B. Tech. Mechanical Engineering

DEPARTMENT OF MECHANICAL ENGINEERING
SYLLABUS FOR COURSE STRUCTURE
B. TECH MECHANICAL ENGINEERING

Semester-I

S.No.	Course Code	Subjects	L-T-P	Credits
1	ME 301	Engineering Graphics I	0-0-4	2
2	GPT 301	Moral and Value Education	2-0-0	2
3	ME 302	Introduction to Manufacturing Process	2-0-0	2
4	LNG 302	Professional Communication	3-0-0	3
5	ME 304	Workshop Practice & Technology	2-0-4	4
6	CE 401	Engineering Mechanics	3-0-0	3
7	MAS 411	Engineering Mathematics I	3-1-0	4
8	CHEM 513	Engineering Chemistry	3-1-2	5

Semester-II

S.No.	Course Code	Subjects	L-T-P	Credits
1	ECE 301	Basic Electronics	2-1-2	4
2	LNG 303	Professional Communication II	3-0-0	3
3	EEE 302	Electrical Engineering	3-0-2	4
4	PHY 312	Engineering Physics	3-1-2	5
5	ME 401	Engineering Graphics II	0-0-4	2
6	COMP 410	Computer and Languages	2-1-2	4
7	MAS 490	Engineering Mathematics II	3-1-0	4
8	ME 305	Mechanical Engineering	3-1-0	4

Semester-III

S.No.	Course Code	Subjects	L-T-P	Credits
1	ME 403	Machine Drawing and Computer Aided Drafting	0-0-4	2
2	ME 404	Applied Thermodynamics	3-1-2	5
3	CE 406	Fluid Mechanics	3-0-2	4
4	CE 408	Strength of Materials	3-0-0	3
5	ME 410	Material Science and Testing	3-0-2	4
6	ENV 415	Environmental Studies – I	2-0-0	2
7	COMP 510	Foundation of Information Technology	2-1-4	5
8	MAS 590	Engineering Mathematics III	3-1-0	4

Semester-IV

S.No.	Course Code	Subjects	L-T-P	Credits
1	EEE 404	Electrical Machines	3-0-2	4
2	ME 405	Measurement and Metrology	2-1-2	4
3	ME 407	Kinematics of Machines	3-1-0	4
4	ME 411	Industrial Engineering	3-1-0	4
5	ME 412	Manufacturing Science I	3-0-2	4
6	ME 416	Management Information System	3-0-0	3
7	MAS 491	Computer Based Numerical &Statistical Techniques	3-1-0	4
8	ENV 416	Environmental Studies	2-0-0	2

Semester- V

S.No.	Course Code	Subjects	L-T-P	Credits
1	BAM 315	Elements of Economics and Principles of Management Science	3-1-0	4
2	ME 409	Machine Design I	2-0-4	4
3	ME 503	Heat and Mass Transfer	3-0-2	4
4	ME 504	Dynamic of Machines	3-0-2	4
5	ME 506	Product Development and Design	2-1-0	3
6	ME 507	Manufacturing Science II	3-0-2	4
7	ME 508	IC Engine	3-1-0	4

Semester-VI

S.No.	Course Code	Subjects	L-T-P	Credits
1	ME 502	Refrigeration and Air Conditioning	3-0-2	4
2	ME 505	Machine Design II	3-0-2	4
3	EEE 509	Automatic Controls	2-1-0	3
4	ME 513	Machine Tool Design	3-1-0	4
5	ME 512	Steam Power Engineering	3-1-0	4
6	ME 515	Fuel Combustion & Pollution	3-1-0	4
7	ME 580	Seminar I	0-0-4	2
8	CE 516	Fluid Machinery	2-1-2	4

Note: Four Weeks Practical summer training-2 after VI Semester (to be evaluated in VII Semester)

Semester-VII

S.No.	Course Code	Subjects	L-T-P	Credits
1	ME 514	Condition Monitoring	3-1-0	4
2	ME 601	Computer Aided Design	3-0-4	5
3	ME 602	Computer aided Manufacturing	3-0-4	5
4	ME 603	Automobile Engineering	2-1-2	4
5	ME 604	Industrial Training	0-0-4	2
6	ME 605	Power Plant Engineering	3-1-0	4
7	ME 680	Seminar II	0-0-4	2
8	ME 699a	Project Formulation	0-0-4	2

Semester-VIII

S.No.	Course Code	Subjects	L-T-P	Credits
1	ME 606	Mechanical System Design	3-1-0	4
2	ME 650-664	Elective -1	3-0-0	3
3	ME 650-664	Elective -2	3-0-0	3
4	ME 650-664	Elective -3	3-0-0	3
5	ME 699b	Project Execution and Report	0-0-12	6

TOTAL 19

ENGINEERING GRAPHICS I

Course Code ME-301 **CREDIT : 2 (0-0-4)**

Introduction: Graphics as a tool to communicate ideas, engineering drawing instruments and its uses. Lettering and dimensioning, scales, layouts of drawing sheets Construction of geometrical figures like pentagon and hexagon.
Orthographic Projection: Principles of orthographic projections, Principal and auxiliary planes, First and Third angle projections. Projection of points. Pictorial view.Projection of lines parallel to both the planes. Parallel to one and inclined to other, Inclined to both the planes. Application to practical problems. Projection of solid in simple position, Axis or slant edge inclined to one and parallel to other Plane, Solids lying on a face or generator on a plane.Sectioning of solids lying in various positions, True shape of the section.Development of lateral surfaces, sheet metal drawing**.**
Isometric Projection: Principles of isometric projection, Isometric projection using box and offset methods.
References:

1. Bhatt N.D.: Elementary Engineering Drawing, Charothar Publishing.
2. Laxmi Narayan V & Vaish W.: A Text Book of Practical Geometry on Geometrical Drawing.

MORAL AND VALUE EDUCATION

Course Code GPT-301 **CREDIT : 2 (2-0-0)**

My country and my people, the many Indians, being and becoming an Indian, nationalism and internationalism.
Some life issues- love, sex and marriage, men and money-value of time, meaning of work, human communication, human suffering, addiction, ecology, women's issues.
Understanding one's neighbour, neibhourhood groups: their structure and functions,
Patterns of social interaction of group dynamics.
Preparation for a career, choice of vocation, motivation for study and research. The present educational system: curriculum and syllabus, teaching methods, examination and work experience.
Definition of value education, moral and ethics, laws and morale based on ten commandments and two great commandments.
Discovery of self, self-awareness, growth of intellect- man's spiritual nature emotions, will, respect, the rights of life, liberty, property, truth and reputation.
Sin, orign of sin, manifestation of sin, the results of sin, the remedy of sin, sin as an act, Sin as a state, sin as a nature.
Conscience- as defined in oxford dictionary and Winston dictionary. Types of consciousness (such as Evil, convicted, purged, pure, weak, good, void of offence).

INTRODUCTION TO MANUFACTURING PROCESS

Course Code ME-302 **CREDIT : 2 (2-0-0)**

1. Introduction to engineering materials- Metals & alloys- composition-properties and uses
2. Manufacturing Process – Classification, mechanization, Automation , Inter-changeability computers in manufacturing , CAD,CAM,CIM,MRP, GT
3. Metal Forming- Brief introduction to press working, casting, plastic processing ,Smithy operations.
4. Machine Tools-Introduction to lathe machines , Drilling, Shaper, Slotter, Planer , Boring machines.
5. Machine Operation-Turning, Threading, Boring, Drilling.
6. Plastic Processing

PROFESSIONAL COMUNICATION I

Course Code LNG-302 **CREDIT : 3 (3-0-0)**

1.Study of selected Literacy Texts.
I.Collection of short essays.
Ii.Collection of short stories.
2.**Testing Written Comprehension Ability.:** Comprehension Passages of 500 words Multiple Choice Questions.
3.Composition & Grammar.
4. **Report Writing:** Characteristics of Business Reports. Structure of reports: Front Matter, Main Body, and Back Matter Style of Reports: Definition, the Scientific Attitude, Readability of Reports, Choice of Words and Phrases, Construction and length of sentences, Construction and length of Paragraphs. The lineout or break up of a format report Blank Form Report, Frogen Report, Memoranda Form Report, Periodic Report, Miscellaneous Report.

5. Speech Drills:

Using the language laboratory to develop Speaking Communication Skills.

(i)Word Accent: Production of correct accentual patterns involving two and three syllabi words.

(j)Rhythm: Stress-tone rhythm in sentences.

(k)Intonation: Rising Tone and Talking Tone Ear Training and Production Tests.

References:

1.Close R.A.: A University Grammar of English Workbook.Longman, London, 1998.

2.Jones, Daniel: English Pronouncing Dictionary, ELBS, and London, 1999.

3.Sharma S.D: A Textbook of Spoken and Written English, Vikas, 1994.

4.Alvarez, Joseph A.: The Elements of Technical Writing, New York: Harcourt, 1998.

5.Bansal, R.K.: Spoken English For India, Orient Longman, 1993.

WORKSHOP PRACTICE AND TECHNOLOGY

Course Code ME-304 **CREDIT : 4 (2-0-4)**

1. Introduction to tools- Description , applications of tools used in different shops
2. Carpentry- Classification of tools-marking and measuring-holding and supporting- planning-cutting- boring –striking- miscellaneous-etc.
3. Fitting shop-Marking & measuring, holding,cutting tools etc
4. Smithy- holding and supporting tools, cutting tools , striking tools
5. Sheet metal

1.Welding

II Properties of metals- Strength, elasticity , plasticity, Malleability , hardness, brittleness etc.

III.Timber- Introduction-selection of timbers-seasoning of timbers – timber defects

IV.Brief introduction to joining process-Nuts& bolts-Screw- Screws-rivets & riveting- welding- electric arc-gas welding- TIG-MIG welding –threads

V.Extrusion-Classification-process geometry- Geometrical relationship- analysis of extrusion- stresses- load – power – maximum reduction possible-working and application of indirect extrusion- hydrostatic extrusion- defects in extruded parts.

VI.Forging – classification- strip sand disc forging- Process geometry-geometrical relationship- Analysis - defects in forged products

ENGINEERING MECHANICS

Course Code CE-401 **CREDIT : 4 (2-0-4)**

force and equilibrium

Basic concepts, force, moment and couple, principle of transmissibility, verigonon's theorem, resultant of force systems, concurrent and non-concurrent coplanar forces, funicular polygon, and free body diagram.

Trusses

Plane structures, various methods of analysis of trusses, method of joints, method of sections and graphical method.

Moment of inertia

Center of gravity, centroids of line, area, volume and composite Bodies, area moment of inertia and mass moment of inertia for plane figures and bodies including composite bodies, product moment of inertia, parallel axis theorem, principal moment of inertia.

Friction

Introduction, dry friction, co-efficient of static friction, friction cone, screw jack and belt friction.

Beams

Bending moment and shear force diagrams for statically determinate beams.

Kinematics of Rigid Bodies

Plane motion, absolute motion, relative motion, translating axes and rotating axes.

Kinetics of Rigid Bodies

Plane motion, force Mass and Acceleration, Work and energy, Impulse and momentum, principles of energy conservation, Principle of virtual work, D'AleMbert's principal and dynamic equilibrium.

References:

1. Beer F.p and Johnston F.R: mechanics for engineers, McGraw hill.
2. Meriam, J.L: Statistics, John Wiley.
3. Meriam, J.L: Dynamics, John Wiley.

4. Shames I.H: Engineering Mechanics, Prentice Hall of India.
5. Dayaratnam, P: Statistics, Tata Mc Graw Hill.
6. Timeshenko, S.and Ypung D: Engineering Mechanics, Mc Graw Hill.

ENGINEERING MATHEMATICS - I

Course Code MAS-411 **CREDIT : 4 (3-1-0)**

1.Matrices : Elementary row and column transformations, Linear dependence, Rank of matrix, Consistency of system of linear equations and solution of linear equations, Characteristic equation, and Caley-Hamilton theorem, Eigen values and eigen vectors, Diagonalisation, Complex and unitary matrices.

2.Differential Calculus-I: Leibnitz theorem, Partial differentiation, Euler's theorem, Asymptotes, Curve tracing, Change of Variables, expansion of functions of one and several variables. Cylindrical and spherical coordinate systems

3.Differential Calculus-II: Jacobian, Approximation of errors, Extrema of function of several variables, Lagrange's method of multipliers (simple applications).

4.Multiple integrals: Double and triple integrals, change of order, change of variables, Gamma & Beta functions,application to area, volume, Disrichlet's integral and its applications.

5.Vector Calculus: Point functions, Gradient, divergence and curl of a vector and their physical interpretations, line, surface & volume integrals, Gauss divergence theorem and Greens & Stokes theorem.

References:

1. Shanti Narayan: A Text Book of matrices, S.Chand & Co.
2. Thomas/Finney: Calculus and Analytic Geometry, Narosa Pub. House.
3. J. N. Kapur: Mathematical Statistis, S. Chand &Co.
4. C. Prasad: Mathematics for Engineers, Prasad Mudranalaya.
5. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers.
6. Jaggi & Mathur : Advanced Engineering Mathematics, Khanna Publishers.
7. Piskunov, N.: Differential & Integral Calculus, Moscow Peace Pub.
8. H.K. Das, Engineering Mathematics.
9. Vijai Shankar Verma & Sanjeev Kumar, Engineering Mathematics.
10. Rakesh Dubey, Engineering Mathematics

CHEMISTRY

Course Code CHEM-513 **CREDIT : 5 (3-1-2)**

1. General Chemistry: Advanced Theory of Chemical Bonding: Valence bond and molecular orbital theory. Structure of NH_3, H_2O, SO_3, PCl_5, XeO_2 molecules. Theories of bonding in metals and semiconductors,n-type and p-type semi-conductors, Imperfections in materials. Born-Haber cycle, Bragg's conditions.

2. Physical Chemistry: Equilibrium on Reactivity: Bronsted and Lewis Acids, pH, pka, pkb Scale, Buffer solution. Stereochemistry of organic compounds, Co-ordination chemistry, Nomenclature, Valence Bond and crystal field theory.

Chemical Kinetics & Catalysis: Rate law, Order of reactions, Parallel and reversible reactions, Catalysis, Homogeneous and heterogeneous catalysis, Characteristics of catalytic reaction, Catalytic promoters and poi-sons, Auto catalysis and negative catalysis, Intermediate compound formation theory and absorption theory.

3. Environment Chemistry: Atmospheric Chemistry & Air Pollution: Environment and Ecology, Environmental segments, Structure and composition of atmosphere, Radiation Balance of Earth and Green House Effect, Formation and depletion of Ozone layer, Chemical and photochemical reactions of various species in atmosphere, Air pollution – sources, reactions and sinks for pollutants, Acid rains and Smog formation. Pollution control methods.

Corrosion and Lubrication: Introduction, causes of corrosion, Theories of corrosion, Factors influencing Corrosion, Corrosion inhibitors, passivity, Types of corrosion, Protection from corrosion and protective coatings. Theory, Classification and mechanism of Lubrication.

4. Applied Chemistry: Water and Waste Water Chemistry: Introduction, Hardness of water, characteristics imparted by impurities, Analysis of contaminants, Treatment of Water by Zeolite, L-S process, Boiler feed water, Waste water treatment.

5. Chemistry of Engineering Materials: Fuels & Combustion: Classification of fuels, Non conventional Energy, Biogas, Biomass and solar energy. Calorific value- gross and net, characteristics of good fuel, Determination of calorific value, Solid fuels, Analysis of coal, Liquid fuels.

Instrumentation: IR, UV, NMR, MASS AND ASS.

6.Industrial Chemistry: Polymer Chemistry: Classification of Polymers, Including Biopolymers condensation and addition polymers and their applications. Industrial Application and mechanism of chemical reaction, Beckman, Hoffman, Reimer Tiemann, Cunnizzaro, Diels Alder and Skraup synthesis.

References:

1.Puri and Sharma/Principles of Physical Chemistry.
2.Manas Chandra/Atomic Structure and Chemical Bond.

3.Bahl and Tuli /Engineering Chemistry.
4.Jain and Jain/A Text-Book of Engineering Chemistry
5.S.S Dara/Environmental Chemistry and Pollution Control.
6.S.S Dara /Environmental Chemistry.
7.A.K De/Environmental Chemistry.

LIST OF EXPERIMENTS (ANY TEN):

1. To determine the percentage of available chlorine in the supplied sample of Bleaching powder.
2. To determine the Ferrous content in the supplied sample of iron ore by titrimetric analysis against standard K□Cr□ solution using K, $Fe(CN)_g$ as external indicator.
3. To determine the chloride content in supplied water sample using Mohr's method.
4. To determine the constituents and amount of alkalinity of the supplied water sample.
5. To determine the Temporary and Permanent hardness of water sample by Coplexometry.
6. To find the Chemical Oxygen Demand of a waste water sample using Potassium dichromate.
7. To determine iron concentration in the sample of water by spectrophotometric method.
8. To find out the Velocity constant for the inversion of cane sugar in acidic medium and to show that inversion follows the first order kinetics.
9. To determine the Molecular weight of a polystyrene sample by using Viscometer method.
10. To determine pH of a solution using a pH-meter and titration of such a solution pH-metrically.
11. To determine the calorific value of a fuel sample by using a Bomb Calorimeter.
12. Analysis of a coal sample by proximate analysis method.

References:

1. Vogel's Qualitative Chemical Analysis: Ed. By Jaffery Bassette et. al. (ELBS).
2. Applied Chemistry- Theory and Practice, 2nd Ed. By Virmani and Narula (New Age International Pub.).
3. Experiments in Engineering Chemistry, Ed. By Masood Alam (Maktaba Jamia Limited).

BASIC ELECTRONICS

Course Code ECE-301 **CREDIT : 4 (2-1-2)**

1.Energy Bands in Solids: Energy band theory of solids, Concept of forbidden gap, Insulators, Metals and Semiconductors.
2.Transport Phenomenon in Semiconductors: Mobility and conductivity, electrons and holes in an intrinsic semiconductor, Donor and acceptor impurities, Fermi level, carrier densities in semiconductor, electrical properties of semiconductor, Hall effect, Diffusion.
3.Junction Diode:P-N junction, depletion layer, V-I characteristics, diode resistance, capacitance, switching time, diode application as a rectifier (half wave and full wave), diode circuits (clipper, clamper, voltage multipliers) Breakdown mechanism, Zener & Avalanche, breakdown characteristics, Zener diode and its applications.
4.Bi-junction Transistor: Bipolar junction Transistor, CE, CB and CC configuration, characteristic curves (cut off, active and saturation region), Requirement of biasing, biasing types and biasing analysis, stability. **5.Transistor as an Amplifier:**Graphical analysis of CE amplifier, concept of voltage gain, current gain and power gain, h-parameter (low frequency), computation of A_v, R_I, R_o and approximate formulae.
6.Operational Amplifiers: Concepts of ideal op-amp, inverting, non-inverting and unity gain amplifiers, adders, difference amplifiers. , Integrators.
7.Switching Theory & Logic Gates: Number systems, conversion of bases, Boolean algebra, Logic Gates, concept of universal gate, canonical forms, and minimization using K-map.
8.Electronic Instruments: Multimeter, CRO and its Applications.

References:

1. Boylestad & Nashelsky/Electronic Devices & Circuits/ PHI.
2. Morris Mano/Digital Computer Design/ PHI.
3. Milliman, J. Halkias/Integrated Electronics/TMH.
4. Malvino & Leach/Digital Principles & Application/

List of Experiments:

1. Study of Diode characteristics.
2. Study of Common Base Transistor characteristics.
3. Study of Common Emitter Transistor characteristics.
4. Study of Half Wave Rectifier with effect of Capacitor and also calculate the ripple factor.
5. Study of Full- Wave Rectifier with effect of Capacitor and also calculate the ripple factor.
6. Study of Various Logic Gates.
7. Study of Clipping and clamping Circuits.

8. Study of C.R.O., Function generator, Multimeter**.**

PROFESSIONAL COMMUNICATION II

Course Code LNG-303 **CREDIT : 3 (3-0-0)**

1. Technical Written Communication

(a) Nature, origin and development of technical written communication.
(b) Salient Features.
(c) Difference between technical writing and general writing.

2. Pre-requisites of Scientific and Technical Communication

(a)Fragment sentences.
(b)Parallel comparisons.
(c)Elements of a series.
(d)Squinting construction and split infinitive.
(e)Modifiers, connectives, antecedents and clause subordination.
(f)Dangling participles and gerunds.
(g)Ellipsis.
(h)Coherence, Unity, Chronological method, spatial method, inductive method, linear method, deductive method, interrupted method.

3. Business Correspondence

(a) General principles of business correspondence.
(b) Ramifications of business letters.
(c) Letters giving instructions, inquiries and answers to enquiries, complaints and adjustments, letters urging action, employment letters, application and resumes.

4. Proposal Writing

(a)Proposal: Definitions and kinds.
(b)Division of format proposals (front matter, title page, summary/ abstract, Table of contents etc.)
(c)Statement of request, body- statement of problem, background, scope, methodology, Advantages and disadvantages.

5. Writing Scientific and Semi-technical Articles

(a) Source material, topic sentence, literature review.
(b) Tables, figures, footnotes, bibliography.

6. Study of Scientific and General Texts.

(A). Prescribed text books for detailed study
1.Arora, V.N (et. al.), Improve your writing (Delhi: Oxford University Press, 1981.
2.Lesson No. 1.2, 1.6, 2.4, 3.5, 4.1, 4.3, 5.1, 5.4, 6.2.
(B). For extended Reading (any one of the following)
1. Orwell George, Nineteen Eighty Four (New York: Penguin, 1984)
2. Hemingway, Ernest, The old man and the Sea, (Oxford: 1990)

7.ListeningComprehension

(a).Ear-training.
(b). Uses of latest scientific techniques (AVR Comprehension trainer,
SRA Comprehension trainer, SRA Comprehension Accelerator, AVR Comprehension Reteometer.)

8.ReadingComprehension..

(a) Scanning method.
(b) Skimming method.

9.Phonetic Transcription

10.Stresses and Intonation

References

1. Sherman, Theodore A. (et al) Modern Technical Writing, New Jersey, Prentice Hall, 1991.
2. Legget, Glenn (et al) Essentials of grammar and composition, Macmillan, Delhi 1994.
3. Strunk, Jr. William (et al), The elements of style, Macmillan, 1987.
4. Sharma, S.D A Text Book of Scientific and Technical Writing, Vikas, Delhi, 1990.

ELECTRICAL ENGINEERING

Course Code EEE-303 **CREDIT : 4 (3-0-2)**

1.**Sinusoidal Steady State Circuit Analysis:**Voltage, Current, Sinusoidal & Phasor representation.1-Phase A.C. Circuit-behavior of resistance, Inductance and Capacitance and their combinations, impedance, concept of power, power factor, series & parallel resonance-bandwidth and quality factor.

2.**Network Theory:**Introduction to basic physical laws, Network theory: Superposition, Thevenin, Norton, Maximum Power transfer theorems, Star-delta transformation, Circuit theory Concepts: Mesh and Nodal analysis.
3.**Three Phase Supply:**Star/delta connections, line and phase voltage/current relations, Three-phase power and its measurement.
4.**Basic Instruments:**Instruments for measurement of voltage, Current, power and energy: Construction, principle and application.
5.**Magnetic Circuit and Transformer:**Magnetic circuit concept, theory and working principle of single-phase transformer.
6.**Rotating Machines:**Principles of energy conversion, Basic concepts of rotating machines, DC machines, Different types and their characteristics & applications. Elementary idea of operation of synchronous and induction machines. Single-phase induction & stepper motors, Applications.
7.**Power Systems:**Introduction, Elements, Line diagram, Supply systems, Power factor improvement.

Reference:

1. V. Del Toro/ Principles of Electrical Engineering/ PHI.
2. W.H Hayt & J.E Kennedy/ Engineering Circuit Analysis/ McGraw Hill.
3. I.J Nagrath/ Basic Electrical Engineering/ Tata McGraw Hill.
4. A.E Fitzgerald/ Electronic Instruments & Measurement Techniques/ PHI.
5. Higginbotham L.Grabel/Basic Electrical Engineering/ McGraw Hill.

LIST OF PRACTICALS

A minimum of 10 experiments from the following**:**
1. Verification of Thevenin's Theorem.
2. Verification of Superposition Theorem.
3. Verification of Norton's Theorem
4. Verification of Kirchoff's Law.
5. To measure the value of impedance and power factor in RLC series A.C. circuit.
6. To measure the value of impedance and power factor in RLC parallel A.C. circuit.
7. To study resonance by frequency variation in series RLC circuit.
8. To calibrate the given energy meter with the help of a standard wattmeter.
9. To find the relation between line current and phase current and line voltage and phase voltage in Star – Delta connections.
10. To perform open circuit and short circuit test and draw the equivalent circuit of a single-phase transformer.
11. To measure three phase power by two-wattmeter method.
12. To draw the magnetizing characteristic of a single-phase transformer.

Additional experiments may be added based on contents of syllabi.

ENGINEERING PHYSICS

Course Code PHY-312 **CREDIT : 5 (3-1-2)**

1.**Special Theory of Relativity:**Michelson Morley experiment, Inertial frames of reference, Postulates of special theory of relativity, Lorentz transformation equation of space and time, length contraction, time dilaton, addition of velocities, variation of mass with velocity, mass-energy equivalence.
2. **Optics :**Interference: Coherent sources, Conditions of interference, Fresnel's bi-prism experiment, displacement of fringes, interference in thin films, wedge shaped film, Newton's rings. Diffraction: Single slit and double slit diffraction, diffraction grating, Reyleigh's criterion of limit of resolution, resolving power of telescope, microscope and grating.Polarization: Polarization of light, Pictorial representation of polarized light, Brewster's law, Malus law, Phenomena of double refraction, Geometry of calcite crystal, Optical activity, Specific rotation, Polarimeter.
3.**Fields:** Scalar and vector fields, Gradient of a scalar field, divergence and curl of a vector field, line integral, conservative vector field, Gauss' Divergence theorem, Stoke's theorem.
4.Electrostatics: Gauss' law and its applications, Poisson and Laplace equations. Maxwell's equations, Basic Concepts of Electromagnetic waves and its solution in free space.
5. Magnetic Properties of Materials: Para, dia, ferro, antiferro and ferro-magnetic materials, hysteresis, Methods of plotting hysteresis curve of a ferro-magnetic material and their uses, magnetic circuits.
6. **X-Rays:** Origin of X-rays, Continuous and characteristic X-Ray spectra, Moseley's law, Absorption of X-rays, Diffraction of X-rays, Bragg's law, Bragg's spectrometer, Practical application of X-rays, Compton effect.
7.Quantum Theory: Wave particle duality, De Broglie concept of matter waves, Davisson and Germer experiment, Heissenberg's uncertainty principle, Schrodinger wave equation and its applications.
8.Laser
Spontaneous and stimulated emission of radiation, Einstein's coefficients, Main components of a laser, types of lasers and their applications.

References:

1.Arthur Beiser: Concepts Of Modern Physics, TMH.
2.Subramanyam & Brij Lal: A Text Book of Optics, S. Chand & Co.
3.K.K. Tiwari: Electricity & Magnetism, S. Chand & Co.

4.Brij Lal & Subramanyam: Electricity & Magnetism.
5. Wehr, Richardo & Adair: Physics of the Atom.

List Of Experiments (Any Ten)

1. To determine the wavelength of monochromatic light by Newton's ring.
2. To determine the wavelength of monochromatic light with the help of Fresnel's biprism.
3. To determine the focal length of two lenses by nodal slide and locate the position of cardinal points.
4. To determine the specific rotation of cane sugar solution using half shade polarimeter.
5. To determine the wavelength of spectral lines using plane transmission grating.
6. To determine the specific resistance of the material of given wire using Carey Foster's bridge.
7. To determine the variation of magnetic field along the axis of a current carrying coil and then to estimate the radius of the coil.
8. To verify Stefan's Law by electrical method.
9. To calibrate the given ammeter and voltmeter.
10. To study the Hall Effect and determine Hall coefficient, carrier density and mobility of a given semiconductor material using Hall Effect set up.
11. To determine the energy band gap of a given semiconductor material.
12. To determine E.C.E of copper using Tangent or Helmholtz galvanometer.
13. To draw hysteresis curve of a given sample of ferromagnetic material and from this to determine magnetic susceptibility and permeability of the given specimen.
14. To determine the ballistic constant of a ballistic galvanometer.
15. To determine the viscosity of a liquid.
16. To determine refractive index of the material of prism using spectrometer.

ENGINEERING GRAPHICS II

Course Code ME-401 **CREDIT:2(0-0-4)**

Introduction: Graphic language, Classification of drawings, Principles of drawing: IS codes for Machine drawing, Lines, Sections, Dimensioning, Standard abbreviation**.**
Orthographic Projections: Principles of first and third angle projections, drawing and sketching of machine elements in orthographic projections, spacing of views.
Screwed (Threaded) Fasteners: Introduction, Screw thread nomenclature, Forms of threads, Thread series, Thread designation. Representation of threads, Bolted joints, Locking arrangements for nuts, Foundation bolts.
Keys and Cotters: Keys, Cotter joints.
Shaft Couplings: Introduction, Rigid and flexible coupling.
Riveted Joints: Introduction, Rivets and riveting, Rivet heads, Classification of riveted joints.
Assembly Drawing: Introduction, Engine parts, Stuffing box etc.
Free Hand Sketching: Need for free hand sketching, Free hand sketching of some threaded fasteners and simple machine components.

References:

1. N. Siddeshwar, P. Kannaiah, V.V.S Shastri: Machine Drawing, TMH, New Delhi.
2. K.L Narayana, P. Kannaiah, K. VenkatReddy: Machine Drawing, New Age International Publications, 2nd edition.
3. Engineering drawing practice for schools and colleges, SP 46-1998(BIS).

COMPUTER AND LANGUAGES

Course Code COM-410 **CREDIT : 4(2-0-4)**

1. Computer hardware components and their functions
2. Basic operating system concepts
3. MS-DOS and getting to know DOS commands
4. Familiarizing with WINDOWS environment
5. Getting started with UNIX
6. Files and Directories and their use in different Operating System Environments
7. Getting to know different editors like edit & vi
8. Introduction to Internet
9. Getting familiar with Web Browsers like Netscape Navigator & Internet Explorer
10. Sending & receiving mail over Internet

11. Introduction to PINE and /or ELM
12. Need of programming languages.
13. Language translators.
14. Introduction to "C" language
15. Data types operators and expressions.
16. Conditional & looping statements.
17. Function & Arrays.
18. Introduction to Pointers & Structures.

References:

1. DOS the complete reference by Kris Jamsa, Tata- McGraw Hill Publication.
2.UNIX POWER TOOLS by J.Peek Tim O'reilly & M. Locekides, BPB Publication.
3.The 'C' Programming Language by B.W Kernighan & D.M Ritchie, Prentice Hall of India.
4.Using LINUX- Latest Edition by Jade Tackett & David Ganter, Prentice Hall of India.

LIST OF PRACTICALS

1. Basic Internal and External DOS Commands.
2. Write a simple batch program.
3. Giving exposure to Windows environment.
4. File and program management in windows.
5. Practice of basic UNIX commands.
6. Write simple shell script.
7. Introduction to word processing.
8. Exposure to advance feature supported by some editors.
9. Net Surfing.
10. Creation and checking of E-mail account.
11. Write C program to demonstrate each of the following:
    1 Conditional statements.
    2 Looping statements.
    3 User defined functions.
    4 Arrays.
    5 Pointers and structures.
12. Familiarizing mail account using PINE, deleting, creating folder/mail-messages, adding signature, creating director of addresses.

ENGINEERING MATHEMATICS II

Course Code MAS-490 **CREDIT : 4 (3-1-0)**

1.Differential Equations: Ordinary differential equations of first order, exact differential equations, Linear differential equations of 1st order with constant coefficients, Complementary functions and particular integrals, Simultaneous linear differential equations, Solution of second order differential equation by changing dependent and independent variables, Method of variation of parameters, Applications to engineering problems(without derivation).

2.Series Solution & Special Functions: Series solutions of ODE of 2nd order with variable coefficients with special emphasis to the differential of legendre and Bessel. Legendre's polynomials, bessel's functions and their properties.

3.LaplaceTransform: Laplace transform, Existence theorem, Laplace transform derivatives and integrals, Inverse Laplace transform, Unit-step function, Dirac Delta function, Laplace transform of periodic functions, convolution theorem Applications to solve simple linear and simultaneous differential equations.

4.Fourier Series And Partial Differential Equations : Periodic functions,Trignometric series, Fourier series of functions with period 2n, Eulers formulae, functions having arbitrary period, even and odd functions, change of interval, half range sine and cosine series. Introdution to partial differtial equations, linear partial differential equation with constant coefficients of 2nd order and their classifications, parabolic, elliptic & hyperbolic with illustrative examples.

5.Application of Partial Differential Equations

Method of separation of variables for solving partial differential equation, Wave equation up to two dimension, Laplace equation in two dimension, Heat conduction equations up to two dimension, Equation of transmission Lines.

References:

1.E. Kreyszig: Advanced Engineering Mathematics, Wiley Eastern Ltd.
2.B.S Grewal: Higher Engineering Mathematics, Khanna Publishers.
3.Jaggi & Mathur: Advanced Engineering Mathematics, Khanna Publishers.

4.Prasad: Advanced Mathematics for Engineers, Prasad Mudranalaya.

MACHINE DRAWING & COMPUTER AIDED DRAFTING LAB

Course Code ME-403 **CREDIT : 2 (0-0-4)**

Review (1 Class)
Orthographic projection, missing lines, interpretation of views and sectioning.
Part and Assembly Drawing (2 Classes):
Introduction, assemblies drawing of stuffing box, steam engine cross head, air valves, lathe tailstock, gate valve, screw jack, connecting rods, spark plug, tool post, safety valves etc. Drawing exercise.
Specification of Materials:
Engineering materials, code designation of steels, copper and aluminum and its alloys.
Limits, Tolerance and fits: (1 Class)
Introduction, Limit systems, tolerance fits, drawings and exercises.
Surface Roughness: Introduction, surface roughness, machining symbols, indication of surface roughness, drawing exercises.
Production Drawing: Introduction to developing and reading or production drawing of simple machine elements like helical gear, bevel gear, flange, pinion shaft, connecting rot, crankshaft, belt pulley, piston details etc. Idea about tool drawing.
Computer Aided Drafting: Introduction, input, output devices, introduction to drafting software like Auto CAD, basic commands and development of simple 2D and 3D drawings.
References:

1. Machine Drawing by Narayana, et.all, New Age.
2. Production Drawing by Narayana, et.all. New Age.
3. Auto CAD 14 for Engineering Drawing by P. Nageswara Rao, TMH.

APPLIED THERMODYNAMICS

Course Code ME-404 **CREDIT : 5 (3-1-2)**

Review of Thermodynamics: Brief review of basic laws of thermodynamics, Helmholtz & Gibb's function, Mathematical conditions for exact deferential. The Maxwell Relations, Clapeyron Equation, Joule – Thompson coefficient curve, Availability & Irreversibility.
Steam Boilers: Brief review of properties of steam, use of steam table and Mollier chart, Steam generators- classifications, working of fire-tube and water tube boilers, boiler mountings & accessories, Air preheater, Feed water heater, Superheater, Boiler efficiency, Equivalent evaporation, Heat balance. Boiler draught.
Steam Engines: Rankine and modified Rankine cycles, Working of engine indicator diagram.
Nozzle: Flow through nozzle, variation of velocity, area and specific volume, Nozzle efficiency, Critical condition.
Steam Turbines: Classification, impulse and reaction turbines, Compounding, Velocity diagram, workdone, Reaction, Efficiency, Bleeding, Comparison with steam engines, Reheat factor, Governing of turbines, Velocity diagram, Work done, Efficiencies of reaction and impulse turbines.
IC Engines: Classification, Constraction details. Application of four stroke and two stroke engines, Review of Otto, diesel and Dual cycles, Work done, Efficiencies, Indicator diagram, Valve timing diagram. Efficiencies
Gas Turbines: Review of Bryaton cycle, Thermal refinement of a gas turbine cycle, Comparison with IC Engine and steam turbine.
Refrigeration and Heat Pump Cycles: Definition, Types, Carnot refrigerating cycle, Bell Coleman cycle. Unit of refrigeration. Description of simple vapour compression and vapour absorption systems. Introduction to air-conditioning.
Compressors: Reciprocating compressor, Construction details and working principle, Efficiency, Power input, Intercooling , Working principle of centrifugal and axial flow compressor, Power input calculation.

Reference:

1. Heat Engineering by V.P. Vasandani & D. S. Kumar Publisher Metropolition Book Co. (P)Ltd.
2. Thermal Engg. By P.L. Blallaney, Khanna Publishers.
3. Theory of Steam Turbine by W. J. Kearton
4. Applied Thermodynamics by R. Yadav 6th edn, CPH, Allahabad.
5. Thermal Engg., By R. K. Rajput, Laxmi Publication.
6. Turbine Compressors & Fans by S. M. Yahya, HMT
7. Thermal Engg. By S .K. kulshrestha, Vicars, Pub. House Ltd.
8. Fundamental of Engg. Thermodynamics by R. Yadav 7th edn, CPH, Allahabad
9. Engg. Thermodynamics by Nag
10. Engg. Thermodynamics by C .P. Arora

FLUID MECHANICS

Course Code CE-406 **CREDIT : 4 (3-0-2)**

I. Introduction: Fluids and continuum Physical properties of fluids, ideal and real fluids, Newtonian and Non-Newtorian fluids, measurement of surface tension.

II. Kinematics of Fluid flow: Steady and unsteady, uniform and nonuniform, laminar and turbulent flows, one, two and three dimensional flows, streamlines, streak lines and path lines, continuity equation, rotation and circulation, elementary explanation of stream function and velocity potential, graphical and experimental methods of drawing flow nets.

III. Fluid Statics: Pressure-density-height relationship, manometers, pressure on plane and curved surfaces center of pressure, buoyancy stability of immersed and floating bodies, fluid masses subjected to uniform accelerations, measurement of pressure.

IV. Dynamics of fluid flow: Euler's equation of motion along a streamline and its integration, Bernoulli's equation and its applications-Pitot tube, flow through orifices, mouthpieces, nozzles, notches & weirs, sluice gates under free and submerged flow conditions, Aeration of nappe, cavitation, free and force vortex momentum equation and its application of energy and momentum equations, flow measurements, determination of Cd, Cc, and Cv, energy loss.

V. Dimensional Analysis and Hydraulic Similitude: Dimensional analysis, Buckingham's Theorem, important dimensionless numbers and their significance, geometric, Kinematic and dynamic similarity, model studies.

VI. Laminar and Turbulent flow through pipes, stoke's law, flow between parallel plates, flow through porous media, fluidisation, measurement of viscosity, transition form laminar to turbulent flwo, turbulent flow, equation for turbulent flow, eddy viscosity, mixing length concept and velocity distribution in turbulent flow, Hot-wire anemometer and LDA.

VII. Boundary Layer Analysis: Boundary layer thicknesses boundary layer over a flat plate, laminar boundary layer, application of momentum equation, turbulent boundary layer, laminar sub-layer, smooth and rough boundaries, atmospheric boundary layer, local and average friction coefficient, separation and its control, measurement of shear.

VIII. Pipe flow: Nature of turbulent flow in pipes, equation for velocity distribution over smooth and rough surfaces, resistance coefficient and its variation, flow in sudden expansion, contraction, diffusers, bends, valves and siphons, concept of equivalent length, branched pipes, pipes in series and parallel, simple networks.

IX. Flow past Submerged Bodies: Drag and lift, drag on a sphere, cylinder and disc, lift, Magnus effect and circulation.

X. Compressibility Effects in pipe Flow: Transmission of pressure waves in rigid and elastic pipes, water hammer, analysis of simple surge tank excluding friction.

References:

1. Som & Biswas: Introduction of fluid mechanics & Machines, TMH.
2. S.K. Agrawal: Fluid Mechanics & Machinery, TMH
3. Garde, R.J. and A.G. Mirajgaoker, "Engineering Fluid Mechanics" (including Hydraulic Machines), Second Ed. Nemchand & Bros, Roorkee, 1983
4. Garde, R.J. "Fluid Mechanics through Problems", Wiley Eastern Limited, New Delhi, 1989
5. Hunter Rouse, "Elementary Mechanics of Fluids", John Wiley & Sons, Omc. 1946
6. L.H. Shames, "Mechanics of Fluids", McGraw Hill, Int. Student, Education.
7. Fluid Mechanics by Jagdish Lal
8. Vijay Gupta and S.K. Gupta, "Fluid Mechanics and its Applications", Villey Eastern Ltd.
9. Fluid Mechanics by Modi & Seth.

FLUID MECHANICS LAB

1.To determine experimentally the metacentric height of ship model.
2.To verify the momentum equation experimentally.
3.To determine the coefficient of discharge of an orifice (or a mouth piece) of a given shape. Also to determine the coefficient of velocity and the coefficient of contraction of the orifice (or the mouth piece)
4.To plot the flow net for a given model using the concept of electrical analogy.
5.To measure surface tension of a liquid.
6.To calibrate an orifice meter and study the variation of the coefficient of discharge with the Reynolds number.
7.To verify Darcy's law and to fine out the coefficient of permeability of the given medium.
8.To study the transition from laminar to turbulent flow and to determine the lower critical Reynolds number.
9.To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile.
10.To study the variation of friction factor, "f" for turbulent flow in smooth and rough commercial pipes.
11.To determine the loss coefficients for the pipe fittings.
12.To study the flow behavior in a pipe bend and to calibrate the pipe bend for descharge measurement.
13.To study the boundary layer velocity profile and to determine boundary layer thickness and displacement thickness. Also to determine the exponent in the power law of velocity distribution.

STRENGTH OF MATERIALS

Course Code CE-408 **CREDIT : 3 (3-0-0)**

Introduction: Brief review, concept of stress, strain, ductility, toughness, elastic constants, hardness, brittleness, tension, compression, shear, Brief review of Mohr's circle for compound stresses & for principal stresses.

Theories of Failure: Various theories of failure and its comparison.

Review of Bending and Torsion: Brief review of bending of beams and shear force & bending moment diagram. Review of torsion of circular shaft and combined bending & torsion. Shearing stresses in beams section.

Deflection of Beams: Deflection of beams, Integration method, Macaulay's method, Area moment method, Unit load method.

Columns and Struts: Theory of columns & Struts, Eulers and Rankine formulae.

Thin Cylinders: Theory of thin cylinders subjected to pressure. Expression for hoop stress and longitudinal stress. Design of thin cylinders.

Thick Cylinders and Spherical Shells: Stresses and strain in thick shells/cylinder subjected to pressures. Compound cylinders press fits on solid shaft.

Fracture, Fatique and Creep: Stress concentration, Grifith's formula. Fatigue loading, endurance limit, Creep.

References:

1. Strength of Materials by Ryder
2. Strength of Materials by Singer
3. Strength of Materials by Oimoshenko
4. Engg. Mechanics of Solids by Popov
5. Mechanics of Materials by Bear Johnson
6. Strength of Materials by R.K. Rajput
7. Strength of Materials by Ramamrutham & Narain.

MATERIAL SCIENCE & TESTING

Course Code ME-410 **CREDIT :4(3-0-2)**

Introduction: Historical perspective, importance of materials, Brief review of modern & atomic concepts in Physics and Chemistry. Atomic models, Periodic table, Chemical bondings.

Crystallography and Imperfections: Concept of unit cell space lattice, Bravais lattices, common crystal structures, Atomic packing factor and density. Miller indices. X-ray crystallography techniques. Imperfections, Defects & Dislocations in solids.

Mechanical Properties and Testing: Stress strain diagram, Ductile & brittle material, Stress Vs Strength. Toughness, Hardness, Fracture, Fatigue and Creep. Testing such as Strength testings, Hardness testing, Impact testings, Fatigue Testing Creep testing, Non-destructive testing (NDT)

Microstructural Exam: Microscope principle and methods. Preparation of samples and microstructure exam and grain size determination. Comparative study of microstructure of various metals & alloys such as Mild steel, CI, Brass.

Phase Diagram and Equilibrium Diagram: Unitary and Binary diagrams, Phase rules, Types of equilibrium diagrams: Solid solution type, eutectic type and combination type. Iron-carbon equilibrium diagram.

Ferrous Materials: Iron and steel manufacture, furnaces. Various types of carbon steels alloy steels and cast irons, its properties and uses.

Heat Treatment: Various types of heat treatment such as Annealing, Normalizing Quenching, Tempering and case hardening. Time Temperature Transformation (TTT) diagrams.

Non-Ferrous metals and alloys: Non-ferrous metals such as Cu, Al, Zn, Cr, Ni, etc. and its applications. Various type Brass, Bronze, bearing materials, its properties and uses. Aluminum alloys such as Duralumin. Other advanced materials/alloys.

Magnetic Properties: Concept of magnetism-Dia, para, ferro Hysteresis. Soft and har magnetic storages.

Electric Properties: Energy ban concept of conductor, insulator and semiconductor. Intrinsic & extrinsic semi-conductors, P-n junction and transistors. Basic devices and its application. Super conductivity and its applications. Messier effect. Type I & II Superconductors. High Te Superconductors.

Ceramics: Structure types and properties and applications of ceramics. Mechanical/Electrical behaviour and processing of plastic.

Plastics: Various types of polymers/plastics and its applications. Mechanical behaviors and processing of plastics. Future of plastics.

Other Materials: Brief description of other material such as concrete, wood, glass etc. and its uses.

Performance of materials in Service: Brief theoretical consideration of fracture, Fatigue, Creep and Corrosion and its control.

References:

1. W.D. Callister, Jr.-Material Science & Engineering Addition Wesly Publishing Co.
2. Van Vlash- Elements of Material Science & Engineering John Wiley & Sons.
3. V. Raghvan- Material Science, Prentice Hall of India
4. Narual- Material Science, TMH
5. Srivastava, Srinivasan – Science of Materials Engineering Newage.

MATERIAL SCIENCE AND TESTING LAB

A. Material Science Lab Experiments: (at least 5 of the following)

1. Making a plastic mould for small metallic specimen.
2. Specimen preparation for micro structural examination – cutting, grinding, polishing, etching.

ENVIRONMENTAL STUDIES-1

Course Code SES-415 **CREDIT 2(2 – 0 - 0)**

1: The Multidisciplinary Nature of Environmental Studies.
Definition, Scope and Importance.
(i) Ecosystems.
Concept of an Ecosystem.
Structure and function of an Ecosystem.
Producers,consumers and decomposers.
Energy flow in he ecosystem.
Ecological successsion.
Food chains,food webs and ecological pyramids.
Introduction,types,Characteristics features,structures and function of the following ecosystem:
(a) Forest Ecosystem.
(b) Grassland Ecosystem.
(c) Desert Ecosystem.
(d) Aquatic Ecosystem (Ponds,streams,lakes,rivers,oceans,estuaries).
(ii) Social Issues and the Environment
From unsustainable to sustainable development.
Urban problems related to energy.
Water conservation, rain water harvesting, water shed management.
Resettlement and rehabilitation of people; its problems and concerns case studies.
Environmental ethics: Issues and possible solutions.
Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, Case studies
Wasteland reclamation.
Consumerism and waste products.
Environment Protection act.
Air (Prevention and Control of Pollution) Act
Visit to local polluted site-Urban/Rural/industrial/Agricultural.
Study of Common plants, insects, birds.
Study of simple ecosystems-ponds, river. Hillslopes etc(Field work equal to 5 lecture hours).
Issues involved in enforcement of environmental legislation; public awareness.

FOUNDATIONS OF INFORMATION TECHNOLOGY

Course Code COMP-510 **CREDIT :5 (2-1-4)**

Fundamental Concept of Information

Information Concept and Processing: Definition of Information, Need of Information, Quality of Information, Value of Information, Concept of Information, Entropy Category and Level of information in Business Organization, Data concepts and Data Processing, Data Representation.

Information Representation: Information Contents, Introduction to information representation in Digital Media, Text, Images, Graphics, Animation, Audio, Video, Elementary concepts in information Preservence, Data compression, Huffman Coding, Shannon Principles, Adaptive Compression, LZW Coding, Images Compression, Introduction to Jpeg, Mpeg, Mheg.

Compute Programming

Computer Appreciation: Definition of Electronic computer, History, Generations, Characteristic and application of computers, classification of computers, RAM/ROM, Computer Hardware, CPU, Various I/O Devices, Peripherals, Storage Media, Software Definition.

Programming Language Classification & Program Methodology: Computer Languages, Generations of Languages, Introduction to 4 GLS, Software Development Methodology, Life Cycles, Software Coding, Testing, Maintenance, Industry Standards, Introduction to ISO, SEI-CMM Standards for IT Industry.

Digital Devices and basic Network Concepts: Digital Fundamentals: Various Codes, Decimal, Binary, Hex Decimal Conversion, Floating Numbers, Gates, Flip Flops, Minimization adder, Multiplexers.

Computer Networks and Communication: Need For Data Transmission Over Distances, Types of Data Transmission, Media for Data Transmission, Networking of Computers-Introduction of Lan and WAN, Network Topologies, basic Concepts in Computer

Networks, Client-Server Architecture, Introduction to Advanced Communication Techniques, ISDN, ATM, Token Based Protocol, CSMA/CD, Mobile Communication.

Internet and Web Technologies

Internet & World Wide Web: Hypertext Markup Language, DHJML, WWW, Gopher, FTP, Telnet, Web Browsers, Net Surfing Search Engines, E-mail, Basic concepts in E-Commerce, EDI, Electronic Payments, Digital Signatures, Network, Security, Fireball.

Web Technologies: Elementary Concepts in, Object Oriented Programming, Corba, Com/Dcom, Wireless Application Protocol, ASP Scripting, HTML, Java, Java Applets, WAP, WML, JSP, EJB, XML.

Advanced Concepts in Information Technology:

IT Industry Trends, Careers and Applications in India: Scientific, Business, Educational and entertainment applications, Industry Automation, Weather forecasting awareness of ongoing IT projects in India, NICNET ernet, Application of IT to E Commerce, Electronic Governance, Multimedia, Entertainment.

Suggested Text Books & References:

1. Curtin, "Information Technology: Breaking News", Tm + 1
2. Raja Raman, V. "Introduction to Computers"
3. Bajpai, Kushwaha & Yadav, "Intrduction to Computer & C Programming", New Age.
4. Nelson, "Data Compression", BPB
5. Bharohoke, "Fundamentals of Information Technology", Excel
6. Peter Nortans "Introduction to Computers", TM +1
7. Leon & Leon "Fundamental of Information Technology", Vikas Publishing House
8. Kanter, "managing Information System"
9. Lehngart, "Internet 101", Addision Wesley
10. Cistems "Internet, An Introduction", Tata McGray Hill.

IT LAB

Write Programs in C for the following.

1. Conversion of Binary to Hexadecimal, Decimal to BCD and vice versa
2. LOGIC Designing of gates and flip flops.
3. For Minimization methods
4. Introduction to information representation in digi8tal media text, Images, Graphics, Animations, Audio, Video.
5. Dataflow diagram for generation of Prime Numbers
6. Demonstrate Different Lan Topologies
7. World Wide Web,File Transfer Protocol,Goffer,Telenet,Web browsers, Search engine ,Email Sites
8. Create your own email address using any of the engines Ex. ID @ engine.com
9. Institutions may add 4 more experiments as per the availability of expertise available with them.

ENGINEERING MATHEMATICS-III

Course Code MAS –590 **Credit 4 (3-1-0)**

1. **Ordinary Y. Differential Difference Equations:** ODE of 2^{nd} order with constant coefficients both homogeneous and non-homogeneous Types with applications to electrical and mechanical systems. Difference equations and their Solutions by z transform. Series solutions of ODE of 2^{nd} orders with variable Coefficients with special emphasis to the differential equations of Legendre, Bessel and Chebyshev. Legendre's polynomials, Chabyshev polynomials and Bessel's functions and Their properties.
2. **Integral Transforms:** Fourier transform and integral Hanker transforms and Hilbert transforms and their Properties, some simple applications. Partial Differential Equations: Linear PDE with constant coefficients of 2^{nd} order and their classifications, PDE of Parabolic, elliptic and hyperbolic type with illustrative examples. Separation of variables Method for solving PDE. Such as two dimensional heat equations, wave equations and Laplace equations.
3. **Functions of a Complex variable:** Analytic (functions, Gauchy- Riemam equations, harmonic functions line integral in the Complex plane, caucry's Integral theorem cauchy's integral formula derivatives of analytic Functions, Liouvilles Theorem, fundamental theorem of Algebra representation of a Function py power series, Taylor's series and Laurent's Series, poles, Singularities and Zeros. Residue theorem, evaluation of integrals using. Residue theorem. Conformal" Mapping, linear fractional transformations, special linear fractional transformations.

Reference:

Kreyszig, E. (1993): Advanced Engg. Mathematics 7^{th} Edition, John Willey & sons inc.
Paopoulis: Signal Analysis 3^{rd} Edition (1988) Me Graw Hill .

ELECTRICAL MACHINES

Course Code EEE-404 **Credit 4(3-0-2)**

D.C. Machines: Constructional features and principles of operation of shunt, series and compound generators and motors including EMF equation and armature reaction, Performance characteristics of generators and motors, starting, Speed control and braking of motors. Two Quadrant and Four Quadrant operation of motors, choice of DC motors for different applications, Losses and efficiency.

Transformers: Construction, EMF equation, Principle of operation, Phasor diagram on no-load, dffect of load, equivalent circuit, Voltage regulation, Losses and efficiency, Tests on transformers, Prediction of efficiency and regulation, Autotransformers, Instrument transformers, Three phase transformers.

Induction Motors: Rotating magnetic fields, principle of operation, Equivalent circuit, Torque-slip characteristic, Starters foe cage and wound rotor type induction motors, Speed control and braking, Single Phase induction motors and methods of starting.

Synchronous Machines: Construction, EMF equation, Effect of pitch and distribution, Armature reaction and determination of regulation of synchronous generators, Principle of motor operation, effect of excitation on line currents (V-curves), methods of synchronization, typical applications of AC motors in industries.

Reference:

1.Hughes Edward, Electrical Technology, Addision Wesley Longman Ltd.
2.Nagrath I.J. & Kothari D.P., Electrical Machines, TMH
3.Cotton H., Advanced Electrical Technology, Wheeler & Co.
4.Fitzgerald, Kingsley. Kusko, Dumas-Electrical Machines TMH
5.Kosow L.L., electrical Machinery and Transformers, PHI
6.Parker Smith, Electrical Engineering Problems, CBS.

MEASUREMENT & METROLOGY

Course Code (ME-405) **Credit4(2-1-2)**

Mechanical Measurements

Introduction: Introduction to Measurement and Measuring instruments, Generalized Measuring system and functional elements, units of Measurement, static and dynamic performance characteristics of Measurement devices, calibration, concept of error, sources of error, statistical analysis of errors.

Sensors and Transducers: Types of Sensors, types of transducers and their characteristics.

Time and Transducers: Counters, Stroboscope, frequency measurement by direct comparison

Measurement of pressure: Gravitational, direct acting, elastic and indirect type pressure transducers. Measurement of very low pressures.

Measurements of Force and Torque: Different types of load cells elastic transducers, Pneumatic & Hydraulic systems.

Temperature Measurement: By thermometers, bimetallic, thermocouples, thermostats and pyrometers. **Vibration and Noise Measurement**

Seismic instruments, vibration pick ups and decibel meters, vibrometers accelerometers.

Data Acquisition system: Introduction to data acquisition systems, single and multi-channel system, microprocessors and PC based data acquisition systems. Input-output devices.

Signal Transmission and Processing: Devices and Systems.

METROLOGY

II. Metrology and Inspection: Standards of linear measurement, line and end standards. Limit, fits and tolerances. Interchangeability and standardization. Linear and angular measurements devices and systems. Limit gauges classification, Taylor's Principle of Gauge Design. Measurement of geometric forms like straightness, flatness, roundness and circularity. Tool makers microscope, profile project autocollimator.

III Interferometer: principle and use of interferometry, optical flat and interferometers, laser interferometers. Measurement of screw threads and gears.

Surface texture: quantitative evaluation of surface roughness and its measurement.

Suggested Text Books & References:

1. Beckwith Thomas G., Mechanical Measurements, Narosa Publishing House, N. Delhi.
2. Doeblein E.O., "Measurement Systems, Application Design", McGraw Hill, 1990
3. Kumar D.S. "Mechanical Measurements and Control", Metropolitan, N.Delhi.
4. Hume K.J., "Engineering Metrology", Mac Donaldd & Co. 1963.
5. Gupta, I.C., "Engineering Metrology", Dhanpat Rai & Sons, New Delhi, 1994.
6. Sirohi, "Mechanical Measurement", New Age Publishers
7. Jain, R.K., "Engineering Met5rology " Khanna Publishers
8. Jain R.K., "Mechanical Measurement" Khanna Publishers

KINEMATICS OF MACHINES

Course Code ME-407 **Credit 4(3-1-0)**

1.**Introduction:** Links, kinematics pairs, linkage mechanisms, inversions of slider crank chain and double slider crank chain, four bar linkage, mechanisms compound chains in brief.

2.**Velocity and Acceleration I Mechanisms:**Velocity of point in mech., relative velocity method, instantaneous center method, Kennedy's theorem acc-diagram, acc-centers, Correolis components acc., Klein's construction for slider crank and four bar mech. Analytical method for slider crank mech.

3.**Mechanism with Lower Parts.:**Pantograph straight line motion mechanisms, Peucellier's Mechanism, hart's straight line mech., Scort Rusel mech., analysis of hook's joint, introduction to the analysis of complex mech., Davis and Ackermann steering gears.

4.**Kinematic Synthesis of Planner Linkages:** Linkages, geometrical methods, 3 position synthesis of coupling rod, analytical method, fredenstem equation for functions generation.

5.**Cams:**Classification & terminology law of gearing, geometric & kinematic characteristic of involute, under cutting & interference, gear trains (simple, compound & planetary)

Books & reference:

1. Theory of Machines Thomas Bevan
2. Theory of Machines and Mechanisms-Shigley.
3. Theory of Machines and Mechanisms – Ghosh and Mullick
4. Theory of Machines & mechanism – Dukhipati.

INDUSTRIAL ENGINEERING

Course Code ME-411 **Credit4(3-1-0)**

1. **Productivity:** Introduction, definition, measurement, productivity index, ways to improve productivity.
2. **Work study:** Meaning and benefits of work study, time and motion study Micromotion study P.M.T.S. man machine Diagram flow chart. Motion economy, Method study, work measurement, work sampling standard time.
3. **Job Evaluation & Merit Rating:** Job analysis, job description job simplification and job evaluation methods & description, merit rating, wage incentive plans.
4. **Plant layout and Materials Handling:** Plant location type of layout, principles of facility layout principles of material handling, Material handling empts.
5. **Production Planning and Control:** Objectives, function, steps in PPC. Planning routine, scheduling, Dispatching & Follow-up, Effectiveness of PPC.
6. **Replacement Analysis:** Depreciation causes, obsolescence, service life of assets, Replacement of items.
7. **Inventory Control:** Inventory, function, cost, deterministic models.
8. **Introduction to MRP & JIT quality control:** Introduction, process control, Control Charts, Single double and sequential sampling, Introduction to TQM & bench marking.
9. **Organization:** Principles of organization, Development of Organizational charts like line, staff, line and staff & functional types.
10. **Industrial Ownership:** Proprietorship, partnership, Joint stock & co-operative stores.
11. **Manpower Planning:** Resources, Human relationship.
12. **Factory Legislation India:** Factory acts, payment of wages, workmen compensation, E.S.I. Sales management & forecasting cost accounting, Budgetary control.
13. **Project management & CPM/PERT:** Methods of drawing networks and computations of various times, updating resources a location, project management.
14. **Break Even Analysis:** Introduction, Assumption, Stepsion BEA, purpose, fixed & variable costs, margin of safety, Angle of incidence profit volume graph.
15. **Operation Research:** Brief outlines of problems, linear programming, transportation problems. Graphical methods.

References:

1. Principles of management, An analysis of management functions-H, Koontz & C.O. Donnel, Tata McGraw-Hill Co.
2. Manufacturing Management- J Moore Prentice Hall Englewoon Cliffs: New Jersey.
3. Modrn Production Operations Management- Buffam E.S. Wiley Eastern.
4. Industrial Engg. & Management by O.P. Khanna
5. Industrial Engineering by Ravi Shanker
6. Industrial Engineering by Mahajan.

MANUFACTURING SCIENCE -1

Course Code (ME 412) **Credit 4(3-0-2)**

Introduction:

Importance of manufacturing, economic & Technological consideration in manufacturing. Survey of Manufacturing Process. Materials & manufacturing process for common items.

Metal Forming Process:

Elastic & Plastic deformation, yield criteria. Hot working Vs cold working, Load required to accomplish metal forming operation. Analysis (equilibrium equation method) of forming process with sliding friction sticking friction and mixed condition for slab and disc. Work required for forging. Analysis of Wire/Strip drawing and max. Reduction, Tube drawing, Extrusion and its application Condition for rolling force and power in rolling. Rolling mills. Design, lubrication and defects in metal forming processes.

Sheet Metal Working:

Die & assembly and press work methods and processes. Cutting mechanism, blanking Vs piercing. Compound Vs. progressing die. Flat faces Vs inclined face punch.

Analysis of forming process like cup/deep drawing and bending.

Unconventional Metal Forming Processes:

Unconventional Metal forming Processes such as explosive forming, electro-magnetic, electro- hydraulic forming.

Powder Metallurgy:

Powder metallurgy manufacturing processes. The process, advantage and applications.

Casting:

Basic principle & survey of casting Process. Types of patterns and allowances. Types and properties of moulding sand. Element of mould and design considerations, gatting, riser, runner, core. Solidification of casting, theory and analysis. Sand casting, defect and remedies and inspection. Cupola furnace.

Die casting centrifugal casting, Investment casting.

Manufacturing Of Plastic Components:

Plastic and its past, present & future uses. Injection moulding. Extrusion of plastic section. Welding of plastics. Future of plastic & application.

Jigs & Fixtures:

Locating and clamping devices/principle. Jigs and fixtures and its application.

Books:

1. Manufacturing science by Ghosh and Mallik.
2. Production Engg. Science by P.C Pandey
3. Production technology by R.K.Jain.
4. Manufacturing technology by P.N.Rao
5. Material and manufacturing by Paul Degarmo.

EXPERIMENTS:

Say Minimum 8 Experiments out of Following (Or Such Experiment)

1. Design of pattern for a desired casting (containg hole).
2. Pattern making.
3. Making a mould (with core) and casting.
4. Sand testing (at least one such as of grain fineness number determination).
5. Injection moulding of plastic.
6. Forging by hand forging processes.

MANAGEMENT INFORMATION SYSTEM

Course Code ME 416 **Credit 3(3-0-0)**

Part I: Organizations, Management and the Networked Enterprise Information Systems in Global Business Today

Global E-Business: How Businesses Use Information Systems Information Systems, Organizations, and Strategy Ethical and Social Issues in Information Systems

Part II: Information Technology Infrastructure IT Infrastructure and Emerging Technologies

Foundations of Business Intelligence: Databases and Information Management

Telecommunications, the Internet and Wireless Technology Securing Information Systems

Part III: Key System Applications for the Digital Age

Achieving Operational Excellence and Customer Intimacy: Enterprise Applications

E-Commerce: Digital Markets, Digital Goods Managing Knowledge Enhancing Decision Making

COMPUTER BASED NUMERICAL & STATISTICAL TECHNIQUES

Course Code (MAS-491) **CREDIT 3 (2-0-2)**

Introduction: Errors in Numerical Computation, Mathematical Preliminaries, Errors and their Analysis, Machine Computations, Computer Software.

Algebraic & Transcendental Equation: Bisection Method, Iteration Method, Method of False Position, Rate of Convergence, Method for Complex Root, Muller's Method, Quotient Difference Method, Newton Raphson Method.

Interpolation: Introduction, Errors in Polynomial Interpolation, Finite Differences, Decision of Errors, Newton's Formulae for Interpolation, Gauss, Stirling, Bessel's, Everett's Formulae, Interpolation by Unevenly Spaced Points, Lagrange's Interpolation Formula, Divided Difference, Newton's General Interpolation Formula.Curve Fitting, Cubic Spline & Approximation**:**
Introduction, Method of Least Square Curve Fitting Procedures, Fitting a Straight Line, Curve Fitting by Sum of Exponentials, Data Fitting with Cubic Splines, Approximation of functions.
Numerical Integration & Differentiation: Introduction, Numerical differentiation, Numerical Integration, Trapezoidal Rule, Simpson 1/3 Rule, Simpson 3/8 Rule, Boole's and Weddle's Rule, Eular—Maclariaun Formula, Gaussian Formula, Numerical Evaluation of Singular Integrals.
Statistical Computation: Frequency Chart, Regression Analysis, Least Square Fit, Polynomial Fit, Linear & Non Linear Regression, Multiple Regressions, Statistical Quality Control Methods.

References:

1. Jain, Iyengar, Jain, "Numerical Methods for Scientific & Engineering Computation", New Age International.
2. Balaguruswamy, "Numerical Methods", TMH.
3. Sastry, "Introductory Method of Numerical Analysis", PHI.
4. Gerald & Wheatly, "Applied Numerical Analysis", Addision Wesley.
5. Probability & Statistic, Schaum Series.
6. Hulquit, "Numerical Method for Engineers & Computer Scientist", Addision Wesley.
7. Flowers, "Numerical Methods In C++", Oxford University Press.
8. Vedamurthy, "Numerical Methods", Vikas.

List of Experiments:

Write Programs in C

1. To deduce errors involved in polynomial Interpolation.
2. Algebraic and transcendental equations using Bisection, Iterative method of false position, also give rate of conversions of roots in tabular form for each of these methods.
3. To implement Bessel's functions, Newton's, Sterling, Languages.
4. To implement method of least square curve fitting.
5. Implement numerical differential using trapezoidal, Simpson 3/8 rules.
6. To show frequency chart, regression analysis, Linear Square fit and polynomial fit

ELEMENTS OF ECONOMICS AND PRINCIPLES OF MANAGEMENT SCIEN

Course Code (BAM-315) **CREDIT 4(3-1-0)**

Industrial Economics;

1. **Introduction:** -Nature and significance of economics, meaning of science, Engineering and technology and their relationship with economic development.
2. **Basic concept: -** The concept of demand and supply, indifference curve analysis, price effect, income effect and substitution effect.
3. **Money and banking: -** Function of money, value of money, inflation and measure to control it. Brief idea function of banking system, viz; commercial and central banking, business fluctuation.

Management:

4. Introduction: **Definition, nature and significance of management, evaluation of management thought, contribution of Max Weber, Taylor and Fayol.**
5. **Human behaviour:** Factors of individuals' behaviour, perception. Learning and personality development, inter personal relationship and group behaviour.

References:

Dewett, K.K./Modern Economics Theory.
Luthers, Fred / Organizational Behaviours.
Prasad L.M/ Principles of Management
A.W. Stonier &D.C Hergne/ A Text Book of Economics Theory /Oxford Publishing House Pvt Ltd

MACHINE DESIGN – I

Course Code (ME-409) **Credit4(2-0-4)**

Introduction, Definition, Methods, Standards in design & selection of preferred size Selection of materials, BIS system of designation of steels, steel & alloys, plastics & rubbers.

Design against static load

Modes of failure, Factor of safety, stress-strain relationship, principal stresses, theories of failure, endurance limit, design for finite & infinite life, Soderberg & Goodman criteria

Design against Fluctuating Load

Joints Riveted joints, welded joint, screwed joints, eccentric loading of above joints, design for fatigue loading.

Shaft, Keys & coupling.

Design against static load, strength & rigidity design, design of square & flat keys & splines, rigid & flexible couplings.

Mechanical Springs.

Helical spring, stress equation, deflection equation, design against static & fatigue loading, Multileaf spring, Nippling, Design, spiral springs.

Power Screws

Form of threads, square threads, trapezoidal threads, stresses in screw, design of screw jack.

Reference:

1. Machine design: Sharma & Agarwal, Kataria
2. Design of M/c Elements: Bhandari TMH
3. M/c Design : Maleev & Hariharan
4. Machine Design SI edition by Shegley, McGray Hill
5. Machine Design by black & Adams, McGray Hill
6. Design of machine elements by Sprots.

MACHINE DESIGN – I LAB

1. Design & drawing of Riveted joints for given operating conditions
2. Design of an eccentrically loaded welded, riveted or bolted joint
3. Design of bolted joint for fluctuating loads
4. Design & drawing of a cotter joint.
5. Design & drawing of a Knuckle joints.
6. Design & drawing of a simple screw jack
7. Design of shaft for different loading conditions
8. Design & drawing of rigid coupling (flanged type)
9. Design & drawing of a flexible coupling (pin-bush type)
10. Design & drawing of a leaf spring for and automobile
11. Design & drawing of a helical spring for a given application

Note-

1. Students may be advised to use design data book for design
2. Drawing shall be made wherever necessary on small drawing sheets

HEAT & MASS TRANSFER

Course Code (ME-503) **Credit 4(3-0-2)**

General: Modes of heat transfer Conduction Convection- Radiation, scope and application of heat transfer, principles in Engineering Practice.

Conduction: Fourier law-Thermal conductivity of solids, liquids and gases, factors affecting thermal conductivity General differential equation for conductions. One dimensional steady state conduction through homogeneous and composite surface-Plane, cylindrical and spherical walls-Effect of variable thermal conductivity Shape factor, Overall heat transfer coefficient-Critical radius of insulation solution of multi dimensional steady state problems using relaxation method. Transient heat conduction based on lumped parameter method.

Convection: Principles of dimensional analysis-pi theorem, Application of dimensional analysis to free and forced convection. Empirical relations for flat plate and tubular geometry. Forced convection from tubes & tube bundles in cross flow. Simple application to straight, rectangular and triangular fins effectiveness of fins. Fundamentals of boiling heat transfer, pool boiling, Heat transfer in condensation: drop wise and film condensation: empirical equations.

Radiation: Nature of thermal-radiation-Definitions and concepts Monochromatic and total emissive power-Absorptivitiy – Reflectivity-Black, gray and real surfaces-concept of a black body-Planck's distribution law-Configuration of geometrical factor Heat exchange by radiation between black surfaces-Large parallel black plates, equal parallel and opposite black squares, black rectangles perpendicular to each other having a common edge-heat exchange by radiation between large parallel planes of different emissivity. Radiation shields Electrical network method of solving radiation problems. Solar radiation & Collectors.

Heat Exchangers: Tubes of heat exchangers- Parallel flow, Counter flow evaporator and condenser, Log mean temperature difference, effectiveness, NTU method, Introduction to compact heat exchangers.

Ficks law of diffusion, Diffusion coefficient, steady state diffusion through stationary media, steady state diffusion through a stagnant gas films, steady state, equivocal counter diffusion.

References:

1. Principles of Heat Transfer Frnak Kreith McGray Hill Book Co. Heat and Mass Transfer C-D Bennett and J-E-M years, Tata McGraw-Hill (19975)
2. Fundamental of moment and heat transfer-Wetly
3. Heat and mass Transfer – Eckert & Drake, McGraw Hill Book Co.

4. Engineering Heat Transfer J.P. Homan, McGraw Hill Book Co.
5. Heat Transfer by Pitts ane Sission, Schaum series.
6. Heat Mass Transfer by R. Yadav
7. Heat Mass Transfer by C.P.Gupta
8. Heat and Mass Transfer by Domkundvar
9. Heat & Mass transfer by R.C. Chandra
10. Heat & Mass Transfer by Vijay Gupta
11. Heat & Mass Transfer by D.S. Kumar

HEAT & MASS TRANSFER –LAB

1- Conduction- Composite wall experiment
2- Conduction- Composite cylinder experiment
3- Convection- Pool Boiling experiment
4- Convection- Experiment on heat transfer from tube-natural convection.
5- Convection- Heat Pipe experiment
6- Convection- Heat transfer through fin-natural convection.
7- Convection- Heat transfer through tube/fin-forced convection.
8- Any experiment- Such as on Stefan's Law
9- Any experiment on radiation-Such as on solar collector.
10-Heat exchanger- Parallel flow experiment
11-Heat exchanger- Counter flow experiment
12-Any other suitable exp. Such as on critical insulation thickness.

DYNAMICS OF MACHINES.

Course Code (ME-504) **Credit 4(3-0-2)**

1. **Force Analysis. Turning moment & Fly Wheel:** Static force analysis of linkages, Equivalent offset inertia force, Dynamic analysis of slider crank and 4 Bar mechanism. Piston and crank effort, inertia, torque Turning moment diagrams, fluctuation of energy, fly wheel.
2. **Balancing of Machines:** Static and dynamic balancing, balancing of rotating and reciprocation masses, Primary and secondary forces and couples.
3. **Friction:**Pivot and collar friction, friction circle, single plate, multiple and cone clutches, centrifugal clutches, Michele & Kings burros thrust bearing and rolling contact bearing, Belts and pulleys, flat and V-Belts, design and selection.
4. **Brakes and Dynamometers:** External and internal shoe brakes, band and block brakes, hydraulic brakes, and absorption and transmission dynamometers.
5. **Governors:**Dead weight and spring loaded governors, sensitivity, stability, hunting, isochronism's, effort and power, friction and insensitivity, gyroscopic couple and rection.
6. **Gyroscopic Motion:** Principles, Gyroscopic acceleration, gyroscopic couple and reaction.
7. **Mechanical Vibration:** Single degree free & forced, undamped and damped vibrations, Critical speeds.

Book & Preferences

1. Theory of Machines: Thomas Bevan (ELBS/CBS pub., New Delhi)
2. Theory of Machines: S.S. Rattan (TMH)
3. Mechanisms & Dynamic of Machines- Mabie
4. Theory of machines: Shinglay
5. Theory of machines – R.K. Bansal (Laxmi Publication)
6. Mechanisms and Machine Theory – A.K. Ambekar Jain Bros.
7. Theory of Machines – W.T. Green
8. Mechanism & Machine Theory- Rao & Dukhipati (New Age)
9. Theory of Machine and Mechanism- Ghsoh & Mullick
10. Theory of Machines – P.L. Ballaney (Khanna Pub.)

PRODUCT DEVELOPMENT & DESIGN

Course Code(ME-506) **Credit3(2-1-0)**

Product, Definition, Scope, Terminology: Design definitions, Old and new design methods, design by evolution, examples such as evolution bicycle, safetyrazor etc. Need based developments, Technology based developments, Physical reliability & Economic feasibility of design concepts.

Morphology of design, Divergent, transformation and convergent phases of product disigh, Identification of need, Analysis of need.

Design for what? Design, criteria, functional aesthetic, ergonomics, form, shape, size, colour.

Mental blocks, Removal blocks, Ideation techniques, creativity, checklist, transformations, brain storming and syneerics, Morphological techniques.

Utility concept, Utility value, Utility index, Decision making under multiple criteria. Economic aspects fixed and variable costs, Break-even analysis.

Reliability considerations, Bath tub curve, reliability of systems in series and parallel, failure rte, MTTF and MTBF, Optimum spares from reliability considerations.

Design of displays and controls, Man-machine Interface, compatibility of displays and controls

Ergonomic Aspects, Anthropometrics data and its importance in design.

Application of Computers in product design.

Book References:

1. Product Design & Manufacturing – A.K. Chitat & R.C. Gupta, PHI (EEE)
2. The Technology of Creation Thinking- R.P. Gewford- Ph.D.
3. The Art of thought- Grohem Wallas- Brev & Co., New York.
4. Product Design & Dection Therory – M.K. Starr, PH
5. Engg. Product Design – C.D. Lain, Business Book
6. Industrial Design for Engineers – W.H. Mayall Hiffe
7. Human Factor Engg. – Mccormic E.J., McGraw Hill
8. Engineering, An Introduction to creative Profession- G.C. Beabley & HW Leach, Mc Millan

MANUFACTURING SCIENCE – II

Course Code (ME-507) **Credit4(3-0-2)**

Metal Cutting and Machine Tools Metal Cutting

Lathe: Principle, types, operations, Turret/Capstan, Semi/Automatic, Tool layout. Shaper, slotter planer: Operation, drive.

Milling: Milling cutter, Up & Down milling, Dividing head, indexing. Max chip thickness, power required.

Drilling and boring: Drilling, boring, reaming tools. Geometry of twist drill

Grinding: Grinding wheel, abrasive, cutting action. Grinding wheel specification. Grinding wheel wear attritious wear, fracture wear. Dressing and trueing. Maxchip thickness and Guest criteria. Flat and cylindrical grinding. Centerless grinding. Super finishing: Honing, lapping, polishing. Metal Joining

Welding :

Survey of welding and allied processes. Gas welding and cutting, process and equipment. Arc welding: Power sources and consumables. TIG & MIG processes and their parameters. Resistance welding- spot, seam projection.

Other welding processes such as atomic hydrogen, submerged are, electroslag, friction welding.

Thermodynamic and Metallurgical aspects in welding and weld. Shrinkage/residual stresses in welds. Defects in weld and remedies. Weld decay in HAZ.

Non conventional Machining and Non-conventional Welding

Benefits, application and working principles of non-conventional machining process. Introduction to Non-conventional Machining and welding (EDM,ECM, LBM, EBM, USM, AJM) similarly, non-conventional welding processes such as LBW, USW, EBW, Plasma arc welding, explosive welding.

Books:

1. Manufacturing science by Ghosh and Mullick
2. Fundamentals of Metal Cutting and Machine Tools by Boothroyd
3. Production Technology, by R.K. Jain
4. Production Technology-HMT
5. Production Engineering Science by P.C. Pandey
6. Modern Machining by P.C. Pandey
7. Manufacturing by Degarmo
8. Fundamentals of metal cutting & machine tools- Juneja & Shekhoin
9. Process & materials of manufacturing- Lind burg
10. Advanced machining process by V.K. Jain

MANUFACTURING SCIENCE –II LAB

1. Shear-angle determination (using formula) with tube cutting (for orthogonal) on lathe machine.
2. Bolt (thread) making on Lathe machine
3. Tools grinding (to provide tool angles) on tool-grinder machine.
4. Gear cutting on milling machine.
5. Machining a block on shaper machine.
6. Finishing of a surface on surface-grinding machine.

7. Drilling holes on drilling machine and study of twist-drill
8. Study of different types of tools and its angles & materials.
9. Experiment on tool wear and tool life
10. Experiment on jigs/Fixtures and its uses
11. Gas welding experiment
12. Arc welding experiment
13. Resistance welding experiment
14. Soldering & Brazing experiment
15. Experiment on in conventional machining
16. Experiment on unconventional welding
17. Experiment on TIG/MIG Welding
18. Macro and microstructure of welding joints, HAZ.

I.C. ENGINES

CourseCode:ME508 **Credit 4(3-1-0)**

Introduction: Review Classification, Application, Constructions details, Working principle, Valve timings, Environment friendly engines. List of auxiliary system.

Gas Cycle & Processes: Review of Otto, Diesel and Dual Cycles, Comparison, Sterling and Bryaton Cycle, Improvement of Performance by modification of gas turbine cycles, Fuel air cycle, Actual cycle.

Combustion in SI & CI Engines: Stiochiometric air fuel, Combustion theory, Combustion phenomena. Engine variables on ignition delay and flame Speed Abnormoral Combustion, Detonation or Knock, Variable affecting knock, Effects of knock, Methods to reduce detonation, Combustor chambers design.

Fuels for I. C. Engine: Types, Chemical Structure, Petroleum refining process, Properties of SI, CI and aviation fuels, Knocking rating of SI and CI fuels, Non- petroleum fuels, Alternative fuels for I.C engine. Stiochiometric air – fuel ratio.

Carburetion and gasoline Injection: Intake and exhaust system, Engine air-fuel requirement, Simple carburetor, Complete carburetor and its elements, Types, Fuel pump, Fuel system, Multi-point fuel injection system. Governing of SI engines.

C.I. Fuel Injection System: Requirements of injection system, Types, Injection pump, Governing, Fuel injector, Injector nozzle.

Ignition System: Requirements, Types – Battery and Magneto ignition system, Spark plug, Contact breaker, Dual angle, Firing order , Spark advance mechanism , Electronic ignition systems

Engine Friction and Lubrication: Total engine friction, Factors affecting engine friction, Lubrication, Mechanism of lubrication, Lubricants and their properties, Additives, Lubrication systems.

Engine Cooling System: Necessity of cooling, Heat transfer and energy balance, Parameters affecting engine heat transfer, Cooling system.

Supercharging : Objective, Methods, Turbocharger, performance.

Two- stroke Engines: Classification, Scavenging processes, advantages and disadvantages, Performance.

Measurement, Testing & Performance: Performance parameters, Type of tests – speed fuel and air consumption, friction, Indicated and brake power, Performance characteristics, Heat balance sheet.

Air Pollution and Control: Sources and classification, Effects of air pollution, Pollutants from I. C. engines, Mechanism of formation of pollutants, Particulate emissions, Exhaust gas treatment.

References:

1. I.C. engine Analysis and practice –E.F. obert
2. A Course in internal combustion engines –M.L. Mathur & R.P. Sharma, Dhanpat, Rai & sons, New Delhi.
3. Internal combustion engines- Maleev
4. Heat Engg.-Vasandani & Kumar
5. Internal Combustion Engine-Gill and Smith
6. Internal combustion Engines and Air Pollution- R. Yadav, CPH, Allahabad
7. I.C. Engines by V. Ganesam, TMH
8. Internal combustion Engine- Heywood, Mc-Graw Hill

REFRIGERATION & AIR CONDITIONING

Course Code (ME-502) **Credit: 4(3-0-2)**

Refrigeration: Introduction to Refrigeration System: Methods of Refrigeration, Carnot Refrigeration cycle, Unit of Refrigeration capacity, C.O.P. applications.

Air Refrigeration cycle, Bryton Refrigeration cycle, Optimum C.O.P. & pressure ratio, Air craft Refrigeration, classification of Air craft Refrigeration system, Actual power for Refrigeration system, Dry Air Rated Temperature (DART).

Vapour Compression system: Single stage system, Effect of pressure change on C.O.P. use of p-h chart, Effect of sub cooling of condensate on C.O.P. & capacity, effect of super heating of vapour-compression constructional details of Refrigerator and Air conditioner.

Vapour-Absorption System: Working Principle of continuous Absorption System. Comparison between Absorption & compression system. Theory of mixtures, Temp-concentration Diagram, Enthalpy concentration diagram. Adiabatic mixing of two systems. Lithium-Bromide water vapour absorption system. Working principle, comparison with Ammonia-water system.
Refrigerants: Classification, Nomenclature, Desirable properties of refrigerants, common refrigerants secondary refrigerants and CFC free refrigerant.
Air Conditioning: Introduction to air-conditioning, psychrometrics, terms.
Definitions, Adiabatic saturation & Thermodynamic, Wet-bulb temperature, psychrometers use of psychrometric chart, Air conditioning requirement for comfort and industrial process, comfort zones, cooling towers, cooling & heating load calculations.
Refrigeration Equipment & Application: Expansion device, Duct design. Food preservation cold storage, Refrigerators, freezes, ice plant, water coolers, thermal analysis for human body.
References:
1.Refrigeration & Air Conditioning by Manohar Prasad.
2.Principles of Refrigeration by Roy J. Dossat.
3.Refrigeration & Air conditioning by Arora & Domkundwar.
4.Refrigeration & Air Conditioning by C.P. Arora.

REFRIGERATION & AIR CONDITIONING LAB
say minimum eight out of flowing in more depth & details
1.To study the basic components of Vapour compression refrigeration system.
2.To study the basic components of Air conditioning system
3.To study different types of Psychrometers
4.To study different types of expansion devices used in refrigeration system.
5.To study different types of evaporators used in Refrigeration system (exp. 6, 7, 8)
6. Calculate the following by performing experiments of refrigeration test Rig.
7. Theoretical & actual C.O.P.
8.Volumetric efficiency of compressor
9.Plot operating on T-S Chart & P-h chart.To calculate the following by performing experiments on Air conditioning test. Rig. (exp. 9, 10, 11)
10. Theoretical & actual C.O.P.
11.By pass factor of cooling load of any room.
13.To study the Air washer
14.Visit of a central air-conditioning plant
15.Visit of cold storage.

MACHINE –DESIGN- II

Course Code (ME-505) **Credit 4(3-0-2)**

Spur gears: Conjugate action, involute gears, gear cutting methods, tooth loads, strength of spur gears I bending and in wear, dynamic loading, gear materials, design of gears in volute spines gear corrections.
Helical Gears: Tooth relation ship, tooth proportions design of the helical gears, crossed helical gears.
Worm gears: Types of worm gearing, analysis of forces, power rating efficiency, worm gear standers and proportions.
Bevel gears: Straight bevel gears, design for bending, wear and dynamic loading, spiral bevel gears, hypoid gears.
Antifriction bearing: Types of ball bearing, roller bearing, needle roller bearing, friction life of bearing, reliability considerations, selection of ball bearing, roller bearing, tapered roller bearings, thrust bearing, lubrication and sealing. Mounting of bearings,
Lubrication and sliding bearing: Type of lubrication, viscosity, hydrodynamic theory of lubrication, types of bearing, design of bearing using design charts, boundary lubrication, hydrostatic bearing, hydrodynamic thrust bearing.
Engine Parts: Design of the connecting rod, cross-head, crank shaft and piston, valve gear mechanism.
References:
1. Mechanical Engineering Desigh-Joseph E. Shigley McGraw –Hill Publications.
2. Design of machine members- alex Valance V.I doughtie, Mg-graw Hill Co.
3. Machine design D.N. Reshetov, Mir Publishers: Mosow.
4. Machine design D.N. Reshetov, Mir Publisher: Mosow.
5. Fundamentals of Machine desigh [Vol: 1-5] Porlov, ir. Pun: Mocow
6. Machine elements: Dobrovsky, Mir, Pub. Moscow data books
7. Fundamentals of Machine design-Rechard M. Phelan, Tata-McGraw Hill Pu. [1978]
8. Machine Design-Maleev and Hartman, CBS.
9. Machine Design –Sharma & Agrawal, Kataria
10.Design of Machine Elements – Bhandari TMH
11.Machine Design- Black & Adams, Mc Graw-Hill

MACHINE DESIGN – II LAB

At least 2 experiments/turns (lecture-classes) from each of the 4 following sections, say, 3 turns for A, 3 turns for B, 2 turns for C and 2 turns of D, total 10.

A. Conventional Design & Drawing-

Conventional design & drawing on small drawing sheet using hand book for items such as engine parts, shafts, gears, bearings etc. by students.

B. Computer and Language-

Lectures should be given by teachers on introduction to computer and languages such as C/Input Out put statements, control statements, if, for while, switch statement etc. Function and its uses. Structure. To make student able to write computer program.

C. Writing computer programme for conventional design-

After section B, students can write compute program for the design done in section A/ theory subjects.

D. Auto CAD-

With initial review teaching of Auto CAD, students can do drawing & drafting of design done in section A.

AUTOMATIC CONTROLS

Course Code (EEE-509) **Credit 3(2-1-0)**

Introduction : Concept of automatic controls-loop and closed-loop systems, servomechanisms, block diagrams, transfer functions. Application of Laplace Transform in control system.

Representation of control components and systems:

Translation and rotational mechanical components, electrical components, series and parallel combinations, cascade systems, analogous system.

System Response: First and second order systems response to impulse, ramp and sinusoidal inputs, properties of unit step response of second order system, systems with velocity lag.

Mode of Controls: Proportional control-proportional pus reset control proportional plus rate control, reset rate, two position control.

Controller Mechanisms: Pneumatic, hydraulic and electric controllers, general principles for generating various control actions. Concept of control value.

Control system analysis: Transient response of simple control systems stability of control system Routh's criterion.

Frequency response analysis: Polar, Bode plots-experimental determination of frequency response, Bode and Niquist stability criteria, gain and phase margins.

Root locus plots: Simple transfer functions transient response from root locus.

References:

1. Automatic control Theory- Rave, McGraw- Hill Book Co.
2. Industrial Automatic controls – lajoy, Longmans Green & Co.
3. Automatic Control Systems – B.C. Kuo, Prentice – Hall [1976]
4. Modern Control Engineering – Linear Control Systems- W-Leonhard, Allied Publishers Pvt. Ltd. [1976]
5. Control systems Engineering- I.J. Nagarth and M. Gopat New Age Pvt. Ltd.
6. Automatic Process Control- D.P. Eckaman, Viley Eastern Ltd.

STEAM POWER ENGINEERING

Course Code ME-512 **CREDIT : 4 (3-1-0)**

1.Vapour power cycle: Review of Carnot and Rankine cycle, Effect of operating conditions on thermal efficiency of Rankine cycle, Principle methods of increasing thermal efficiency, Deviation of actual cycle from theoretical cycle, Efficiencies, Requirement of ideal working fluid, Binary vapour cycle, Regenerative feed heating cycles, Calculation of mass of bled steam, Optimum feed water temperature, temperature distribution in feed heaters, Deaerators, Effect of flow of wet. steam in nozzles and blades, Erosion and corrosion of blades and its prevention, Reheating and? regenerative cycles, Practical feed heating systems.

2. Flow through nozzles and diffusers: ?Classification of nozzles and diffusers. Steady flow energy equation through nozzles, momentum equation. Nozzle and diffuser efficiencies, mass flow rate through nozzle under isentropic flow condition, critical in nozzle flow, physical explanation of critical pressure for a given initial velocity under isentropic and actual flow conditions, general relationship, between area, velocity and pressure in nozzles and diffuser, design of nozzles and diffusers, supersaturated flow through nozzles, effect of variation of back pressure in nozzle.

3. Steam turbines: Principles of working of steam turbines, classification comparison, velocity diagram for impulse and reaction turbines. Power output, axial thrust diagram efficiency; energy lost by impulse and reaction turbines. Optimum value of blade-speed ration in impulse and reaction turbines, losses in steam turbines, state point locus and reheat factor, need of governing, throttle governing, nozzle governing and by pass governing speeder and anticipatory gear, governing of reheat turbines, direct digital control, governing characteristics, steam turbine auxiliary systems.

4. Condensers and Cooling Towers: Function of condenser, condensing system, surface and jet condensers, mass of circulating water, condenser and vacuum efficiency, Cooling tower: construction details and analysis.

5. Steam generator: Function of boilers, Classification of boilers, modern boilers, heat absorption in water tube boilers, circulation in down comer-riser circuits and their sizing, steam drum and internal, mountings and accessories, Ash loading system, feed water

treatment, Fuel handling systems, Fuel burning equipment. Fluidized bed boilers, stean generator control, draught, performance of boilers.

REFERENCES

Theory of Steam Turbine by W.J.Kearton
Steam & Gas turbines and Power Plant Enginering, VII ed., 2004, Central Publishing House Allahabad.
Turbines, Compressors and Fans by S.M.Yahya
Power Plant Technology by M.M. El-wakil, McGraw Hill, Internal Edition.
Power Plant Enginering by Domkundwar and Arora, Dhanpat Rai and Sons.
Power Plant system Design by K.W. Li and B. P. Priddy, John Wiley, 1985.

MACHINE TOOL DESIGN

Course Code ME-513 **(Elective-I)** **CREDIT : 4 (3-1-0)**

UNIT – I Introduction to Machine Tool Drives and Mechanisms –
General Principles of Machine Tool Design: Working and Auxiliary Motions inMachine Tools. Parameters Defining Working Motions of a Machine Tool. MachineTool Drives. Hydraulic Transmission and its elements. Mechanical Transmissionand its Elements. Techno-Economical Prerequisites for Undertaking the Design of New Machine Tool. General Requirements of Machine Tool Design. Engineering Design Process Applied to Machine Tools. Layout of Machine Tool.

UNIT – II Regulation of Speed and Feed Rates:
Aim of speed and feed rate regulation. Stepped regulation of Speed: Design of speedbox. – Design of Feed Box – Machine Tool Drives using Multiple Speed Motions –Special Cases of Gear Box Design – General Recommendations for Developingthe Gearing Diagram – Stepless Regulation of Speed and Feed Rates.

UNIT-III Design of Machine Tool Structures:
Function of Machine Tool Structures and their requirements – Design criteria formachine tool structures – Materials of machines Tools structures – Static andDynamic stiffness – Profiles of machine tool structure – Basic Design proceduresof machine tool structures – Design of Beds – Design of Columns – Design of
Housings – Design of Bases and Tables – Design of Cross Rails, Arms, Saddlesand carriages – Design of Rams – Model Technique in design in machine toolstructures.

UNIT-IV Design of Guideways and Power Screws:
Functions and types of Guideways – Design of Slideways – Design criteria andcalculations for slideways – Guideways operative under liquid friction conditions –Design of Aerostatic slideways – Design of Anti-Friction Guideways – CombinationGuideways – Protecting devices for slideways – Design of power screws.

UNIT-V Design of Spindles and Spindle Supports :
Functions of Spindle Unit and requirements – Materials of Spindles – Effect ofmachine tool compliance on machining accuracy - Design calculations of spindles– Anti friction bearing – Sliding bearings.

UNIT-VI Dynamics of Machine tools
Machine tool elastic system-cutting process closed-loop system – general procedurefor assessing dynamic stasbility of EES –cutting process closed-loop system –Dynamic characteristics of elements and systems - Dynamic characteristics of theequivalent elastic systems - Dynamic characteristics of the cutting process – Stability
analysis – Forced vibrations of machine tools.

UNIT – VII Control systems in machine tools :
Functions, requirements and classification – Control systems for changing speedsand Feeds – Control systems for executing forming and Auxiliary motions – Manualcontrol system – Automatic control systems – Adaptive control system.

UNIT-VIII Numerical Control of Machine Tools : Fundamental concepts,
classification and structure of numerical control systems – Manual part programming– Computer Added part programming. Various elements of a CNC machines –Drives used and their selection.

TEXT BOOKS :

1. Mehta N.K. Machine Tool Design, TMII.
2. Sen G.S. & Bhattacharya, Principles of Machine Tools, New Central Book Agency, Calcutta – 1986.

REFERENCES :

1. Acherkan N, Machine Tool Design, Vol. 2 & 3 Mir publishers, Moscow, 1968.
2. Basu S.K., Design of Machine Tools, Allied Publisher, 1989
3. Koenigs Berger & Tlusty, Design of Machine Tools, Pergaman Press 1970
4. Russe W. Henke, Introductionto Fluid Power Circuits and systems, Addison Wesley, 1970

For more details, visit http://jntu.ac.in/dap/syl.html

FUEL COMBUSTION AND POLLUTION

Course Code ME-515 **CREDIT : 4 (3-1-0)**

Module 1

Working of two stroke & four stroke - Petrol and Diesel Engines (Review Only) - valve timing diagrams - Fuels - Chemical structure - qualities, ratings of fuels - Alternative fuels, Alcohol, vegetable oils, biogas.

Types of Engines - Wankel E/n, Stirling E/n, Stratified charge e/n, VCR E/n, free piston E/n. Fuel air cycle (actual) for petrol and diesel engines - variation of specific heats - heat losses - Dissociation

Module 2

Carburation - Air fuel mixture requirements - stoichiometry and excess air calculations - types of carburetors - Fuel injection systems - classifications - fuel injection pump - nozzle - direct and indirect injection - Injection in S. I. Engine - M. P. F. I. System - Ignition system - Battery & Magneto type - firing order - Ignition timing and spark advance - Lubrication systems - types - properties of lubricants - additives for lubricants - Heat rejection and cooling - Theory of engine heat transfer - types of cooling system - Air and liquid system - Super charging & turbo charging.

Module 3

Combustion in S. I. E/n - Ignition limits - stages of combustion - combustion quality - Ignition lag - Flame propagation - Abnormal combustion - detonation - effects - Theory, chemistry and control - flash point, fire point & viscosity index - combustion chamber design considerations.

Module 4

Combustion in C. I. Engines - Air Fuel ratio in C. I. Engines - Ignition Lag - diesel knock - Controlling Methods - Various stages of combustion - vaporization of fuel droplets and spray formation - Air motion - Swirl - combustion chamber - design considerations.

Module 5

Pollutant formation and control in S. I. And C. I. Engine, Nox, CO, Unburned hydro Carbon and particulate - Exhaust gas treatment - catalytic converter - Thermal reaction - Particulate Trap.

Engine operating characteristics - Testing of I. C. Engines - Indicated power - Brake power - Volumetric Efficiency - Heat balance Test - Morse Test - Measurement of exhaust smoke and exhaust emission.

References

1. Internal Combustion Engine Fundamentals - John B. Heywood
2. Internal Combustion Engine and Air Pollution -Obert E. F.
3. Internal Combustion Engine - Lichty L. C.
4. Internal Combustion Engine - V. Genesan
5. A course in internal combustion Engine - Mathur and Sharma.

FLUID MACHINERY

Course Code (CE-576) **Credit 4(2-1-2)**

1. Jet Theory: Introduction to hydro dynamic thrust of a jet on a fixed and movin g suface (flat, curve), effect of inclination of jet with the surface.

2. Hydraulic Turbines: Pelton Wheel, Francis and Kaplan turbines classification of turbines, working principles, work done, efficiency, draft tube theory, cavitations in turbines, performance, testing of turbines, model testing, selection of a turbines, stability of a turbine (Static & dynamic), performance curves, constant efficeiency curves, Muschel curves, governing of turbines, specific speeds.

3. Pumps: Centrifugal pumps, classifications, work done by impeller, efficiencies of centrifugal pumps, priming, specific speed, cavitations and separation, surging, checking, model testing, performance characteristics, reciprocating pumps, classification, work done (single and double acting), slip, variation of pressure, work saved by fitting air vessels, multicylinder pumps, comparison of centrifugal and reciprocating pumps, design aspects.

4.Hydraulic machines: Hydraulic systems, hydraulic press, cranks, jacks, accumulator, intensifier, ram, fluid coupling, fluid torque converter, water hammer, jet pumps and air lift pumps.

5.Gas Turbines and Jet propulsion: Introduction, working cycle, different types of gas turbines, jet propulsion, thrust power and propulsion efficiency.

References:

1. Hydraulic Machines Dr. J. Lal
2. Heat Engg. V.P. Vasandani & D.S. Kumar
3. Hydraulic machines V.P. Vasandani
4. Fluid machinery- K.R. Arora
5. Fluid machinery – P.N. Modi & S.M. Seth.

FLUID MACHINERY LAB

Say minimum eight experiment following or such experiment

1. Impact of jet experiment
2. Turbine exp. On pelton wheel
3. Turbine exp. On Francis turbine
4. Turbine exp. On Kaplan turbine
5. Exp. On Reciprocating pump
6. Exp. On centrifugal pump.
7. Exp on Hydraulic Jack/Press

8. Exp. On Hydraulic Brake
9. Exp. On Hydraulic Ram
10. Study through first visit of any pumping station/plant
11. Study through second visit of any pumping station/ plant
12. Any other suitable experiment/test rig such as comparison & performance of different types of pumps and turbines.

CONDITION MONITORING

Course Code ME-514 **CREDIT 4 (3-1-0)**

Introduction,

1.Principles, Economics and Application; ConditionMonitoring Methods. Economics of Condition Monitoring, Setting up aCM Activity, Implementation of Condition Based Maintenance,Consequences of implementation of CBM. Information System,Selection of Monitoring Methods, Assessment of monitoring techniques,Case studies. (06 Hrs)

2**. Vibration Monitoring and analysis**

Introduction, Machinery signatures, Selection of Transducers. AnalysisTechniques, Machine failure modes, Measurement location, Vibration severitycriteria, Vibration frequency analysis. Permanent Monitoring, Case studies.
(06 Hrs)

3. **Vibration Monitoring of ball and roller bearings**

Introduction, Shock pulse method, SPM for testing Antifriction bearings, ManualMonitoringContinuous monitoring, The Kurtosis method, Fiber optics system, Vibrationsignature analysis, Contact resistance method, Case studies. SPM and its Applications. (06 Hrs)

4. Non-Destructive testing

Introduction, Visual testing, Liquid Penetrate inspection, Water-washablemethod. Precleaning, Penetrant application, Dwell time, Excess surfacepenetrateremoval, Surface drying, Developer application, Interpretation, Postemulsifiable penetrants, Solvent-Soluble penetrants.Radiographic examination, X-ray Apparatus, X-ray generation, Tube shielding, Control console, Other X-ray sources, Electrostatic or Ven De Graffgenerators,Linear accelerators. Gamma-ray Radiography-Sources-Radium, Thallium 170,Iridium 192, Cobalt 62. Isotope Projectors-Geometric factors, Radiographic film, Radiograph. Safety Hazards and Government control; Cost.Sonics, Ultra Sonics, Pulse echo technique, Transmission technique, Resonancetechnique, Frequency modulation techniques. (07 Hrs)

5. Specialized techniques of condition monitoring

Acoustic imaging, Ultra sonic triangulation fault location Acoustic emissiontechnique (AET)- Instrumentation, Transducers, Preamplifier and filter, Main amplifier and Signal processing/ Display unit, Signals and processing, Magnetictesting Methods, Current flow Magnetisation, Induction Magnetic Flow Method,Induction Threading bar method, Induction Magnetising Coil method, InducedCurrent flow method, Magnetic particle Inspection Inks, Strippable Magnetic film, Eddy Current apparatus,Thermography-Thermographic Equipment, Application of Thermography, Corrosion monitoring, Need for corrosion monitoring, Fields of application, Monitoring Techniques, Resistance techniques.Other probe techniques-Analytical technique and others. (07 Hrs)

6. Performance Trend monitoring

Introduction, Thermodynamic and Fluid dynamic analysis, Primary andSecondary, performance parameter, Steam turbine performance parameters,Case examples.(06 Hrs)

7**. Mechanical Fault Diagnosis By Wears Monitoring & Lubricant**

AnalysisIntroduction, Source of Contamination, Significant oil contaminants, Used oilContamination-time trends, Changes in the carrier fluid, Ferratic wear debris.Wear process monitoring techniques- Direct debris detection methods, Debriscollection methods.Lubricant sampling & analysis-Sampling, Lubricant sampling methods,Lubricant analysis methods, Interpretation of results, Indications from theamount of debris present, Indication from the size distribution of debris,Application of chemical analysis of debris, Wear detection using proximitymonitors, Case examples. (08 Hrs)

8. Condition Monitoring case Studies & Applications

Failure of fan bearings- History of failures, Analysis of the failures, Solution.High frequency vibration of gas compressor-History of trouble, Analysis oftrouble, Solution. Monitoring of cracks in rotors- Turbocompressor misalignment. Detection of faulty electrical components. Turbine shelldistortion. Symptoms and Detections. (06 Hrs)

Text Books:

1. R.A., Caollacatt Chapman “Mechanical Fault Diagnosis and Condition Monitoring”, Chapman and hall 1977.

References:

1. L.F.Pau Marcel Deker “Failure Diagnosis and Performance Monitoring”.

2. Update CEP ISTE New Delhi "Condition Monitoring and condition based maintenance".

COMPUTER AIDED DESIGN

Course Code (ME-601) **Credit 5(3-0-2)**

1.Introduction: Introduction to CAD / CAED / CAE and its engineering applications, importance & necessity.

2.Programming in C, C++

Brief introduction and review computer and languages. C, C++ Input output statements, control statement, if for while, switch statement, function. Pointer nations.

Array, matrix, string, structure, class concept of object oriented Programming, Features of C++ over C.

3. Computer Graphics-

Graphic systems, CTR, Display devices, Co-ordinate representation, Graphic functions. Output primitives-Breseham's line drawing and Mid-point circle algorithms. 2-D and 3-D transformations concatenation. Exercise and programs. Curve representation. Interpolation vs approximation. Spline curve. Bezier curves and its properties. Brief mention of other curves.

3-D Graphic - Polygon surface, quadric and super quadric surface and Bobby objects. Solid modeling-Sweep representation wire mesh, constructive solid geometry and Boolean operations. Boundary representation, Colours.

4. Computer Aided Design of Machine Elements and Other systems.

CAD of machine elements such as shaft, springs, bearing and problem from other system such as heat exchanger, inventory control etc. Writing computer program in C.A. Auto CAD and its uses.

5.Introduction to Numerical Methods and Optimization Technique-

Introduction to Numerical techniques and optimization. Curve fittings. least square method. Newton Raphson method for root finding an for optimization. Brief introduction to numerical differentiation and integration. Linear programming for constrained optimization (only graphical method) .

6.Introduction to Finite Element Method (FEM)

Introduction and applications of FEM. One / Two dimensional beam element (spring system) analysis.

Books / References.

1. Computer Graphic by Hearn & Baker, Prentice Hall.
2. CAD / CAM by Groover
3. Let us C by yaswant kanetkar and also on C^{++}
4. Computer aided analysis & design of machine elements by Rao & Dukhipati
5. Numerical methods using C by Xavier.
6. Optimization - SS Rao
7. FEM - SS Rao

CAD LAB

say minimum 6 experiments from following

1. Line drawing or Circle drawing algorithm experiment : writing the program and running it on Computer.
2. Transformations algorithm experiment for translation / rotations / scaling : writing program and running it on computer.
3. Design problem experiment: writing the program for design of of machine element or other system and running it on computer.
4. Optimisation problem experiment: writing a program for optimizing a function and running it on computer.
5. Auto CAD experiment: understanding and use of Auto CAD commands.
6. Writing a small program for FEM for 2 spring system and running it. OR using a FEM package.
7. Use of graphic software standards packages e.g. GKss / PHICS / GL etc.
8. Use of pro Engineer / Idea etc.

Computer Aided Manufacturing

Course Code (ME-602) **Credit 5(3-0-4)**

1. Introduction: Need and future of NC systems and CAM in India. Advantages & Disadvantages. Classification. Open and closed loop. Historical development and future trends. Closed loop. Historical development and future trends.

2.Features of NC Programming: Difference between ordinary and NC machine tools. Methods for Improving Accuracy and Productivity.

3.NC Part Programming:(a)Manual (word address format) programming. Examples drilling and milling.

(b) APT programming, Geometry, Motion and Additional statements, Macro statement.

4.System Device: Introduction to DC motors, stepping motors, Feed back device such as encoder, counting devices, Digital to Analog converter and Vice versa.

5.Interpolators: Principle, Digital Differential Analyses. Linear Interpolator and its software interpolator.

6.Control of NC systems: Open and closed loops. Automatic control of closed loops with encoder & tachometers. Speed variation of DC motor. Adaptive control.

7.Computer integrated manufacturing system: Manufacturing cell, Transfer lines, FMS, CIM, CAD / CAM concept.

8.Robotics:NC machine vs Robots. Types and generations of Robots. Robot applications. Economics, Robot programming methods. VAL and AML with examples. Introduction to Artificial intelligence for intelligent manufacturing.

Books / References:

1. Computer control of Manufacturing systems by Koren
2. Robots by Koren
3. NC Machines by Koren
4. CAD / CAM by Groover.

CAM LAB

Minimum four experiments

1. Writing a part - programing (in word address format or in APT) for a job for drilling operation (contouring and running on NC machine.
2. Writing a part programming (in word address format or in APT) for a job milling operation (conducting) and running on NC machine.
3. Experiment on Robots and its programs.
4. Experiment of difference between ordinary machine and NC machine, study or retrofitting.
5. Experiment on difference between ordinary machine and NC machine, study or retrofitting.
6. Experiment on study of system devices such as motor and feed devices.
7. Experiment on Mechatronics & controls.

AUTOMOBILE ENGINEERING

Course Code (ME-603) **Credit 4(2-1-2)**

Power Unit Gear Box:

Principles of design of main components. Valve mechanism. Power and Torque characteristic. Rolling, air and gradient resistance. Tractive effort, Gear Box, Gear ratio determination. Design of gear Box.

Transmission system:

Requirements, clutches. Torque converts. Over Drive and free wheel, Universal joint. Differential Gear Mechanism of Rear Axle. Automatic transmission, steering and Front Axle. Castor Angle, wheel camber & Toe in Toe out etc. Steering geometry. Ackerman mechanism, Understeer and Oversteer.

Braking System:

Generals requirements, Road, tyre adhesion, weight transfer, Braking ratio. Mechanical brakes, Hydraulic brakes. Vaccum and airbrakes. Thermal aspects.

Chasis and suspension system:

Loads on the frame. Strength and stiffness. Various suspension system.

Electrical System:

Types of starting motors, generators & regulators, lighting system, Ignition system, Horn, Battery etc.

Fuel System:

Diesel & Petrol Vehicle system such as Fuel Injection Pump, injector & Fuel Pump, Carburator etc. MPFI.

Cooling & Lubrication System:

Different type of cooling system and lubrication system. Maintenance System: Preventive maintenance, break down maintenance, and over hauling system.

References:

1. Automotive Engineering - Heitner
2. Automotive Engineering - Kripal Singh
3. Automotive Engineering - Narang
4. Automotive Mechanics - Crouse
5. Automotive Engineering - Newton and Steed.

AUTOMOBILE ENGINEERING - LAB

Say any study & experiment from the following

1. Study & experiment on braking system.
2. Study & experiment on fuel supply system.
3. Study & experiment on ignition system.
4. Study & experiment on steering system
5. Study & experiment on transmission system
6. Study & experiment on suspension system.

7. Study safety aspect of automobile design.
8. Study & experiment on Lighting or lubrication system.
9. Study & experiment on lubrication and cooling system
10. Comparative study features of common small cars (such as Fiat, Ambassador, Maruti, Matiz, Santro, Indica and its variations) available in India.
11. Comparative study & technical features of common scooter & motorcycles available in India. Case study / term paper.
12. Comprative & technical features of common heavy vehicles available in India. case study / term paper.
13. Engine tuning and carburator servicing experiment.
14. Experiment & study of MPFL system.
15. Experiment on fuel consumption measurement.
16. Review experiment on IC Engines & modern trends.
17. Visit of a Automobile factory.
18. Study & experiment of main gear box and differential gear box.

POWER PLANT ENGINEERING

Course Code (ME-605) **Credit4(3-1-0)**

1.Introduction-Requirement of power and problems.
2.Variable Load Problem-Load curve, Load factor, Plant Capacity factor, Plant use factor etc.
3. Steam Power Plants-Site Selection, Fuel Preparation and handing. Firing systems-solid fuel firing, suspension firing, burners for pulvirized coal, puilverizing mills. Furnace.
4.Hydro Electric Power Stations-Site selection, Classification Different Components and working. Dams, Penstock, surge tank etc. Water hammer. Brief Review of Prime movers.
5 I.C. Engine & Gas Turbine Power Plant
6.Nuclear Power Plant-
7Basics of Power Plant economics.
8.Pollution due to power generation
9.Introduction to non-conventional sources of energy solar, wind, geo-thermal, tidal.

References:

1.Power Plant Engineering - Arora
2.Power Plant Engineering - P.K. Nag
3.Power Station Engineering & Economy - Skrotzkil
4.Power Plant Engineering - Francis
5.Power Plant Engineering - F.T. Morse
6.wer Plant Engineering - Mahesh Verma
7.Non-Conventional Energy Resources.

MECHANICAL SYSTEMS DESIGN

Course Code (ME-606) **Credit 4(3-1-0)**

1. **Engineering Process and Systems Approach:** Applications of systems concepts in Engineering, Identification of engineering, Identification of engineering functions, systems approach, Engineering Activities Matrix, Defining the proposed effort, Role of Engineering problem solving. Concurrent Engineering. A case study : eg. Viscous lubrication system in wire drawing.
2. **Problem formulation:** Nature of engineering problems, needs statement, Hierarchial Nature of systems hierarchial nature of problem environment, Problem scope and constraints. A case Study; e.g.Heating duct insulation-System High - Speed belt drive system.
3. **System Theories:** System analysis View-points, Black Box approach, state theory approach, component integration approach. Decision. Process approach; A case study: e.g. Automobile instrumentation panel system.
4. **System Modeling:**Need for modeling, modeling types and purpose, Linear graph modeling concepts, Mathematical Modeling, Concepts, A case study: e.g. A compound bar system.
5. **Linear Graph Analysis:**Graph modeling and analysis process, Path problem, Network flow problem, A case study: e.g. Aluminium extrusion system.
6. **Optimization concepts:**Optimization process, Motivation and freedom of choice goals and objectives- Criteria, Methods of optimization analytical combinatorial , subjective. A case study : e.g. Aluminium extrusion system.
7. **System Evaluation:**Feasibility assessment, planning horizon, time value of money, Financial analysis. A case study e.g. manufacture of a maize-starch system.
8. **Calculus Methods for optimization:**Model with one decision variable, Model with two decision variables, Model with equality constraint, Model with inequality constraint. A case study : e.g. Optimization of an insulation - system.

9. **Decision Analysis:** Elements of a decision problem, Decision model Probability a dignity function, Expected monetary value. Unity value, Baye's theorem : A case study : e.g. Installation of a machinery.
10. **Systems Simulation:** Simulation concepts, simulation models, Icons Analog Analytical, Waiting Line simulation, Simulation process problem definition, input model construction, solution process, limitations of simulation approach : A case study : e.g. An inventory control in a Production-Plant.

Suggested Text Books / References:

1. Design and Planning of Engineering systems- by D.D. Raredith, K.V. Wong, R.W. Woodhead, and R.R. Worthman, Prentice Hall Inc. Englewood Clifts, New Jersey.
2. Design Engineering Design Method- by J.R. Dixon, Tata Mc.Graw-Hill Publishing Company, New Delhi.
3. An Introduction to Engineering Design Method- by V. Gupta and P.N. Murthy, Tata Mc-Graw-Hill.
4- Engineering Design- Robert Matousck, Blackie and Son Ltd. Glasgow.
5. Optimization Techniques- S.S. Rao.
6. System Analysis and Project Management- Devid I Cleland, William R. King. McGraw-Hill.

NON CONVENTIONAL ENERGY SOURCES

Elective -1

Course Code ME-650 **CREDIT : 3 (3-0-0)**

1. INTRODUCTION : the energy crisis - causes and options , renewable and nonrenewable forms of Energy and their characteristics , availability of renewable energy and land area requirements.

2. BIOMASS ENERGY : Thermochemical and biological conversion to solid, liquid and gaseous fuels; production of bio ethanol, biogas and producer gas

3**. OCEAN , WAVE AND TIDAL ENERGY**- Ocean thermal energy conversion- closed and open Cycles and their limitations, Wave Energy and its conversion through oscillating water column , Tidal Energy – nature of the tides and tidal barrages for power generation.

4. WIND ENERGY - Power in wind, site selection, maximum power coefficient, wind turbine types- Horizontal axis and vertical axis machines, performance of wind machines .

5. GEOTHERMAL ENERGY – Hot aquifiers and hot and dry acquifiers

6. SOLAR ENERGY - i) Solar radiation at the earth surface , flat plate and concentrating collectors, solar ponds and energy storage, solar thermal power generation ii) Solar photovoltaic power generation- monocrystalline, poly crystalline and amorphous silicon modules and their production technology.

REFERENCES

1. Renewable energy sources and conversion technology' by Bansal , Kleemann and Mellis
2. Solar Energy – principles of thermal collection and storage' by Sukhatme, Tata – Mc Graw Hill 1996.

THERMAL TURBO MACHINES

Course CodeME-651 **CREDIT : 3 (3- 0-0)**

UNIT –I

Brief history of turbo machinery, Introduction to blowers, pumps, compressors, steam and gas turbines, turbo jet , Reviews of laws of thermodynamics & SFEE in reference to turbo machinery, Energy transfer in turbo machines, Euler's equation , velocity diagrams for axial & radial turbo machinery and pumps

UNIT – II

Centrifugal Compressors - Principle of operation , Work done and pressure rise , diffuser , compressibility effects , Non dimensional quantities for plotting compressor characteristics , compressor characteristics.

UNIT- III

Axial flow Compressors - basic operation, elementary theory, factors affecting stage pressure ratio, blockage in compressor annulus , degree of reaction , 3- D flow . design process, blade design, calculation of stage performance , axial compressor characteristics.

UNIT – IV

Gas Turbine Cycles- Shaft power cycles, Ideal cycles and methods of accounting for component losses, gas turbine cycles for aircraft propulsion , intake and propelling nozzle efficiencies , turbo fan engine , turbojet engine , turboprop engine. Thrust augmentation , design operation of single shaft gas turbine , free turbine engine and jet engines, method of improving part load performance.

UNIT – V

Steam Turbines - Constructional details , working of steam turbines

Reciprocating pumps, Main components , Indicator diagrams and modifications due to piston acceleration, performance and characteristics axial flow pumps , hydraulic turbines

REFERENCES

1. Gas turbine theory : Gohen & Rogers , Addison Weslay Longman Ltd.
2. Design of high efficiency turbomachinery and gas turbines , David Gordon Wilson , Theodosios Korakinitis , Prentice Hall International ,
3. Turbo machinery : S.M.Yahya .
4. Turbine , Compressors and Fans , S.M.Yahya , Tata Mc Graw Hill
5. Gas Turbine – Ganeshan , Tata Mc Graw Hill

UNCONVENTIONAL MANUFACTURING PROCESS

Course CodeME-652 **CREDIT : 3 (3-0-0)**

Unit 1

INTRODUCTION : Limitations of conventional manufacturing processes , Need of Unconventional manufacturing processes and its application .

Unit II

Unconventional machining process : Principle and working and applications of unconventional machining process such as electro- discharge- machining . Electro – Chemical maching . ultrasonic machining , Abrasive jet maching etc.

Unit III

Unconventional welding process : Principle and working and application of unconventional welding processes such as laser beam welding , electron beam welding , ultrasonic welding , Plasma arc welding .

Unit IV

Explosive welding , Cladding etc. Under water welding , Metallising .

Unit V

UNCONVENTIONAL FORMING PROCESSES : Principle , working and applications of High energy Forming processes such as explosive forming , Electro magnetic forming , Electro discharge forming , water hammer forming , explosive compaction etc .

REFERENCES :

1. Modern machining process- P.C.Pandey.
2. Unconventional maching – V.K.Jain .

ROBOTICS AND APPLICATION

Course Code ME-653 **CREDIT : 3 (3-0-0)**

INTRODUCTION : Past , Present and future ; Robot Terminology ; Applications , Components and Sub-systems Classification of Robot , End Effectors , Different types of grippers and design concepts .

ROBOT K8INAMETICS : Object location , Homogeneous , Transformations , Direct and inverse kinematics , Manipulator motion .

ROBOT DRIVES, ACTUATORS and CONTROL: Drive systems hydraulics , pneumatic and electrical .
DC Motor , Stepper Motor , Robot motion and path control , Controller.

SENSORS AND PERCEPTION : Type of sensors , vision system . Computer interfaces

OPERATION RESEARCH

Course Code ME-654 **CREDIT : 3 (3-0-0)**

Linear Programming: Simplex methods, primal & dual problem sensitivity analysis. Transportation & assignment problems.
Dynamic Programming: Multistage decision problem & solution, principle of optimality.
Decision theory: Decision under various conditions.
Game Theory: Minimax & maximum strategies. Application of linear programming.
Stochastic Inventory Models: Single & multi period models with continuous & discrete demands.
Simulations: Monte carlo simulation, generation of random numbers & simulation languages.
Queing Models: M.M.I & M/M/S system cost consideration.

REFERENCES

1. Operations Research by: Wangner.
2. Production Planning of Operation Management : by Bugga.
3. Int. to Operation Research by :Ravindran.

4. Optimization Techniques by S.S. Rao.
5. Operation Research by: Pant.

ADVANCE STRENGTH OF MATERIALS

Course Code ME-655 **CREDIT : 3 (3-0-0)**

Introduction:
Concept of 3-D stress and strain, their relationship compatibility relation, airys function, St. Venant`s principle, Castingliano`s theorem.

Curved Beams:
Bending of beams with large initial curvature circumferential Stress, location of the neutral axis, application to beams with rectangular and trapezoidal cross-section, stress in crane hooks application to indeterminate case of circular ring and chain links.

Unsymmetrical Bending:
Properties of beams cross-section slope of the neutral axis stress and deflection in Unsymmetrical Bending determination of shear centre and flexural axis (for symmetry about both axis and for symmetry about only one axis) for 1 section and channel section.

Helical and Leaf Springs:
Deflection of springs by energy method, helical spring under axial load and under axil twist (respectively for circular and square cross sections) axial load and twisting moment acting simultaneously or circular cross-section of open and could spring laminated springs.

Rotating Disks and Cylinder:
Stresses in uniform rotating disks, rotating disks of uniform strength, stresses in rotating cylinders.

Indeterminate Structures:
Conditions for static indeterminacy, integration method, continuous beams and the principles of three moments, use of energy methods for solving indeterminate beam problems, redundant frames.

Torsion of Non-Circular Section and Hollow Sections:
Torsion of non-circular section torsion, of hollow section.

REFERENCES AND BOOKS:

1. Strength of materials by Timoshenko and Young.
2. Strength of materials by Rajput.
3. Strength of materials by Ryder.
4. Strength of materials by Singer.
5. Advance mechanics of solids by Kazami, TMH.

MODELLING AND SIMULATION IN ENGINEERING

Course Code ME-**656** **CREDIT : 3 (3-0-0)**

Fundamental aspects of modeling : Technical and commercial aspects , types of modeling –
Analytical experimental, mechanistic, numerical, AI based stochastic. Model Testing, Principles of simulation, Discrete event simulation, Application in design and manufacturing

MECHATRONICS

Course Code ME-657 **CREDIT : 3 (3-0-0)**

Fundamentals of Mechatronics, definitions and Concepts;Conventional vs Mechantronics Systems; Need of? Mechantronics in Mechanical Engineering; Sensors and Transducers with? Special?? reference to Mechatronics. Signals System and actuating devices; real time interfacing. Applications of? Mechatronics in Manufacturing and Automation Case Studies.

METAL FORMING

Fundaments of Elasticity, Plasticity and Viscoplastcity, Stress and strain invariant Elasticity- State of stress and strain, stress-strain relations,? strain-displacement relations. Plasticity and Viscoplasticity: Yeld?? criterian, effective stress and strain, state of plastic strain, Plastic strain rate, Flow rule, Effective strain rate, plastic anisotropy and viscoplasticity (determination of load and power) concept of solid and flow formulations.?

Analysiz of Deformation Processes using SSM, UBM & SLM Plain strain Problems: Drawing and Extrusion of sheet, Rolling and forging of strips. Axisymmetric?? Problems: Drawing and Extrusion of bar and tube, forging of solid and Hallow disc. Sheet metal problems: Axisymmetric deep drawing and stretching.

Advanced Manufacturing Processes

Course Code ME-658 **CREDIT : 3 (3-0-0)**

Introduction: Need and classification of unconventional manufacturing processes, brief overview

Unconventional Machining Processes: Process Principle, Analysis and Applications of Electric Discharge Machining, Laser Beam Machining, Electron Beam Machining, Ion Beam Machining, Plasma Beam Machining, Ultra-Sonic Machining, Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Ice Jet Machining, Electrochemical Machining, Chemical Machining, Bio Chemical Machining. Hybrid Machining Processes: Electrochemical Discharge Machining, Electro-Chemical Abrasive Grinding, Electro Discharge Abrasive Grinding

Unconventional Finishing Processes: Need, classification, process principle and applications of Abrasive Flow Finishing, Magnetic Abrasive Flow Finishing, Magnetic Abrasive Finishing, Electrogel Magnetic Abrasive Finishing, Magneto-Rheological Finishing.

Unconventional Welding Processes: Laser Beam Welding, Electron Beam Welding, Ultra-Sonic Welding, Plasma Arc Welding, Explosive Welding, Under Water Welding, Welding in Space, Micro Welding Processes.

Generative Manufacturing Processes: Concept of generative manufacturing, need and Classification, Process principle and Applications of Selective Laser Sintering, Fused Deposition Manufacturing, SterioLithography, Ballistic Particle Manufacturing, Three Dimensional Printing, Laminated Object Manufacturing.

Unconventional Forming Processes: Explosive forming, Electro hydraulic forming, Electro magnetic forming, Laser Bending, Powder rolling, Spray rolling, Hydro forming, Hydrostatic and Powder extrusion, powder, rotary and isothermal forming.

REFERENCES:

1. V.K.Jain, Advance Machining Processes, Allied Publisher Bombay
2. Ghosh and Malik, Manufacturing Science,EWP Private Ltd.
3. P.C.Pandey, Modern Machining Processes, TMH Publication, New Delhi
4. Benedict G.F., Non Traditional Manufacturing Processes, Marcel Dekker
5. J.A.McGough, Advanced Machining Methods.
6. D.Kochan, Solid Freeform Manufacturing.

QUALITY ENGINEERING

Course Code ME-659 **CREDIT : 3 (3-0-0)**

Concept of quality, basic statistical concepts, Control of accuracy and precision, Process capability, standardization and interchangeability; Statistical Quality Control: Objectives, Applications, organization, cost aspects, theory of statistical tolerance.

Control Charts: General theory of Control Charts, Group Control Charts. Shewhart control chart for process control; Control Charts for variables such as X, R Control Charts for charts for attributes such as c and p charts;, Acceptance control chart; Cumulative Sum Control Charts; Subgroup selection; Process Capability, Cause-Effect and Pareto diagrams.

Acceptance Sampling: Multiple and Sequential Sampling Plans, Multi-Continuous Sampling Plan, Acceptance Sampling by Variables, Advantages limitations. Sampling plans using different Criteria. Comparison of various types of sampling plans. Rectifying Inspection.

Reliability, Availability and Maintainability: Introduction to reliability, Bathtub curve, Series and Parallel system; MTBF, Evaluation of Availability and Maintainability.

Quality Design: Design of experiment concept, System, Parameter and Tolerance Design; Concept of Robust Design, Taguchi Concept-Orthogonal Arrays and S/N ratio.

Reference Books

1. Quality Control and Introduction statistics- Duncan A.J.
2. Introduction to Quality Control-Jamison A.
3. Statistical Quality Control by Grant and Leavarworth
4. Maintenance for reliability by Rao

SOLAR ENERGY AND ITS APPLICATIONS

Course Code ME-661 **CREDIT : 3 (3-0-0)**

1. The energy crisis- causes and options, renewable and non-renewable forms of energy and their characteristics, solar energy option ? availability and land area requirements.
2. Solar radiation outside the earth?s atmosphere and at the earth?s surface, instruments for measuring solar radiation, solar radiation geometry, basic earth-sun angles, flux on tilted surfaces.
3. Liquid flat-plate collectors ? design and performance parameters, solar air heaters, concentrating collectors, solar ponds and energy storage.
4. Solar thermal power generation: low, medium and high temperature cycles, solar cooling, drying and desalination, solar air and water heating, solar passive architecture.

5. Solar photovoltaic power generation: monocrystalline, polycrystalline and amorphous cells, Fabrication and performance of SPV modules.
6. Indirect methods of solar energy utilization: biomass, wind, wave and ocean thermal energy conversion technologies. Economic considerations.

REFERENCES

1. Solar Energy: principles of thermal collection and storage? by Sukhatme, Tata McGraw-Hill, 1996
2. Solar Energy:fundamentals and applications? by Garg and Prakash, Tata McGraw-Hill, 1997

Metal Forming

Course Code ME-662 **CREDIT : 3 (3-0-0)**

UNIT-I

Plasticity –True stress strain diagrams in simple tension – Deviation from Engineering stress – Strain curves. Three dimensional stress system, strain tensor andyield Criteria of metals.

UNIT-II

Fundamentals of metal forming – Classification of forming processes – Cold working– Recovery – Recrystallisation and grain growth, hot working. Strain rate effects– work of plastic deformation

UNIT-III

Flow stress curves – Super plasticity in materials – Hot working and cold working operation – Relative merits and applications.

UNIT-IV

Sheet metal working: Standard die sets, simple, compound, combination, progressiveand transfer dies. Process parameters and estimation of loads in shearing,bending, deep drawing, shear spinning operations. Mechanical and hydraulic presses, relative merits and application – constructional features and operation.

UNIT-V

FORGING: Open die and closed die forging, machine forging, upset forging etc.,forging loads, forging die design. Estimation of forging loads for rectangular andcylindrical slugs. Forgeability Tests. Defects in forging, Forging equipment – constructional features and operation.

UNIT-VI

ROLLING: Principles of rolling, Process parameters, Estimation of rolling loads by consideration of stresses. Principles of roll pass design for various product shapes.Principles of ring rolling. Processing maps and their applications in metal working operation. Rolling mills – Their constructional features and operation.

UNIT- VII

EXTRUSION: Classification of extrusion processes, extrusion equipment. Hot extrusion. Deformation and defects in extrusion. Analysis of the extrusion proceses, cold extrusion. Extrusion of tubing and production of seamless pipe and tubing.

UNIT- VIII

DRAWING OF RODS, WIRES AND TUBES: Road and wire drawing, tube drawing process, residual stresses in rod, wire and tubes.

TEXT BOOK:

G. E Dieter: Mechanical Metallurgy.

REFERENCE BOOKS :

1.” An Introduction to the Principles of Metal Working “ by Geoffery W. Rowe.
2. “ Sheet working of Metal “ by Eary and Reads.
3. “ Manufacturing Sciences “ by Amitabh Ghosh and Mallik.
4. “ Manufacturing Technology” by P. N. Rao.

MECHANICAL VIBRATION

Course Code ME-663 **CREDIT : 3 (3-0-0)**

UNIT - I

Introduction

Periodic motion, harmonic motion, superposition of simple harmonic motions, beats, Fourier analysis Single Degree Freedom SystemFree vibration, Natural frequency, Equivalent systems, Energy method for determiningnatural frequency, response to an initial disturbance, Torsional vibrations, Damped vibrations, Vibrations of systems with viscous damping, Logarithmic decrement

UNIT – II

Single Degree Freedom: Forced VibrationForced vibration, Harmonic excitation with viscous damping, steady state vibrations,Forced vibrations with rotating and reciprocating unbalance, Support excitation, Vibration isolation, Transmissibility, Vibration measuring instruments, Displacement, velocity and acceleration measuring instruments

UNIT- III

Two Degree Freedom systems: Introduction, Principal modes, Double pendulum, Torsional system with damping, coupled system, undamped dynamic vibration absorbers, Centrifugal pendulum absorbers, Dry friction damper

UNIT- IV

Multi Degree Freedom system: Exact Analysis Undamped free and forced vibrations of multi-degree freedom systems, influencenumber, Reciprocal theorem, Torsional vibration of multi-degree rotor system, Vibrationof gear system, Principal coordinates, Continuous systems- Longitudinal vibrations ofbars, Torsional vibrations of circular shafts 8

UNIT- V

Multi Degree Freedom system: Numerical Analysis Rayleigh's, Dunkerely's, Holzer's ad Stodola methods, Rayleigh-Ritz meth

CRITICAL SPEED OF SHAFTS

Shaft with one disc with and without damping, Multi-disc shafts, Secondary critical
speed.

Books and References:

1. Mechanical Vibrations – P. Srinivasan, TMH
2. Mechanical Vibrations – G. K. Groover, Jain Brothers, Roorkee
3. Mechanical Vibrations – W. T. Thomson
4. Mechanical Vibrations – JS Rao & K Gupta, New Age
5. Mechanical Vibrations – Tse, Morse & Hinkle
6. Mechanical Vibrations – V. Rama Murthy, Narosa Publications

COMPOSITE MATERIALS

Course Code ME-664 **CREDIT : 3 (3-0-0)**

UNIT -I

INTRODUCTION: Definition – Classification of Composite materials based on structure – based on matrix.

UNIT –II

Advantages of composites – application of composites – functional requirements of reinforcement and matrix.

UNIT - III

FIBERS: Preparation, properties and applications of glass fibers, carbon fibers, Kevlar fibers and metal fibers – properties and applications of whiskers, particle reinforcements.

UNIT - IV

MANUFACTURING OF ADVANCED COMPOSITES: Polymer matrix composites: Preparation of Moulding compounds and prepregs – hand lay up method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding.

UNIT -V

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing.

UNIT -VI

Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering.

UNIT -VII

Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving.

UNIT - VIII

RESPONSE OF COMPOSITES TO STRESS: (a) Iso Strain condition (b) Iso Stress condition
(c) Load friction shared by the fibers.

TEXT BOOKS:

1. Material Science and Technology – Vol 13 – Composites by Cahn – VCH, West Germany
2. Composite Materials – K.K.Chawla

REFERENCE:

1. Hand Book of Composite Materials-ed-Lubin

MECHANICAL ENGINEERING

Course Code: ME 330 **Credits 4(3-1-0)**

1. Fundamental Concepts and Definitions: Introduction to S.I units, Definition of thermodynamics, System surrounding and universe, phase, concept continuum, macroscopic and microscopic point of view, density, sp. Volume, pressure, thermodynamic equilibrium, property, state, path, process, cyclic process, quasistatic process, reversible and irreversible process, energy and its forms, work and head, NTP and STP.

2. Ideal and Real Gases: Concept of ideal gas, characteristic equation of gas, universal and characteristic gas constant, enthalpy and specific heat, deviation of real gas from ideal gas, compressibility factor and the Van der Wall's equation of state for real gas.

3. Laws of Thermodynamics: Zeroth law, concept of temperature, equality of temperature, zeroth law, principle of thermometry and temperature scale.

First Law: First Law of thermodynamics, concept processes, flow processes and control volume, flow work, steady flow energy equation, Mechanical work in a steady flow process, Throttling process, Application of first law to open systems.

Second Law: Essence of second law, Thermal reservoir, heat engines and thermal efficiency, COP of heat, pump and refrigerator, Definition of available and unavailable energy, Statement of second law, Carnot cycle, Carnot's theorem, Clausius inequality, Concept of entropy, Entropy change for ideal gases.

4. Properties of steam: Generation of steam at constant pressure, various states of water, properties of steam, use of property diagram, process of vapour in closed and open system, determination of dryness fraction of steam by separating and throttling calorimeter, Rankine cycle.

5. Thermodynamic Cycles: Definitions of bore, Stroke clearance ratio, compression ratio, definition and calculation of mean effective pressure from the cycle work (proof not required), indicated pressure, air standard cycles (Otto and diesel cycles), principle of working and description of two and four stroke SI and CI engines.

B.Tech. Production & Industrial Engineering

DEPARTMENT OF MECHANICAL ENGINEERING
SYLLABUS FOR COURSE STRUCTURE
B. TECH PRODUCTION & INDUSTRIAL ENGINEERING

Semester-I

S.No.	Course Code	Subjects	L-T-P	Credits
1	ME 301	Engineering Graphics I	0-0-4	2
2	GPT 301	Moral and Value Education	2-0-0	2
3	ME 302	Introduction to Manufacturing Process	2-0-0	2
4	LNG 302	Professional Communication	3-0-0	3
5	ME 304	Workshop Practice & Technology	2-0-4	4
6	CE 401	Engineering Mechanics	3-0-0	3
7	MAS 411	Engineering Mathematics I	3-1-0	4
8	CHEM 513	Engineering Chemistry	3-1-2	5

Semester-II

S.No.	Course Code	Subjects	L-T-P	Credits
1	ECE 301	Basic Electronics	2-1-2	4
2	LNG 302	Professional Communication II	3-0-0	3
3	EEE 302	Electrical Engineering	3-0-2	4
4	PHY 312	Engineering Physics	3-1-2	5
5	ME 401	Engineering Graphics II	0-0-4	2
6	COMP 410	Computer and Languages	2-1-2	4
7	MAS 490	Engineering Mathematics II	3-1-0	4
8	ME 305	Mechanical Engineering	3-1-0	4

Semester-III

S.No.	Course Code	Subjects	L-T-P	Credits
1	ME 403	Machine Drawing and Computer Drafting	0-0-4	2
2	ME 404	Applied Thermodynamics	3-1-2	5
3	CE 406	Fluid Mechanics	3-0-2	4
4	CE 408	Strength of Materials	3-0-0	3
5	ME 410	Material Science and Testing	3-0-2	4
6	ENV 415	Environmental Studies – I	2-0-0	2
7	COMP 510	Foundation of Information Technology	2-1-2	4
8	MAS 590	Engineering Mathematics III	3-1-0	4

Semester-IV

S.No.	Course Code	Subjects	L-T-P	Credits
1	EEE 404	Electrical Machines	3-0-2	4
2	ME 405	Measurement and Metrology	2-1-2	4
3	ME 407	Kinematics of Machines	3-1-0	4
4	ME 411	Industrial Engineering	3-1-0	4
5	ME 412	Manufacturing Science I	3-0-2	4
6	ME 416	Management Information System	3-0-0	3
7	MAS 491	Computer Based Numerical &Statistical Techniques	3-1-0	4
8	ENV 416	Environmental Studies – II	2-0-0	2

Semester-V

S.No.	Course Code	Subjects	L-T-P	Credits
1	BAM 315	Elements of Economics and Principles of Management Science	3-1-0	4
2	ME 409	Machine Design I	2-0-4	4
3	ME 503	Heat and Mass Transfer	3-0-2	4
4	ME 504	Dynamic of Machines	3-0-2	4
5	ME 506	Product Development and Design	2-1-0	3
6	ME 507	Manufacturing Science II	3-0-2	4
7	ME 508	IC Engine	3-1-0	4

Semester-VI

S.No.	Course Code	Subjects	L-T-P	Credits
1	ME 501	Tool Design	3-0-2	4
2	ME 505	Machine Design II	3-0-2	4
3	ME 509	Project Management	2-1-0	3
4	EEE 509	Automatic Controls	2-1-0	3
5	ME 510	Quality Engineering	3-0-2	4
6	ME 516	Energy Management	3-1-0	4
7	ME 580	Seminar I	0-0-4	2
8	CE 516	Fluid Machinery	2-1-2	4

Note: Four Weeks Practical summer training-2 after VI Semester (to be evaluated in VII Semester)

Semester-VII

S.No.	Course Code	Subjects	L-T-P	Credits
1	ME 518	Design against Fatigue and Failure	3-1-0	4
2	ME 601	Computer Aided Design	3-0-4	5
3	ME 602	Computer aided Manufacturing	3-0-4	5
4	ME 603	Automobile Engineering	2-1-2	4
5	ME 604	Industrial Training	0-0-2	1
6	ME 680	Seminar II	0-0-4	2
7	ME 699a	Project (Project Formulation)	0-0-4	2

Semester-VIII

S.No.	Course Code	Subjects	L-T-P	Credits
1	ME 606	Mechanical System Design	3-1-0	4
2	ME 665-679	Electives -1	3-0-0	3
3	ME 665-679	Electives -2	3-0-0	3
4	ME 665-679	Electives -3	3-0-0	3
5	ME 699b	Project (Project Execution and Report)	0-0-12	6

ENGINEERING GRAPHICS I

Course Code ME-301 **CREDIT : 2 (0-0-4)**

1. Introduction: Graphics as a tool to communicate ideas, engineering drawing instruments and its uses. Lettering and dimensioning, scales, layouts of drawing sheets Construction of geometrical figures like pentagon and hexagon.
2. **Orthographic Projection:** Principles of orthographic projections, Principal and auxiliary planes, First and Third angle projections. Projection of points. Pictorial view.Projection of lines parallel to both the planes. Parallel to one and inclined to other, Inclined to both the planes. Application to practical problems. Projection of solid in simple position, Axis or slant edge inclined to one and parallel to other Plane, Solids lying on a face or generator on a plane. Sectioning of solids lying in various positions, True shape of the section.Development of lateral surfaces, sheet metal drawing**.**
3. Isometric Projection: Principles of isometric projection, Isometric projection using box and offset methods.

References

1. Bhatt N.D.: Elementary Engineering Drawing, Charothar Publishing.
2. Laxmi Narayan V & Vaish W.: A Text Book of Practical Geometry on Geometrical Drawing.

MORAL AND VALUE EDUCATION

Course Code GPT-301 **CREDIT : 2 (2-0-0)**

My country and my people, the many Indians, being and becoming an Indian, nationalism and internationalism.
Some life issues- love, sex and marriage, men and money-value of time, meaning of work, human communication, human suffering, addiction, ecology, women's issues.
Understanding one's neighbour, neibhourhood groups: their structure and functions,
Patterns of social interaction of group dynamics.
Preparation for a career, choice of vocation, motivation for study and research. The present educational system: curriculum and syllabus, teaching methods, examination and work experience.
Definition of value education, moral and ethics, laws and morale based on ten commandments and two great commandments.
Discovery of self, self-awareness, growth of intellect- man's spiritual nature emotions, will, respect, the rights of life, liberty, property, truth and reputation.
Sin, orign of sin, manifestation of sin, the results of sin, the remedy of sin, sin as an act, Sin as a state, sin as a nature.
Conscience- as defined in oxford dictionary and Winston dictionary. Types of consciousness (such as Evil, convicted, purged, pure, weak, good, void of offence

INTRODUCTION TO MANUFACTURING PROCESS

Course Code ME-302 **CREDIT : 2 (2-0-0)**

1. Introduction to engineering materials- Metals & alloys- composition-properties and uses
2. Manufacturing Process – Classification, mechanization, Automation , Inter-changeability, computers in manufacturing , CAD,CAM,CIM,MRP, GT
3. Metal Forming- Brief introduction to press working, casting, plastic processing ,Smithy operations.
4. Machine Tools-Introduction to lathe machines , Drilling, Shaper, Slotter, Planer , Boring machines.
5. Machine Operation-Turning, Threading, Boring, Drilling.

PROFESSIONAL COMUNICATION I

Course Code LNG-302 **CREDIT : 3 (3-0-0)**

1. Study of selected Literacy Texts.
   I. Collection of short essays.
   II.Collection of short stories.

2.Testing Written Comprehension Ability.: Comprehension Passages of 500 words Multiple Choice Questions.
3.Composition & Grammar.
4.Report Writing: Characteristics of Business Reports. Structure of reports: Front Matter, Main Body, and Back Matter Style of Reports: Definition, the Scientific Attitude, Readability of Reports, Choice of Words and Phrases, Construction and length of sentences, Construction and length of Paragraphs. The lineout or break up of a format report Blank Form Report, Frogen Report, Memoranda Form Report, Periodic Report, Miscellaneous Report.
5. Speech Drills:
Using the language laboratory to develop Speaking Communication Skills.

(i)Word Accent: Production of correct accentual patterns involving two and three syllabi words.
(ii)Rhythm: Stress-tone rhythm in sentences.
(iii)Intonation: Rising Tone and Talking Tone Ear Training and Production Tests.

References:

1. Close R.A.: A University Grammar of English Workbook. Longman, London, 1998.
2. Jones, Daniel: English Pronouncing Dictionary, ELBS, and London, 1999.
3. Sharma S.D: A Textbook of Spoken and Written English, Vikas, 1994.
4. Alvarez, Joseph A.: The Elements of Technical Writing, New York: Harcourt, 1998.
5. 5.Bansal, R.K.: Spoken English For India, Orient Longman, 1993.

WORKSHOP PRACTICE AND TECHNOLOGY

Course Code ME-304 **CREDIT : 4 (2-0-4)**

I. Introduction to tools- Description , applications of tools used in different shops
2. Carpentry- Classification of tools-marking and measuring-holding and supporting- planning-cutting- boring –striking-miscellaneous-et
3. Fitting shop-Marking & measuring, holding, cutting too
4. Smithy- holding and supporting tools, cutting tools , striking tools
5. Sheet metal
1.Welding
II Properties of metals- Strength, elasticity , plasticity, Malleability , hardness, brittleness etc.
III.Timber- Introduction-selection of timbers-seasoning of timbers – timber defects
IV.Brief introduction to joining process-Nuts& bolts-Screw- Screws-rivets & riveting- welding-electric arc-gas welding- TIG-MIG welding –threads
V.Extrusion-Classification-process geometry- Geometrical relationship- analysis of extrusion-stresses- load – power – maximum reduction possible-working and application of indirect extrusion-hydrostatic extrusion- defects in extruded parts.
VI . Forging – classification- strip sand disc forging- Process geometry-geometrical relationship-Analysis - defects in forged products .
VII. Rolling – classification-process geometry-geometrical relationship analysis-rolling pressure & rolling separating force.

ENGINEERING MECHANICS

Course Code CE-401 **CREDIT : 4 (2-0-4)**

force and equilibrium
Basic concepts, force, moment and couple, principle of transmissibility, verigonon's theorem, resultant of force systems, concurrent and non-concurrent coplanar forces, funicular polygon, and free body diagram.

Trusses
Plane structures, various methods of analysis of trusses, method of joints, method of sections and graphical method.
Moment of inertia
Center of gravity, centroids of line, area, volume and composite Bodies, area moment of inertia and mass moment of inertia for plane figures and bodies including composite bodies, product moment of inertia, parallel axis theorem, principal moment of inertia.
Friction
Introduction, dry friction, co-efficient of static friction, friction cone, screw jack and belt friction.
Beams
Bending moment and shear force diagrams for statically determinate beams.
Kinematics of Rigid Bodies
Plane motion, absolute motion, relative motion, translating axes and rotating axes.
Kinetics of Rigid Bodies
Plane motion, force Mass and Acceleration, Work and energy, Impulse and momentum, principles of energy conservation, Principle of virtual work, D'AleMbert's principal and dynamic equilibrium.
References:

1. Beer F.p and Johnston F.R: mechanics for engineers, McGraw hill.
2. Meriam, J.L: Statistics, John Wiley.
3. Meriam, J.L: Dynamics, John Wiley.
4. Shames I.H: Engineering Mechanics, Prentice Hall of India.
5. Dayaratnam, P: Statistics, Tata Mc Graw Hill.
6. Timeshenko, S.and Ypung D: Engineering Mechanics, Mc Graw Hill.

ENGINEERING MATHEMATICS

Course Code MAS-411 **CREDIT : 4 (3-1-0)**

1. **Matrices :**Elementary row and column transformations, Linear dependence, Rank of matrix, consistency of system of linear equations and solution of linear equations, Characteristic equation, and Caley-Hamilton theorem, Eigen values and eigen vectors, Diagonalisation, Complex and unitary matrices.
2. **Differential Calculus-I:**Leibnitz theorem, Partial differentiation, Euler's theorem, Asymptotes, Curve tracing, Change of Variables, expansion of functions of one and several variables. Cylindrical and spherical coordinate systems
3. **Differential Calculus-II:**Jacobian, Approximation of errors, Extrema of function of several variables, Lagrange's method of multipliers (simple applications).
4. **Multiple integrals:**Double and triple integrals, change of order, change of variables, Gamma & Beta functions,application to area, volume, Disrichlet's integral and its applications.
5. **Vector Calculus:**Point functions, Gradient, divergence and curl of a vector and their physical interpretations, line, surface & volume integrals, Gauss divergence theorem and Greens & Stokes theorem.

References:

1.Shanti Narayan: A Text Book of matrices, S.Chand & Co.
2.Thomas/Finney: Calculus and Analytic Geometry, Narosa Pub. House.
3.J. N. Kapur: Mathematical Statistis, S. Chand &Co.
4.C. Prasad: Mathematics for Engineers, Prasad Mudranalaya.
5.B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers.
6. Jaggi & Mathur : Advanced Engineering Mathematics, Khanna Publishers.
7. Piskunov, N.: Differential & Integral Calculus, Moscow Peace Pub.
8.H.K. Das, Engineering Mathematics.
9.Vijai Shankar Verma & Sanjeev Kumar, Engineering Mathematics.
10. Rakesh Dubey, Engineering Mathematics

CHEMISTRY

Course Code CHEM-513 **CREDIT : 5 (3-1-2)**

1.General Chemistry: Advanced Theory of Chemical Bonding: Valence bond and molecular orbital theory. Structure of NH_3, H_2O, SO_3, PCl_5, XeO_2 molecules. Theories of bonding in metals and semiconductors,n-type and p-type semi-conductors, Imperfections in materials. Born-Haber cycle, Bragg's conditions.

2.Physical Chemistry: Equilibrium on Reactivity: Bronsted and Lewis Acids, pH, pka, pkb Scale, Buffer solution. Stereochemistry of organic compounds, Co-ordination chemistry, Nomenclature, Valence Bond and crystal field theory.

Chemical Kinetics & Catalysis: Rate law, Order of reactions, Parallel and reversible reactions, Catalysis, Homogeneous and heterogeneous catalysis, Characteristics of catalytic reaction, Catalytic promoters and poi-sons, Auto catalysis and negative catalysis, Intermediate compound formation theory and absorption theory.

3.Environment Chemistry: Atmospheric Chemistry & Air Pollution: Environment and Ecology, Environmental segments, Structure and composition of atmosphere, Radiation Balance of Earth and Green House Effect, Formation and depletion of Ozone layer, Chemical and photochemical reactions of various species in atmosphere, Air pollution – sources, reactions and sinks for pollutants, Acid rains and Smog formation. Pollution control methods.

Corrosion and Lubrication: Introduction, causes of corrosion, Theories of corrosion, Factors influencing Corrosion, Corrosion inhibitors, passivity, Types of corrosion, Protection from corrosion and protective coatings. Theory, Classification and mechanism of Lubrication.

4. Applied Chemistry: Water and Waste Water Chemistry: Introduction, Hardness of water, characteristics imparted by impurities, Analysis of contaminants, Treatment of Water by Zeolite, L-S process, Boiler feed water, Waste water treatment.

5. Chemistry of Engineering Materials: Fuels & Combustion: Classification of fuels, Non conventional Energy, Biogas, Biomass and solar energy. Calorific value- gross and net, characteristics of good fuel, Determination of calorific value, Solid fuels, Analysis of coal, Liquid fuels. Instrumentation: IR, UV, NMR, MASS AND ASS.

6.Industrial Chemistry: Polymer Chemistry: Classification of Polymers, Including Biopolymers condensation and addition polymers and their applications. Industrial

Application and mechanism of chemical reaction, Beckman, Hoffman, Reimer Tiemann, Cunnizzaro, Diels Alder and Skraup synthesis.

References:

1. Puri and Sharma/Principles of Physical Chemistry.
2. Manas Chandra/Atomic Structure and Chemical Bond.
3. Bahl and Tuli /Engineering Chemistry.
4. Jain and Jain/A Text-Book of Engineering Chemistry
5. S.S Dara/Environmental Chemistry and Pollution Control.
6. S.S Dara /Environmental Chemistry.
7. A.K De/Environmental Chemistry.

LIST OF EXPERIMENTS (ANY TEN):

1. To determine the percentage of available chlorine in the supplied sample of Bleaching powder.
2. To determine the Ferrous content in the supplied sample of iron ore by titrimetric analysis against standard K□Cr□ solution using K, $Fe(CN)_g$ as external indicator.
3. To determine the chloride content in supplied water sample using Mohr's method.
4. To determine the constituents and amount of alkalinity of the supplied water sample.
5. To determine the Temporary and Permanent hardness of water sample by Coplexometry.
6. To find the Chemical Oxygen Demand of a waste water sample using Potassium dichromate.
7. To determine iron concentration in the sample of water by spectrophotometric method.
8. To find out the Velocity constant for the inversion of cane sugar in acidic medium and to show that inversion follows the first order kinetics.
9. To determine the Molecular weight of a polystyrene sample by using Viscometer method.
10. To determine pH of a solution using a pH-meter and titration of such a solution pH-metrically.
11. To determine the calorific value of a fuel sample by using a Bomb Calorimeter.
12. Analysis of a coal sample by proximate analysis method.

References:

1.Vogel's Qualitative Chemical Analysis: Ed. By Jaffery Bassette et. al. (ELBS).
2.Applied Chemistry- Theory and Practice, 2nd Ed. By Virmani and Narula (New Age International Pub.).
3.Experiments in Engineering Chemistry, Ed. By Masood Alam (Maktaba Jamia Limited).

BASIC ELECTRONICS

Course Code ECE-301 **CREDIT : 4 (2-1-2)**

1. Energy Bands in Solids: Energy band theory of solids, Concept of forbidden gap, Insulators, Metals and Semiconductors.
2. Transport Phenomenon in Semiconductors: Mobility and conductivity, electrons and holes in an intrinsic semiconductor, Donor and acceptor impurities, Fermi level, carrier densities in semiconductor, electrical properties of semiconductor, Hall effect, Diffusion.
3.Junction Diode:P-N junction, depletion layer, V-I characteristics, diode resistance, capacitance, switching time, diode application as a rectifier (half wave and full wave), diode circuits (clipper, clamper, voltage multipliers) Breakdown mechanism, Zener & Avalanche, breakdown characteristics, Zener diode and its applications.
4.Bi-junction Transistor: Bipolar junction Transistor, CE, CB and CC configuration, characteristic curves (cut off, active and saturation region), Requirement of biasing, biasing types and biasing analysis, stability.
5.Transistor as an Amplifier: Graphical analysis of CE amplifier, concept of voltage gain, current gain and power gain, h-parameter (low frequency), computation of A_v, R_I, R_o and approximate formulae.
6.Operational Amplifiers: Concepts of ideal op-amp, inverting, non-inverting and unity gain amplifiers, adders, difference amplifiers. , Integrators.
7.Switching Theory & Logic Gates: Number systems, conversion of bases, Boolean algebra, Logic Gates, concept of universal gate, canonical forms, and minimization using K-map.
8.Electronic Instruments: Multimeter, CRO and its Applications.

References:

1.Boylestad & Nashelsky/Electronic Devices & Circuits/ PHI.
2.Morris Mano/Digital Computer Design/ PHI.
3.Milliman, J. Halkias/Integrated Electronics/TMH.
4.Malvino & Leach/Digital Principles & Application/

List of Experiments:

1.Study of Diode characteristics.
2.Study of Common Base Transistor characteristics.
3.Study of Common Emitter Transistor characteristics.
4.Study of Half Wave Rectifier with effect of Capacitor and also calculate the ripple factor.
5.Study of Full- Wave Rectifier with effect of Capacitor and also calculate the ripple factor.
6.Study of Various Logic Gates.
7.Study of Clipping and clamping Circuits.
8.Study of C.R.O., Function generator, Multimeter**.**

PROFESSIONAL COMMUNICATION II

Course Code LNG-303 **CREDIT : 3 (3-0-0)**

1. Technical Written Communication

(a)Nature, origin and development of technical written communication.
(b)Salient Features.
(c)Difference between technical writing and general writing.

2. Pre-requisites of Scientific and Technical Communication

(a)Fragment sentences.
(b)Parallel comparisons.
(c)Elements of a series.
(d)Squinting construction and split infinitive.
(e)Modifiers, connectives, antecedents and clause subordination.
(f)Dangling participles and gerunds.
(g)Ellipsis.
(h)Coherence, Unity, Chronological method, spatial method, inductive method, linear method, deductive method, interrupted method.

3. Business Correspondence

(a)General principles of business correspondence.
(b)Ramifications of business letters.
(c)Letters giving instructions, inquiries and answers to enquiries, complaints and adjustments, letters urging action, employment letters, application and resumes.

4. Proposal Writing

(a)Proposal: Definitions and kinds.
(b)Division of format proposals (front matter, title page, summary/ abstract, Table of contents etc.)
(c)Statement of request, body- statement of problem, background, scope, methodology, Advantages and disadvantages.

5. Writing Scientific and Semi-technical Articles

(a)Source material, topic sentence, literature review.
(b)Tables, figures, footnotes, bibliography.

6. Study of Scientific and General Texts.

(A). Prescribed text books for detailed study
1Arora, V.N (et. al.), Improve your writing (Delhi: Oxford University Press, 1981.
2 Lesson No. 1.2, 1.6, 2.4, 3.5, 4.1, 4.3, 5.1, 5.4, 6.2.
(B). For extended Reading (any one of the following)
1 Orwell George, Nineteen Eighty Four (New York: Penguin, 1984)
2Hemingway, Ernest, The old man and the Sea, (Oxford: 1990)

7.ListeningComprehension

(a).Ear-training.
(b). Uses of latest scientific techniques (AVR Comprehension trainer, SRA Comprehension trainer, SRA Comprehension Accelerator, AVR Comprehension Reteometer.)

8.ReadingComprehension.

(a) Scanning method.
(b) Skimming method.

9. Phonetic Transcription

10. Stresses and Intonation.

References

1. Sherman, Theodore A. (et al) Modern Technical Writing, New Jersey, Prentice Hall, 1991.
2. Legget, Glenn (et al) Essentials of grammar and composition, Macmillan, Delhi 1994.
3. Strunk, Jr. William (et al), The elements of style, Macmillan, 1987.
4. Sharma, S.D A Text Book of Scientific and Technical Writing, Vikas, Delhi, 1990.

ELECTRICAL ENGINEERING

Course Code EEE-303 **CREDIT : 4 (3-0-2)**

1.**Sinusoidal Steady State Circuit Analysis:**Voltage, Current, Sinusoidal & Phasor representation.1-Phase A.C. Circuit-behavior of resistance, Inductance and Capacitance and their combinations, impedance, concept of power, power factor, series & parallel resonance-bandwidth and quality factor.

2.**Network Theory:**Introduction to basic physical laws, Network theory: Superposition, Thevenin, Norton, Maximum Power transfer theorems, Star-delta transformation, Circuit theory Concepts: Mesh and Nodal analysis.

3.**Three Phase Supply:**Star/delta connections, line and phase voltage/current relations, Three-phase power and its measurement.

4.**Basic Instruments:**Instruments for measurement of voltage, Current, power and energy: Construction, principle and application.

5.**Magnetic Circuit and Transformer:**Magnetic circuit concept, theory and working principle of single-phase transformer.

6.**Rotating Machines:**Principles of energy conversion, Basic concepts of rotating machines, DC machines, Different types and their characteristics & applications. Elementary idea of operation of synchronous and induction machines. Single-phase induction & stepper motors, Applications.

7.**Power Systems:**Introduction, Elements, Line diagram, Supply systems, Power factor improvement.

Reference:

1.V. Del Toro/ Principles of Electrical Engineering/ PHI.
2.W.H Hayt & J.E Kennedy/ Engineering Circuit Analysis/ McGraw Hill.
3.I.J Nagrath/ Basic Electrical Engineering/ Tata McGraw Hill.
4.A.E Fitzgerald/ Electronic Instruments & Measurement Techniques/ PHI.
5.Higginbotham L.Grabel/Basic Electrical Engineering/ McGraw Hill.

LIST OF PRACTICALS

A minimum of 10 experiments from the following**:**

1.Verification of Thevenin's Theorem.
2.Verification of Superposition Theorem.
3.Verification of Norton's Theorem
4.Verification of Kirchoff's Law.
5.To measure the value of impedance and power factor in RLC series A.C. circuit.
6.To measure the value of impedance and power factor in RLC parallel A.C. circuit.
7.To study resonance by frequency variation in series RLC circuit.
8.To calibrate the given energy meter with the help of a standard wattmeter.
9.To find the relation between line current and phase current and line voltage and phase voltage in Star – Delta connections.
10. To perform open circuit and short circuit test and draw the equivalent circuit of a single-phase transformer.
11. To measure three phase power by two-wattmeter method.
12. To draw the magnetizing characteristic of a single-phase transformer.

Additional experiments may be added based on contents of syllabi.

ENGINEERING PHYSICS

Course Code PHY-312 **CREDIT : 5 (3-1-2)**

1. **Special Theory of Relativity:**Michelson Morley experiment, Inertial frames of reference, Postulates of special theory of relativity, Lorentz transformation equation of space and time, length contraction, time dilaton, addition of velocities, variation of mass with velocity, mass-energy equivalence.
2. **Optics :**Interference: Coherent sources, Conditions of interference, Fresnel's bi-prism experiment, displacement of fringes, interference in thin films, wedge shaped film, Newton's rings.
   Diffraction: Single slit and double slit diffraction, diffraction grating, Reyleigh's criterion of limit of resolution, resolving power of telescope, microscope and grating.
   Polarization: Polarization of light, Pictorial representation of polarized light, Brewster's law, Malus law, Phenomena of double refraction, Geometry of calcite crystal, Optical activity, Specific rotation, Polarimeter.
3. **Fields:** Scalar and vector fields, Gradient of a scalar field, divergence and curl of a vector field, line integral, conservative vector field, Gauss' Divergence theorem, Stoke's theorem.
4. **Electrostatics:** Gauss' law and its applications, Poisson and Laplace equations. Maxwell's equations, Basic Concepts of Electromagnetic waves and its solution in free space.
5. **Magnetic Properties of Materials:**Para, dia, ferro, antiferro and ferro-magnetic materials, hysteresis, Methods of plotting hysteresis curve of a ferro-magnetic material and their uses, magnetic circuits.
6. **X-Rays:** Origin of X-rays, Continuous and characteristic X-Ray spectra, Moseley's law, Absorption of X-rays, Diffraction of X-rays, Bragg's law, Bragg's spectrometer, Practical application of X-rays, Compton effect.
7. **Quantum Theory:**Wave particle duality, De Broglie concept of matter waves, Davisson and Germer experiment, Heissenberg's uncertainty principle, Schrodinger wave equation and its applications.
8. **Laser**

Spontaneous and stimulated emission of radiation, Einstein's coefficients, Main components of a laser, types of lasers and their applications.

References:

1. Arthur Beiser: Concepts Of Modern Physics, TMH.
2. Subramanyam & Brij Lal: A Text Book of Optics, S. Chand & Co.
3. K.K. Tiwari: Electricity & Magnetism, S. Chand & Co.
4. Brij Lal & Subramanyam: Electricity & Magnetism.
5. Wehr, Richardo & Adair: Physics of the Atom.

List Of Experiments (Any Ten)

1.To determine the wavelength of monochromatic light by Newton's ring.
2.To determine the wavelength of monochromatic light with the help of Fresnel's biprism.
3.To determine the focal length of two lenses by nodal slide and locate the position of cardinal points.

4. To determine the specific rotation of cane sugar solution using half shade polarimeter.
5. To determine the wavelength of spectral lines using plane transmission grating.
6. To determine the specific resistance of the material of given wire using Carey Foster's bridge.
7. To determine the variation of magnetic field along the axis of a current carrying coil and then to estimate the radius of the coil.
8. To verify Stefan's Law by electrical method.
9. To calibrate the given ammeter and voltmeter.
10. To study the Hall Effect and determine Hall coefficient, carrier density and mobility of a given semiconductor material using Hall Effect set up.
11. To determine the energy band gap of a given semiconductor material.
12. To determine E.C.E of copper using Tangent or Helmholtz galvanometer.
13. To draw hysteresis curve of a given sample of ferromagnetic material and from this to determine magnetic susceptibility and permeability of the given specimen.
14. To determine the ballistic constant of a ballistic galvanometer.
15. To determine the viscosity of a liquid.
16. To determine refractive index of the material of prism using spectrometer.

ENGINEERING GRAPHICS II

Course Code ME-401 **CREDIT:2(0-0-4)**

1. Introduction: Graphic language, Classification of drawings, Principles of drawing: IS codes for Machine drawing, Lines, Sections, Dimensioning, Standard abbreviation**.**
2. Orthographic Projections: Principles of first and third angle projections, drawing and sketching of machine elements in orthographic projections, spacing of views.
3. Screwed (Threaded) Fasteners: Introduction, Screw thread nomenclature, Forms of threads, Thread series, Thread designation. Representation of threads, Bolted joints, Locking arrangements for nuts, Foundation bolts.
4. Keys and Cotters: Keys, Cotter joints.
5. Shaft Couplings: Introduction, Rigid and flexible coupling.
6. Riveted Joints: Introduction, Rivets and riveting, Rivet heads, Classification of riveted joints.
7. Assembly Drawing: Introduction, Engine parts, Stuffing box etc.
8. Free Hand Sketching: Need for free hand sketching, Free hand sketching of some threaded fasteners and simple machine components.

References:

1. N. Siddeshwar, P. Kannaiah, V.V.S Shastri: Machine Drawing, TMH, New Delhi.
2. K.L Narayana, P. Kannaiah, K. VenkatReddy: Machine Drawing, New Age International Publications, 2nd edition.
3. Engineering drawing practice for schools and colleges, SP 46-1998(BIS).

COMPUTER AND LANGUAGES

Course Code COM-410 **CREDIT : 4(2-0-4)**

1Computer hardware components and their functions
2Basic operating system concepts
3MS-DOS and getting to know DOS commands
4Familiarizing with WINDOWS environment
5Getting started with UNIX
6Files and Directories and their use in different Operating System Environments
7Getting to know different editors like edit & vi
8Introduction to Internet
9Getting familiar with Web Browsers like Netscape Navigator & Internet Explorer
10Sending & receiving mail over Internet
11Introduction to PINE and /or ELM
12Need of programming languages.
13Language translators.
14Introduction to "C" language
15Data types operators and expressions.
16Conditional & looping statements.

17Function & Arrays.
18 Introduction to Pointers & Structures.

References:

1.DOS the complete reference by Kris Jamsa, Tata- McGraw Hill Publication.
2.UNIX POWER TOOLS by J.Peek Tim O'reilly & M. Locekides, BPB Publication.
3.The 'C' Programming Language by B.W Kernighan & D.M Ritchie, Prentice Hall of India.
4.Using LINUX- Latest Edition by Jade Tackett & David Ganter, Prentice Hall of India.

LIST OF PRACTICALS

1.Basic Internal and External DOS Commands.
2.Write a simple batch program.
3.Giving exposure to Windows environment.
4.File and program management in windows.
5.Practice of basic UNIX commands.
6.Write simple shell script.
7.Introduction to word processing.
8.Exposure to advance feature supported by some editors.
9.Net Surfing.
10. Creation and checking of E-mail account.
11. Write C program to demonstrate each of the following:
1Conditional statements.
2Looping statements.
3User defined functions.
4Arrays.
5Pointers and structures.
12. Familiarizing mail account using PINE, deleting, creating folder/mail-messages, adding signature, creating director of addresses.

ENGINEERING MATHEMATICS II

Course Code MAS-490 **CREDIT : 4 (3-1-0)**

1.Differential Equations: Ordinary differential equations of first order, exact differential equations, Linear differential equations of 1st order with constant coefficients, Complementary functions and particular integrals, Simultaneous linear differential equations, Solution of second order differential equation by changing dependent and independent variables, Method of variation of parameters, Applications to engineering problems(without derivation).
2.Series Solution & Special Functions: Series solutions of ODE of 2nd order with variable coefficients with special emphasis to the differential of legendre and Bessel. Legendre's polynomials, bessel's functions and their properties.
3.LaplaceTransform: Laplace transform, Existence theorem, Laplace transform derivatives and integrals, Inverse Laplace transform, Unit-step function, Dirac Delta function, Laplace transform of periodic functions, convolution theorem Applications to solve simple linear and simultaneous differential equations.
4.Fourier Series And Partial Differential Equations : Periodic functions,Trignometric series, Fourier series of functions with period 2n, Eulers formulae, functions having arbitrary period, even and odd functions, change of interval, half range sine and cosine series.
Introdution to partial differtial equations, linear partial differential equation with constant coefficients of 2nd order and their classifications, parabolic, elliptic & hyperbolic with illustrative examples.
5. Application of Partial Differential Equations
Method of separation of variables for solving partial differential equation, Wave equation up to two dimension, Laplace equation in two dimension, Heat conduction equations up to two dimension, Equation of transmission Lines.

References:

1.E. Kreyszig: Advanced Engineering Mathematics, Wiley Eastern Ltd.
2.B.S Grewal: Higher Engineering Mathematics, Khanna Publishers.
3.Jaggi & Mathur: Advanced Engineering Mathematics, Khanna Publishers.
4.C. Prasad: Advanced Mathematics for Engineers, Prasad Mudranalaya

MACHINE DRAWING & COMPUTER AIDED DRAFTING LAB

Course Code ME-403 **CREDIT : 2 (0-0-4)**

Review (1 Class)
Orthographic projection, missing lines, interpretation of views and sectioning.
Part and Assembly Drawing (2 Classes):
Introduction, assemblies drawing of stuffing box, steam engine cross head, air valves, lathe tailstock, gate valve, screw jack, connecting rods, spark plug, tool post, safety valves etc. Drawing exercise.
Specification of Materials:
Engineering materials, code designation of steels, copper and aluminum and its alloys.
Limits, Tolerance and fits: (1 Class)
Introduction, Limit systems, tolerance fits, drawings and exercises.
Surface Roughness: Introduction, surface roughness, machining symbols, indication of surface roughness, drawing exercises.
Production Drawing: Introduction to developing and reading or production drawing of simple machine elements like helical gear, bevel gear, flange, pinion shaft, connecting rot, crankshaft, belt pulley, piston details etc. Idea about tool drawing.
Computer Aided Drafting: Introduction, input, output devices, introduction to drafting software like Auto CAD, basic commands and development of simple 2D and 3D drawings.
References:

1.Machine Drawing by Narayana, et.all, New Age.
2.Production Drawing by Narayana, et.all. New Age.
3.Auto CAD 14 for Engineering Drawing by P. Nageswara Rao, TMH.

APPLIED THERMODYNAMICS

Course Code ME-404 **CREDIT : 5 (3-1-2)**

Review of Thermodynamics: Brief review of basic laws of thermodynamics, Helmholtz & Gibb's function, Mathematical conditions for exact deferential. The Maxwell Relations, Clapeyron Equation, Joule – Thompson coefficient curve, Availability & Irreversibility.
Steam Boilers: Brief review of properties of steam, use of steam table and Mollier chart, Steam generators- classifications, working of fire-tube and water tube boilers, boiler mountings & accessories, Air preheater, Feed water heater, Superheater, Boiler efficiency, Equivalent evaporation, Heat balance. Boiler draught.
Steam Engines: Rankine and modified Rankine cycles, Working of engine indicator diagram.
Nozzle: Flow through nozzle, variation of velocity, area and specific volume, Nozzle efficiency, Critical condition.
Steam Turbines: Classification, impulse and reaction turbines, Compounding, Velocity diagram, workdone, Reaction, Efficiency, Bleeding, Comparison with steam engines, Reheat factor, Governing of turbines, Velocity diagram, Work done, Efficiencies of reaction and impulse turbines.
IC Engines: Classification, Constraction details. Application of four stroke and two stroke engines, Review of Otto, diesel and Dual cycles, Work done, Efficiencies, Indicator diagram, Valve timing diagram. Efficiencies
Gas Turbines: Review of Bryaton cycle, Thermal refinement of a gas turbine cycle, Comparison with IC Engine and steam turbine.
Refrigeration and Heat Pump Cycles: Definition, Types, Carnot refrigerating cycle, Bell Coleman cycle.
Unit of refrigeration. Description of simple vapour compression and vapour absorption systems.
Introduction to air-conditioning.
Compressors: Reciprocating compressor, Construction details and working principle, Efficiency, Power input, Intercooling , Working principle of centrifugal and axial flow compressor, Power input calculation.
Reference:

1.Heat Engineering by V.P. Vasandani & D. S. Kumar Publisher Metropolition Book Co. (P)Ltd.
2.Thermal Engg. By P.L. Blallaney, Khanna Publishers.
3.Theory of Steam Turbine by W. J. Kearton
4.Applied Thermodynamics by R. Yadav 6th edn, CPH, Allahabad.
5.Thermal Engg., By R. K. Rajput, Laxmi Publication.
6.Turbine Compressors & Fans by S. M. Yahya, HMT
7.Thermal Engg. By S .K. kulshrestha, Vicars, Pub. House Ltd.
8.Fundamental of Engg. Thermodynamics by R. Yadav 7th edn, CPH, Allahabad
9.Engg. Thermodynamics by Nag
10.Engg. Thermodynamics by C .P. Arora

FLUID MECHANICS

Course Code CE-406 **CREDIT : 4 (3-0-2)**

I. Introduction: Fluids and continuum Physical properties of fluids, ideal and real fluids, Newtonian and Non-Newtorian fluids, measurement of surface tension.

II. Kinematics of Fluid flow: Steady and unsteady, uniform and nonuniform, laminar and turbulent flows, one, two and three dimensional flows, streamlines, streak lines and path lines, continuity equation, rotation and circulation, elementary explanation of stream function and velocity potential, graphical and experimental methods of drawing flow nets.

III. Fluid Statics: Pressure-density-height relationship, manometers, pressure on plane and curved surfaces center of pressure, buoyancy stability of immersed and floating bodies, fluid masses subjected to uniform accelerations, measurement of pressure.

IV. Dynamics of fluid flow: Euler's equation of motion along a streamline and its integration, Bernoulli's equation and its applications-Pitot tube, flow through orifices, mouthpieces, nozzles, notches & weirs, sluice gates under free and submerged flow conditions, Aeration of nappe, cavitation, free and force vortex momentum equation and its application of energy and momentum equations, flow measurements, determination of Cd, Cc, and Cv, energy loss.

V. Dimensional Analysis and Hydraulic Similitude: Dimensional analysis, Buckingham's Theorem, important dimensionless numbers and their significance, geometric, Kinematic and dynamic similarity, model studies.

VI. Laminar and Turbulent flow through pipes, stoke's law, flow between parallel plates, flow through porous media, fluidisation, measurement of viscosity, transition form laminar to turbulent flwo, turbulent flow, equation for turbulent flow, eddy viscosity, mixing length concept and velocity distribution in turbulent flow, Hot-wire anemometer and LDA.

VII. Boundary Layer Analysis: Boundary layer thicknesses boundary layer over a flat plate, laminar boundary layer, application of momentum equation, turbulent boundary layer, laminar sub-layer, smooth and rough boundaries, atmospheric boundary layer, local and average friction coefficient, separation and its control, measurement of shear.

VIII. Pipe flow: Nature of turbulent flow in pipes, equation for velocity distribution over smooth and rough surfaces, resistance coefficient and its variation, flow in sudden expansion, contraction, diffusers, bends, valves and siphons, concept of equivalent length, branched pipes, pipes in series and parallel, simple networks.

IX. Flow past Submerged Bodies: Drag and lift, drag on a sphere, cylinder and disc, lift, Magnus effect and circulation.

X. Compressibility Effects in pipe Flow: Transmission of pressure waves in rigid and elastic pipes, water hammer, analysis of simple surge tank excluding friction.

References:

1. Som & Biswas: Introduction of fluid mechanics & Machines, TMH.
2. S.K. Agrawal: Fluid Mechanics & Machinery, TMH
3. Garde, R.J. and A.G. Mirajgaoker, "Engineering Fluid Mechanics" (including Hydraulic Machines), Second Ed. Nemchand & Bros, Roorkee, 1983
4. Garde, R.J. "Fluid Mechanics through Problems", Wiley Eastern Limited, New Delhi, 1989
5. Hunter Rouse, "Elementary Mechanics of Fluids", John Wiley & Sons, Omc. 1946
6. L.H. Shames, "Mechanics of Fluids", McGraw Hill, Int. Student, Education.
7. Fluid Mechanics by Jagdish Lal
8. Vijay Gupta and S.K. Gupta, "Fluid Mechanics and its Applications", Villey Eastern Ltd.
9. Fluid Mechanics by Modi & Seth.

FLUID MECHANICS LAB

1. To determine experimentally the metacentric height of ship model.
2. To verify the momentum equation experimentally.
3. To determine the coefficient of discharge of an orifice (or a mouth piece) of a given shape. Also to determine the coefficient of velocity and the coefficient of contraction of the orifice (or the mouth piece)
4. To plot the flow net for a given model using the concept of electrical analogy.
5. To measure surface tension of a liquid.
6. To calibrate an orifice meter and study the variation of the coefficient of discharge with the Reynolds number.
7. To verify Darcy's law and to fine out the coefficient of permeability of the given medium.
8. To study the transition from laminar to turbulent flow and to determine the lower critical Reynolds number.
9. To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile.
10. To study the variation of friction factor, "f" for turbulent flow in smooth and rough commercial pipes.
11. To determine the loss coefficients for the pipe fittings.
12. To study the flow behavior in a pipe bend and to calibrate the pipe bend for descharge measurement.
13. To study the boundary layer velocity profile and to determine boundary layer thickness and displacement thickness. Also to determine the exponent in the power law of velocity distribution.

STRENGTH OF MATERIALS

Course Code CE-408 **CREDIT : 3 (3-0-0)**

Introduction: Brief review, concept of stress, strain, ductility, toughness, elastic constants, hardness, brittleness, tension, compression, shear, Brief review of Mohr's circle for compound stresses & for principal stresses.

Theories of Failure: Various theories of failure and its comparison.

Review of Bending and Torsion: Brief review of bending of beams and shear force & bending moment diagram. Review of torsion of circular shaft and combined bending & torsion. Shearing stresses in beams section.

Deflection of Beams: Deflection of beams, Integration method, Macaulay's method, Area moment method, Unit load method.

Columns and Struts: Theory of columns & Struts, Eulers and Rankine formulae.

Thin Cylinders: Theory of thin cylinders subjected to pressure. Expression for hoop stress and longitudinal stress. Design of thin cylinders.

Thick Cylinders and Spherical Shells: Stresses and strain in thick shells/cylinder subjected to pressures. Compound cylinders press fits on solid shaft.

Fracture, Fatique and Creep: Stress concentration, Grifith's formula. Fatigue loading, endurance limit, Creep.

References:

1.Strength of Materials by Ryder
2.Strength of Materials by Singer
3.Strength of Materials by Oimoshenko
4.Engg. Mechanics of Solids by Popov
5.Mechanics of Materials by Bear Johnson
6.Strength of Materials by R.K. Rajput
7.Strength of Materials by Ramamrutham & Narain.

MATERIAL SCIENCE & TESTING

Course Code ME-410 **CREDIT :4(3-0-2)**

Introduction: Historical perspective, importance of materials, Brief review of modern & atomic concepts in Physics and Chemistry. Atomic models, Periodic table, Chemical bondings.

Crystallography and Imperfections: Concept of unit cell space lattice, Bravais lattices, common crystal structures, Atomic packing factor and density. Miller indices. X-ray crystallography techniques. Imperfections, Defects & Dislocations in solids.

Mechanical Properties and Testing: Stress strain diagram, Ductile & brittle material, Stress Vs Strength. Toughness, Hardness, Fracture, Fatigue and Creep. Testing such as Strength testings, Hardness testing, Impact testings, Fatigue Testing Creep testing, Non-destructive testing (NDT)

Microstructural Exam: Microscope principle and methods. Preparation of samples and microstructure exam and grain size determination. Comparative study of microstructure of various metals & alloys such as Mild steel, CI, Brass.

Phase Diagram and Equilibrium Diagram: Unitary and Binary diagrams, Phase rules, Types of equilibrium diagrams: Solid solution type, eutectic type and combination type. Iron-carbon equilibrium diagram.

Ferrous Materials: Iron and steel manufacture, furnaces. Various types of carbon steels alloy steels and cast irons, its properties and uses.

Heat Treatment: Various types of heat treatment such as Annealing, Normalizing Quenching, Tempering and case hardening. Time Temperature Transformation (TTT) diagrams.

Non-Ferrous metals and alloys: Non-ferrous metals such as Cu, Al, Zn, Cr, Ni, etc. and its applications. Various type Brass, Bronze, bearing materials, its properties and uses. Aluminum alloys such as Duralumin. Other advanced materials/alloys.

Magnetic Properties: Concept of magnetism-Dia, para, ferro Hysteresis. Soft and har magnetic storages.

Electric Properties: Energy ban concept of conductor, insulator and semiconductor. Intrinsic & extrinsic semi-conductors, P-n junction and transistors. Basic devices and its application. Super conductivity and its applications. Messier effect. Type I & II Superconductors. High Te Superconductors.

Ceramics: Structure types and properties and applications of ceramics. Mechanical/Electrical behaviour and processing of plastic.

Plastics: Various types of polymers/plastics and its applications. Mechanical behaviors and processing of plastics. Future of plastics.

Other Materials: Brief description of other material such as concrete, wood, glass etc. and its uses.

Performance of materials in Service: Brief theoretical consideration of fracture, Fatigue, Creep and Corrosion and its control.

References:

1.W.D. Callister, Jr.-Material Science & Engineering Addition Wesly Publishing Co.
2.Van Vlash- Elements of Material Science & Engineering John Wiley & Sons.
3.V. Raghvan- Material Science, Prentice Hall of India
4.Narual- Material Science, TMH
5.Srivastava, Srinivasan – Science of Materials Engineering Newage.

MATERIAL SCIENCE AND TESTING LAB

A. Material Science Lab Experiments: (at least 5 of the following)

1. Making a plastic mould for small metallic specimen.
2. Specimen preparation for micro structural examination – cutting, grinding, polishing, etching.

ENVIRONMENTAL STUDIES-1

Course Code SES-415 **CREDIT 2(2 – 0 - 0)**

1: The Multidisciplinary Nature of Environmental Studies.
Definition, Scope and Importance.
(i) Ecosystems.
Concept of an Ecosystem.
Structure and function of an Ecosystem.
Producers,consumers and decomposers.
Energy flow in he ecosystem.
Ecological successsion.
Food chains,food webs and ecological pyramids.
Introduction,types,Characteristics features,structures and function of the following ecosystem:
(a) Forest Ecosystem.
(b) Grassland Ecosystem.
(c) Desert Ecosystem.
(d) Aquatic Ecosystem (Ponds,streams,lakes,rivers,oceans,estuaries).
(ii) Social Issues and the Environment
From unsustainable to sustainable development.
Urban problems related to energy.
Water conservation, rain water harvesting, water shed management.
Resettlement and rehabilitation of people; its problems and concerns case studies.
Environmental ethics: Issues and possible solutions.
Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust,
Case studies
Wasteland reclamation.
Consumerism and waste products.
Environment Protection act.
Air (Prevention and Control of Pollution) Act
Visit to local polluted site-Urban/Rural/industrial/Agricultural.
Study of Common plants, insects, birds.
Study of simple ecosystems-ponds, river. Hillslopes etc(Field work equal to 5 lecture hours).
Issues involved in enforcement of environmental legislation; public awareness.

FOUNDATIONS OF INFORMATION TECHNOLOGY

Course Code COMP-510 **CREDIT :5 (2-1-4)**

Fundamental Concept of Information

Information Concept and Processing: Definition of Information, Need of Information, Quality of Information, Value of Information, Concept of Information, Entropy Category and Level of information in Business Organization, Data concepts and Data Processing, Data Representation.

Information Representation: Information Contents, Introduction to information representation in Digital Media, Text, Images, Graphics, Animation, Audio, Video, Elementary concepts in information Preservence, Data compression, Huffman Coding, Shannon Principles, Adaptive Compression, LZW Coding, Images Compression, Introduction to Jpeg, Mpeg, Mheg.

Computer Programming

Computer Appreciation: Definition of Electronic computer, History, Generations, Characteristic and application of computers, classification of computers, RAM/ROM, Computer Hardware, CPU, Various I/O Devices, Peripherals, Storage Media, Software Definition.

Programming Language Classification & Program Methodology: Computer Languages, Generations of Languages, Introduction to 4 GLS, Software Development Methodology, Life Cycles, Software Coding, Testing, Maintenance, Industry Standards, Introduction to ISO, SEI-CMM Standards for IT Industry.

Digital Devices and basic Network Concepts: Digital Fundamentals: Various Codes, Decimal, Binary, Hex Decimal Conversion, Floating Numbers, Gates, Flip Flops, Minimization adder, Multiplexers.

Computer Networks and Communication: Need For Data Transmission Over Distances, Types of Data Transmission, Media for Data Transmission, Networking of Computers-Introduction of Lan and WAN, Network Topologies, basic Concepts in Computer

Networks, Client-Server Architecture, Introduction to Advanced Communication Techniques, ISDN, ATM, Token Based Protocol, CSMA/CD, Mobile Communication.

Internet and Web Technologies

Internet & World Wide Web: Hypertext Markup Language, DHJML, WWW, Gopher, FTP, Telnet, Web Browsers, Net Surfing Search Engines, E-mail, Basic concepts in E-Commerce, EDI, Electronic Payments, Digital Signatures, Network, Security, Fireball.

Web Technologies: Elementary Concepts in, Object Oriented Programming, Corba, Com/Dcom, Wireless Application Protocol, ASP Scripting, HTML, Java, Java Applets, WAP, WML, JSP, EJB, XML.

Advanced Concepts in Information Technology:

IT Industry Trends, Careers and Applications in India: Scientific, Business, Educational and entertainment applications, Industry Automation, Weather forecasting awareness of ongoing IT projects in India, NICNET ernet, Application of IT to E Commerce, Electronic Governance, Multimedia, Entertainment.

Suggested Text Books & References:

1. Curtin, "Information Technology: Breaking News", Tm + 1
2. Raja Raman, V. "Introduction to Computers"
3. Bajpai, Kushwaha & Yadav, "Intrduction to Computer & C Programming", New Age.
4. Nelson, "Data Compression", BPB
5. Bharohoke, "Fundamentals of Information Technology", Excel
6. Peter Nortans "Introduction to Computers", TM +1
7. Leon & Leon "Fundamental of Information Technology", Vikas Publishing House
8. Kanter, "managing Information System"
9. Lehngart, "Internet 101", Addision Wesley
10. Cistems "Internet, An Introduction", Tata McGray Hill.

IT LAB

Write Programs in C for the following

1. Conversion of Binary to Hexadecimal, Decimal to BCD and vice versa
2. LOGIC Designing of gates and flip flops.
3. For Minimization methods
4. Introduction to information representation in digi8tal media text, Images, Graphics, Animations, Audio, Video.
5. Dataflow diagram for generation of Prime Numbers
6. Demonstrate Different Lan Topologies,World Wide Web,File Transfer Protocol,Goffer,Telenet,Web browsers,Search engine,Email Sites

Create your own email address using any of the engines Ex. ID @ engine.com

7. Institutions may add 4 more experiments as per the availability of expertise available with them.

ENGINEERING MATHEMATICS-III

Course Code MAS –590 **Credit 4(3-1-0)**

1.**Ordinary Y. Differential Difference Equations:** ODE of 2^{nd} order with constant coefficients both homogeneous and non-homogeneous Types with applications to electrical and mechanical systems.Difference equations and their Solutions by z transform. Series solutions of ODE of 2^{nd} orders with variable Coefficients with special emphasis to the differential equations of Legendre, Bessel and Chebyshev. Legendre's polynomials, Chabyshev polynomials and Bessel's functions and Their properties.

2.**Integral Transforms:** Fourier transform and integral Hanker transforms and Hilbert transforms and Their Properties, some simple applications. Partial Differential Equations: Linear PDE with constant coefficients of 2^{nd} order and their classifications, PDE of Parabolic, elliptic and hyperbolic type with illustrative examples. Separation of variables Method for solving PDE. Such as two dimensional heat equations, wave equations and Laplace equations.

3.**Functions of a Complex variable:** Analytic (functions, Gauchy- Riemam equations, harmonic functions line integral in the Complex plane, caucry's Integral theorem cauchy's integral formula derivatives of analytic Functions, Liouvilles Theorem, fundamental theorem of Algebra representation of a Function py power series, Taylor's series and Laurent's Series, poles, Singularities and Zeros. Residue theorem, evaluation of integrals using. Residue theorem. Conformal" Mapping, linear fractional transformations, special linear fractional transformations.

Reference:

Kreyszig, E. (1993): Advanced Engg. Mathematics 7^{th} Edition, John Willey & sons inc.
Paopoulis: Signal Analysis 3^{rd} Edition (1988) Me Graw Hill .

ELECTRICAL MACHINES

Course Code EEE-404 **Credit 4(3-0-2)**

D.C. Machines: Constructional features and principles of operation of shunt, series and compound generators and motors including EMF equation and armature reaction, Performance characteristics of generators and motors, starting, Speed control and braking of motors. Two Quadrant and Four Quadrant operation of motors, choice of DC motors for different applications, Losses and efficiency.

Transformers: Construction, EMF equation, Principle of operation, Phasor diagram on no-load, dffect of load, equivalent circuit, Voltage regulation, Losses and efficiency, Tests on transformers, Prediction of efficiency and regulation, Autotransformers, Instrument transformers, Three phase transformers.
Induction Motors: Rotating magnetic fields, principle of operation, Equivalent circuit, Torque-slip characteristic, Starters foe cage and wound rotor type induction motors, Speed control and braking, Single Phase induction motors and methods of starting.
Synchronous Machines: Construction, EMF equation, Effect of pitch and distribution, Armature reaction and determination of regulation of synchronous generators, Principle of motor operation, effect of excitation on line currents (V-curves), methods of synchronization, typical applications of AC motors in industries.

Reference:

1.Hughes Edward, Electrical Technology, Addision Wesley Longman Ltd.
2.Nagrath I.J. & Kothari D.P., Electrical Machines, TMH
3.Cotton H., Advanced Electrical Technology, Wheeler & Co.
4.Fitzgerald, Kingsley. Kusko, Dumas-Electrical Machines TMH
5.Kosow L.L., electrical Machinery and Transformers, PHI
6.Parker Smith, Electrical Engineering Problems, CBS.

MEASUREMENT & METROLOGY

Course Code (ME-405) **Credit4(2-1-2)**

1.Mechanical Measurements
Introduction: Introduction to Measurement and Measuring instruments, Generalized Measuring system and functional elements, units of Measurement, static and dynamic performance characteristics of Measurement devices, calibration, concept of error, sources of error, statistical analysis of errors.
Sensors and Transducers: Types of Sensors, types of transducers and their characteristics.
Time and Transducers: Counters, Stroboscope, frequency measurement by direct comparison
Measurement of pressure: Gravitational, direct acting, elastic and indirect type pressure transducers. Measurement of very low pressures.
Measurements of Force and Torque: Different types of load cells elastic transducers, Pneumatic & Hydraulic systems.
Temperature Measurement: By thermometers, bimetallic, thermocouples, thermostats and pyrometers. **Vibration and Noise Measurement**
Seismic instruments, vibration pick ups and decibel meters, vibrometers accelerometers.
Data Acquisition system: Introduction to data acquisition systems, single and multi-channel system, microprocessors and PC based data acquisition systems. Input-output devices.
Signal Transmission and Processing: Devices and Systems.
METROLOGY
II. Metrology and Inspection: Standards of linear measurement, line and end standards. Limit, fits and tolerances. Interchangeability and standardization.
Linear and angular measurements devices and systems.
Limit gauges classification, Taylor's Principle of Gauge Design.
Measurement of geometric forms like straightness, flatness, roundness and circularity.
Tool makers microscope, profile project autocollimator.
III.Interferometer: principle and use of interferometry, optical flat and interferometers, laser interferometers. Measurement of screw threads and gears.
Surface texture: quantitative evaluation of surface roughness and its measurement.
Suggested Text Books & References:

1. Beckwith Thomas G., Mechanical Measurements, Narosa Publishing House, N. Delhi.
2. Doeblein E.O., "Measurement Systems, Application Design", McGraw Hill, 1990
3. Kumar D.S. "Mechanical Measurements and Control", Metropolitan, N.Delhi.
4. Hume K.J., "Engineering Metrology", Mac Donaldd & Co. 1963.
5. Gupta, I.C., "Engineering Metrology", Dhanpat Rai & Sons, New Delhi, 1994.
6. Sirohi, "Mechanical Measurement", New Age Publishers
7. Jain, R.K., "Engineering Met5rology " Khanna Publishers
8. Jain R.K., "Mechanical Measurement" Khanna Publishers

KINEMATICS OF MACHINES

Course Code ME-407 **Credit 4(3-1-0)**

1 **Introduction:** Links, kinematics pairs, linkage mechanisms, inversions of slider crank chain and double slider crank chain, four bar linkage, mechanisms compound chains in brief.

2 **Velocity and Acceleration I Mechanisms:**Velocity of point in mech., relative velocity method, instantaneous center method, Kennedy's theorem acc-diagram, acc-centers, Correolis components acc., Klein's construction for slider crank and four bar mech. Analytical method for slider crank mech.

3 **Mechanism with Lower Parts.:**Pantograph straight line motion mechanisms, Peucellier's Mechanism, hart's straight line mech., Scort Rusel mech., analysis of hook's joint, introduction to the analysis of complex mech., Davis and Ackermann steering gears.

4 **Kinematic Synthesis of Planner Linkages:** Linkages, geometrical methods, 3 position synthesis of coupling rod, analytical method, fredenstem equation for functions generation.

5.**Cams:**Classification & terminology law of gearing, geometric & kinematic characteristic of involute, undercutting & interference, gear trains (simple, compound & planetary)

Books & reference:

1. Theory of Machines Thomas Bevan
2. Theory of Machines and Mechanisms-Shigley.
3. Theory of Machines and Mechanisms – Ghosh and Mullick
4. Theory of Machines & mechanism – Dukhipati.

NDUSTRIAL ENGINEERING

Course Code ME-411 **Credit4(3-1-0)**

1.**Productivity:** Introduction, definition, measurement, productivity index, ways to improve productivity.

2.**Work study:** Meaning and benefits of work study, time and motion study Micromotion study P.M.T.S. man machine Diagram flow chart. Motion economy, Method study, work measurement, work sampling standard time.

3.**Job Evaluation & Merit Rating:** Job analysis, job description job simplification and job evaluation methods & description, merit rating, wage incentive plans.

4.**Plant layout and Materials Handling:** Plant location type of layout, principles of facility layout principles of material handling, Material handling empts.

5.**Production Planning and Control:** Objectives, function, steps in PPC. Planning routine, scheduling, Dispatching & Follow-up, Effectiveness of PPC.

6.**Replacement Analysis:** Depreciation causes, obsolescence, service life of assets, Replacement of items.

7.**Inventory Control:** Inventory, function, cost, deterministic models.

8.**Introduction to MRP & JIT quality control:** Introduction, process control, Control Charts, Single double and sequential sampling, Introduction to TQM & bench marking.

9.**Organization:** Principles of organization, Development of Organizational charts like line, staff, line and staff & functional types.

10.**Industrial Ownership:** Proprietorship, partnership, Joint stock & co-operative stores.

11.**Manpower Planning:** Resources, Human relationship.

12.**Factory Legislation India:** Factory acts, payment of wages, workmen compensation, E.S.I. Sales management & forecasting cost accounting, Budgetary control.

13.**Project management & CPM/PERT:** Methods of drawing networks and computations of various times, updating resources a location, project management.

14.**Break Even Analysis:** Introduction, Assumption, Stepsion BEA, purpose, fixed & variable costs, margin of safety, Angle of incidence profit volume graph.

15.**Operation Research:** Brief outlines of problems, linear programming, transportation problems. Graphical methods.

References:

1.Principles of management, An analysis of management functions-H, Koontz & C.O. Donnel, Tata McGraw-Hill Co.
2.Manufacturing Management- J Moore Prentice Hall Englewoon Cliffs: New Jersey.
3.Modrn Production Operations Management- Buffam E.S. Wiley Eastern.
4.Industrial Engg. & Management by O.P. Khanna
5.Industrial Engineering by Ravi Shanker
6.Industrial Engineering by Mahajan.

MANUFACTURING SCIENCE -1

Course Code (ME 412) **Credit 4(3-0-2)**

Introduction:

Importance of manufacturing, economic & Technological consideration in manufacturing. Survey of Manufacturing Process. Materials & manufacturing process for common items.

Metal Forming Process:

Elastic & Plastic deformation, yield criteria. Hot working Vs cold working, Load required to accomplish metal forming operation. Analysis (equilibrium equation method) of forming process with sliding friction sticking friction and mixed condition for slab and disc. Work required for forging. Analysis of Wire/Strip drawing and max. Reduction, Tube drawing, Extrusion and its application

Condition for rolling force and power in rolling. Rolling mills.Design, lubrication and defects in metal forming processes.

Sheet Metal Working:

Die & assembly and press work methods and processes. Cutting mechanism, blanking Vs piercing. Compound Vs. progressing die. Flat faces Vs inclined face punch.

Analysis of forming process like cup/deep drawing and bending.

Unconventional Metal Forming Processes:

Unconventional Metal forming Processes such as explosive forming, electro-magnetic, electro- hydraulic forming.

Powder Metallurgy:

Powder metallurgy manufacturing processes. The process, advantage and applications.

Casting:

Basic principle & survey of casting Process. Types of patterns and allowances. Types and properties of moulding sand. Element of mould and design considerations, gatting, riser, runner, core. Solidification of casting, theory and analysis. Sand casting, defect and remedies and inspection. Cupola furnace.

Die casting centrifugal casting, Investment casting.

Manufacturing Of Plastic Components:

Plastic and its past, present & future uses. Injection moulding. Extrusion of plastic section. Welding of plastics. Future of plastic & application.

Jigs & Fixtures:

Locating and clamping devices/principle. Jigs and fixtures and its application.

Books:

1. Manufacturing science by Ghosh and Mallik.
2. Production Engg. Science by P.C Pandey
3. Production technology by R.K.Jain.
4. Manufacturing technology by P.N.Rao
5. Material and manufacturing by Paul Degarmo.

MANUFACTURING SCIENCE-1 LAB

EXPERIMENTS:

Say Minimum 8 Experiments out of Following (Or Such Experiment)

1. Design of pattern for a desired casting (containg hole).
2. Pattern making.
3. Making a mould (with core) and casting.
4. Sand testing (at least one such as of grain fineness number determination).
5. Injection moulding of plastic.
6. Forging by hand forging processes.

MANAGEMENT INFORMATION SYSTEM

Course Code ME 416 **Credit 3(3-0-0)**

Part I: Organizations, Management and the Networked Enterprise Information Systems in Global Business Today

Global E-Business: How Businesses Use Information Systems Information Systems, Organizations, and Strategy Ethical and Social Issues in Information Systems

Part II: Information Technology Infrastructure IT Infrastructure and Emerging Technologies Foundations of Business Intelligence: Databases and Information Management Telecommunications, the Internet and Wireless Technology Securing Information Systems

Part III: Key System Applications for the Digital Age

Achieving Operational Excellence and Customer Intimacy: Enterprise Applications

E-Commerce: Digital Markets, Digital Goods Managing Knowledge Enhancing Decision Making

COMPUTER BASED NUMERICAL & STATISTICAL TECHNIQUES

Course Code (MAS-491) **CREDIT 3 (2-0-2)**

Introduction: Errors in Numerical Computation, Mathematical Preliminaries, Errors and their Analysis, Machine Computations, Computer Software.

Algebraic & Transcendental Equation: Bisection Method, Iteration Method, Method of False Position, Rate of Convergence, Method for Complex Root, Muller's Method, Quotient Difference Method, Newton Raphson Method.

Interpolation: Introduction, Errors in Polynomial Interpolation, Finite Differences, Decision of Errors, Newton's Formulae for Interpolation, Gauss, Stirling, Bessel's, Everett's Formulae, Interpolation by Unevenly Spaced Points, Lagrange's Interpolation Formula, Divided Difference, Newton's General Interpolation Formula.

Curve Fitting, Cubic Spline & Approximation:Introduction, Method of Least Square Curve Fitting Procedures, Fitting a Straight Line, Curve Fitting by Sum of Exponentials, Data Fitting with Cubic Splines, Approximation of functions.

Numerical Integration & Differentiation: Introduction, Numerical differentiation, Numerical Integration, Trapezoidal Rule, Simpson 1/3 Rule, Simpson 3/8 Rule, Boole's and Weddle's Rule, Eular—Maclariaun Formula, Gaussian Formula, Numerical Evaluation of Singular Integrals.

Statistical Computation: Frequency Chart, Regression Analysis, Least Square Fit, Polynomial Fit, Linear & Non Linear Regression, Multiple Regressions, Statistical Quality Control Methods.

References:

1.Jain, Iyengar, Jain, "Numerical Methods for Scientific & Engineering Computation", New Age International.

2.Balaguruswamy, "Numerical Methods", TMH.

3.Sastry, "Introductory Method of Numerical Analysis", PHI.

4.Gerald & Wheatly, "Applied Numerical Analysis", Addision Wesley.

5.Probability & Statistic, Schaum Series.

6.Hulquit, "Numerical Method for Engineers & Computer Scientist", Addision Wesley.

7.Flowers, "Numerical Methods In C++", Oxford University Press.

8.Vedamurthy, "Numerical Methods", Vikas.

List of Experiments:

Write Programs in C

1.To deduce errors involved in polynomial Interpolation.

2.Algebraic and transcendental equations using Bisection, Iterative method of false position, also give rate of conversions of roots in tabular form for each of these methods.

3.To implement Bessel's functions, Newton's, Sterling, Languages.

4.To implement method of least square curve fitting.

5.Implement numerical differential using trapezoidal, Simpson 3/8 rules.

6.To show frequency chart, regression analysis, Linear Square fit and polynomial fit

ELEMENTS OF ECONOMICS AND PRINCIPLES OF MANAGEMENT SCIENCE

Course Code (BAM-315) **CREDIT 4(3-1-0)**

Industrial Economics;

1.Introduction: -Nature and significance of economics, meaning of science, Engineering and technology and their relationship with economic development.

2.Basic concept: - The concept of demand and supply, indifference curve analysis, price effect, income effect and substitution effect.

3.Money and banking: - Function of money, value of money, inflation and measure to control it. Brief idea function of banking system, viz; commercial and central banking, business fluctuation.

Management:

4.Introduction: Definition, nature and significance of management, evaluation of management thought, contribution of Max Weber, Taylor and Fayol.

5.Human behaviour: Factors of individuals' behaviour, perception. Learning and personality development, inter personal relationship and group behaviour.

References:

1.Dewett, K.K./Modern Economics Theory.

2.Luthers, Fred / Organizational Behaviours.

3.Prasad L.M/ Principles of Management

4.A.W. Stonier &D.C Hergne/ A Text Book of Economics Theory /Oxford Publishing House Pvt Ltd

MACHINE DESIGN – I

Course Code (ME-409) **Credit4(2-0-4)**

Introduction, Definition, Methods, Standards in design & selection of preferred size Selection of materials, BIS system of designation of steels, steel & alloys, plastics & rubbers.

Design against static load

Modes of failure, Factor of safety, stress-strain relationship, principal stresses, theories of failure, endurance limit, design for finite & infinite life, Soderberg & Goodman criteria

Design against Fluctuating Load

Joints Riveted joints, welded joint, screwed joints, eccentric loading of above joints, design for fatigue loading.

Shaft, Keys & coupling.
Design against static load, strength & rigidity design, design of square & flat keys & splines, rigid & flexible couplings.
Mechanical Springs.
Helical spring, stress equation, deflection equation, design against static & fatigue loading, Multileaf spring, Nippling, Design, spiral springs.
Power Screws
Form of threads, square threads, trapezoidal threads, stresses in screw, design of screw jack.
Reference:

1.Machine design: Sharma & Agarwal, Kataria
2.Design of M/c Elements: Bhandari TMH
3.M/c Design : Maleev & Hariharan
4.Machine Design SI edition by Shegley, McGray Hill
5.Machine Design by black & Adams, McGray Hill
6.Design of machine elements by Sprots.

MACHINE DESIGN – I LAB

1. Design & drawing of Riveted joints for given operating conditions
2. Design of an eccentrically loaded welded, riveted or bolted joint
3. Design of bolted joint for fluctuating loads
4. Design & drawing of a cotter joint.
5. Design & drawing of a Knuckle joints.
6. Design & drawing of a simple screw jack
7. Design of shaft for different loading conditions
8. Design & drawing of rigid coupling (flanged type)
9. Design & drawing of a flexible coupling (pin-bush type)
10. Design & drawing of a leaf spring for and automobile
11. Design & drawing of a helical spring for a given application

Note-

1.Students may be advised to use design data book for design
2.Drawing shall be made wherever necessary on small drawing sheets

HEAT & MASS TRANSFER

Course Code (ME-503) **Credit 4(3-0-2)**

General: Modes of heat transfer Conduction Convection- Radiation, scope and application of heat transfer, principles in Engineering Practice.
Conduction: Fourier law-Thermal conductivity of solids, liquids and gases, factors affecting thermal conductivity General differential equation for conductions. One dimensional steady state conduction through homogeneous and composite surface-Plane, cylindrical and spherical walls-Effect of variable thermal conductivity Shape factor, Overall heat transfer coefficient-Critical radius of insulation solution of multi dimensional steady state problems using relaxation method. Transient heat conduction based on lumped parameter method.
Convection: Principles of dimensional analysis-pi theorem, Application of dimensional analysis to free and forced convection. Empirical relations for flat plate and tubular geometry. Forced convection from tubes & tube bundles in cross flow. Simple application to straight, rectangular and triangular fins effectiveness of fins. Fundamentals of boiling heat transfer, pool boiling, Heat transfer in condensation: drop wise and film condensation: empirical equations.
Radiation: Nature of thermal-radiation-Definitions and concepts Monochromatic and total emissive power-Absorptivitiy – Reflectivity-Black, gray and real surfaces-concept of a black body-Planck's distribution law-Configuration of geometrical factor Heat exchange by radiation between black surfaces-Large parallel black plates, equal parallel and opposite black squares, black rectangles perpendicular to each other having a common edge-heat exchange by radiation between large parallel planes of different emissivity. Radiation shields Electrical network method of solving radiation problems. Solar radiation & Collectors.
Heat Exchangers: Tubes of heat exchangers- Parallel flow, Counter flow evaporator and condenser, Log mean temperature difference, effectiveness, NTU method, Introduction to compact heat exchangers.
Ficks law of diffusion, Diffusion coefficient, steady state diffusion through stationary media, steady state diffusion through a stagnant gas films, steady state, equivocal counter diffusion.
References:

1.Principles of Heat Transfer Frnak Kreith McGray Hill Book Co. Heat and Mass Transfer C-D Bennett and J-E-M years, Tata McGraw-Hill (19975)
2.Fundamental of moment and heat transfer-Wetly

3.Heat and mass Transfer – Eckert & Drake, McGraw Hill Book Co.
4.Engineering Heat Transfer J.P. Homan, McGraw Hill Book Co.
5.Heat Transfer by Pitts ane Sission, Schaum series.
6.Heat Mass Transfer by R. Yadav
7.Heat Mass Transfer by C.P.Gupta
8.Heat and Mass Transfer by Domkundvar
9.Heat & Mass transfer by R.C. Chandra
10.Heat & Mass Transfer by Vijay Gupta
11.Heat & Mass Transfer by D.S. Kumar

HEAT & MASS TRANSFER –LAB

1-Conduction- Composite wall experiment
2-Conduction- Composite cylinder experiment
3-Convection- Pool Boiling experiment
4-Convection- Experiment on heat transfer from tube-natural convection.
5-Convection- Heat Pipe experiment
6-Convection- Heat transfer through fin-natural convection.
7-Convection- Heat transfer through tube/fin-forced convection.
8-Any experiment- Such as on Stefan's Law
9-Any experiment on radiation-Such as on solar collector.
10-Heat exchanger- Parallel flow experiment
11-Heat exchanger- Counter flow experiment
12-Any other suitable exp. Such as on critical insulation thickness.

DYNAMICS OF MACHINES.

Course Code (ME-504) **Credit 4(3-0-2)**

1.**Force Analysis. Turning moment & Fly Wheel:** Static force analysis of linkages, Equivalent offset inertia force, Dynamic analysis of slider crank and 4 Bar mechanism. Piston and crank effort, inertia, torque Turning moment diagrams, fluctuation of energy, fly wheel.
2.**Balancing of Machines:** Static and dynamic balancing, balancing of rotating and reciprocation masses, Primary and secondary forces and couples.
3.**Friction:**Pivot and collar friction, friction circle, single plate, multiple and cone clutches, centrifugal clutches, Michele & Kings burros thrust bearing and rolling contact bearing, Belts and pulleys, flat and V-Belts, design and selection.
4.**Brakes and Dynamometers:** External and internal shoe brakes, band and block brakes, hydraulic brakes, and absorption and transmission dynamometers.
5.**Governors:**Dead weight and spring loaded governors, sensitivity, stability, hunting, isochronism's, effort and power, friction and insensitivity, gyroscopic couple and rection.
6. **Gyroscopic Motion:** Principles, Gyroscopic acceleration, gyroscopic couple and reaction.
7.**Mechanical Vibration:** Single degree free & forced, undamped and damped vibrations, Critical speeds.

Book & Preferences

1.Theory of Machines: Thomas Bevan (ELBS/CBS pub., New Delhi)
2.Theory of Machines: S.S. Rattan (TMH)
3.Mechanisms & Dynamic of Machines- Mabie
4.Theory of machines: Shinglay
5.Theory of machines – R.K. Bansal (Laxmi Publication)
6.Mechanisms and Machine Theory – A.K. Ambekar Jain Bros.
7.Theory of Machines – W.T. Green
8.Mechanism & Machine Theory- Rao & Dukhipati (New Age)
9.Theory of Machine and Mechanism- Ghsoh & Mullick
10.Theory of Machines – P.L. Ballaney (Khanna Pub.)

PRODUCT DEVELOPMENT & DESIGN

Course Code(ME-506) **Credit3(2-1-0)**

Product, Definition, Scope, Terminology: Design definitions, Old and new design methods, design by evolution, examples such as evolution bicycle, safetyrazor etc. Need based developments, Technology based developments, Physical reliability & Economic feasibility of design concepts.

Morphology of design, Divergent, transformation and convergent phases of product disigh, Identification of need, Analysis of need.
Design for what? Design, criteria, functional aesthetic, ergonomics, form, shape, size, colour.
Mental blocks, Removal blocks, Ideation techniques, creativity, checklist, transformations, brain storming and syneerics, Morphological techniques.
Utility concept, Utility value, Utility index, Decision making under multiple criteria. Economic aspects fixed and variable costs, Break-even analysis.
Reliability considerations, Bath tub curve, reliability of systems in series and parallel, failure rte, MTTF and MTBF, Optimum spares from reliability considerations.
Design of displays and controls, Man-machine Interface, compatibility of displays and controls
Ergonomic Aspects, Anthropometrics data and its importance in design.
Application of Computers in product design.

Book References:

1.Product Design & Manufacturing – A.K. Chitat & R.C. Gupta, PHI (EEE)
2.The Technology of Creation Thinking- R.P. Gewford- Ph.D.
3.The Art of thought- Grohem Wallas- Brev & Co., New York.
4.Product Design & Dection Therory – M.K. Starr, PH
5.Engg. Product Design – C.D. Lain, Business Book
6.Industrial Design for Engineers – W.H. Mayall Hiffe
7.Human Factor Engg. – Mccormic E.J., McGraw Hill
8.Engineering, An Introduction to creative Profession- G.C. Beabley & HW Leach, Mc Millan

MANUFACTURING SCIENCE – II

Course Code (ME-507) **Credit4(3-0-2)**

Metal Cutting and Machine Tools Metal Cutting

Lathe: Principle, types, operations, Turret/Capstan, Semi/Automatic, Tool layout. Shaper, slotter planer: Operation, drive.
Milling: Milling cutter, Up & Down milling, Dividing head, indexing. Max chip thickness, power required.
Drilling and boring: Drilling, boring, reaming tools. Geometry of twist drill
Grinding: Grinding wheel, abrasive, cutting action. Grinding wheel specification. Grinding wheel wear attritious wear, fracture wear. Dressing and trueing. Maxchip thickness and Guest criteria. Flat and cylindrical grinding. Centerless grinding. Super finishing: Honing, lapping, polishing. Metal Joining Welding :
Survey of welding and allied processes. Gas welding and cutting, process and equipment. Arc welding: Power sources and consumables. TIG & MIG processes and their parameters. Resistance welding- spot, seam projection.
Other welding processes such as atomic hydrogen, submerged are, electroslag, friction welding.
Thermodynamic and Metallurgical aspects in welding and weld. Shrinkage/residual stresses in welds. Defects in weld and remedies. Weld decay in HAZ.
Non conventional Machining and Non-conventional Welding
Benefits, application and working principles of non-conventional machining process. Introduction to Non-conventional Machining and welding (EDM,ECM, LBM, EBM, USM, AJM) similarly, non-conventional welding processes such as LBW, USW, EBW, Plasma arc welding, explosive welding.

Books:

1.Manufacturing science by Ghosh and Mullick
2.Fundamentals of Metal Cutting and Machine Tools by Boothroyd
3.Production Technology, by R.K. Jain
4.Production Technology-HMT
5.Production Engineering Science by P.C. Pandey
6.Modern Machining by P.C. Pandey
7.Manufacturing by Degarmo
8.Fundamentals of metal cutting & machine tools- Juneja & Shekhoin
9.Process & materials of manufacturing- Lind burg
10.Advanced machining process by V.K. Jain

MANUFACTURING SCIENCE –II LAB

1.Shear-angle determination (using formula) with tube cutting (for orthogonal) on lathe machine.
2.Bolt (thread) making on Lathe machine
3.Tools grinding (to provide tool angles) on tool-grinder machine.
4.Gear cutting on milling machine.
5.Machining a block on shaper machine.
6.Finishing of a surface on surface-grinding machine.
7.Drilling holes on drilling machine and study of twist-drill
8.Study of different types of tools and its angles & materials.

9.Experiment on tool wear and tool life
10.Experiment on jigs/Fixtures and its uses
11.Gas welding experiment
12.Arc welding experiment
13.Resistance welding experiment
14.Soldering & Brazing experiment
15.Experiment on in conventional machining
16.Experiment on unconventional welding
17.Experiment on TIG/MIG Welding
18.Macro and microstructure of welding joints, HAZ.

I.C. ENGINES

CourseCode:ME508 **Credit 4(3-1-0)**

Introduction: Review Classification, Application, Constructions details, Working principle, Valve timings, Environment friendly engines. List of auxiliary system.
Gas Cycle & Processes: Review of Otto, Diesel and Dual Cycles, Comparison, Sterling and Bryaton Cycle, Improvement of Performance by modification of gas turbine cycles, Fuel air cycle, Actual cycle.
Combustion in SI & CI Engines: Stiochiometric air fuel, Combustion theory, Combustion phenomena. Engine variables on ignition delay and flame Speed Abnormoral Combustion, Detonation
or Knock, Variable affecting knock, Effects of knock, Methods to reduce detonation, Combustor chambers design.
Fuels for I. C. Engine: Types, Chemical Structure, Petroleum refining process, Properties of SI, CI and aviation fuels, Knocking rating of SI and CI fuels, Non- petroleum fuels, Alternative fuels for I.C engine. Stiochiometric air – fuel ratio.
Carburetion and gasoline Injection: Intake and exhaust system, Engine air-fuel requirement, Simple carburetor, Complete carburetor and its elements, Types, Fuel pump, Fuel system, Multi-point fuel injection system. Governing of SI engines.
C.I. Fuel Injection System: Requirements of injection system, Types, Injection pump, Governing, Fuel injector, Injector nozzle.
Ignition System: Requirements, Types – Battery and Magneto ignition system, Spark plug, Contact breaker, Dual angle, Firing order , Spark advance mechanism , Electronic ignition systems
Engine Friction and Lubrication: Total engine friction, Factors affecting engine friction, Lubrication, Mechanism of lubrication, Lubricants and their properties, Additives, Lubrication systems.
Engine Cooling System: Necessity of cooling, Heat transfer and energy balance, Parameters affecting engine heat transfer, Cooling system.
Supercharging : Objective, Methods, Turbocharger, performance.
Two- stroke Engines: Classification, Scavenging processes, advantages and disadvantages, Performance.
Measurement, Testing & Performance: Performance parameters, Type of tests – speed fuel and air consumption, friction, Indicated and brake power, Performance characteristics, Heat balance sheet.
Air Pollution and Control: Sources and classification, Effects of air pollution, Pollutants from I. C. engines, Mechanism of formation of pollutants, Particulate emissions, Exhaust gas treatment.

References:
1.I.C. engine Analysis and practice –E.F. obert
2.A Course in internal combustion engines –M.L. Mathur & R.P. Sharma, Dhanpat, Rai & sons, New Delhi.
3.Internal combustion engines- Maleev
4.Heat Engg.-Vasandani & Kumar
5.Internal Combustion Engine-Gill and Smith
6.Internal combustion Engines and Air Pollution- R. Yadav, CPH, Allahabad
7.I.C. Engines by V. Ganesam, TMH
8.Internal combustion Engine- Heywood, Mc-Graw Hill

TOOL DESIGN

Course Code (ME-501) **Credit: 4(3-0-2)**

1.Broad classification of Tools-cutting tools. Dies. Holding and measuring tools
2.**Design of cutting tools** : Single point and multipoint cutting tools . Single point cutting tools : Classification. Nomenclature . geometry . design of single point tools for Shapers . planers . etc. Chip breakers and their design. Multipoint Cutting Tools :Classification and specification. Nomenclature. Design of drills , milling cutters Broaches, taps etc. Design of form tools : Flat and circular form tools, their design and application.
3.**Design of Dies** : Classification of Dies , Design of Dies for bulk metal deformation , - wire drawing , Extrusion, Forging and Rolling . Design of Dies for sheet metal , Blanking and Piercing . Bending and

Deep drawing . Design of Dies for Casting and Moulding . Power Metallurgy die design .
4 **Design of Jigs and Fixtures** : Classification of Jigs and Fixtures , Fundamental Principles of design of jigs and fixtures, Location and clamping in jigs and fixtures , Simple design of drilling jigs, milling fixtures , etc. indexing jigs and fixtures .

MACHINE –DESIGN- II

Course Code (ME-505) **Credit 4(3-0-2)**

Spur gears: Conjugate action, involute gears, gear cutting methods, tooth loads, strength of spur gears I bending and in wear, dynamic loading, gear materials, design of gears in volute spines gear corrections.
Helical Gears: Tooth relation ship, tooth proportions design of the helical gears, crossed helical gears.
Worm gears: Types of worm gearing, analysis of forces, power rating efficiency, worm gear standers and proportions.
Bevel gears: Straight bevel gears, design for bending, wear and dynamic loading, spiral bevel gears, hypoid gears.
Antifriction bearing: Types of ball bearing, roller bearing, needle roller bearing, friction life of bearing, reliability considerations, selection of ball bearing, roller bearing, tapered roller bearings, thrust bearing, lubrication and sealing. Mounting of bearings,
Lubrication and sliding bearing: Type of lubrication, viscosity, hydrodynamic theory of lubrication, types of bearing, design of bearing using design charts, boundary lubrication, hydrostatic bearing, hydrodynamic thrust bearing.
Engine Parts: Design of the connecting rod, cross-head, crank shaft and piston, valve gear mechanism.
References:

1.Mechanical Engineering Desigh-Joseph E. Shigley McGraw –Hill Publications.
2.Design of machine members- alex Valance V.I doughtie, Mg-graw Hill Co.
3.Machine design D.N. Reshetov, Mir Publishers: Mosow.
4.Machine design D.N. Reshetov, Mir Publisher: Mosow.
5.Fundamentals of Machine desigh [Vol: 1-5] Porlov, ir. Pun: Mocow
6.Machine elements: Dobrovsky, Mir, Pub. Moscow data books
7.Fundamentals of Machine design-Rechard M. Phelan, Tata-McGraw Hill Pu. [1978]
8.Machine Design-Maleev and Hartman, CBS.
9.Machine Design –Sharma & Agrawal, Kataria
10.Design of Machine Elements – Bhandari TMH
11.Machine Design- Black & Adams, Mc Graw-Hill

MACHINE DESIGN – II LAB

At least 2 experiments/turns (lecture-classes) from each of the 4 following sections, say, 3 turns for A, 3 turns for B, 2 turns for C and 2 turns of D, total 10.
A. Conventional Design & Drawing-
Conventional design & drawing on small drawing sheet using hand book for items such as engine parts, shafts, gears, bearings etc. by students.
B. Computer and Language-
Lectures should be given by teachers on introduction to computer and languages such as C/Input Out put statements, control statements, if, for while, switch statement etc. Function and its uses. Structure. To make student able to write computer program.
C. Writing computer programme for conventional design-
After section B, students can write compute program for the design done in section A/ theory subjects.
D. Auto CAD-
With initial review teaching of Auto CAD, students can do drawing & drafting of design done in section A.

PROJECT MANAGMENT

Course Code (ME509) **Credit 3(2-1-0)**

Project management concept, establishing the project and goals; organizing human resource and contracting; organizing systems and procedures for implementation; project direction, coordination and control, project management performance; project management case studies, project management information system; computer based project management; future of project management.
Development of Project Network:
Time estimation, determination of critical path (CPM) Event slacks and floats, choice of schedule in view of resource constraints. Programme evaluation review technique (PERT) examples. Illustrations & case studies.
Misc. Topics:
Introduction to MRP? ERP, TQM and E-commerce etc.
REFERENCE:

1. Project management-Kerzner, CBS.
2. Essentials of project management-Dennis Lock, Groover,
3. Projects-planning, analysis, selection, impletation & review -P, Chandra,TMH

4. Project management Basic-R.L.Kimmons, Dekker.
5. System analysis & Project management - Cleland & kind McGraw hill.
6. Practical Project management - RG Ghattas & Sandra L. Mckec, Pearson Education Asia.

AUTOMATIC CONTROLS

Course Code (EEE-509) **Credit 3(2-1-0)**

Introduction : Concept of automatic controls-loop and closed-loop systems, servomechanisms, block diagrams, transfer functions. Application of Laplace Transform in control system.
Representation of control components and systems:
Translation and rotational mechanical components, electrical components, series and parallel combinations, cascade systems, analogous system.
System Response: First and second order systems response to impulse, ramp and sinusoidal inputs, properties of unit step response of second order system, systems with velocity lag.
Mode of Controls: Proportional control-proportional pus reset control proportional plus rate control, reset rate, two position control.
Controller Mechanisms: Pneumatic, hydraulic and electric controllers, general principles for generating various control actions. Concept of control value.
Control system analysis: Transient response of simple control systems stability of control system Routh's criterion.
Frequency response analysis: Polar, Bode plots-experimental determination of frequency response, Bode and Niquist stability criteria, gain and phase margins.
Root locus plots: Simple transfer functions transient response from root locus.
References:
1.Automatic control Theory- Rave, McGraw- Hill Book Co.
2.Industrial Automatic controls – lajoy, Longmans Green & Co.
3.Automatic Control Systems – B.C. Kuo, Prentice – Hall [1976]
4.Modern Control Engineering – Linear Control Systems- W-Leonhard, Allied Publishers Pvt. Ltd. [1976]
5.Control systems Engineering- I.J. Nagarth and M. Gopat New Age Pvt. Ltd.
6.Automatic Process Control- D.P. Eckaman, Viley Eastern Ltd.

QUALITY ENGINEERING

Course Code ME-510 **Credit : 4 (3-0-2)**

Concept of quality , basic statistical concept , Control of accuracy and precision , Process capability , standardization and interchangeability , Statistical quality control : Objectives , Applications , Organization , Cost Aspects, theory of statistical tolerance.
Control Charts : General theory of control charts , Group control chart , Shewhart control chart
for process control; control charts for variables such as X , R , Control charts for charts for attributes such as c and p charts , Acceptance control chart ; Cumulative sum control charts ;
Subgroup selection ; Process capability , Cause – effect and pareto diagrams
Acceptance Sampling :Multiple and Sequential sampling plans , Multi-Continuous sampling Plans, Acceptance Sampling by variables , Advantages Limitations , Sampling plans using different
Criteria , Comparison of various types of sampling plans , Rectifying Inspection .
Reliability , Availability and maintainability : Introduction to reliability , Bathtub curve , series
and parallel system ; MTBF , Evaluation of Availability and Maintainability .
Quality Design : Design of experiment concept , System , Parameter and Tolerance Design ;
concept of robust design , Taguchi Concept - Orthogonal arrays and S/N ratio
Reference Books:

1.Quality Control and Introduction Statistics – Duncan A. J.
2.Introduction to Quality Control – C.O.P. applications
3. Statistical Quality Control by Grant andv Leavarworth .
4. Maintenance for reliability by Rao .

ENERGY MANAGMENT

Course Code ME-516 **Credit : 4 (3-1-0)**

Introduction : The energy-economy link. Patterns of energy use in developing countries, the electricity- economy link for developing economies, options to overcome the energy crisis. Characteristics of conventional and non-conventional energy resources.
Conventional energy resources and their utilization; thermal, nuclear and hydro-electric power plants, use of diesel engines and gas turbines for power generation. Combined cycles for efficient power generation.
Non-conventional energy resources and their utilization: solar , geothermal, wind, wave, biomass and ocean-thermal energy conversion and their limitations. Energy storage techniques.
Energy conservation: energy auditing, process energy and gross energy requirement, energy recovery: insulation, heat recovery heat exchangers, heat-pumps, combined heat and power plants (cogeneration), efficient lighting and energy conservation in buildings.
Environmental aspects of energy resource utilization: combustion generated air pollution, global warming, acid rain, fly ash disposal, radioactive pollution and nuclear waste disposal.
REFERENCES:
(A)'Energy for a sustainable world' by Goldemberg et al. Wiley Eastern Limited. 1988.
(B) 'Power Plant Technology' by M.M.El-Wakil. McGraw-Hill. 1984.
(C)'Managing energy in commerce and industry' by Gordon A Payne. Butterworths, 1984.

FLUID MACHINERY

Course Code (CE-576) **Credit 4(2-1-2)**

1. Jet Theory: Introduction to hydro dynamic thrust of a jet on a fixed and movin g suface (flat, curve), effect of inclination of jet with the surface.
2. Hydraulic Turbines: Pelton Wheel, Francis and Kaplan turbines classification of turbines, working principles, work done, efficiency, draft tube theory, cavitations in turbines, performance, testing of turbines, model testing, selection of a turbines, stability of a turbine (Static & dynamic), performance curves, constant efficeiency curves, Muschel curves, governing of turbines, specific speeds.
3. Pumps: Centrifugal pumps, classifications, work done by impeller, efficiencies of centrifugal pumps, priming, specific speed, cavitations and separation, surging, checking, model testing, performance characteristics, reciprocating pumps, classification, work done (single and double acting), slip, variation of pressure, work saved by fitting air vessels, multicylinder pumps, comparison of centrifugal and reciprocating pumps, design aspects.
4. Hydraulic machines: Hydraulic systems, hydraulic press, cranks, jacks, accumulator, intensifier, ram, fluid coupling, fluid torque converter, water hammer, jet pumps and air lift pumps.
5. Gas Turbines and Jet propulsion: Introduction, working cycle, different types of gas turbines, jet propulsion, thrust power and propulsion efficiency.
References:
1.Hydraulic Machines Dr. J. Lal
2.Heat Engg. V.P. Vasandani & D.S. Kumar
3.Hydraulic machines V.P. Vasandani
4.Fluid machinery- K.R. Arora
5.Fluid machinery – P.N. Modi & S.M. Seth.

FLUID MACHINERY LAB

Say minimum eight experiment following or such experiment
1.Impact of jet experiment
2.Turbine exp. On pelton wheel
3.Turbine exp. On Francis turbine
4.Turbine exp. On Kaplan turbine
5.Exp. On Reciprocating pump
6.Exp. On centrifugal pump.
7.Exp on Hydraulic Jack/Press
8.Exp. On Hydraulic Brake
9.Exp. On Hydraulic Ram
10.Study through first visit of any pumping station/plant
11.Study through second visit of any pumping station/ plant
12.Any other suitable experiment/test rig such as comparison & performance of different types of pumps and turbines.

DESIGN AGAINST FATIGUE AND FAILURE CREDIT

Course Code ME-518 **Credit 4 (3-1-0)**

A. FRACTURE OF CRACKED MEMBERS

1. **INTRODUCTION** :
   (1) Cracks as stress raisers
   (2) Behavior at crack tips in real materials
   (3) Effects of cracks on strength
   (4) Effect of cracks on brittle versus ductile behaviors

2. MATHEMATICS CONCEPT OF
   (1) Strain Energy release rate ratio , G .
   (2) Stress intensity factor K .

3. APPLICATION OF K TO DESIGN & ANALYSIS
   (1) Mathematical form used to express K
   (2) Cases of special interest for practical application
   (3) Discussion

4. Fracture toughness values and trends
   (1) Trends of KIC with materials
   (2) Effects of temperature and loading rates
   (3) Micro structural influences on KIC

5. Plastic zone size and plasticity limitation on LEFM
   (1) Plastic zone size for plane stress
   (2) Plastic zone size for plain strain
   (3) Plasticity limitation on LEFM

6. Standard Test Methods for
   (1) Fracture Toughness Testing
   (2) Effect of thickness on Fracture behaviour

COMPUTER AIDED DESIGN

Course Code (ME-601) **Credit 5(3-0-4)**

1.Introduction: Introduction to CAD / CAED / CAE and its engineering applications, importance & necessity.

2.Programming in C, C++

Brief introduction and review computer and languages. C, C++ Input output statements, control statement, if for while, switch statement, function. Pointer nations. Array, matrix, string, structure, class concept of object oriented Programming, Features of C++ over C.

3.Computer Graphics-

Graphic systems, CTR, Display devices, Co-ordinate representation, Graphic functions. Output primitives-Breseham's line drawing and Mid-point circle algorithms. 2-D and 3-D transformations concatenation. Exercise and programs. Curve representation. Interpolation vs approximation. Spline curve. Bezier curves and its properties. Brief mention of other curves. Graphic - Polygon surface, quadric and super quadric surface and Bobby objects Solid modeling-Sweep representation wire mesh, constructive solid geometry and Boolen operations. Boundary representation, Colours.

4. Computer Aided Design of Machine Elements and Other systems.

CAD of machine elements such as shaft, springs, bearing and problem from other system such as heat exchanger, inventory control etc. Writing computer program in C.A. Auto CAD and its uses.

5. Introduction to Numerical Methods and Optimization Technique-

Introduction to Numerical techniques and optimization. Curve fittings. least square method. Newton- Raphson method for root finding an for optimization. Brief introduction to numerical differentiation and integration. Linear programming for constrained optimization (only graphical method) .

6.Introduction to Finite Element Method (FEM)

Introduction and applications of FEM. One / Two dimensional beam element (spring system) analysis.

Books / References.

1.Computer Graphic by Hearn & Baker, Prentice Hall.
2.CAD / CAM by Groover
3.Let us C by yaswant kanetkar and also on C^{++}
4.Computer aided analysis & design of machine elements by Rao & Dukhipati
5. Numerical methods using C by Xavier.
6.Optimization - SS Rao
7.FEM - SS Rao

CAD LAB

minimum 6 experiments from following

1. Line drawing or Circle drawing algorithm experiment : writing the program and running it on Computer.

2.Transformations algorithm experiment for translation / rotations / scaling : writing program and running it on computer.
3.Design problem experiment: writing the program for design of of machine element or other system and running it on computer.
4.Optimisation problem experiment: writing a program for optimizing a function and running it on computer.
5.Auto CAD experiment: understanding and use of Auto CAD commands.
6.Writing a small program for FEM for 2 spring system and running it. OR using a FEM package.
7.Use of graphic software standards packages e.g. GKss / PHICS / GL etc.
8.Use of pro Engineer / Idea etc.

Computer Aided Manufacturing

Course Code (ME-602) **Credit 5(3-0-4)**

1.Introduction:Need and future of NC systems and CAM in India. Advantages & Disadvantages. Classification. Open and closed loop. Historical development and future trends. Closed loop. Historical development and future trends.
2.Features of NC Programming: Difference between ordinary and NC machine tools. Methods for Improving Accuracy and Productivity.
3.NC Part Programming:(a)Manual (word address format) programming. Examples drilling and milling.
(b) APT programming, Geometry, Motion and Additional statements, Macro statement.
4.System Device: Introduction to DC motors, stepping motors, Feed back device such as encoder, counting devices, Digital to Analog converter and Vice versa.
5.Interpolators: Principle, Digital Differential Analyses. Linear Interpolator and its software interpolator.
6.Control of NC systems: Open and closed loops. Automatic control of closed loops with encoder & tachometers. Speed variation of DC motor. Adaptive control.
7.Computer integrated manufacturing system: Manufacturing cell, Transfer lines, FMS, CIM, CAD / CAM concept.
8.Robotics:NC machine vs Robots. Types and generations of Robots. Robot applications. Economics, Robot programming methods. VAL and AML with examples. Introduction to Artificial intelligence for intelligent manufacturing.

Books / References:

1. Computer control of Manufacturing systems by Koren
2. Robots by Koren
3. NC Machines by Koren
4. CAD / CAM by Groover.

CAM LAB

Minimum four experiments

1.Writing a part - programing (in word address format or in APT) for a job for drilling operation (contouring and running on NC machine.
2.Writing a part programming (in word address format or in APT) for a job milling operation (conducting) and running on NC machine.
3. Experiment on Robots and its programs.
4. Experiment of difference between ordinary machine and NC machine, study or retrofitting.
5.Experiment on difference between ordinary machine and NC machine, study or retrofitting.
6. Experiment on study of system devices such as motor and feed devices.
7.Experiment on Mechatronics & controls.

AUTOMOBILE ENGINEERING

Course Code (ME-603) **Credit 4(2-1-2)**

Power Unit Gear Box:
Principles of design of main components. Valve mechanism. Power and Torque characteristic. Rolling, air and gradient resistance. Tractive effort, Gear Box, Gear ratio determination. Design of gear Box.

Transmission system:
Requirements, clutches. Torque converts. Over Drive and free wheel, Universal joint. Differential Gear Mechanism of Rear Axle. Automatic transmission, steering and Front Axle. Castor Angle, wheel camber & Toe in Toe out etc. Steering geometry. Ackerman mechanism, Understeer and Oversteer.

Braking System:
Generals requirements, Road, tyre adhesion, weight transfer, Braking ratio. Mechanical brakes, Hydraulic brakes. Vaccum and airbrakes. Thermal aspects.

Chasis and suspension system:
Loads on the frame. Strength and stiffness. Various suspension system.

Electrical System:
Types of starting motors, generators & regulators, lighting system, Ignition system, Horn, Battery etc.

Fuel System:
Diesel & Petrol Vehicle system such as Fuel Injection Pump, injector & Fuel Pump, Carburator etc. MPFI.

Cooling & Lubrication System:

Different type of cooling system and lubrication system. Maintenance System: Preventive maintenance, break down maintenance, and over hauling system.

References:

1.Automotive Engineering - Heitner
2.Automotive Engineering - Kripal Singh
3.Automotive Engineering - Narang
4.Automotive Mechanics - Crouse
5.Automotive Engineering - Newton and Steed.

AUTOMOBILE ENGINEERING - LAB

Say any study & experiment from the following

1.Study & experiment on braking system.
2.Study & experiment on fuel supply system.
3.Study & experiment on ignition system.
4.Study & experiment on steering system
5.Study & experiment on transmission system
6.Study & experiment on suspension system.
7.Study safety aspect of automobile design.
8.Study & experiment on Lighting or lubrication system.
9.Study & experiment on lubrication and cooling system
10.Comparative study features of common small cars (such as Fiat, Ambassador, Maruti, Matiz, Santro, Indica and its variations) available in India.
11.Comparative study & technical features of common scooter & motorcycles available in India. Case study / term paper.
12.Comprative & technical features of common heavy vehicles available in India. case study / term paper.
13.Engine tuning and carburator servicing experiment.
14.Experiment & study of MPFL system.
15.Experiment on fuel consumption measurement.
16.Review experiment on IC Engines & modern trends.
17.Visit of a Automobile factory.
18.Study & experiment of main gear box and differential gear box.

MECHANICAL SYSTEMS DESIGN

Course Code (ME-606) **Credit 4(3-1-0)**

1.Engineering Process and Systems Approach: Applications of systems concepts in Engineering, Identification of engineering, Identification of engineering functions, systems approach, Engineering Activities Matrix, Defining the proposed effort, Role of Engineering problem solving. Concurrent Engineering. A case study : eg. Viscous lubrication system in wire drawing.

2. Problem formulation: Nature of engineering problems, needs statement, Hierarchial Nature of systems hirarchial nature of problem environment, Problem scope and constraints. A case Study; e.g.Heating duct insulation-System High - Speed belt drive system.

3.System Theories: System analysis View-points, Black Box approach, state theory approach, component integration approach. Decision. Process approach; A case study: e.g. Automobile instrumentation panel system.

4.System Modeling: Need for modeling, modeling types and purpose, Linear graph modeling concepts, Mathematical Modeling, Concepts, A case study: e.g. A compound bar system.

5. Linear Graph Analysis: Graph modeling and analysis process, Path problem, Network flow problem, A case study: e.g. Aluminium extrusion system.

6.Optimization concepts: Optimization process, Motivation and freedom of choice goals and objectives- Criteria, Methods of optimization analytical combinatorial , subjective. A case study : e.g. Aluminium extrusion system.

7.System Evaluation: Feasibility assessment, planning horizon, time value of money, Financial analysis. A case study e.g. manufacture of a maize-starch system.

8.Calculus Methods for optimization: Model with one decision variable, Model with two decision variables, Model with equality constraint, Model with inequality constraint. A case study : e.g. Optimization of an insulation - system.

9.Decision Analysis: Elements of a decision problem, Decision model Probability a dignity function, Expected monetary value. Unity value, Baye's theorem : A case study : e.g. Installation of a machinery.

10.Systems Simulation: Simulation concepts, simulation models, Icons Analog Analytical, Waiting Line simulation, Simulation process problem definition, input model construction, solution process, limitations of simulation approach : A case study : e.g. An inventory control in a Production-Plant.

Suggested Text Books / References:

1. Design and Planning of Engineering systems- by D.D. Raredith, K.V. Wong, R.W. Woodhead, and R.R. Worthman, Prentice Hall Inc. Englewood Clifts, New Jersey.
2.Design Engineering Design Method- by J.R. Dixon, Tata Mc.Graw-Hill Publishing Company, New Delhi.
3.An Introduction to Engineering Design Method- by V. Gupta and P.N. Murthy, Tata Mc-Graw-Hill.

4-Engineering Design- Robert Matousck, Blackie and Son Ltd. Glasgow.
5.Optimization Techniques- S.S. Rao.
6.System Analysis and Project Management- Devid I Cleland, William R. King. McGraw-Hill.

TOTAL QUALITY MANAGEMENT

Course Code ME-665 **CREDIT : 3 (3-0-0)**

-Concept of quality, Quality control and quality management.
-Science of quality. Human resources and quality
-Quality Organization and management: Quality manual. Quality cost .Quality related tasks
- Quality Information system : planning. Hardware-software
-Statistical process control and quality development techniques
-Controlling quality through measurement and through counting
- Quality system and ISO 9000 series
- Quality assurance. Reports on quality. Quality audit Quality training
-Newer quality management approaches
-Quality Tools

ROBOTICS

Course Code ME-670 **CREDIT; 3(3-0-0)**

INTRODUCTION : Past , Present and future ; Robot Terminology ; Applications , Components and Sub-systems , Classification of Robot , End Effectors , Different types of grippers and design concepts .
ROBOT K8INAMETICS : Object location , Homogeneous , Transformations , Direct and inverse kinematics , Manipulator motion
ROBOT DRIVES, ACTUATORS and CONTROL: Drive systems hydraulics , pneumatic and electrical .
DC Motor , Stepper Motor , Robot motion and path control , Controller.
SENSORS AND PERCEPTION : Type of sensors , vision system . Computer interfaces

FINITE ELEMENT METHOD IN ENGINEERING

Course Code ME-671 **CREDIT; 3(3-0-0)**

Approaches of FEM- Discrete, Variational and Weighted Residual; Direct Problems- Spring, Hydraulic Network; Resistance Network and Truss Systems; 1-D Field and Beam Bending Problems; 2-D and Axisymetric Field and Stress Problems; Plate Bending; 3-D Stress Analysis; Solutions of Unsteady Problems related to Stress? Analysis, Heat Conduction,?? Fluid flow and Vibration. Solutions of Plane Stress, Plane Strain and Axisymetric Plasticity Problems.

ADVANCED WELDING? TECHOLOGY

Course Code ME-672 **CREDIT 3(3-0-0)**

A review of various metal joining? techniques such as welding, brazing, soldering and adhesive bonding, welding compared with other processes of fabrication. Classification of welding processes. Application of welding processes.
Fusion Welding: Mechanism of arc initiation and maintenance, Temperature distribution. Techniques, scope and limitations of manual metal arc. TIG, MIG, submerged arc. Electroslag welding. Plasma Arc and Electro gas welding. Various gas welding processes e.g. oxyacetylene oxy-hydrogen welding processes.
Resistance welding, Modern welding processes viz. Electron Beam, Ultrasonic; Explosive, laser beam processes and their applications. Solid state welding processes viz.? Friction, Diffusion, cold pressure process and their applications.
Oxygen cutting Plasma Arc cutting. laser cutting processes etc.
Brazing, soldering and adhesive bonding. Scope and application.
Welding? defect? and remedies. Weld cracking and prevention. Testing and inspection of welds.

MECHATRONICS

Course Code ME-673 **CREDIT : 3 (3-0-0)**

Fundamentals of Mechatronics, definitions and Concepts;Conventional vs Mechantronics Systems; Need of? Mechantronics in Mechanical Engineering; Sensors and Transducers with? Special?? reference to Mechatronics. Signals System and actuating devices; real time interfacing. Applications of? Mechatronics in Manufacturing and Automation Case Studies.

METAL FORMING

1-Fundaments of Elasticity, Plasticity and Viscoplastcity, Stress and strain invariant.?Elesticity- State?? of stress and strain, stress-strain relations,? strain-displacement relations.Plasticity and Viscoplasticity: Yeld?? criterian, effective stress and strain, state of plastic strain, Plastic strain rate, Flow rule, Effective strain rate, plastic anisotropy and viscoplasticity (determination of load and power) concept of solid and flow formulations.?

2-Analysiz of Deformation Processes using SSM, UBM & SLM.Plain strain Problems: Drawing and Extrusion of sheet, Rolling and forging of strips.Axisymmetric?? Problems: Drawing and Extrusion of bar and tube, forging of solid and Hallow disc.Sheet metal problems: Axisymmetric deep drawing and stretching.

ENERGY CONSERVATION

Course Code ME-674 **CREDIT : 3 (3-0-0)**

1.Introduction: The energy crisis and options: the energy conservation option, energy intensity of developed and developing economies, energy auditing ? basic requirements, scope and purpose, process energy and gross energy requirements.

2.**Efficient energy conversion**: efficient combustion, waste as a fuel, combined cycles for efficient power generation, combined heat and power plants, combined cooling and power plants.

3. **Energy recovery**: insulation: insulating materials, economic thickness of insulation; heat recovery heat exchangers: recuperative heat exchangers, run-around coil systems, regenerative heat exchangers; heat pumps; and heat-pipes.

4. **Process integration**: basic concepts of pinch technology, stream networks, significance of the pinch, design of energy recovery system.

5. **Energy conservation in buildings**: degree-days, steady state loads and comfort. Conditioning the air for process requirements and human comfort, thermal performance monitoring, efficient lighting systems, solar passive features.

6. Economics of energy saving schemes and case studies.

REFERENCES

(A) Energy efficiency? by Eastop and Croft, Longman Scientific and Technical, 1990

(B) Managing energy in commerce and industry? by Gordon A Payne, Butterworths, 1984.

CAD OF THERMAL SYSTEMS

Course Code ME-675 **CREDIT : 3 (3-0-0)**

Study of the design aspects. Fluid flow and heat transfer characteristics and materials requirements of at least two of the? following types of heat exchange equipment: :Liquid-to-liquid. Liquid -to-gas and gas-to-gas heat exchangers. Cooling???? tower, Familiarity with the use of the design related international/national and other codes.Preparation of necessary computer programs for designing the thermal system. Learning of the techniques for presenting design features of the thermal equipment.

Reference Book:

1. Process Heat Transfer by D.Q.Kern
2. Heat Exchanger Design by A.P.Fraas and M.N.Ozisik
3. Heat Exchangers: Selection., Rating and Thermal Design-Hongtan Lui & Sadic Kakac. CRC Press.
   ISO, ISI and TEMA Codes.

METAL FORMING

Course Code ME-676 **CREDIT : 3 (3-0-0)**

METALFORMING

UNIT-I

Plasticity –True stress strain diagrams in simple tension – Deviation from Engineering Stress – Strain curves. Three dimensional stress system, strain tensor and yield Criteria of metals.

UNIT-II

Fundamentals of metal forming – Classification of forming processes – Cold working – Recovery – Recrystallisation and grain growth, hot working. Strain rate effects – work of plastic deformation

UNIT-III

Flow stress curves – Super plasticity in materials – Hot working and cold working operation – Relative merits and applications.

UNIT-IV

Sheet metal working: Standard die sets, simple, compound, combination, progressive and transfer dies. Process parameters and estimation of loads in shearing, bending, deep drawing, shear spinning operations. Mechanical and hydraulic presses, relative merits and application – constructional features and operation.

UNIT-V

FORGING: Open die and closed die forging, machine forging, upset forging etc., forging loads, forging die design. Estimation of forging loads for rectangular and cylindrical slugs. Forgeability Tests. Defects in forging, Forging equipment – constructional features and operation.

UNIT-VI

ROLLING: Principles of rolling, Process parameters, Estimation of rolling loads by consideration of stresses. Principles of roll pass design for various product shapes. Principles of ring rolling. Processing maps and their applications in metal working operation. Rolling mills – Their constructional features and operation.

UNIT- VII

EXTRUSION: Classification of extrusion processes, extrusion equipment. Hot extrusion. Deformation and defects in extrusion. Analysis of the extrusion proceses, cold extrusion. Extrusion of tubing and production of seamless pipe and tubing.

UNIT- VIII

DRAWING OF RODS, WIRES AND TUBES: Road and wire drawing, tube drawing process, residual stresses in rod, wire and tubes.

TEXT BOOK:
G. E Dieter: Mechanical Metallurgy.
REFERENCE BOOKS :
1. An Introduction to the Principles of Metal Working " by Geoffery W. Rowe.
2.Sheet working of Metal " by Eary and Reads.
3. Manufacturing Sciences " by Amitabh Ghosh and Mallik.
4. Manufacturing Technology" by P. N. Rao.

REVERSE ENGINEERING

Course Code ME-677 **CREDIT : 3 (3-0-0)**

Introduction of Reverse and? concurrent engineering. Elements of concurrent engineering. Advantage and applications.
Theory of measurements. Linear, angular, curved surfaces, methods of advanced Measuring devices, Coordinate Measuring machine. Elements to CMM. Data accumulation, retrieval..
Geometric Modelling. 2D and 3D Graphics, concepts of various transformation of Geometric Models, Wireframe surface and solid modelling techniques, representation of parametric and non-parametric curvesand surfaces, Mathematical representation of solid and solid modeling- based applications. CAD/CAM data exchanges. Visual realism and Graphics Tools, Applications, Auto-CAD, Auto surt, Auto Mil. And UNIGRAPHICS. CAD/CAM interfaces, process planning, computer aided production planning systems. Capacity plannint. Part Programming. APT, CAPPS programming, Geometry definition, Tool Path generation.
Rapid Prototyping: Concurrent Engineering, Need of Rapid Prototyping. Techniques, Resins, (Laser engines) Laser, Laser production and control. Post curing, Data rerrieval from? CAD,? MIC codes generation, Apparatus for quality measurement.(CMM)

SUPPLY CHAIN MANAGEMENT

Course Code ME-678 **CREDIT : 3 (3-0-0)**

1. Introduction to Logistics and Supply Chain Management. Concepts, Drivers and obstacles.
2. Planning Demand and supply in a supply chain-Demand forecasting, Aggregate Planning.
3. Management of Inventory in global? supply Chain.
4. Role of Information Technology in supply chain.? e-Business and the supply chain
5. Factors influencing logistics and? decision.
6. Bench making and performance measurement.

MECHANICAL VIBRATION

Course Code ME-679 **CREDIT : 3 (3-0-0)**

UNIT - I
Introduction
Periodic motion, harmonic motion, superposition of simple harmonic motions, beats, Fourier analysis 3Single Degree Freedom System Free vibration, Natural frequency, Equivalent systems, Energy method for determining
natural frequency, response to an initial disturbance, Torsional vibrations, Damped vibrations, Vibrations of systems with viscous damping, Logarithmic decrement.
UNIT - II
Single Degree Freedom: Forced Vibration Forced vibration, Harmonic excitation with viscous damping, steady state vibrations, Forced vibrations with rotating and reciprocating unbalance, Support excitation, Vibration isolation, Transmissibility, Vibration measuring instruments, Displacement, velocity and acceleration measuring instruments
UNIT- III
Two Degree Freedom systems Introduction, Principal modes, Double pendulum, Torsional system with damping,
coupled system, undamped dynamic vibration absorbers, Centrifugal pendulum absorbers, Dry friction damper
UNIT- IV
Multi Degree Freedom system: Exact Analysis Undamped free and forced vibrations of multi-degree freedom systems, influence number, Reciprocal theorem, Torsional vibration of multi-degree rotor system, Vibration
of gear system, Principal coordinates, Continuous systems- Longitudinal vibrations of bars, Torsional vibrations of circular shafts
UNIT- V
Multi Degree Freedom system: Numerical Analysis Rayleigh's, Dunkerely's, Holzer's ad Stodola methods, Rayleigh-Ritz method
CRITICAL SPEED OF SHAFTS
Shaft with one disc with and without damping, Multi-disc shafts, Secondary critical speed.
Books and References:
1. Mechanical Vibrations – P. Srinivasan, TMH
2. Mechanical Vibrations – G. K. Groover, Jain Brothers, Roorkee
3. Mechanical Vibrations – W. T. Thomson
4. Mechanical Vibrations – JS Rao & K Gupta, New Age
5. Mechanical Vibrations – Tse, Morse & Hinkle
6. Mechanical Vibrations – V. Rama Murthy, Narosa Publications

MECHANICAL ENGINEERING

Course Code: ME 330 **Credits 4(3-1-0)**

1. Fundamental Concepts and Definitions: Introduction to S.I units, Definition of thermodynamics, System surrounding and universe, phase, concept continuum, macroscopic and microscopic point of view, density, sp. Volume, pressure, thermodynamic equilibrium, property, state, path, process, cyclic process, quasistatic process, reversible and irreversible process, energy and its forms, work and head, NTP and STP.

2. Ideal and Real Gases: Concept of ideal gas, characteristic equation of gas, universal and characteristic gas constant, enthalpy and specific heat, deviation of real gas from ideal gas, compressibility factor and the Van der Wall's equation of state for real gas.

3. Laws of Thermodynamics: Zeroth law, concept of temperature, equality of temperature, zeroth law, principle of thermometry and temperature scale.

First Law: First Law of thermodynamics, concept processes, flow processes and control volume, flow work, steady flow energy equation, Mechanical work in a steady flow process, Throttling process, Application of first law to open systems.

Second Law: Essence of second law, Thermal reservoir, heat engines and thermal efficiency, COP of heat, pump and refrigerator, Definition of available and unavailable energy, Statement of second law, Carnot cycle, Carnot's theorem, Clausius inequality, Concept of entropy, Entropy change for ideal gases.

4. Properties of steam: Generation of steam at constant pressure, various states of water, properties of steam, use of property diagram, process of vapour in closed and open system, determination of dryness fraction of steam by separating and throttling calorimeter, Rankine cycle.

5. Thermodynamic Cycles: Definitions of bore, Stroke clearance ratio, compression ratio, definition and calculation of mean effective pressure from the cycle work (proof not required), indicated pressure, air standard cycles (Otto and diesel cycles), principle of working and description of two and four stroke SI and CI engines.