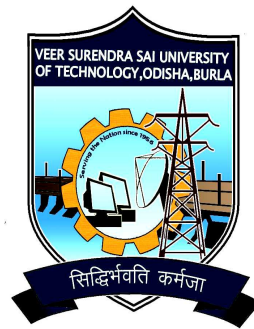# Course Structure & Syllabus

of

B.Tech Programme

in

Mechanical Engineering

(From the Session 2015-16)

VSSUT, BURLA

Course Struucture

1ST YEAR

FIRST SEMESTER				SECOND SEMESTER			
Theory		Contact Hrs.	CR	Theory		Contact Hrs.	CR
Course Code	Subject	L-T-P		Course Code	Subject	L-T-P	
	Mathematics - I	3 - 1 - 0	4		Mathematics - II	3-1-0	4
	Physics-I/ Chemistry-I	3 - 1 - 0	4		Chemistry-I/ Physics-I	3-1-0	4
	Engineering Mechanics/ Computer Programming	3 - 1 - 0	4		Computer Programming/ Engineering Mechanics	3-1-0	4
	Basic Electrical Engineering/ Basic Electronics	3 - 1 - 0	4		Basic Electronics/ Basic Electrical Engineering	3-1-0	4
	English for Communication/ Environmental Science	3 - 1 - 0	4		Environmental Science/ English for communication	3-1-0	4
Sessionals							
	Applied Physics Lab./Chemistry Lab	0 - 0 - 3	2		Chemistry Lab/Applied Physics Lab.	0-0-3	2
	Workshop-I/ Engineering Drawing	0 - 0 - 3	2		Engineering Drawing/ Workshop-I	0-0-3	2
	Basic Electrical Engg. Lab/ Basic Electronics Lab	0 - 0 - 3	2		Basic Electronics Lab/ Basic Electrical Engg. Lab	0-0-3	2
	Business Communication Skill/ Programming Lab	0 - 0 - 3	2		Programming Lab/ Business Communication Skill	0-0-3	2
		15-5-12	**28**			**15-5-12**	**28**

2ND YEAR

THIRD SEMESTER				FOURTH SEMESTER			
Theory		Contact Hrs.	CR	Theory		Contact Hrs.	CR
Course Code	Subject	L-T-P		Course Code	Subject	L-T-P	
	Mathematics-III	3-1-0	4		Mathematics-IV	3-1-0	4
	Mechanics of Solids	3-1-0	4		Machine Design-I	3-1-0	4
	Manufacturing Science and Technology-I	3-1-0	4		Materials Engineering	3-1-0	4
	Basic Thermodynamics	3-1-0	4		Fluid Mechanics	3-1-0	4
	Engineering Economics	3-1-0	4		Organization Behaviour	3-1-0	4
	Sessional/Lab				**Sessional/Lab**		
	Material Testing and Applied Mechanics	0-0-3	2		Machine Design Sessional-I	0-0-3	2
	Machine Drawing	0-0-3	2		Metallographic Study and Non Destructive Testing Lab	0-0-3	2
	Workshop Practice-II	0-0-3	2		Workshop Practice -III	0-0-3	2
	Thermal Engineering and Foundry Lab	0-0-3	2		Fluid Mechanics Lab	0-0-3	2
		15-5-12	**28**			**15-5-12**	**28**

3RD YEAR

FIFTH SEMESTER				SIXTH SEMESTER			
Theory		**Contact Hrs.**	**CR**	**Theory**		**Contact Hrs.**	**CR**
Course Code	**Subject**	**L-T-P**		**Course Code**	**Subject**	**L-T-P**	
	Machine Dynamics-I	3-1-0	4		Machine Dynamics-II	3-1-0	4
	Manufacturing Science Technology-II	3-1-0	4		Internal Combustion Engine and Gas Turbine	3-1-0	4
	Fluid Dynamics and Hydraulic Machines	3-1-0	4		Industrial Engineering and Operation Research	3-1-0	4
	Machine Design-II	3-1-0	4		Heat Transfer	3-1-0	4
	Metal Forming Processes	3-1-0	4		Core Elective	3-1-0	4
	Sessional/Lab				**Sessional/Lab**		
	Machine Design Sessional-II and Advanced Dynamics Lab	0-0-3	2		Heat Transfer Lab	0-0-3	2
	Metal Cutting and Metal Forming Lab	0-0-3	2		Mechanical Engineering Design Project	0-0-3	2
	Hydraulic Machines Lab	0-0-3	2		Product Design and Production Tooling	0-0-3	2
	Advanced Production Engineering Lab	0-0-3	2		Thermal Engineering Lab	0-0-3	2
		15-5-12	**28**			**15-5-12**	**28**

4TH YEAR

SEVENTH SEMESTER				EIGHTH SEMESTER			
Theory		**Contact Hrs.**	**CR**	**Theory**		**Contact Hrs.**	**CR**
Course Code	Subject	L-T-P		Course Code	Subject	L-T-P	
	Advanced Mechanics of Solid	3-1-0	4		Automobile Engineering	3-1-0	4
	Refrigeration and Air Conditioning	3-1-0	4		Mechanical Engineering Instrument and Control	3-1-0	4
	Metrology Quality Control and Reliability	3-1-0	4		Open Elective	3-1-0	4
	Core Elective	3-1-0	4				
	Open Elective	3-1-0	4				
Sessional/Lab				**Sessional/Lab**			
	Minor Project	0-0-3	2		Seminar	0-0-0	2
	Refrigeration and Air Conditioning Lab	0-0-3	2		Comprehenssive Viva	0-0-0	2
					Major Project	0-0-6	8
		15-5-6	**24**			**9-3-6**	**24**

Core Electives:

1. Operation Management

2. Advanced Manufacturing Technology

3. Tribology

4. Fatigue, Fracture and Creep

5. Power Plant Engineering

6. Non Conventional Energy

7. Mechanical Vibration

Open Electives:

1. Entrepreneurship

2. Industrial Management

3. Finite Element Method

4. Industrial Noise and Control

5. Turbomachinery

6. Computational Fluid Dynamics

SYLLABUS
FIRST & SECOND SEMESTER
(COMMON TO ALL BRANCHES)

PHYSICS – I (3 – 1 – 0)

Module I

Interference

Superposition of waves - coherent and incoherent superposition, Intensity distribution.

Two source interference theory, Interference in thin films. Newton's Rings, Determination of wavelength of light and refractive index of liquid.

Diffraction

Diffraction: Introduction, Types of diffraction ,Fraunhofer diffraction at a single slit,Plane Diffraction grating,Diffraction spectra, Determination of wavelength of light, angular dispersion, resolving power.

Polarization

Polarization: Introduction, Types of Polarization, Production of polarized light(elementary idea) Brewster's law, Malu's law, Double refraction(only statement, explanation), Construction and working of :Nicol prism, Half wave plate and Quarter wave plate, Application of polarization(Polrimeter:Construction,Principle,Working).

Module II

Electromagnetism

Vector Calculus : Gradient, Divergence, Curl of vector field, Gauss divergence theorem. Stoke's theorem, Green's theorem,Maxwell's electromagnetic equation in differential form and in integral form , Electromagnetic wave equation: in vacuum and in conducting medium. Pyonting vector ,Pyonting theorem, preliminary ideas about waveguides.

Module III

Quantum mechanics

Need for Quantum Physics, wave particle duality,Davisson Germer experiment, Schroedinger wave equation (time dependent and time independent), properties of wave function, Operators , eigen value , eigen function, expectation value, probability current, Simple applications: particle in a box, finite well, step potential and tunneling

Module IV

Lasers

Introduction, Characteristics of lasers, Einstein's coefficients & Relation between them, Lasing action, Population inversion, Different types of Lasers (Ruby Laser,He-Ne Laser), Three and Four level pumping schemes, Applications of LASER(elementary ideas)

Fiber optics

Introduction, Principle of wave propagation in Optical Fiber, Structure of Optical Fiber,Types of Optical Fibers, Acceptance angle and acceptance cone, Numerical aperture, Applications of optical fibers in communications

Nanomaterials

Introduction, Classification, Physical characteristics and applications (fundamental)

Text books:
1. Optics – A.K.Ghatak
2. Concepts of Modern Physics – A. Beiser

Reference Books:
1. Electricity & Magnetism – D. Griffiths
2. Quantum Mechanics – Gascirowicz
3. Lasers, theory and applications - K. Thyagarajan and A.K. Ghatak, New York :   Plenum Press.
4. Quantum Mechanics – M. Das and P.K Jena
5. An Introduction to Fiber Optics - A.Ghatak, K.Thyagarajan: Cambridge University Press.
6. .Nano Materials by B.Viswanathan,Narosa Book Distributer

List of Experiments

1. To Determine the Young's Modulus (Y) of the material of a Wire by Searle's Method.
2. Determination of Surface Tension of water by Capillary rise method.
3. Determination of Acceleration due to gravity by using a Bar Pendulum.
4. To determine thermal conductivity of a bad conductor by using Lee's Apparatus.
5. Determination of Wavelength of monochromatic light with the help of a Newton's Ring Apparatus.
6. Determination of Grating element of a Diffraction grating using spectrometer.
7. To verify the laws of transverse vibration of string by using sonometer.
8. To determine the Rigidity modulus of the material of a wire by using Barton's apparatus.
9. To draw the characteristics of a Bipolar Junction Transistor.
10. To draw the V-I characteristics of a P. N Junction diode.

CHEMISTRY – I (3 – 1 – 0)

Module–I 10 Hours

Failure of Classical Mechanics, Schrodinger's Wave Equation (Need not be Derived), Energy for 1-D Potential Box, Interaction of Wave with Matter
Fundamental of Microwave, IR, UV-Vis Spectroscopy:
Basic Concept of Spectroscopy, Selection Rule, Numericals, Frank-Condon Principle,

Module – II 10 Hours

Thermodynamics of Chemical Processes: 05 Hours
Concept of Entropy, Chemical Potential, Equilibrium Conditions for Closed Systems, Phase and Reaction Equilibria, Maxwell Relations

Module – III 10 Hours

Definition of Terms: Phase, Components, Degree of Freedom, Phase Rule Equation. Phase Diagrams: One Component Systems – Water and Sulphur, Two Component System – Lead-Silver, Cooling Curves, Iron-Carbon Phase Diagram

Module–IV 10 Hours

Electrode Potentials and its Relevance to Oxidation and Reduction, Measurement of EMF, Determination of pH, Hydrogen, Glass, Quinhydrone Electrodes, Dry Cells, Fuel Cells and Corrosion: Concept, Galvanic Corrosion
Kinetics of Chemical Reactions: 05 Hours
Reversible, Consecutive and Parallel Reactions, Steady State Approximation, Chain
Engineering application of materials: 05 Hours
Organometallics and Nanomaterials

1) P. W. Atkins, Elements of Physical Chemistry, 4th Edition, Oxford University Press
2) C. N. Banwell and E. M. MacCash, Fundamentals of Molecular Spectroscopy, 5th Edition,
3) P. K. Kar, S. Dash and B. Mishra, B.Tech. Chemistry Vol. I, Kalyani Publications

Chemistry Laboratory

(Any ten Experiments)

1. Determination of amount of sodium hydroxide and sodium carbonate in a Mixture.

2. Determination of Total hardness of water by EDTA method.

3. Estimation of calcium present in the limestone.

4. Preparation of aspirin.

5. Standardization of $KMnO_4$ using sodium oxalate.

6. Determination of ferrous iron in Mohr's salt by potassium permanganate.

7. Determination of Rate constant of acid catalyzed hydrolysis of ester.

8. Determination of dissolved oxygen in a sample of water.

9. Determination of Viscosity of lubricating oil by red wood Viscometer.

10. Determination of Flash point of given oil by Pensky Marten's Flash point Apparatus.

11. Determination of available chlorine in bleaching powder.

Reference Book: B.Tech practical Chemistry-Kalyani publisher

MATHEMATICS - I

Subject – Mathematics I (Calculus, Linear Algebra and Numerical Method) (3-1-0)

Module 1: (10 Lectures)
Open sets, Closed sets, Limit points of a set, Limits, Continuous functions, Functions continuous on closed intervals, The derivative, Increasing and decreasing functions, Darboux's theorem, Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Extremum values; Riemann integral: Definition and existence of the integral, Integral as a limit of sums, some integrable functions, Fundamental theorem of calculus, Mean value theorems for integral calculus.

Module 2: (10 Lectures)
Matrices, Vectors: Addition and Scalar Multiplication, Matrix Multiplication, Linear Systems of Equations, Gauss Elimination, Linear Independence, Rank of a Matrix, Vector Space, Solutions of Linear Systems: Existence, Uniqueness, Determinants, Cramer's Rule, Gauss-Jordan Elimination, Vector Spaces, Inner Product Spaces,

Module 3: (10 Lectures)
Eigenvalues, Eigenvectors, Some Applications of Eigenvalue Problems, Symmetric, Skew-Symmetric, and Orthogonal Matrices, Eigenbases, Diagonalization, Quadratic Forms, Complex Matrices and Forms, IncIusion of Matrix Eigenvalues, Power Method for Eigenvalues

Module 4: (10 Lectures)
Numerical methods in general, Introduction, Solution of Equations by Iteration, Interpolation, Numerical Integration and Differentiation

Text Books:
1) S.C. Malik and S. Arora, Mathematical Analysis, New Age International
2) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd

Chapters: S.C. Malik - 2(2.1- 2.3), 5(5.1-5.3), 6(6.1, 6.3-6.7), 7(7.1), 9(9.1, 9.6, 9.7, 9.9,9.10)
E. Kreyszig - 7(7.1-7.5, 7.7, 7.8,7.9), 8, 20 (20.7, 20.8), 19(19.1, 19.2, 19.3, 19.5)

Reference Books:
1) George B. Thomas , Jr. and Ross L. Finney, Calculus and Analytic Geometry, Addison Wesley Publishing Company
2) R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Taylor & Francis
3) K.A. Stroud, Advanced Engineering Mathematics, Industrial Press

MATHEMATICS - II

Differential Equations (3-1-0)

Module 1: (10 Lectures)
Basic Concepts, Modeling, Separable ODEs, Modeling, Exact ODEs, Integrating Factors, Linear ODEs, Bernoulli Equation, Population Dynamics, Existence and Uniqueness of Solutions. Homogeneous Linear ODEs of Second Order, Homogeneous Linear ODEs with Constant Coefficients, Euler-Cauchy Equations, Existence and Uniqueness of Solutions, Wronskian, Nonhomogeneous ODEs, Solution by Variation of Parameters.

Module 2: (10 Lectures)
General linear differential equations of order n, Differential Operators, Homogeneous Linear ODEs, Homogeneous Linear ODEs with Constant Coefficients, Nonhomogeneous Linear ODEs, Conversion of an nth-Order ODE to a System, Basic Theory of Systems of ODEs.

Power Series Method, Theory of the Power Series Method, Frobenius Method, Sturm-Liouville Problems, Orthogonal Functions.

Module 3: (10 Lectures)
Laplace Transforms, Laplace Transform, Inverse Transform, Linearity. s-Shifting, Transforms of Derivatives and Integrals, ODEs, Unit Step Function, t-Shifting, Short Impulses, Dirac's Delta Function, Partial Fractions, Convolution, Integral Equations, Differentiation and Integration of Transforms.

Module 4: (10 Lectures)
Partial differential equations, Basic Concepts, Modeling: Vibrating String, Wave Equation Solution by Separating Variables, Use of Fourier Series, D' Alembert's Solution of the Wave Equation. Characteristics, Heat Equation: Solution by Fourier Series, Solution of PDEs by Laplace Transforms.

Text Book:
1) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd, 9th edition.

Chapters: 1(1.1-1.5, 1.7), 2(except 2.4, 2.8, 2.9), 3, 4(4.1, 4.2), 5(5.1, 5.2, 5.4), 6(6.1-6.5), 12(12.1-12.5, 12.11)

Reference Books:
1) R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Taylor & Francis
2) K.A. Stroud, Advanced Engineering Mathematics, Industrial Press
3) J. Sinha Roy and S. Padhy, Ordinary and Partial Differential Equation, Kalyani Publisher.
4) Richard Bronsan and Gabriel Costa, Scahum's Outline of Differential Equations, McGraw Hill
5) Paul Duchateau and D.W. Zachmann, Scahum's Outline of Partial Differential Equations, McGraw Hill
6) B.V. Ramana, Higher Engineering Mathematics, McGraw Hill

English for Communication
(Credit: 4-0-0)

Objective- For developing the ability to communicate effectively in professional environment by enhancing their skills in communication.

Module 1:Fundamentals of Communication   (10 Hours)
- ❖ Communication:Process, pattern and stages of communication, channels and types of communication and Barriers to Communication.
- ❖ Functions of language: Descriptive, Expressive and Social Functions.
- ❖ Formal and Informal English
- ❖ Plain English
- ❖ Bias free language

Module 2: Communicative Grammar (10 Hours)
- ❖ Time, Tense and Aspects
- ❖ Verbs of State and Events
- ❖ Use of Modal Verbs
- ❖ Phrasal Verbs
- ❖ Passive and Active Voice
- ❖ Conditionals

Module 3: Sounds of English (10 Hours)
- ❖ The Speech Mechanism and Organs of Speech
- ❖ ConsonantSounds of English
- ❖ Vowel Sounds of English
- ❖ Stress Pattern: Syllable, Stress and Intonation.
- ❖ Problem sounds for Indian Speakers

Module 4: Business and Official Writing (10 Hours)
- ❖ Paragraph writing and Sentence Linker
- ❖ Business and Official Letters
- ❖ Report and Proposal writing,
- ❖ Notice, Circular and Memo writing
- ❖ Résumé (CV) Writing.

Text Books:

1. Effective Technical Communication by M Ashraf Rizvi (Tata McGraw Hill)
2. Better English Pronunciations By J. D.O Conner (Cambridge University Press)
3. A Communicative Grammar of English by G.N. Leech and Jan Svartik (OUP)

Reference Books: "Business communication" by Ramachandran, Lakshmi and Krishna (Macmillan)

ENGLISH COMMUNICATION SKILLS (Credit :0-0-2)

Objective: For enhancing corporate readiness among students by inculcating several skills of communication through activities.

Laboratory Activities:

1. **Giving Introduction (Self and others)**
2. **Group Discussion**
3. **Interviews**
4. **Role Play**
5. **Listening skill Development**
6. **Reading skill Development**
7. **Writing skill Development**
8. **Speaking skill Development**
9. **Meeting**
10. **Presenatation**

Books Recommended:

1. Soft Skills – By Dr K Alex (S Chand)

ENGINEERING MECHANICS

Module - I

1. **Concurrent forces on a plane**: Composition, resolution and equilibrium of concurrent coplanar forces, method of moment, friction (chapter 1). (7)

2. **Parallel forces on a plane**: General case of parallel forces, center of parallel forces and center of gravity, centroid of composite plane figure and curves(chapter 2.1 to 2.4) (4)

Module - II

3. **General case of forces on a plane**: Composition and equilibrium of forces in a plane, plane trusses, method of joints and method of sections, plane frame, principle of virtual work, equilibrium of ideal systems.(8)

4. **Moments of inertia**: Plane figure with respect to an axis in its plane and perpendicular to the plane, parallel axis theorem(chapter 3.1 to3.4, 5.1, appendix A.1 to A.3) (3)

Module - III

5. **Rectilinear translation:** Kinematics, principle of dynamics, D Alembert's Principle, momentum and impulse, work and energy, impact (chapter 6). (11)

Module – IV

6. **Curvilinear translation:** Kinematics, equation of motion, projectile, D Alembert's principle of curvilinear motion. (4)

7. **Kinematics** of rotation of rigid body (Chapter 9.1) (3)

Text book:

1. Engineering Mechanics: S Timoshenko & Young; 4th Edition (International edition) Mc Graw Hill.

Reference books:

1. Fundamental of Engineering mechanics (2nd Edition):
   S Rajesekharan & G Shankara Subramanium; Vikas Pub. House Pvt ltd.

2. Engineering mechanics: K.L. Kumar; Tata MC Graw Hill.

SESSIONAL

Workshop Practice-I
(Consists of 3 sections) **:**

1. Carpentry Section: Wooden rack/bench/chair/stool (any one)
2. Fitting Section: Paper Wt. Square or Rectangular joint (male and female joint) (any one)
3. Black Smith Section : Weeding hook/Hexagonal headed bolt blank (any one)

COMPUTER PROGRAMMING

L-T-P: 3-1-0   **Cr.-4**

Module I:

Introduction to computing- Block architecture of a computer, bit, bytes, memory, representation of numbers in memory. Introduction to problem solving- Basic concepts of an algorithm, program design methods, flowcharts.C Language Fundamentals- Character set, Identifiers, Keywords, Data Types, Constant and Variables, Statements.Input &Output - Input & Output Assignments, Formatted Outputs. Operatorsand Expressions-Operators, Precedence of operators.

Module II:

Decision Control Structure, Loop Control Structure and Case Control Structure.Functions-Monolithic vs Modular programs, User defined vs standard functions, formal vs Actualarguments, Functions category, function prototypes, parameter passing, Recursion.Arrays- 1D Array, 2D Array & Multi-Dimensional Array. Strings- Declaration &Initialization,String Handling Functions.

Module III:

Pointers- Pointer variable and its importance, Pointer Arithmetic, Passing parameters, pointer to pointer, pointer to function.Dynamic Memory Allocation.Structure- Nested Structure, Array of Structures, Pointer to Structure, Structure & Functions, typedef, Enumerated Data Type, Bit Fields. Union- Array of Union Variables, Union inside Structure.Storage Class.

Module IV:

Preprocessor Directives- Types, Pragma Directives, Conditional Directives.Files- Reading data from Files, Reading data from Files, Writing data to Files, Error Handling during File Operations.Advanced Issues in Input & Output – using *argc*&*argv*.Operation on Bits.

Text Books:

1. C: The Complete Reference: Herbert Schildt
2. Computer Fundamentals &Programming in C: ReemaThareja, Oxford University Press.

Reference Books:

1. Let us C- Y.Kanetkar, BPB Publications.
2. Programming with ANSI and Turbo C- Kamthane, A.N. Pearson Education
3. C How to Program- Deitel and Deitel, Pearson Education.
4. The C programming Language- Brian W. Kernighan and Dennis M. Ritchie,Prentice-Hall.

PROGRAMMING LAB (CS15-984)

L-T-P: (0-0-3)   **Cr:** 2

Introduction to OS : Linux/Unix, Dos, Windows, Vi editor, File Handling, Directory Structure, File Permissions, Creating and editing simple c programs, Compilation and Execution
C programming on variables and expression assignment, simple arithmetic loops, If-else, Case statements, Break, Continue, Go to
Single and Multidimensional arrays
Functions, Recursion, File handling in C
Pointers, address operator, Declaring pointers and operators on pointers, Address of an array, Structures, Pointer to structure, Dynamic memory allocation
Fundamental Programs on Data Structures (Stack, Queue, Linked lists, Trees, Graphs)

(EL15-002) BASIC ELECTRICAL ENGINEERING (3-1-0)

MODULE-I (10 HOURS)

DC Networks: Kirchhoff's laws, node and mesh analysis, Delta-star and star-delta transformations. Superposition, Thevenin's and Norton's theorem. Transients, in R-L, R-C and R-L-C circuits with DC. Excitation.

Single Phase AC Circuits: Single phase EMF generation, average and effective values of sinusoids, j-operations, complex representation of impedances, phasor diagrams, power factor, power in complex notation, solution of series and parallel circuits. Introduction to resonance in series RLC circuit.

Three Phase AC Circuit: Three phase EMF generation, delta and star connection, Line and Phase quantities. Solutions of 3-phase circuits with balanced load. Power in 3-phase balanced circuits.

MODULE-II (10 HOURS)

Magnetic Circuits: B-H Curve, Hysteresis, Permeability and reluctance, solution of simple magnetic circuits, Hysteresis and Eddy current losses.

DC Generator: Different types, Principle of Operation of DC generator, EMF equation, methods of excitation. DC Motor: Back e.m.f., speed and torque of a DC Motor, Conditions for maximum Power. Speed control of DC shunt motor.

Transformers: Construction and Principle of operation of single-phase transformer, EMF equation, Single-phase autotransformer.

MODULE-III (10 HOURS)

Three phase Induction Motor: Construction and principle of operation, types; Slip-torque characteristics.

Synchronous Machines: Construction & principle of operation of Synchronous generator and motor. EMF equation, Voltage regulation, Applications and starting of Synchronous motor.

Introduction to single-phase induction Motor.

MODULE-IV (10 HOURS)

Measuring Instruments: DC PMMC instruments, Extension of range by shunts and multipliers. Moving iron ammeters and voltmeters, Dynamometer type Watt meters, Induction type Energy Meter.

Power supply systems: Principle of generation - thermal, hydel and nuclear. Transmission and distribution of electric energy. Introduction to Electric Heating & Welding.

TEXT BOOKS

[1]. Edward Hughes (revised by Ian McKenzie Smith), "Electrical & Electronics Technology", Pearson Education Limited. Indian Reprint 2002, 10th Edition.

[2]. D.Kulshreshtha, " Basic Electrical Engineering" TMH, 1st Edition.

REFERENCE BOOKS

[3]. H.Cotton, "Advanced Electrical Technology", CBS Publishers, New Delhi, 7th Edition.

[4]. C.L. Wadhwa, "Electrical Engineering", New Age International Publishers, 2nd Edition.

[5]. S. Parker Smith, "Problems in Electrical Engineering", Asia Publications, 10th Edition.

(EL15-003) BASIC ELECTRICAL ENGINEERING LAB (0-0-3)

1. Preliminary: Preparation of symbol chart for various systems & components as per ISS, To study the constructional & operational features for Voltmeter, Ammeter, Wattmeter, Frequency meter, multi-meter and Rheostat, Study of safety rules as per ISS

2. Measurement of the armature & field resistance of D.C. Machine by volt-amp method. & Starting and speed control of a D.C. shunt motor

3. Study of BH Curve

4. Determination of open circuit characteristics (O.C.C) of D.C shunt generator when separately excited at different speeds.

5. Measurement of earth resistance and insulation resistance

6. Starting of Induction motor and measurement of three phase power & power factor by 2-wattmeter method.

7. Calibration of a single phase Energy Meter by directed loading & Phantom loading

BASIC ELECTRONICS (3-1-0)

UNIT-1   **(10 Hours)**

Introduction to Electronics: Signals, Frequency Spectrum of Signals, Analog and Digital Signals, Linear Wave Shaping Circuits: RC LPF, Integrator, RC HPF, Differentiator.

Properties of Semiconductors: Intrinsic, Extrinsic Semiconductors, Current Flow in Semiconductors,
Diodes: p-n junction theory, Current-Voltage characteristics, Analysis of Diode circuits, Rectifiers, Clippers, Clampers, Special diodes- LED, Photo diode, Zener Diode.

UNIT-II **(14 Hours)**
Bipolar junction Transistor (BJTs): Device Structure and Operation, Current-Voltage Characteristics, BJT as an Amplifier and as a Switch, Introduction to Power Amplifiers, A,B and C types.
JFET: Physical Structure, Operation and Characteristics MOSFET: Physical Structure, Operation and Characteristics, Feedback Amplifiers & Oscillators: General Feedback Structure, Properties of Negative Feedback, Four Basic Feedback Topologies (block diagram only), Basic Principles of Sinusoidal Oscillators(Crystal, Hartley & Collpit).
Operational Amplifiers (OP-AMPs): The Ideal OP-AMP, Inverting Configuration, Non-Inverting Configuration. OP-AMP Applications (Adder, Subtractor, Integrator, Differentiator).

UNIT-III **(10 Hours)**
Digital Fundamentals: Binary Numbers, Signed-binary numbers, Decimal-to-Binary & Binary-to-Decimal Conversion, Binary Addition, Subtraction, Multiplication and Division, Hexadecimal Number Systems, Logic Gates, Boolean Algebra, De Morgan's Theorems, Laws of Boolean Algebra, RS Flip flop, JK Flip flop.

UNIT-IV **(10 Hours)**
Introduction to Electronic Instruments: CRO: CRT, Waveform Display, Applications of CRO, Electronic Multimeter, Audio Signal Generator: Block diagram, Front Panel Controls.
Principles of Communication: Fundamentals of AM & FM, Block diagram of Transmitters & Receivers.

TEXT BOOKS:

1. Microelectronics Circuits, A.S Sedra, K.C. Smith, Oxford University Press. Selected portions from chapters 1 to 3, 5, 8, 13.
2. Electronics Fundamentals and Applications, D Chattopadhyay and P.C. Rakshit, NewAge International Publications. Selected portions from chapters 4 to 12,14, 16 to 18,20,21.

REFERENCE BOOKS:

1. Integrated Electronics, Millman and Halkias, TMH Publications.
2. Electronic Devices & Circuit Theory, R.L Boylestad and L. Nashelsky, Pearson Education.

BASIC ELECTRONICS LAB
LIST OF EXPERIMENTS

1. Familiarity with electronic components and devices(Testing of semiconductor diode, Transistor, IC Pins connection) Digital multimeter should be used.

2. Study and use of CRO to view waveforms and measure its Amplitude and Frequency.

3. V-I Characteristics of a Semiconductor Diode. Determining DC and AC resistance.
4. Clipper and Clamper Circuit.
5. Half Wave and Full Wave Rectifier without Capacitor filter. Record of Waveforms, Measurement of Average and RMS value.
6. V-I (Output) Characteristics of N-P-N Transistor in CE Configuration.
7. OP-AMP: Inverting and Non-Inverting Configuration. Record of Waveforms.
8. Verification of Truth table of Logic gates (AND, OR,NOT, NAND, NOR, EX-OR)

CE 15001: ENVIRONMENTAL SCIENCE & ENGINEERING (3-1-0) CR-04

Module – I   **(6 Hours)**

Components of Earth System: Lithosphere, Cryosphere, Atmosphere, Hydrosphere, Biosphere and Outer space.

Ecological concepts and natural Resources: Ecological perspective and value of environment, Environmental auditing, Biotic components, Levels of organizations in environment Ecosystem Process: Energy, Food chain, Environmental gradients, Tolerance levels of environmental factor.

Natural Resources covering Renewable and Non-renewable Resources, Forests, water, minerals, Food and land (with example of one case study); Energy, Growing energy needs, energy sources (conventional and alternative).

Hydrological cycle, water balance, energy budget, precipitation, infiltration, evaporation and evapotranspiration.

Module – II (15 Hours)

Environmental Pollution: Definition, Causes, effects and control measures of: Water pollution, Air pollution, Noise pollution, Soil pollution, Marine pollution, Thermal pollution, Nuclear hazards

Environmental Issues: Climate change, Global warming, Acid rain, Ozone layer depletion, Sustainable development, Bio gas, Natural gas, Biodiversity, Urban problems related to energy, water scarcity, Water conservation, rain water harvesting, artificial recharge, watershed management, carbon trading, carbon foot print

National Ambient Air quality Standards, Noise standards, Vehicle emission standards

Module – III (12 Hours)

Drinking water standard (IS 10500), Water Quality Criteria and wastewater effluent standards

Water treatment: Water sources and their quality, Lay out of a water treatment plant and working of each unit/ principles of each process i.e. Screening, Aeration, Sedimentation, coagulation, flocculation, Filtration, Disinfection. Miscellaneous treatment: Removal of color, tastes and odour control, removal of iron and manganese, fluoridation and defloridation. Advanced water treatment: Ion exchange, electro-dialysis, RO, desalination

Working principles of ready-made water filter/purification system commercially available

Lay out of a wastewater treatment plant and working of each unit.

Module – IV (7 Hours)

Solid waste management: Source, classification and composition of MSW, Storage and transport of MSW, MSW management, Waste minimization of MSW, Reuse and recycling, Biological & thermal treatment (principles only), land fill

Biomedical Waste management – sources, treatment (principles only) and disposal

Hazardous Waste Management- Introduction, Sources, Classification, treatment (principles only)

Introduction to e-waste management.

Environmental impact Assessment: Project screening for EIA, Scoping studies

Environmental policies and acts (Air, Noise, Water, Forest, E-waste, Hazardous waste acts).

Text Book:

1 Environmental Engineering, G. Kiely, TMH, 2007

Reference Books:

1 Environmental Engineering, H.S. Peavy, D.R.Rowe and G. Tchobanoglous, McGraw Hill, 1985.

2   Introduction to Environmental Engineering, M. L. Davis and D. A Cornwell, McGraw Hill International, 2005.

CE 15002: ENGINEERING DRAWING (0-0-3) CR-02

(Minimum 8 sheets and 2 Auto Cad classes)

Introduction to Engineering Drawing: Drawing instruments, lines, lettering and dimensioning.

Scales: Plain, Diagonal and Vernier Scales.

Curves: Parabola, Ellipse, Hyperbola, Cycloid, Epicycloid, Hypocycloid and Involute.

Orthographic Projections: Concepts, Orthographic projections of points, Lines, Planes and Solids.

Sections of solids; Development of surfaces

Isometric Projections: Principles, Isometric Scale, Isometric Views, Isometric Views of lines, Planes, Simple and compound Solids,

Introduction to Auto-Cad:

Curves: Parabola, Ellipse, Hyperbola, Cycloid, Epicycloid, Hypocycloid and Involute.

Text Book:

1   Engineering drawing by N.D. Bhatt and V.M Panchal, Charotar Publishing House, Anand.

Reference Books:

1. Engineering Drawing by Venugopal, New Age publisher.

THIRD SEMESTER

MATHEMATICS - III

Multivariable Calculus and Special Functions (3-1-0)

Module 1: (10 Lectures)

Vector and Scalar Functions and Fields, Derivatives, Gradient of a Scalar Field, Directional Derivative, Divergence of a Vector Field, Curl of a Vector Field; Line Integrals, Path Independence of Line Integrals, Double Integrals, Green's Theorem in the Plane, Surfaces for Surface Integrals, Surface Integrals, Triple Integrals, Divergence Theorem of Gauss, Further Applications of the Divergence Theorem, Stokes's Theorem.

Module 2: (10 Lectures)
Fourier series and integral, Dirichlet criterion, Parseval's identity, the convolution theorem.

Module 3: (10 Lectures)
Orthogonal curvilinear coordinates, Jacobians, gradient, divergence, curl and Laplacian in curvilinear coordinates, Special curvilinear coordinates.

Module 4: (10 Lectures)
Gama function, The Beta function – Dirichlet integral; Other special functions– Error function, exponential integral, sine and cosine integrals, Bessel's Equation, Bessel Functions J (x), Bessel Functions of the Second Kind Y   (x), Legendre's Equation, Legendre Polynomials $P_n(x)$.

Text Books:
1) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd
   Chapters: 5(5.3, 5.5, 5.6), 9(9.4, 9.7, 9.8, 9.9), 10, 11(11.1-11.3, 11.6, 11.7), A3.4, A3.1

Reference Books:
1) S.C. Mallik and S. Arora, Mathematical Analysis, New Age International
2) Milton Abramowitz and Irene A. Stegun, *Handbook of Mathematical Functions*, National Bureau of Standards, Applied Mathematics Series - 55
3) **Yury A. Brychkov, Handbook of Special Functions: Derivatives, Integrals, Series and Other Formulas, CRC Press**
4) R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Taylor & Francis
5) K.A. Stroud, Advanced Engineering Mathematics, Industrial Press

Mechanics of Solids

Module – I (10 Hours)

1. Definition of stress, stress tensor, normal and shear stresses in axially loaded members.

Stress & Strain :- Stress-strain relationship, Hooke's law, Poisson's ratio, shear stress, shear strain, modulus of rigidity. Relationship between material properties of isotropic materials. Stress-strain diagram for uniaxial loading of ductile and brittle materials. Introduction to mechanical properties of metals-hardness, impact.

Composite Bars In Tension & Compression:-Temperature stresses in composite rods – statically indeterminate problem. (10)

Module – II (10 Hours)

2. **Two Dimensional State of Stress and Strain**: Principal stresses, principal strains and principal axes, calculation of principal stresses from principal strains.Stresses in thin cylinder and thin spherical shells under internal pressure , wire winding of thin cylinders.

3. **Torsion** of solid circular shafts, twisting moment, strength of solid and hollow circular shafts and strength of shafts in combined bending and twisting. (10)

Module – III (12 Hours)

4. **Shear Force And Bending Moment Diagram**: For simple beams, support reactions for statically determinant beams, relationship between bending moment and shear force, shear force and bending moment diagrams.

5. **Pure bending** theory of initially straight beams, distribution of normal and shear stress, beams of two materials.

6. Deflection of beams by integration method and area moment method. (12)

Module – IV (8 Hours)

7. Closed coiled helical springs.

8. **Buckling of columns :** Euler's theory of initially straight columns with various end conditions, Eccentric loading of columns. Columns with initial curvature. (8)

Text Books-:
1. Strength of materials by G. H. Ryder, Mc Millan India Ltd.,
2. Elements of Strength of Materials by S.P. Timoshenko and D.H. Young, East West Press Pvt. Ltd.,

Ref. Books:-
1. Introduction to solid mechanics by H. Shames, Prentice Hall India, New Delhi
2. Engineering mechanics of solid by E. P. Popov, Prentice Hall India, New Delhi
3. Engineering physical metallurgy, by Y. Lakhtin, MIR pub, Moscow.

Manufacturing Science & Technology – I (M)

A. **Casting Processes**:

Module – I (12 Hours)

1. **Sand Casting Process**: Introduction, pattern-types, materials, allowances, moulding sand-composition, properties, testing; Core: core material (core sand), properties of core materials, types of core, core prints, chaplets, moulding types, moulding procedures, gating system: gates, riser, design of gating system for simple casting shape, Melting and furnaces for ferrous and non ferrous metals: Basic idea in cupola, induction furnace and Electric arc furnace, Charge calculation. Degasification, Solidification and Cooling of casting.   (12)

Module – II (8 Hours)

2. **Special Casting Processes** : Continuous casting process , Precision Investment casting process , Centrifugal casting process , Die casting , Shell mould casting , Permanent mould casting , Pressure casting process , Squeeze casting . Casting cleaning, Casting defects and remedial measures, Inspection of casting.

B. Welding and Cutting Process:

Module – III (12 Hours)

3. **Fusion Welding**: Principles of welding, brazing, soldering and adhesive bonding, Physics of welding, Types of welded joints, Joint design preparation.

    Oxyfuel gas welding: Fuel gases, Types of flames, Welding equipments, Welding techniques.

    Electric arc welding: Principle of arc, Arc welding, Arc welding equipments, Electrodes, Manual metal arc welding, Carbon arc welding.

    TIG and MIG welding, Submerged arc welding, Plasma arc welding, Electro-slag welding, Thermit welding, Resistance welding, Electron beam welding, Laser beam welding, Under water welding, Diffusion Bonding.

    Introduction to brazing, soldering and adhesive Bonding.Welding defects & testing, weldability of metal, Welding safety

    Cutting: Oxyfuel gas cutting, Arc cutting, Plasma cutting

Module – IV (8 Hours)

4. **Introduction to Conventional Machining Processes:** Turning, Methods of screw production, Drilling, Boring, Milling, Gear Manufacturing, Production of flat surfaces, Grinding and finishing processes**.**

Text Books:

1. Manufacturing Technology Vol-I, (Foundry Forming and Welding), P. N. Rao, 3rd edition TMH
2. Manufacturing Technology Vol-II, P. N. Rao , 3rd edition TMH

Reference Books:

1. Principle of Metal Casting, R. W. Heine, C. R. Loper, P. C. Rosenthal , 2nd edition TMH
2. Welding and Welding technology, R. L. Little , TMH
3. Welding Engg. & Technology, R. S. Parmar, Khanna Pub.
4. Manufacturing Engineering & technology, S. Kalpakjain, S. R.Schmid , 4th Low Price Edition

Basic Thermodynamics

Module – I (8 Hours)

1. **Basic Concepts**:- Thermodynamics system and surrounding, state, properties, processes and cycles. Thermodynamic equilibrium and Quasi-static processes.

2. **Properties of a Pure Substance**: The pure substance and its Phase change process, property diagram and thermodynamic table, Ideal gas equation of state, P-V-T behavior of low and moderate density gases

Module – II (10 Hours)

1. **Work and Heat**: Definition of Work, Moving boundary work for simple compressible system, Definition of Heat and modes of heat transfer, Comparison of Heat and Work

2. **First Law of Thermodynamics**: - First law for a closed system undergoing a cycle and undergoing a change of state. Internal energy as system properties. Enthalpy a thermodynamic property, Internal energy, enthalpy and specific heats of ideal gases. Application of first law to different thermodynamic processes. First law of thermodynamics for a control volume and its application to steady and variable flow processes

Module – III (16 Hours)

3. **Second Law of Thermodynamics**: - Heat engine, Refrigerators and Heat Pumps, second law of thermodynamics, Equivalence of Kelvin-Plank and Clausis statements, Reversible and irreversible processes. Carnot cycle and its proposition. Thermodynamic temperature scale

4. **Entropy and second Law analysis for a Control volume**: The Inequality of Clausius, Entropy: a property of a system. Entropy change of a control mass in reversible and irreversible processes, Entropy change for solid, liquid and ideal gases. Entropy Generation and principle of increase of entropy

5. **Available Energy, Availability and Irreversibility**: Available energy, Reversible work and irreversibility, Availability and second Law efficiency, Exergy balance equation

Module – IV (6 Hours)

6. **Thermodynamic property relations**: The Maxwell relations, The Clapeyron equation

7. **Gas Power Cycles**: Basic considerations in power cycle analysis. Air standard assumptions. Otto, Diesel and Brayton cycles,

Text Book:

1. Fundamentals of Thermodynamics by Sontag,Borgnakke,Van Wylen. Willey Publisher.

2. Thermodynamics by P K Nag, Publisher: TMH

Reference Book:

1. Thermodynamics, An Engineering Approach by Cengel and Boles. Publisher:Mc Grawhill

2. Thermodynamics by Moran and Sapiro Publisher: Willey

ENGINEERING ECONOMICS

Module I (10 Hours)

Theory of Demand: Modern Utility Theory, The Neumann-Morgenslern Approach, The Friedman-Savard Hypothesis, Uncertainty and Consumer Behaviour,Expectedvalue of Perfect Information, Revealed Preference Theory,Intertemporal Choice Slutsky Equation, Annual Economic Worth, Present Value, Discount Rate-IRR and NPV.

Module II (10 Hours)

Profit Maximization: Theory of Production-Laws of Production, Returnto Scale and Variable Proportions, Equilibriumof Firm, and Choice of Optimal Combination of Factors, Cost Minimization-Calculus Analysis of Cost Minimization, Average and Marginal Cost-The Short Run Cobb-Douglas Cost Function. Constant Returns to Scale and cost functions, long run and short run cost curves-factor prices and cost functions, the envelop Theorem for Constrained Optimization, Cost Control Techniques, Critique of The Principle Of Profit Optimization And Modern Theories of Firms-Baumol'sSales Maximization Hypothesis, MonisModel of Managerial Enterprise, Hall And Hitch Report and Full-Cost Pricing Principle, Bain's Limit Pricing Theory.

Module III (10 Hours)

Analysis of Public Projects: Benefit-Cost Analysis, Public Goods,Private Goods, Common Property, Free Rider Problem, Market Failure and Externalities, Private And Social Cost,Social Welfare Functions- Welfare Maximization and Pareto Optimality, Market Responses to Externalities-Mergers, Social Conventions, Property Right And Bargaining Coase Theorem.

Module IV (10 Hours)

Linear Models: Simple Regression Model the Problem and Estimation, Classical Normal Linear Regression Model, Two Variable Regression-Interval Estimation and Hypothesis Testing; MultipleRegression Analysis-The Problem of Estimation, Dummy Variable Regression Models, Multiple Parameter Sensitivity Analysis, Linear Programming-Graphic and Simplex Method; Game Theory-The Pay-Off Matrix of Game, Nash Equilibrium, The Mixed Strategies and The Prisoner's Dilemma.

Text Books:

1. Varian,H.R.(1992). Introduction to Micro Economic analysis, Norton and Company, New York.
2. Wooldridge, J.M.(2009) Introductory Econometrics-A Modern Approach, South Western CENGAGE learning.
3. Pearce,D.W. and Turner(1990) Economics of Environment and Natural Resources, Harvester Wheatsheaf, New York.
4. Damodaran, S.(2012) Managerial Economics, Second Edition, OUP

Materials testing and Applied Mechanics lab

A. Materials testing lab

1. Determination of tensile strength of ductile material using UTM.

2. Determination of hardness number of different materials using Rockwell hardness testing machine.

3. Ericson cupping test and impact test for 3different specimen.

4. Fatigue Test of a given specimen

B. Applied Mechanics

1. Determination of rigidity modulus of a given wire .

2. Dermination of M.I of a fly wheel.

3. Study of Epicyclic gear train.

4. Determination of mechanical advantage & velocity ratio of various lifting machines .

Machine Drawing (10 sheets)

Screw threads,Screwed fastening,Keys,Cotter joints,Knuckle joints, Rivetted joints,Flange coupling,Engine parts,Introduction to computer graphics, computer aided drawing.

Workshop Practice –II

Foundry shop : 1. Sand casting with core

2. Study of cupola and other furnaces

Welding shop : 1. Gas welding & Arc welding with small job.

2. Study of MIG,TIG & spot welding

3. Brazing & soldering practices

Thermal engineering and Foundry Lab.

A. Thermal engineering:

1. Study of IC engine (cut model).
2. Study of Cochran Boiler.
3. Load test on Rusten Diesel Engine.
4. Performance test on two stage reciprocating air Compressor.

B. Foundry :

1. Determination of Grain Fineness Number (GFN) of a given moulding sand .

2. Determination of permeability number and compressive strength of a given moulding sand.

3. Determination of clay content of given moulding sand.

4. Determination of moisture content of given moulding sand.

FOURTHE SEMESTER
Mathematics IV
(Complex Analysis, and Probability and Statistics) (3-1-0)

Module 1: (10 Lectures)
Complex Numbers, Complex Plane, Polar Form of Complex Numbers, Powers and Roots Derivative, Analytic Function, Cauchy-Riemann Equations, Laplace's Equation, Exponential Function, Trigonometric and Hyperbolic Functions, Logarithm, General Power; Line Integral in the Complex Plane, Cauchy's Integral Theorem, Cauchy's Integral Formula, Derivatives of Analytic Functions

Module 2: (10 Lectures)
Sequences, Series, Convergence Tests, Power Series, Functions Given by Power Series, Taylor and Maclaurin Series, Laurent Series, Singularities and Zeros, Residue Integration Method, Residue Integration of Real Integrals, Geometry of Analytic Functions: Conformal Mapping, Linear Fractional Transformations.

Module 3: (10 Lectures)
Random Variables, Probability Distributions, Mean and Variance of a Distribution, Binomial. Poisson, and Hypergeometric Distributions, Normal Distribution

Module 4: (10 Lectures)
Introduction. Random Sampling, Point Estimation of Parameters, Confidence Intervals, Testing of Hypotheses, Fitting Straight Lines, Correlation and regression.

Text Book:
1) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd

Chapters: 13, 14, 15(except 15.5), 16, 17(except 17.5), 24(24.5-24.8), 25(25.1-25.4, 25.9)

Reference Books:
1) B.V. Ramana, Higher Engineering Mathematics, McGraw Hill
2) R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Taylor & Francis
3) K.A. Stroud, Advanced Engineering Mathematics, Industrial Press

Machine Design-I (M)

(Data Books are allowed)

Module – I **(10 Hours)**

1. **Introduction to machine design**: Stages in design , standardization interchangeability, strength, rigidity, engg. materials, ferrous, nonferrous ,Indian standard specification for ferrous materials, allowable stress, factor of safety.(10)

Module – II (10 Hours)

2. **Design of joints**: Revetted , welded and bolted joints based on different types of loading , illustrative problems with solutions. Design of cotter joints with socket and spigot, with a gib , design of knuckle joint.(12)

Module – III (10 Hours)

3. **Design of shaft** : Solid and hollow shaft based on strength and on rigidity design of key and pins, design of couplings-only protective type of solid flange coupling . (8)

Module – IV (10 Hours)

4. **Design of Spring** : Helical, leaf springs.

5. Design of belt, rope chain drives and screw jack . Illustrative problems with solutions.(10)

Text books:

1. Machine Design by P.C. Sharma,D.K.Agrawal–Kataria And Sons

2. Mechanical Engg. Design by J.E.Shigley and I.C Mitchelle-–TMH

3. Any data book

Reference book:

1. Elements of machine design by Pandya & N.C.E Shah

Materials Engineering

Module – I

1. Classification of engineering materials, Basic concepts on structure of metals and alloys, Properties of engineering materials.

2. Mechanism of Crystallization, Defects in crystalline materials, plastic deformation by slip and twining. Effects of cold working on properties, Review of strengthening methods.

Module - II

3. **Constitutions of Alloys**:-Pure metal, Intermediate alloy phase, solid solution: Substitutional and interstitial.

4. **Phase Diagram**:-Binary phase diagram, phase diagram rules, iron-carbon equilibrium diagram, phase transformation in iron-carbon system.

Module - III

5. **Heat Treatment of Steels:** Structure and properties of common engineering materials, Annealing: different types of annealing, Normalizing, Hardening: Tire Temperature Transformation (TTT) diagram, different cooling curves and transformation on continuous cooling, Tempering, sub-zero treatment of steel, Defects due to heat treatment.
    (7)

6. **Surface Hardening of Steels**:-Induction hardening, Flame hardening, Case hardening: Carburizing, Nitriding, Cyaniding, carbonitriding, Diffusion coating.

Module - IV

7. **Introductory Ideas On Ferrous Alloys**:-Steel and cast iron-basic differences, Effect of alloying elements on the properties of steels, general classification of steels : carbon steels-types, Alloys steels-nickel steel, chromium steel, manganese steel, wear resistant steel, Corrosion resistant steels, Stainless steels, Tool steels, Steel designation, Cast Iron: types of Cast Irons.

8. **Nonferrous Alloys**:-Plastics, Ceramics, Composite materials, common applications of various materials.

Text Books:

1. Material Science and Engg, V. Raghvan, 5th Edition, PHI.

2. Introduction to Physical Metallurgy, S. H. Avner, 2nd Edition, TMH.

Reference Books:

1. Engineering Physical Metallurgy, Y. Lakhtin, MIR Pub, Moscow.

2. Material Science and Engg, W. D. Callister Jr. 6th Edition, , John Wiley & Son

3. Introduction to Material Science for Engineers, J. F. Shackleford, 3rd Ed, PHI.

4. Foundation of Materials Science and Engineering, W. F. Smith 2nd Ed., TMH.

Fluid Mechanics

Module – I

1. **Introduction and Fundamental Concepts**: Definition of a fluid, Scope of fluid mechanics, Basic equations and methods of analysis, Fluid as a continuum, Physical properties of fluids: Viscosity Newtonian and Non Newtonian Fluids, Surface Tension, Vapor pressure, Velocity field: One, two and three dimensional Flows, Path lines, streamline and streak line, Stress field., Classification of fluid motion: Viscous and Inviscid flows, Laminar and Turbulent Flows, Compressible and incompressible flows.

2. **Fluid Statics**: Basic equation of fluid statics, Manometers, Hydrostatic force on plane and curved submerged surface, Centre of pressure, Buoyancy, Stability of immersed and floating bodies, Fluid masses subjected to uniform acceleration, Free and Forced vortex.

Module - II

3. **Basic equations in Integral form for a Control Volume:** Relation of system Derivatives to the control volume formulation, Conservation of mass, Momentum equation for inertial and non inertial control volume, The angular momentum principle and its application.

4. **Differential Analysis to Fluid Motion:** Conservation of mass, Motion of a fluid element(Kinematics):Stream function for two dimensional incompressible flow and concept of flow net, Fluid Translation, Fluid Rotation and fluid deformation, Vorticity vector: Concept of rotational and irrotational flow. Navier stokes equation in 2 D Cartesian coordinate system (No Derivation).

Module – III

5. **Incompressible Inviscid flow:** Euler's equations of motion, Bernoulli equation: Integration of Euler equation along a streamline, Derivation using rectangular coordinates,Static,dynamic and stagnation pressure, Limitation of Bernoulis equation, kinetic energy correction factor, Relation between the first law of Thermodynamics and the Bernoulli equation.

Module - IV

6. **Flow through pipes (Incompressible Flow)**: Laminar and turbulent flows in pipes- Hydraulic mean radius, Concept of friction loss, Darcy-Weisbach equation- Moody's diagram, Flows in sudden expansion and contraction, Minor losses in fittings, Branched pipes in parallel and series, Transmission of power, Water hammer in pipes, Sudden closure condition.

7. **Measurements**: Pitot tube, Venturimeter, Orifice meter, Notches and weir, Hook Gauge

Text Book:

1. Fluid Mechanics: Som & Biswas, TMH Publisher.

Reference Book:

1. Introduction to Fluid Mechanics by Fox & McDonald, Willey Publisher.

2. Fluid Mechanics by F.M White, McGrawHill Publisher

ORGANISATIONAL BEHAVIOUR

Module-1

OB: Learning objectives, Definition & Meaning, Why to study OB, An OB model, New challenges for OB Manager

LEARNING: Nature of learning, How learning occurs, Learning & OB

Case Study Analysis

Module-2

PERSONALITY: Meaning & Definition, Determinants of Personality, Personality Traits, Personality & OB

PERCEPTION: Meaning & Definition, Perceptual process, Importance of Perception in OB

MOTIVATION: Nature & Importance, Herzberg's Two Factor theory, Maslow's Need Hierarchy theory, Alderfer's ERG theory

Case Study Analysis

Module-3

COMMUNICATION: Importance, Types, Barriers to communication, Communication as a tool for improving Interpersonal Effectiveness

GROUPS IN ORGANISATION: Nature, Types, Why do people join groups, Group Cohesiveness & Group Decision Making- managerial Implications, Effective Team Building

LEADERSHIP: Leadership & management, Theories of leadership- Trait theory, Behavioural Theory, Contingency Theory, Leadership & Followership, How to be an Effective Leader

CONFLICT: Nature of Conflict & Conflict Resolution

TRANSACTIONALANALYSIS: An Introduction to Transactional Analysis

Case Study Analysis

Module-4

ORGANISATIONAL CULTURE: Meaning & Definition, Culture &Organisational Effectiveness

HUMAN RESOURCE MANAGEMENT: Introduction to HRM, Selection,Orientation,Training& Development, Performance Appraisal, Incentives

ORGANISATIONAL CHANGE: Importance of Change, Planned Change & OB Techniques

INTERNATIONAL OB: An Introduction to Individual & Interpersonal Behaviour in Global Perspectives

Case Study Analysis

Machine Design sessional-I

Design and drawing of:

1. A pressure vessel. 2. Bolted joint. 3. Welded joint. 4. Cotter joint. 5. Knuckle joint.
6. Flexible coupling. 7. Screw jack.

Metallographic Study & Non Destructive Testing Lab

A. Metallographic Study :

1. Sample(mild steel and cast iron) preparation .

2. Microstructure study of a steel specimen using metallographic microscope.

3. Microstructure study of a cast iron   specimen using metallographic microscope.

B.   ND Testing :

1. Flaw detection by ultrasonic method.

2. Flaw detection by Eddy Current method.

3. Detection of surface defect by magnetic particle test

4. Detection of surface defect by liquid penetration method

Workshop Practice –III

1. **Turning shop** : A suitable job preparation with thread cutting and taper turning operations

2. **Machine shop** : Operation of different machines such as milling, shaper, planner

Slotter , gear hobbing , surface grinder & radial drilling m/c

FIFTH SEMESTER

Machine Dynamics-I (M)

Module - I

1. **Mechanisms**: Basic kinematic concepts & definitions, mechanisms, link, kinematic pair, degrees of freedom, kinematic chain, degrees of freedom for plane mechanism, Gruebler's equation, inversion of mechanism, four bar chain & their inversions, single slider crank chain, double slider crank chain & their inversion.

Module - II

2. **Kinematics analysis**: Determination of velocity using graphical and analytical techniques, instantaneous centre method, relative velocity method, Kennedy theorem, velocity in four bar mechanism, slider crank mechanism, acceleration diagram for a slider crank mechanism, kleins construction method, rubbing velocity at pin joint, coriolli's component of acceleration & it's applications

Module - III

3. **Inertia force in reciprocating parts**: Velocity & acceleration of connecting rod by analytical method, pison effort, force acting along connecting rod, crank effort, turning moment on crank shaft, dynamically equivalent system, compound pendulum, correction couple, friction, pivot & collar friction, friction circle, friction axis

4. **Friction clutches**: Transmission of power by single plate, multiple & cone clutches, belt drive, initial tension, Effect of centrifugal tension on power transmission, maximum power transmission.

Module - IV

5. **Brakes & dynamometers**: Classification of brakes, analysis of simple block, band & internal expanding shoe brakes, braking of a vehicle, absorbing & transmission dynamometers, prony brakes, rope brakes, band brake dynamometer, belt transmission dynamometer & torsion dynamometer

6. **Gear trains**: Simple trains, compound trains, reverted train & epicyclic train

Text Book :

1. A text book of theory of machine by R.K Bansal & J.S. Brar, Laxmi Publication Pvt.Ltd.

Reference Books :

1. Theory of machines, by S.S Ratan,TMH

2. Theory of machine by Thomas Bevan, TMH

Manufacturing Science & Technology-II (M)

Module - I

1. Classification of Machining Processes, Tool Materials, Types of Tools- Single Point and Multipoint, Tool Geometry and Nomenclature: ASA, ORS, NRS System, Effect of Tool Geometry and Effect of Machining Variables on Machining .

2. Mechanism of Chip Formation, Shear deformation and shear plane Types of Chips, Factors Involved in Chip Formation, Effect of Cutting Variables on Chip Reduction Co-Efficient.

Module - II

3. **Force System in Turning**: Merchants circle diagram, velocity relationship and Resenberg relationship, stress in conventional shear plane. Energy of cutting process, restricted cutting, Ernst and merchant angle relationship, measurement of forces – dynamometers for measuring turning and drilling forces.

Module - III

4. Evaluation of Machinability, Mechanism of Tool Wear, Tool Life, Taylors Tool Life Equations, Determination of Optimum Cutting Speed In Machining, Thermal Aspects of Machining, Chip-Tool Interface Temperature, Cutting Fluids. Economics of machining.

5. **Jigs and Fixtures**:- Principle, type of Turning, Milling fixture and Drilling, Boring Jigs, Principles of Location and Clamping, Tool Guidance.

Module - IV

6. Design of Single Point Cutting Tool, Form Tool (Graphical Method) and Broach tool.

7. **Non Conventional Machining Processes:** Principle, Process and application of AJM, EDM, ECM, LBM and USM.

8. **Computer control manufacturing system**: Basic CAD and CAM, CNC, DNC, FMS, Automation and Robotics.

Text Books:

1. Metal Cutting Theory and Practice, A Bhattacharya, New Central Book Agency.
2. Machining and Machine Tools, A B Chattopadhyay, Wiley-India Publication.

Reference Books:

1. Manufacturing Technology Metal Cutting and Machine Tools, P N Rao, TMH.
2. Metal Cutting Principles, M C Shaw, CBS Publication.
3. Manufacturing science, A Ghosh, A K Mallik, EWP PVT LTD
4. A Textbook of Production Engineering, P C Sharma, S Chand Publications.
1. CNC Technology & Programming, Tilak Raj, Dhanpat Rai Publication.

Fluid Dynamics & Hydraulics Machines (M)

Module - I

1. **Dimensional Analysis and Principles of Model Testing**: Dimensional homogeneity, Dimensional analysis, Rayleigh's method and Buckingham Theorem. Similarity laws and model studies. Distorted models.

2. **Navier stokes equation and its solution**: Derivation and its exact solution to plane and circular Couette flow, fully developed flow between infinite parallel plates, axial flow though circular pipe and annulus

Module - II

3. **Boundary layer theory:** Boundary layer growth over a flat plate. Boundary layer thickness, Nominal thickness, displacement thickness, momentum thickness and energy thickness, laminar and turbulent boundary layer, Momentum integral equation using momentum principle. Boundary Layer Separation and its control.

4. **Drag and lift** : Drag and lift coefficient, pressure drag and friction drag on stream lined body and bluff body. Drag over flat plate. Profile drag. Drag characteristics of sphere, cylinder and disc Circulation and lift on a circular cylinder, magnus effect. Circulation and lift on an Airfoil

Module - III

5. **Hydraulic Turbines**: Classification of turbines, Different heads and efficiencies of turbines, Study of Pelton , Francis and Kaplan Turbines, Specific speed and unit quantities, performance of turbines, Governing of turbines, Cavitations in reaction turbines, Principles of similarity applied to turbines

Module - IV

6. **Centrifugal Pump**: Principle, classification, pressure changes in a pump .Velocity vector diagrams and work done, minimum speed of pump to deliver liquid, multistage pumps. Similarity Relations and specific speed. (3)

7. **Reciprocating pump**: Principle of working, slip, work done, effect of acceleration and frictional resistances, separation, air vessels.(3)

8. **Miscellaneous machines** : Hydraulics - Intensifier , ram, coupling, press, accumulator & Air injection pump(3)

Text Books:

1. Fluid Mechanics & Hydraulics Machines –By:Modi and Seth, Standard Book House

2. Introduction to Fluid Mechanics & Fluid Machines – By S. K .Som & G .Biswas, TMH Pub. (p) Ltd

Reference Books :

1. Dixon, S. L. *Fluid mechanics and thermodynamics of turbo machinery*: Butterworth

2. Fluid Mechanics & Hydraulic Machines- By Dr.R.K.Bansal Laxmi   Pub.(p) Ltd.)

Machine Design-II (M)

(Data books are allowed)

Module - I

1. **Theories of failure**: Application of theories of failure to practical problems, dynamic stresses and stress concentration, design of machine members based on fatigue consideration, (Soderberg and Goodman criteria) notch sensitivity, S. C. F.

Module - II

2. **Design of engine components**: Cylinders, piston, connecting rod, flywheel, crank shaft and valve

Module - III

3. **Design of transmission components**-: clutches(friction and centrifugal type), straight and helical spur gears, bevel gears and worm gears

Module - IV

4. Design of journal bearings based on hydrodynamic theory of lubrication, types of ball and roller bearing, dynamics and static load rating, selection of ball and roller bearings, properties of lubricants, viscosity and oiliness

Text Books:

1. Machine design, P. C. Sharma and D. K. Agrawal, Kataria & Sons

2. Machine Design, P. Kannaiah; Scitech Publications

3. Any Machine Design data book

Metal Forming Processes (M)

Module - I

1. **Introduction**: Principle of plastic deformation and yield criteria, Fundamental of hot and cold working processes, Effect of strain rate on forming process.
2. **Forging**: Open die forging, Drop forging, Press forging, Load estimation in forging, Forging design, allowances, die design for drop forging, design of flash and gutter, Upset forging die design, forging defects and inspection.

Module - II

3. **Rolling**: Principle of rolling, Rolling stand arrangement, Rolling load calculation, Roll passes, Flat rolling, Pipe rolling, Defects in rolled products.
4. **Extrusion**: Forward and backward extrusion, Hydrostatic Extrusion, Extrusion Forging, Load estimation in extrusion, Extrusion of tubes, Calculation of force in hot extrusion, Effect of Extrusion Variables, Extrusion Defects.

Module - III

5. **Drawing:** Wire drawing, Rod and tube drawing, Drawing forces, Drawing defects.
6. **Sheet Metal Forming and bending:** Sheet metal working-shearing, blanking piercing, deep drawing operation. Die design for sheet metal operations, progressive and compound die, strippers, stops, strip layout. Principle of bending, Spring back effect, Coining.

Module – IV

7. **Advanced forming processes:** High energy rate forming, explosive forming, electro hydro forming, electromagnetic forming, rubber die forming.
8. **Powder Metallurgy Forming Process:** Method of Powder production, Powder characteristic analysis, Powder annealing, Precompaction studies, Cold compaction Studies, Sintering and sintering atmosphere, Post sintering operations (coining, infiltration, hot forging etc.) Hot and cold iso-static pressing, Properties of P/M products and applications.

Text Books:

1. Manufacturing Technology, P. N. Rao Vol. 3   3rd Edition, TMH Publication
2. Manufacturing Engineering and Technology, S. Kalpakian, S. Schimid, Pearson Publication

M/c Design sessional -II and Advanced Dynamics lab

A. M/C Design Lab

1. Problems for practice on theories of failure.

2. Problems for practice on fatigue failure.

3. Design of clutches.

4. Design of spur gear.

5. Design of spiral and bevel gear.

6. Design of crank piston and cylinder.

7. Design of connecting rod and shaft.

8. Design of journal bearing.

B. Advanced Dynamics lab

1. Determination of Torque & Brake Power using brake dynamometer.

2. Performance characteristics of spring loaded Governer.

3. Determination of critical speed of a rotating shaft.

4. Determination of Natural frequency under damped vibration (Torsional vibration).

Metal cutting & Metal forming Lab.

A. Metal Cutting Lab:

1. Determination of surface roughness of 3 diffferent specimen using Taylor Hobsons Talysurf.

2. Determination of cutting forces during turning operation using force dynamometer.

3. Determination of thrust and torque using drill tool dynamometer.

4. Demonstration of spinning operation.

B. Metal forming lab:

1. Comparison of loads in forward and backward extrusion processes.
2. Determination of load variations with different extrusion ratios.
3. Experiment on deep drawing.
4. Determination of friction factor in ring/disc compression test.

Hydraulic Machines Lab

1. Expt. On Reciprocating pump

2. Expt. On hydraulic ram

7. Pelton Turbine with generator loading.

8. Franci's Turbine with generator loading.

Advanced Production Engg. Lab

A. Nonconventional Machining Processes

1. Expt. on EDM
2. Expt. on USM.
3. Expt. on AJM
4. Expt.on on ECM

SIXTH SEMESTER

Machine Dynamics-II (M)

Module – I

1. **Toothed Gears**: Theory of shape and action of tooth properties and methods of generation of standard tooth profiles, standard proportion , interference and undercutting, methods for eliminating interference ,minimum number of teeth to avoid interference

2. **Gyroscope**: Gyroscopic couple, plane disc, analysis of forces on bearing due to forced precession of rotating disc mounted on shaft, gyroscopic effect on a two wheel and a four wheel vehicle ,gyroscopic stabilization

Module - II

3. **Cams**: Simple harmonics, constant velocity and acceleration types, displacement, velocity and acceleration of follower ,cams with specified contours

4. **Governors**: Centrifugal governors – Watt and Porter governors ,spring loaded governors - Hartnell governors , sensitiveness ,stability isochronism, hunting , governer effort and power ,curves of controlling force , effect of friction

Module - III

5. **Balancing**: Balancing of revolving masses in one plane and different planes ,partial balancing of single cylinder ,engine balancing of multicylinder engine ,v and radial engine ,methods of direct and reverse cranks(5)

6. **Dynamics Of Machine**: Turning moment diagram ,flywheel

Module - IV

7. **Vibration** : Introduction to vibration, causes of vibration, elimination of vibration, types of vibration – longitudinal, transverse , torsional ; definition of terminology like natural frequency, amplitude , time period , free vibration, forced vibration, resonance, degree of freedom with examples , calculation of natural frequency of undamped single degree of freedom system by Newton's 2nd Law, D-Alembert's principle and energy method, Equivalent spring constant for the system having different types of combination of springs and calculation of their natural frequencies , calculation of natural frequency of single degree of spring – mass system taking mass of spring into account

Text Books:

1. Theory of Machines by S S Ratan , TMH
2. Theory of machine by R K Bansal,Laxmi Pub. Pvt. Ltd.,

Reference Books:

1. Mechanism of Machine theory by Rao and Dulchipati, New Age Publication
2. Theory of Mechanism and Machine by Ghosh and Mallick ,East West Press

Internal Combustion Engine & Gas Turbines (M)

Module - I

1. Introduction: Classification of I.C engines, working cycles, comparison of Two stroke &four stroke engines, Comparison between SI & CI engines

2. Fuel combustion &Fuel injection: Structure & composition of I.C engine fuel, Fuel rating Properties of fuel, Fuel additives and non petroleum fuels .Fuel air requirement for ideal normal operation, maximum power & quick acceleration, simple carburettor & it's draw back. Practical carburettor, petrol injection. Requirements & type of diesel injection system, fuel pump, injectors &nozzles

Module - II

3. Ignition &combustion in I.C Engines: Battery, Magneto & Electronic ignition systems, Ignition timing, spark advance mechanism. Stages of SI engine combustion, Effect of engine variables on ignition lag flame front propagation. Abnormal combustion, preignition & detonation, Theory of detonation, Effect of engine variables on detonation, Control of detonation. Requirement of good combustion chambers for SI engines. Stages of CI engine combustion. Effect of engine variables on delay periods. Diesel Knock & methods of control in CI engine combustion chambers.

Module - III

4. Testing and performance : Power ,Fuel and air measurement methods, performance of SI.
    and CI. Engines, Characteristic curve, Variables affecting performance and methods to improve engine performance.

5. Cooling and Lubricating Systems, Engine Emission & Controls : Air cooling and Water cooling system,Effect of cooling on power output & efficiency, properties of lubricants & tyres of lubricating system engine emission & it's harmful effect. Methods of measuring pollutants and control of engine emission

Module - IV

6. Gas turbines: Introduction, open & closed cycle gas turbines, Constant volume &constant pressure cycles. Thermodynamic analysis of ideal basic cycle with regeneration reheat & intercooling, Analysis of ideal basic cycle considering actual losses. Application of gas turbine

Text Books:

1. A course in I.C. Engines-By –Mathur and Sharma ,Dhanpat Rai & Sons.
2. Gas Turbines-V.Ganesan, TMH

Reference Books:

1. A Text book of Internal Combustion Engines – R.K. Rajput , Laxmi Pub.(P) Ltd.

2. Internal Combustion Engine Fundamentals – J.B.Heywood, Mc.Grow Hill

Industrial Engineering & Operation Research (M)

Module - I

1. **Production Planning & Control**: Definition & Objectives, Aggregate Planning, Materials Requirement Planning, Routing, Scheduling, Machine Loading Using Johnson's Rule, Dispatching.

2. **Inventory Control**: Introduction, Relevant Costs, Basic EOQ Model, Models with Quantity Discount, Economic Batch Quantity, Periodic and Continuous Review System for Stochastic System, Safety Stock, Re-Order Point and Order Quantity Calculation, ABC Analysis.

Module - II

3. **Project Management**: Project Management through PERT / CPM, Network Construction, CPM, Network Calculation, Crashing of Project Network, Project Scheduling with Limited Resources, Line-Of-Balance.

4. **Modern Management System**: ISO-9000 Series, Poke a Yoke, Kaizen, Kanban, Quality Circle JIT, TQM.

Module - III

5. **Linear Programming**: Mathematical formulation of the problem, graphical solution method, general linear programming problem.

6. **Simplex & Duplex Method**: Simplex method, introduction, fundamental properties of solution, computational procedure, concept of duality in simplex method, dual simplex algorithm.

Module - IV

7. **Transportation Problem**: Initial basic feasible solution, transportation table moving towards optimality, degeneracy in transportation problem.

8. **Assignment & Routing Problem**: Assignment problem, assignment algorithm, routing problems.

9. **Queueing Theory**: Introduction, classification, simple queueing model.

Text Books:

1. Industrial Engineering & Production Management, M Mahajan, Dhanpat Rai Publication.

2. Operation Research by Kanti Swaroop, P K Gupta, Manmohan, S Chand & Sons.

Heat Transfer (M)

Module - I

1. I**ntroduction**: Modes of heat transfer, basic laws of heat transfer , combined heat transfer mechanism, analogy between flow of heat and electricity, Unit and dimension

2. **Conduction**: Derivation of three dimensional Fourier conduction equation in Cartesian coordinates, transformation of Fourier equation into polar coordinates. One dimensional steady state conduction through slab, cylinder, sphere and composite medium, critical insulation thickness. Effect of variable thermal conductivity. Heat transfer through rectangular and pin fins. Fin effectiveness and fin efficiency. Solution of fin equation for different boundary condition. Effect of fin on heat flow, Fin arrangements. Solution of fin problems using numerical techniques. Introduction to two dimensional steady state heat conduction. Analytical method for solving two dimensional heat conduction problems

Module - II

3. **Convection**: Hydrodynamic and thermal boundary layer for laminar flow over a flat plate. Integral solution of boundary layer equation for laminar flow over a plate. Heat transfer for laminar flow in tubes. Mechanism of heat transfer in turbulent flow, Reynolds analogy. Laminar free convection boundary layer equation for flow over a vertical plate and approximate solution of these equations. Dimensional analysis applied to forced and free convection

Module - III

4. **Empirical correlation** : Correlation for external flow – laminar and turbulent. Correlation for heat transfer to liquid metals. Correlation for free convection heat transfer

5. **Boiling and Condensation**: Film and drop wise condensation Nusselt's theory of laminar film condensation, pool boiling regimes, nucleate boiling, film boiling , peak heat flux, Rohsenow correlation for nucleate boiling

Module - IV

6. **Radiation**: Basic theories of radiant heat transfer. Black body and monochromatic radiation, total emissive power. Stephen Boltzmann law. Grey body. Kirchhoff's law. Wien's displacement law.
Radiation between two black bodies, shape factors for simple geometries, radiation between two grey bodies, electrical network method for solving radiation problems, radiation shields

7. Heat exchangers: Types of heat exchangers, Overall heat transfer coefficient. Fouling factor, logarithmic mean temperature difference, effectiveness, Number of Transfer Units , heat exchanger design.(5)

Text Book:
1. Heat transfer by J.P. Holman, TMH (P) Ltd.

Reference Book :
1. Fundaments 0f Heat and Mass Transfer by R. C. Sachdeva (New Age International (P)Ltd.
2. Heat transfer- A basic approach by M. Niyati, Ozisik, MC Graw Hills.

Heat Transfer Lab.

1. Heat balance in Rusten Diesel Engine(single cyl.)
2. Morse test on BMC Petrol Engine
3. Study of modern Carburator
4. Study of fuel Injection system
5. Load test on variable compression ratio engine
6. Load test on variable injection pressure
7. Study of steam turbine plant.
8. Study of power transmission system in automobile.

Mechanical engineering Design Project

Product Design & Production Tooling

1. Design of single point cutting tool
2. Design of broach tool.
3. Design of form tool
4. Design of press tool
5. Design of limit gauges
6. Design of forging dies
7. Design of press tool
8. Design of deep drawing dies
9. Design of drilling jig
10. Production Process planning

SEVENTH SEMESTER

Advanced Mechanics of Solids

Module – I

1. Elementary concept of elasticity: stresses in three dimension, equation of equilibrium & compatibility

2. Thick walled cylinder: Thick cylinders subjected to internal and external pressures, compound thick cylinder

Module - II

3. Energy method based on strain energy due to bending: Strain energy due to axial load, bending moment & twisting moment, principle of virtual work, castiglianos theorem

4. Maxwell's theorem of reciprocal relations. Unit load and unit couple method for determining deflection and slope.

Module - III

5. Curved beam: Bending of beam with large initial curvature, stess distribution in beam with rectangular, circular, trapezoidal cross section, stresses in crane hooks, ring & chain links

Module - IV

6. Unsymmetrical bending: Properties of beam cross section , slope of neutral axis, stresses & deflection in unsymmetrical bending, shear centre

7. Advanced topics in strength of materials: Repeated stresses & fatigue in metals, concept of stress, concentration, notch & stress concentration factor, concept of creep

Text Books:

1. Advanced Mechanics of Materials by Seely & Smith , John Wiley, New york

2. Advanced Mechanics of Solids by L.S.Srinath,TMH.

Reference Book:

1. Advanced mechanics of materials, Kumar and Ghai, Khanna pub.

Refrigeration and Air-Conditioning

UNIT –I (Refrigeration):

Module - I

1. **Air Refrigeration Cycles** :Introduction, Units of Refrigeration, Coefficient of performance of a refrigerator, Open air refrigeration cycle, Closed or Dense air Refrigeration cycle. Air Refrigerator Working on Reversed carnot cycle. Air Refrigerator working on Belt Coleman cycle.(5)
2. **Vapour Compression Refrigeration System** :Analyis of Theoretical vapour Compression cycle, Representation of the cycle on P-H, T-S and P-V diagrams, Simple Saturation Cycle, Sub-cooled cycles and Superheated cycle. Effect of suction and discharge pressure on performance. Actual Vapour compression Cycle.

Module - II

3. **Compound Vapour Compression Refrigeration Cycle** : Introduction, Methods of improving C.O.P – Optimum Interstage Pressure for Two-Stages Refrigeration System. Single load systems, Multi load systems with single Compressor, Multiple Evaporator and Compressor systems. Dual Compression systems
4. **Vapour Absorption Refrigeration Systems** : Introduction, simple vapour Absorption system. Practical Vapour Absorption System. Advantages of Vapour Absorption sytem over vapour compression system. Coefficient of Performance of an Ideal Vapour Absorption Ref. System. Electrolux(Ammonia-Hydrogen) Refrigerator, Lithium Bromide Absorption Refrigeration System

Module - III

5. **Refrigerants** : Introduction, Desirable properties of an Ideal Refrigerant. Classification of Refrigerants, Designation System of Refrigerants, Properties of Refrigerants, Uses of Important Refrigerants, Secondary Refrigerants – Brine

UNIT-II (Air Conditioning)

Module - IV

1. Psychrometry and Psychrometric properties, psychrometric Relations, Psychrometric chart, Psychrometric processes. Adiabatic mixing of two air streams. Requirements of Comfort Air-Conditioning : Requirements of comfort Air-Conditioning, Thermodynamics of Human Body, The body defence, Effect of heat on work performance, Comfort and Comfort chart, Effective Temperature.

   Air Conditioning Systems: Process in Air-Conditioning, Summer,Winter and Year Round Air-Conditioning, Cooling Load Calculations, Design of Air-Conditioning Systems

Text Book :

1. A course in Refrigeration and Air-Conditioning By S.C. Arora and S. Domkundwar, Dhanpat Rai Sons.

Reference Books :

1. Refrigeration and Air Conditioning by P.L. Balany, Khanna Pub.
2. A text book of Refrigeration and Air-conditioning by R.S. Khurmi and J.K. Jai, S.Chand & Co.

Metrology, Quality Control and Reliability

Module – I

Introduction:

1. Need of Inspection, Sources of errors, Basic types of errors, precision and accuracy. Method of estimating accuracy and precision, standard and their evolutions.
2. **Simple measurement tools**: Rules, Callipers, Height gauges, Micrometers, Depth gauge, Dial indicator, slip gauges, sine bar, Comparators: Allignment tests.

Module - II

3. **Limit, fits and tolerance and Gauge Design**: Basic concepts of limit fits and tolerance, Interchangeability and selective assembly, ISO system of tolerance, Taylor's principle of gauge design, Gauge design–Basic design rules for plug and ring gauges
4. **Interferrometers**: Types of light sources and interferometers, Types of scale and grading, Optical flats

Module - III

5. **Screw Thread Measurement**: Standard thread profiles, Effective diameter, Measurement of effective diameter by 2 wires and 3 wires methods. Best wire size.
6. **Surface Roughness**: Source of surface Irregularities in manufacturing. Roughness and waviness RMS and CLA values, Measurement of surface roughness using Taylor Hobson's Talysurf, CMM

Module - IV

7. **Statistical Quality Control**: Frequency distribution, Process capability, Variables and Attributes. Control charts (X & R charts) for variables, Control chart for attributes (p, np and C charts). OC curve, Single and Double sampling plan
8. **Reliability**: Definition, Relationship of Reliability with maintainability and availability, Failure data analysis –Bath tub curve, System reliability, Reliability improvement

Text Books:

1. Engg. Metrology, R. K. Jain, Khanna Publication
2. A text book of Metrology, M. Mahajan, Dhanpat Rai and co Pvt Ltd.

Reference Books:

3. Statistical Quality Control, M. Mahajan, Dhanpat Rai and co Pvt Ltd.
4. Reliability Engg. L. S. Srinath, East West press

Minor project

Different small projects on thrust areas to different groups of students.

RAC lab.

1. Study of Ice plant.
2. Determination of COP of refrigerator tutor.
3. Study of psychrometric process in AC tutor.
4. Study of domestic refrigerator.

EIGHTH SEMESTER

Automobile Engineering

Module - I

1. **Introduction:** Main units of automobile , chassis and body , different system of automobiles , descriptions and materials of main parts of the engine , cylinder head , cylinder block, cylinder liner, crank case, piston , piston rings, piston pin, connecting rod, crank shaft, bearing, valve, valve driving mechanism . Impulse and mechanical balancing of engine .

2. **Power Propulsion :** Resistance to motion, rolling resistance , air resistance, gradient resistance , calculation of power required for propulsion, tractive effort and traction, road performance curves.

Module - II

3. **Clutch:** Types of clutch , Material and construction of clutch , Calculation of main dimension of dry friction clutch . Fluid coupling and its characteristics .

4. **Gearbox:** Sliding mesh ,Constant mesh and synchromesh gearboxes . Design of three speed and four speed gear boxes . Epicyclic gear box . Torque convertor and its characteristic , principle of automatic transmission ,Transfer case .

Module - III

5. **Hooke's joint** , Propellor shaft , Differential , Rear axle , Types of rear axle, semifloating ,three quarter floating and full floating types . Different types of rear axle drives , Hotch kiss and torque tube drive

6. **Braking System:** Hydraulic braking system , Braking of Vehicle when applied to rear , front and all four wheels . Theory of internal shoe brake , Servo and power brakes

Module - IV

7. **Front wheel geometry and steering system:**Camber , Castor ,Kingpin indicator .Toe-in ,Centre point steering , condition for true rolling , Akerman and Davis steering ,components of steering mechanism,Power steering

8. **Suspension System :** Introduction , functions and requirement of suspension system, element of suspension system. Springs, Damper, types of suspension system, wheels and tyres.

9. **Electrical and Electronic system of automobile :** Starting system and starting drive , Generating system ,Igniting system and their electrical sysyem . Recent advances in automotive electronic such as multipleying , sensors and actuators engine and drive line controls , information systems , electronic display Relay , Switching and inter connector and Instrumentation .

Text book:

1. Automobile Engg. By R.K. Rajput, S.Chand
2. Automobile Mechanics (through problem) by Dr.N.K. Giri, Khanna Pub.

Ref. Book:

1. The motor vehicle by Newton & Steed, London Liffee Books Ltd.
2. Automobile Engg. By K.M.Gupta.l, Vol.I & II, Umesh Pub

Mechanical Engineering Instrumentation & Control

Module - I

1. **Introduction :** The significance of mechanical measurement ,basic detector transducer elements : Electrical transducer , Sliding contact devices ,Variable-inductance transducer elements ,the differential transformer, variable-reluctance transducer , capacitive transducer , The piezoelectric effect, Photo electric transducers . Intermediate modifying system : Electrical intermediate modifying devices , input circuitry , The simple current sensitive circuit , the ballast circuit , the voltage dividing potentiometer circuit , Resistance bridges .   Terminating Devices and Methods : Introduction , Meter indicators , CRO, Oscillographs

Module - II

2. **Strain Measurement :** The electrical resistance strain gauge , The metallic resistance strain gauge, circuitry ,metallic strain gauge . The strain gauge ballast circuit ,the strain gauge bridge circuit, Temperature compensation

3. **Temperature Measurement** :   Use of bimetals pressure thermometers , Thermocouples , Pyrometry , Calibration of temperature measuring devices

Module - III

4. **Measurement of Pressure :**   Pressure measurement systems , Pressure measurement transducer, Gravitational transducer ,Electric transducers ,Elastic diaphragms , Secondary transducer used with diaphragms ,strain gauge pressure cells , measurement of high pressure , measurement of low pressures, calibration methods

5. **Measurement of Fluid Flow** :   Flow characteristic obstruction meters , obstruction meters for compressible fluids , The variable area meter , calibration of flow measurement devices .

Module - IV

6. **Control System**: Description of open and closed loop control system and their block diagrams use of block diagrams , Use of block diagram and signal flow graph to find overall transfer function , 1st and 2nd order systems and their response to step and sinusoidal input , error analysis , static and dynamic error coefficients , Routh's stability criterion, Polar plot, Nyquist plot, gain margin and phase margin .

 Text books ;

1. Mechanical Measurements , T.G. Beckwith and M.Lewis Buck , Oxford & IBH Publishing co.
2. A course in Mechanical Measurements and Instrumentation   by   A.K. Sawhney , Puneet Sawhney
3. Modern control Engineering   , K.K. Ogata , Prentice Hall India .

Seminar

Individual student has to deliver a seminar talk of either on field training or on advanced technical topic.

Comprehensive viva voce

At the end of semester, a viva voce is to be conducted in the presence of a field expert, external and internal examiners from academic..

Major project

Different projects on thrust areas to different groups of students.

Core Electives

Operation Management

Module – I

1. **Organization**: definition, system approach, essential elements of good organization, structure of organization, line, staff and functional organization.

2. **Forms Of Business Organization**: types of ownership, individual, partnership, joint stock, cooperative public sector, private sector.

Module - II

3. **Productivity**: definition, importance, productivity and production, measurement of productivity, productivity index, productivity improvement procedure.

4. **Forecasting**: definition, basic types, objectives, methods of forecasting, advantages and limitations.(5)

Module - III

5. **Facilities Location and Design**: Factors Influencing Plant and Warehouse Location, Impact of Location on Cost And Revenues, Layout Types, Process, Product, Fixed Position, CRAFT, workplace design, working conditions: Noise, Illumination

6. **Design of Products & Services:** Design of Products, Services and Products, Life Cycle, Product Development and Design, Product Vs Service Design of Service, Value Engineering, Value Analysis for Cost.

7. **Capacity Planning**: Plant Capacity, Machine Capacity and Machine Selection, Line Balancing, Break-Even Analysis

Module - IV

8. **Job Design**: Job Analysis, Job Evaluation & Merit Rating

9. **Method Study & Work Measurement**: Introduction To Work Study, Basic Procedure / Steps In Method Study, Recording Techniques, Work Measurement: Techniques, Time Study Using Stop Watch, Standard Time

Text Books:

1. Production & Operation Management, E. E. Adam, R. J. Ebert, Prentice Hall Of India.

2. Production & Operation Management, S. N. Chary, TMH.

References Books:

1. Production & Operation Management, R. Paneersalvam, Prentice Hall Of India.

Production Systems Analysis & Control, J. L. Riggs, John Wiley Publication

Advanced Manufacturing Technology

Module-I

1. **Advanced Machining Processes**: Classification, Electron discharge machining, Electrochemical machining, Ultrasonic machining, Abrasive jet machining, Electron beam machining, Plasma cutting, Chemical milling, Electrolytic grinding

Module-II

2. **Advanced Fabrication Processes**: Explosive welding, Ultrasonic welding, Diffusion bonding, Friction welding

3. **Processing of Plastic**: Thermoplastic, Thermosetting, Injection moulding, Machining of plastics, Welding of plastics

Module-III

4. **Surface Coating Technology**: Use of Coating, Methods of Coatings, CVD, PVD, Physical and Mechanical characterization of coatings.

5. **Use of sensors in Manufacturing**: Basic Fundamentals, Sensors for Workpieces, Sensors for Machine Tools and Robots, Sensors for Process Monitoring.

Module-IV

6. Nanomanufacturing: Nanometric machining, Nanogrinding

Text Books:

1. Modern Machines Process: P. C. Pandey, H. S. Shan, Tata McGraw Hill Publication
2. Manufacturing Science: A. Ghosh, A. K. Mallick, East West Press

References Books:

1. Welding and Welding Technology: R. L. Little, Tata McGraw Hill Publication
2. Non-Conventional Machining: P. K. Mishra, Narosa Publication
3. Introduction to Manufacturing Processes, J. Schey, McGraw-Hill Publication
4. Handbook of Hard Coatings Deposition Technologies, Properties and Applications, R. F. Bunshah, Noyes Publication
5. Sensors in Manufacturing, H. K. Tönshoff, I. Inasaki, Wiley-VCH

Tribology

Module - I

1. Introduction : Lubricant and lubrication, Types of bearings, properties and testing of lubricants, equations of flow, Hag poiseulle flow, flow between two parallel plates

2. Hydro dynamic lubrication :Petroffs equation for a lightly loaded bearing mechanism, pressure development in an oil film, Reynold's equation in two dimensions, load carrying capacity of journal bearing, Heat balance of lubricants

Module – II

3. Hydrostatic Bearing:Principles, Component of hydrostatic lubrication, Hydrostatic circular thrust bearing, calculation of required in pressure, load carrying capacity, flow rate, power loss in bearing due to friction, concept of gas lubricated bearing

Module – III

4. Design and selection of antifriction bearing

Module - IV

5. Friction and wear of metals: Theories of friction, surface contaminants, Effect of sliding speed on friction, classification and mechanism of water resistant materials.

Text books:

1. Introduction to Triboloty of Bearing, B.C. Majumdar(AHW)

2. Basic Lubrication theory, A. Cameron(John Wiley & Sons)

Reference Books:

1. Mechanism and machine Theory, J.S. Rao & R.V. Sukki Patti, New Age Int. Pub.

FATIGUE CREEP & FRACTURE

Module - I

Fatigue: Fatigue under normal conditions, Controlling factors in fatigue. Design for fatigue. Fracture Theories of strength and working stresses.

Module - II

Creep: Temperature and Creep Stress-strain properties, creep in tension, Creep in bending, Creep in Torsion, Creep buckling, Members subjected to creep and combined stresses.

Module - III

Fracture: Basic modes of fracture, Grith theory of Brittle fracture Irwin's theory of fracture in elastic-plastic materials.

Module - IV

Theories of linear elastic fracture mechanics, stress intensity function, Fracture toughness testing.

Text Books:

1. Strength and Resistance of Materials – by J.M. Lessles, Chapter 6, 7, 8 & 11.

2. Fracture Mechanics – KN Heller.

Reference Books:

Mechanical Behaviour of Engg. Materials by J. Marin Chapter 7 & 8.

Power Plant Engineering

Module - I

1. **Introduction**:-Energy sources for generation of electric power, principal types of power plant, their special features and applications

2. **Steam Power Plant**: Selection of sites, general layout of modern steam power plant, high pressure boilers, super heater and air preheater, fluidised bed boilers, fuel and ash handling equipments, water treatment plant, spray ponds and cooling towers, steam condenser type and calculation

Module - II

3. **Steam Power Plant Cycles**: Rankine cycles, Modified Rankine cycles, reheat cycles, regenerative cycles

4. **Introduction To Steam Flow Through Nozzles, Steam Turbines:** Types of nozzles, Isentropic flow through nozzles, Effect of friction, Nozzle efficiency, Critical Pressure ratio and maximum discharge, throat and exit area. Classification : impulse and reaction turbines, difference between two, Types of power in steam turbine, steam turbine governing and control

Module - III

5. **Nuclear Power Plant**: Classifications and essential component of nuclear reactor, heavy water moderator and cooled reactors, CANDU reactors, light water reactor, gas cooled reactors, liquid metal cooled reactors, disposal of nuclear waste

Module - IV

6. **Power Plant Economics**: Plant investment cost, fixed charges, operating costs, energy cost and depreciation, factors of affecting economics of the generation and distribution

7. **Pollution And Its Control**: Air water pollution by thermal power plant and its control, thermal pollution by thermal and nuclear power plants, radio active pollution, methods suggested to reduce pollution

NON – CONVENTIONAL ENERGY

Module – I

1. *Introduction to Energy Sources*: Renewable and non-renewable energy sources, energy consumption as a measure of Nation's development; strategy for meeting the future energy requirements Global and National scenarios, Prospects of renewable energy sources.

2. *Solar Energy*: Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, Solar air heaters-types, solar driers, storage of solar energy-thermal storage, solar pond , solar water heaters, solar distillation, solar still, solar cooker, solar heating & cooling of buildings, photo voltaic - solar cells & its applications.

Module – II

3. *Wind Energy*: Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations.

4. *Energy from Biomass*: Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection, digester design consideration, filling a digester for starting, maintaining biogas production, Fuel properties of bio gas, utilization of biogas.

Module – III

5. *Geothermal Energy*: Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.

6. *Energy from the ocean*: Ocean Thermal Electric Conversion (OTEC) systems like open cycle, closed cycle, Hybrid cycle, prospects of OTEC in India. Energy from tides, basic principle of tidal power, single basin and double basin tidal power plants, advantages, limitation and scope of tidal energy. Wave energy and power from wave, wave energy conversion devices, advantages and disadvantages of wave energy.

7. *Magneto Hydro Dynamic (MHD) Power Generation*: Principle of MHD power generation, MHD system, Design problems and developments, gas conductivity, materials for MHD generators and future prospects.

Module – IV

8. *Fuel Cells*: Introduction, Design principle and operation of fuel cell, Types of fuel cells, conversion efficiency of fuel cell, application of fuel cells.

9. *Hydrogen Energy*: Introduction, Hydrogen Production methods, Hydrogen storage, hydrogen transportation, utilization of hydrogen gas, hydrogen as alternative fuel for vehicles

10. *Energy Management*: Energy economics, energy conservation, energy audit, general concept of total energy system, scope of alternative energy system in India

Text Books:

1. Non-conventional energy sources by G.D. Rai, Khanna Publishers

2. Solar Energy: Fundamentals and Applications by H.P. Garg & Jai Prakash, Tata McGraw Hill

Reference Books:

1. Solar Energy: Principles of Thermal Collection and Storage by S,P Sukhatme, Tata McGraw Hill

2. Alternative Energy Sources by B.L. Singhal Tech Max Publication

3. Non Conventional Energy Resources by S.Hasan Saeed and D.K.Sharma

4. Fuel Cells by Bockris and Srinivasan; McGraw Hill

5. Magneto Hydrodynamics by Kuliovsky and Lyubimov, Addison

6. Solar Engineering of Thermal Processes by Duffic and Beckman, John Wiley

Mechanical Vibration

Module - I

1. **Damped System with Single degree of freedom**: Equilibrium method , Viscous damping : Law of damping , Logarithmic decrement , Steady state solution with viscous damping , Reciprocating and Rotating unbalance , Base excitation Vibration Isolation, Energy dissipated by damping , Equivalent viscous damping . Sharpness of resonance , Vibration measuring instruments , Whirling of rotating shafts, Rigid shaft supported by flexible bearings

Module - II

2. **Two degree of freedom system** : Generalised derivation of equation of motion , co-ordinate coupling , Langrange's equation . Application of dynamic vibration absorber

Module - III

3. **Multi-degree of system** : Derivation of equation , Calculation of natural frequencies, Maxwell's reciprocal theorem, Rayleigh ,Stodala ,matrix iteration & Holzer methods

Module - IV

4. **Torsional Vibration**: Single & multi rotor system , Geared system and Branched system

5. **Vibration of continuous system** : Euler equation for beam, Transverse vibration of beams with different end conditions(cantilever beam , simple supported beam and fixed beam).

Text Books:

1. Mechanical Vibration -Tse , Morse & Hinkle Prentice Hall of India

2. Mechanical Vibration with application –W.T.Thomas CPC Publication

Open Electives

Entrepreneurship

Module - I

1. **Entrepreneurship:** Concept, Historical background, Economic development and entrepreneurship, Role of Entrepreneurship in Industrialization, Entrepreneurship programmes (EDPS) in India, Indian middle class values.

Module - II

2. **Entrepreneurial Qualities:** Achievement motivation, Creativity, perception, Risk taking, Entrepreneurial goal setting, Group activities

3. Environmental scanning, Business opportunity guidance, Product selection, Market research, marketing channels.

Module - III

4. **Assistance of Govt. agencies** – Role of DIC, SFC, SISI, MSME and banks, Procedure in setting up of an enterprise, Incentives and subsidies

Module - IV

5. Assessment of working capital, preparation of project report, project appraisal elementary knowledge on costing, Book keeping, Balance sheet preparation, Ratio analysis, Income tax etc.(8)

6. Management of small scale industry-Decision making, Leadership, Communication skill, Stress management

Text Books:

1. Entrepreneurial Development, C. B. Gupta, S. Chand Publication.

2. Entrepreneurship of small industries by M. U. Deshpande – Deep and Deep Publication.

Industrial Management

Module - I

1. **Basic Management Theory**: Evolution of Management Thought, Scientific Management, Organization as a System, Function Of Management, Principles of Management, Planning, Decision Making, Organizing Principle, Delegation Of Authority, Line and Staff Function, Leadership, Motivation, Communication, Controlling.

Module - II

2. **Personnel Management**: Organization as Social System, Motivation and Behaviour, Role of Personnel Management, Recruitment, Selection, Training, Performance Appraisal, Job Evaluation and Merit Rating, Wage Policy, Incentives, Group Dynamics, Job Satisfaction and Morale.

3. **Materials Management**: Purchasing, Selection of Vendor, Learning Curve Concept, MRP.

Module - III

4. **Marketing Management**: Selling and Marketing Concept, Role of Marketing Management in the Process of Marketing Management, Product Life Cycle, New Product Development Strategy, Market Research, Consumer Behaviour, Sales Promotion Advertising, Pricing Strategy, Break even analysis, Channel of Distribution.

Module - IV

5. **Financial Management**: Scope, Time Value of Money, Depreciation cost of a product, Financial Statement Analysis, Ratio Analysis, Working Capital, Sources of Finance.

6. **Industrial Relation**: Trade Union, Industrial Dispute, Workers Participation In Management, Industrial Legislation, Labour Law, Factory Act.

Text Books:

1. Industrial Engineering & Production Management, M. Mahajan, Dhanpat Rai Publication.

2. Industrial Engineering & Management Science, T. R. Banga, N. K. Agarwal, S. C. Sharma, Khanna Publication.

Reference Books:

1. Personnel Management, A. Mannappa, M. S. Saiyadain.

2. Fundamentals of Financial Management, Prasanna Chandra, TMH.

Finite Element Method

Module - I

1. Structural stiffness and network analysis, Assembly and analysis of a structure

2. Finite elements of an elastic continuum, Displacement approach, Minimisation of total potential energy, convergence criteria.

Module - II

3. Generalisation of finite element concepts, Nodeless variables, Alternative approaches to finite element formulations.

4. Plane stress and plane strain, Element characteristics, Some practical applications.

Module - III

5. Axisymmetric stress analysis, Element characteristics, Some illustrative examples.

6. Three dimensional stress analysis : Tetrahedral Element characteristics.

Module - IV

7. Computer methods and computer programmes, Data input, stiffness generations, Assembly and solution of equations and output of results.

Text Book:

1. A First Course in the Finite Element Method by Daryl L Logan, Course Technology

2. The Finite Element Method in Engineering Science by Zienkiwics, TMH

Ref. Book:

1. Introduction to Finite Element Method by Abel and Desai - EWP

Industrial Noise and Control

Module-I
Principle of sound generation and propagation, Sound attenuation, sound absorption,
Module- II
Sources of industrial noise, effect of noise, noise measurement units and instruments, identification of source of noise,
Module-III
Noise evaluation procedures, acoustical enclosures, design of reactive and absorptive mufflers, active noise control.
Module-IV
Designing for quieter machines and processes, various case studies.

Text Books

1. L.N.Beraneck, Noise and Vibration control, Mc Graw Hill.

2. Baxa, Noise Contro of iC engine, Willey.

Reference books:

3. Harold Lord, Gately and Eversen, Noise control for Engineers, Mc Graw Hill.

4. R.H. Lyon, Machinery Noise Diagnostics, Butterworths.

5. C. H. Harris, Handbook of Noise Control, Mc Graw Hill

6. J D Irwin and E R Graf, Industrial Noise and vibration control, Prentice Hall.

Turbo Machinery

Module 1*:* Steam Turbines-Types of turbines, constructional details, application of turbines, types of seals, and packing to reduce leakage, losses in turbines. Compounding of turbine, velocity diagrams, output efficiency, losses in turbines, reaction turbine, velocity, diagrams, degree of reaction, constructional features of blades. Governing of turbines

Module 2*:* Gas Turbine-Theory and fundamentals of gas turbines, principles, classification, Joule' s cycles, assumptions for simple gas turbines, cycle analysis, work ratio, concept of maximum and optimum pressure ratio, actual cycle, effect of operating variable on thermal efficiency. Regeneration, inter cooling, reheating, their effects on performance. Closed cycle and semi closed cycles gas turbine plant/ Applications of gas turbines

Module 3: Jet Propulsion-Introduction, types of jet engine, application of jet engine. Theory of
jet propulsion, energy flow through jet engine, thrust, thrust power, and propulsive efficiency.
Turbo jet, turbo prop, turbo fan engine, pulse jet and ram jet engine, performance characteristics thrust segmentation. Concept of rocket propulsion.

Module 4: Rotary Compressor- Concepts of: Rotary compressors, Root blower and vane type
compressors, Centrifugal compressors. Velocity diagram construction and expression for work
Done, introduction to slip factor, power input factor.

Module 5: Hydraulic Turbines- Classification of hydraulic turbines, Heads & various efficiencies. Impulse momentum principle, Fixed and moving flat plate and curve vanes, series of plates &vanes. Velocity triangles and their analysis, work done, efficiency etc. Impulse turbine: Maincomponents and constructional features of pelton wheel, velocity diagrams & work done, condition for max. Hydraulic Efficiency, number of buckets, jets, Non dimensional parameters (speed ratio, jet ratio) Governing mechanisms for pelton wheel. Reaction turbine, main components &constructional features, types of reaction turbine (Francis, Kaplan) draft tube types, efficiency,cavitation, , Francis, Kaplan turbines, Types of characteristic curves, unit quantities, selection of turbine considering various factors, specific speed, Application of similarity as applied to turbines, scale effect.

Text Books:
1. Yahya, S. M. *Turbines compressors and fans*: Tata McGraw-Hill.
2. Gorla, R. S. R., & Khan, A. A. *Turbomachinery: Design and Theory*: Marcel Dekker, Inc.

Reference Books:

1. Dixon, S. L. *Fluid mechanics and thermodynamics of turbo machinery*: Butterworth-Heinemann.
2. Peng, W. W. *Fundamentals of turbomachinery*: J. Wiley.
3. Baskharone, E. A. *Principles of turbomachinery in air-breathing engines*: Cambridge University Press.
4. Turbo Machines by BU Pai, Willey Publication
5. R.K.Turton, Principles of Turbomachinery, E & F N Spon Publishers, London & New York.

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Computational Fluid Dynamics

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Module 1: Governing Differential Equations and Finite Difference Method- Classification of PDEs- Initial and Boundary conditions - Initial and Boundary value problems - Finite difference method,- Central, Forward, Backward difference for a uniform grid – Central difference expressions for a non-uniform grid - Numerical error - Accuracy of solution – Grid independence test

Module 2: Conduction Heat Transfer- Applications of Heat conduction - Steady and Unsteady conductions - One dimensional steady state problems - Two dimensional steady state problems - Three dimensional steady state problems - Transient one dimensional problem

Module 3: Convection Heat Transfer- Introduction - Steady one dimensional Convection- Diffusion - Unsteady one. Dimensional Convection – Diffusion – Unsteady two dimensional Convection - Diffusion.

Module 4: Incompressible Fluid Flow- Introduction - Governing equations - Difficulties in solving Navier- Stokes equation - Stream function - Vorticity method - In viscid flow (steady) - Determination of pressure for viscous flow

Module 5: Applications of Computational Fluid Dynamics- Computer graphics in CFD - Future of CFD - Enhancing the design process - understanding - Applications - Automobile, Engine, Industrial, Civil, Environmental

Text Books:

1. Patankar, Suhas V., "Numerical Heat Transfer and Fluid Flow.", Taylor and Francis.

2. Muralidhar, K., and Sundararajan, T., "Computational Fluid flow and Heat Transfer", Narosa Publishing House,

Reference Books:

1. Ghoshdasdidar, P.S., "Computer simulation of flow and heat transfer", Tata McGraw – Hill, New Delhi

2. Anderson, D. A., Tannehill, J. L, and Pletcher, R.H., "Computational fluid mechanics and Heat Transfer", Hemisphere Publishing Corporation,

3. John David Anderson, "Computational Fluid Dynamics: The Basics with Applications", McGraw Hill , New York