : Differences between surface roughness and Surface Waviness-Numerical assessment of surface finish – CLA, R.M.S, Rz values, Methods of measurement of surface finish – profilograph, Talysurf

UNIT-IV: Measuring Instruments

Measurement systems, generalized configuration and functional descriptions of measuring instruments, Static and Dynamic performance characteristics, sources of error - Classification and elimination of error. Measurement of Displacement: Theory and construction of various transducers to measure displacement – Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers.

UNIT-V:

Measurement of Temperature: Classification – Ranges – Various Principles of measurement – Expansion, Electrical Resistance – Thermistor , Thermocouple , RTD, Optical and total radiation pyrometers.

Flow Measurement: Rotameter, magnetic, Ultrasonic, Turbine flow meter, Hot wire anemometer, Laser Doppler Anemometer (LDA).

Measurement of Speed: Mechanical Tachometers, Electrical tachometers, Stroboscope.

Measurement of Force: Elastic force meters, load cells. Measurement of Strain: Various types of strain measurements – electrical strain gauge – gauge factor – method of usage of resistance strain gauge – bending, torque, compressive and tensile load, Strain gauge Rosettes.

Text Book(s)

1. R.K. Jain, “Engineering Metrology”, Khanna Publishers.
1. BeckWith, Marangoni,Linehard, “ Mechanical Measurements”, 6th edition, PHI / PE.

References

1. Mahajan,”Engineering Metrology “,Danpath Rai Publications.
2. D.S.Kumar, “Measurement Systems: Applications & design”, Anuradha Agencies.
3. I.C.Gupta ,”Engineering Metrology”, Danpath Rai Publications.
4. Connie Dotson “Fundamentals of Dimensional Metrology 4e “,Thomson Publications.
5. S.Bhaskar, “Instrumentation and Control systems “, Anuradha Agencies.

B.TECH VI SEMESTER		**PEC-II**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
20ME6T04	**FINITE ELEMENT METHODS (PROFESSIONAL ELECTIVE -II)**					

Pre-requisite: Mechanics of Solids

Course Objective:

1. To learn the theory and characteristics of finite elements that represent engineering structures of trusses and beams
2. To learn finite element modeling of two dimensional stress analysis
3. To learn the finite modelling for high order and isoperimetric elements
4. To learn the usage of finite element method for the steady state heat transfer analysis

Course Outcomes: At the end of the course, student will be able to

CO1: Understand the basic concepts of finite element. Method

CO2: Formulate simple problems into finite elements.

CO3: Solve structural and thermal problems.

CO4: Solve complicated 2D structural problems for stress analysis under various loads

CO5: Analyze and formulate 1D and 2D problems under steady load conditions. Formulate finite element model under dynamic load conditions.

SYLLABUS

UNIT-I:

Introduction to finite element methods for solving field problems, Stress and equilibrium, Boundary conditions, Strain-Displacement relations, Stress- strain relations for 2D and 3D Elastic problems. Potential energy and equilibrium, The Rayleigh-Ritz method, Formulation of Finite Element Equations.

One dimensional problems: Finite element modelling coordinates and shape functions. Assembly of global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions, Quadratic shape functions.

UNIT-II:

Analysis of trusses: Stiffness Matrix for plane truss element. Stress Calculations and Problems.

Analysis of beams: Element Stiffness Matrix for two nodded, two degrees of freedom per node beam element and simple problems.

UNIT-III:

Finite element modelling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions. Estimation of load Vector, Stresses. Finite element modelling of Axis-symmetric solids subjected to axis-symmetric loading with triangular elements. Two dimensional four nodded isoperimetric elements and problems.

UNIT-IV:

Steady state heat transfer analysis: One dimensional analysis of slab and fin, two dimensional analysis of thin plate. Analysis of a uniform shaft subjected to torsion.

UNIT-V:

Dynamic analysis: Formulation of finite element model, element –mass matrices, evaluation of Eigen values and Eigen vectors for a stepped bar truss.

3D Problems: Finite Element formulation for stress analysis, Convergence requirements, mesh generation, techniques such as semi-automatic and fully automatic use of software's such as ANSYS,NISA,NASTRAN.

Text Books:

1. Chandraputla, Ashok &Belegundu, Introduction to Finite Element in Engineering, Prentice Hall.
2. S.S.Rao, The Finite Element Methods in Engineering, Elsevier Butterworth -Heinemann 2nd Edition, 2011.

References:

1. J N Reddy, An introduction to the Finite Element Method, McGraw – Hill, New York, 1993.
2. R D Cook, D S Malkus and M E Plesha, Concepts and Applications of Finite Element Analysis, 3rd Edition, John Wiley, New York, 1989.
3. K J Bathe, Finite Element Procedures in Engineering Analysis, Prentice-Hall, Englewood Cliffs, 1982.

4. T J R Hughes, the Finite Element Method, Prentice-Hall, Englewood Cliffs, NJ, 1986.
5. O C Zienkiewicz and R L Taylor, the Finite Element Method, 3rd Edition. McGraw-Hill, 1989.

B.TECH VI SEMESTER		**PEC-II**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
20ME6T05	**COMPUTATIONAL FLUID DYNAMICS (PROFESSIONAL ELECTIVE -II)**					

Pre-requisite: Finite Element Methods

Course Objective: The students will acquire the knowledge:

1. To explain elementary details and numerical techniques for solving various engineering problems involving fluid flow.
2. To solve problems of fluid flow using applied numerical methods and understand equations governing fluid flow and heat transfer
3. To interpret fluid flow problems with steady flow and finite difference in heat conduction and convention
4. To understand the concepts of finite differences, discretization, consistency, stability and fundamentals of fluid flow modelling
5. To understand the concepts of first order wave equation and finite volume method

Course Outcomes: At the end of the course, student will be able to

CO1: Find elementary details and numerical techniques for solving various engineering problems involving fluid flow.

CO2: Solve problems of fluid flow using applied numerical methods and understand equations governing fluid flow and heat transfer

CO3: Interpret fluid flow problems with steady flow and finite difference in heat conduction and convention

CO4: Understand the concepts of finite differences, discretization, consistency, stability and fundamentals of fluid flow modelling

CO5: Understand the concepts of first order wave equation and finite volume method.

SYLLABUS

UNIT-I: ELEMENTARY DETAILS IN NUMERICAL TECHNIQUES:

Number system and errors, representation of integers, fractions, floating point arithmetic, loss of significance and error propagation, condition and instability, computational methods for error estimation, convergence of sequences.

UNIT-II:

APPLIED NUMERICAL METHODS: Solution of a system of simultaneous linear algebraic equations, iterative schemes of matrix inversion, direct methods for matrix inversion, direct methods for banded matrices.

REVIEW OF EQUATIONS GOVERNING FLUID FLOW AND HEAT TRANSFER: Introduction, conservation of mass, Newton's second law of motion, expanded forms of navier-stokes equations, conservation of energy principle, special forms of the navier-stokes equations.

UNIT-III:

Steady flow, dimensionless form of momentum and energy equations, stokes equation, conservative body force fields, stream function – vorticity formulation. Finite difference applications in heat conduction and convention – heat conduction, steady heat conduction in a rectangular geometry, transient heat conduction, finite difference application in convective heat transfer, closure.

UNIT-IV:

Finite differences, discretization, consistency, stability, and fundamentals of fluid flow modelling: introduction, elementary finite difference quotients, implementation aspects of finite-difference equations, consistency, explicit and implicit methods.

UNIT-V:

Introduction to first order wave equation, stability of hyperbolic and elliptic equations, fundamentals of fluid flow modeling, conservative property, the upwind scheme.

FINITE VOLUME METHOD: Approximation of surface integrals, volume integrals, interpolation and differentiation practices, upwind interpolation, linear interpolation and quadratic interpolation.

Text Books:

1. Numerical heat transfer and fluid flow / Suhas V. Patankar- Butter-worth Publishers.
2. Computational fluid dynamics – Basics with applications – John. D. Anderson / Mc Graw Hill.

References:

1. Computational Fluid Flow and Heat Transfer/ Niyogi, Pearson Publications.
2. Fundamentals of Computational Fluid Dynamics – Tapan K. Sengupta / Universities Press.
3. Computational fluid dynamics, 3rd edition/Wendt/Springer publishers

B.TECH VI SEMESTER		**PEC-II**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
20ME6T06	**PRODUCTION PLANNING & CONTROL (PROFESSIONAL ELECTIVE -II)**					

Pre-requisite: Industrial Engineering and Management

Course Objective:

1. To understand the problems and opportunities faced by the operations manager in manufacturing and service organizations.
2. To develop an ability to apply PPC concepts in a various areas like marketing, accounting, finance, engineering, personnel management, logistics, etc.
3. To integrate operations concepts with other functional areas of business
4. To understand the PPC function in both manufacturing and service organizations.
5. To examine several classic Operations Management planning topics Including production planning and inventory control.
6. To learn several important contemporary topics relevant to business managers of all functional disciplines, including quality management, lean concepts, and sustainability.

Course Outcomes: At the end of the course, student will be able to

CO1: Recognize the objectives, functions, applications of PPC and forecasting techniques.

CO2: Explain different Inventory control techniques.

CO3: Solve routing and scheduling problems

CO4: Summarize various aggregate production planning techniques.

CO5: Describe way of integrating different departments to execute PPC functions

SYLLABUS

UNIT-I: **Introduction:**

Definition – Objectives of production Planning and Control – Functions of production planning and control – Elements of production control – Types of production – Organization of production planning and control department – Internal organization of department.

UNIT-II:

Forecasting – Importance of forecasting – Types of forecasting, their uses – General principles of forecasting – Forecasting techniques – qualitative methods and quantitative methods.

UNIT-III:

Inventory management – Functions of inventories – relevant inventory costs – ABC analysis – VED analysis – EOQ model – Inventory control systems – P–Systems and Q-Systems. Introduction to MRP I,MRP II & ERP, LOB (Line of Balance), JIT and CANBAN system.

UNIT-IV:

Routing – Definition – Routing procedure –Route sheets – Bill of material – Factors affecting routing procedure. Schedule –definition – Difference with loading

UNIT-V:

Scheduling Policies – Techniques, Standard scheduling methods, line balancing, Aggregate planning, Expediting, controlling aspects.

Dispatching – Activities of dispatcher – Dispatching procedure – follow up – definition – Reason for existence of functions – types of follow up.

Text Books:

1. Elements of Production Planning and Control / Samuel Eilon.
2. Manufacturing,Planning and Control, Partik Jonsson Stig-Arne Mattsson, Tata Mc Graw Hill.

References:

1. Operations Management – S.N. Chary.
2. Inventory Control Theory and Practice / Martin K. Starr and David W. Miller.
3. Reliability Engineering & Quality Engineering by Dr. C. Nadha Muni
4. Reddy and Dr. K. Vijaya Kumar Reddy, Galgotia Publications, Pvt., Limited.
5. Production Control A Quantitative Approach / John E. Biegel.
6. Production Control / Moore.

		L	T	P	C
B.TECH VI SEMESTER	**PCC**	**0**	**0**	**3**	**1.5**

20ME6L09 METROLOGY & INSTRUMENTATION LAB

Pre-requisite: Acquire some experimental kills.

Course Objective: To impart hands on training in measuring methods and metrology instruments.

Course Outcomes: At the end of the course, student will be able to

CO1:	Measure length, height, diameter and angles using various instruments
CO2:	Measure surface roughness with roughness measurement instrument and alignment tests on Lathe Machine tool
CO3:	Apply resistant temperature detector for temperature measurement
CO4:	Utilize LVDT transducer and of rotameter
CO5:	Utilize displacement strain measurement trainer and capacitance measurement trainer

LIST OF EXPERIMENTS

1	Use of gear teeth Vernier calipers and checking the chordal addendum and chordal height of spur gear.
2	Alignment test on the lathe and milling machine using dial indicators
3	Study of Tool maker's microscope and its application
4	Angle and taper measurements by Bevel protractor, Sine bars.
5	Use of spirit levels in finding the flatness of the surface plate.
6	Surface roughness measurement by Talysurf instrument.
7	Calibration of Strain Gauge for load measurement.
8	Study and calibration of rotameter for flow pressure.
9	Calibration of transducer or thermocouple for temperature measurement.

10	Calibration of LVDT transducer for displacement measurement.
11	Calibration of capacitive transducer for angular measurement.
12	Calibration of photo and magnetic speed pickups for the measurement of speed.

Note: Any 10 number of experiments from above mentioned list.

B.TECH VI SEMESTER	**PCC**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

20ME6L10 HEAT TRANSFER LAB

Pre-requisite: Acquire some experimental skills.

Course Objective: The laboratory course is aimed to provide the practical exposure to the students with regard to the determination of amount of heat exchange in various modes of heat transfer including condensation & boiling for several geometries.

Course Outcomes:

At the end of the course, student will be able to

CO1:	Find the thermal conductivity of different materials, composite slabs and powders.
CO2:	Solve heat transfer coefficient for free and forced convection and pin fin efficiency for forced and free convection
CO3:	Examine the Stefan Boltzmann Constant and emissivity of grey body.
CO4:	Compare parallel and counter flow heat exchanger performance characteristics and investigation of Lambert's cosine law
CO5:	Solve the heat transfer rate through lagged pipes and heat transfer rate in film and drop wise condensation

LIST OF EXPERIMENTS

1	Determine the overall heat transfer coefficient across the width of composite wall
2	Determine the thermal conductivity of a metal rod
3	Determine the thermal conductivity of insulating powder material through concentric Sphere apparatus
4	Determine the thermal conductivity of insulating material through lagged pipe apparatus
5	Determine the efficiency of a pin fin in natural and forced convection.

6	Determine the heat transfer coefficient for a vertical cylinder in natural convection
7	Determine the heat transfer coefficient in forced convection of air in a horizontal tube.
8	Determine the heat transfer coefficients on film and drop wise condensation apparatus.
9	Determine the effectiveness of a parallel and counter flow heat exchanger.
10	Study the pool boiling phenomenon and different regimes of pool boiling.
11	Experiment on pool boiling
12	Determine the emissivity of the test plate surface.
13	Experiment on Stefan-Boltzmann apparatus
14	Determine the heat transfer rate coefficient in fluidized bed apparatus

Note: Any 10 number of experiments from above mentioned list.

			L	T	P	C
B.TECH VI SEMESTER		**PCC**	**0**	**0**	**3**	**1.5**
20ME6L11	**CAE & CFD LAB**					

COMPUTER AIDED ENGINEERING (CAE)

Pre-requisite: Acquire some experimental skills.

Course Objective:

1. To introduce fundamentals of the analysis software, its features and applications.
2. To learn the basic element types in Finite Element analysis.
3. To know the concept of discretization of continuum, Loading conditions and analyse the structure using pre-processor and postprocessor conditions.

Course Outcomes:

At the end of the course, student will be able to

CO1:	Classify the types of Trusses (Plane Truss & Spatial Truss) and Beams (2D & 3D) with various cross sections to determine Stress, Strains and deflections under static, thermal and combined loading
CO2:	Generalize Plane stress, plane strain conditions & axis-symmetric loading on inplane members to predicting the failure behavior and finding the SCF
CO3:	Analyse connecting rod with tetrahedron and brick elements, performing static analysis on flat & curved shells to determine stresses, strains with different boundary conditions.
CO4:	Predict the natural frequencies and modes shapes using Modal, Harmonic analysis. Also finding the critical load using Buckling analysis
CO5:	Simulate steady state heat transfer analysis of chimney, Transient heat transfer of castings, Non-linear, Buckling analysis of shells &CFD analysis

LIST OF EXPERIMENTS

1 Analysis of Plane Truss & Spatial Truss with various cross sections and materials to determine member forces, member strains & stresses, joint deflections under static, thermal and combined loading

2 2D & 3D beam analysis with different sections, different materials for different loads (forces and moments) with different end supports

3 Static analysis of plate with a hole to determine the deformations, the Stresses to study the failure behavior and SCF.

4 Plane stress, plane strain and axis-symmetric loading on the in plane members with in plane loading to study the stresses and strains.

5 Static analysis of connecting rod with tetrahedron and brick elements

6 Static Analysis of flat and curved shell due to internal pressure and moments to estimate the strains, stresses and reactions forces and moments with different boundary conditions

7 Buckling analysis of plates, shells and beams to estimate BF and modes

8 Modal analysis of beams, plates and shells for natural frequencies and mode shapes

9 Harmonic analysis of a Shaft subjected to periodic force and transient analysis of plate subjected to stepped and ramped loading with varying time

10 Steady state heat transfer Analysis Cross section of chimney and transient heat transfer analysis of solidification of castings.

11 Non linear analysis of cantilever beam with non-linear materials at tip moment and post Buckling analysis of shells for critical loads

12 Coupled field analysis.

13 Flow analysis of pipe with different fluids/gasses/air for velocity and pressure gradients

14 CFD analysis of aerofoil design

15 CFD analysis of ducts/impeller/fan

16 Use of MATLAB for finding B matrix, stiffness matrix and loading matrices of beam/in plane/solid elements and interfacing with CAE softwares.

COMPUTATIONAL FLUID DYNAMICS (CFD)

Pre-requisite: Acquire some experimental skills.

Course Objective:

This Course will provide core knowledge of the fundamentals of CFD for engineers, and an introduction to the methods and analysis techniques used in CFD. It also provides an introduction to the use of commercial CFD codes to analyze Internal and External flow heat transfer, Multiphase and Combustion problems of practical engineering interest.

1. To introduce student to applied computational fluid dynamics and to teach them how to solve a fluid flow problem using commercially available CFD software
2. Equip the Participant with the Computational Fluid Dynamics Fundamentals.
3. Enable the student formulate the design problems into CFD/FEA.

Course Outcomes: At the end of the course, student will be able to

CO1: Have a working knowledge of a variety of computational techniques that can be used for solving engineering problems.

CO2: To develop an understanding for the major theories, approaches and methodologies used in CFD;

CO3: To build up the skills in the actual implementation of CFD methods (e.g. boundary conditions, turbulence modelling etc.) in using commercial CFD codes;

CO4: To gain experience in the application of CFD analysis to real engineering designs.

CO5: Proficiency in engineering design

LIST OF EXPERIMENTS

1 Geometric Creation – Session01

2 Geometric Creation – Session02

3 Fluid Flow inside a bend pipe

4	Interpreting the results
5	Case Study
6	Governing Equations / Mathematical Models
7	Flow inside a cyclone / scrubber
8	External flow over a airfoil
9	External flow over a 2D/3D car
10	Case Study
11	Turbulent models
12	Pressure drop analysis in a valve
13	Heat Transfer mechanism
14	Heat transfer analysis in heat exchanger
15	Heat transfer analysis in solar flat plate collector
16	Heat transfer analysis in solar air heater
17	Multi-phase flow / species
18	Multi-phase fluidization
19	Multi-phase cyclone
20	Species (Combustion experiment)

Note: 1. Any of FEA software package may be used
ANSYS/ABAQUS/NASTRAN/NISA/CAEFEM/ADINA
2. Any 10 experiments from above mentioned list.

B. TECH VI SEMESTER

	L	T	P	C
SC	0	0	4	2

20ME6S12 SOFT SKILLS

(Skill Oriented Course)

Course Outcomes

The student will acquaint himself with various nuances of Soft Skills and Personality Development besides aspects related to Campus Recruitment Process.

SYLLABUS

1 Life Skills

2 JAM

3 Presentation Skills

4 Resume Writing

5 Group Discussion

6 Interview Skills

References:

1. ***Interact*,** Orient Blackswan

2. **Communication Skills,** Sanjay Kumar and Pushp Latha.OUP,2011

B.TECH VI SEMESTER

	L	T	P	C
MC	2	0	0	-

20ME6M13 DISASTER MANAGEMENT

Course Learning Objectives: The objective of this course is to

1. Understand Types of disasters like Earthquake, Landslide, Flood, Drought, Fire
2. Know Panchayati Raj Institutions/ Urban Local Bodies (PRIs/ ULBs), States, Centre, and other stakeholders
3. Understand Climate Change Adaptation - IPCC Scenario and Scenarios in the context of India
4. Understand Role of GIS and Information Technology Components in Preparedness, Risk Assessment
5. Know various case studies

Course Learning Outcomes:

On successful completion of this course, the students will be able to

CO1: Differentiate the types of disasters, causes and their impact on environment and society

CO2: Assess vulnerability and various methods of risk reduction measures as well as mitigation.

CO3: Draw the hazard and vulnerability profile of India, Scenarios in the Indian context

CO4: Analyze the Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

CO5: Understand about Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment

SYLLABUS

UNIT-I:

INTRODUCTION TO DISASTERS Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT-II:

APPROACHES TO DISASTER RISK REDUCTION (DRR) Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Institutional Processes and Framework at State and Central Level State Disaster Management Authority (SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT-III:

INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources

UNIT-IV:

DISASTER RISK MANAGEMENT IN INDIA Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT-V:

DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters:

Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

Text Books:

1. Singhal J.P.“Disaster Management”, Laxmi Publications, 2010. ISBN-10:

   ISBN-13: 978-9380386423

2. Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361]

3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011

Reference Books:

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

2. Government of India, National Disaster Management Policy, 2009

B.TECH VII SEMESTER		**PEC**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
20ME7T01	**ADVANCED MATERIALS (PROFESSIONAL ELECTIVE -III)**					

Pre-requisite: Material Science

Course Objective:

1. Understand the different composite and reinforcement materials.
2. Understand the different manufacturing methods for composites materials.
3. Analyze mechanical structure of composite materials.
4. Understand the properties and applications of functionally graded materials, shape memory alloys and nonmaterial.

Course Outcomes:

At the end of the course, student will be able to

CO1: Classify the composite materials and identify the applications

CO2: Identify the aerospace materials and their applications

CO3: Understand macro-mechanical analysis of a lamina

CO4: Interpret the functionally graded materials and their properties

CO5: Understand types of Nano materials and their properties

SYLLABUS

UNIT-I:

INTRODUCTION TO COMPOSITE MATERIALS: Introduction, Classification: Polymer Matrix Composites, Metal Matrix Composites, Ceramic Matrix Composites, Carbon–Carbon Composites, Fiber-Reinforced Composites and Nature-Made Composites, and Applications.

REINFORCEMENTS: Fibres- Glass, Silica, Kevlar, Carbon, Boron, Silicon carbide, and Born carbide fibres.

UNIT-II:

Polymer Composites, Thermoplastics, Thermosetting Plastics, Manufacturing of PMC, MMC & CCC and their applications.

UNIT-III:

MANUFACTURING METHODS: Autoclave, Tape Production, Moulding Methods, Filament Winding, HandLayup, Pultrusion, RTM.

UNIT-IV:

MACROMECHANICAL ANALYSIS OF A LAMINA: Introduction, Generalized Hooke's Law, Reduction of Hooke's law in Three Dimensions to Two Dimensions, Relationship of compliance and stiffness matrix to engineering elastic constants of an orthotropic lamina, laminate-laminate code.

UNIT-V:

FUNCTIONALLY GRADED MATERIALS: Types of functionally graded materials-Classification-Different systems-Preparation-Properties and applications of functionally graded materials.

SHAPE MEMORY ALLOYS: Introduction-Shape memory Effect-Classification of shape memory alloys Composition- Properties and applications of shape memory alloys.

NANO MATERIALS: Introduction-Properties at Nano Scales-Advantages & Disadvantages, Applications in comparison with bulk materials (Nano – Structure, Wires, Tubes, Composites).

Text Books:

1. Nano material /A.K. Bandyopadyay/New age Publishers
2. Material science and Technology: A comprehensive treatment/Robert W.Cahn,/VCH
3. Engineering Mechanics of Composite Materials / Isaac and M
4. Daniel/Oxford University Press

Reference Books:

1. Mechanics of Composite Materials / R. M. Jones/ Mc Graw Hill Company, New York, 1975.
2. Analysis of Laminated Composite Structures / L. R. Calcote/Van Nostrand Rainfold,NY 1969
3. Analysis and performance of fibre Composites /B. D. Agarwal and L. J.
4. Broutman /Wiley-Interscience, New York, 1980
5. Mechanics of Composite Materials – Second Edition (Mechanical Engineering) /Autar K.Kaw / CRC Press.

B.TECH VII SEMESTER	PEC	L	T	P	C
		3	0	0	3

20ME7T02 **POWER PLANT ENGINEERING (PROFESSIONAL ELECTIVE -III)**

Pre-requisite: Applied Thermodynamics

Course Objective: The course is aimed at providing knowledge of power generation through different prime movers viz steam, ICGT, Hydro, nuclear and hybrid systems along with their economics and Environmental considerations.

Course Outcomes:

At the end of the course, student will be able to

CO1: Identify the various conventional energy resources, and understand the concept of coal handling.

CO2: Understand the concept of combustion process and cooling towers.

CO3: Understand various Power plants like gas, hydro, diesel.

CO4: To understand the concept of nuclear power plant and types of nuclear reactors.

CO5: To understand and estimate unit power cost under specified conditions list out power plant effluents and their impact on environment.

SYLLABUS

UNIT-I:

INTRODUCTION: Energy sources and Power Development in India.

STEAM POWER PLANT: Plant Layout-Working of Different circuits-Types of Coal-Coal handling systems--Coal storage- Overfeed and underfeed fuel beds-Pulverized Fuel burning system -Ash handling systems-Dust collection and its disposal-Mechanical type –Electrostatic Precipitator Cooling Towers and heat rejection.

UNIT-II:

DIESEL POWER PLANT: Plant layout with auxiliaries-Fuel storage and Fuel supply system-Air supply system-Exhaust system-Water cooling system-Lubrication system-Starting system Supercharging-Advantages and

Disadvantages of Diesel plants over Thermal plants.

GAS TURBINE PLANT: Introduction-Classification-Layout with auxiliaries-Principles of working of Closed and Open cycle gas turbines-introduction to Combined cycle power plants and comparison

UNIT-III:

HYDRO ELECTRIC POWER PLANT: Hydrology-Hydrological cycle- Rainfall-Run off Hydrograph- Flow duration curve- Mass curve--Site selection of hydro plant-layout And types of hydro plants.

NUCLEAR POWER PLANT: Nuclear Fission and Fusion - Nuclear Fuels-Breeding Components of Reactor-Types of Nuclear Reactors-Pressurized water reactor(PWR)-Boiling water reactor(BWR)-CANDU reactor-Gas cooled reactor-Liquid metal cooled reactor-Fast Breeder Reactor-Nuclear waste and its Disposal.

UNIT-IV:

POWER FROM NON-CONVENTIONAL SOURCES: Solar power plants-Utilization of Solar collectors-Principle of working of Wind energy-Types- Tidal Energy.

DIRECT ENERGY CONVERSION SYSTEM: Solar cell- Fuel cell-Thermo Electric and Thermo ionic conversion system-MHD generation.

UNIT-V:

POWER PLANT ECONOMICS: Fixed cost-Operating cost.-Fluctuating loads-General arrangement of Power Distribution-Load curves-Load duration curve-Connected load- Maximum demand-Demand factor-Average load-Load factor-Diversity factor- Plant capacity factor.

POLLUTION AND CONTROL: Introduction- Particulate and gaseous pollutants-Air and Water pollution by Thermal plants and its control—Acid rains -Methods to control pollution.

Text books:

1. G.D. Rai, “An Introduction to Power Plant Technology”, Khanna Publishers, 2004, 3rd Edition.
2. P.K.Nag, “Power Plant Engineering”, 2nd Edition, Tata McGraw-Hill Education, 2014, 4th Edition.

Reference Books:

1. S.C. Arora and S. Domkundwar "A Course in Power Plant Engineering", Dhanpat Rai & Co. (P) Limited, 2014.
2. R. K. Rajput, "A Text Book of Power Plant Engineering", Laxmi Publications, New Delhi, 2016, 4th Edition.
3. M.M.El-Wakil, "Power Plant Technology", Tata McGraw-Hill Education, Revised 2nd edition.

B.TECH VII SEMESTER **PEC**

L	T	P	C
3	0	0	3

20ME7T03 **ADVANCED OPTIMIZATION TECHNIQUES (PROFESSIONAL ELECTIVE -III)**

Pre-requisite: Numerical Methods

Course Objective:

1. To introduce the advanced optimization techniques such as classical optimization techniques, numerical optimization techniques and genetic algorithms.
2. Learn the knowledge to formulate optimization problems

Course Outcomes:

At the end of the course, student will be able to

CO1: Solve single and multi-variable optimization techniques.

CO2: Apply various numerical methods to determine the optimized value.

CO3: Understand and Apply GA to find optimum value.

CO4: Apply various optimization techniques to mechanical applications.

SYLLABUS

UNIT-I:

Classical optimization techniques: Single variable optimization with and without constraints, multi – variable optimization without constraints, multi – variable optimization with constraints – method of Lagrange multipliers, Kuhn-Tucker conditions.

UNIT-II:

Numerical methods for optimization: Nelder Mead's Simplex search method, Gradient of a function, Steepest descent method, Newton's method, types of penalty methods for handling constraints.

UNIT-III:

Genetic algorithm (GA) : Differences and similarities between conventional and evolutionary algorithms, working principle, reproduction, crossover, mutation, termination criteria, different reproduction and crossover operators, GA for constrained optimization, draw backs of GA, Multi-Objective GA: Pareto's analysis, Non-dominated front, multi – objective GA, Non-dominated sorted GA, convergence criterion, applications of multi-objective problems.

UNIT-IV:

Genetic Programming (GP): Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, random population generation, solving differential equations using GP.

UNIT-V:

Applications of Optimization in Design and Manufacturing systems: Some typical applications like optimization of path synthesis of a four-bar mechanism, minimization of weight of a cantilever beam and general optimization model of a machining process.

Text books:

1. Optimal design – JasbirArora, McGraw Hill (International) Publishers
2. Optimization for Engineering Design – Kalyanmoy Deb, PHI Publishers
3. Engineering Optimization – S.S.Rao, New Age Publishers

Reference Books:

1. Genetic algorithms in Search, Optimization, and Machine learning – D.E.Goldberg, Addison Wesley Publishers
2. Genetic Programming- Koza 3. Multi objective Genetic algorithms - Kalyanmoy Deb, PHI Publishers

B.TECH VII SEMESTER	PEC	L	T	P	C
		3	0	0	3

20ME7T04 **MANAGEMENT SCIENCE (PROFESSIONAL ELECTIVE -IV)**

Course Objectives:

1.To impart knowledge of source and function of values.
2.Demonstrate an understanding of the importance of values, ethics, and social responsibility for the self and for contemporary society.
3.Reflect on how values shape personal and community ethics and decision-making. An ability to function effectively on multi-disciplinary teams (team work).
4.Inculcate professional, ethical, legal, security and social issues and responsibilities
5.Gain personal and professional insight into organizational behaviour, diversity, personalities, goal setting, motivation, empowerment, and leadership style.

Course Outcomes: At the end of the course, student will be able to

1. Exercise critical thinking to propose, communicate, and implement, action plan that address opportunities and issues.
2. Identify and utilize ethical and legal standards in psychology while taking into account all relevant stakeholders.
3. Observe and recognize behaviours in organizational settings to aid in predicting outcomes.
4. Appreciate the importance of time management, planning, and communication in completing a group project.
5. Integrate knowledge of the key theories across the disciplines of public administration.
6. Compare various perspectives across organizational environments and the role of manager in core management and public policy disciplines

SYLLABUS

UNIT-I: Introduction to Management:

CONCEPTS OF MANAGEMENT AND ORGANISATION: Functions of management, evolution of management thought, Taylor's scientific management, fayol's principles of management, Hertzberg's Maslow's hierarchy of human needs, theory x and y, Hawthorne experiment, morale, motivation, working environmental conditions, systems approach to management. DESIGNING ORGANISATIONAL STRUCTURES: Basic concepts related to organisation - departmentation and decentralization, types of organization structures.

Unit-II: PLANT LOCATION

Definition, factors affecting the plant location, comparison of rural and urban sites, methods for selection of plant- matrix approach. Plant layout - definition, objectives, types of plant layout, various data analyzing forms travel chart.

WORK STUDY: Definition, objectives, method study - definition, objectives, steps involved- various types of associated charts, difference between micro motion and memo motion studies. Work measurement- definition, time study, steps involved, equipment, different methods of performance rating, allowances, standard time calculation. Work Sampling - definition, steps involved, standard time calculations, and differences with time study.

UNIT-III: INTRODUCTION TO PERT / CPM :

Project management, network modelling-probabilistic model, various types of activity times estimation, programme evaluation review techniques, critical path, probability of completing the project, deterministic model, critical path method (CPM), critical path calculation, crashing of simple of networks.

INSPECTION AND QUALITY CONTROL: Types of inspections, statistical quality control, techniques, variables and attributes, assignable and non assignable causes, variable control charts, and R charts, attributes control charts, p charts and c charts. Acceptance sampling plan, single sampling and double sampling plans, OC curves. Introduction to TQM - quality circles, ISO 9000 series procedures.

UNIT-IV: MATERIALS MANAGEMENT:

Objectives, inventory functions, types, associated costs, inventory classification techniques-ABC and VED analysis. Inventory control systems, continuous review system, periodical review system. Stores management and stores records. Purchase management, duties of purchase of manager, associated forms.

UNIT-V: INTRODUCTION TO HUMAN RESOURCE MANAGEMENT:

Functions of HRM, job evaluation, different types of evaluation methods. Job description, merit rating, different methods of merit ratings, wage incentives, different types of wage incentive schemes. Marketing, selling, marketing mix, product life cycle.

Text Books:

1. O. P. Khanna (2004), Industrial Engineering and Management, Dhanpat Rai, New Delhi.

References:

1. Stoner, Freeman (2005), Gilbert, Management, 6th edition, Pearson Education, New Delhi.
2. Panner Selvam (2004), Production and Operations Management, Prentice Hall of India, New Delhi.
3. Ralph M. Barnes (2004), Motion and Time Studies, John Wiley and Sons Aircraft & Missile propulsion /MJ Zucrow/Wiley, 1958.

B.TECH VII SEMESTER	PEC	L	T	P	C
		3	0	0	3

20ME7T05 **ADDITIVE MANUFACTURING (PROFESSIONAL ELECTIVE -IV)**

Pre-requisite: Manufacturing Process

Course Objective:

The course aims at the importance of Additive Manufacturing, Classifications, models, specifications of various Additive Manufacturing Techniques. To learn the different tools, soft-wares required and the applications of Additive Manufacturing

Course Outcomes: At the end of the course, student will be able to

CO1: Understand the working principle and process parameters of AM processes

CO2: Explore the applications of AM processes in various fields

CO3: Apply the suitable process and material for fabricating a given product

CO4: Use the suitable post process based on product application

CO5: Design and develop a product for AM Process

SYLLABUS

UNIT-I:

Additive Manufacturing Process: Basic Principles of the Additive Manufacturing Process, Generation of Layer Information, Physical Principles for Layer Generation. Elements for Generating the Physical Layer, Classification of Additive Manufacturing Processes, Evaluation of the Theoretical Potentials of Rapid Prototyping Processes.

UNIT-II:

Machines for Rapid Prototyping: Overview of Polymerization: Stereo lithography (SL), Sintering/Selective Sintering: Melting in the Powder Bed, Layer Laminate Manufacturing (LLM) and Three-Dimensional Printing (3DP).

UNIT-III:

Rapid Prototyping: Classification and Definition, Strategic Aspects for the Use of Prototypes, Applications of Rapid Prototyping in Industrial Product Development. Rapid Tooling: Classification and Definition of Terms, Properties of Additive Manufactured Tools, Indirect Rapid

UNIT-IV:

Tooling Processes: Molding Processes and Follow-up Processes, Indirect Methods for the Manufacture of Tools for Plastic Components, Indirect Methods for the Manufacture of Metal Components.

UNIT-V:

Direct Rapid Tooling Processes: Prototype Tooling: Tools Based on Plastic Rapid Prototyping Models and Methods, Metal Tools Based on Multilevel AM Processes, Direct Tooling: Tools Based on Metal Rapid Prototype Processes.

Text Books:

1. Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing, Ian Gibson, David W Rosen, Brent Stucker, Springer, 2015, 2nd Edition.
2. 3D Printing and Additive Manufacturing: Principles & Applications, Chua Chee Kai, Leong Kah Fai, World Scientific, 2015, 4th Edition.

References:

1. Rapid Prototyping: Laser-based and Other Technologies, Patri K. Venu vinod and Weiyin Ma, Springer, 2004.
2. Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling, D.T. Pham, S.S. Dimov, Springer 2001.
3. Rapid Prototyping: Principles and Applications in Manufacturing, Rafiq Noorani, John Wiley & Sons, 2006.

B.TECH VII SEMESTER	**PEC**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

20ME7T06 **ADVANCED MACHINING PROCESSES (PROFESSIONAL ELECTIVE -IV)**

Pre-requisite: Metal Cutting & Machine Tools

Course Objective: The Students will acquire the knowledge

1. To understand basic concepts of modern machining processes and ultrasonic machining.

2. To interpret the principles and procedure of principles of electro chemical machining.

3. To apply the principles and procedure of thermal metal removal processes.

4. To illustrate the principles and procedure of electron beam machining, laser beam machining and plasma machining. 5. To interpret the principles and procedure of abrasive jet machining.

Course Outcomes: At the end of the course, student will be able to

CO1: Understand the concepts of modern machining processes and ultrasonic machining.

CO2: Interpret the principles and procedure of principles of electro chemical machining.

CO3: Apply the principles and procedure of thermal metal removal processes.

CO4: Illustrate the principles and procedure of electron beam machining, laser beam machining and plasma machining

CO5: Interpret the principles and procedure of abrasive jet machining

SYLLABUS

UNIT-I: Introduction:

Need for non-traditional machining methods-classification of modern machining processes considerations in process selection, applications.
Ultrasonic machining – Elements of the process, mechanics of material removal, MRR process parameters, economic considerations, applications and limitations.

UNIT-II: ELECTRO – CHEMICAL MACHINING:

Fundamentals of electro chemical machining, electrochemical grinding, electro chemical honing and deburring process, metal removal rate in ECM, Tool design, Surface finish and accuracy, economic aspects of ECM – Simple problems for estimation of metal removal rate, fundamentals of chemical, machining, advantages and applications.

UNIT-III: THERMAL METAL REMOVAL PROCESSES:

General principle and applications of Electric Discharge Machining, Electric Discharge Grinding and wire EDM – Power circuits for EDM, Mechanics of metal removal in EDM, Process parameters, selection of tool electrode and dielectric fluids, surface finish and machining accuracy, characteristics of spark eroded surface.

UNIT-IV:

Electron Beam Machining, Laser Beam Machining - Basic principle and theory, mechanics of material removal, process parameters, efficiency & accuracy, applications.

Plasma Machining: Application of plasma for machining, metal removal mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries.

UNIT-V:

Abrasive jet machining, Water jet machining and abrasive water jet machining: Basic principles, equipments, process variables, mechanics of material removal, MRR, application and limitations, agnetic abrasive finishing, abrasive flow finishing, Electro stream drilling, shaped tube electrolytic machining.

Text Books:

1. Fundamentals of Machining Processes-Conventional and non – conventional processes/Hassan Abdel – Gawad El-Hafy/CRCPress-2016.

References:

1. Modern Machining Process / Pandey P.C. and Shah H.S./TMH.
2. New Technology / Bhattacharya A/ the Institution of Engineers, India1984.
3. Non Traditional Manufacturing Processes / Benedict.

B.TECH VII SEMESTER	PEC	L	T	P	C
		3	0	0	3

20ME7T07 **MECHANICAL VIBRATIONS (PROFESSIONAL ELECTIVE -V)**

Pre-requisite: Engineering Mathematics, Mechanics of Solids.

Course Objective:

1. To analyze the various 1-D periodic and periodic responses of a vibrating system with and¬ without damping.
2. Able to derive equations of motion and solutions for two and multi degree freedom systems by the application of analytical methods .
3. Able to understand the numerical methods for quick estimation of 1st natural frequency of multi¬ degree freedom systems.
4. Apply the knowledge of the various physical vibration measuring instruments and their¬ applications in real life vibration data acquisition.
5. Apply the knowledge of transient vibrations to the various engineering Applications.

Course Outcomes: At the end of the course, student will be able to

CO1: To learn basic principles of mathematical modeling of vibrating systems

CO2: To learn the basic concepts free and forced multi degree freedom systems

CO3: To learn concepts involved in the torsional vibrations

CO4: To learn the principals involved in the critical speed of shafts

CO5: To learn the basic concepts of transient vibrations

SYLLABUS

UNIT-I: INTRODUCTION:

Relevance of and need for vibrational analysis – Basics of SHM - Mathematical modelling of vibrating systems - Discrete and continuous systems - single-degree freedom systems - free and forced vibrations, damped and undamped systems.

UNIT-II: MULTI DEGREE FREEDOM SYSTEMS:

Free and forced vibrations of multi-degree freedom systems in longitudinal, torsional and lateral modes - Matrix methods of solution- normal modes - Orthogonality Principle-Energy methods, Eigen values and Eigen vectors, modal analysis.

UNIT-III: CONTINUOUS SYSTEMS:

Torsional vibrations - Longitudinal vibration of rods - transverse vibrations of beams – Governing equations of motion - Natural frequencies and normal modes - Energy methods, Introduction to nonlinear and random vibrations.

UNIT-IV: CRITICAL SPEEDS OF SHAFTS:

Critical speed of a light shaft having a single disc without damping and with damping, critical speeds of shaft having multiple discs, secondary critical speed, critical speeds light cantilever shaft with a large heavy disc at its end.

UNIT-V: TRANSIENT VIBRATIONS:

Laplace transformations response to an impulsive input, response to a step input, response to pulse (rectangular and half sinusoidal pulse), phase plane method.

Text Books:

1. S.S. Rao, “Mechanical Vibrations ", 5th Edition, Prentice Hall, 2011.
2. L. Meirovitch, “Elements of vibration Analysis", 2nd Edition, McGraw-Hill, New York, 1985.

References:

1. W.T. Thomson, M.D. Dahleh and C Padmanabhan, “Theory of Vibration with Applications”, 5th Edition, Pearson Education, 2008.

B.TECH VII SEMESTER	**PEC**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

20ME7T08 **AUTOMOBILE ENGINEERING (PROFESSIONAL ELECTIVE -V)**

Pre-requisite: Applied Thermodynamics

Course Objective:

1. Understand the basic lay-out of an automobile, engine cooling, lubrication.
2. Understand the operation of ignition, electrical and air conditioning systems.
3. Understand the principles of transmission, steering
4. Understand the principles of braking and suspension systems.
5. Study latest developments in automobile emissions and safety systems.

Course Outcomes: At the end of the course, student will be able to

CO1: Describe the basic lay-out of an automobile and its components and classify various lubricating and cooling systems of an automobile.

CO2: Describe various fuel supply and electrical systems in SI and CI engines

CO3: Understand the concept of power transmission system and vehicle controlling.

CO4: Explain the principles of suspension and braking System

CO5: Explain the principles of safety systems and emission standards.

SYLLABUS

UNIT-I:

Introduction: Classification of automobiles, Components of four wheeler automobile- chassis, body, power unit, power transmission- front wheel drive, rear wheel drive, four-wheel drive

Lubricating System: Functions & properties of lubricants, methods of lubrication-splash, pressure, dry sump and wet sump lubrication, oil filters and oil pumps.

Cooling System: Necessity, methods of cooling - air cooling & water cooling, components of water cooling, radiator, thermostat.

UNIT-II:

Fuel supply systems: Carburetor-types, defects in carburetor, electronic injection system, multi point fuel injection system, fuel injection system in diesel engine, fuel injection pumps, fuel injector and nozzles.

Ignition System: Functions, requirements, types of an ignition system, battery ignition system - components, Magneto ignition system, Electronic ignition system

Electrical System: charging circuit- generator, current-voltage regulator, stating System-Bendix drive mechanism, lighting system, indicating devices, horn.

UNIT-III:

Transmission system: Types and functions of the clutches- cone clutch, single plate clutch, multi plate clutch, centrifugal and semi centrifugal clutch, Types of gear boxes- Sliding mesh, Constant mesh, Synchromesh, propeller shaft, universal joint and differential. wheels and tyres.

Steering System: steering geometry, condition for correct steering, types of steering Mechanisms-Ackermann and Davis steering mechanism, steering gears, power steering.

UNIT-IV:

Suspension System: Objectives of suspension system, front suspension system-rigid axle suspension system, independent suspension system, rear axle suspension, torsion bar, shock absorber.

Braking System: Mechanical brakes, hydraulic brakes-master cylinder, wheel cylinder, tandem master cylinder, brake fluid, air brakes and vacuum brakes.

UNIT-V:

Emissions from Automobile: Emission norms - Bharat stage and Euro norms. Engine emissions - exhaust and non-exhaust.

Safety Systems: seat belt, air bags, bumper, antilock brake system (ABS), wind shield, suspension sensor, traction control, central locking, electric windows, speed control.

Text Books:

1. Kirpal Singh, “Automobile Engineering Vol-1 & vol-2”, Standard Publishers Distributors, 11th edition.
2. William H Crouse & Donald L Anglin, Automotive Mechanics, Tata Mc Graw Hill Publications, 10th edition.

References:

1. R.B Gupta , Automobile Engineering, Satya Prakashan Publications, 6th edition.
2. Newton steeds & Garrett, “The Motor vehicle”, Society of Automotive Engineers, 13th edition.
3. G.B.S. Narang, “Automotive Engineering”, Khanna Publishers, 5th edition.
4. Joseph Heitner, “Automotive Mechanics”, IPC Transport Press Ltd, 2nd Edition.
5. Harbons singh Reyat, “The Automobile”, S. Chand & company pvt. ltd., 6th edition.

B.TECH VII SEMESTER **PEC**

L	T	P	C
3	0	0	3

20ME7T09 **NON DESTRUCTIVE EVALUATION (PROFESSIONAL ELECTIVE -V)**

Pre-requisite: Advanced Machining Processes

Course Objective:

1. To understand the concepts of various NDE techniques and their applications.
2. To gain knowledge of various NDE techniques using radiography, ultrasonics, liquid penetrates, magnetic patches and Eddy currents
3. To gain the knowledge on basic principles of these methods and will be able to select a testing process
4. To understand the advantages and disadvantages of these techniques.

Course Outcomes: At the end of the course, student will be able to

CO1: Understand the concepts of various NDE techniques and the requirements of radiography techniques and safety aspects.

CO2: Interpret the principles and procedure of ultrasonic testing

CO3: Understand the principles and procedure of Liquid penetration and eddy current testing

CO4: Illustrate the principles and procedure of Magnetic particle testing

CO5: Interpret the principles and procedure of infrared testing and thermal testing

SYLLABUS

UNIT-I:

Introduction to non-destructive testing, Industrial Applications of NDE: Span of NDE Activities Railways, Nuclear, Non-nuclear and Chemical Industries, Aircraft and Aerospace Industries, Automotive Industries, Offshore Gas and Petroleum Projects, Coal Mining Industry, NDE of pressure vessels, castings, welded constructions

UNIT-II:

Ultrasonics Test: Ultrasonic Transducers and their Characteristics, Ultrasonic Equipment and Variables Affecting Ultrasonic Test, Ultrasonic Testing, Interpretations and Guidelines for Acceptance, Rejection - Effectiveness and Limitations of Ultrasonic Testing.

UNIT-III: Liquid Penetrant Test:

Liquid Penetrant Test, Basic Concepts, Liquid Penetrant System, Test Procedure, Effectiveness and Limitations of Liquid Penetrant Testing.

Radiographic test, Sources of X and Gamma Rays and their interaction with Matter, Radiographic equipment, Radiographic Techniques, Safety Aspects of Industrial Radiography

UNIT-IV: Magnetic Particle Test:

Magnetic Materials, Magnetization of Materials , Demagnetization of Materials, Principle of Magnetic Particle Test, Magnetic Particle Test Equipment, Magnetic Particle Test Procedure, Standardization and Calibration, Interpretation and Evaluation, Effective Applications and Limitations of the Magnetic Particle Test

UNIT-V: Eddy Current Test:

Principle of Eddy Current, Eddy Current Test System, Applications of Eddy Current Testing Effectiveness of Eddy Current Testing

Text Books:

1. Non-destructive test and evaluation of Materials, J Prasad, GCK Nair, TMH Publishers
2. Ultrasonic testing by Krautkramer and Krautkramer 3. Non-destructive testing, Warress, JMc Gonmade

References:

1. Ultrasonic inspection training for NDT: E. A. Gingel, Prometheus Press,
2. ASTM Standards, Vol 3.01, Metals and alloys
3. Non-destructive, Hand Book – R. Hamchand

B.TECH VII SEMESTER		L	T	P	C
	P	0	0	0	3

20ME7I16 INDUSTRIAL/RESEARCH INTERNSHIP

Pre-requisite: Industrial Training/In-House Training.

Course Objective:

The main objective of this course is to make the student employable through Industrial exposure or any training on advanced technology through online mode.

Course Outcomes:

At the end of the course, student will be able to

CO1:	Apply the academic knowledge in Industry or any advanced technology.
CO2:	Understand administrative functions and ethical principles of the organisation.
CO3:	Analyze and develop the concepts by practical observation.
CO4:	Improve the report writing skills.

B.TECH VIII SEMESTER	**P**	**L**	**T**	**P**	**C**
		0	**0**	**0**	**12**

20ME8P01 **PROJECT (Project work/Internship)**

Pre-requisite:

Knowledge gained in all the theory and practical courses, as well as the knowledge gained in industrial training, internship and executing the mini project.

Course Objective:

The main objective of this course is to make the student plan and execute a project as a team using the available recourses within and outside the institute.

Course Outcomes:

At the end of the course, student will be able to

CO1: Implement the concepts of mechanical engineering.

CO2: Formulate and solve theoretical or practical engineering problems.

CO3: Analyze the concepts by practical observation.

CO4: Implement the knowledge in the report writing skills.

CO5: Manage and plan the work as a team.

		L	T	P	C
B.TECH V SEMESTER	**OEC**	**3**	**0**	**0**	**3**

20CE5T04 ARCHITECTURE AND TOWN PLANNING
(OPEN ELECTIVE-I)

Course Objectives: The objective of this course is to

- Initiating the students to different architectures of the world.
- Salient features of Egyptian, Greek, Roman, Indian Vedic, Indus valley civilization.
- Architectural Design concepts, Principles of Planning and Composition.
- To understand town planning from ancient times to modern times.
- To impart the concepts of town planning standards.

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

CO1: Student should be able to distinguish architectural styles of eastern and Western world.

CO2: Student should understand the importance of Orders of Architecture.

CO3: Should be able to compose spaces of buildings using design concepts, planning principles.

CO4: Student should understand the town planning standards, landscaping features.

SYLLABUS

UNIT-I:

History of Architecture: Western Architecture: Egyptian, Greek, Roman Architectures- Orders. Indian Architecture: Vedic age, Indus valley civilization– Buddhist period: Stambas, Stupa, Toranas, Chaityas, Viharas – Hindu temples: Dravidian and Indo Aryan Styles-Temple of Aihole, Madurai, Bhuvaneshwar, Mount Abu. Indo Sarsanic (Islamic) Architecture: Mosque - Palace – Fort - Tomb.

UNIT-II:

Architectural Design: Principles of designing – Composition of Plan – relationship between plan and elevation- building elements, form, surface texture, mass, line, color, tone- Principles of Composition: Unity, contrast, proportion, scale, balance, circulation, rhythm, character, expression.

UNIT-III:

Principles of Planning: Principles of planning a residence- site selection, site orientation- aspect, prospect, grouping, circulation, privacy, furniture requirements,

Post-classic Architecture: Introduction of post-classic architecture contribution of eminent architects to modern period-Edward Lutyens, Le Corbusier, Frank Lloyd Wright, Walter Groping.

UNIT-IV:

Histroical Back Ground of Town Planning: Town planning in India – Town plans of mythological Manasa-Town plans of ancient towns: Harappa, Mohenjodaro, Pataliputra, Delhi, Acropolis (Greece), Jerusalem, Mecca, Rome, London.

UNIT-V:

Modern Town Planning: Zoning- Roads and road traffic- Housing- Slums, Parks, Play grounds- Public Utility Services- Surveys and maps for planning- neighbor hood Planning.

Standards of Town planning: Planning new towns, planning standards and specifications, national and regional planning, town planning and legislation planning regulations and limitations.

Text books:

1. 'The great ages of World Architecture' by G.K. Hiraskar.
2. 'Planning and Design of Buildings by Section of Architecture' by Y. S.Sane.
3. 'Professional Practice' by G.K.Krishnamurthy, S.V.Ravindra, PHI Learning, NewDelhi.
4. 'Indian Architecture – Vol. I & II' by Percy Brown, Taraporevala Publications, Bombay.
5. 'Fundamentals of Town Planning'by G.K. Haraskar.

Reference Books:

1. 'Drafting and Design for Architecture' by Hepler, Cengage
2. Learning 'Architect's Portable Handbook' by John Patten Guthrie – Mc Graw Hill International Publications.
3. 'Mordern Ideal Homes for India' by R. S. Deshpande.
4. 'Town and County Planning' by A.J. Brown and H.M. Sherrard.
5. 'Town Design' by Federik Glbbard, Architectural press, London.

B.TECH V SEMESTER	OEC	L	T	P	C
		3	0	0	3

20CE5T05 ELEMENTS OF CIVIL ENGINEERING

(OPEN ELECTIVE-I)

Course Objectives: The objective of this course is to

To introduce basics of Civil Engineering concepts in the fields of surveying, building materials, water resources, Water Supply, Sanitary, Electrical Works in Building and Highway engineering.

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

CO1: The student should be able to know the basics of civil engineering and concepts of surveying.

CO2: The student should be able to know various properties of building materials and various types of building.

CO3: The student should be able to know the fundamentals of Water Resources, Water Supply, Sanitary and Electrical Works in Building.

CO4: The student should be able to know the fundamental concepts highway engineering.

SYLLABUS

UNIT-I:

Introduction. Introduction of Civil Engineering, Scope of Civil Engineering, Role of Civil Engineer in Society. Impact of infrastructural development on economy of country.

UNIT-II:

Surveying Introduction: Definition of Surveying, Fundamental principles of surveying, Classification of surveying.

Linear Measurement: Methods, Instruments used in chain surveying, Selection of stations, Chaining and Ranging.

Angular Measurement: Instruments used, Types of compass, Types of meridians and bearings, Measurement of bearings, computation of angles. Compass traversing local attraction.

Levelling: Objectives and applications-terminology-Instruments, component parts of dumpy level, Types of levelling, levelling staff

UNIT-III:

Building Materials and Construction Materials: Introduction to construction materials - Stones, Bricks, Lime, Cement, Timber, Sand, Aggregates, Mortar, Concrete and bitumen. Construction: Classification of buildings, Building components and their functions.

UNIT-IV:

Water Resources Hydrologic cycle, water use and its conservation, Introduction to dams, barrages and check dams. Water Supply, Sanitary and Electrical Works in Building Introduction, water supply system, water supply layout of a building, house drainage, traps, electrical works in building.

UNIT–V:

Transportation Engineering, classification of roads, Introduction of flexible and rigid pavements, Introduction to road traffic and traffic control mechanism.

Text Books:

1. Elements of Civil Engineering, Mimi Das Saikia, Bhargab Mohan Dasand Madan Mohan Das Publisher: PHI Learning Private Limited New Delhi.
2. Elements of Civil Engineering, Dr. R.K. Jain and Dr. P.P. Lodha, Publisher: McGraw Hill Education, India Pvt. Ltd.
3. Surveying Vol. I, Dr. B. C. Punmia, Ashokkumar Jain, Arun kumar Jain, 16th Edition Publisher: Laxmi Publication Delhi.

Reference Books:

1. Surveying Theory and Practice, James M Anderson and Edward, 7th Edition, M Mikhail Publisher: McGraw Hill Education, India Pvt. Ltd.
2. Surveying and Leveling, R. Subramanian Publisher, Oxford University.
3. Building drawing, M.G. Shah, C.M.Kale and S.Y. Patki Publisher: TataMcGraw Hill.

		L	T	P	C
B.TECH V SEMESTER	**OEC**	**3**	**0**	**0**	**3**

20EE5T04 BASICS OF CONTROL SYSTEMS
(OPEN ELECTIVE-I)

Course Objectives:

- To Enable the student to understand the importance of Modelling of Control systems
- To understand the First order & second order systems
- To understand the transfer function analysis
- To understand the Stability of the systems
- To understand the States Space Analysis

Course Outcomes:

At the end of the course, the student will be able to

CO1: Understand the different Classification of control systems and modelling

CO2: Understand the functioning of Signals & time response analysis

CO3: Understand the concept of Root Locus & Construction of Root Loci

CO4: Understand the concept of Bode plot & Nyquist Plot

CO5: Understand the concept of States Space Analysis of LTI System

SYLLABUS

UNIT – I

Mathematical Modeling of Control Systems: Classification of control systems, Open Loop and closed loop control systems and their differences, Feed-Back Characteristics, transfer function of linear system, Differential equations of electrical networks, Translational and Rotational mechanical systems

UNIT-II

Time Response Analysis: Standard test signals - Time response of first and second order systems - Time domain specifications - Steady state errors and error constants – Effects of proportional derivative, proportional integral systems.

UNIT – III

Stability and Root locus Technique: The concept of stability – Routh's stability criterion –limitations of Routh's stability –Root locus concept - construction of root loci

UNIT–IV

Frequency Response Analysis: Introduction to Frequency domain specifications-Bode diagrams- transfer function from the Bode Diagram-Phase margin and Gain margin-Stability Analysis from Bode Plots, Polar Plots.

UNIT–V

State Space Analysis of LTI Systems: Concepts of state variables and state model, state space representation of transfer function, Diagonalization- Solving the time invariant state equations.

Text Books:

1. Control Systems principles and design, M.Gopal, Tata McGraw Hill education Pvt Ltd., 4th Edition.
2. Automatic control systems, Benjamin C.Kuo, Prentice Hall of India,2nd Edition.

Reference Books:

1. Modern Control Engineering, Kotsuhiko Ogata, Prentice Hall of India.
2. Control Systems, Manik Dhanesh N, Cengage publications.
3. Control Systems Engineering, I.J.Nagarath and M.Gopal, Newage International
   Publications, 5th Edition.
4. Control Systems Engineering, S.Palani,TataMcGraw Hill Publications.

B.TECH V SEMESTER **OE**

L	T	P	C
3	0	0	3

20EE5T05 SPECIAL ELECTRICAL MACHINES

(OPEN ELECTIVE-I)

Course Objective:

- To explain theory of operation and control of switched reluctance motor.
- To explain the performance and control of stepper motors, and their applications.
- To describe the operation and characteristics of permanent magnet dc motor.
- To distinguish between brush dc motor and brush less dc motor.
- To explain the theory of travelling magnetic field and applications of linear motors.

Course Outcomes:

The student should be able to

CO1: Distinguish between brush dc motor and brush less dc motor.

CO2: Explain the performance and control of stepper motors, and their applications.

CO3: Explain theory of operation and control of switched reluctance motor.

CO4: Explain the theory of travelling magnetic field and applications of linear motors.

CO5: Understand the significance of electrical motors for traction drives.

SYLLABUS

Unit I: Stepper Motors: Classification and construction details of stepper motors – Hybrid and Variable Reluctance Motor (VRM) - Construction and principle of hybrid type synchronous stepper motor – Different configuration for switching the phase windings control circuits for stepper motors – Open loop and closed loop control of stepper motors – Applications of stepping motors.

Unit II: Switched Reluctance Motors: Construction – Comparison of conventional and switched reluctance motors –Torque producing principle and torque expression – Different converter configurations for SRM – Drive and power circuits for SRM – Position sensing of rotor – Applications of SRM.

Unit III : Brushless DC Motor: Construction – Principle of operation of BLDM – sensing and logic scheme, basic drive circuit, power converter circuit, transient analysis Theory of brushless DC motor as variable speed synchronous motor. Torque and EMF equations – Torque speed characteristics – Performance and efficiency.

UNIT-IV: **Linear motors:** Linear induction motor: Construction– principle of operation– applications. Linear synchronous motor: Construction – principle of operation– applications.

Unit V: Electric Motors for traction drives: AC motors– DC motors –Single sided linear induction motor for traction drives – Comparison of AC and DC traction.

Text Books:

1. Special electrical Machines, K. Venkata Ratnam, University press, 2009, New
2. "Linear Electric Motors: Theory, Design and Practical application" , Naser A and Boldea I, Prentice Hall Inc, New Jersey, 1987.

Reference Books:

1. Generalized Theory of Electrical Machines – PS Bhimbra, Khanna Publishers.
2. "Brushless Permanent Magnet and Reluctance Motor Drives" , Miller T.J.E. Clarendon Press, Oxford, 1989.
3. Electric Machines – Theory, operation, Applications and Control - Charles I. Hubert – Pearson Publications.

B.TECH V SEMESTER		**OEC**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
20ME5T04	**DESIGN THINKING & PRODUCT INNOVATION (OPEN ELECTIVE-I)**					

Pre-requisite: Managerial Economics and Financial Analysis,

Management Science.

Course Objective: At the end of the course, The student will able to

1. Design and develop the new product
2. Explain the basics of design thinking.
3. Describe the role of reverse engineering in product development.
4. Identify the needs of society and convert into demand.
5. Explain the product planning and product development process

Course Outcomes: At the end of the course, student will be able to

CO1: To bring awareness on innovative design and new product development.

CO2: To explain the basics of design thinking.

CO3: To familiarize the role of reverse engineering in product development.

CO4: To train how to identify the needs of society and convert into demand.

CO5: To introduce product planning and product development process.

SYLLABUS

UNIT-I: SCIENCE TO ENGINEERING:

Job of engineers, engineering units and measurement, elements of engineering analysis, forces and motion, energy, kinematics and motion, conversion of linear motion to rotary and vice versa, motion transmission. Physics to Engineering: Application of Newton laws, Pascal's law, Bouncy, Bernoulli's theorem, Ohm's law, electrical induction in
engineering products.

UNIT-II: HISTORICAL DEVELOPMENT:

Invention wheel, early mechanics in design, mechanical advantages,
industrial revolution, steam and petrol for mobility. Innovations in Electrical and Electronics: Electrical energy generation, electrical bulb, electrical equipment, electronics and automation, computing for early days to present, innovations in communications.

UNIT-III: SYSTEMATIC APPROACH TO PRODUCT DEVELOPMENT:

Design Thinking, Innovation, Empathize Design Thinking as a systematic approach to Innovation, brainstorming, visual thinking, design challenges, innovation, art of Innovation, strategies for idea generation, creativity, teams for innovation. Solution finding methods: Conventional, intuitive, discursive, methods for combining solution, decision making for new design.

UNIT-IV: REVERSE ENGINEERING IN PRODUCT DEVELOPMENT:

Reversing engineering methods, identifying the bad features in a product, reduction in size and weight, usage of new materials, 3D printing, study of introducing electrical and electronic controls to the old products, importance of ergonomics in product development, environmental considerations in design, safety considerations in design.

UNIT-V:

Study of Product Development- Agriculture, development of machines for separation of corn seeds, peeling of groundnut shells, husk removing from paddy. Electrical: Design of burglar alarm, speedometer, water level indicator, smart gates, smart lights. Design of electrical vehicles, unmanned vehicles, design principles in drones.

Text Books:

1. Philip Kosky, Robert T. Balmer, William D. Keat, George Wise, “Exploring Engineering: An Introduction to Engineering and Design”, 4th edition, Elsevier, 2016.
2. David Ralzman, “History of Modern Design”, 2nd edition, Laurence King Publishing Ltd., 2010
3. An AVA Book, “Design Thinking”, AVA Publishing, 2010.

Reference Books:

1. G. Pahl, W.Beitz, J. Feldhusen, KH Grote, “Engineering Design: A Systematic Approach”, 3rd edition, Springer, 2007.
2. Tom Kelley, Jonathan Littman, “Ten Faces in Innovation”, Currency Books, 2006.

B.TECH V SEMESTER		**OEC**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
20ME5T05	**NANOTECHNOLOGY (OPEN ELECTIVE-I)**					

Pre-requisite: Materials Science

Course Objective:

- To familiarize with principles of quantum mechanics on which nano materials behave
- To elucidate applications of nanotechnology

Course Outcomes:

At the end of the course, student will be able to

CO1: Analyze the concepts and preparation methods of Nano materials

CO2: Understand the nano material properties and their behavior

CO3: Use various techniques for investigating nano material

CO4: Know the importance of Nano Technology for advanced materials processing

CO5: Know the importance of Nano structured Materials for Various Energies.

SYLLABUS

UNIT-I: Introduction to Nano technology:

Introduction: History and Scope, Can Small Things Make a Big Difference? Classification of Nanostructured Materials, Fascinating Nanostructures, Applications of Nanomaterials, Nature: The Best of Nanotechnologist, Challenges, and Future Prospects

UNIT-II: Unique Properties of Nanomaterials:

Microstructure and Defects in nanocrystalline Materials: Dislocations, Twins, stacking faults and voids, Grain Boundaries, triple, and disclinations, Effect of Nano-dimensions on Materials Behavior: Elastic properties, Melting Point, Diffusivity, Grain growth characteristics, enhanced solid solubility, Magnetic Properties: Soft magnetic Nanocrystalline alloy, Permanent magnetic Nanocrystalline materials, Giant Magnetic Resonance, Electrical Properties, Optical Properties, Thermal Properties, and Mechanical Properties.

UNIT-III: Synthesis Routes :

Bottom up approaches: Physical Vapor Deposition, Inert Gas Condensation, Laser Ablation, Chemical Vapor Deposition, Molecular Beam Epitaxy, Solgel method ,Self assembly, Top down approaches: Mechanical alloying, Nano-lithography, Consolidation of Nanopowders: Shock wave consolidation, Hot isostatic pressing and Cold isostatic pressing Spark plasma sintering.

UNIT-IV: Nanomaterials for Energy Conversion Systems:

Issues and Challenges of functional Nanostructured Materials for electrochemical Energy, Conversion Systems, Fuel Cells, Principles and nanomaterials design for Proton exchange membrane fuel cells (PEMFC); Direct methanol fuel cells (DMFC).

UNIT-V:

Issues and Challenges of functional Nanostructured Materials for electrochemical Energy Storage Systems, Primary and Secondary Batteries (Lithium ion Batteries), Cathode and anode materials, Nanostructured Carbon based materials, Nano-Oxides, Novel hybrid electrode materials, Current status and future trends.

Text books:

1. Electrochemical methods: Fundamentals and Applications, Allen J.Bard and Larry R. Faulkner, 2ndEdition John Wiley & Sons. Inc (2004)
2. D. Linden Ed., Handbook of Batteries, 2nd edition, McGraw-Hill, New York (1995)
3. G.A. Nazri and G. Pistoia, Lithium Batteries: Science and Technology, KulwerAcdemic Publishers, Dordrecht, Netherlands (2004).
4. J. Larmine and A. Dicks, Fuel Cell System Explained, John Wiley, New York (2000).

Reference Books:

1. Science and Technology of Lithium Batteries-Materials Aspects: An Overview, A. Manthiram, Kulwer Academic Publisher (2000).
2. M. S. Whittingham, A. J. Jacobson, Intercalation Chemistry, Academic Press, New York (1982).
3. M. Wakihara, O. Yamamoto, (Eds.) Lithium Ion Batteries: Fundamentals and Performance, Wiley –VCH ,Weinheim (1998).

			L	T	P	C
B. Tech V SEMESTER		**OEC**	**3**	**0**	**0**	**3**

20EC5T04 LINEAR SYSTEM ANALYSIS (OPEN ELECTIVE –I)

Pre-requisite: Basic knowledge about vectors, differentiation and integration

COURSE OBJECTIVES:
The main objectives of this course are given below:

	At the end of the course, student will be able to
1	To understand basics of Signals and Systems required for all Engineering related courses.
2	To understand the behaviour of signal in time and frequency domain.
3	To understand the characteristics of LTI systems.
4	To understand concepts of Signals and Systems and its analysis using different transform techniques.
5	To understand sampling, convolution and correlation.

COURSE OUTCOMES:
At the end of this course the student will able to:

	At the end of the course, student will be able to
CO1:	Differentiate various signal functions.
CO2:	Represent any arbitrary signal in time and frequency domain.
CO3:	Understand the characteristics of linear time invariant systems.
CO4:	Analyse the signals with different transform technique.
CO5:	Understand the concept of sampling.

SYLLABUS

UNIT-I: Signal Analysis

Analogy between Vectors and Signals, Orthogonal Signal Space, Classification of Signals and systems, Exponential and Sinusoidal signals, Concepts of Impulse function, Unit Step function, Signum function

UNIT-II: Fourier series & Fourier transforms

Representation of Fourier series, Continuous time periodic signals, Properties of Fourier Series, Dirichlet's conditions, Trigonometric Fourier Series and Exponential Fourier Series.Deriving Fourier Transform from Fourier series, Fourier Transform of arbitrary signal, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of Fourier Transform.

UNIT-III: Signal Transmission through Linear Systems

Linear System, Impulse response, Response of a Linear System, Linear Time Invariant(LTI) System, Linear Time Variant (LTV) System, Transfer function of a LTI System, Filter characteristic of Linear System, Distortion less transmission through a system, Signal bandwidth, System Bandwidth, Pauley-Wiener criterion for physical realization, Relationship between Bandwidth and rise time.

UNIT-IV: Laplace Transforms & Z–Transforms

Laplace Transforms (L.T), Inverse Laplace Transform, Concept of Region of Convergence (ROC) for Laplace Transforms, Properties of L.T, Relation between L.T and F.T of a signal.

Concept of Z- Transform of a Discrete Sequence, Distinction between Laplace, Fourier and Z Transforms, Region of Convergence in Z-Transform, ROC for various classes of signals, Inverse Z-transform, Properties of Z-transforms

UNIT-V: Sampling theorem & Correlation

Graphical and analytical proof for Band Limited Signals, Natural and Flat top Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing, Introduction to Band Pass Sampling.

Cross Correlation and Auto Correlation of Functions, Properties of Correlation Functions, Energy Density Spectrum, Parseval's Theorem, Power Density Spectrum, Relation between Autocorrelation Function and Energy/Power Spectral Density Function, Relation between Convolution and Correlation.

Text Books:

1. Signals, Systems & Communications - B.P. Lathi, 2013, BSP.
2. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawabi, 2nd Ed.

Reference Books:

1. Signals and Systems – Simon Haykin and Van Veen, Wiley 2 Ed.,
2. Signals and Systems – A. Rama Krishna Rao, 2008, TMH

B. TECH V SEMESTER

		L	T	P	C
	OEC	3	0	0	3

20EC5T05 DIGITAL LOGIC DESIGN (OPEN ELECTIVE –I)

Course Objectives:

At the end of the course, student will be able to

1. To represent numbers and conversion between different representations.
2. To analyze logic processes and implement logical operations.
3. To develop the combinational logic circuits.
4. To understand concept of programmable logic devices like PROM, PLA, PAL.
5. To design and analyze the concepts of sequential circuits.

Course Outcomes:
At the end of this course the student will able to:

CO1: Understand different number systems and their conversions.

CO2: Analyze the logical operations and Boolean algebra

CO3: Develop combinational circuits and perform logical operations.

CO4: Understand different programmable logic devices.

CO5: Design the sequential logic functions.\

SYLLABUS

UNIT-I:

Number Systems: Binary- Octal- Decimal- Hexadecimal Number Systems- Conversion of Numbers from One Radix to Another Radix- r‘s Complement- (r-1)‘s Complement- Subtraction of Unsigned Numbers- Signed Binary Numbers- Problems.

UNIT-II:

Logic Gates and Boolean Algebra: Basic Gates- Universal Gates- Ex-Or and Ex-Nor Gates- SOP- POS- Boolean Theorems- Dual of Logical Expressions- Minimizations of Logic Functions Using Boolean Theorems- K Map Method- Minimization of Boolean Functions.

UNIT-III: Signal Transmission through Linear Systems

Combinational Logic Circuits: Design of Half Adder- Full Adder- Half Subtractor- Full Subtractor- Ripple Adder and Subtractor- Design of Decoders- Encoders- Multiplexers- Demultiplexers- Magnitude Comparator.

UNIT-IV: Laplace Transforms & Z–Transforms

Introduction to Programmable Logic Devices (PLDs): PLA- PAL- PROM- Realization of Switching Functions Using PROM- Comparison of PLA, PAL and PROM.

UNIT-V: Sampling theorem & Correlation

Introduction to Sequential Logic Circuits: Basic Sequential Logic Circuits- Latch and Flip-Flop- RS- Latch Using NAND and NOR Gates- RS, JK, T and D Flip Flops- Conversion of Flip Flops- Flip Flops With Asynchronous Inputs (Preset and Clear)- Design of Registers- Universal Shift Register- Ring Counter- Johnson Counter.

TEXT BOOKS

1. Digital Design, M.Morris Mano, Michael D Ciletti, 4thEdition, PEA, 2003.

2. Fundamentals of Logic Design, Roth, 5thEdition, Cengage, 2004

REFERENCE BOOKS

1. Switching and Finite Automata Theory, Kohavi, 3rd Edition, Jha, Cambridge, 2005

2. Digital Logic Design, Leach, Malvino, Saha, TMH, 2000.

B. TECH V SEMESTER **OEC**

L	T	P	C
3	0	0	3

SOLID STATE DEVICES
20EC5T06 (OPEN ELECTIVE –I)

Course Objectives: Students undergoing this course, are expected to

1. Familiarize with the fundamentals of Semiconductor physics
2. Familiarize with various diodes and characteristics.
3. Familiarize with the transistors and their configurations.
4. Disseminate Amplifications with transistors
5. Understand the operation and working of Oscillators

Course Outcomes:

After undergoing the course, students will be able to

CO1: Understand importance of semiconductors.

CO2: Analyze Diode characteristics.

CO3: Differentiate various Transistor BJT configurations.

CO4: Design amplifiers at different applications using transistor.

CO5: Analyze different Feedback amplifiers & oscillators design

SYLLABUS.

Unit I: Basics Concepts of Semiconductor Physics, Charged Particles, Field Intensity, Potential, Energy, the eV unit of energy, Energy Band theory of Crystals, Insulators, Semiconductors and metals, Mobility and Conductivity, Electrons and Holes, Donor and Acceptor impurities, Charge Densities in a Semiconductor, Electrical properties of Ge and Si, Hall Effect, Diffusion and Drift Currents, Mass action Law, Fermi-Dirac distribution.

Unit II: Diodes: PN junction diode- Energy band diagram of PN junction Diode-V-I Characteristics –Current components in PN junction Diode- Diode equation-Diode resistance and capacitance, Characteristics of Zener Diode, Varactor Diode- SCR and UJT.

Unit III: Transistors Bipolar Junction Transistor: Transistor current components- Transistor equation- Transistor configurations- Characteristics of a transistor in CB, CC&CE configurations- Transistor as a Switch,Transistor as an amplifier. Field Effect Transistors (FET): Junction Field Effect Transistor construction & operation, characteristics of CS, CD & CG

Unit IV: Small Signal Transistor Amplifier models: Low Frequency Transistor Amplifier Models: Two port network, Transistor hybrid model, determination of h- parameters, generalized analysis of transistor amplifier model using h-parameters

Unit V: Feedback Amplifiers and Oscillators: Feedback principle and concept, types of feedback, classification of amplifiers, feedback topologies, Characteristics of negative feedback amplifiers Oscillators: Oscillator principle, condition for oscillations, types of oscillators, RC-phase shift and Wein bridge oscillators with BJT and their analysis. Generalized analysis of LC Oscillators, Hartley and Colpitt‘s oscillators with BJT and their analysis.

Text Books:

1) Millman, Halkias, ―Integrated Electronics- Analog and Digital Circuits and Systems, TMH.

2).Pulse, Digital and Switching Waveforms - J. Millman and H. Taub, Mothiki S Prakash Rao McGrawHill,Second Edition.

Reference Books:

1) Electronic Devices and Circuits Theory – Robert L. Boylestad and Louis Nashelsky, Pearson/Prentice Hall, Tenth Edition.

2) . Basic Electronic Circuits -V.K.Mehta, S-chand Publications,2008

B. TECH V SEMESTER	**OEC**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

INTRODUCTION TO ARTIFICIAL INTELLIGENCE
20CS5T07 (OPEN ELECTIVE –I)

Course Objectives:

- To gain a historical perspective of Artificial Intelligence and its foundations.
- To familiarize the basic principles of Artificial Intelligence towards problem solving Inference, Perception, Knowledge representation and Learning.
- To understand advanced topics of AI such as learning, natural language processing, agents and robotics, expert systems.

Course Outcomes: At the end of the course, the students will be able to:

CO1: To Understand the history of Artificial Intelligence and its foundations.

CO2: Apply various Artificial Intelligence Techniques for problem solving.

CO3: Formalization of knowledge using the framework of predicate logic.

CO4: Ability to apply knowledge representation and reasoning to real world problems.

CO5: Derive conclusions from uncertain knowledge and quantify the uncertainty in the Conclusions obtained.

SYLLABUS

UNIT-1:

Introduction, history, intelligent systems, foundations of AI, applications, tic-tac-toe game playing, development of AI languages, current trends.

UNIT-2: Problem Solving:

State-space search and control strategies: Introduction, general problem solving, characteristics of problem, exhaustive searches, heuristic search techniques, iterative deepening A*, constraint satisfaction.

Problem Reduction and Game Playing: Introduction, problem reduction, game playing, alpha beta pruning, two-player perfect information games.

UNIT-3: Logic Concepts:

Introduction, propositional calculus, proportional logic, natural deduction system, axiomatic system, semantic tableau system in proportional logic, resolution refutation in proportional logic, predicate logic.

UNIT-4: Knowledge representation:

Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR, knowledge representation using frames.

Advanced knowledge representation techniques: Introduction, conceptual dependency theory, script structure, CYC theory, case grammars, semantic web.

UNIT-5: Expert system and applications:

Introduction phases in building expert systems, expert system versus traditional systems.

Uncertainty measure: probability theory: Introduction, probability theory, Bayesian belief networks, certainty factor theory, dempster-Shaffer theory, Fuzzy sets and fuzzy logic: Introduction, fuzzy sets, fuzzy set operations, types of membership functions.

TEXT BOOKS:

1. Artificial Intelligence- Saroj Kaushik, CENGAGE Learning (Units 1,2,3,4,5)

REFERENCES:

1. Artificial Intelligence- Deepak Khemani, TMH, 2013
2. Introduction to Artificial Intelligence, Patterson, PHI
3. Artificial intelligence, structures and Strategies for Complex problem solving, -George F Lugar, 5thed, PEA
4. Artificial intelligence, A modern Approach , 2nded, Stuart Russel, Peter Norvig, PEA

B. TECH V SEMESTER

	L	T	P	C
OEC	3	0	0	3

OPERATING SYSTEMS
20CS5T08 (OPEN ELECTIVE –I)

Course Objectives:

- Understand the importance of Operating System and its services.
- To impart the concepts of process, memory and file management techniques.
- To familiarize with the deadlock handling techniques.

Course Outcomes:

CO1: Understand the importance, functions and structures of operating systems.

CO2: Analyze and compare the performance of various CPU scheduling algorithms.

CO3: Develop software or hardware-based solutions for process synchronization.

CO4: Apply deadlock handling techniques to avoid deadlocks.

CO5: Compare various Memory Management Schemes and analyze various disk Scheduling Algorithms.

SYLLABUS

UNIT - I: Introduction: Defining operating system, operating system structures, operating systems operations, User and Operating-System Interface, Operating-system services, System calls: Types of system calls, operating system debugging, System Boot.

Study of Linux System: Components of LINUX, Inter process Communication

UNIT - II: Process Management: Process Concept, Process state, Process control block (PCB), Process scheduling, Scheduling queues, Schedulers, Operations on Processes, Process creation, Process Termination, Process, Inter process communication.

Multithreaded Programming: Multithreading models, Scheduling: Basic Concepts, Scheduling algorithms

UNIT – III: Synchronization: The critical section problem, Peterson’s solution, Synchronization hardware, Semaphores, Classic problems of synchronization, Monitors.

File System Interface: File attributes, File operations, Access methods, Directory and Disk structures

UNIT - IV: Deadlocks: Deadlock characterization, Methods for handling deadlocks: deadlock- Prevention - Mutual Exclusion, Hold and wait, No preemption, Circular wait, Avoidance-Safe state, Resource allocation, Bankers’s Algorithm, Safety Algorithm, Detection-Single instance of each resource type, several instances of a resource type, Detection algorithm usage, recovery from Dead lock.

UNIT - V:

Memory Management Strategies: Swapping, Contiguous memory allocation, Paging, Segmentation

Virtual-Memory Management: Demand paging, Page replacement Algorithms, Thrashing.

Mass-storage structure: Magnetic disk, Disk Scheduling

TEXT BOOKS:

1. Abraham Silberschatz, Peter B, Galvin, Greg Gagne, Operating System, John Wiley, 9thedition.(Unit-1,2,3,4,5)
2. Stallings, Operating Systems - Internal and Design Principles, Pearson education, 6th edition–2005.(Unit-5)

REFERENCES:

1. D. M. Dhamdhere, Operating systems- A Concept based Approach, TMH, 2nd edition.
2. Andrew S Tanenbaum, Modern Operating Systems, PHI, 4th edition.
3. Charles Crowley ,Operating Systems: A Design-Oriented Approach, Tata Mc Graw Hill Education,1996.

B. TECH V SEMESTER

	L	T	P	C
OEC	3	0	0	3

SOFTWARE ENGINEERING
20CS5T09 (OPEN ELECTIVE –I)

Course Objective:

- Gain knowledge about software process models.
- Familiarize the basic software engineering methods, practices and its applications.
- Facilitate students in software design.

Course Outcomes:

CO1: Understand the software life cycle models

CO2: Understand the scrum approach to agile project management**.**

CO3: Analyze the software requirements and generate SRS document

CO4: Understand some of the different models that may be used to design

CO5: Understand various software testing approaches and quality control to ensure good quality software

SYLLABUS

Unit-I:

Introduction to Software Engineering: Nature of software, Software engineering, The Software Processes, Software Myths.

Process Models: A Generic Process Model, Process Assessment and Improvement, Prescriptive Process Models, Specialised Process models, The Unified Process, Personal and Team Process Models.

Unit-II:

Requirements Engineering: Functional and Non-Functional Requirements, The Software Requirements Document, Requirements Specification, requirements Engineering, Requirements Elicitation and Analysis, Requirement Validation, Requirement Management.

Requirements Modelling: Requirement Analysis, Scenario-Based Modelling, Data Modelling Concepts, Class-Based Modelling

Unit-III:

Design Concepts: The Design Process, Design Concepts, The Design Models, Architectural Design: Software Architecture, Architectural Genres, Architectural Styles. User Interface Design: The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation.

Unit-IV:

Understanding of UML diagrams: Structural diagrams - class diagram, object diagram, component diagram, deployment diagram, Behavioural diagrams - Use-case diagram, activity diagram, sequence diagram, collaboration diagram, state chart diagram.

Unit-V:

Implementation: Structured coding Techniques, Coding Styles-Standards and Guidelines, Implementation Issues.

Software Testing Strategies: A Strategic approach to Software Testing, Strategic Issues and Test Strategies for Conventional Software, Validation Testing, System Testing, The Art of Debugging, White-Box Testing, Black Box Testing, Software Quality concepts.

TEXT BOOKS:

1. Roger S. Pressman (2010), Software Engineering, A Practitioner's Approach, 7th Edition, McGraw-Hill International Edition, India.
2. Ian Sommerville (2011), Software Engineering, 9th Edition, Pearson education, India.
3. Grady Booch, Robert A. Maksimchuk, Michael W. Engle, Bobbi J. Young, Ph.D.Jim ConallenKelli A. Houston," Object-Oriented Analysis and Design with Applications", 3rd edition.

REFERENCES:

1. Pankaj Jalote (2010), Software Engineering, A Precise Approach, Wiley India.
2. Waman S. Jawadekar (2008), Software Engineering: A Primer, McGraw-Hill, India.
3. Hans Van Vilet (2008), Software Engineering Principles and Practice, 3rd Edition, John Wiley & Sons Ltd.
4. Rajib Mall (2005), Fundamental of Software Engineering, PHI.
5. Deepak Jain, Software Engineering, Principles and Practices, Oxford, University Press, India.

B. TECH V SEMESTER

	L	T	P	C
OEC	**3**	**0**	**0**	**3**

COMPUTER NETWORKS
20IT5T07 (OPEN ELECTIVE –I)

Course Objectives:

- Familiarize the student with the basic taxonomy and terminology of the computer networking area.
- Introduce the students to basic principles of networking using the goals like protocol layering and top down approach.
- Build an understanding of the basics of the internetworking and routing used in the computer networks.
- To provide guidelines in developing network applications

Course Outcomes:

At the end of the course, student will be able to

CO1- Independently enumerate the layers of the OSI model and TCP/IP.

CO2- Identify the different types of network topologies and protocols.

CO3- Compare and contrast methods to identify Errors and correct them

CO4- Differentiate between various network routing algorithms.

CO5- Understand WWW and HTTP Architectures.

SYLLABUS

UNIT - I: Introduction:

OSI overview, TCP/IP and other networks models, Examples of Networks: Arpanet, Internet, Network Topologies Wide Area Networks(WAN), Local Area Networks(LAN), Metropolitan Area Networks(MAN).

UNIT - II: Physical Layer and overview of PL Switching:

Multiplexing: frequency division multiplexing, wave length division multiplexing, synchronous time division multiplexing, statistical time division multiplexing, introduction to switching: Circuit Switched Networks, Datagram Networks, Virtual Circuit Networks

UNIT – III: Data link layer:

Design issues, Framing: fixed size framing, variable size framing, flow control, error control, error detection and correction, CRC, Checksum: idea, one's complement internet checksum, services provided to Network.

Elementary Data Link Layer protocols: Simplex protocol, Simplex stop and wait, Simplex protocol for Noisy Channel.

Sliding window protocol: One bit, Go-back N, Selective Repetitive protocol, Stop and wait protocol.

UNIT - IV: Random Access:

ALOHA, MAC addresses, Carrier sense multiple access (CSMA), CSMA with Collision Detection, CSMA with Collision Avoidance, Controlled Access: Reservation, Polling, Token Passing, Channelization: Frequency Division Multiple Access(FDMA), Time Division Multiple Access (TDMA), Code Division Multiple Access(CDMA).

Network layer: Shortest Path, Distance Vector Routing Algorithm, Hierarchal routing algorithm.

UNIT - V: Application layer (WWW and HTTP):

WWWARCHITECTURE: Client (Browser), Server, Uniform Resource Locator, Resource Record, HTTP: HTTP Transaction, HTTP Operational Model and Client/Server Communication, HTTP Request Message Format, HTTP Response Message Format

TEXT BOOKS:

1. Data Communications and Networks – Behrouz A. Forouzan. Third Edition TMH. (Units 1,2,4,5)
2. Computer Networks - Andrew S Tanenbaum, 4th Edition. Pearson Education(Units 1, 3, 4)

REFERENCES:

1. An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition, Pearson Education.
2. Understanding communications and Networks, 3rd Edition, W.A. Shay, Thomson.

B. TECH V SEMESTER

OEC	L	T	P	C
	3	0	0	3

COMPUTER GRAPHICS
20IT5T08 (OPEN ELECTIVE –I)

Course Objectives:

- To develop, design and implement two and three dimensional graphical structures
- To enable students to acquire knowledge Multimedia compression and animations
- To learn Creation, Management and Transmission of Multimedia objects.

Course Outcomes:

After learning the course, the student will be able:

CO1: Illustrate the basics of computer graphics, different graphics systems and applications of computer graphics with various algorithms for line, circle and ellipse drawing objects for 2D transformations.

CO2: Apply projections and visible surface detection techniques for display of 3D scene on 2D screen.

CO3: Illustrate able to create the general software architecture of programs that use 3D object sets with computer graphics.

CO4: Know and be able to select among models for lighting/shading: Color, ambient light; distant and light with sources; Phong reflection model; and shading (flat, smooth, Gourand, Phong).

CO5: Know and be able to discuss hardware system architecture for computer graphics. This Includes, but is not limited to: graphics pipeline, frame buffers, and graphic accelerators/co-processors.

SYLLABUS

UNIT - I: Introduction to Graphics:

Application area of Computer Graphics, overview of graphics systems, video-display devices, graphics monitors and work stations and input devices. 2D Primitives: Output primitives-Line, Circle and Ellipse drawing algorithms, Attributes of output primitives, Two dimensional Geometric transformations, Two dimensional viewing Line, Polygon, Curve and Text clipping algorithms.

UNIT - II: 3D Concepts:

Parallel and Perspective projections, Three dimensional object representation-Polygons, Curved lines, Splines, Quadric Surfaces, Visualization of data sets, 3D transformations, Viewing, Visible surface identification.

UNIT – III: Graphics Programming:

Color Models- RGB, YIQ, CMY, HSV, Animations -General Computer Animation, Raster, Key frame. Graphics programming using OPENGL-Basic graphics primitives, Drawing three dimensional objects, Drawing three dimensional scenes

UNIT – IV: Rendering:

Introduction to shading models, Flat and Smooth shading, Adding texture to faces, Adding shadow of objects, Building a camera in a program, Creating shaded objects

UNIT - V: Overview of Ray Tracing:

Intersecting rays with other primitives, Adding Surface texture, Reflections and Transparency, Boolean operations on Objects.

TEXT BOOKS:

1. Donald Hearn, Pauline Baker, Computer Graphics– C Version, second edition, Pearson Education, 2004

REFERENCES:

1. James D. Foley, Andries Van Dam, Steven K. Feiner, John F. Hughes, Computer Graphics- Principles and practice, Second Edition in C, Pearson Education, 2007

B. TECH V SEMESTER	OEC	L	T	P	C
		3	0	0	3

20HS5T01 QUANTITATIVE APTITUDE AND REASONING (OPEN ELECTIVE –I)

SYLLABUS

Unit-I: Divisibility and remainder rules of numbers, Unit digit , square root, cube root and simplification of numbers, HCF and LCM of numbers, Averages and Percentages, Alphabetical and miscellaneous series, Coding and decoding and Blood Relations

Unit-II: Profit & loss, Simple interest and Compound interest, Direction, Order and Ranking, Sitting arrangement and Puzzle

Unit-III: Ratio & proportions, Partnership, Alligation and mixtures and Ages.
Data sufficiency, Inequalities and Decision making.

Unit-IV: Time and work, Pipes & cisterns and Time and distance.
Syllogism, Statement and course of action and Statement and Assumption.

Unit-V: Boats and streams, Areas, Volume and surface areas.
Statement and argument, Cause and effect and Drawing inference.

Text Books:

1. “Objective Arithmetic” by R.S. Agarwal, S. Chand Publications.
2. Verbal and non-verbal Reasoning, R.S. Agarwal, S. Chand Publications

Reference Books:

1. Quantitative Aptitude by Dinesh Khattar, Pearson Education.
2. Quantitative Aptitude by Abhjit Guha.
3. Fast Track objective Arithmetic, Rajesh Verma, Arihant publications.

B. TECH V SEMESTER	OEC	L	T	P	C
		3	0	0	3

PRINCIPLES OF MANAGEMENT
20MB5T01 (OPEN ELECTIVE –I)

COURSE OBJECTIVE

This course ensures that the students understand

1. Management Concepts
2. Applications of Concepts in Practical aspects of business and Development of Managerial Skills.
3. Managers manage business organizations in the dynamic global environment and maintain competitive advantage.
4. Business decisions are made using various tools and techniques to remain competitive
5. Managers use problem-solving strategies, critical thinking skills in real-life situations and implement successful planning.

COURSE OUTCOME

After learning the contents of this course, the student would be able to know

CO1: What are the circumstances that lead to management evolution and how it will affect future managers.

CO2: Analyze and evaluate the influence of historical forces on the current practice of management

CO3: Develop the process of management's functions: Planning and Organizing.

CO4: Evaluate leadership styles to anticipate the consequences of each leadership style and directing.

CO5: Identify the areas to control and selecting the appropriate controlling methods/techniques.

SYLLABUS

UNIT I

Introduction to Management: Definition, Functions, Process, Scope and Significance of Management.

Nature of Management, Functions of Management, Managerial Roles, Levels Managerial Skills and Activities, Difference between Management and Administration, Significance of Values and Ethics in Management.

Challenges of Management

UNIT II

Evolution of Management Thought: Approaches to Management - Classical Approach- Scientific and Administrative Management; The Behavioral approach; The Quantitative approach; The Systems Approach; Contingency Approach, IT Approach.

UNIT III

Planning and Organizing: Nature, Scope, Objective and Significance of Planning, Elements and Steps of Planning, Decision Making Organizing Principles, Span of Control, Line and Staff Relationship, Authority, Delegation and Decentralization. Effective Organizing, Organizational Structures, Formal and Informal Organizations, Staffing.

UNIT IV

Directing: Effective Directing, Supervision, Motivation, Different Theories of Motivation-Maslow, Herzberg, McClelland, Vroom, Porter and Lawler, Job Satisfaction. Concept of Leadership- Theories and Styles. Communication Process, Channels and Barriers, Effective Communication.

UNIT V

Controlling and Coordinating: Elements of Managerial Control, Control Systems, Management Control Techniques, Effective Control Systems. Coordination Concept, Importance, Principles and Techniques of Coordination, Concept of Managerial Effectiveness.

TEXT BOOKS

1. Management Fundamentals, Robert N Lussier, 5e, Cengage Learning, 2013.
2. Fundamentals of Management, Stephen P. Robbins, Pearson Education, 2009.
3. Management-Tasks, Responsibilities & Practices, Drucker, F. Peter
4. Principles of Management, Terry and Franklin

REFERENCES

1. Essentials of Management, Koontz Weihrich, Tata McGraw Hill.
2. Management Essentials, Andrew DuBrin, 9e, Cengage Learning, 2012

NPTEL WEB COURSE:

nptel.ac.in/courses/122108038/

NPTEL VIDEO COURSE:

nptel.ac.in/courses/122108038/#

B. TECH V SEMESTER	OEC	L	T	P	C
		3	0	0	3

TECHNOLOGY MANAGEMENT
20MB5T02 (OPEN ELECTIVE –I)

Course Objective

- The course aims at providing an overview of various issues connected with Management of Technology in organizations.

Course Outcomes

CO1: To understand the importance of technology and innovation management

CO2: To understand the technology absorption, incremental innovation, research and development, technovation and technology fusion that dominate the contemporary world industry.

CO3: To understand the nature, significance, dimensions requirements, concepts, issues, themes, policies and structure of the management of technology and technovation.

SYLLABUS

UNIT-I

Evolution of Technology-Effects of New Technology- Technology Innovation.-Invention-Innovation- Diffusion- Revolutionary and Evolutionary Innovation- Product and Process Innovation- Strategic Implications of Technology- Technology – Strategy Alliance -Convergent and Divergent Cycle- The Balanced Approach.

UNIT-II

Technology Assessment- Technology Choice- Technological Leadership and Followership- Technology Acquisition- Technological Forecasting- Exploratory, Intuitive, Extrapolation, Growth Curves, Technology Monitoring- Normative: Relevance Tree, Morphological Analysis, Mission Flow Diagram.

UNIT-III

Diffusion of Technology- Rate of Diffusion; Innovation Time and Innovation CostSpeed of Diffusion- Technology Indicators- Various Indicators- Organizational Implications of Technology- Relationship between Technical Structure and Organizational Infrastructure- Flexible Manufacturing Management System (FMMS).

UNIT-IV

Financial Aspects in Technology Management- Improving Traditional Cost - Management System- Barriers to the Evaluation of New Technology- Social Issues in Technology Management- Technological Change and Industrial Relations- Technology Assessment and Environmental Impact Analysis.

UNIT-V

Human Aspects in Technology Management- Integration of People and Technology Organizational and Psychological Factors- Organizational Outcome- Technology Transfer-Technology Management Scenario in India.

Text Books

1. Sharif Nawaz: Management of Technology Transfer & Development, APCFT, Bangalore, 1983.

2. Rohtagi P K, Rohtagi K and Bowonder B: Technological Forecasting, Tata McGraw Hill,New Delhi.

References

1. Betz Fredrick: Managing Technology, Prentice Hall, New Jersey.
2. Gaynor: Handbook of Technology Management, McGraw Hill.
3. Tarek Khalil: Management of Technology, McGraw Hill International, 2000.
4. “Managing Technology and Innovation”, Robert & Roland, 1st Edition, Routledge.

B. TECH V SEMESTER

	L	T	P	C
OEC	3	0	0	3

FOUNDATIONS OF DATA SCIENCE
20AD5T07 (OPEN ELECTIVE –I)

Course Objective: *This* ***course*** explains vital data science concepts and teaches you how to accomplish the fundamental tasks that occupy data scientists. You'll explore data visualization, graph databases, the use of NoSQL, and the data science process. You'll use the Python language and common Python libraries as you experience firsthand the challenges of dealing with data at scale.

Course Outcomes: At the end of the course, student will be able to

CO1: Describes benefits of data science, facets of data

CO2: Illustrates data science process and describes the need of machine learning

CO3: Describes the problems of handling large data

CO4: Introduces distributed data storage and processing frame works

CO5: Describes about graph databases and text analytics

SYLLABUS

UNIT-1: Data science in a big data world: Benefits and uses of data science and big data, Facets of data, The data science process, The big data eco system and data science, An introductory working example of Hadoop.

UNIT-2:

The data science process: Overview of the data science process, Step 1: Defining research goals and creating a project charter, Step 2: Retrieving data, Step 3: Cleansing, integrating, and transforming data, Step 4: Exploratory data analysis, Step 5: Build the models, Step 6: Presenting findings and building applications on top of them. Machine learning: What is machine learning and why should you care about it?, The modeling process, Types of machine learning, Semi-supervised learning.

UNIT-3:

Handling large data on a single computer: The problems you face when handling large data, General techniques for handling large volumes of data, General programming tips for dealing with large data sets, Case study 1: Predicting malicious URLs, Case study 2: Building a recommender system inside a database.

UNIT-4: First steps in big data: Distributing data storage and processing with frameworks, Case study: Assessing risk when loaning money, Join the NoSQL movement: Introduction to NoSQL, ACID: the core principle of relational databases, CAP Theorem: the problem with DBs on many nodes, The BASE principles of NoSQL databases, NoSQL database types, Case study: What disease is that?

UNIT-5: The rise of graph databases: Introducing connected data and graph databases , Introducing Neo4j: a graph database, Connected data example: a recipe recommendation engine, Text mining and text analytics: Text mining in the real world, Text mining techniques, Case study: Classifying Reddit posts.

Text Book:

Introducing Data Science by Davy Cielen, Arno D. B. Meysman, and Mohamed Ali

B. TECH V SEMESTER

OEC	L	T	P	C
	3	0	0	3

20AM5T07 INTRODUCTION TO MACHINE LEARNING (OPEN ELECTIVE –I)

Pre-requisite: Probability and Statistics, Linear Algebra

Course Objective: *This **course*** explains basic concepts of Machine Learning and teaches you to use recent machine learning software for solving problems and understanding supervised and unsupervised learning methods

Course Outcomes: At the end of the course, student will be able to

CO1: Identify the characteristics of machine learning.

CO2: Summarize the Model building and evaluation approaches.

CO3: Apply Bayesian learning and regression algorithms for real-world Problems.

CO4: Apply supervised learning algorithms to solve the real-world Problems.

CO5: Apply unsupervised learning algorithms for the real world data.

SYLLABUS

Unit-1: Introduction to Machine Learning and Preparing to Model:

Introduction to Machine Learning- Introduction, What is Human Learning? Types of Human Learning, What is Machine Learning? Types of Machine Learning, Problems Not To Be Solved Using Machine Learning, Applications of Machine Learning.

Preparing to Model- Introduction, Machine Learning Activities, Basic Types of Data in Machine Learning, Exploring Structure of Data, Data Quality and Remediation, Data Pre-Processing

Modeling & Evaluation, Basics of Feature Engineering:

Modeling & Evaluation - Introduction, Selecting a Model, Training a Model (for Supervised Learning), Model Representation and Interpretability, Evaluating Performance of a Model.

Basics of Feature Engineering - Introduction, Feature Transformation, Feature Subset Selection.

Unit-2: Bayesian Concept Learning and Regression:

Bayesian Concept Learning - Introduction, Why Bayesian Methods are Important? Bayes' Theorem, Bayes' Theorem and Concept Learning, Bayesian Belief Network.

Regression: Introduction, Regression Algorithms - Simple linear regression, Multiple linear regression, Polynomial Regression Model, Logistic Regression, Maximum Likelihood Estimation.

Unit-3: Supervised Learning: Classification, Ensemble Learning: Classification-Introduction, Example of Supervised Learning, Classification Model, Classification

Learning Steps, Common Classification Algorithms - k-Nearest Neighbour (KNN), Decision tree, Random forest model, Support vector machines.

Ensemble Learning- Boosting, Bagging

Unit-4: Basics of Neural Network

Introduction, Understanding the Biological Neuron, Exploring the Artificial Neuron Types of Activation Functions, Early Implementations of ANN, Architectures of Neural Network, Learning Process in ANN, Backpropagation, Deep Learning

Unit-5: Unsupervised Learning:

Introduction, Unsupervised vs Supervised Learning, Application of Unsupervised Learning.

Principle Component Analysis: Introduction, Probabilistic PCA- Maximum Likelihood PCA, EM Algorithm for PCA, Bayesian PCA, Factor Analysis; Kernel PCA

Clustering: Clustering as a Machine Learning task, Different types of clustering techniques, Partitioning methods, Hierarchical clustering, Density-based methods: DBSCAN.

Finding Pattern using Association Rule - Definition of common terms, Association rule, Apriori algorithm.

Text Books:

1. Subramanian Chandramouli, Saikat Dutt, Amit Kumar Das, “Machine Learning”, Pearson Education India ,1st edition.
2. Christopher M. Bishop, “Pattern Recognition and Machine Learning”. New York :Springer, 2006.

Reference Books:

1. Tom M. Mitchell, “Machine Learning’, MGH, 1997.
2. Shai Shalev-Shwartz, ShaiBen David, “Understanding Machine Learning: From Theory to Algorithms”, Cambridge.
3. Peter Harington, “Machine Learning in Action” , Cengage, 1st edition, 2012.

B.TECH VI SEMESTER	OEC	L	T	P	C
		3	0	0	3

20CE6T08 REMOTE SENSING AND GIS (OPEN ELECTIVE-II)

Course Objectives: The objective of this course is to

- Introduce the basic principles of Remote Sensing and GIS techniques.
- Learn various types of sensors and platforms
- learn concepts of visual and digital image analyses
- Understand the principles of spatial analysis
- Appreciate application of RS and GIS to Civil engineering

Course Outcomes:

On successful completion of this course, the students will be able to

CO1: Be familiar with ground, air and satellite based sensor platforms.

CO2: Interpret the aerial photographs and satellite imageries

CO3: Create and input spatial data for GIS application

CO4: Apply RS and GIS concepts in water resources engineering

SYLLABUS

UNIT–I:

Introduction to remote sensing: Basic concepts of remote sensing, electromagnetic radiation, electromagnetic spectrum, interaction with atmosphere, energy interaction with the earth surfaces characteristics of remote sensing systems. Sensors and platforms: Introduction, types of sensors, airborne remote sensing, space borne remote sensing, image data characteristics, digital image data formats-band interleaved by pixel, band interleaved by line, band sequential, IRS, LANDSAT, SPOT.

UNIT–II:

Image analysis: Introduction, elements of visual interpretations, digital image processing- image preprocessing, image enhancement, image classification, supervised classification, unsupervised classification.

UNIT–III:

Geographic Information System: Introduction, key components, application areas of GIS, map projections. Data entry and preparation: spatial data input, raster data models, vector data Models.

UNIT – IV:

Spatial data analysis: Introduction, overlay function-vector overlay operations, raster overlay operations, arithmetic operators, comparison and logical operators, conditional expressions, overlay using a decision table, network analysis-optimal path finding, network allocation, network tracing.

UNIT–V:

RS and GIS applications: Land cover and land use, agriculture, forestry, geology, geomorphology, urban applications. Application to Hydrology and Water Resources: Flood zoning and mapping, groundwater prospects and potential recharge zones, watershed management.

Text Books:

1. Bhatta B (2008), 'Remote sensing and GIS', Oxford University Press
2. Lillesand, T.M, R.W. Kiefer and J.W. Chipman (2013) 'Remote Sensing and Image Interpretation', Wiley India Pvt. Ltd., New Delhi
3. Schowenger, R. A (2006) 'Remote Sensing' Elsevier publishers.
4. 'Fundamentals of Remote Sensing' by George Joseph, Universities Press, 2013.
5. 'Fundamentals of Geographic Information Systems' by Demers, M.N, Wiley India Pvt. Ltd, 2013.

Reference Books:

1. 'Remote Sensing and its Applications' by Narayan LRA, Universities Press, 2012.
2. 'Concepts and Techniques of Geographical Information System' by Chor Pang Lo and A KW Yeung, Prentice Hall (India), 2006
3. 'Introduction to Geographic Information Systems' by Kand Tsung Chang, McGraw Hill Higher Education, 2009.
4. 'Basics of Remote sensing & GIS' by Kumar S, Laxmi Publications, New Delhi, 2005.
5. 'Principals of Geographical Information Systems' by Burrough P A and R.A. McDonnell, Oxford University Press, 1998.

B.TECH VI SEMESTER | **OEC** | **L T P C** | **3 0 0 3**

20CE6T09 ENVIRONMENTAL IMPACT ASSESSMENT
(OPEN ELECTIVE-II)

Course Objectives: The objective of this course is to

- impart knowledge on different concepts of Environmental Impact Assessment
- know procedures of risk assessment
- learn the EIA methodologies and the criterion for selection of EIA methods
- pre-requisites for ISO 14001 certification
- know the procedures for environmental clearances and audit
- appreciate the importance of stakeholder participation in EIA

Course Outcomes:

On successful completion of this course, the students will be able to

CO1: Prepare EMP, EIS, and EIA report

CO2: Identify the risks and impacts of a project

CO3: Selection of an appropriate EIA methodology

CO4: Evaluation the EIA report

CO5: Estimate the cost benefit ratio of a project

CO6: Know the role of stakeholder and public hearing in the preparation of EIA

SYLLABUS

UNIT–I:

Basic concept of EIA: Elements of EIA-factors affecting EIA-Initial environmental Examination-life cycle analysis preparation of Environmental Base map- Classification of environmental parameters – role of stakeholders in the EIA preparation – stages in EIA.

UNIT–II:

E I A Methodologies: introduction, Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods, cost/benefit Analysis - EIS and EMP.

UNIT-III:

Impact of Developmental Activities and Land use: Introduction and Methodology for the assessment of soil and ground water, Delineation of study area, Identification of actives- application of remote sensing and GIS for EIA.

UNIT-IV:

Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures - E I A with reference to surface water, Air and Biological environment: Methodology for the assessment of Impacts on surface water environment, Generalized approach for assessment of Air pollution Impact.

UNIT–V:

Assessment of Impact of development Activities on Vegetation and wildlife, environmental Impact of Deforestation.

Environmental Risk Assessment and Risk management in EIA: Risk assessment and treatment of uncertainty-key stages in performing an Environmental Risk Assessment-advantages of Environmental Risk Assessment. Case studies and preparation of Environmental Impact assessment statement for various Industries.

Text Books:

1. Environmental Impact Assessment, Canter Larry W., McGraw-Hill education Edi (1996)
2. Environmental Impact Assessment Methodologies, Y. Anjaneyulu, B. S. Publication, Sultan Bazar, Hyderabad.

Reference Books:

1. Environmental Science and Engineering, J. Glynn and Gary W. Hein Ke – Prentice Hall Publishers
2. Environmental Science and Engineering, Suresh K. Dhaneja, S. K. , Katania & Sons Publication., New Delhi.
3. Environmental Pollution and Control, H. S. Bhatia, Galgotia Publication (P) Ltd, Delhi

B.TECH VI SEMESTER **OEC**

L	T	P	C
3	0	0	3

20EE6T08 RENEWABLE ENERGY SOURCES (OPEN ELECTIVE-II)

Course Objective:

- To give sufficient knowledge about the promising new and renewable sources of energy
- Explain the concept of various forms of renewable energy
- Learn the present energy scenario
- Analyse the environmental aspects of renewable energy resources.

Course Outcomes:

CO1: Know the need of various renewable energy systems

CO2: understand the concepts of bio-energy,

CO3: Acquire the knowledge of OTEC, tidal,

CO4: Acquire the knowledge of geothermal and Alternative energy sources

SYLLABUS

UNIT-I

Introduction: Introduction to energy sources, reserves and estimates, global energy scenario, renewable energy -environment implications, global warming and climate change, limitations of conventional energy sources, classification of non-conventional energy sources - solar energy, wind energy, bio-energy, Ocean Thermal Energy Conversion (OTEC), tidal, geothermal and hydro.

UNIT-II

Bio-energy: Biomass and its sources, energy plantation, production of fuel wood, bio-conversion processes, bio-gas, bio-diesel and ethanol production and utilization, thermo-chemical processes, biomass gasification, process, types of reactors, utilization of producer gas for thermal and electricity generation.

UNIT-III

Ocean thermal energy conversion, tidal, geothermal: Tidal energy, wave energy, data, technology options; open and closed *Ocean thermal energy conversion* cycles, geothermal energy sources, power plant and environmental issues.

UNIT-IV

Fuel Cells: Hydrogen generation-storage, transport and utilization, applications, power generation. Fuel cells-Technologies, types, economics and power generation.

UNIT-V

Solar Energy Storage and Applications:

Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

Text Books:

1. Non-Conventional Energy Sources by G.D. Rai, Khanna Publishers, 2006
2. Renewable Energy Resources – Twidell&Wier, CRC Press(Taylor & Francis), 2012
3. *Y. W. B. Charles*, *B.H. Essel*, *―Biomass Conversion and Technology‖*, John Wiley, Latest Edition

Reference Books:

1. Renewable energy resources by G. N. Tiwari, M. K. Ghosal, Alpha Science International, 2005.
2. Renewable Energy Technologies by R. Ramesh, K. Uday Kumar, M. Anandakrishnan, Narosa Publishing House, 1997
3. Non-Conventional Energy Systems by K Mittal, A. H. Wheeler Publishing Company Limited, 01-Jan-1999.
4. Renewable energy sources and emerging technologies by D.P.Kothari,K.C.Singhal, P.H.I.
5. Godfrey Boyle, ―Renewable Energy- Power for a Sustainable Future‖, Oxford University Press, U.K.,
6. Twidell, J.W. & Weir, A., ―Renewable Energy Sources‖, E.F.N Spon Ltd., UK.

B.TECH VI SEMESTER	OEC	L	T	P	C
		3	0	0	3

20EE6T09 ENERGY AUDIT, CONSERVATION AND MANAGEMENT (OPEN ELECTIVE-II)

Course Objective:

- To understand energy efficiency, scope, conservation and technologies.
- To design energy efficient lighting systems.
- To estimate/calculate power factor of systems and propose suitable compensation techniques.
- To understand energy conservation in HVAC systems.
- To calculate life cycle costing analysis and return on investment on energy efficient technologies.

Course Outcomes:
At the end of the course student will be able to

- Explain energy efficiency, conservation and various technologies.
- Design energy efficient lighting systems.
- Calculate power factor of systems and propose suitable compensation techniques.
- Explain energy conservation in HVAC systems.
- Calculate life cycle costing analysis and return on investment on energy efficient technologies.

SYLLABUS

UNIT-I

Basic Principles of Energy Audit and management: Energy audit – Definitions – Concept – Types of audit – Energy index – Cost index – Piecharts – Sankey diagrams – Load profiles – Energy conservation schemes and energy saving potential – – Principles of energy management – Initiating, planning, controlling, promoting, monitoring, reporting – Energy manager – Qualities and functions –Language – Questionnaire – Check list for top management.

UNIT-II

Lighting: Modification of existing systems – Replacement of existing systems – Priorities**:** Definition of terms and units – Luminous efficiency – Polar curve – Calculation of illumination level –Illumination of inclined surface to beam – Luminance or brightness – Types of lamps –Types of lighting – Electric lighting fittings (luminaries) – Flood lighting – White light LED and conducting Polymers – Energy conservation measures.

UNIT-III

Power Factor and energy instruments: Power factor – Methods of improvement – Location of capacitors – Power factor with nonlinear loads – Effect of harmonics on Power factor – Numerical problems. Energy Instruments – Watt–hour meter – Data loggers – Thermocouples – Pyrometers – Lux meters– Tong testers – Power analyzer.

UNIT-IV

Space Heating and Ventilation: Ventilation – Air–Conditioning (HVAC) and Water Heating**:** Introduction – Heating of buildings – Transfer of Heat–Space heating methods – Ventilation and air–conditioning –Insulation–Cooling load – Electric water heating systems – Energy conservation methods.

UNIT-V

Economic Aspects and Financial Analysis: Understanding energy cost - Economics Analysis – Depreciation Methods – Time value of money – Rate of return – Present worth method – Replacement analysis – Life cycle costing analysis – Energy efficient motors (basic concepts) – Economics of energy efficient motors and systems.

Computation of Economic Aspects

Need of investment, appraisal and criteria - Calculation of simple payback period–Return on investment – Net present value – Internal rate of return – numerical examples – Power factor correction – Lighting – Applications of life cycle costing analysis – Return on investment –Numerical examples.

Text Books:

1. Hand Book of Energy Audit by Sonal Desai- Tata McGraw hill

2. Energy efficient electric motors by John .C. Andreas, Marcel Dekker Inc Ltd– 2nd edition, 1995

Reference Books:

1. Energy management by W.R. Murphy & G. Mckay Butter worth, Elsevierpublications. 2012

2. Electric Energy Utilization and Conservation by S C Tripathy, Tata McGraw hill publishing company Ltd. New Delhi.

3. Energy management by Paul o' Callaghan, Mc–Graw Hill Book company–1st edition, 1998.

4. Energy management hand book by W.C.Turner, John wiley and sons.

5. Energy management and conservation –k v

B.TECH VI SEMESTER **OEC**

L	T	P	C
3	0	0	3

20ME6T07 INDUSTRIAL ROBOTICS (OPEN ELECTIVE-II)

Pre-requisite: Kinematics and Mathematics

Course Objective:

1. The student will be exposed to the concepts of automation and fundamentals of robotics
2. The students will be exposed to the concepts of transformations and robot kinematics,
3. The students will understand the functioning of sensors and actuators
4. The students will be exposed to robot programming languages and Programming.
5. The student will be exposed to the applications of robotics in manufacturing.

Course Outcomes: At the end of the course, student will be able to

CO1 Understand various applications of robotics and classification of coordinate system and control systems.

CO2 Build the concepts of components of industrial robotics.

CO3 Apply kinematic analysis with D-H notation, forward and inverse kinematics and Solve dynamic analysis with Lagrange – Euler and Newton – Euler formulations.

CO4 Model trajectory planning for a manipulator by avoiding obstacles.

CO5 Understand different types of actuators and applications of robots in manufacturing.

SYLLABUS

UNIT-I:

Introduction: Automation and Robotics – An over view of Robotics – present and future applications. Components of the Industrial Robotics: common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, Design of end effectors, Precision of Movement: Resolution, Accuracy and Repeatability, Speed of Response and Load Carrying Capacity.

UNIT-II: MOTION ANALYSIS AND CONTROL:

Motion Analysis: Basic Rotation Matrices, Composite Rotation Matrices. Homogeneous transformations as applicable to rotation and translation – problems. Manipulator Kinematics-H notation-H method of Assignment of frames-H Transformation Matrix, joint coordinates and world coordinates, Forward and inverse kinematics – problems.

UNIT-III:

Differential transformation of manipulators, Jacobians – problems. Dynamics: Lagrange – Euler and Newton – Euler formations – Problems. Trajectory planning and avoidance of obstacles, path planning, Slew motion, joint interpolated motion straight line motion.

UNIT-IV:

Robot actuators and Feedback components: Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors, comparison of Actuators, Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors, Tactile and Range sensors, Force and Torque sensors – End Effectors and Tools.

UNIT-V:

Robot Application in Manufacturing: Material Transfer – Material handling, loading and unloading- Processing – spot and continuous arc welding & spray painting – Assembly and Inspection. Robotic Programming Methods – Languages: Lead Through Programming, Textual Robotic Languages such as APT, MCL.

Text Book(s)

1. Industrial Robotics / Groover M P /Pearson Edu.
2. Introduction to Robotic Mechanics and Control by JJ Craig, Pearson, 3rd edition.

References

1. Robotics / Fu K S/ McGraw Hill.
2. Robotic Engineering / Richard D. Klafter, Prentice Hall
3. Robot Analysis and Intelligence / Asada and Slotine / Wiley Inter-Science.
4. Robot Dynamics & Control – Mark W. Spong and M. Vidyasagar / John Wiley

5. Introduction to Robotics by SK Saha, The McGrah Hill Company, 6th, 2012
6. Robotics and Control / Mittal R K &Nagrath I J / TMH

B.TECH VI SEMESTER	OEC	L	T	P	C
		3	0	0	3

20ME6T08 **3D PRINTING (OPEN ELECTIVE-II)**

Pre-requisite: Manufacturing Process

Course Objective:

The course aims at the importance of Additive Manufacturing, Classifications, models, specifications of various Additive Manufacturing Techniques. To learn the different tools, soft-wares required and the applications of Additive Manufacturing

Course Outcomes: At the end of the course, student will be able to

CO1:	Understand the working principle and process parameters of AM processes
CO2:	Explore the applications of AM processes in various fields
CO3:	Apply the suitable process and material for fabricating a given product
CO4:	Use the suitable post process based on product application
CO5:	Design and develop a product for AM Process

SYLLABUS

UNIT-I:

Additive Manufacturing Process: Basic Principles of the Additive Manufacturing Process, Generation of Layer Information, Physical Principles for Layer Generation. Elements for Generating the Physical Layer, Classification of Additive Manufacturing Processes, Evaluation of the Theoretical Potentials of Rapid Prototyping Processes.

UNIT-II:

Machines for Rapid Prototyping: Overview of Polymerization: Stereolithography (SL), Sintering/Selective Sintering: Melting in the Powder Bed, Layer Laminate Manufacturing (LLM) and Three-Dimensional Printing (3DP).

UNIT-III:

Rapid Prototyping: Classification and Definition, Strategic Aspects for the Use of Prototypes, Applications of Rapid Prototyping in Industrial Product Development. Rapid Tooling: Classification and Definition of Terms, Properties of Additive Manufactured Tools, Indirect Rapid

UNIT-IV:

Tooling Processes: Molding Processes and Follow-up Processes, Indirect Methods for the Manufacture of Tools for Plastic Components, Indirect Methods for the Manufacture of Metal Components

UNIT-V:

Direct Rapid Tooling Processes: Prototype Tooling: Tools Based on Plastic Rapid Prototyping Models and Methods, Metal Tools Based on Multilevel AM Processes, Direct Tooling: Tools Based on Metal Rapid Prototype Processes.

Text Books:

1. Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing, Ian Gibson, David W Rosen, Brent Stucker, Springer, 2015, 2nd Edition.
2. 3D Printing and Additive Manufacturing: Principles & Applications, Chua Chee Kai, Leong Kah Fai, World Scientific, 2015, 4th Edition.

References:

1. Rapid Prototyping: Laser-based and Other Technologies, Patri K. Venuvinod and Weiyin Ma, Springer, 2004.
2. Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling, D.T. Pham, S.S. Dimov, Springer 2001.
3. Rapid Prototyping: Principles and Applications in Manufacturing, Rafiq Noorani, John Wiley & Sons, 2006.

B.TECH VI SEMESTER | **OEC** | **L T P C** / **3 0 0 3**

		L	T	P	C
B.TECH VI SEMESTER	**OEC**	**3**	**0**	**0**	**3**

20EC6T07 ELECTRONIC CIRCUITS AND NETWORKS (OPEN ELECTIVE-II)

Course Objectives:

At the end of the course, student will be able to

1. To understand the Differentiator and Integrator circuits
2. To understand the concept of wave shaping circuits, Switching Characteristics of diode and transistor.
3. To Introduce to Time-base Generators and Principles of Synchronization and Frequency division.
4. To Understand Sampling Gates and to Design NAND and NOR gates using various logic families.
5. To understand and Design gates using various logic families.

Course Outcomes:

At the end of this course the student will able to:

CO1: Understand the basic concepts of Optoelectronic Devices

CO2: Design linear wave shaping circuits.

CO3: Design Non- linear wave shaping circuits.

CO4: Design Different Time Base Generators

CO5: understand the concepts of one port networks

SYLLABUS

UNIT-I: Optoelectronic Devices

Introduction, Photo sensors, Photoconductors, Photodiodes, Phototransistors, Light-Emitting Diodes, Liquid Crystal Displays, Cathode Ray Tube Displays, Emerging Display Technologies, Opto couplers.

UNIT-II: LINEAR WAVE SHAPING

High pass, low pass RC circuits, their response for sinusoidal, step, pulse, square and ramp inputs. RC network as differentiator and integrator, attenuators, its applications in CRO probe, RL and RLC circuits and their response for step input, Ringing circuit.

UNIT-III: NON-LINEAR WAVE SHAPING

Diode clippers, Transistor clippers, clipping at two independent levels, Transfer characteristics of clippers, Emitter coupled clipper, Comparators, applications of voltage comparators, clamping operation, clamping circuits using diode with different inputs, Clamping circuit theorem, practical clamping circuits, effect of diode characteristics on clamping voltage, Transfer characteristics of clampers.

UNIT-IV: VOLTAGE TIME BASE GENERATORS

General features of a time base signal, methods of generating time base waveform, Miller and Bootstrap time base generators – basic principles, Transistor miller time base generator, Transistor Bootstrap time base generator.

UNIT-V: Synthesis of one port networks

Synthesis of one port networks
Synthesis of reactive one-ports by Foster's and Cauer methods (forms I and II) - Synthesis of LC, RC and RL driving-point functions.

Text Books:

1. Pulse, Digital and Switching Waveforms - J. Millman and H. Taub, McGraw-Hill, 1991.

2. K. S. Suresh Kumar, ―Electric Circuit Analysis‖, Pearson Publications, 2013.

Reference Books:

1. Pulse and Digital Circuits – A. Anand Kumar, PHI, 2005.

2. Solid State Pulse circuits - David A. Bell, PHI, 4th Edn., 2002

B.TECH VI SEMESTER **OEC**

L	T	P	C
3	0	0	3

20EC6T08 PRINCIPLES OF COMMUNICATIONS (OPEN ELECTIVE – II)

Course Objectives:

At the end of the course, student will be able to

1. Familiarize with the fundamentals of analog communication systems
2. Familiarize with various techniques for analog modulation and demodulation of signals
3. Familiarize with the fundamentals of digital communication systems
4. Familiarize with various techniques for digital modulation and demodulation of signals
5. Distinguish the figure of merits of various analog modulation methods

Course Outcomes:

At the end of this course the student will able to:

CO1: Differentiate various Analog modulation schemes

CO2: Analyze demodulation schemes and their spectral characteristics

CO3: Analyze demodulation schemes and their spectral characteristics

CO4: Analyze demodulation schemes and their spectral characteristics

CO5: Analyze noise characteristics of various analog modulation methods

SYLLABUS

UNIT-I: Introduction: Overview of Communication system, Communication channels, Need for modulation, Baseband and Pass band signals, Amplitude Modulation: Double sideband with Carrier (DSB-C), Double side band without Carrier DSB-SC, Single Side Band Modulation SSB, Modulators and Demodulators, Vestigial Side Band (VSB), Quadrature Amplitude Modulator, Radio Transmitter and Receiver

UNIT-II: Angle Modulation, Frequency and Phase modulation, frequency deviation, Bandwidth, FM Modulators and Demodulators, Narrow band and wide band FM, FM Broadcasting.

UNIT-III: Pulse digital Transmission of Analog Signals: Sampling Theorem and its applications, Pulse Amplitude Modulation (PAM), Pulse Width Modulation, Pulse Position Modulation, Generation and Demodulation, Frequency Division Multiplexing, Time Division Multiplexing

UNIT-IV: Digital Representation of Analog Signals, Pulse Code Modulation (PCM), Differential Pulse Code Modulation, Delta Modulation. Adaptive Delta Modulation, Sources of Noises, Frequency domain representation of Noise, Super position of Noises, Mathematical Representation of Noise.

UNIT-V: Noise in Amplitude Modulation: Analysis, Signal to Noise Ratio, Figure of Merit. Noise in Frequency Modulation: Pre-emphasis, De-Emphasis and SNR Improvement, Phase Locked Loops.

Text Book:

1. Herbert Taub and Donald L. Schilling, ―Principles of Communication Systems., Tata McGrawHill.

2. Rishabh Anand, Communication Systems, Khanna Publishers

Reference Books:

1. B.P.Lathi,―Modern Digital and Analog communication Systems, 3rd Edition, Oxford University Press.

2. Simon Haykin, ―Communication Systems, 4th Edition, Wiley India

B. TECH VI SEMESTER

	L	T	P	C
OEC	3	0	0	3

20EC6T09 **MICROCONTROLLERS & ITS APPLICATIONS (OPEN ELECTIVE-II)**

Course Objectives:

At the end of the course, student will be able to

1. To understand the basics of 8051 Microcontroller and its functionalities
2. To understand the 8051 family instruction set
3. To develop machine language programming in microprocessors.
4. Todesign and develop microcontroller based interfacing for real time applications using low level language like ALP.
5. To understand the basics of ARM architectures and its functionalities.

Course Outcomes:

At the end of this course the student will able to:

CO1: To be able to understand the overview of 8051 Micro controller in general.

CO2: To be able to understand the instruction set of 8051 microcontroller

CO3: To be able to understand the Assembly Language Programming in microcontrollers.

CO4: To be able to understand the microcontroller is interfacing with I/O devices, memory, and serial communication using ALP.

CO5: To be able to understand the overview of ARM Architecture in general.

SYLLABUS

UNIT-I: Introduction to 8051 Microcontrollers

Overview of 8051 microcontrollers, Architecture, I/O ports, Memory organization, Addressing modes, SFRs, Counters and timers, Synchronous serial-cum, Asynchronous serial communication, Interrupts and priorities.

UNIT-II: 8051 FAMILY MICROCONTROLLERS INSTRUCTION SET

Basic assembly language programming, Data transfer instructions, Data and bit- manipulation instructions, Arithmetic instructions, Instructions for logical operations on the test among the registers, Program flow control instructions, Interrupt control flow.

UNIT-III: 8051 REAL TIME CONTROL

Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the serial communication Interrupts, programming Timers and Counters, serial port and its programming,

UNIT-IV: I/O and Memory Interface and Serial Communication and Bus Interface

I/O and Memory Interface: LCD, Keyboard, External Memory RAM, ROM Interface, ADC, DAC Interface to 8051

Serial Communication and Bus Interface: Serial Communication Standards, Serial Data Transfer, USART, External Communication Interfaces-RS232,USB

UNIT-V: ARM Architecture:

ARM processor fundamentals, ARM Architecture –Register, exceptions and interrupts, interrupt vector table, ARM instruction set- Data processing, Branch, load and store instructions; Software instructions, Program status register instructions loading constants

TEXTBOOKS:

1. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System
   Design, 2/e, Pearson Education, 2005.
2. Kenneth. J. Ayala, The 8051 Microcontroller, 3/e, Cengage Learning, 2004.

REFERENCE:

1. Mazidi and Mazidi, The 8051 Microcontroller and Embedded Systems, 2/e, Pearson Education, 2007
2. ARM system Developers guide, Andrew N Sloss, Dominic Symes, Chris Wright, Elsevier,2012

B. TECH VI SEMESTER

OEC	L	T	P	C
	3	0	0	3

INTRODUCTION TO MACHINE LEARNING
20CS6T07 (OPEN ELECTIVE –II)

Course Objective:

This course will enable students to,

- To introduce the basic concepts and techniques of Machine Learning.
- To develop the skills in using recent machine learning software for solving practical problems.
- To be familiar with a set of well-known supervised, semi-supervised and unsupervised learning algorithms

Course Outcomes:

After studying this course, the students will be able to

CO1: Choose the learning techniques and investigate concept learning

CO2: Identify the characteristics of decision tree and solve problems associated with

CO3: Apply effectively neural networks for appropriate applications

CO4: Apply Bayesian techniques and derive effectively learning rules

CO5: Evaluate hypothesis and investigate instant based learning and reinforced learning

SYLLABUS:

UNIT-I:

Introduction: Well-posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning.

Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias.

UNIT-II:

Decision Tree Learning: Decision tree representation, Appropriate problems for decision treelearning, Basic decision tree learning algorithm, hypothesis space search in decision treelearning, Inductive bias in decision tree learning, Issues in decision tree learning.

UNIT-III:

Artificial Neural Networks: Introduction, Neural Network representation, Appropriate problems, Perceptions, Back propagation algorithm.

Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, Naive Bayes classifier, Bayesian belief networks.

UNIT-IV:

Learning Sets of Rules: Introduction, sequential covering algorithms, learning rule sets: summary, learning First-Order rules, learning sets of First-Order rules: FOIL, Induction as inverted deduction, inverting resolution.

UNIT-V:

Instance Based Learning: Introduction, k-nearest neighbour learning, locally weighted regression, radial basis function, cased-based reasoning,

Reinforcement Learning: Introduction, Learning Task, Q Learning

TEXT BOOKS:

1. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.

REFERENCES:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning,2nd edition, springer series in statistics.
2. EthemAlpaydın, Introduction to machine learning, second edition, MIT press.

B. TECH VI SEMESTER

	L	T	P	C
OEC	3	0	0	3

INFORMATION SECURITY
20CS6T08 (OPEN ELECTIVE –II)

Course Objectives:

- Understand the concepts of classical encryption techniques and concepts of finite fields and number theory
- Understand Working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes and message digests, and public key algorithms
- Understand the Design issues and working principles of various authentication protocols, PKI standards
- Concepts of cryptographic utilities and authentication mechanisms to design secure applications.

Course Outcomes:

CO1: Compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication

CO2: Apply the knowledge of cryptographic checksums and evaluate the performance of different message digest algorithms for verifying the integrity of varying message sizes.

CO3: Apply different digital signature algorithms to achieve authentication and create secure applications

CO4: Apply network security basics, analyze different attacks on networks and evaluate the performance of firewalls and security protocols like SSL, IPSec, and PGP

CO5: Apply the knowledge of cryptographic utilities and authentication mechanisms to design secure applications

SYLLABUS

UNIT - I: Classical Encryption Techniques:

The OSI Security Architecture, Security Attacks, Services & Mechanisms, Symmetric Cipher Model, Substitution Techniques: Caesar Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Ciphers, One-Time Pad, Transposition Techniques: Rail fence, Row Transposition cipher, Block Ciphers: Traditional Block Cipher Structure, Block Cipher Design Principles.

UNIT - II:

Symmetric Key Cryptography: Data Encryption Standard (DES), Advanced Encryption Standard (AES), Block Cipher Modes of Operations.

Number Theory: Prime and Relatively Prime Numbers, Modular Arithmetic, Fermat's and Euler's Theorems, The Chinese Remainder Theorem

UNIT – III:

Public Key Cryptography: Principles, Public Key Cryptography Algorithms, RSA Algorithm, Diffie Hellman Key Exchange, Elliptic Curve Cryptography.

Cryptographic Hash Functions: Application of Cryptographic Hash Functions, Requirements & Security, Secure Hash Algorithm, Message Authentication Functions, Requirements & Security.

Digital Signatures: NIST Digital Signature Algorithm, Key Management and Distribution

UNIT - IV:

User Authentication: Remote User Authentication Principles, Kerberos.

Electronic Mail Security: Pretty Good Privacy (PGP) And S/MIME.

IP Security: IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload.

UNIT - V:

Transport Level Security: Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS)

Firewalls: Characteristics, Types of Firewalls, Placement of Firewalls, Firewall Configuration

TEXT BOOKS:

1. Cryptography and Network Security- William Stallings, Pearson Education, 7th Edition. [Units 1,2,3,4,5]
2. Cryptography, Network Security and Cyber Laws – Bernard Menezes, Cengage Learning, 2010 edition. [Units 1,2,3,4,5]

REFERENCES:

1. Cryptography and Network Security- Behrouz A Forouzan, Debdeep Mukhopadhyaya, Mc-GrawHill, 3rd Edition, 2015.
2. Network Security Illustrated, Jason Albanese and Wes Sonnenreich, MGH Publishers, 2003.

B. TECH VI SEMESTER

OEC	L	T	P	C
	3	0	0	3

AGILE TECHNOLOGIES
20CS6T09 (OPEN ELECTIVE –II)

COURSE OBJECTIVES:

1. To have an understanding of the Agile Manifesto and Principles
2. To Apply Agile based techniques in each of the development phases.

COURSE OUTCOMES:

CO1: Understand the Agile Manifesto and Principles.
CO2: Apply agile software development practices to create high-quality software.
CO3: Acquire Knowledge on software design, set of software technologies and APIs.
CO4: Examine and demonstrate knowledge of Agile development
CO5: Demonstrate the Agile Approach to estimate project variables, control and Risk Management

SYLLABUS

UNIT-I

Agile Software Development: Genesis of Agile, Introduction and Background, Traditional Model Vs Agile Model, Values of Agile, Agile Manifesto and Principles, Stakeholders, Challenges.

UNIT-II

Lean Approach: Waste Management, Kaizen and Kanban, Add process and products add Value, Roles related to life cycle, Differences between Agile and Traditional Plans, Differences at different life cycle phases, Key techniques, Principles, Understand as a means of assessing the initial status of the project, How agile helps to build quality.

UNIT-III

Agile Scrum Framework: Introduction to Scrum, Project phases, Agile estimation, Planning game, Product backlog, Sprint backlog, Iteration planning, **Agile Requirements:** User story definition, Characteristics and contents of user stories, Acceptance tests and verifying stories, Product Velocity, Burn down chart, Sprint planning and retrospective, Daily Scrum, Scrum roles- Product Owner, Scrum Master, Scrum Team, Scrum Case Study, Tools for Agile Project Management.

UNIT-IV

Agile Software Design and Development: Agile Design practices, Role of design principles including Single Responsibility principle, Open Closed Principle, Liskov Substitution principle, Interface Segregation principles, Dependency Inversion principle in Agile Design, Refactoring- Need and significance, Refactoring techniques, Continuous Integration, Automated Build tools, Version Control.

UNIT-V

Agile Testing and Review: Agile Testing Techniques, Test Driven Development, User Acceptance Test, Agile Metrics and Measurements, The Agile Approach to estimate project variables, Agile control- The 7 control parameters, Agile Approach to Risk, Agile approach to Configuration Management, Atern Principles and Philosophy, Best practices to manage Scrum.

TEXT BOOKS:

1. Robort C. Martin, Agile Software Development- Principles, Patterns and Practices, Prentice Hall, 2013(Units 1, 3, 5)

2. Ken Schawber, Mike Beedle, Agile Software Development with Scrum, Pearson(Units 3,4)

3. Mike Cohn, Succeeding with Agile: Software Development Using Scrum, Addison Wesley Series.(Units 3, 4)

REFERENCES:

1. David J. Anderson and Eli Schragenheim, Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2003.

2. Hazza and Dubinsky, ―Agile Software Engineering, Series: Undergraduate Topics in Computer Science, Springer,.

3. Craig Larman, ―Agile and Iterative Development: A Managers Guide, Addison-Wesley.

4. Kevin C. Desouza, ―Agile Information Systems: Conceptualization, Construction, and management, Butterworth-Heinemann.

B. TECH VI SEMESTER

	L	T	P	C
OEC	3	0	0	3

20IT6T07 FUNDAMENTALS OF MACHINE LEARNING (OPEN ELECTIVE –II)

Course Objective:

This course will enable students to,

- To introduce the basic concepts and techniques of Machine Learning.
- To develop the skills in using recent machine learning software for solving practical problems.
- To be familiar with a set of well-known supervised, semi-supervised and unsupervised learning algorithms

Course Outcomes:

After studying this course, the students will be able to

CO1: Choose the learning techniques and investigate concept learning

CO2: Identify the characteristics of decision tree and solve problems associated with

CO3: Apply effectively neural networks for appropriate applications

CO4: Apply Bayesian techniques and derive effectively learning rules

CO5: Evaluate hypothesis and investigate instant based learning and reinforced learning

SYLLABUS:

UNIT-I:

Introduction: Well-posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning.

Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias.

UNIT-II:

Decision Tree Learning: Decision tree representation, Appropriate problems for decision treelearning, Basic decision tree learning algorithm, hypothesis space search in decision treelearning, Inductive bias in decision tree learning, Issues in decision tree learning.

UNIT-III:

Artificial Neural Networks: Introduction, Neural Network representation, Appropriate problems, Perceptions, Back propagation algorithm.

Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, Naive Bayes classifier, Bayesian belief networks.

UNIT-IV:

Learning Sets of Rules: Introduction, sequential covering algorithms, learning rule sets: summary, learning First-Order rules, learning sets of First-Order rules: FOIL, Induction as inverted deduction, inverting resolution.

UNIT-V:

Instance Based Learning: Introduction, k-nearest neighbour learning, locally weighted regression, radial basis function, cased-based reasoning,

Reinforcement Learning: Introduction, Learning Task, Q Learning

TEXT BOOKS:

2. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.

REFERENCES:

3. Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning,2nd edition, springer series in statistics.
4. Ethem Alpaydın, Introduction to machine learning, second edition, MIT press.

B. TECH VI SEMESTER

	L	T	P	C
OEC	3	0	0	3

20IT6T08 DATABASE MANAGEMENT SYSTEMS (OPEN ELECTIVE –II)

Course Objectives:

- Understand the basic database concepts, applications, schema and various models.
- Familiarize with entity relation model for a data base and write queries using SQL.
- Emphasize the importance of normalization, transaction management and concurrency control in databases

Course Outcomes:

CO1: Understand the concept of database, database models and familiarize with Entity Relationship models

CO2: Demonstrate the use of constraints, relational algebra operations.

CO3: Apply SQL queries to interact with database and understand the basics of NOSQL.

CO4: Apply normalization in database design to eliminate anomalies.

CO5: Understand the basic concepts of transaction processing and concurrency control.

SYLLABUS

UNIT-I: Database System Applications:

A Historical Perspective, File Systems versus a DBMS, the Data Model, Levels of Abstraction in a DBMS, Data Independence, Structure of a DBMS.

Introduction to Database Design: Database Design and ER Diagrams, Entities, Attributes, and Entity Sets, Relationships and Relationship Sets, Additional Features of the ER Model, Conceptual Design with the ER Model.

UNIT-II: Introduction to the Relational Model:

Integrity constraint over relations, enforcing integrity constraints, querying relational data, logical data base design, introduction to views, destroying/altering tables and views. Relational Algebra, Tuple relational Calculus, Domain relational calculus.

UNIT-III: SQL:

QUERIES, CONSTRAINTS, TRIGGERS: form of basic SQL query, UNION, INTERSECT, and EXCEPT, Nested Queries, aggregation operators, NULL values, complex integrity constraints in SQL, triggers and active data bases.

NOSQL: Definition of NOSQL, History of NOSQL and Different NOSQL products, Applications, features of NoSQL, Difference between SQL and NoSQL.

UNIT-IV: Schema Refinement (Normalization):

Introduction to Schema Refinement, Functional Dependencies Reasoning about FDs, Normal Forms, Properties of decomposition, Normalization, Schema refinement in database design, Other kinds of dependencies.

UNIT-V: Transaction Management and Concurrency Control:

Properties of transactions, Transactions and Schedules, Concurrent execution of transactions, Lock-based concurrency control, deadlocks, Performance of locking.

Concurrency control: 2PL, Serializability, recoverability, Introduction to lock management, dealing with deadlocks.

TEXT BOOKS:

1. Raghu rama Krishnan, Johannes Gehrke, “Data base Management Systems”, 3rd Edition, TATA McGraw Hill.
2. "Professional NOSQL” by Shashan k Tiwari, 2011, WROX Press.

REFERENCE:

1. Peter Rob & Carlos Coronel, “Data base Systems design, Implementation, and Management”, 7th Edition, Pearson Education, 2000.
2. Silberschatz, Korth, “Data base System Concepts”, 6th Edition, McGraw Hill, 2010.
3. ElmasriNavathe, “Fundamentals of Database Systems”, 5th Edition, Pearson Education, 2007.
4. C.J.Date, “Introduction to Database Systems”, 7th Edition, Pearson Education, 2002

B. TECH VI SEMESTER

OEC	L	T	P	C
	3	0	0	3

OPERATIONS RESEARCH
20HS6T01 (OPEN ELECTIVE –II)

Course Objectives:

1) Identify and develop operational research models from the verbal description of the real system.
2) Understand the mathematical tools that are needed to solve optimization problems.
3) Use mathematical software to solve the proposed models.
4) Develop a report that describes the model and the solving technique, analyze the results and propose recommendations in language understandable to the decision-making processes in Management Engineering.

Course Outcomes:

CO1: Understand the methodology of Operations Research& concepts of linear programming

CO2: Formulate the solutions to transportation problems

CO3: Explain the solutions for various sequencing problems

CO4: Illustrate the solutions to different replacement policies

CO5: Apply game theory to solve real world problems

SYLLABUS

UNIT-I

Introduction to Operations Research: Basics definition, scope, objectives, phases, models and limitations of Operations Research. Linear Programming Problem – Formulation of LPP, Graphical solution of LPP. Simplex Method, Artificial variables, big-M method, two-phase method, degeneracy and unbound solutions.

UNIT-II

Transportation Problem. Formulation, Solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel's approximation method. Optimality test: MODI method.

UNIT-III

Assignment model. Formulation. Hungarian Method for optimal solution. Solving Unbalanced problem. Sequencing Models. Solution of Sequencing Problem – Processing n Jobs through 2 Machines – Processing n Jobs through 3 Machines – Processing 2 Jobs through m machines Processing n Jobs through m Machines.

UNIT-IV

Replacement Models. Replacement of Items that Deteriorate whose maintenance costs increase with time without change in the money value. Replacement of items that fail suddenly: individual replacement policy, group replacement policy.

UNIT-V

Game Theory. Competitive games, rectangular game, saddle point, minimax (maximin) method of optimal strategies, value of the game. Solution of games with saddle points, dominance principle. Rectangular games without saddle point – mixed strategy for 2 X 2 games.

Inventory models. Inventory costs. Models with deterministic demand – model (a) demand rate uniform and production rate infinite, model (b) demand rate non-uniform and production rate infinite, model (c) demand rate uniform and production rate finite.

TEXT BOOKS:

1) P. SankaraIyer,"Operations Research", Tata McGraw-Hill, 2008.
2) A.M. Natarajan, P. Balasubramani, A. Tamilarasi, "Operations Research", Pearson Education, 2005.

REFERENCES:

1) J K Sharma. "Operations Research Theory & Applications, 3e", Macmillan India Ltd, 2007.
2) P. K. Gupta and D. S. Hira, "Operations Research", S. Chand & co., 2007.

B. TECH VI SEMESTER

OEC	L	T	P	C
	3	0	0	3

20MB6T01 ORGANIZATIONAL BEHAVIOUR (OPEN ELECTIVE –II)

Course Objectives

1 To understand the fundamentals of Organizational Behaviour.
2 For the understanding and balancing of Values and Emotions at work place.
3 To improve the student's Personality and Attitude.
4 To understand and improve the skill of perception and Group Behaviour.
5 Understanding and managing organizational culture, leadership and conflict.

Course Outcomes

Learning Organizational Behavior enables engineers:

CO1: To understand the psychology of workers and other members in the organization.
CO2: To be equipped with the right knowledge and skills regarding organizational processes, group behavior, organizational structure and culture.
CO3: To build up strategies for development at their work place.
CO4: To motivate and control employees.
CO5: To resolve organizational conflict effectively.

SYLLABUS

UNIT I

Fundamentals of OB: Definition, Scope and Importance of OB, Relationship between OB and the individual, Evolution of OB, Models of OB (Autocratic, Custodial, Supportive, Collegial & SOBC), Limitations of OB.

Unit II

Values, Attitudes and Emotions: Introduction, Values, Attitudes, Definition and Concept of Emotions, Emotional Intelligence - Fundamentals of Emotional Intelligence, The Emotional Competence Framework, Benefits of Emotional Intelligence, difference between EQ and IQ. Stress at workplace: Work Stressors – Prevention and Management of stress – Balancing work and Life, Workplace spirituality.

Unit III

Personality & Attitude: Definition Personality, importance of personality in Performance, The Myers-Briggs Type Indicator and The Big Five personality model, Johari Window, Transaction Analysis. Attitude – Definition, Importance of attitude in an organization, Right Attitude, Components of attitude, Relationship between behavior and attitude.

Unit IV

Perception: Factors influencing perception, Selective perception, Attribution theory, Perceptual process, Social perception (stereotyping and halo effect). Motivation:

Definition & Concept of Motive & Motivation. Group and Team Dynamics: Meaning Group Dynamics, Types of Groups, Group Development, Team Effectiveness & Team Building.

Unit V

Organizational Culture: Types of Culture, Creating and Maintaining Organization Culture, Managing Cultural Diversity. Organizational Change: Types of Organizational change, Forces that acts as stimulants to change, overcome the Resistance to Change, Developing a Learning Organization. Leadership: Introduction, Managers V/s Leaders. Overview of Leadership- Traits and Types. Conflict Management: Sources of Conflict, Types of Conflict, Conflict Management Approaches.

Text Books

1. Pareek Udai: "Understanding Organizational Behavior", Oxford University Press, New Delhi, 2007.

1. K.Aswathappa: "Organizational Behavior-Text, Cases and Games", Himalaya Publishing House, New Delhi,2008.

2. Steven L McShane, Mary Ann Von Glinow, Radha R Sharma: "Organizational Behavior", Tata McGraw Hill Education, New Delhi, 2008.

References

1. Jerald Greenberg and Robert A Baron: "Behavior in Organizations", PHI Learning Pvt Ltd, New Delhi, 2009.

2. Robbins, Stephen P. Organizational behavior, 14/E. Pearson Education India, 2001.

B. TECH VI SEMESTER

	L	T	P	C
OEC	3	0	0	3

20MB6T02 PROJECT MANAGEMENT (OPEN ELECTIVE –II)

Course Objectives

The objective of this course is to enable the students to gain basic knowledge about the concept of project, project management, project life-cycle, project appraisal; to acquaint the students about various issues of project management.

SYLLABUS

Unit -I

Basics of Project Management –Concept– Project environment – Types of Projects – Project life cycle – Project proposals – Monitoring project progress – Project appraisal and Project selection – Causes of delay in Project commissioning– Remedies to avoid overruns. Identification of Investment opportunities – Sources of new project ideas, preliminary screening of projects – Components for project feasibility studies.

Unit- II

Market feasibility -Market survey – Categories of Market survey – steps involved in conducting market survey– Demand forecasting techniques, sales projections.

Unit- III

Technical and Legal feasibility: Production technology, materials and inputs, plant capacity, site selection, plant layout, Managerial Feasibility Project organization and responsibilities. Legalities – Basic legal provisions. Development of Programme Evaluation & Review Technique (PERT) –Construction of PERT (Project duration and valuation, slack and critical activities, critical path interpretation) – Critical Path Method (CPM)

Unit- IV

Financial feasibility – Capital Expenditure – Criteria and Investment strategies – Capital Investment Appraisal Techniques (Non DCF and DCF) – Risk analysis – Cost and financial feasibility – Cost of project and means of financing — Estimation of cash flows – Estimation of Capital costs and operating costs; Revenue estimation – Income – Determinants – Forecasting income –Operational feasibility - Breakeven point – Economics of working.

Unit -V

Project Implementation and Review: Forms of project organization – project planning – project control – human aspects of project management – prerequisites for successful project implementation – project review – performance evaluation – abandonment analysis.

Text Books

1. Prasanna Chandra, ―Projects, Planning, Analysis, Selection, Financing, Implementation and Review, Tata McGraw Hill Company Pvt. Ltd., New Delhi 1998.

2. Gido: Effective Project Management, 2e, Thomson, 2007.

References

1. Singh M.K, ―Project Evaluation and Management‖.

2. Vasanth Desai, Project Management, 4th edition, Himalaya Publications 2018.

3. Clifford F. Gray, Erik W. Larson, ―Project Management, the Managerial Emphasis, McGraw Hill, 2000.

B. TECH VI SEMESTER

	L	T	P	C
OEC	3	0	0	3

20AM6T07 BIG DATA ANALYTICS (OPEN ELECTIVE –II)

Pre-requisite: Data Base Management System

<u>Course objectives</u>:

In this course student will learn about

1. To understand the need of Big Data, challenges and different analytical architectures
2. Installation and understanding of Hadoop Architecture and its ecosystems
3. Processing of Big Data with Advanced architectures like Spark.
4. Describe graphs and streaming data in Spark.

Course Outcomes: At the end of the course, student will be able to

CO1: Discuss the challenges and their solutions in Big Data

CO2: Understand and work on Hadoop Framework and eco systems.

CO3: Explain and Analyze the Big Data using Map-reduce programming in Both Hadoop and Spark framework.

CO4: Demonstrate spark programming with different programming languages.

CO5: Demonstrate the graph algorithms and live streaming data in Spark.

SYLLABUS

Unit-I:

Introduction to big data: Data, Types of digital data, Evolution and Definition of big data, Challenges of big data, Characteristics and Need of big data.

Introduction to Hadoop: Introducing Hadoop, need of Hadoop, limitations of RDBMS, RDBMS versus Hadoop, Distributed Computing Challenges, History of Hadoop, Hadoop Overview, Hadoop Distributors.

HDFS (Hadoop Distributed File System): HDFS Daemons, Anatomy of file read, Anatomy of file write, working with HDFS commands.

Unit-II:

Introduction to MAPREDUCE Programming: Processing Data with Hadoop, Managing Resources and Applications with Hadoop YARN (Yet another Resource Negotiator), Mapper, Reducer, Combiner, Partitioner, Searching, Sorting , Compression, Hadoop EcoSystem.

Unit-III:

Introduction to Pig: Key Features of pig, The Anatomy of Pig, Pig on Hadoop , Pig Philosophy, Pig Latin Overview, Data Types in Pig, Running Pig, Execution Modes of Pig, Relational Operators.

Introduction to HIVE: HIVE features, HIVE architecture, HIVE datatypes, HIVE File Formats, HIVE Query Language.

Unit-IV:

NoSQL: Introduction to NOSQL, Types of NoSQL Databases, and Advantages of NoSQL databases, CAP Theorem, BASE, SQL versus NoSql.

NoSQL databases: Introduction to MongoDB, Data types in MongoDB, MongoDB query language.

Unit-V:

Spark: Introduction to data analytics with Spark, Spark Stack, Programming with RDDS, Working with key/value pairs, Spark SQL, Schema RDDs,

Sparking Streaming: High level architecture of Spark Streaming, DStreams, Transformations on DStreams, Different Types of Transformations on DStreams.

Text Books:

[1].SeemaAcharya, SubhashiniChellappan, Big Data and Analytics, Wiley Publishers

[2].Holden Karau, Andy Konwinski, Patrick Wendell, MateiZaharia, "Learning Spark: Lightning-Fast Big Data Analysis", O'Reilly Media, Inc.

Reference Books:

[1]. TomWhite, Hadoop,"TheDefinitiveGuide",3rdEdition,O'ReillyPublications, 2012.

[2].David Loshin, "BigDataAnalytics: From Strategic Planning to Enterprise IntegrationwithTools,Techniques,NoSQL,andGraph",MorganKaufmannPublishers, 2013

[3].Hadoopin PracticebyAlexHolmes, MANNING

[4].Hadoop in Action byChuckLam, MANNING

[5] Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch , "Understanding Big Data Analytics for Enterprise ClassHadoopandStreamingData", 1st Edition, TMH,2012.

[6] HienLuu, Beginning Apache Spark 2

E-resources and Other digital materials:

[1].Big Data Use cases for Beginners | Real Life Case Studies | Success Stories https://www.youtube.com/watch?v=HHR0-iJp2sM

[2]. Alexey Grishchenko, Hadoopvs MPP, https://0x0fff.com/hadoop-vs-mpp/

[3]. Random notes on bigdata- SlideShare: Available www.slideshare.net/yiranpang/random-notes-on-big-data-26439474

B. TECH VI SEMESTER

	L	T	P	C
OEC	3	0	0	3

20AD6T07 VISUAL ANALYTICS (OPEN ELECTIVE –II)

Pre-requisite: There is no prerequisite to learn this course.

Course Objective: *This **course*** explains apply the fundamentals of Tableau tool, Use all the basic functionality to visualize their data, Connect to various data sources, Build a variety of basic charts, Combine insights into a useable dashboard, Share and publish visualizations.

Course Outcomes: At the end of the course, student will be able to

CO1: Examine, navigate, and learn to use the various features of Tableau

CO2: Create and design visualizations and dashboards for your intended audience

CO3: apply predicative analytics to improve business decision making

CO4: Assess the quality of the data and perform exploratory analysis

CO5: Combine the data to and follow the best practices to present your story

SYLLABUS

UNIT-1:

Introduction: Tableau Application Suite, Installing and Activating Tableau Desktop, Data Preparation, Finding the Dataset, Understanding the Data, The Tableau Workspace, Saving, Opening, and Sharing Your Workbooks, Setting Up a Data Connector, Adding a Table to a Data Model, Data Extracts and Live Connections, Data Protection and Data Governance, Data Types, Data Collection with IFTTT and Google Sheets, Website Analysis with Google Analytics, Performance Optimization.

UNIT-2:

Data Visualizations and Aggregate Functions: Chart Types, Scatter Plots, Bar Charts, Legends, Filters, and Hierarchies, Line Charts, Straight Lines, Step Charts, Continuous Date Fields, Highlight Tables, Heat maps, Bullet Charts, Aggregate Functions, Calculated Fields, Aggregations in Calculated Fields, Text Operators, Splits, Date Fields, and Formats, Working with NULL Values, Parameters

UNIT-3:

Table Calculations and Maps: Different Types of Calculations, Quick Table Calculations, Customized Table Calculations, Bump Charts, Dual Axis Charts, Keywords and Syntax, Cohort Analysis, Regional Averages, Different Types of Maps, Map Layers, Maps with Pie Charts: Creating a Pie Chart Map, Dual Axis Map Embedding the Chart in Tooltips, Mapbox Maps, Mapbox in Tableau, Using the Background Map, Spatial Data.

UNIT-4:

Advanced Analytics and Interactive Dashboards: Overview of the Tableau Analytics Pane, Constant, Average, and Reference Lines, Trend Lines, Forecasts, Model Description, Cluster Analysis, Clustering in Tableau, Python, R, and MATLAB Integration, Connecting Tableau with TabPy, Security, The Dashboard Pane, Placing Charts on the Dashboard, Dashboard Actions, Filter Actions, Adding Web Content via URL Actions, Design Tips for Creating a Dashboard

UNIT-5:

Data Preparation with Tableau: Connecting to Data, Wildcard Unions, Inspecting the Data, Removing Unneeded Fields, Data Cleaning and Formatting, Cleaning Steps and Built-in Cleaning Features, Unions, Joins, Splits Grouping, Running the Flow and Outputting the Data, Saving Flows.

Text Book:

Alexander Loth, "**Visual Analytics with Tableau**", ISBN: 978-1-119-56020-3, Wiley 2019

Reference Books:

1. "**Visual Thinking for Design"** by Colin Ware
2. "**Storytelling With Data: A Data Visualization Guide for Business Professionals"** by Cole Nussbaumer Knaflic
3. "**Visualize This: The Flowing Data Guide to Design, Visualization, and Statistics"** by Nathan Yau

B.TECH VII SEMESTER **OEC**

L	T	P	C
3	0	0	3

20CE7T13 CONSTRUCTION TECHNOLOGY AND MANAGEMENT (OPEN ELECTIVE-III)

Course Objectives:

- To introduce to the student the concept of project management including network drawing and monitoring
- To introduce various equipments like earth moving equipment, trucks and handling equipment, aggregate production and construction equipment and machinery, related to constriction.
- to introduce the importance of safety in construction projects

Course Outcomes:

CO1: appreciate the importance of construction planning

CO2: understand the functioning of various earth moving equipment

CO3: the methods of production of aggregate products and concreting and usage of machinery required for the works.

CO4: apply the gained knowledge to project management and construction techniques

SYLLABUS

UNIT-I:

Construction project management and its relevance – qualities of a project manager – project planning – coordination –scheduling - monitoring – bar charts – milestone charts– critical Path Method – Applications

UNIT-II:

Project Evaluation and Review Technique – cost analysis - updating – crashing for optimum cost – crashing for optimum resources – allocation of resources

UNIT-III:

Construction equipment – economical considerations – earthwork equipment – Trucks and handling equipment – rear dump trucks – capacities of trucks and handling equipment – calculation of truck production – compaction equipment – types

UNIT–IV:

Hoisting and earthwork equipment – hoists – cranes – tractors - bulldozers –graders – scrapers– draglines - clamshell buckets

UNIT –V:

Concreting equipment – crushers – jaw crushers – gyratory crushers – impact crushers– selection of crushing equipment - screening of aggregate – concrete mixers – mixing and placing of concrete – consolidating and finishing Construction methods – earthwork – piling – placing of concrete – form work – fabrication and erection – quality control and safety engineering

Text Books:

1. Construction Planning Equipment and Methods, Peurifoy and Schexnayder, Shapira, Tata Mcgrawhill
2. Construction Project Management Theory and Practice, Kumar Neeraj Jha (2011), Pearson.
3. Construction Technology, Subir K. Sarkar and Subhajit Saraswati, Oxford University press.
4. Project Planning and Control with PERT and CPM, B. C. Punamia and K K Khandelwal, Laxmi Publications Pvt Ltd. Hyderabad.

Reference Books:

1. Construction Project Management - An Integrated Approach, Peter Fewings, Taylor and Francis
2. Construction Management Emerging Trends and Technologies, Trefor Williams , Cengage learning.
3. Hand Book of Construction Management, P. K. Joy, Trinity Press Chennai, New Delhi.

B.TECH VII SEMESTER **OEC**

L	T	P	C
3	0	0	3

20CE7T14 GREEN BUILDINGS (OPEN ELECTIVE-III)

Course Objectives:

- To introduce the different concepts of green building techniques and how they may be synthesized to best fit a construction.
- To Know the importance of Green buildings
- To know and implement energy conservation and renewable resources
- To understand the knowledge of ECBC, LEED, GRIHA etc.

Course Outcomes:

CO1: Able to describe the importance and necessity of green building.

CO2: Able to suggest materials and technologies to improve energy efficiency of building.

CO3: Able to assess a building on the norms available for green building.

SYLLABUS

UNIT-I:

Introduction of Green Buildings, Salient features of green buildings, Advantages of Green Buildings- Sustainable site selection and planning of buildings to improve comfort, day lighting, ventilation, planning for drainage.

UNIT-II:

ENERGY EFFICIENT BUILDINGS Passive cooling and day lighting – Active solar and photovoltaic, building energy analysis methods, Lighting system design, Lighting economics and aesthetics, Impacts of lighting efficiency, Technological options for energy management.

UNIT-III:

ENERGY CONSERVATION Need for energy conservation, various forms of energy used in buildings, embodied energy of materials, energy used in transportation and construction processes- water conservation systems in buildings, waste to energy management in residential complexes or gated communities.

UNIT-IV:

RENEWABLE ENERGY RESOURCES Wind and Solar Energy Harvesting, potential of solar energy in India and world, construction and operation of various solar, windand hydro power appliances, success case studies of fully solar, wind and hydro power energies.

UNIT-V:

ENERGY REQUIREMENT AND GREEN BUILDING RATING SYSTEMS Energy

Conservation Building Code (ECBC) requirement for green buildings, Requirement for green rating systems - Leadership in Energy and Environment Design (LEED), Green Rating systems for Integrated Habitat Assessment (GRIHA), Building automation and building management systems.

Text Books:

1. 'Handbook on Green Practices published by Indian Society of Heating Refrigerating and Airconditioning Engineers', 2009
2. 'Alternative building materials and technologies' by K.S. Jagadish, B.V. Venkatarama Reddyand K.S. Nanjunda Rao.
3. 'Green Building Handbook' by Tomwoolley and Samkimings, 2009

Reference Books:

1. 'Complete Guide to Green Buildings' by Trish riley.
2. 'Non-Conventional Energy Resources' by G. D. Rai, Khanna Publishers.
3. 'Standard for the design for High Performance Green Buildings' by Kent Peterson, 2009
4. Ganesan T P, "Energy Conservation in Buildings", ISTE Professional Center, Chennai, 1999.

B.TECH VII SEMESTER **OEC**

L	T	P	C
3	0	0	3

20EE7T13 CONCEPT OF POWER SYSTEM ENGINEERING (OPEN ELECTIVE-III)

Course Objective: To develop problem solving skills and understanding of Power System concepts through the application of techniques and principles of electrical Power Generation methods.

Course Outcomes: At the end of the course, student will be able to

CO1: Various electrical Power System Components, Supply systems

CO2: Thermal Power Station working procedure, each module path directions

CO3: Hydro Power Station working procedure, classifications

CO4: Nuclear Power Station working procedure, Chain Reaction

CO5: Solar power generation & Wind Power Generation, Applications

SYLLABUS

UNIT-I: **Power System Components**

Single line Diagram of Power system, Different kinds of supply system, conventional and Non-conventional energy sources, Applications.

UNIT-II: Thermal Power Stations

Choice of site Selection, general layout of a thermal power plant showing paths of coal, steam, water, air, ash and flue gasses, ash handling system, Brief description of components: Boilers, Super, heaters, Economizers, electrostatic precipitators

UNIT-III: Hydro & Nuclear Power Stations

Choice of site, arrangement of hydroelectric installations, Hydrology. Mass curve, flow duration curve, classification of Hydro Power Plants, Location of nuclear power plant, Working principle, Nuclear fission, Nuclear fuels, Nuclear chain reaction, nuclear reactor Components

UNIT-IV: Solar power generation & Wind Power Generation

Solar radiation spectrum. Radiation measurement. Applications of solar thermal systems Solar Photovoltaic (SPV) systems, Introduction to wind energy, basic principles of wind energy conversion.

UNIT-V: Transmission & Distribution

Transmission structure, classifications, types of conductors, primary & secondary distribution, Substation Equipments , layout.

Text Books:

1. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, S.Bhatnagarand, A Chakrabarti, DhanpatRai& Co. Pvt. Ltd.

2. Generation, Distribution and Utilization of Electric Energy by C.L.Wadhawa New age International (P) Limited, Publishers
3. Non-Conventional Energy Resources/ Khan B.H/ Tata McGraw Hill, New Delhi, 2006

B.TECH VII SEMESTER **OEC**

L	T	P	C
3	0	0	3

20EE7T14 INSTRUMENTATION (OPEN ELECTIVE-III)

Course Objectives:

1 To study the basics of measuring system.
2 To study various Electrical transducers and to measure the various types of Non–electrical quantities
3 To study various types of digital voltmeters
4 To study the working principles of various types of oscilloscopes and their applications.
5 To study various types of signal analyzers

Course Outcomes:

CO1: Able to study the basics of measuring system.
CO2: Acquire proper knowledge to use various types of Transducers and able to monitor and measure various parameters such as strain, Fow, temperature and pressure
CO3: Acquire proper knowledge and working principle of various types of digital voltmeters.
CO4: Able to measure various parameters like phase and frequency of a signal with the help of CRO.
CO5: Acquire proper knowledge and able to handle various types of signal analyzers.

SYLLABUS

UNIT-I

Basics of Measuring System: Measuring Systems, Performance Characteristics – Static characteristics – Dynamic Characteristics – Errors in Measurement – Gross Errors – Systematic Errors and Random Errors, Statistical analysis of random errors.

UNIT-II

Transducer Basics and Applications: Definition of transducers – Classification of transducers – Advantages of Electrical transducers –Characteristics and choice of transducers – Principle operation of resistor, inductor, LVDT and capacitor transducers. Measurement of Temperature, Pressure, Strain and Flow.

UNIT-III

Digital Voltmeters: Digital voltmeters – Successive approximation, ramp, dual–Slope integration continuous balance type – Microprocessor based ramp type DVM, digital frequency meter – Digital phase angle meter.

UNIT-IV

Oscilloscope: Cathode ray oscilloscope – Time base generator – Horizontal and vertical amplifiers – Measurement of phase and frequency – Lissajous patterns – Sampling oscilloscope, data logger, Transient recorder.

UNIT-V

Signal Analyzers: Wave Analyzers – Frequency selective analyzers – Heterodyne – Application of Wave analyzers – Harmonic Analyzers – Total Harmonic distortion – Spectrum analyzers – Basic spectrum analyzers – Spectral displays – Vector impedance meter – Q meter – Peak reading and RMS voltmeters

Text Books:

1. Electronic Instrumentation–by H.S.Kalsi Tata MCGraw–Hill Edition, 1995.
2. A course in Electrical and Electronic Measurements and Instrumentation, A.K. Sawhney, Dhanpatrai & Co

Reference Books:

1. Measurement and Instrumentation theory and application, Alan S.Morris and Reza Langari, Elsevier
2. Measurements Systems, Applications and Design – by D O Doeblin
3. Principles of Measurement and Instrumentation – by A.S Morris, Pearson/Prentice Hall ofIndia
4. Modern Electronic Instrumentation and Measurement techniques – by A.D HelfrickandW.D.Cooper, Pearson/Prentice Hall of India.
5. Transducers and Instrumentation by D.V.S Murthy, Prentice Hall of India.

B.TECH VII SEMESTER	OEC	L	T	P	C
		3	0	0	3

20ME7T10 GREEN ENGINEERING SYSTEMS (OPEN ELECTIVE -III)

Pre-requisite: Thermodynamics, Environmental Sciences

Course Objective: The course aims to highlight the significance of alternative sources of energy, green energy systems and processes and provides the theory and working principles of probable sources of renewable and green energy systems that are environmental friendly.

Course Outcomes: At the end of the course, student will be able to

CO1: Evaluate the impact of technology on environment

CO2: Compare biological ecology to industrial ecology

CO3: Design eco-friendly product

CO4: Create sustainable products, facilities, processes and infrastructure

CO5: Asses the life cycle of a product to evaluate its impact on energy and materials use. Determine the effects of air and water quality

SYLLABUS

UNIT-I:

INTRODUCTION: SOLAR RADIATION: Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems and coordinates of the sun, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data, numerical problems. Photo voltaic energy conversion – types of PV cells, I-V characteristics.

SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

UNIT-II:

SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, sensible, latent heat and stratified storage, solar ponds, solar applications- solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney.

WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, betz criteria, types of winds, wind data measurement.

UNIT-III:

BIO-MASS: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, bio fuels, I.C. engine operation and economic aspects.

GEOTHERMAL ENERGY: Resources, types of wells, methods of harnessing the energy, potential in India.

OCEAN ENERGY: OTEC, Principles of utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

UNIT-IV: ENERGY EFFICIENT SYSTEMS:

(A) ELECTRICAL SYSTEMS: Energy efficient motors, energy efficient lighting and control, selection of luminaire, variable voltage variable frequency drives (adjustable speed drives), controls for HVAC (heating, ventilation and air conditioning), demand site management.

(B) MECHANICAL SYSTEMS: Fuel cells- principle, thermodynamic aspects, selection of fuels & working of various types of fuel cells, Environmental friendly and Energy efficient compressors and pumps.

UNIT-V: ENERGY EFFICIENT PROCESSES:

Environmental impact of the current manufacturing practices and systems, benefits of green manufacturing systems, selection of recyclable and environment friendly materials in manufacturing, design and implementation of efficient and sustainable green production systems with examples like environmental friendly machining, vegetable based cutting fluids, alternate casting and joining techniques, zero waste manufacturing.

Text Books:

1. Solar Energy – Principles of Thermal Collection and Storage/Sukhatme S.P. and J.K.Nayak/ TMH
2. Non-Conventional Energy Resources/ Khan B.H/ Tata McGraw Hill, New Delhi, 2006
3. Green Manufacturing Processes and Systems, Edited / J. Paulo Davim/Springer 2013

References:

1. Alternative Building Materials and Technologies / K.S Jagadeesh, B.V Venkata Rama Reddy and K.S Nanjunda Rao/New age international

2. Principles of Solar Engineering / D.YogiGoswami, Frank Krieth& John F Kreider / Taylor & Francis
3. Non-Conventional Energy / Ashok V Desai /New Age International (P) Ltd
4. Renewable Energy Technologies /Ramesh & Kumar /Narosa
5. Non conventional Energy Source/ G.D Roy/Standard Publishers
6. Renewable Energy Resources-2nd Edition/ J.Twidell and T. Weir/ BSP Books Pvt.Ltd
7. Fuel Cell Technology –Hand Book / Gregor Hoogers / BSP Books Pvt. Ltd.

B.TECH VII SEMESTER	OEC	L	T	P	C
		3	0	0	3

20ME7T11 HYBRID ELECTRIC VEHICLES (OPEN ELECTIVE -III)

Pre-requisite: Internal-Combustion engines.

Course Objective:

The main objective of this course is to provide the knowledge on architecture of Hybrid Electric Vehicles, Fuel cells and their sub-systems. The focus is as well on explaining the requirements of hybrid electric vehicles and Fuel-cells for automobile applications. At the same time, various design considerations in fuel cell vehicles and electric vehicles will be explained.

Course Outcomes: At the end of the course, student will be able to

CO1:	Compare and contrast the working of Conventional and Electric Vehicles.
CO2:	Comprehend the use of Series and Hybrid Electric vehicle drive trains
CO3:	Apply the fundamentals of to develop the propulsion and storage systems for Hybrid Electric Vehicles.
CO4:	Perform a case study on Hybrid Electric vehicle drive trains for different parameters
CO5:	Describe the working principle of various types of fuel-cells.

SYLLABUS

UNIT-I:

ELECTRIC VEHICLES: Introduction, Electric Vehicle Principle- Components of Electric Vehicle Constituents of a conventional vehicle-Drive cycles and Drive Terrain, Operating principle of Fuel Cell, Differences between conventional battery and Electric battery, Transmission differences between conventional and Electric Vehicles, Differences between conventional lighting system and Electric vehicle lighting system.

UNIT-II:

HYBRID ELECTRIC VEHICLES: Introduction, A Brief history of Hybrid Electric vehicles (HEVs),Basics of Hybrid Electric Vehicles (HEVs), Architecture of HEVs-Series HEVs, Parallel HEVs, Series-Parallel HEVs.

HYBRID ELECTRIC VEHICLE DRIVE TRAINS: Parallel Hybrid Drive trains with Torque coupling, Parallel Hybrid Drive trains with both Speed coupling, Parallel Hybrid Drive trains with both speed Torque coupling.

UNIT-III:

ELECTRIC PROPULSION SYSTEMS: DC Motors- Operating principle and control of DC motors, Induction Motor Drives: Operating principle and Control Mechanisms, Brushless Motor Drives-Principle and Construction, Switched Reluctance Motor (SRM) Drives- Basic structure, Drive Convertor, Modes of Operation.

ENERGY STORAGE SYSTEMS: Electrochemical Batteries, Lead-Acid Batteries, Nickel Based Batteries, Lithium Based Batteries, Ultra Capacitors- Basic Principles and Performance, Ultrahigh-speed flywheels- Basic Principle and Power Capacity, Fly Wheel technologies.

UNIT-IV:

DESIGN OF SERIES HYBRID ELECTRIC VEHICLE DRIVES: Design of Series Hybrid Electric Vehicle Drive- Control Strategies, Sizing of Major Components and Case Study for designing for various parameters.

DESIGN OF PARALLEL HYBRID ELECTRIC VEHICLE DRIVES: Design of Parallel Hybrid Electric Vehicle Drive- Control Strategies of Drive Train and Design of Drive Train Parameters.

UNIT-V:

FUEL CELL ELECTRIC VEHICLES: Operating principles of fuel cells, Fuel and oxidant consumption, Fuel cell system characteristics, Fuel cell technologies- Proton Exchange membrane fuel cells, Alkaline Fuel cells, Phosphoric acid fuel cells, Molten carbonate fuel cells, Solid oxide fuel cells, Fuel supply- Hydrogen storage-Hydrogen production, Ammonia as hydrogen carrier, Non-Hydrogen fuel cells, Fuel Cell Hybrid Vehicle Drive Train.

Text Books:

1) MehrdadEhsani, YiminGao, Ali Emadi, 2nd edition, Modern Electric, Hybrid Electric and Fuel cell vehicles, CRC Press, Taylor and Francis Group, 2010.
2) Chris Mi, M.AbulMasrur and David WenzhongGao, 1st Edition, Hybrid Electric Vehicles, John Wiley & Sons, Ltd, 2011.

B. TECH VII SEMESTER **OEC**

L	T	P	C
3	0	0	3

20EC7T10 DATA COMMUNICATIONS (OPEN ELECTIVE-III)

COURSE OBJECTIVES:
The main objectives of this course are given below:

	At the end of the course, student will be able to
1	To focus on information sharing and networks.
2	To Introduce flow of data, categories of network, different topologies.
3	To focus on different coding schemes.
4	To brief the students regarding protocols and standards.
5	To give clear idea of signals, transmission media, errors in data communications and their correction, networks classes and devices, etc.

COURSE OUTCOMES:
At the end of this course the student will able to:

CO1:	Know basic knowledge of data Communication
CO2:	Know basic knowledge of Analog & Digital Signals
CO3:	Understand the basic knowledge of Analog Transmission
CO4:	know Different types of transmission media
CO5:	Focus on DTE-DCE Interface

SYLLABUS

UNIT-I:

Introduction to data communication and networking: Reason to study data communication, Data Communication, Networks, Protocols and Standards, Standards Organizations. Line Configuration, Topology, Transmission Modes, Categories of Networks Internet works. Study of OSI and TCP/IP protocol suit: The Model, Functions of the layers, TCP/IP Protocol Suites

UNIT-II:

Study of Signals: Analog and Digital, Periodic and Aperiodic Signals, Analog Signals, Time and Frequency Domains, Composite Signals, Digital Signals. Study of Digital transmission: Digital to Digital Conversion, Analog to Digital Conversion.

UNIT-III:

Study of Analog transmission: Digital to Analog Conversion, Analog to Analog Conversion. Study of Multiplexing: Many to one/one to Many, Frequency division Multiplexing, Wage division Multiplexing, Time division Multiplexing, Multiplexing applications.

UNIT-IV:

Types of transmission media: Guided Media, Unguided Media, Transmission Impairments, Performance Wavelength, Shannon Capacity, Media Comparison, PSTN, Switching. Error Detection and Correction: Types of Errors, Detection, Parity Check, Vertical Redundancy Check, Longitudinal Redundancy Check, Cyclic Redundancy Check, Checksum, Error Correction.

UNIT-V:

Study of DTE-DCE in brief: Digital data transmission, DTE-DCE Interface, Modems, 56K Modems, Cable Modems. Introduction to networks and devices: Network classes, Repeaters, Hub, Bridges, Switches, Routers, Gateways Routers, Routing Algorithms, Distance Vector Routing, Link State Routing.

Text Books:

1. Data communication & Networking by Bahrouz Forouzan.

2. Computer Networks by Andrew S. Tanenbaum

Reference Books:

1. Data and Computer Communications by William Stallings

2. Kleinrock, Leonard. Queueing Systems, Vol 1: Theory. New York, NY: Wiley J., 1975. ISBN: 0471491101.

B. Tech VII Semester **OEC**

L	T	P	C
3	0	0	3

20EC7T11 MECHATRONICS (OPEN ELECTIVE III)

Course Objective: The main objective of this course is

- To introduce the integrative nature of Mechatronics.
- To describe the basic programming, different components and devices of mechatronics systems.

Course Outcomes:
At the end of this course the student will able to:

CO1: Basic concepts of mechatronics

CO2: To design mechatronics system with the help of Microprocessor

CO3: To design PLC and other electrical and Electronics Circuits

CO4: To understand the concept of solid state Devices

CO5: To know Dynamic models & controllers

SYLLABUS

UNIT-I:

Introduction to Mechatronics – Systems – Concepts of Mechatronics approach – Need for Mechatronics – Emerging areas of Mechatronics – Classification of Mechatronics. Sensors and Transducers: Static and dynamic Characteristics of Sensor, Potentiometers – LVDT – Capacitance sensors – Strain gauges – Eddy current sensor – Hall effect sensor – Temperature sensors – Light sensors.

UNIT-II:

Introduction – Architecture of 8085 – Pin Configuration – Addressing Modes –Instruction set, Timing diagram of 8085 – Concepts of 8051 microcontrollers – Block diagram

UNIT-III:

Introduction – Basic structure – Input and output processing – Programming – Mnemonics – Timers, counters and internal relays – Data handling – Selection of PLC, Basic programming in PLC.

UNIT-IV:

Solid state electronic devices - PN junction diode, BJT, FET, DIAC, TRIAC and LEDs. Analog signal conditioning, operational amplifiers, noise reduction, filtering.

UNIT-V:

Dynamic models and analogies, System response. Process Controllers – Digital Controllers, Programmable Logic Controllers, Design of mechatronics systems & future trend

TEXT BOOKS:

1. Bolton, ―Mechatronics‖, Printice Hall, 2000
2. Ramesh S Gaonkar, ―Microprocessor Architecture, Programming, and Applications with the 8085‖, 5th Edition, Prentice Hall, 2008.

REFERENCE BOOKS:

1. Mechatronics System Design / Devdas shetty/Richard/Thomson.
2. Mechatronics/M.D.Singh/J.G.Joshi/PHI.

B. TECH VII SEMESTER

OEC	L	T	P	C
	3	0	0	3

BIOMEDICAL INSTRUMENTATION.

20EC7T12 (OPEN ELECTIVE III)

Course Objectives:

1. To introduce student to basic biomedical engineering technology
2. To understand the anatomy & physiology of major systems of the body in designing equipment for medical treatments.
3. To impart knowledge about the principle and working of different types of bio-medical electronic equipment/devices.

Course- Outcomes:

After going through this course the student will able

CO1.To understand Physiological System of the Body and Bioelectric Potentials.

CO2.To understand Electrodes, Transducer and Sensors used in Biomedical field.

CO3 To understand the problem and identify the necessity of equipment for diagnosis and therapy.

CO4 To understand the importance of electronics engineering in medical field.

CO5 To understand the importance of telemetry in patient care

SYLLABUS

UNIT-1: INTRODUCTION TO BIOMEDICAL INSTRUMENTATION

Age of Biomedical Engineering, Development of Biomedical Instrumentation, Man Instrumentation System, Components of the Man-Instrument System, Physiological System of the Body, Problems Encountered in Measuring a Living System, Sources of Bioelectric Potentials, Muscle, Bioelectric Potentials, Sources of Bioelectric Potentials, Resting and Action Potentials, Propagation of Action Potential, Bioelectric Potentials-ECG, EEG and EMG, Envoked Responses.

UNIT-II: ELECTRODES AND TRANSDUCERS: Introduction, Electrode Theory, Biopotential Electrodes, Examples of Electrodes, Basic Transducer Principles, Biochemical Transducers, The Transducer and Transduction Principles, Active Transducers, Passive Transducers, Transducers for Biomedical Applications, Pulse Sensors, Respiration Sensor, Transducers with Digital Output**.**

UNIT-III: CARDIOVASCULAR SYSTEM AND MEASUREMENTS: The Heart and Cardiovascular System, Electro Cardiography, Blood Pressure Measurement, Measurement of Blood Flow and Cardiac Output, Measurement of Heart Sound, Plethysmography.

MEASUREMENTS IN THE RESPIRATORY SYSTEM: The Physiology of The Respiratory System, Tests and Instrumentation for The Mechanics of Breathing, Respiratory Therapy Equipment.

UNIT-IV: PATIENT CARE AND MONITORING: Elements of Intensive-Care Monitoring, Patient Monitoring Displays, Diagnosis, Calibration and Repair ability of Patient-Monitoring Equipment, Other Instrumentation for Monitoring Patients, Organization of the Hospital for Patient-Care Monitoring, Pacemakers, Defibrillators, Radio Frequency Applications of Therapeutic use.

THERAPEUTIC AND PROSTHETIC DEVICES: Audiometers and Hearing Aids, Laparoscope, Shock Hazards and Prevention, Physiological Effects and Electrical Current, Shock Hazards from Electrical Equipment, Methods of Accident Prevention,

UNIT-V: DIAGNOSTIC TECHNIQUES AND BIO-TELEMETRY: Principles of Ultrasonic Measurement, Ultrasonic Imaging, Ultrasonic Applications of Therapeutic Uses, Ultrasonic Diagnosis, X-Ray and Radio-Isotope Instrumentations, CAT Scan, Emission Computerized Tomography, MRI, Introduction to Biotelemetry, Physiological Parameters Adaptable to Biotelemetry, The Components of Biotelemetry System, Implantable Units, Telemetry for ECG Measurements during Exercise, Telemetry for Emergency Patient Monitoring**.**

Text Books:

1. Bio-Medical Instrumentation‖, Cromwell , Wiebell, Pfeiffer
2. Hand Book of Bio-Medical Instrumentation‖, Instrumentation‖, Kandahar. McGraw-Hill

References

1. Introduction to Bio-Medical Equipment Technology‖, 4th Edition, Joseph J. Carr, John M. Brown, Pearson Publications.
2. “Bio-Medical Electronics and Instrumentation”, Onkar N. Pandey, Rakesh Kumar, Katson Books.

B. TECH VII SEMESTER

OEC	L	T	P	C
	3	0	0	3

ARTIFICIAL NEURAL NETWORKS.

20CS7T10 (OPEN ELECTIVE III)

Course Objectives:

- To deal with the historical developments of artificial intelligence leading to artificial neural networks (ANN).
- To introduce the basic concepts and models of ANN for solving real world problems.

Course Outcomes:

At the end of this course the student will be able to:

CO1- Understand biological neuron & artificial neuron and basic building blocks of ANN.

CO2-Understand different single layer/multiple layer Perceptron learning algorithms.

CO3- Understand and analyze Adaline and Madeline Networks and their applications

CO4- Learning algorithms based on basic gradient descent, backpropagation and their modifications.

CO5- Understand self-organization learning, ART, Radial basis Functions.

SYLLABUS

UNIT - I: Introduction to Artificial Neural Networks:

Introduction, Artificial Neural Networks, Historical Development of Neural Networks, Biological Neural Networks, Comparison Between them and the Computer, Comparison Between Artificial and Biological Neural Network Basic Building Blocks of Artificial Neural Networks, Artificial Neural Network (ANN) terminologies.

UNIT - II: Fundamental Models of Artificial Neural Networks:

Introduction, McCulloch - Pitts Neuron Model, Learning Rules, Hebbian Learning Rule Perceptron Learning Rule, Delta Learning Rule (Widrow-Hoff Rule or Least Mean Square (LMS)Rule,Competitive Learning Rule, Out Star Learning, Boltzmann Based Learning, Hebb Net.

Perceptron Networks: Introduction, Single Layer Perceptron, Brief Introduction to Multilayer Perceptron Networks

UNIT – III: Adaline and Madaline Networks:

Introduction, Adaline, Madaline. Associative Memory Networks: Introduction, Algorithms for Pattern Association, Hetero Associative Memory Neural Networks, Auto Associative Memory Network, Bi- directional Associative Memory.

UNIT - IV: Feedback Networks:

Introduction, Discrete Hopfiled Net, Continuous Hopfiled Net, Relation between BAM and Hopfiled Nets.

Feed Forward Networks: Introduction, Back Propagation Network (BPN), Radial Basis Function Network (RBFN).

UNIT - V: Self Organizing Feature Map:

Introduction, Methods Used for Determining the Winner, Kohonen Self Organizing Feature Maps, Learning Vector Quantization (LVQ),Max Net, Maxican Hat, Hamming Net

Adaptive Resonance Theory: Introduction, ART Fundamentals, ART 1, ART2.

TEXT BOOKS:

1. Sivanandam, S Sumathi, S N Deepa; "Introduction to Neural Networks", 2nd ed.,TATA McGraw HILL : 2005.

REFERENCES:

1. "Simon Haykin, "Neural networks A comprehensive foundations", 2nd ed., Pearson Education, 2004.
2. B Yegnanarayana, "Artificial neural networks", 1st ed., Prentice Hall of India P Ltd, 2005.
3. Li Min Fu, "Neural networks in Computer intelligence", 1st ed., TMH, 2003

B. TECH VII SEMESTER

OEC	L	T	P	C
	3	0	0	3

CYBER SECURITY
20CS7T11 (OPEN ELECTIVE III)

Course Objective:

- Understand the importance of Cyber Security principles, Security architecture, risk management, attacks, incidents, and emerging IT and IS technologies.
- Students will gain insight into the importance of Cyber Security and the integral role of Cyber Security professionals.

Course Outcomes:

CO1: Understand and classify various forms of Cybercrimes

CO2: Interpret the reasons for Cyber offence

CO3: Detect and analyze vulnerabilities in Mobile and Wireless devices

CO4: Analyze tools used to perform cyber crimes

CO5: Understand cyber security Laws

SYLLABUS:

UNIT-I: Introduction, Cybercrime:

Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals? , Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes

UNIT-II: Cyber offenses:

How Criminals Plan Them –Introduction, How Criminals Plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector Cloud Computing.

UNIT-III: Cybercrime Mobile and Wireless Devices:

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile.

UNIT-IV: Tools and Methods Used in Cybercrime:

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks.

UNIT-V: Cybercrimes and Cyber security:

The Indian Context, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signatures and the Indian IT Act, Information Security Planning and Governance, Information Security Policy Standards, Practices, The information Security Blueprint, Security education, Training and awareness program

TEXT BOOKS:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole, SunitBelapure, Wiley.
2. Principles of Information Security, MichealE.Whitman and Herbert J.Mattord, Cengage Learning.

REFERENCES:

1. Information Security, Mark Rhodes, Ousley, MGH.

B. TECH VII SEMESTER

	L	T	P	C
OEC	3	0	0	3

SOFTWARE TESTING METHODOLOGIES
20CS7T12 (OPEN ELECTIVE III)

Course Objectives:

- To study fundamental concepts in software testing, including software testing objectives, process, criteria, strategies, and methods.
- To Understand different levels of Testing
- Apply Black Box and White Box Testing Techniques
- To learn how to plan a test project, design test cases and data, conduct testing operations, and generate a test report.
- To understand software test automation problems and solutions.

Course Outcomes:

CO1: Have an ability to apply software testing knowledge and engineering methods.

CO2: Ability to identify the needs of software test automation, and define a test tool to support test automation.

CO3: Understand and identify various software testing problems, and solve these problems by designing and selecting software test models, criteria, strategies, and methods.

CO4: Use various communication methods and skills to communicate with their teammates to conduct their practice-oriented software testing projects.

CO5: Apply techniques and skills to use modern software testing tools to support software testing projects.

SYLLABUS

UNIT-I: Software Testing:

Introduction, Evolution, Dichotomies, Goals & Typical Objectives of Testing, Model for testing, Software Testing Principles, **Software Testing Terminology and Methodology:** Software Testing Terminology, Errors, Defects, Failures, Root Causes and Effects, Software Testing Life Cycle, Software Testing Methodology.

UNIT-II: Verification and Validation:

Verification & Validation Activities, Categories of Test Techniques: Dynamic Testing,
Black Box testing techniques: Boundary Value Analysis, Equivalence class Testing, State Table based testing, Decision table based testing, Cause-Effect Graphing based testing,

White-Box Testing: Need, Logic coverage criteria, Basis path testing, Graph matrices, Loop testing, data flow testing, mutation testing

UNIT-III: Static Testing:

Inspections, Structured Walkthroughs, Technical reviews, Benefits of Static Testing, Static Vs Dynamic Testing.

Levels of Testing: Unit testing, Integration Testing,. Function testing, System testing and Acceptance testing.

Regression testing: Progressive Vs Regressive testing, Objectives of regression testing, Regression testing techniques

UNIT-IV: Test Management:

Test Organization, Test Planning, Test Design and Test case specifications, Structure of a Testing Group, Reasons for the growth of a Test suite, Test suite Minimization, Test suite prioritization, Types of test case prioritization, prioritization techniques, Measuring the effectiveness of a prioritized test suite. Software Quality Management: Software Quality metrics, SQA models

Debugging: Debugging process, Debugging Techniques, Correcting Bugs, Debuggers

UNIT-V: Automation and Testing Tools:

Need for automation, Testing Tool Considerations, Test Tool Classification, Benefits and Risks of Test automation, Special Considerations for Test execution and Test Management Tools, Principles for tool selection, Testing tools- success factors, Guidelines for automated testing, overview of some commercial testing tools.

Object oriented testing Testing Web based Systems: Challenges in testing for web based software, quality aspects, web **engineering**, testing of web based systems, Testing mobile systems.

TEXT BOOKS:

1. Software testing techniques - Baris Beizer, International Thomson computer press, second edition. (Unit 1)
2. Software Testing, Principles and Practices, Naresh Chauhan, Oxford Publishers(Unit 2,3,4,5)

REFERENCES:

Effective Methods for Software testing, Willian E Perry, 3ed, Wiley

1. Software Testing, Principles, techniques and Tools, M G Limaye, TMH
2. Foundations of Software testing, Aditya P Mathur, 2ed, Pearson

B. TECH VII SEMESTER

OEC	L	T	P	C
	3	0	0	3

INTERNET OF THINGS
20IT7T10 (OPEN ELECTIVE III)

Course Objectives:

- Understand the architecture of Internet of Things and connected world.
- Explore on use of various hardware, communication and sensing technologies to build IoT applications
- Develop the real time IoT applications to make smart world.
- Understand challenges and future trends in IoT.

Course Outcomes:

CO1: Design and Deployment of IoT.

CO2: Design and comparing M2M with IoT.

CO3: Understand Platform design and modeling of IoT

CO4: Apply IoT in different devices using Python

CO5: Implement IoT and cloud platforms.

SYLLABUS

UNIT-I: Introduction to Internet of Things (IoT):

Definition and characteristics of IoT, physical design of IoT, logical design of IoT, IoT Enabling Technologies, IoT levels and deployment, domains Specific IoTs.

UNIT-II: IoT and M2M :

Introduction, M2M, difference between IoT and M2M, software defined networking (SDN) and network function virtualization (NFV) for IoT, basics of IoT system management with NETCONF-YANG.

UNIT-III: IoT Platforms Design Methodology:

IoT Architecture: State of the art introduction, state of the art; Architecture reference model: Introduction, reference model and architecture, IoT reference model. Logical design using Python: Installing Python, Python data types and data Structures, control flow, functions, modules, packages, file handling. Raspberry PI with Python, other IoT devices.

UNIT-IV: IoT Protocols:

Messaging Protocols- MQ Telemetry Transport (MQTT), Constrained Application Protocol (CoAP) Transport Protocols-Light Fidelity (Li-Fi), Bluetooth Low Energy (BLE) IoT Protocols: Addressing and Identification: Internet Protocol Version 4 (IPV4), Internet Protocol Version 6(IPV6), Uniform Resource Identifier (URI)

UNIT-V: IoT Physical Servers And Cloud Offerings: Introduction to cloud storage models and communication APIs, WAMP –Auto Bahn for IoT, Xively cloud for IoT, case studies illustrating IoT design –home automation, smart cities, smart environment.

TEXT BOOKS:

1. ArshdeepBahga, Vijay Madisetti, "Internet of Things: A Hands-on-Approach", VPT, 1st Edition, 2014. (Units1,2,3,5)
2. Matt Richardson, Shawn Wallace, "Getting Started with Raspberry Pi", O'Reilly (SPD), 3rd Edition, 2014. (Unit 3)
3. Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram " Internet of Things" Wiley (Unit 4).

REFERENCE BOOKS:

1. Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw Hill Higher Education
2. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", John Wiley and Sons2014.

B. TECH VII SEMESTER

OEC	L	T	P	C
	3	0	0	3

COMPUTER VISION
20IT7T11 (OPEN ELECTIVE III)

Course Objectives:

- To review image processing techniques for computer vision.
- To understand shape and region analysis.
- To understand Hough Transform and its applications to detect lines, circles, ellipses.
- To understand motion analysis.
- To study some applications of computer vision algorithms

Course Outcomes:

CO1: Implement fundamental image processing techniques required for computer vision.

CO2: Perform shape analysis.

CO3: Apply Hough Transform for line, circle, and ellipse detections.

CO4: Apply 3D vision techniques.

CO5: Develop applications using computer vision techniques

SYLLABUS

UNIT - I:

IMAGE PROCESSING FOUNDATIONS

Review of image processing techniques – classical filtering operations – thresholding techniques – edge detection techniques – corner and interest point detection – mathematical morphology –texture.

UNIT - II: SHAPES AND REGIONS

Binary shape analysis – connectedness – object labeling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moments.

UNIT – III: HOUGH TRANSFORM

Line detection – Hough Transform (HT) for line detection – foot-of-normal method – line localization – line fitting – RANSAC for straight line detection – HT based circular object detection – accurate center location – speed problem – ellipse detection – Case study: Human Iris location – hole detection – generalized Hough Transform (GHT) – spatial matched filtering – GHT for ellipse detection – object location – GHT for feature collation.

UNIT - IV: 3D VISION AND MOTION

Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion – spline-based motion – optical flow – layered motion

.**UNIT - V: APPLICATIONS**

Application: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians.

TEXT BOOKS:

1.D. L. Baggio et al., ―Mastering OpenCV with Practical Computer Vision Projects‖, Packt Publishing, 2012.

2. E. R. Davies, ―Computer & Machine Vision‖, Fourth Edition, Academic Press, 2012.

REFERENCES:

1. Jan Erik Solem, ―Programming Computer Vision with Python: Tools and algorithms for analyzing images‖, O'Reilly Media, 2012.
2. Mark Nixon and Alberto S. Aquado, ―Feature Extraction & Image Processing for Computer Vision‖, Third Edition, Academic Press, 2012.
3. R. Szeliski, ―Computer Vision: Algorithms and Applications‖, Springer 2011.
4. Simon J. D. Prince, ―Computer Vision: Models, Learning, and Inference‖, Cambridge University Press, 2012.

B. TECH VII SEMESTER

OEC	L	T	P	C
	3	0	0	3

FUZZY SETS
20HS7T01 (OPEN ELECTIVE III)

COURSE OBJECTIVES:

1) Provide an understanding of the basic mathematical elements of the theory of fuzzy sets.
2) Explain different types operations performed on fuzzy sets.
3) Provide the knowledge of Arithmetic operations on fuzzy numbers.
4) Emphasis on different kinds of crisp and fuzzy relations
5) Enable students to know the validity of arguments by fuzzy logic.

COURSE OUTCOMES:

CO1: Understand basic knowledge of fuzzy sets and fuzzy logic.
CO2: Apply various kinds of operations on fuzzy sets.
CO3: Understand the concepts of fuzzy arithmetic to solve fuzzy equations.
CO4: Illustrate the properties of fuzzy sets to design modeling software system.
CO5: Apply fuzzy logic to solve the problems in neural networks.

SYLLABUS

UNIT-I

Fuzzy Sets(all theorems without proofs): Introduction, Crisp sets, Fuzzy sets: Basic types and basic concepts, additional properties of α-cuts, representations of Fuzzy sets, extension principle for Fuzzy sets.

UNIT-II

Operations on Fuzzy Sets(all theorems without proofs): Types of operations, Fuzzy complements, Fuzzy intersections: t-norms, Fuzzy unions: t-conorms, Combinations of operations, Aggregation operations.

UNIT-III

Fuzzy Arithmetic(all theorems without proofs): Fuzzy numbers, Linguistic variables, Arithmetic operations on intervals, Arithmetic operations on Fuzzy numbers, Lattice of Fuzzy numbers, Fuzzy equations.

UNIT-IV

Fuzzy Relations(all theorems without proofs): Crisp versus Fuzzy relations, Projection and cylindrical extensions, Binary Fuzzy relations, Binary relations on a single set, Fuzzy equivalence relations, Fuzzy compatibility relations, Fuzzy ordering relations, Fuzzy morphisms.

UNIT-V

Fuzzy Logic(all theorems without proofs): Classical logic: an over view, multivalued logics, Fuzzy propositions, Fuzzy quantifiers, Linguistic hedges, Inference from conditional Fuzzy propositions, Inference from conditional and qualified propositions, Inference from quantified propositions.

TEXT BOOKS:

1. George J. Klir& Bo Yuan, Fuzzy Sets & Fuzzy Logic, Pearson Education, PHI, 1995.
2. H. J. Zimmermann, Fuzzy Set Theory and its Applications, 4th edition, Springer.

REFERENCES:

1. Timothy J. Ross, Fuzzy Logic with Engineering Applications, 3rd edition, Wiley, 2010.
2. John Yen & Reza Langari, Fuzzy Logic, Pearson.

B. TECH VII SEMESTER

	L	T	P	C
OEC	3	0	0	3

DIGITAL MEDIA MANAGEMENT

20MB7T01 (OPEN ELECTIVE III)

Course Objective

Digital marketing channels that can helps the students to understand the increased business visibility and brand awareness. Moreover, having a professional presence on social media helps them to reach a broader target audience to secure more leads and convert them into loyal customers.

SYLLABUS

Unit – I

Understanding Digital Marketing: Concept, Components of Digital Marketing, Need and Scope of Digital Marketing, Benefits of Digital Marketing, Digital Marketing Platforms and Strategies, Comparison of Marketing and Digital Marketing, Digital Marketing Trends.

Unit – II

Channels of Digital Marketing: Digital Marketing, Website Marketing, Search Engine Marketing, Online Advertising, Email Marketing, Blog Marketing, Social Media Marketing, Audio, Video and Interactive Marketing, Online Public Relations, Mobile Marketing, Migrating from Traditional Channels to Digital Channels. Marketing in the Digital Era Segmentation – Importance of Audience Segmentation, How different segments use Digital Media –

Organizational Characteristics, Purchasing Characteristics, Using Digital Media to Reach, Acquisition and Retention of new customers, Digital Media for Customer Loyalty.

Unit – III

Digital Marketing Plan: Need of a Digital Marketing Plan, Elements of a Digital Marketing Plan – Marketing Plan, Writing the Marketing Plan and Implementing the Plan, Executive Summary, Mission, Situational Analysis, Opportunities and Issues, Goals and Objectives, Marketing Strategy, Action Plan, Budget.

Unit – IV

Search Engine Marketing and Online Advertising: Importance of SEM, understanding Web Search – keywords, HTML tags, Inbound Links, Online Advertising vs. Traditional Advertising, Payment Methods of Online Advertising – CPM (Cost-per-Thousand) and CPC (Cost per-click), Display Ads - choosing a Display Ad Format, Landing Page and its importance.

Unit – V

Social Media Marketing: Understanding Social Media, Social Networking with Facebook, LinkedIn, Blogging as a social medium, Microblogging with Twitter, Social Sharing with YouTube, Social Media for Customer Reach, Acquisition and Retention. Measurement of Digital Media: Analyzing Digital Media Performance, Analyzing Website Performance, Analyzing Advertising Performance.

TEXT BOOKS

1 Richard Gay, Alan Charles worth and Rita Essen, Online Marketing, Oxford University Press, 2016.

REFERENCES

1. Dave Chaffey, Fiona Ellis-Chadwick, Richard Mayer, Kevin Johnston. Internet Marketing Strategy, Implementation and Practice,3rd Ed .Prentice Hall.
2. Rob Stokes e-Marketing: The essential guide to marketing in a digital world. 5th Ed. Quirk e-Marketing (Pty) Ltd.

B. TECH VII SEMESTER

		L	T	P	C
	OEC	3	0	0	3

20MB7T02 ENTREPRENEURSHIP DEVELOPMENT (OPEN ELECTIVE III)

SYLLABUS

UNIT –I

Entrepreneurship- definition. growth of small scale industries in developing countries and their positions vis-a-vis large industries; role of small scale industries in the national economy; characteristics and types of small scale industries; demand based and resources based ancillaries and sub-control types. Government policy for small scale industry; stages in starting a small scale industry.

UNIT -II

Project identification- assessment of viability, formulation, evaluation, financing, field-study and collection of information, preparation of project report, demand analysis, material balance and output methods, benefit cost analysis, discounted cash flow, internal rate of return and net present value methods.

UNIT -III

Accountancy- Preparation of balance sheets and assessment of economic viability, decision making, expected costs, planning and production control, quality control, marketing, industrial relations, sales and purchases, advertisement, wages and incentive, inventory control, preparation of financial reports, accounts and stores studies.

UNIT -IV

Project Planning and control: The financial functions, cost of capital approach in project planning and control. Economic evaluation, risk analysis, capital expenditures, policies and practices in public enterprises. profit planning and programming, planning cash flow, capital expenditure and operations. control of financial flows, control and communication.

UNIT -V

Laws concerning entrepreneur viz, partnership laws, business ownership, sales and income taxes and workman compensation act. Role of various national and state agencies which render assistance to small scale industries.

Text / Reference Books:

1. Forbat, John, “Entrepreneurship” New Age International.

2. Havinal, Veerbhadrappa, “Management and Entrepreneurship” New Age International

3. Joseph, L. Massod, “Essential of Management", Prentice Hall of India.

B. TECH VII SEMESTER

	L	T	P	C
OEC	3	0	0	3

20AD7T10 **DATA ANALYSIS AND VISUALIZATION WITH PYTHON (OPEN ELECTIVE III)**

Pre-requisite:

Course Objective: *This course* explains vital data science concepts and teaches you how to accomplish the fundamental tasks that occupy data scientists. You'll explore data visualization, graph databases, the use of NoSQL, and the data science process. You'll use the Python language and common Python libraries as you experience firsthand the challenges of dealing with data at scale.

Course Outcomes: At the end of the course, student will be able to

CO1: Describes benefits of data science, facets of data

CO2: Illustrates data science process and describes the need of machine learning

CO3: Describes the problems of handling large data

CO4: Introduces distributed data storage and processing frame works

CO5: Describes about graph databases and text analytics

SYLLABUS

Unit-1:

Preliminaries: What Kinds of Data?, Why Python for Data Analysis?, Python as Glue, Solving the "Two-Language" Problem, Why Not Python?, Essential Python Libraries, Installation and Setup.

Python Language Basics, IPython, and Jupyter Notebooks: The Python Interpreter, IPython Basics, Python Language Basics.

NumPy Basics: Arrays and Vectorized Computation:

The NumPy ndarray: A Multidimensional Array Object, Universal Functions: Fast Element-Wise Array Functions, Array-Oriented Programming with Arrays, File Input and Output with Arrays, Linear Algebra, Pseudorandom Number Generation.

Unit-2:

Introduction to pandas Data Structures: Series, DataFrame, Index Objects

Essential Functionality: Reindexing, Dropping Entries from an Axis, Indexing, Selection, and Filtering, Integer Indexes, Arithmetic and Data Alignment, Function Application and Mapping, Sorting and Ranking, Axis Indexes with Duplicate Labels, Summarizing and Computing Descriptive Statistics: Correlation and Covariance, Unique Values, Value Counts, and Membership.

Unit-3:

Data Loading, Storage, and File Formats Reading and Writing Data in Text Format: Reading Text Files in Pieces, Writing Data to Text Format, Working with Delimited Formats, JSON Data, XML and HTML: Web Scraping

Binary Data Formats: Using HDF5 Format, Reading Microsoft Excel Files

Data Cleaning and Preparation:

Handling Missing Data: Filtering Out Missing Data, Filling In Missing Data

Data Transformation: Removing Duplicates, Transforming Data Using a Function or Mapping, Replacing Values, Renaming Axis Indexes, Discretization and Binning, Detecting and Filtering Outliers, Permutation and Random Sampling, Computing Indicator/Dummy Variables

Unit-4:

Data Wrangling: Join, Combine, and Reshape:

Hierarchical Indexing: Reordering and Sorting Levels, Summary Statistics by Level, Indexing with a DataFrame's columns.

Combining and Merging Datasets: Database-Style DataFrame Joins, Merging on Index, Concatenating Along an Axis, Combining Data with Overlap.

Reshaping and Pivoting: Reshaping with Hierarchical Indexing, Pivoting "Long" to "Wide" Format, Pivoting "Wide" to "Long" Format.

Unit-5:

Plotting and Visualization

A Brief matplotlib API Primer: Figures and Subplots, Colors, Markers, and Line , Styles, Ticks, Labels, and Legends, Annotations and Drawing on a Subplot, Saving Plots to File, matplotlib Configuration.

Plotting with pandas and seaborn: Line Plots, Bar Plots, Histograms and Density Plots, Scatter or Point Plots, Facet Grids and Categorical Data, Other Python Visualization Tools.

Text Book:

"Python for Data Analysis" Data Wrangling With Pandas, Numpy, And Ipython Second Edition by Wes McKinney, Oreilly Publications.

B. TECH VII SEMESTER **OEC**

L	T	P	C
3	0	0	3

20AM7T10 **NoSQL DATABASES (OPEN ELECTIVE III)**

Pre-requisite: Linear Algebra, Calculus, Python Programming

Course Objective: *This* ***course*** explains define, compare and use the four types of NoSQL Databases, demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases, explain the detailed architecture, define objects, load data, query data and performance tune Document oriented NoSQL databases, ability to design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data

Course Outcomes: At the end of the course, student will be able to

CO1: Identify the type of NoSQL database to implement based on business requirements

CO2: Apply NoSQL data modeling from application specific queries

CO3: Understand NoSQL Storage Architecture

CO4: Use Atomic Aggregates and denormalization as data modeling techniques to optimize query processing

CO5: Apply indexing and ordering of data sets

SYLLABUS

Unit-1:

Introduction to NoSQL: Definition And Introduction, Sorted Ordered Column-Oriented

Stores, Key/Value Stores, Document Databases, Graph Databases, Examining Two Simple Examples, Location Preferences Store, Car Make And Model Database, Working With Language Bindings.

Unit-2:

Interacting with NoSQL: If NoSql Then What, Language Bindings For NoSQL Data Stores, Performing Crud Operations, Creating Records, Accessing Data, Updating And Deleting Data

Unit-3:

NoSQL Storage Architecture: Working With Column-Oriented Databases, Hbase Distributed Storage Architecture, Document Store Internals, Understanding Key/Value

Stores In Memcached And Redis, Eventually Consistent Non-Relational Databases.

Unit-4:

NoSQL Stores: Similarities between Sql and Mongodb Query Features, Accessing Data

From Column-Oriented Databases like Hbase, Querying Redis Data Stores, Changing Document Databases, Schema Evolution in Column-Oriented Databases, Hbase Data Import And Export, Data Evolution In Key/Value Stores.

Unit-5:

Indexing and Ordering Data Sets: Essential Concepts behind a Database Index, Indexing And Ordering In Mongodb, Creating and Using Indexes In Mongodb, Indexing And Ordering In Couchdb, Indexing In Apache Cassandra.

Reference Books:

1) Pramod Sadalage and Martin Fowler, NoSQL Distilled, Addison-Wesley Professional,2012.

2) Dan McCreary and Ann Kelly, Making Sense of NoSQL, Manning Publications,2013.

3) Shashank Tiwari, Professional NoSQL, Wrox Press, Wiley, 2011, ISBN:978-0-470-94224-6

4) Gaurav Vaish, Getting Started with NoSQL, Packt Publishing, 2013.

B.TECH VII SEMESTER **OEC**

L	T	P	C
3	0	0	3

20CE7T15 WASTE WATER TREATMENT
(OPEN ELECTIVE-IV)

Course Objectives: To study about waste water treatment

Course Outcomes: Able to provide waste management techniques

SYLLABUS

UNIT–I:

Quality requirements of boiler and cooling waters – Quality requirements of process water for Textiles – Food processing and Brewery Industries – Boiler and Cooling water treatment methods.

UNIT–II:

Basic Theories of Industrial Waste water Management – Volume reduction – Strength reduction – Neutralization – Equalization and proportioning. Joint treatment of industrial wastes and domestic sewage – consequent problems, Industrial waste water discharges into streams. Lakes and oceans- consequent problems.

UNIT–III:

Recirculation of Industrial Wastes – Use of Municipal Waste Water in Industries, Manufacturing Process and design origin of liquid waste from Textiles, Paper and Pulp industries, Thermal Power Plants and Tanneries, Special Characteristics, Effects and treatment methods. Manufacturing Process and design origin of liquid waste from Fertilizers, Distillers, and Dairy, Special Characteristics, Effects and treatment methods.

UNIT-IV:

Manufacturing Process and design origin of liquid waste from Sugar Mills, Steel Plants, Oil Refineries, and Pharmaceutical Plants, Special Characteristics, Effects and treatment methods.

UNIT–V:

Common Effluent Treatment Plants – Advantages and Suitability, Limitations, Effluent Disposal Methods.

Text Books:

1. Waste Water Treatment by M.N. Rao and Dutta, Oxford & IBH, New Delhi.

Reference Books:

1. Liquid waste of Industry by Newmerow.
2. Water and Waste Water technology by Mark J. Hammer and Mark J. Hammer (Jr).

B.TECH VII SEMESTER **OEC**

L	T	P	C
3	0	0	3

20CE7T16 REPAIR AND REHABILITATION OF CONCRETE STRUCTURES
(OPEN ELECTIVE-IV)

Course Objectives:

- Familiarize Students with deterioration of concrete in structures
- Equip student with concepts of NDT and evaluation
- To evaluate the performance of the materials for repair
- To strategize different repair and rehabilitation of structures.

Course Outcomes:

CO1: Explain deterioration of concrete in structures

CO2: Carryout analysis using NDT and evaluate structures

CO3: Students must gain knowledge on quality of concrete

CO4: Examine how the Concrete repair industry equipped with variety of repair Material sand techniques .

SYLLABUS

UNIT–I:

Maintenance and Repair Strategies Maintenance, Repair and Rehabilitation, Facets of Maintenance, importance of Maintenance, Various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration.

UNIT-II:

Causes of Damage To Structures Causes of Distress in Structures - Extrinsic and Intrinsic causes for damage of structures; Effect of Chemical and Marine Environment on structures.

UNIT-III:

Semi Destructive Tests for Damage Assessment Core Test, LOK test, CAPO test, Penetration Tests Non-Destructive Tests for Damage Assessment Rebound Hammer Test, Ultrasonic Pulse Velocity test, Resistivity Test, Carbonation Test, Corrosion: Methods for corrosion measurement and assessment including half-cell potential and resistivity, Mapping of data.

UNIT-IV:

Materials for Repair: Criteria for durable concrete repair, selection of repair materials, Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement, Fiber reinforced concrete, FRP sheets.

UNIT-V:

Techniques for Repair: Crack repair techniques – Crack Stitching, Mortar and dry pack, vacuum concrete, Shotcreting, Epoxy injection, Mortar repair for cracks Methods of Strengthening: Repairs to overcome low member strength – Jacketing, blanketing

Text Books:

1. 'Maintenance & Repair of Civil Structures' by B.L. Gupta & Amit Gupta.
2. 'Rehabilitation of Concrete Structures' by B. Vidivelli, Standard Publishers.
3. 'Concrete Bridge Practice Construction, Maintenance & Rehabilitation' by V. K. Raina

Reference Books:

1. 'Concrete Structures- protection Repair and Rehabilitation' by R. Doodge Woodson, BH Publishers
2. ShettyM.S., "Concrete Technology – Theory and Practice", S. Chand and Company, 2008.
3. Dov Kominetzky. M. S., "Design and Construction Failures", Galgotia Publications Pvt.Ltd., 2001
4. Ravishankar.K., Krishnamoorthy. T. S, "Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures", Allied Publishers, 2004.
5. CPWD and Indian Buildings Congress, Hand book on Seismic Retrofit of Buildings, Narosa Publishers, 2008,
6. Gambhir. M. L., "Concrete Technology", McGraw Hill, 2013

B.TECH VII SEMESTER **OEC**

L	T	P	C
3	0	0	3

20EE7T15 POWER QUALITY
(OPEN ELECTIVE-IV)

Course Objective:

- To introduce the power quality problem
- To educate on production of voltages sags, over voltages and harmonics and methods of control.
- To study overvoltage problems
- To study the sources and effect of harmonics in power system
- To impart knowledge on various methods of power quality monitoring.

Course Outcome:

At the end of this course the student should be able to

CO1: Differentiate between different types of power quality problems.

CO2: Explain the sources of voltage sag, voltage swell, interruptions, transients, long duration over voltages and harmonics in a power system.

CO3: Analyze power quality terms and power quality standards.

CO4: Explain the principle of voltage regulation and power factor improvement methods.

CO5: Explain the power quality monitoring concepts and the usage of measuring instruments.

SYLLABUS

Unit-I

Introduction to Power Quality: Terms and definitions of transients, Long Duration Voltage Variations: Under Voltage and Sustained Interruptions; Short Duration Voltage Variations: interruption, Sag, Swell; Voltage Imbalance; Notching DC offset; waveform distortion; voltage fluctuation; power frequency variations.

Unit-II

Voltage Sag: Sources of voltage sag: motor starting, arc furnace, fault clearing etc; estimating voltage sag performance and principle of its protection; solutions at end user level- Isolation Transformer, Voltage Regulator, Static UPS, Rotary UPS, and Active Series Compensator.

Unit-III

Electrical Transients: Sources of Transient Over voltages- Atmospheric and switching transients-motor starting transients, pf correction-capacitor switching transients, ups switching transients, neutral voltage swing etc; devices for over voltage protection.

Unit-IV

Harmonics: Causes of harmonics; current and voltage harmonics, measurement of harmonics, THD; effects of harmonics on – Transformers, AC Motors, Capacitor Banks, Cables, and Protection Devices, Energy Metering, Communication Lines etc. harmonic mitigation techniques.

Unit-V

Monitoring and Instrumentation: Power quality monitoring and considerations – Historical perspective of PQ measuring instruments – PQ measurement equipment – Assessment of PQ measuring data – Application of intelligent systems – PQ monitoring standards.

Text Books:

1. Roger C Dugan, McGrahan, Santoso & Beaty, "Electrical Power System Quality" McGraw Hill
2. Arinthom Ghosh & Gerard Ledwich, "Power Quality Enhancement Using Custom Power Devices" Kluwer Academic Publishers
3. Sankaran, " Power Quality" CRC Press.

Reference Books:

1. Power Quality Primer, Kennedy B W, First Edition, McGraw–Hill, 2000.
2. Understanding Power Quality Problems: Voltage Sags and Interruptions, Bollen M HJ, First Edition, IEEE Press; 2000.
3. Power System Harmonics, Arrillaga J and Watson N R, Second Edition, John Wiley & Sons, 2003.
4. Electric Power Quality control Techniques, W. E. Kazibwe and M. H. Sendaula, Van Nostrad Reinhold, New York.
5. Harmonics and Power Systems –Franciso C.DE LA Rosa–CRC Press (Taylor & Francis) Power Quality in Power systems and Electrical Machines–EwaldF.fuchs, Mohammad A.S. Masoum–Elsevier.

B.TECH VII SEMESTER	**OEC**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

20EE7T16 ELECTRIC VEHICLES

(OPEN ELECTIVE-IV)

Course Objective:

- To study the different drive train configurations of electric vehicles
- To propose the various propulsion and energy storage systems for EHVs
- To know the sizing of propulsion motors and other systems involved in EH vehicles
- To carry out different design case studies of EHv and BEVs

Course Outcomes: At the end of the course, the student will be able to:

CO1: Assess the performance, societal and environmental impact of EHVs having known their past history

CO2: Implement various drive train topologies and control strategies in Electric and Hybrid vehicles

CO3: Recommend, Design/Size and Control different electric propulsion units and other components of EHVs and BEVs

CO4: Appropriately select the energy storage system and strategize its management in EHVs

CO5: Define Ancillary Service Management and explain different ancillary services.

SYLLABUS

UNIT-I INTRODUCTION TO ELECTRIC VEHICLES:

History of electric vehicles (EV) and hybrid electric vehicle (EHV), need and importance of EV and HEV, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies, Power/energy supplies requirements for EV/HEV applications, vehicle power source characterization, and transmission characteristics.

UNIT-II HYBRID ELECTRIC DRIVE-TRAINS: Basic architecture and concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis

UNIT-III ELECTRIC PROPULSION UNIT:

Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Induction Motor drives, Permanent Magnet Motor drives, and Switch Reluctance Motor drives, drive system efficiency.

UNIT-IV BATTERY ENERGY STORAGE SYSTEMS:

Battery Basics - Lead-Acid Battery -Cell Discharge Operation - Cell Charge Operation-Construction-Battery Parameters - Battery Capacity-Discharge Rate - State of Charge- State of Discharge- Depth of Discharge-Technical Characteristics - Practical Capacity -Battery Energy -Constant Current Discharge -Specific Energy - Battery Power -Specific Power -Batteries for EV applications.

UNIT-V MODELLING OF EV/HEV:

Modelling and analysis of EV/HEV drive train sizing of motor, and design of traction power electronics, various vehicle subsystems.

TEXT BOOKS:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2010.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press,2009.
3. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.

REFERENCES:

1. Jefferson, C.M., Barnard and R.H., Hybrid Vehicle Propulsion, WIT Press, Boston, 2002
2. Jack Erjavec and Jeff Arias, “Hybrid, Electric and Fuel Cell Vehicles”, Cengage Learning, 2012
3. SerefSoylu “Electric Vehicles - The Benefits and Barriers”, InTech Publishers, Croatia, 2011
4. Jack Erjavec and Jeff Arias, “Alternative Fuel Technology – Electric, Hybrid and Fuel Cell Vehicles”, Cengage Learning Pvt. Ltd., New Delhi, 2007
5. Seth Leitman, “Build Your Own Electric Vehicle” McGraw hill, New York, USA, 2013

B.TECH VII SEMESTER **OEC**

L	T	P	C
3	0	0	3

20ME7T12 MICRO-ELECTRO- MECHANICAL SYSTEMS (OPEN ELECTIVE -IV)

Pre-requisite: Calculus and Differential Eq., Fundamentals of Physics (Mechanics, Optics, Electricity and magnetism), Fundamentals of Inorganic Chemistry.

Course Objective: The main objective of this course is to introduce the integrative nature of Micro Electro Mechanical systems. To describe the different components and devices of Micro Electro Mechanical systems.

Course Outcomes: At the end of the course, student will be able to

- **CO1:** Explain MEMS and Principles of sensing and actuation
- **CO2:** Explain Thermal Sensors and Actuators & Magnetic Sensors and Actuators
- **CO3:** Explain Micro-Opto-Electro Mechanical Systems
- **CO4:** Explain Radio Frequency (RF) MEMS & Micro Fluidic Systems
- **CO5:** Explain Chemical And Bio Medical Micro Systems

SYLLABUS

UNIT-I:

INTRODUCTION: Definition of MEMS, MEMS history and development, micro machining, lithography principles & methods, structural and sacrificial materials, thin film deposition, impurity doping, etching, surface micro machining, wafer bonding, LIGA.

MECHANICAL SENSORS AND ACTUATORS: Principles of sensing and actuation: beam and cantilever, capacitive, piezo electric, strain, pressure, flow, pressure measurement by micro phone, MEMS gyroscopes, shear mode piezo actuator, gripping piezo actuator, Inchworm technology.

UNIT-II:

THERMAL SENSORS AND ACTUATORS: Thermal energy basics and heat transfer processes, thermisters, thermo devices, thermo couple, micro machined thermo couple probe, peltier effect heat pumps, thermal flow sensors, micro hot plate gas sensors, MEMS thermo vessels, pyro electricity, shape memory alloys (SMA), U-shaped horizontal and vertical electro thermal actuator, thermally activated MEMS relay, micro spring thermal actuator, data storage cantilever.

MAGNETIC SENSORS AND ACTUATORS: Magnetic materials for MEMS and properties, magnetic sensing and detection, magneto resistive sensor, more on hall effect, magneto diodes, magneto transistor, MEMS magnetic sensor, pressure sensor utilizing MOKE, magnetic MEMS actuators, by directional micro actuator, feedback circuit integrated magnetic actuator, large force reluctance actuator, magnetic probe based storage device.

UNIT-III: MICRO-OPTO-ELECTRO MECHANICAL SYSTEMS:

Principle of MOEMS technology, properties of light, light modulators, beam splitter, micro lens, micro mirrors, digital micro mirror device (DMD), light detectors, grating light valve (GLV), optical switch, wave guide and tuning, shear stress measurement.

UNIT-IV:

RADIO FREQUENCY (RF) MEMS: RF – based communication systems, RF MEMS, MEMS inductors, varactors, tuner/filter, resonator, clarification of tuner, filter, resonator, MEMS switches, phase shifter.

MICRO FLUIDIC SYSTEMS: Applications, considerations on micro scale fluid, fluid actuation methods, dielectrophoresis (DEP), electro wetting, electro thermal flow, thermo capillary effect, electro osmosis flow, opto electro wetting (OEW), tuning using micro fluidics, typical micro fluidic channel, microfluid dispenser, micro needle, molecular gate, micro pumps.

UNIT-V: CHEMICAL AND BIO MEDICAL MICRO SYSTEMS:

Sensing mechanism & principle, membrane transducer materials, chem.-lab-on-a-chip (CLOC) chemoresistors, chemocapacitors, chemotransistors, electronic nose (Enose), mass sensitive chemosensors, fluroscence detection, calorimetric spectroscopy.

Text Books:

1. MEMS, NitaigourPremchandMahalik, TMH Publishing co.

References:

1. Foundation of MEMS, Chang Liu, Prentice Hall Ltd.
2. Bio-MEMS (Micro systems), Gerald Urban, Springer.
3. MEMS and Micro Systems: Design and Manufacture, Tai-Ran Hsu, TMH Publishers.

B.TECH VII SEMESTER	**OEC**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

20ME7T13 **SOLAR ENERGY SYSTEMS (OPEN ELECTIVE -IV)**

Pre-requisite: Thermodynamics, Environmental Sciences

Course Objective: To impart knowledge on non-conventional sources of energy and techniques used in exploiting solar, wind, tidal and geothermal sources of energy and bio-fuels.

Course Outcomes: At the end of the course, student will be able to

CO1: Significance of renewable energy and describe the principles of solar radiation. Analyze various solar collectors.

CO2: Know the various storage methods and application of solar energy.

CO3: Understand the concept of converting wind energy into electrical energy using both horizontal and vertical axis wind machines.

CO4: Know biomass disasters, functional operation of geothermal systems. Generalize the operation of ocean, tidal and wave energy systems.

CO5: understand the operating principle of direct energy conversion systems .and to recognize the need and ability to engage in lifelong learning for further developments in this field.

SYLLABUS

UNIT-I: FUNDAMENTALS OF SOLAR RADIATION:

Energy conservation principle, Energy scenario (world and India), Solar angles, Solar time, Solar radiation: Outside earth's atmosphere, Earth surface, measurements of solar radiation: Pyrometer, Sunshine recorder, Pyro heliometer.

UNIT-II: ENERGY STORAGE SYSTEMS:

Energy –Environment-Economy Necessity of energy storage, Specifications of energy storage devices, energy storage Methods-Mechanical Energy Storage-Thermal Energy Storage-Sensible Heat Storage-Solid media storage.

UNIT-III: SOLAR COLLECTORS:

Classifications, comparison of concentrating and non-concentrating types – Liquid flat plate collectors, Evacuated tube collectors. Modified flat plate collectors: Compound parabolic concentrator(CPC), Cylindrical parabolic Concentrator, Fixed mirror solar concentrator, Paraboloid Dish Collector.

UNIT-IV: SOLAR THERMAL DEVICES:

Solar water heater, Solar space heating and cooling systems, Solar industrial heating systems, Solar refrigeration and air conditioning systems, Solar Desalination – Solar cooker: domestic, community – Solar pond – Solar drying.

UNIT-V: SOLAR PHOTOVOLTAIC SYSTEMS:

Solar cell fundamentals, Energy band model of semiconductors, Working Principle of photovoltaic cell, solar cell classification, solar cell technologies, solar PV systems-classification. Solar cell –module-array Construction.

Text Books:

1. Goswami D.Y., Kreider, J. F. and Francis., "Principles of Solar Engineering', Taylor and Francis, 2000.
2. Chetan Singh Solanki, "Solar Photovoltatics – Fundamentals, Technologies and Applications", PHI Learning Private limited, 2011.
3. Sukhatme S.P., Nayak.J.P, 'Solar Energy – Principle of Thermal Storage and collection", Tata McGraw Hill, 2008.
4. Solar Energy International, "Photovoltaic – Design and Installation Manual" – New Society Publishers, 2006.
5. Roger Messenger and Jerry Vnetre, "Photovoltaic Systems Engineering", CRC Press, 2010.

Reference Books:

1. B.H.Khan "Non – conventional Energy Resources" Tata McGraw Hill education Pvt. Ltd.
2. G.D. Rai, "Non-Conventional Energy Sources", Dhanpat Rai and Sons .

B. TECH VII SEMESTER

	L	T	P	C
OEC	3	0	0	3

INTRODUCTION TO EMBEDDED SYSTEMS

20EC7T13 (OPEN ELECTIVE –IV)

Course Objectives:

At the end of the course, student will be able to

1. The basic concepts of an embedded system are introduced.
2. The various elements of embedded hardware and their design principles are explained
3. Internals of Real-Time operating system and the fundamentals of RTOS based embedded firmware design is discussed
4. Embedded system implementation and testing tools are introduced and discussed.
   Technology capabilities and limitations of the hardware, software components
5. Design Methodologies

Course Outcomes:

At the end of the course, student will be able to

CO1: Understand the basic concepts of an embedded system and able to know an embedded system design Approach to perform a specific function.

CO2: The various embedded firmware design approaches on embedded environment.

CO3: Identify the unique characteristics of real-time systems

CO4: Design, implement and test an embedded system.

CO5: Define the unique design problems and challenges of real-time systems

SYLLABUS

UNIT-I: Introduction to Embedded systems

What is an embedded system Vs. General Computing system, history, classification, major application areas, and purpose of embedded systems, Core of embedded system, Characteristics and Quality Attributes of Embedded systems

UNIT-II: Embedded Hardware Design

Analog and digital electronic components, I/O types and examples, Serial communication devices, Parallel device ports, Wireless devices, Timer and counting devices, Watchdog timer, Real-time clock, Application specific and Domain specific embedded systems-Examples

UNIT-III:

Embedded Firmware design approaches, Embedded Firmware Development languages, ISR concept, Interrupt sources, Interrupt servicing mechanism, Multiple interrupts, DMA,Device driver programming, Concepts of C versus Embedded C and Compiler versus Cross-compiler.

UNIT-IV:

Factors to be considered in selecting a controller, 8051 Architecture, RTOS and Scheduling Operating basics, types, RTOS, Tasks, Process and Threads, Multiprocessing and Multitasking, Types of multitasking, Non preemptive Scheduling, Preemptive Scheduling.

UNIT-V: Design and Development

Embedded system development Environment – IDE, Simulators, Emulators, Debuggers, Embedded Product Development life cycle (EDLC), Trends in embedded Industry

Text books:

1. Introduction to embedded systems Shibu. K.V, TMH, 2009.
2. Embedded Systems, Rajkamal, TMH, 2009.

References:

1. Ayala &Gadre: The 8051 Microcontroller & Embedded Systems using Assembly and C, CENGAGE
2. Embedded Systems: A Contemporary Design Tool Paperback by James K. Peckol

B. Tech VII Semester

OEC	L	T	P	C
	3	0	0	3

20EC7T14 INTERNET OF THINGS (OPEN ELECTIVE –IV)

COURSE OBJECTIVES:
The main objectives of this course are given below:

At the end of the course, student will be able to

1. To introduce the terminology, technology and its applications
2. To introduce the concept of M2M (machine to machine) with necessary protocols
3. To introduce the Python Scripting Language which is used in many IoT devices
4. To introduce the Raspberry PI platform, that is widely used in IoT applications
5. To introduce the implementation of web-based services on IoT devices

COURSE OUTCOMES:
At the end of this course the student will able to:

At the end of the course, student will be able to

CO1: Understanding of IoT value chain structure (device, data cloud), application areas and technologies involved.

CO2: Understand IoT sensors and technological challenges faced by IoT devices, with a focus on Bwireless, energy, power, and sensing modules

CO3: Market forecast for IoT devices with a focus on sensors

CO4: Explore and learn about Internet of Things with the help of preparing projects designed for Raspberry Pi

SYLLABUS

UNIT-I: Introduction to Internet of Things

Definition and Characteristics of IoT, Sensors, Actuators,
Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry.

UNIT-II: IoT and M2M

Software defined networks, network function virtualization, difference between SDN and NFV for IoT, Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER

UNIT-III: IoT Physical Devices and Endpoints

Introduction to Arduino and Raspberry Pi- Installation,
Interfaces (serial, SPI, I2C), Programming – Python program with Raspberry PI with focus on interfacing external gadgets, controlling output, reading input from pins.

UNIT-IV: Controlling Hardware-

Connecting LED, Buzzer, Switching High Power devices with transistors, Controlling AC Power devices with Relays, Controlling servo motor, speed control of DC Motor, unipolar and bipolar Stepper motors

Sensors- Light sensor, temperature sensor with thermistor, voltage sensor, ADC and DAC, Temperature and Humidity Sensor DHT11, Motion Detection Sensors, Wireless Bluetooth Sensors, Level Sensors, USB Sensors, Embedded Sensors, Distance Measurement with ultrasound sensor

UNIT-V: IoT Physical Servers and Cloud Offerings–

Introduction to Cloud Storage models and
communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API

TEXT BOOKS:

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759

REFERENCE BOOKS:

1. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015 3. Editors Ovidiu Vermesan
2. N. Ida, Sensors, Actuators and Their Interfaces, SciTech Publishers, 2014.

		L	T	P	C
B. TECH VII SEMESTER	**OEC**	**3**	**0**	**0**	**3**

20EC7T15 ANALOG AND DIGITAL IC APPLICATIONS (OPEN ELECTIVE –IV)

Course Objectives:

At the end of the course, student will be able to

1. To understand the analysis & design of different types of active filters using op-amps
2. To learn the internal structure, operation and applications of different analog ICs
3. In this course, students can study Integrated circuits for all digital operational designs like adder, subtractor, multipliers, multiplexers, registers, counters, flip flops, encoders, decoders and memory elements like RAM and ROM.
4. Design and to develop the internal circuits for different digital operations and simulate them using hardware languages using integrated circuits.
5. Understand the concepts of Latches and Flip-Flops and Design of Counters using Digital ICs, modeling of sequential logic integrated circuits using VHDL

Course Outcomes:

At the end of the course, student will be able to

CO1: Design circuits using operational Amplifier for various applications

CO2: Understand the concept of A/D & D/A Converters

CO3: Analyze and design amplifiers and active filters using Op-amp.

CO4: Understand the concepts of Combinational logic circuits in digital system

CO5: Understand the concepts of sequential logic circuits in digital system

SYLLABUS

UNIT-I: OPERATIONAL AMPLIFIER

The Ideal Operational Amplifier; Operational Amplifier Internal Circuit. Op-Amp parameters & Measurement, DC Characteristics, input & output off set voltages & currents, slew rate, CMRR, PSRR, drift, AC Characteristics and Compensation Techniques.

UNIT-II: OPERATIONAL AMPLIFIER APPLICATIONS

Basic Op-Amp Applications; Inverting and Non-inverting amplifier,. Integrator and differentiator, Difference amplifier, Instrumentation Amplifier; AC Amplifier; V to I and I to V Converters. Op-Amp Circuits using Diodes, Sample and Hold Circuit, Comparator, Regenerative Comparator (Schmitt Trigger).

D-A AND A-D CONVERTERS Introduction; Series Op-Amp Regulator; Basic DAC Techniques Weighted Resistor DAC,R-2R DAC ; AD Converters, Flash ADC and Successive approximation Converter.

UNIT-III: FILTERS USING OP-AMP & 555 TIMERS

Analysis of Butterworth active filters – 1st order, 2nd order LPF, HPF filters. Band pass, Band reject and all pass filters.

Description of Functional Diagram of 555 Timer; Monostable Operation; Astable Operation and its Applications and PLL, Applications PLL. VCO and its applications.

UNIT-IV: Digital Design Using HDL

Design flow, program structure, VHDL requirements, Levels of Abstraction, Elements of VHDL, Concurrent and Sequential Statements, Packages, Libraries and Bindings, Objects and Classes, Subprograms, Comparison of VHDL and Verilog HDL.

UNIT-V: Combinational And sequential Logic Design

Combinational Logic Design: Adders & Sub tractors, ALU, Decoders, encoders, three state devices, multiplexers and demultiplexers, Code Converters, parity circuits, comparators, multipliers, Barrel Shifter, Simple Floating-Point Encoder, Dual Priority Encoder.

Sequential Logic Design: Flip-Flops, Counters, Ring Counter, Johnson Counter, Modulus N Synchronous Counters, Shift Registers, Modes of Operation of Shift Registers, Universal Shift Register. Linear feedback shift register and applications.

TEXT BOOKS:

1. Pulse, Digital and Switching Waveforms - J. Millman and H. Taub, McGrawHill,4th Edition,2005
2. Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition,2003.

REFERENCES:

1. "Fundamentals of Digital logic design with VHDL". Stephen Brown & Zvonko Vranesic, Tata McGraw Hill, 2nd edition.2004
2. Designing with TTL Integrated Circuits: Robert L. / John R. Morris & Miller.

B. TECH VII SEMESTER **OEC**

L	T	P	C
3	0	0	3

20CS7T13 DATA ANALYTICS (OPEN ELECTIVE –IV)

Course Objectives:

1. To understand Data Analytics lifecycle and Business Challenges.
2. To understand Analytical Techniques
3. To understand various tools and technologies to handle big data

Course Outcomes:

CO1: Understand big data and data analytics life cycle.
CO2: Explore various supervised learning methods.
CO3: Explore various unsupervised learning methods.
CO4: Understand and apply ARIMA model on time series data.
CO5: Learn various technology and tools in big data analytics.

SYLLABUS

UNIT-I

Introduction to Big Data Analytics: Big Data Overview, State of the Practice in Analytics, Key Roles for the new big data Ecosystem, Examples of Big Data Analytics. Data Analytics Life Cycle: Data Analytics life cycle Overview, Discovery, Data Preparation, Model,Planning, Model Building, Communicate Results, Operationalize, Case Study.

UNIT-II

Supervised Learning: Decision Trees – Overview of Decision Trees, The General Algorithm, Decision Tree Algorithms, Evaluating a Decision Tree. Naive Bayes: Baye's Theorem, Naïve Baye's Classifier, Diagnostics of Classifiers.
Regression –Linear Regression, Logistic Regression.

UNIT-III

Unsupervised Learning: Association Rule Mining–Overview, Apriori Algorithm, Evaluation of Candidate Rules, Applications of Association Rules. Cluster Analysis – Overview of Clustering, k-means

UNIT IV

Time Series Analysis: Overview of Time Series Analysis, ARIMA Model
Text Analysis: Text Analysis Steps, Example, Collecting Raw Data, Representing Text, TFIDF, Categorizing Documents by Topics, Determining Sentiments, Gaining Insights.

UNIT-V

Technology and Tools: MapReduce and Hadoop- Analytics for Unstructured Data, The Hadoop Ecosystem In-DataBase Analytics: SQL Essentials, In-Database Text Analysis, Advanced SQL.

TEXT BOOKS:

1. David Dietrich, Barry Hiller, "Data Science and Big Data Analytics", EMC education services, Wiley publications, 2012.

REFERENCE BOOKS:

1. Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with
advanced analytics, John Wiley & sons, 2012.

2. Glenn J. Myatt, Making Sense of Data, John Wiley & Sons, 2007 Pete Warden, Big Data Glossary, O"
Reilly, 2011.

3. Jiawei Han, Micheline Kamber "Data Mining Concepts and Techniques", Second Edition, Elsevier, Reprinted 2008.

B. Tech VII Semester **OEC**

L	T	P	C
3	0	0	3

20CS7T14 BLOCK CHAIN TECHNOLOGY (OPEN ELECTIVE –IV)

Course Objectives

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

- Understand how major block chain systems work.
- To securely interact with them.
- Design, build, and deploy smart contracts and distributed applications.
- Integrate ideas from block chain technology into their own projects.

Course Outcomes

CO 1: Understand the design principles of Bitcoin and Ethereum.

CO 2: Understand and apply Nakamoto consensus.

CO 3: Analyze the differences between proof-of-work and proof-of-stake consensus.

CO 4: Understand cryptocurrency

CO 5: Understand cryptocurrency Regulations

SYLLABUS

Unit I: Basics:

Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. • Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.

Unit II: Blockchain:

Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.

Unit III: Distributed Consensus:

Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.

Unit IV: Cryptocurrency: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin

Unit V: Cryptocurrency Regulation:

Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy.

Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.

Text Book

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).

Reference Books

1. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies
2. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
3. DR. Gavin Wood, “ETHEREUM: A Secure Decentralized Transaction Ledger,”Yellow paper.2014.
4. Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts

B. TECH VII SEMESTER **OEC**

L	T	P	C
3	0	0	3

20CS7T15 SOFTWARE PROJECT MANAGEMENT (OPEN ELECTIVE –IV)

Course Objectives:

At the end of the course, the student shall be able to:

- To describe and determine the purpose and importance of project management from the perspectives of planning, tracking and completion of project
- To compare and differentiate organization structures and project structures
- To implement a project to manage project schedule, expenses and resources with the application of suitable project management tools

Course Outcomes:

Upon the completion of the course students will be able to:-

CO1: Apply the process to be followed in the software development life-cycle models.

CO2: Apply the concepts of project management & planning.

CO3: Implement the project plans through managing people, communications and change

CO4: Conduct activities necessary to successfully complete and close the Software projects

CO5: Implement communication, modeling, and construction & deployment practices in software development.

SYLLABUS

UNIT I:

Conventional Software Management: The waterfall model, conventional software Management performance.

Evolution of Software Economics: Software Economics, pragmatic software cost estimation.

Improving Software Economics: Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections.

UNIT II:

The Old Way and The New: The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.

Life Cycle Phases: Engineering and production stages, inception, Elaboration, construction, transition phases.

Artifacts of The Process: The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts.

UNIT III:

Model Based Software Architectures: A Management perspective and technical perspective.

Work Flows of the Process: Software process workflows, Iteration workflows.

Checkpoints of the Process: Major mile stones, Minor Milestones, Periodic status assessments.

UNIT IV:

Iterative Process Planning: Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning.

Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, evolution of Organizations.

UNIT V:

Process Automation: Automation Building blocks, The Project Environment.

Project Control and Process Instrumentation: The seven core Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics automation.

Project Estimation and Management: COCOMO model, Critical Path Analysis, PERT technique, Monte Carlo approach (Text book 2)

TEXT BOOKS:

1. Software Project Management, Walker Royce, Pearson Education, 2005.
2. Software Project Management, Bob Hughes, 4th edition, Mike Cotterell, TMH.

REFERENCES:

1. Software Project Management, Joel Henry, Pearson Education.
2. Software Project Management in practice, Pankaj Jalote, Pearson Education, 2005.
3. Effective Software Project Management, Robert K.Wysocki, Wiley,2006.

B. TECH VII SEMESTER	OEC	L	T	P	C
		3	0	0	3

20IT7T13 CLOUD COMPUTING (OPEN ELECTIVE –IV)

Course Objectives:

- Explain the technology and principles involved in building a cloud environment
- To implement Virtualization
- Understand various types of cloud and its services
- Contrast various programming models used in cloud computing

Course Outcomes:

CO1: Describe the principles of parallel and distributed computing and evaluation of cloud computing from existing technologies

CO2: Illustrate Virtualization for Data-Center Automation.

CO3: Explain and characterize different cloud deployment models and service models

CO4: Program data intensive parallel applications in cloud.

CO5: Understand commercial cloud computing technologies such as AWS, AZURE and AppEngine

SYLLABUS

UNIT-I: Introduction:

Cloud Computing at a Glance, The Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead, Historical Developments, Distributed Systems, Virtualization, Web 2.0, Service-Oriented Computing, Utility-Oriented Computing, Building Cloud Computing Environments, Application Development, Infrastructure and System Development, Computing Platforms and Technologies, Amazon Web Services (AWS), Google AppEngine, Microsoft Azure, Hadoop, Force.com and Salesforce.com, Microsoft Aneka.

UNIT-II: Virtualization:

Virtualization, Introduction, Characteristics of Virtualized, Environments Taxonomy of Virtualization Techniques, Execution Virtualization, Other Types of Virtualization, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples: Xen, VMware, Microsoft Hyper – V.

UNIT-III: Cloud Computing Architecture:

Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Definition Cloud Interoperability and Standards Scalability and Fault Tolerance Security, Trust, and Privacy.

UNIT-IV: Data Intensive Computing: Map-Reduce Programming:

What is Data-Intensive Computing? Characteristics, Challenges, Historical Perspective. Technologies for Data Intensive Computing: Storage Systems, Programming Platforms.

Cloud Applications: Scientific Applications, Healthcare: ECG Analysis in the Cloud, Social Networking, Media Applications, Multiplayer Online Gaming.

UNIT-V: Cloud Platform in Industry and Cloud Applications:

Cloud Platforms in Industry: Amazon Web Services, Compute Services, Storage Services, Communication Services, Additional Services, Google App Engine, Architecture and Core Concepts, Application Life-Cycle, Cost Model, Observations, Microsoft Azure, Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance.

TEXTBOOKS:

1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi Mastering Cloud Computing McGraw Hill Education.

REFERENCES:

1. Essentials of cloud Computing: K. Chandrasekhran, CRC press, 2014
2. Buyya, Rajkumar, James Broberg, and Andrzej M. Goscinski, eds. Cloud computing: Principles and paradigms. Vol. 87. John Wiley & Sons, 2010.
3. Hwang, Kai, Jack Dongarra, and Geoffrey C. Fox. Distributed and cloud computing: from parallel processing to the internet of things. Morgan Kaufmann, 2013.

B. TECH VII SEMESTER **OEC**

L	T	P	C
3	0	0	3

20IT7T14 BUSINESS INTELLIGENCE (OPEN ELECTIVE –IV)

Course Objectives:

- Introduce the concepts and components of Business Intelligence (BI)
- Evaluate the technologies that make up BI (data warehousing, OLAP)
- Identify the technological architecture that makes up BI systems

Course Outcomes:

CO1: Understand concepts and components of Business Intelligence.

CO2: Explain the complete life cycle of BI development.

CO3: Illustrate technology and processes associated with Business Intelligence framework.

CO4: Demonstrate a business scenario, identify the metrics, indicators and make recommendations to achieve the business goal.

CO5: Ability to design expert system using AI tools.

SYLLABUS

UNIT-I:

Business intelligence: Effective and timely decisions, Data, information and knowledge, The role of mathematical models, Business intelligence architectures, Ethics and business intelligence

Decision support systems: Definition of system, Representation of the decision-making process, Evolution of information systems, Definition of decision support system, Development of a decision support system

UNIT-II:

Role of OLAP tools in the BI architecture, OLAP performance directly on operational databases, A peek into the OLAP operations on multidimensional data, Leveraging ERP data using analytics. **Getting started with business intelligence:** Using analytical information for decision support, Information sources before dawn of BI, Business intelligence (BI) defined, Evolution of BI and role of DSS, EIS, MIS and digital dashboards, Need for BI at virtually all levels, BI for past, present and future, The BI value chain, Introduction to business analytics.

UNIT-III:

BI Definitions and concepts: BI Component framework, Need of BI, BI Users, Business Intelligence applications, BI Roles and responsibilities, Best practices in BI/DW, The complete BI professional, Popular BI tools.

Basis of data integration: Need for data warehouse, Definition of data warehouse, data mart,OSS, Raiph Kimball's approach vs. W.H.Inmon's approach, Goals of a data warehouse, constituents of a data warehouse, Extract, transform, load, data Integration, Data integration technologies, Data quality, Data profiling.

UNIT-IV:

Business Intelligence Applications:

Marketing models: Relational marketing, Sales force management,

Logistic and production models: Supply chain optimization, Optimization models for logistics planning, Revenue management systems.

Data envelopment analysis: Efficiency measures, Efficient frontier, The CCR model, Identification of good operating practices

UNIT-V:

Knowledge Management: Introduction to Knowledge Management, Organizational Learning and Transformation, Knowledge Management Activities, Approaches to Knowledge Management, Information Technology (IT) In Knowledge Management, Knowledge Management Systems Implementation, Roles of People in Knowledge Management

Artificial Intelligence and Expert Systems:

Concepts and Definitions of Artificial Intelligence, Artificial Intelligence Versus Natural Intelligence, Basic Concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, Development of Expert Systems

TEXT BOOKS:

1. Fundamental of Business Intelligence" Grossmann W, Rinderle-Ma Springer, 2015
2. "Fundamentals of Business Analytics" – By R N Prasad and SeemaAcharya, Publishers: Wiley India.

REFERENCE BOOKS:

1. Larissa T Moss and Shaku Atre – Business Intelligence Roadmap : TheCompleteProject Lifecycle for Decision Support Applications, Addison WesleyInformation Technology
2. David Loshin - Business Intelligence: The Savvy Manager's Guide, Publisher: Morgan Kaufmann.

B. Tech VII Semester **OEC**

L	T	P	C
3	0	0	3

20HS7T02 POLYMER CHEMISTRY (OPEN ELECTIVE –IV)

PREREQUISITES: Chemistry I and Chemistry II of AICTE syllabus

Course Outcomes

CO1: After studying this course, the learners are expected to: Relate polymer properties to their structure and conformation

CO2: Analyse different mechanisms of polymer formation and use this information in the synthesis of different polymers.

CO3: Distinguish between enthalpic and entropic contributions to polymerisation/crystallization.

CO4: Distinguish between absolute and relative methods for molecular weight determination.

CO5: Determine the flow properties of polymer melts and solutions.

CO6: Interpret experimental data and determine parameters such as polymerization ratesand copolymer composition.

CO7: Estimate the solubility of a given polymer in various solvents and blends.

CO8: Evaluate the effect of factors such as polymer structure, molecular weight, branching and diluents on crystallinity.

CO9: Assess the effect of synthetic polymers on the environment.

SYLLABUS

Unit 1. Definitions, origin, nomenclature, classification and types of macromolecules; molecular weight (MW) and its distribution; Determination of molecular weight – methods for measuring number average, weight average, viscosity average MW; gel permeation chromatography; spectroscopic techniques to determine chemical composition and molecular microstructure, thermal transitions; melting temperature and glass transition temperature. Colligative properties, osmotic pressure, light scattering, refractive index, viscosity, small angle X-ray scattering (6)

Unit 2tep-Growth Polymerization: Reactivity of functional groups; kinetics; molecular weight in open and closed system cyclization vs. linear polymerization, cross-linking and gel point; process condition; step-copolymerization, examples of step polymers (3)

Unit 3. Free radical Polymerization: Nature of chain polymerization and its comparison with step polymerization; radical vs. ionic polymerizations; structural arrangements of monomer units; kinetics of chain polymerization; molecular weight and its distribution; chaintransfer, inhibition, retardation, auto-acceleration; energetic characteristics; techniques of radical polymerization – bulk, solution, emulsion, suspension polymerization; examples of polymers made by radical chain polymerization (4)**.** Ionic Polymerization: Propagation and termination of cationic polymerization, anionic and ring opening polymerization, active polycarbanions (2)

Unit 4. Copolymerization: types of copolymers, copolymer compositions, reactivity ratio; radical and ionic co-polymerizations; Block and Graft copolymer synthesis, examples (2). Thermodynamics of polymer solutions; Flory-Huggins theory, theta conditions; solubility parameters; fractionation of macromolecules, osmotic pressure, lower criticalsolution temperature (3)

Unit 5. Naturally occurring polymers, biodegradability, biosynthesis, polymers frombio/renewable resources (2)

Polymers for Electronics: Polymer resists for integrated circuit fabrication, lithography and photolithography, Electron beam, X-ray and ion sensitive resists, Conducting polymers, types, properties and applications, electroluminescence, molecular basis of electrical conductivity, Photonic applications and non-linear optics, optical information storage (3)

Text Books:

1. NPTEL Polymer Chemistry Course, D. Dhara, IIT Kharagpur
2. Polymer chemistry and Physics of Modern Materials, 2nd edn, J. M. G. Cowie, Stanley Thornes, UK, 1998
3. Contemporary Polymer Chemistry, 3rd edn. H. R. Allcock, F. W. Lampe and J. E.Mark, Pearson
4. Polymers: Chemistry and Physics of Modern Materials, J.M.G. Cowie, CRC Press
5. Introduction to Physical Polymer Science, L. H. Sperling, Wiley
6. Introduction to Soft matter, I. W. Hamley, John Wiley and Sons, 2007
7. Polymer Chemistry, 2nd edn, P. C. Hiemenz and T. P. Lodge, CRC Press (2007)

B. TECH VII SEMESTER **OEC**

L	T	P	C
3	0	0	3

20MB7T03 TOTAL ENGINEERING QUALITY MANAGEMENT (OPEN ELECTIVE –IV)

Course Objective

To understand the Engineering and Management aspects of Planning, Designing, Controlling and Improving Quality in Manufactured products.

Course Outcome

1. To understand the fundamentals of quality
2. To understand the role of TQM tools and techniques in elimination of wastages and reduction of defects
3. To develop quality as a passion and habit
4. To Facilitate the understanding of Quality Management principles and process.
5. The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

SYLLABUS

UNIT I

Quality Gurus And TQM Kitemarks: Definition, Need & Evolution of TQM – Contributions of Quality Guru's – Edward Deming – Joseph Juran – Philip Crosby – Genichi Taguchi – Walter Shewart – Criteria for Deming's Prize.

UNIT II

Product Design & Analysis : Dimensions of product and service quality, Basic Design Concepts and TQM – Design Assurance – Design Validation –Failure Mode Effect Analysis – Fault Tree Analysis – Design for Robustness – Value Analysis.

UNIT III

Process Improvement & Modern Production Management Tools

Control Charts – Process Capability, -Bench Marking, Six Sigma Approach – Total Productive Maintenance – Just-In-Time – Lean Manufacturing Paradigms.

UNIT IV

Quality Improvement Tools & Continuous Improvement

Traditional Q-7Tools, New Q-7 Tools, Quality Function Deployment (QFD), Kaizen 5S, Poka-Yoke, Failure Mode and Effects Analysis(FMEA) – Stages, Types, Taguchi Quality Loss Function(QFD) – Total Productive Maintenance (TPM).

UNIT V

Quality Management Systems ISO 9000, ISO 9001: 2008, QS 9000, ISO 14000, TS16949:2002 and EMS14001 certifications of quality systems- Elements, Documentation, Quality Auditing — Concepts, Requirements and Benefits – TQM Implementation in manufacturing and service sectors.

TEXT BOOKS

1. Total Engineering Quality Management, Sunil Sharma, 1st Edition, MacMillan India Limited.
2. Total Quality Management, Poornima M. Charantimath, 2nd Edition, Pearson Education.
3. Dale H. Besterfiled, et at., "Total quality Management", Pearson Education Asia, Third Edition, Indian Reprint 2006.

REFERENCES

1. "Quality and Performance Excellence", James R Evans, Edition, 7th Edition, Cengage Learning.
2. "Quality Management", Howard S Gitlow, Alan J Oppenheim, Rosa Oppenheim, David M Levine,3rd Edition , Tata McGraw Hill Limited.
3. "Fundamentals of Quality Control & Improvement", Amitava Mitra, 3rd Edition, Wiley Publications, 2012.
4. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.

B. TECH VII SEMESTER	OEC	L	T	P	C
		3	0	0	3

20MB7T04 STRESS MANAGEMENT (OPEN ELECTIVE –IV)

OBJECTIVES

This course examines different sources from where individuals experience a stress response. Through diligent individual and group study, students will be able to learn to apply stress management principles in order to achieve high levels of performance and understand the role of relationships to the management of stress and health.

Course Outcomes

1. Understand the physiological systems that are affected by stressors and the long-term effects and illnesses that can result from stressors.
2. Understand the specific applications of stress as it relates to the workplace and different target groups.
3. Create effective stress management plans for individual clients and for workplace environments. Enhancing significance of training and development, performance evaluation

SYLLABUS

UNIT I: UNDERSTANDING STRESS

Meaning – Symptoms – Work Related Stress – Individual Stress – Reducing Stress - Sources of stress –Consequence of stress-Burnout-symptoms of Burnout- Stress vs Burnout-Model of stress-strategies for coping stress (individual and organizational strategies)

UNIT II: TIME MANAGEMENT

Techniques – Importance of Planning the day –developing concentration – Prioritizing, Beginning at the start – Techniques for conquering procrastination – Sensible delegation – Taking the right breaks – Learning to say "No."

UNIT III:CAREER PLATEAU

Career plateau – Identifying Career plateaus – Structural and Content - Plateauing – Making a fresh start – Importance of Sabbaticals – Counseling out – Executive leasing – Sustaining a marketable Career.

UNIT IV:CRISIS MANAGEMENT

Implications – People issues – Structure issues – Environmental issues –Learning to keep calm - Preventing interruptions – Controlling crisis – Pushing new ideas – Empowerment – Work place Humour, Developing a sense of Humour – Learning to laugh – Role of group cohesion and team spirit.

UNIT V: SELF DEVELOPMENT

Improving personality – Leading with Integrity – Enhancing Creativity – Effective Decision Making – Sensible Communication – The Listening Game – Managing Self – Mediation for peace – Yoga for Life

TEXT BOOKS

1. Bhatia R.L., The Executive Track: An Action Plan for Self Development Wheeler Publishing, New Delhi

2. Charavathy. S.K, “Human Values for Manager”, McGraw Hill/Henely Management Series

REFERENCES

1. Jeffr Davison, Managing Stress, Prentice Hall of India, New Delhi

2. Jerrold S Greenberg, Comprehensive Stress Management, Jain Books, 2009

B. TECH VII SEMESTER	OEC	L	T	P	C
		3	0	0	3

20AD7T11 NATURAL LANGUAGE PROCESSING (OPEN ELECTIVE –IV)

Pre-requisite: Nil

Course Educational Objective: The Objective of the course is to make learn the basic elements of C programming, control structures, derived data types, Modular programming, user defined structures, basics of files and its I/O operations.

Course Outcomes: At the end of this course, the student will be able to

CO1: Familiar with the basic components of NLP.

CO2: Applying N-gram models to predict a sequence of text.

CO3: Build a basic language understanding system using preliminary concepts of NLTK library.

CO4: Exposure on advanced techniques for understanding patterns in text

CO5: Understand the semantics of linguistic components in a natural dialogue

Syllabus

UNIT – I:

Introduction

Knowledge in Speech and Language Processing; Ambiguity; Models and Algorithms; Language, Thought and Understanding; History Regular Expressions Regular Expression; Words; Corpora; Text Normalization; Minimum Edit Distance

UNIT – II

N-gram Language Models

N-Grams; Evaluating Language Models, Generalization and Zeros, Smoothing: Laplace Smoothing; Add-k Smoothing; Backoff and Interpolation; Kneser-Ney Smoothing

UNIT – III

Natural language processing tools in Python (NLTK Package)

Part-I: Introduction to NLTK; Tokenizing; Filtering Stop words; Stemming; Tagging parts of speech; Lemmatizing; Chunking; Chinking

Part-II: Using Named Entity Recognition (NER); Getting Text to Analyze; Using a Concordance; Making a Dispersion Plot;

UNIT – IV

Information Extraction:

Relation Extraction Algorithms; Using Patterns to extract relations; Relation extraction via supervised learning; Semi supervised relation extraction via bootstrapping; Distant Supervision for Relation Extraction; Evaluation of Relation Extraction; Extracting Times; Extracting Events and their Times; Template Filling

UNIT – V

Word Senses and WordNet

• Defining Word Senses; How many senses do words have?

• Relations between senses

WordNet: Sense relations in WordNet; Word Sense Disambiguation; Alternate WSD algorithms and Tasks

Text Books:

1. Daniel Jurafsky, James H. Martin ,"Speech and Language Processing" , Third Edition, PHI, 2020.
2. https://realpython.com/nltk-nlp-python/#getting-text-to-analyze

Reference Books:

1. Natural Language Processing with Python: Analysing Text with the Natural Language Toolkit, Steven Bird, Ewan Klein, 2011
2. Applied Text Analysis with Python: Enabling Language-Aware Data Products with Machine Learning, Benjamin Bengfort, Rebecca Bilbro, 2018
3. Speech and Language Processing, 2nd Edition, Daniel Jurafsky, James H. Martin, 2009

B. TECH VII SEMESTER **OEC**

L	T	P	C
3	0	0	3

20AM7T11 DEEP LEARNING (OPEN ELECTIVE –IV)

Pre-requisite: Linear Algebra, Calculus, Python Programming

Course Objective: *This* ***course*** explains understanding basics of deep neural networks, CNN architectures of deep neural networks, concepts of Artificial Neural Networks, basics of Data science in Deep learning, applications of deep learning in AI and Data Science

Course Outcomes: At the end of the course, student will be able to

CO1: Explain the basics in deep neural networks

CO2: Apply Convolution Neural Network for image processing

CO3: Explain the basics of Artificial Intelligence using deep learning

CO4: Apply deep learning algorithms for data science

CO5: Apply deep learning algorithms for variety applications

SYLLABUS

Unit-1:

DEEP NETWORKS BASICS

Linear Algebra: Scalars -- Vectors -- Matrices and tensors; Probability Distributions -- Gradient-based Optimization – Machine Learning Basics: Capacity – Over fitting and under fitting – Hyper parameters and validation sets -- Estimators -- Bias and variance -- Stochastic gradient descent -- Challenges motivating deep learning; Deep Networks: Deep feed forward networks; Regularization -- Optimization .

Unit-2:

CONVOLUTIONAL NEURAL NETWORKS

Convolution Operation -- Sparse Interactions -- Parameter Sharing -- Equivariance -- Pooling -- Convolution Variants: Strided -- Tiled -- Transposed and dilated convolutions; CNN Learning: Nonlinearity Functions -- Loss Functions -- Regularization -- Optimizers -- Gradient Computation.

Unit-3:

DEEP LEARNING ALGORITHMS FOR AI

Artificial Neural Networks – Linear Associative Networks – Perceptrons -The Back propagation Algorithm - Hopfield Nets - Boltzmann Machines - Deep RBMs - Variational Auto encoders - Deep Backprop Networks- Auto encoders

Unit-4:

DATA SCIENCE AND DEEP LEARNING

Data science fundamentals and responsibilities of a data scientist - life cycle of data science – Data science tools - Data modeling, and featurization - How to work with data variables and data science tools - How to visualize the data - How to work with machine learning algorithms and Artificial Neural Networks

Unit-5:

APPLICATIONS OF DEEP LEARNING

Detection in chest X-ray images -object detection and classification -RGB and depth image fusion -NLP tasks - dimensionality estimation - time series forecasting - building electric power grid for controllable energy resources - guiding charities in maximizing donations and robotic control in industrial environments.

Text Books:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, ``Deep Learning'', MIT Press, 2016

2. Stone, James. (2019). Artificial Intelligence Engines: A Tutorial Introduction to the Mathematics of Deep Learning, Sebtel Press, United States, 2019

3. Vance, William, Data Science: A Comprehensive Beginners Guide to Learn the Realms of Data Science (Hardcover - 2020), Joiningthedotstv Limited

4. Wani, M.A., Raj, B., Luo, F., Dou, D. (Eds.), Deep Learning Applications, Volume 3,Springer Publications 2022

5. Charu C. Aggarwal, ``Neural Networks and Deep Learning: A Textbook'', Springer International Publishing, 2018.

B.TECH HONORS		**HN**	**L**	**T**	**P**	**C**
			4	**0**	**0**	**4**
20MEHN01	**ADVANCED MECHANICS OF SOLIDS (Honors Engineering Course)**					

Pre-requisite: Mechanics of Solid

Course Objective: The students will acquire the knowledge:

1. To understand theories of stress and strain and Stress –strain temperature relations
2. To determine failure criteria and elastic deflections for statically indeterminate members and structures
3. To study the effect of unsymmetrical bending and curved beam theory
4. To determine the effect of Torsion with Linear elastic solution and Prandtl elastic membrane (Soap Film) Analogy
5. To solve the problems for determining contact stresses and deflections of bodies with point contact.

Course Outcomes: At the end of the course, student will be able to

CO1: Interpret failure criteria and elastic deflections for statically indeterminate members and structures.

CO2: Summarize the effect of unsymmetrical bending

CO3: Understand the effect of curved beam theory

CO4: Find the effect of Torsion with Linear elastic solution and Prandtl elastic membrane (Soap-Film) Analogy.

CO5: Solve the problems for determining contact stresses and deflections of bodies with point contact.

SYLLABUS

UNIT-I:Introduction

Theories of stress and strain, Definition of stress at a point, stress notation, principal stresses, other properties, differential equations of motion of a deformable body, deformation of a deformable body, strain theory, principal strains, strain of a volume element, small displacement theory. Stress –strain temperature relations: Elastic and non-elastic response of a solid, first law of thermodynamics, Hooke's Law, Anisotropic elasticity, Hooke's Law, Isotropic elasticity, initiation of Yield, Yield criteria.

UNIT-II:FAILURE CRITERIA:

Modes of failure, Failure criteria, Excessive deflections, Yield initiation, fracture, Progressive fracture, (High Cycle fatigue for number of cycles N > 106, buckling. Application of energy methods: Elastic deflections and statically indeterminate members and structures: Principle of stationary potential energy, Castiglione's theorem on deflections, Castiglione's theorem on deflections for linear load deflection relations, deflections of statically determinate structures.

UNIT-III:UNSYMMETRICAL BENDING:

Bending stresses in Beams subjected to Non-symmetrical bending; Deflection of straight beams due to non-symmetrical bending. Curved beam theory: Winkler Bach formula for circumferential stress – Limitations – Correction factors –Radial stress in curved beams – closed ring subjected to concentrated and uniform loads stresses in chain links.

UNIT-IV:TORSION :

Linear elastic solution; Prandtl elastic membrane (Soap-Film) Analogy; Narrow rectangular cross Section ;Hollow thin wall torsion members ,Multiply connected Cross Section.

UNIT-V:CONTACT STRESSES:

Introduction; problem of determining contact stresses; Assumptions on which a solution for contact stresses is based; Expressions for principal stresses; Method of computing contact stresses; Deflection of bodies in point contact; Stresses for two bodies in contact over narrow rectangular area (Line contact), Loads normal to area; Stresses for two bodies in line contact, Normal and Tangent to contact area.

Text Books:

1. Advanced Mechanics of materials by Boresi& Sidebottom-Wiely International.
2. Theory of elasticity by Timoschenko S.P. and Goodier J.N. McGraw-Hill Publishers 3rd Edition
3. Advanced Mechanics of Solids, L.S Srinath

Reference Books:

1. Advanced strength of materials by Den Horton J.P.

			L	T	P	C
B.TECH HONORS		**HN**	**4**	**0**	**0**	**4**
20MEHN02	**FRACTURE MECHANICS (Honors Engineering Course)**					

Pre-requisite : Mechanics of Solids

Course Objective:

1. To examine the concept of failure in members with pre-existing flaws.
2. The purpose of this course is for the student to acquire basic skills, to work professionally as an engineer.
3. This means applying fracture mechanics theory and to calculate stress areas and the "energy release rate" around crack tips and crack growth due to fatigue.
4. Failure of structural components will be examined from both the mechanics and micro structural points of view.

Course Outcomes: At the end of the course, student will be able to

CO1: Have a solid foundation in the theory, concepts and principles of fracture mechanics

CO2: Be gaining the physical intuition necessary to idealise a complicated practical problem.

CO3: Possess the analytical and computational tools needed to solve the idealised problem.

CO4: Have acquired the judgment required to interpret the results of these solutions.

CO5: Be able to use these solutions to guide a corresponding design, manufacture, or failure analysis.

SYLLABUS

UNIT-I: Introduction

Prediction of mechanical failure. Macroscopic failure modes; brittle and ductile behaviour. Fracture in brittle and ductile materials – characteristics of fracture surfaces; inter-granular and intra-granular failure, cleavage and micro-ductility, growth of fatigue cracks, The ductile/brittle fracture transition temperature for notched and unnotched components. Fracture at elevated temperature.

UNIT-II: Griffiths analysis

Concept of energy release rate, G, and fracture energy, R. Modification for ductile materials, loading conditions. Concept of R curves. Linear Elastic

Fracture Mechanics, (LEFM). Three loading modes and the state of stress ahead of the crack tip, stress concentration factor, stress intensity factor and the material parameter the critical stress intensity factor, crack tip plasticity, effect of thickness on fracture toughness.

UNIT-III:

Elastic-Plastic Fracture Mechanics; (EPFM).The definition of alternative failure prediction parameters, Crack Tip Opening Displacement, and the J integral. Measurement of parameters and examples of use.

UNIT-IV: Fatigue:

Definition of terms used to describe fatigue cycles, High Cycle Fatigue, Low Cycle Fatigue, mean stress R ratio, strain and load control. S-N curves. Goodman's rule and Miners rule. Micro mechanisms of fatigue damage, fatigue limits and initiation and propagation control, leading to a consideration of factors enhancing fatigue resistance. Total life and damage tolerant approaches to life prediction.

UNIT-V: Creep deformation:

the evolution of creep damage, primary, secondary and tertiary creep. Micro mechanisms of creep in materials and the role of diffusion. Ashby creep deformation maps. Stress dependence of creep – power law dependence. Comparison of creep performance under different conditions – extrapolation and the use of Larson-Miller parameters. Creep-fatigue interactions.

Text books:

1. T.L. Anderson, Fracture Mechanics Fundamentals and Applications, 2nd Ed. CRC press, (1995)
2. B. Lawn, Fracture of Brittle Solids, Cambridge Solid State Science Series 2nd ed1993.

Reference Books:

1. J.F. Knott, Fundamentals of Fracture Mechanics, Butterworths (1973)
2. J.F. Knott, P Withey, Worked examples in Fracture Mechanics, Institute of Materials.
3. H.L.Ewald and R.J.H. Wanhill Fracture Mechanics, Edward Arnold, (1984).
4. S. Suresh, Fatigue of Materials, Cambridge University Press, (1998)
5. L.B. Freund and S. Suresh, Thin Film Materials Cambridge University Press,(2003).

B.TECH HONORS		**HN**	**L**	**T**	**P**	**C**
			4	**0**	**0**	**4**
20MEHN03	**ADVANCED MACHINE DESIGN (Honors Engineering Course)**					

Pre-requisite: Design of Machine Elements

Course Objective:

- To study design concepts in order to enhance the basic design.
- To study behavior of mechanical components under fatigue and creep.
- To study statistical techniques and its applications in mechanical design.

Course Outcomes: At the end of the course, student will be able to

CO1	Ability to analyze behavior of mechanical elements under different loads
CO2	Understand the design of different transmission elements of automobile
CO3	Ability to analyze mechanical elements critically
CO4	Understand the Surface Failures
CO5	Understand the Economic Factors Influencing Design

SYLLABUS

UNIT-I: DESIGN PHILOSOPHY

Design process, Problem formation, Introduction to product design, various design models-Shigley model, Asimov model and Norton model, Need analysis, Strength considerations -standardization. Creativity and Creative techniques, Material selection in machine design, design for safety and Reliability, concept of product design

UNIT-II: FAILURE THEORIES

Static failure theories, Distortion energy theory, Maximum shear stress theory, Coulomb-Mohr's theory, Modified Mohr's theory, Fracture mechanics theory., Fatigue mechanisms, Fatigue failure models, Design for fatigue strength and life, creep: Types of stress variation, design for fluctuating stresses, design for limited cycles, multiple stress cycles,

UNIT-III: FATIGUE FAILURE THEORIES

cumulative fatigue damage, thermal fatigue and shock, harmful and beneficial residual stresses, Yielding and transformation.

UNIT-IV: SURFACE FAILURES

Surface geometry, mating surfaces, oil film and their effects, design values and procedures, adhesive wear, abrasive wear, corrosion wear, surface fatigue, different contacts, dynamic contact stresses, surface fatigue failures, surface fatigue strength.

UNIT-V: ECONOMIC FACTORS INFLUENCING DESIGN

Economic analysis, Break-even analysis, Human engineering considerations, Ergonomics, Design of controls, Design of displays. Value engineering, Material and process selection in value engineering, Modern approaches in design. Team work and Ethics in engineering design: Team formation, functioning, discharge, team dynamics, Ethical issues considered during engineering design process

Text Book(s)

1. Machine Design An Integrated Approach by Robert L. Norton, Prentice-Hall New Jersey, USA.
2. Mechanical Engineering Design by J.E. Shigley and L.D. Mitchell published by McGraw-Hill
3. International Book Company, New Delhi.

References

1. Fundamentals of machine elements by Hamrock, Schmidt and Jacobian, 2nd edition, McGraw- Hill International edition.
2. Product design and development by Karl T. Ulrich and Steven D. Eppinger. 3rd edition, Tata McGraw Hill.
3. Product Design and Manufacturing by A.K. Chitale and R.C. Gupta, Prentice Hall
4. Engineering Design / George E Dieter / McGraw Hill /2008
5. Fundamentals of machine elements/ Hamrock, Schmid and Jacobian/ 2nd edition /McGraw-Hill International edition.

			L	T	P	C
B.TECH HONORS		**HN**	**4**	**0**	**0**	**4**
20MEHN04	**TRIBOLOGY (Honors Engineering Course)**					

Pre-requisite: Fluid Mechanics – Friction, Lubrication and Design of Bearings

Course Objective:

The Students will acquire the knowledge

1. To learn basic concepts of friction and wear mechanisms, lubrication and Lubrication systems
2. To learn the selection process for rolling element bearings
3. To learn the design of the various types of hydrostatic bearings
4. To learn the design of the various types of hydrodynamic bearings
5. To learn the operating principles of various mechanical seals, failure of bearings and dry rub bearings

Course Outcomes: At the end of the course, student will be able to

CO1:	Build the basic concepts of friction and wear mechanisms, lubrication and Lubrication systems
CO2:	Illustrate the selection process for rolling element bearings
CO3:	Understand the design of the various types of hydrostatic bearings
CO4:	Analyze the design of the various types of hydrodynamic bearings
CO5:	Illustrate the operating principles of various mechanical seals, failure of bearings and dry rub bearings

SYLLABUS

UNIT-I: INTRODUCTION

Nature of surfaces and contact-Surface topography-friction and wear mechanisms, wear maps, effect of lubricants- methods of fluid film formation. Lubrication: Choice of lubricants, types of oil, Grease and solid lubricants- additives-lubrication systems and their selection.

UNIT-II: SELECTION OF ROLLING ELEMENT BEARINGS

Nominal life, static and dynamic capacity-Equivalent load, probabilities of survival-cubic mean load- bearing mounting details, pre loading of bearings, conditioning monitoring using shock pulse method.

UNIT-III: HYDROSTATIC BEARINGS

Thrust bearings – pad coefficients- restriction- optimum film thickness journal bearings – design procedure –Aerostatic bearings; Thrust bearings and Journal bearings – design procedure.

UNIT-IV: HYDRODYNAMIC BEARINGS:

Fundamentals of fluid formation – Reynold's equation; Hydrodynamic journal bearings – Sommerfield number- performance parameters – optimum bearing with maximum load capacity – Friction – Heat generated and Heat dissipated. Hydrodynamic thrust bearings; Raimondi and Boyd solution for hydrodynamic thrust bearings- fixed tilting pads, single and multiple pad bearings-optimum condition with largest minimum film thickness.

UNIT-V: SEALS

Different type-mechanical seals, lip seals, packed glands, soft piston seals, Mechanical piston rod packing, labyrinth seals and throttling bushes, oil flinger rings and drain grooves – selection of mechanical seals. Failure of Tribological components: Failure analysis of plain bearings, rolling bearings, gears and seals, wear analysis using soap and Ferrography. Dry rubbing Bearings: porous metal bearings and oscillatory journal bearings – qualitative approach only.

Text Books:

1. Rowe WW& O' Dionoghue, "Hydrostatic and Hybrid bearing design " Butterworths &Co. Publishers Ltd,1983.
2. Collacott R.A," Mechanical Fault diagnosis and condition monitoring", Chapman and Hall, London 1977.
3. Bernard J.Hamrock, "Fundamentals of fluid film lubricant", McGraw-Hill Co.,1994.

References:

1. Neale MJ, (Editor) " Tribology hand Book" Neumann Butterworths, 1975.
2. Connor and Boyd JJO (Editors) " Standard hand book of lubrication engineers " ASLE, McGraw Hill Book & Co.,1968
3. Shigley J, E Charles," Mechanical Engineering Design", McGraw Hill Co.

B.TECH HONORS		**HN**	**L**	**T**	**P**	**C**
			4	**0**	**0**	**4**
20MEHN05	**MEASUREMENTS IN HEAT TRANSFER (Honors Engineering Course)**					

Pre-requisite: Fluid Mechanics and Heat Transfer

Course Objective:

The Students will acquire the knowledge

1. To introduce students to a selection of currently used measuring devices in heat transfer
2. To provide the students with hands on experience on carrying out a pressure and flow measurement.
3. To provide the students with hands on experience on carrying out a temperature and thermal radiation measurement.

Course Outcomes: At the end of the course, student will be able to

CO1:	Understand various basic electrical and sensing devices used in heat transfer.
CO2:	Illustrate the measurement of pressure using different types of measuring devices.
CO3:	Design and analyze various flow measuring devices
CO4:	Understand the principle of various temperature and thermal radiation measuring devices used in heat transfer.

SYLLABUS

UNIT-I:

Basic electrical measurements and sensing devices - Transducers, The variable - Resistance transducers, The differential transformer (LVDT), Capacitive transducers, Piezoelectric transducers, Photoelectric effects, Photoconductive transducers, Photovoltaic cells, Ionization transducers, Magnetometer search coil: Hall-effect transducers.

UNIT-II:

Pressure measurement: Dynamic response considerations, Mechanical pressure - Measurement devices, Dead-weight tester, Bourdon-tube pressure gauge, Diaphragm and bellows gauges, The Bridgman gauge, Low-pressure measurement. The Mcleod gauge, Pirani thermal-conductivity gauge, The Knudsen gauge, The ionization gauge, The alphatron.

UNIT-III:

Flow measurement: Positive displacement methods flow - Obstruction methods, Practical consideration for obstruction meters, The sonic nozzle. Flow measurement by drag effects, Hotwire and hot-film anemometers, Magnetic flow meters, Flow- visualization methods, The shadowgraph, The schlieren, The interferometer, The Laser Doppler Anemometer (LDA), Smoke methods, Pressure probes, Impact pressure in supersonic flow

UNIT-IV:

Measurement of temperature: Temperature scales. The ideal-gas thermometer, Temperature measurement by mechanical effect. Temperature measurement by electrical effects, Temperature measurement by radiation, Effect of heat transfer or temperature measurement, Transient response of thermal systems, Thermocouple compensation, Temperature measurements in high-speed flow.

UNIT-V:

Thermal and transport Property measurement: Thermal conductivity measurements, Thermal conductivity of liquids and gases, Measurement of viscosity, Gas diffusion, Calorimetry, Convection heat-transfer measurements. Humidity measurements, Heat-flux meters.

Thermal radiation measurements: Detection of thermal radiation, Measurement of emissivity, Reflectivity and transmissivity measurements, Solar radiation measurements.

Text Books:

1. Experimental Methods for Engineers by Holman, J.P.
2. Mechanical Measurements by Thomas G. Beckwith, N. Newis Buck.

Reference Books:

1. Measurements in Heat Transfer by Eckert and gold stein.

B.TECH HONORS	**HN**	**L**	**T**	**P**	**C**
		4	**0**	**0**	**4**

20MEHN06 **ADVANCED MECHANICS OF FLUIDS (Honors Engineering Course)**

Pre-requisite: Fluid Mechanics & Hydraulic Machinery

Course Objective: The course is intended to

1. Establish an understanding of the fundamental concepts of fluid mechanics.
2. Understand and apply the potential flow equations to basic flows.
3. Understand and apply the differential equations of fluid mechanics including the ability to apply and understand the impact of assumptions made in the analysis.
4. Understand the boundary layer concepts with respect to fluid flow.
5. Understand and apply the compressible flow equations.

Course Outcomes: At the end of the course, student will be able to

CO1: Understanding the concept of fluid and the models of fluids.

CO2: Understanding the basic physical meaning of general equations.

CO3: Understanding the concept of stream function and potential function.

CO4: Ability to derive the equation for viscous flow, including laminar flow and turbulent flow.

CO5: Ability to address such problems in engineering, and to solve the problems

SYLLABUS

UNIT-I:

Inviscid Flow of Incompressible Fluids: Lagrangian and Eulerain Descriptions of fluid motion- Path lines, Stream lines, Streak lines, stream tubes – velocity of a fluid particle, types of flows, Equations of three-dimensional continuity equation- Stream and Velocity potential functions.

Basic Laws of fluid Flow: Condition for irrotationality, circulation & vorticity Accelerations in Carte systems normal and tangential accelerations, Euler's, Bernoulli equations in 3D– Continuity and Momentum Equations

UNIT-II: VISCOUS FLOW

Derivation of Navier-Stoke's Equations for viscous compressible flow – Exact solutions to certain simple cases: Plain Poiseuille flow - Coutte flow with and without pressure gradient - Hagen Poiseuille flow - Approximate solutions – Creeping motion (Stokes) – Oseen's approximation.

UNIT-III: BOUNDARY LAYER THEORY

Prandtl's contribution to real fluid flows – Prandtl's boundary layer theory - Boundary layer thickness for flow over a flat plate –- Von-Karman momentum integral equation - Blasius solution- Laminar boundary layer – Turbulent Boundary Layer — Expressions for local and mean drag coefficients for different velocity profiles. – Total Drag due to Laminar & Turbulent Layers – Problems.

UNIT-IV:

Introduction to Turbulent Flow: Fundamental concept of turbulence – Time Averaged Equations – Boundary Layer Equations - Prandtl Mixing Length Model - Universal Velocity Distribution Law: Van Driest Model –Approximate solutions for drag coefficients – More Refined Turbulence Models – k- epsilon model - boundary layer separation and form drag – Karman Vortex Trail, Boundary layer control, lift on circular cylinders

Internal Flow: Smooth and rough boundaries – Equations for Velocity Distribution and frictional Resistance in smooth rough Pipes – Roughness of Commercial Pipes – Moody's diagram.

UNIT-V:

Compressible Fluid Flow – I: Thermodynamic basics – Equations of continuity, Momentum and Energy - Acoustic Velocity Derivation of Equation for Mach Number – Flow Regimes – Mach Angle – Mach Cone – Stagnation State

Compressible Fluid Flow – II: Area Variation, Property Relationships in terms of Mach number, Nozzles, Diffusers – Fanno and Releigh Lines, Property Relations – Isothermal Flow in Long Ducts – Normal Compressible Shock, Oblique Shock

Text Books:

1. Fluid Mechanics and Fluid Machines by S K Som and G Biswas, TMH
2. Fluid Mechanics by Joseph H Spurk and Nuri Aksel, Springer
3. Compressible Fluid Dynamics by B K Hodge and Keith Koenig, Pearson
4. Fluid Mechanics by Potter, Cengage Learning.
5. Fluid Mechanics and Hydraulic Machines by Dr. R.K. Bansal.

References:

1. Fluid Mechanics by Jog, Cambridge
2. Fluid Mechanics and Machinery by Khan, Oxford
3. Fluid Mechanics by Cohen and Kundu, Elsevier, 5th edition
4. Fluid Mechanics by William S Janna, CRC Press
5. Dynamics & Theory and Dynamics of Compressible Fluid Flow by Shapiro.
6. Fluid Dynamics by William F. Hughes & John A. Brighton, TMH

B.TECH HONORS		**HN**	**L**	**T**	**P**	**C**
			4	**0**	**0**	**4**
20MEHN07	**ENERGY STORAGE SYSTEMS (Honors Engineering Course)**					

Pre-requisite: Thermodynamics, Thermal Engineering.

Course Objective:

To provide the insights on different types of energy storage systems, principles of energy storage and applications.

Course Outcomes: At the end of the course, student will be able to

CO1: Understand the need and scope of energy storage systems.

CO2: Comprehend the different types of energy storage systems.

CO3: Describe the direct energy storage and conversion systems.

CO4: Apply fundamental design principles for sizing of battery storage.

CO5: Understand the hybrid energy storage systems and future technologies.

SYLLABUS

UNIT-I: INTRODUCTION

Necessity of energy storage, different types of energy storage, mechanical, chemical, electrical, electrochemical, biological, magnetic, electromagnetic, thermal, comparison of energy storage technologies.

UNIT-II: ENERGY STORAGE SYSTEMS

Thermal Energy storage, sensible and latent heat, phase change materials, Energy and Exergy analysis of thermal energy storage, Electrical Energy storagesuper-capacitors, Magnetic Energy storage-Superconducting systems, Mechanical-Pumped hydro, flywheels and pressurized air energy storage, Chemical-Hydrogen production and storage.

UNIT-III:

DIRECT ENERGY STORAGE SYSTEMS: Introduction, Characteristic features of energy storage system, Photovoltaic energy storage, Electrochemical Energy Storage- Battery, primary, secondary and flow batteries. DIRECT ENERGY

CONVERSION SYSTEMS: Principle of direct energy conversion using fuel cells, thermodynamics of fuel cells, Types of fuel cells, AFC, PEMFC, MCFC, and SOFC, Microbial fuel cell and its performance.

UNIT-IV: DESIGN AND APPLICATIONS OF ENERGY STORAGE:

Renewable energy storage-Battery sizing and stand-alone applications, stationary (Power Grid application), Small scale applicationPortable storage systems and medical devices.

UNIT-V: MOBILE STORAGE APPLICATIONS:

Electric vehicles (EVs), types of EVs, batteries and fuel cells, future technologies, hybrid systems for energy storage.

Text Books:

1. Energy Storage - Technologies and Applications by Ahmed Faheem Zobaa, In Tech.
2. Fundamentals of Energy Storage by J. Jensen and B. Sorenson, Wiley-Interscience, New York.
3. Handbook of battery materials by C. Daniel, J. O. Besenhard, Wiley VCH Verlag GmbH & Co. KgaA.
4. Electric & Hybrid Vehicles by G. Pistoia, Elsevier B. V.
5. Thermal energy storage: Systems and Applications by Dincer I. and Rosen M. A., Wiley pub.

References:

1. Energy Storage: Fundamentals, Materials and Applications, by Huggins R. A., Springer.
2. Fuel cell Fundamentals by R. O'Hayre, S. Cha, W. Colella and F. B. Prinz, Wiley Pub.
3. Chemical and Electrochemical Energy System by R. Narayan and B. Viswanathan, University Press.
4. Battery Systems Engineering by C. D. Rahn and C. Wang, Wiley Pub. Electrochemical Energy Storage for Renewable sources and grid balancing by P. T. Moseley and J. Garche, Elsevier Science.
5. Compressed air energy storage by F. P. Miller, A. F. Vandome, M. B. John, VDM publishing.

B.TECH HONORS		**HN**	**L**	**T**	**P**	**C**
			4	**0**	**0**	**4**
20MEHN08	**ADVANCED THERMODYNAMICS (Honors Engineering Course)**					

Pre-requisite: Thermodynamics

Course Objective: The students will acquire the knowledge:

The present course on Advanced Engineering Thermodynamics deals with review on laws of thermodynamics, thermodynamics relations, exergy involvement in thermal systems, reactive mixtures, and propulsion systems.

Course Outcomes: At the end of the course, student will be able to

CO1: Distinguish the laws of thermodynamics applied to thermal systems.

CO2: Apply the thermodynamics laws to solve various thermal system problem

CO3: Analyse the thermodynamic properties of various thermal systems

CO4: Compare the exergy and irreversibility of closed and open thermal systems.

CO5: Describe the working of advanced power cycles.

SYLLABUS

UNIT-I:

THERMODYNAMICS – Introduction, Review of Zeroth, First, Second and third law of thermodynamics.

THERMODYNAMIC RELATIONS: Introduction – Reciprocity and cyclic relations – The Maxwell's relations – The Gibbs and Helmholtz relations - The Clapeyron Equation, General relations for du, dh, ds - Co-efficient of volumetric expansion - Isothermal compressibility.

UNIT-II:

KINETIC THEORY OF GASES: Kinetic theory of gases- introduction, basic assumptions, mean free path, molecular flux, collisions with a moving wall,- intermolecular forces, The Vander Waals equation of state.

UNIT-III:

NON REACTIVE MIXTURES: Review of basic thermodynamics of ideal gas mixtures, Stoichiometry, Fundamentals of combustion kinetics, General characteristics of combustion flame and detonation.

REACTIVE GAS MIXTURES: Introduction- Fuels and Combustion-theoretical and actual combustion processes- Enthalpy of formation and Enthalpy of reaction- First and Second law analysis of reacting systems- Applications.

UNIT-IV:

EXERGY AND IRREVERSIBILITY: Introduction - Availability of heat - Availability of a closed system - Availability of open system - Applications. Irreversibility for closed and open system – Effectiveness-Applications.

UNIT-V:

ADVANCED POWER CYCLES: Atkinson cycle, Lenoir cycle, second law analysis of vapour and gas power cycles, Working of Binary vapour, Cogeneration, and combined gas power cycles Applications.

Textbooks

1. Sonntag, Borgnakke, Van Wyllan, Fundamentals of Thermodynamics: 5th Edition John Wiley and Sons, 2010.
2. P.K.Nag, Engineering Thermodynamics: 4th Edition 2008, TMH.

References

1. Yunus A. Cengel& Michael Boles, Thermodynamics (An Engineering Approach) 7th Edition 2011, TMH.
2. E.Rathakrishnan, Fundamentals of Engineering Thermodynamics 2nd Edition, EEE, PHI Publishers, 2010.
3. J.P.Holman, Thermodynamics, 9th Edition, 2012, TMH.

B.TECH HONORS		HN	L T P C 4 0 0 4
20MEHN09	**METROLOGY AND COMPUTER AIDED INSPECTION (Honors Engineering Course)**		

Course Outcomes: At the end of the course, student will be able to

CO1: Explain the significance of calibration, traceability and uncertainty

CO2: Identify measurement errors and suggest suitable techniques to minimize them

CO3: Analyze the methods and devices for dimensional metrology.

CO4: Design limit gauges

CO5: Assess surface roughness and form errors by computer aided inspection techniques.

SYLLABUS

UNIT-I:

INTRODUCTION: Metrology concepts- Abbe's principle-need for high precision measurements- problems associated with high precision measurements.Standards for length measurement- Shop floor standards and their classification- Light interference- Method of coincidence- Slip gauge calibration-measurement errors.

UNIT-II:

Various tolerances and their specifications, gauging principles, selective assembly, comparators. Angular measurements - principles and Instruments, Gear and Thread measurements

UNIT-III:

Surface and form metrology- Flatness, roughness, waviness, roundness, cylindricity, etc.

Computer Aided Metrology- principles and interfacing, software metrology.

UNIT-IV:

COMPUTER AIDED LASER METROLOGY: Laser metrology- Applications of lasers in precision measurements- Laser interferometer, speckle measurements, laser scanners.

Coordinate Measuring Machine- Non contact CMM Electro optical sensors for dimensional metrology- Non contact sensors for surface finish measurements

UNIT-V:

IMAGE PROCESSING FOR METROLOGY: Overview, Computer imaging systems, Image Analysis, Pre-processing, Human vision system, Image model, Image enhancement, grey scale models, histogram models, Image Transforms – Examples.

TEXT BOOKS:

1. A text-book of Metrology, M. Mahajan, DhanpatRai& Co, 2009.
2. Engineering Metrology, R. K. Jain, Khanna Publishers, 19/e, 2005.

REFERENCES:

3. Engineering Metrology, K. J. Hume, Mc Donald & Co (Publishers), London, 1970.
4. Metrology for Engineers, J.F.W. Galyer and C.R.Shotbolt, ELBS Edition, 5/e, 1993.
5. Engineering Metrology, Thomas. G. G, Butterworth PUB.1974.

B.TECH HONORS		**HN**	**L**	**T**	**P**	**C**
			4	**0**	**0**	**4**
20MEHN10	**LEAN MANUFACTURING (Honors Engineering Course)**					

Course Outcomes: At the end of the course, student will be able to

CO1: Understand the concepts in Lean Manufacturing.

CO2: Understand the tools and methods of Lean Manufacturing.

CO3: Analyze the issues in Lean implementation.

CO4: Distinguish Lean with TPS, ERP and ISO 9001:2000.

SYLLABUS

UNIT-I: INTRODUCTION TO LEAN MANUFACTURING:

Objectives of lean manufacturing-key principles and implications of lean manufacturing- traditional Vs lean manufacturing.

UNIT-II: LEAN MANUFACTURING CONCEPTS:

Value creation and waste elimination- main kinds of waste- pull production-different models of pull production-continuous flow-continuous improvement / Kaizen- worker involvement -cellular layout- administrative lean.

UNIT-III: LEAN MANUFACTURING TOOLS AND METHODOLOGIES:

Standard work -communication of standard work to employees -standard work and flexibility -visual controls-quality at the source- 5S principles preventative maintenance-total quality management-total productive maintenance changeover/setup time -batch size reduction -production leveling.

UNIT-IV: VALUE STREAM MAPPING:

The as-is diagram-the future state map-application to the factory simulation scenario-line balancing -Poke Yoke -Kanban – overall equipment effectiveness.

UNIT-V:

Just in time manufacturing: Introduction - elements of JIT - uniform production rate – pull versus push method- Kanban system - small lot size - quick, inexpensive set-up – continuous improvement. Optimised production technology.

One-piece flow: Process razing techniques – cells for assembly line – case studies. Implementing lean: Road map-senior management Involvement-best practices.

Reconciling lean with other systems: Toyota production system-lean six sigma-lean and ERP lean with ISO9001:2000.

Text Books:

1. James P. Womack, Daniel T. Jones, and Daniel Roos, “The Machine that Changedthe World: the Story of Lean Production”, Simon and Schuster, 1996.
2. Jeffrey K. Liker, “Becoming Lean”, Industrial Engineering and Management Press,1997.
3. James P. Womack and Daniel T. Jones, “Lean Thinking”, Free Press-Business andEconomics, 2003.
4. Rother M. and Shook J., “Learning to See”, The Lean Enterprise Institute, Brookline,2003.
5. George, Michael. L. “Lean Six Sigma: Combining Six Sigma Quality with LeanSpeed”, Tata McGraw Hill Education, New Delhi, 2002.
6. Larson, Alan,“Demystifying Six Sigma : A Company-Wide Approach to Continuous Improvement”, Jaico, Mumbai, 2007.

References:

1. Askin R G and Goldberg J B, Design and Analysis of Lean Production Systems, JohnWiley and Sons Inc., 2003.
2. Micheal Wader, Lean Tools: A Pocket Guide to Implementing Lean Practices,Productivity and Quality Publishing Pvt Ltd, 2002.
3. Richard B Chase F Robert Jacobs and Nicholas J Aquilano, Operations Management for Competitive Advantage, 10th Edition, McGraw Hill/Irwin, 2003.
4. Masaaki Sato, The Toyota Leaders – An Executive Guide, Vertical Inc, New York, 2008.

B.TECH HONORS		HN	L	T	P	C
			4	0	0	4

20MEHN11 **FLEXIBLE MANUFACTURING SYSTEMS (Honors Engineering Course)**

Course Outcomes: At the end of the course, student will be able to

CO1: Classify and distinguish FMS and other manufacturing systems.

CO2: Analyze processing stations and material handling systems used in FMS environments.

CO3: Design and analyze FMS using simulation and analytical techniques.

CO4: Develop management and control systems for tools, material handling and configurations in FMS.

CO5: Analyze the production management problems in planning, loading, scheduling, routing and breakdown in a typical FMS.

SYLLABUS

UNIT-I: UNDERSTANDING OF FMS:

Evolution of Manufacturing Systems, FMS: Definition, objective and Need, FMS: components, Merits, Demerits and Applications, Flexibility in Pull and Push type.

UNIT-II:

Classification of FMS Layout: FMS: Layouts and their Salient features, Single line, dual line, loop, ladder, robot centre type etc.

Salient features of processing stations: Processing stations- Machining Centers, Turning centre, Coordinate measuring machine (CMM), Washing/ Deburring station.

UNIT-III:

MHS; An introduction: Material Handling System Conveyor, Robots, Automated Guided Vehicle (AGV), Automated Storage Retrieval System (ASRS).

UNIT-IV:

Management Technology: Tool Management, tool magazine, Tool preset, identification, Tool monitoring and fault detection, FMS: Configuration planning and routing, FMS: Production Planning and Control, FMS: Scheduling and loading.

UNIT-V:

Design of FMS: Performance Evaluation introduction, Analytical model of FMS, Simulation model of FMS.

Text Books:

1. William W Luggen, "Flexible Manufacturing Cells and System" Prentice Hall of Inc New Jersey, 1991
2. Reza A Maleki "Flexible Manufacturing system" Prentice Hall of Inc New Jersey, 1991

References:

1. John E Lenz "Flexible Manufacturing" marcel Dekker Inc New York, 1989.
2. Groover,M.P "Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall of India Pvt.Ltd. New Delhi 2009

B.TECH HONORS		HN	L	T	P	C
			4	0	0	4

20MEHN12 **ROBOTICS & CONTROL (Honors Engineering Course)**

Course Outcomes: At the end of the course, student will be able to

CO1: Classify robots based on joints and arm configurations.

CO2: Design application specific End Effectors for robots.

CO3: Compute forward and inverse kinematics of robots and determine trajectory plan.

CO4: Program robot to perform typical tasks including Pick and Place, Stacking and Welding.

CO5: Design and select robots for Industrial and Non-Industrial applications.

SYLLABUS

UNIT-I:

Robotics classification, Sensors-Position sensors, Velocity sensors, Proximity sensors, Touch and Slip Sensors, Force and Torque sensors.

UNIT-II: GRIPPERS AND MANIPULATORS :

Gripper joints, Gripper force, Serial manipulator, Parallel Manipulator, selection of Robot-Selection based on the Application

UNIT-III:

Kinematics-Manipulators Kinematics, Rotation Matrix, Homogenous Transformation Matrix, Direct and Inverse Kinematics for industrial robots for Position and orientation. Differential Kinematics and static- Dynamics-Lagrangian Formulation, Newton-Euler Formulation for RR & RP Manipulators,

UNIT-IV:

Trajectory planning-Motion Control- Interaction control, Rigid Body mechanics, Control architecture- position, path velocity and force control systems, computed torque control, adaptive control, and Servo system for robot control.

UNIT-V:

Programming of Robots and Vision System- overview of various programming languages Application of Robots in production systems- Application of robot in welding, machine tools, material handling, and assembly operations parts sorting and parts inspection.

Text Books:

1. Fu, K.S., Gonzalez, R.C., and Lee, C.S.G., Robotics control, Sensing, Vision and Intelligence, McGraw-Hill Publishing company, New Delhi, 2003.
2. Klafter, R.D., Chmielewski, T.A., and Negin. M, Robot Engineering-An Integrated Approach, Prentice Hall of India, New Delhi, 2002.

Reference Books:

1. Craig, J.J., Introduction to Robotics Mechanics and Control, Addison Wesley, 1999.

B.TECH HONORS	**HN**	**L**	**T**	**P**	**C**
		4	**0**	**0**	**4**
20MEHN13	**QUALITY ENGINEERING IN MANUFACTURING (Honors Engineering Course)**				

Course Objectives: The Students will acquire the knowledge

1. To Interpret quality engineering in production design, Loss Function and Quality Level in production process
2. To explain tolerance design for Ntype. L-type and S-type characteristics and tolerance allocation
3. To interpret ANOVA techniques and need for ANOVA with multiple level factors.
4. To make use of orthogonal arrays for typical test strategies and interpolate experimental results
5. To explain six sigma DMAIC methodology and tools for process improvement in services and small organizations

Course Outcomes: At the end of the course, student will be able to

CO1: Interpret quality engineering in production design, Loss Function and Quality Level in production process

CO2: Illustrate tolerance design for N-type. L-type and S-type characteristics and tolerance allocation

CO3: Interpret ANOVA techniques and need for ANOVA with multiple level factors

CO4: Make use of orthogonal arrays for typical test strategies and interpolate experimental results

CO5: Understand six sigma DMAIC methodology and tools for process improvement in services and small organizations

SYLLABUS

UNIT-I:

QUALITY VALUE AND ENGINEERING: An overall quality system, quality engineering in production design, quality engineering in design of production processes. Loss Function and Quality Level: Derivation and use of quadratile loss function, economic consequences of tightening tolerances as a means to improve quality, evaluations and types tolerances.(N type,S type and L-type)

UNIT-II:

TOLERANCE DESIGN AND TOLERANCING: Functional limits, tolerance design for N type. L-type and S-type characteristics, tolerance allocation fbr multiple components. Parameter and Tolerance Design: Introduction to parameter design, signal to noise ratios, Parameter design strategy, some of the case studies on parameter and tolerance designs.

UNIT-III:

ANALYSIS OF VARIANCE (ANOVA): Introduction to ANOVA, Need for ANOVA, NO way ANOVA, One-way ANOVA, Two-way ANOVA, Critique of F-test, ANOVA for four level factors, multiple level factors.

UNIT-IV:

ORTHOGONAL ARRAYS: Typical test strategies, better test strategies, efficient test strategies, steps in designing, conducting and analyzing an experiment. Interpolation of Experimental Results: Interpretation methods, percent contributor, estimating the mean.

UNIT-V:

SIX SIGMA AND THE TECHNICAL SYSTEM: Six sigma DMAIC methodology, tools for process improvement, six sigma in services and small organizations, statistical foundations, statistical methodology.

Text Books:

1. Taguchi Techniques for Quality Engineering / Phillip J. Ross / McGraw Hill/ Intl. II Edition,1995.

References:

1. Quality Engineering in Production systems by G. Taguchi, A. Elsayed et al, McGraw Hill Intl.Pub 1989.
2. Taguchi Methods explained: Practical steps to Robust Design / Papan P. Bagchi I Prentice Hall Pvt.Ltd. New Delhi

B.TECH HONORS		**HN**	**L**	**T**	**P**	**C**
			4	**0**	**0**	**4**
20MEHN14	**PRECISION ENGINEERING (Honors Engineering Course)**					

Course Objectives: The Students will acquire the knowledge

1. Understand the BIS code fits and tolerances for geometrical dimensioning and tolerance (GD & T).
2. Understand the principal application of different measuring instruments.
3. Summarize the application of latest manufacturing techniques (Nano).

Course Outcomes: At the end of the course, student will be able to

CO1: Describes the General concept of accuracy, dimensional wear of cutting tools, location of rectangular prism alignment tests.

CO2: Understand the Influence of static stiffness, thermal effects, compliance of workpiece, Influence of vibration on accuracy

CO3: Explains Top down and bottom up approach, development of Nanotechnology, precision and micro-machining, Stereo microlithography.

CO4: Describes Nano Measuring Systems such as mechanical measuring systems, optical measuring systems.

CO5: Explores various types of Lithography, ion Beam lithography, optical lithography, LIGA process, dip pen lithography, deep UV.

SYLLABUS

UNIT-I: ACCURACY AND ALIGNMNET TEST

Accuracy and alignment tests: General concept of accuracy, Spindle rotation accuracy, test methods, displacement accuracy, dimensional wear of cutting tools, accuracy of NC systems, clamping errors, setting errors, location of rectangular prism, cylinder, basic type of tests, measuring instruments used for testing machine tools, alignment tests, straightness, flatness, parallelism, squareness, Circularity, cylindricity.

UNIT-II: INFLUENCE OF STATIC STIFFNESS,THERMAL EFFECTS

Influence of static stiffness, thermal effects: Static stiffness, nature of deformation in a machine tool, overall stiffness of a lathe, compliance of work piece, errors due to the variation of the cutting force and total compliance, accuracies due to thermal effects, methods of decreasing thermal effects-Influence of vibration on accuracy.

UNIT-III: PRECISION MACHINING

Top down and bottom up approach, development of Nanotechnology, precision and micro-machining, diamond turning of parts to nanometer accuracy. Stereo microlithography, machining of micro-sized components, mirror grinding of ceramics, ultra precision block gauges.

UNIT-IV: NANO MEASURING SYSTEMS

In-process measurement of position of processing point, post process and online measurement of dimensional features, mechanical measuring systems, optical measuring systems, electron beam measuring systems, pattern recognition and inspection systems.

UNIT-V: LITHOGRAPHY

Nano Lithography: Photolithography, nano lithography, photolithography, electron beam lithography, ion Beam lithography, optical lithography, LIGA process, dip pen lithography, deep UV.

Text Books:

1. Murthy.R.L, ―Precision Engineering in Manufacturing‖ , New Age International, New Delhi, 2005.

2. Norio Taniguchi, ―Nanotechnology‖ , Oxford university press, Cambridge, 1996.

References:

1. Lee Tong Hong, ―Precision Motion control, Design and Implementation‖ , Springer Verlag, U.K.2001

2. Liangchi Zhang, ―Precision Machining of Advanced Materials‖ , Trans Tech Publications Ltd., Switzerland, 1st Edition, 2001.

3. HiromuNakazawa, ―Principles of Precision Engineering‖ , Oxford university press, 1st Edition, 1994.

B.TECH HONORS		**HN**	**L**	**T**	**P**	**C**
			4	**0**	**0**	**4**
20MEHN15	**AUTOMATION IN MANUFACTURING (Honors Engineering Course)**					

Course Objectives: The Students will acquire the knowledge

1. To know about the Automation and types of Automations in the industries
2. To understand the different automated flow lines in the Industries.
3. To perform one or more processing and/or assembly operations on a starting raw material, part, or set of parts.
4. To perform a sequence of automated or mechanized assembly operations Flexible manufacturing system (FMS)—a highly automated machine cell that produces part.
5. To know product families often consists of workstations comprising CNC machine tools.

Course Outcomes: At the end of the course, student will be able to

CO1:	Students will understand the process of automation and types
CO2:	Students will get exposure to workstation, which refers to the location in the factory where some well-defined task or operation is accomplished by an automated machine.
CO3:	Worker-and-machine combination or a worker using hand tools
CO4:	Understand the Automated Material handling equipments and types
CO5:	Student gets exposure on portable power tools

SYLLABUS

UNIT-I:

Introduction: Types and strategies of automation, pneumatic and hydraulic components circuits, Automation in machine tools, Mechanical Feeding and to changing and machine tool control transfer the automation.

UNIT-II:

Automated flow lines: Methods or work part transport transfer Mechanical buffer storage control function, design and fabrication consideration.

Analysis of Automated flow lines: General terminology and analysis of transfer lines without and with buffer storage, partial automation, implementation of automated flow lines.

UNIT-III:

Assembly system and line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

UNIT-IV:

Automated material handling: Types of equipment, functions, analysis and design of material handling systems conveyor systems, automated guided vehicle systems.

Automated storage systems: Automated storage and retrieval systems; work in process storage, interfacing handling and storage with manufacturing.

UNIT-V:

Fundamentals of Industrial controls: Review of control theory, logic controls, sensors and actuators, Data communication and LAN in manufacturing.

Business process Re-engineering: Introduction to BPE logistics, ERP, Software configuration of BPE.

Text Books:

1. Automation, production systems and computer integrated manufacturing/ Mikell.P Groover/PHI/3rd edition/2012,

References:

1. CAD/CAM/CIM/ P. Radha Krishnan & S. Subrahamanyarn and Raju/New Age International Publishers/2003.
2. System Approach to Computer Integrated Design and Manufacturing/ Singh/John Wiley /96.
3. Computer Aided Manufacturing/Tien-Chien Chang, Richard A. Wysk and Hsu-Pin Wang/Pearson/ 2009
4. Manufacturing and Automation Technology / R Thomas Wright and
5. Michael Berkeihiser /Good Heart/Willcox Publishers

			L	T	P	C
B.TECH HONORS		**HN**	**4**	**0**	**0**	**4**
20MEHN16	**MATERIALS CHARACTERIZATION TECHNIQUES (Honors Engineering Course)**					

Course Objectives: The Students will acquire the knowledge

1. To understand the use the various Structure analysis tools likeX-ray diffraction
2. To apply the microscopy techniques in materials characterization.
3. To understand the concepts of thermal analysis technique.
4. To analyze the knowledge on magnetic characterization techniques.
5. To illustrate optical and electronic characterization techniques.

Course Outcomes: At the end of the course, student will be able to

CO1: Understand the use the various Structure analysis tools like X-ray diffraction

CO2: Apply the microscopy techniques in materials characterization..

CO3: Understand the concepts of thermal analysis technique

CO4: Analyze the knowledge on magnetic characterization techniques

CO5: Illustrate optical and electronic characterization techniques.

SYLLABUS

UNIT-I:

Introduction to materials and Techniques, Structure analysis tools: X-ray diffraction: phase identification, indexing and lattice parameter determination, Analytical line profile fitting using various models, Neutron diffraction, Reflection High Energy Electron Diffraction, and Low Energy Electron Diffraction.

UNIT-II:

Microscopy techniques: Optical microscopy, transmission electron microscopy (TEM), energy dispersive Xray microanalysis (EDS), scanning electron microscopy (SEM), Rutherford backscattering spectrometry (RBS), atomic force microscopy (AFM) and scanning probe microscopy (SPM).

UNIT-III:

Thermal analysis technique: Differential thermal analysis (DTA), Differential Scanning Calorimetry (DSC), Thermogravimetric analysis (TGA); Electrical characterization techniques: Electrical resistivity, Hall effect, Magneto resistance.

UNIT-IV:

Magnetic characterization techniques: Introduction to Magnetism, Measurement Methods, Measuring Magnetization by Force, Measuring Magnetization by Induction method, Types of measurements using magnetometers: M-H loop, temperature dependent magnetization, time dependent magnetization, Measurements using AC susceptibility, Magneto-optical Kerr effect, Nuclear Magnetic Resonance, Electron Spin Resonance

UNIT-V:

Optical and electronic characterization techniques: UV-VIS spectroscopy, Fourier transform infrared spectroscopy, Raman spectroscopy, X-ray photoelectron spectroscopy.

Text Books:

1. Characterization of Materials (Materials Science andTechnology:A Comprehensive Treatment, Vol 2A & 2B,
2. Semiconductor Material and Device Characterization, 3rdEdition, D. K. Schroder, Wiley-IEEE Press (2006).
3. Materials Characterization Techniques, S Zhang, L. Li andshok Kumar, CRC Press (2008).

References:

1. Physical methods for Materials Characterization, P. E. J.Flewitt and R K Wild, IOP Publishing (2003).
2. Characterization of Nanophase materials, Ed. Z L Wang,Willet-VCH (2000).

B.TECH MINOR	MN	L	T	P	C
		3	1	0	4

20MEMN01 ENGINEERING MECHANICS (Minor Engineering Course)

UNIT – I

Introduction to Engg. Mechanics – Basic Concepts.

Systems of Forces: Coplanar Concurrent Forces – Components in Space – Resultant – Moment of Force and its Application – Couples and Resultant of Force Systems.

Equilibrium of Systems of Forces: Free Body Diagrams, Equations of Equilibrium of Coplanar Systems, Spatial Systems for concurrent forces. Lamis Theorm, Graphical method for the equilibrium of coplanar forces, Converse of the law of Triangle of forces, converse of the law of polygon of forces condition ofequilibrium.

UNIT II

Friction: Introduction**,** limiting friction and impending motion, coulomb's laws of dry friction, coefficient of friction, cone of friction, Wedges.

Analysis of plane trusses-Method of Joints, Method of Sections.

UNIT – III

Centroid: Centroids of simple figures (from basic principles) – Centroids of Composite Figures

Centre of Gravity: Centre of gravity of simple body (from basic principles), centre of gravity of composite bodies, Pappus theorems.

UNIT – IV

Area moments of Inertia: Definition – Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia.

Mass Moment of Inertia: Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia, mass moment of inertia of composite bodies.

UNIT – V

Kinematics: Rectilinear and Curvilinear motions – Velocity and Acceleration – Motion of Rigid Body – Types and their Analysis in Planar Motion.

Kinetics: Analysis as a Particle and Analysis as a Rigid Body in Translation– Central Force Motion – Equations of Plane Motion – Fixed Axis Rotation –

Rolling Bodies.

Work – Energy Method: Equations for Translation, Work-Energy Applications to Particle Motion, Connected System-Fixed Axis Rotation and Plane Motion. Impulse momentum method.

TEXT BOOKS:

1. S.Timoshenko & D.H.Young, Engineering Mechanics, 4^{th}Edn, McGraw Hillpublications.

2. S S Bhavikati, Engineering Mechanics,–New Age InternationalPublishers

REFERENCES:

1. I.H.Shames, Engineering Mechanics, statics and dynamics ,PearsonPubl.

2.A Nelson, Engineering Mechanics statics and dynamics, McGraw Hillpublications

3. A KTayal, Engineering Mechanics Statics and Dynamics, Umesh Publishers.

4. R.K.Bansal, Engineering Mechanics ,LaxmiPublications

5. KL Kumar,Engg. Mechanics- -Tata McGraw Hillpublications

B.TECH MINOR		MN	L	T	P	C
			3	1	0	4
	20MEMN02	THERMAL ENGINEERING (Minor Engineering Course)				

Unit I

Basic Concepts Of Thermodynamics: Introduction- Macroscopic and Microscopic approaches-System, Properties of System, State, Path, Process and cycles, path and Point Functions. Thermodynamic Equilibrium, Law s of Thermodynamics

Unit II

Thermodynamic Cycles: Introduction, Carnot cycle, Basic Rankine Cycle, Diesel Cycle, Brayton Cycle, Bell-Coleman cycle.

Unit III

Internal Combustion Engines: Classification of IC Engines, Basic Engine Components- Working principles of 2-Stroke and 4-Stroke engines, Applications of I.C Engines. ENGINE SYSTEMS: Introduction, Need of Fuel supply system, ignition system, lubrication and cooling systems, supercharging and turbo charging of IC engines.

Unit IV

STEAM TURBINE POWER PLANT COMPONENTS: Introduction, steam turbine power plant Components, Methods to improve efficiency of steam power cycle. GAS TURBINE POWER PLANT COMPONENTS: Introduction, Gas turbine plant and Its Components, Classification of Gas Turbine plants and its applications.

Unit V

HEAT TRANSFER: Basic Modes of Heat Transfer- Basic laws of Heat transfer- - Steady and unsteady state heat Transfer, Applications of heat transfer. ELECTRONIC COOLING SYSTEM: Introduction, Need of electronic cooling, Air and liquid cooling systems, cooling of printed circuit boards (PCBs).

Text Book(s):

1. P.K.Nag, Engineering Thermodynamics, 5/e, Tata McGraw Hill,2013.
2. R.K.Rajput, Thermal Engineering, Laxmi publications, 5th Edition, 2005.

References

1. Arora &Domkundwar, A course in Power Plant Engineering-DhanpatRai&Company 5th Revised Reprint Edition, 2004.

2. R.C.Sachdeva - Fundamentals of Engineering Heat and Mass Transfer — New Age Science Publishers, 3nd Edition, 2009.

B.TECH MINOR		MN	L T P C
			3 1 0 4
20MEMN03	PRODUCTION TECHNOLOGY (Minor Engineering Course)		

UNIT – I

CASTING: Steps involved in making a casting. Patterns – Types of patterns – Materials used for patterns, pattern allowances, Gating ratio and design of Gating systems. Risers – Types, function and design, casting design considerations. Gases in metals. Solidifications. General defects in castings. Basic principles and applications of Centrifugal casting, Die casting and Investment casting-advantages, disadvantages and applications.

UNIT – II

WELDING: Classification of welding processes, types of welded joints and their characteristics, Gas welding, Different types of flames and uses, Oxy – Acetylene Gas cutting. Basic principles of Arc welding, Manual metal arc welding, Submerged arc welding, Inert Gas welding- TIG & MIG welding- advantages, disadvantages and applications. Welding defects – causes and remedies – destructive and non- destructive testing of welds. Introduction to brazing & soldering.

UNIT – III

METAL FORMING: Hot working and Cold working, Strain hardening and Annealing. Bulk forming processes: Forging - Smith forging, Drop Forging, Roll forging, Forging hammers, Rotary forging, forging defects; Rolling – fundamentals, types of rolling mills and products, Forces in rolling and power requirements. Extrusion and its characteristics. Types of extrusion, Impact extrusion, Hydrostatic extrusion; Wire drawing and Tube drawing. Introduction to powder metallurgy – compaction and sintering, advantages and applications.

UNIT – IV

SHEET METAL FORMING: - Blanking and piercing, Forces and power requirement in these operations, Deep drawing, Stretch forming, Bending, Spring back and its remedies, Coining, Spinning, Types of presses and press tools. High energy rate forming processes: Principles of explosive forming, electromagnetic forming, Electrohydraulic forming, rubber pad forming, advantages and limitations.

UNIT – V

Plastics and Polymers: Introduction, Types of plastics and Composites based on plastics.

Processing of Plastics:

Thermoplastics: Blow and Injection molding**,**

Thermosets: Liquid Molding Process, Reaction injection molding, Resin transfer molding

Text Books:

1. P.N. Rao, Manufacturing Technology -Vol I- 1st edition, Tata McGraw Hill Education and 2013

2.Mikell P. Groover. Fundamentals of Modern Manufacturing Materials, Processes, and Systems -John Wiley publications, 4th edition and 2010.

References:

1.A.Ghosh&A.K.Malik – Manufacturing Science - East West Press Pvt. Ltd, 2nd edition and 2010.

2.Allyn and Bacon - Process and materials of manufacture- PHI publisher, 4th Edition, 1990.

3. R.K. Jain - Production Technology, Khanna Publisher 1st edition and 2015.

4.P C Sharma- Production Technology - S. Chand, 1st edition and 2006.

5.H.S. Shaun - Manufacturing Processes- Pearson publication, 1st edition, 2012.

6.J.P. Kaushish - Manufacturing Processes- PHI publication, 1st edition and 2010.

7.Charles A. Harper, Edward M. Petrie, Plastics Materials and Processes: A Concise Encyclopedia, John Wiley Publications.

B.TECH MINOR		**MN**	**L**	**T**	**P**	**C**
			3	**1**	**0**	**4**
20MEMN04	**FUNDAMENTALS OF ENGINEERING DESIGN (Minor Engineering Course)**					

UNIT- I

INTRODUCTION – Design philosophy – Introduction - Basic concept of machine design – Types of design - Types of design based on methods - Factors to be considered in machine design – Problems. Engineering Materials – Introduction – Ferrous, non-ferrous materials – Non metals, Mechanical properties of common engineering materials. Design and manufacturing – Introduction – Types of limits, fits - Preferred numbers - Common manufacturing processes.

UNIT - II

SYSTEM OF FORCES: Introduction, Basic terminology in Mechanics, laws of Mechanics, characteristics of force, system of forces-types, Resolution and Composition of forces, Resultant of coplanar concurrent force system, Resultant of coplanar non-concurrent force system-moment of a force and couple. EQUILIBRIUM OF SYSTEM OF FORCES: Free Body Diagram, Lami's theorem, Equilibrium of a rigid body subjected to coplanar concurrent forces and non-concurrent forces, Equilibrium of connected bodies.

UNIT - III

SIMPLE STRESSES: Introduction – load, stress, strain, types of stress and strain, stress-strain diagram, factor of safety, types of modulus, poison's ratio, relation between different types of modulus, stresses due to axial loads. BENDING AND TORSIONAL STRESSES: Bending stress in straight beams, bending equation, Torsion, torsional shear stress, torsion equation, Theories of failure, problems.

UNIT – IV

ANALYSIS OF COMBINED STRESSES: State of plane stress at a point in stressed body, Normal and Tangential stresses on inclined planes - Principal stresses and their planes - Plane of maximum shear - Mohr‘s circle of stresses. SHAFT DESIGN-Introduction, materials used for shafts, manufacturing of shafts, types of shafts, stresses in shafts.

UNIT - V

BELT AND ROPE DRIVES: Introduction - Selection of belt drive- Types of belt drives materials- Velocity ratio- Slip -Creep - Tensions for flat belt drive& V-belt drive -Angle of contact Centrifugal tension- Maximum tension – Rope drives. GEARS: Introduction, Terminology, Types, Law of gearing- Profile for gears- Involute action Path of contact, Arc of contact, Contact ratio- Velocity of sliding –Interference and Undercutting.

TEXT BOOKS

1.S.S. Bhavikatti, Engineering Mechanics, 4thedition, New Age International (P) Ltd, 2012.

2. Sadhu Singh, ―Strength of Materials‖, Khanna Publishers, 10thEdition, 2013.

3. Rattan S.S, ―Theory of Machines‖, 3rd Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2011.

4. Bhandari V.B, Design of Machine Elements, 3rdEdition, Tata McGraw Hill 2010.

REFERENCES

1. Manoj K Harbola, Engineering Mechanics, 2nd edition, Cengage Learning, 2012.

2. S.Ramamrutham, ―Strength of Materials‖, 14thEdition, DhanpatRai& Sons, 2011.

3. Sadhu Singh ―Theory of Machines‖, 3rd Edition, Pearson Education, 1997.

4. Shigley J.E and Mischke C. R., Mechanical Engineering Design, 6thEdition, Tata McGraw Hill, 2003

B.TECH MINOR	**MN**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

20MEMN05 **PRODUCTION PLANNING AND CONTROL (Minor Engineering Course)**

UNIT – I

Introduction : Definition – Objectives of production Planning and Control – Functions of production planning and control – Elements of production control – Types of production – Organization of production planning and control department – Internal organization of department.

UNIT – II

Forecasting – Importance of forecasting – Types of forecasting, their uses – General principles of forecasting – Forecasting techniques – qualitative methods and quantitative methods.

UNIT – III

Inventory management – Functions of inventories – relevant inventory costs – ABC analysis – VED analysis – EOQ model – Inventory control systems – P–Systems and Q-Systems. Introduction to MRP I,MRP II & ERP, LOB (Line of Balance), JIT and CANBAN system.

UNIT –IV

Routing – Definition – Routing procedure –Route sheets – Bill of material – Factors affecting routing procedure. Schedule –definition – Difference with loading

UNIT – V

Scheduling Policies – Techniques, Standard scheduling methods, line balancing, Aggregate planning, Expediting, controlling aspects.

Dispatching – Activities of dispatcher – Dispatching procedure – follow up – definition – Reason for existence of functions – types of follow up.

TEXT BOOKS :

1.Samuel Eilon, Elements of Production Planning and Control.

2. Partik Jonsson Stig-Arne Mattsson, Manufacturing, Planning and Control, Tata McGraw Hill.

REFERENCES:

1. S.N. Chary, Operations Management.

2. Martin K. Starr and David W. Miller, Inventory Control Theory and Practice.

3. Kumar Reddy,Reliability Engineering & Quality Engineering,Galgotia Publications, Pvt., Limited.

4.John E. Biegel, Production Control A Quantitative Approach.

5. Moore, Production Control.

B.TECH MINOR		**MN**	**L**	**T**	**P**	**C**
			3	**1**	**0**	**4**
20MEMN06	**MATERIALS TECHNOLOGY (Minor Engineering Course)**					

UNIT-I

ENGINEERING MATERIALS: Introduction, classification of engineering materials and their mechanical properties. Bonds in solids: Ionic bond, covalent bond and metallic bond. Mechanism of crystallization of metals, grain and grain boundaries, Effect of grain boundaries on the properties of metals and alloys – Determination of grain size. CONSTITUTION OF ALLOYS: Necessity of alloying, Solid Solutions-Interstitial Solid Solution and Substitution Solid Solution, Hume Rothery rules.

UNIT-II

EQUILIBRIUM DIAGRAMS: Experimental methods of construction of equilibrium diagrams, Classification of equilibrium diagrams- isomorphous, eutectic, partial eutectic equilibrium diagrams. Equilibrium cooling and heating of alloys, lever rule, coring. Study of Cu-Ni and Bi-Cd equilibrium diagrams.

UNIT-III

FERROUS METALS AND ALLOYS: Study of Iron-Iron carbide equilibrium diagram. Transformations in the solid state – allotropy, eutectic, eutectoid, peritectoid reactions. STEEL: Classification of steels, structure, properties and applications of plain carbon steels, low carbon steel, medium carbon steel and high carbon steel.

CAST IRONS: Structure, properties and applications of white cast iron, malleable cast iron, grey cast iron, spheroidal graphite cast iron. NON FERROUUS MATERIALS: Properties and applications of aluminium and copper.

UNIT-IV

HEAT TREATMENT OF ALLOYS: Annealing, normalizing and hardening. Construction of TTT diagram for eutectoid steel. Hardenability-determination of harden ability by jominy end quench test. Surface hardening methods and age hardening treatment and applications.

UNIT-V

NON-METALLIC MATERIALS: Introduction and classification of non metallic materials. Classification of Polymers on basis of Thermal behavior (Thermoplastics & Thermosetting). Properties and applications of polymers. COMPOSITES: Introduction of composite, Characteristics of composites, Constituents of composite, Types and applications of composites.

TEXT BOOKS

1. V.D.Kotgire, S.V.Kotgire, Material Science and Metallurgy, Everest Publishing House, 24thEdition, 2008.
2. Sidney H. Avener, Introduction to Physical Metallurgy, Tata McGraw-Hill, 3rdEdition, 2011.

REFERENCES

1. Richard A.Flinn, Paul K.Trojan, Engineering Materials and Their Applications, Jaico Publishing House, 4thEdition, 1999.
2. William and callister, Materials Science and engineering, Wiley India private Ltd., 2011.
3. U.C Jindal and AtishMozumber, Material since and metallurgy, Pearson education- 2012.

B.TECH MINOR		MN	L	T	P	C
			3	1	0	4
20MEMN07	**BASICS OF MECHANICAL ENGINEERING (Minor Engineering Course)**					

Unit-I

Heat and Work: Heat and Work, Point and Path function. Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry – Reference Points – Const. Volume gas Thermometer – Scales of Temperature, Ideal Gas Scale – PMM I, Problems on heat and work for various processes.

First law of thermodynamics, application of steady flow energy equation to various components of a power plant (boiler, turbine, condenser and pump), Carnot engine.

UNIT-II

Introduction to cycles: Power cycle: Introduction to 2 stroke and 4 stroke engine, Otto cycle, Diesel cycle, problems on Otto and Diesel cycle

Refrigeration cycle: Refrigerant, Vapour compression refrigeration (VCR) cycle, Problems on VCR cycle, vapour absorption refrigeration cycle, domestic refrigerator, window and split AC.

Unit-III

Hydro Prime Movers: Hydraulic Turbines: Classification, Principles and operations of Pelton wheel, Francis turbine and Kaplan turbine, Performance and characteristic curves.

Hydro Power: Components of hydro-electric power plant, Estimation of water power potential, Estimation of load on turbines: load curve, load factor, capacity factor, utilization factor, diversity factor, load-duration curve, firm power, secondary power, prediction of load.

Unit-IV

Introduction to Engg. Mechanics – Basic Concepts. Systems of Forces: Coplanar Concurrent Forces– Resultant – Moment of Force and its Application – Couples and Resultant of Force Systems.

Equilibrium of Systems of Forces: Free Body Diagrams, Equations of Equilibrium of Coplanar Systems, Spatial Systems for concurrent forces. LamisTheorm, analysis of plane trusses.

Unit-V

Stresses and strains: kinds of – stress-strains, elasticity and plasticity, Hooks law, stress –strain diagrams, modules of elasticity, Poisson's ratio, linear and volumetric strain, relation between E, N, and K, bars of uniform strength, compound bars and temperature stresses.

Types of supports– loads – Shear force and bending moment for cantilever and simply supported beams without overhanging for all types of loads.

Text books:

1. PK Nag, Engineering Thermodynamics, 4th Edn , TMH.
2. Dr. P.N. Modi& Dr. S.M. Seth,Hydraulics & Fluid Mechanics Including Hydraulics Machines,Rajsons Publications, 21st Ed., 2017.
3. S.Timoshenko&D.H.Young, Engg. Mechanics, 4th Edn, McGraw Hill publications.
4. S SBhavikatti, Strength of materials,Lakshmi publications.

References:

1. S Trymbaka Murthy, A Textbook of Elements of Mechanical Engineering, University Press(India) Pvt Ltd, 4th Edition, 2006.

			L	T	P	C
B.TECH MINOR		**MN**	**3**	**1**	**0**	**4**
20MEMN08	**AUTOMOBILE ENGINEERING (Minor Engineering Course)**					

UNIT - I

Introduction to vehicle structure and engine components: Vehicle construction - Chassis and body - Specifications - Engine - Types - Construction - Location of engine - Cylinder arrangement - Construction details - Cylinder block - Cylinder head - Cylinder liners - Piston – piston rings - Piston pin - Connecting rod - Crankshaft - Valves. Lubrication system - Types - Oil pumps - Filters - Cooling system - Types - Water pumps - Radiators - Thermostats - Anti-freezing compounds.

UNIT - II

Ignition, fuel supply and emission control system: Ignition system - Coil and Magneto - Spark plug - Distributor – Electronic ignition system - Fuel system - Carburetor - Fuel pumps - Fuel injection systems - Mono point and Multi point – Unit injector – Nozzle types - Electronic Fuel Injection system (EFI) – GDI, MPFI, DTSI-Automobile Emissions - Source of formation – Effects on human health and environment - Control techniques - Exhaust Gas Recirculation (EGR) - Catalytic converter - Emission tests and standards (Indian and Europe)

UNIT - III

Transmission system: Clutches - Function - Types - Single plate, Multiple plate and Diaphragm Clutch – Fluid coupling - Gearbox - Manual - Sliding - Constant - Synchromesh - Overdrive – Automatic transmission - Torque converter - Epicyclic and Hydromatic transmission – Continuously variable transmission - Universal joint - Propeller shaft - Hotchkiss drive – Final drive - Rear axle assembly - Types -Differential - Need - Construction – Non-slip differential – Differential locks - Four wheel drive.

UNIT - IV

Steering, suspension and braking system: Principle of steering - Steering Geometry and wheel alignment - Steering linkages – Steering gearboxes - Power steering - front axle - Suspension system - Independent and Solid axle

– coil, leaf spring and air suspensions - torsion bar - shock absorbers – Wheels and Tires - Construction - Type and specification - Tire wear and causes - Brakes - Needs – Classification –Drum and Disc Mechanical - Hydraulic and pneumatic - Vacuum assist – Retarders – Anti-lock Braking System(ABS).

UNIT - V

Automobile electrical systems, instrumentation and advances in automobile engineering: Battery-General electrical circuits-Dash board instrumentation - Passenger comfort – Safety and security - HVAC - Seat belts - Air bags - Automotive Electronics - Electronic Control Unit (ECU) - Variable Valve Timing (VVT) - Active Suspension System (ASS) - Electronic Brake Distribution (EBD) – Electronic Stability Program(ESP) Traction Control System (TCS) - Global Positioning System (GPS) - X-by-wire - Electric - Hybrid vehicle.

TEXTBOOKS:

1. William.H.Crouse, Automotive Mechanics, 10/e Edition, McGraw-Hill, 2006.
2. David A. Corolla, Automotive Engineering: Powertrain, Chassis System and Vehicle Body, Butterworth-Heinemann Publishing Ltd., 2009.
3. Richard Stone, Jeffrey K. Ball, Automotive Engineering Fundamentals, SAE International, 2004.

REFERENCES:

1. Bosch, Automotive Hand Book, 6/e SAE Publications, 2007.
2. K. Newton and W. Steeds, The motor vehicle, 13/e Butterworth-Heinemann Publishing Ltd.
3. Kirpal Singh, Automobile Engineering, Vol.1&2, Standard Publications.