

DEPARTMENT OF MATHEMATICS

21 1x01 MATHEMATICS- I

L-T-P : 3-1-0

Credit : 4

1. **ALGEBRA OF MATRICES** : Elementary transformation, inverse by row transformation, canonical reduction, rank, solution of simultaneous equations, characteristic equation, Eigen values – & Eigen vectors, Caley's Hamilton theorem, similarity transformation, reduction to diagonal matrices. **Lecture : 8**

2. **DIFFERENTIAL CALCULUS** : Higher order derivatives (successive differentiation) and Leibnitz theorem, indeterminate form, Tangent and normal, review of maxima & minima ,concavity and convexity of a curve point of inflexion, curvature and radius of curvature , pedal equation asymptotes (for Cartesian curve only) Taylor's and Maclaurin's series, partial derivatives, Euler's theorem on homogeneous function , harmonic function , Taylor's expansion of several variables, maxima and minima of several variable, Lagrange's method for undetermined multipliers. **Lecture : 20**

3. **DIFFERENTIAL EQUATION** : First order equation, separable, homogeneous , exact ,linear and Bernoulli's form ,second and higher order equation with constant coefficients, Euler's equation: methods of their solution . dependent and independent of solution, Wronskian's system of first order equation **Lecture : 8**

4. **INTEGRAL CALCULUS - I** : Convergence of improper integral – comparison test. Abel's test, beta & gamma functions (definition & related problems) , error function , differentiation under integral sign – Leibnitz rule. **Lecture : 8**

Text Books :

1. Advance engineering mathematics by H.K.Dass, S.Chand & Company Ltd.
2. Higher engineering mathematics by B.S. Grewal, Khanna Publishers
3. Differential calculus by Das & Mukherjee –U.N. Dhar & sons
4. Integral calculus by Das & Mukherjee – U.N. Dhar & sons

Reference Books :

1. Advance engineering mathematics by E. Kreyszig, 8th Edition, John Wiley & Sons, New York
2. Advance engineering mathematics by Wiley & Barratt- Tata McGraw Hill
3. Linear Algebra by K. Hoffman and R Kunze-Prentice Hall

21 1x02 MATHEMATICS –II

L-T-P : 3-1-0

Credit : 4

1. **INFINITE SERIES** : Notion of convergence and divergence of infinite series - Ratio test , comparison test, Raabe's test, Root test, alternating series – Leibnitz test absolute and conditional convergence. Uniform convergence. **Lecture : 6**

2. **FOURIER ANALYSIS** : Periodic function : functions of arbitrary period, Even & odd functions, Half Range Expansions, Harmonic analysis, Complex Fourier series, Laplace transform: Definition and properties of Laplace transform, shifting theorem, transform of derivatives and integrals, Multiplication by t^n , Division by t , Evaluation of integrals by L.T., Inverse Transforms. **Lecture : 14**

3. **INTEGRAL CALCULUS II** : Double & Triple integrals, Rectification, computation of surfaces & volumes, Change of variables in double integrals, Jacobians of transformations, Integrals dependent on parameters- applications. **Lecture : 12**

4. **VECTOR CALCULUS** : Scalar & vector point function, differentiation of vector, velocity and acceleration, direct derivatives, concept of gradient, divergence curl, line integral, Greens theorem in plane, Gauss & Stoke's theorem and simple application. **Lecture : 12**

Text Books :

1. Advance engineering mathematics by R.K.Jain & S.R.K. Iyengar, Narosa publishing house
2. Higher engineering mathematics by Wiley & Barrett-Tata McGraw hill

Reference Books :

1. Advanced engineering mathematics by Wiley & Barrett – Tata McGraw Hill
2. Advanced engineering mathematics by E. Kreyszig 8th edition, John Wiley & sons. New York
3. Vector analysis 2nd edition by Chatterjee, Prentice Hall of India

21 1x03 MATHEMATICS – III

L-T-P: 3-1-0

Credit : 4

1. **ORDINARY DIFFERENTIAL EQUATIONS & SPECIAL FUNCTIONS** : Series solution of differential equations (Frobenius method), Bessel's equation, Its solution, Bessel's function of first & second kind, Recurrence formula, Legendre's equation, Its solution, Legendre polynomials, Rodrigue's formula, Orthogonality of Legendre polynomial.

Lecture : 10

2. **PARTIAL DIFFERENTIAL EQUATION** : Basic concept, 1st & 2nd order linear & quasi – linear partial differential equation, Classification of second order P.D.E., Boundary and initial conditions, wave equations, Separation of variables, use of fourier series, D'Alembert's solution of wave equation, Heat equation, Solution by fourier series.

Lecture : 10

3. **COMPLEX ANALYSIS - I** : Function of complex variables – limit, continuity, differentiability and analyticity of functions Cauchy-Riemann equations, Laplace's equation, harmonic function, Cauchy's integral theorem, Cauchy's integral formula, Taylor's and Laurent series, Residues and its applications to evaluating real integrals.

Lecture : 10

4. **PROBABILITY & STATISTICS** : Theorems on probability, including Baye's rule, Random variable – cumulative distribution function, Probability mass function, probability density function, Mathematical expectation, mean variance, moment, generating function & characteristics function, standard probability models Binomials, Poisson exponential, Weibull, normal and lognormal, sampling & sampling distribution, Chi- square and F distributions, large and small sample tests of significance.

Lecture : 12

Text Books :

1. Advanced Engineering Mathematics by R.K.Jain & S.R.K. Iyengar
2. Higher engineering mathematics by B.S. Grewal
3. Fundamentals of mathematical statistics by V.K.Kapoor & S.C. Gupta- sultan & sons

References :

1. Advance Engineering Mathematics by E.Kreyszig 8th edition , John Wiley & sons
2. Complex variable and applications by Churchill & Brown –McGraw hill
3. Elements of Partial Differential equation by I.N.Sneddon - McGraw Hill
4. Introduction to Probability & Statistics for engineering by S.M.Ross – John Wiley and Sons, New York.

21 1304 NUMERICAL METHOD & COMPUTATIONAL TECHNIQUE

L-T-P : 3-1-0

Credit : 4

1. **Introduction to computer language** : Machine language, assembly language, higher level language, compilers, problem solving using computer algorithm, flow chart, examples.

Lecture : 5

2. **C/C++ Programming** : Constant & variables, arithmetic expression, I/O statement, specification statement, control statements, subscripted variables, logical expression, function and subroutines, examples of programming should include numerical as well as non numeric applications, matrix operations, searching , sorting etc.

Lecture : 15

3. **Iterative Techniques for solution of equations :**

i. **Solution of non linear equation** - Simple iteration scheme, Bisection method, Regula-falsi method, Newton - Raphson method, Secant method, their rates of convergence, order of errors etc.

Lecture : 5

ii. **Solution of linear equation** – Gaussian elimination, matrix inversion by Gaussian method, computation of determinants, Jacobi and Gauss Seidel iteration method.

Lecture : 4

4. **Polynomial approximation** : Interpolation, several form of interpolating polynomials like Lagrangian interpolation of polynomial and Newtons forward and backward difference formula, curve fitting(least square) .

Lecture : 6

5. **Numerical integration** : Trapezoidal method, Simpson's rule, order of errors in integration.

Lecture : 4

6. **Solution of initial value problem** : Euler's method, Runge-Kutta second order and fourth order methods, solution of boundary value problem - Finite difference method.

Text Books:

1. Numerical methods for scientific and engineering computations by M.K. Jain, S.R.K. Iyengar, and R.K.Jain, New Age International Publishers, New Delhi.
2. Introductory Method of Numerical Analysis by S.S. Sastry, Prentice Hall of India Pvt. Ltd.

Reference Books

1. Numerical Analysis in Engineering by Rama B. Bhat, S. Chakravarty, Narosa Publishing House.
2. Advanced Engineering Mathematics by E.Kreyszig, 8th edition by John Wiley & Sons, New York.

21 1x05 DISCRETE MATHEMATICAL STRUCTURE & GRAPH THEORY

L-T-P : 3-1-0

Credit : 4

UNIT-I:

Mathematical Logic and Set Theory: Statement and Notation, Negation, Conjunction, Disjunction, Tautologies, Truth tables, Basic concepts of set theory, Inclusion and equality of sets, The power set, Ordered pairs and n-tuples.

UNIT-II:

Relations and Functions: Relation and ordering, Properties of Binary Relations in a set Relation Matrix and the Graphs a Relation, Partition and Covering of a set. Equivalence relation, Partial ordering, Partially ordered set, Functions (definition and introduction), Composition of functions, Inverse functions, Characteristics function of a set.

UNIT-III:

Group Theory: Semigroups and Monoids(definitions and examples), Homomorphism of semigroups and monoids, Subsemi groups and submonoids, Groups(definitions and examples) Subgroups and Homomorphisms, Cosets and Lagrange's theorem, Normal subgroups, Codes and group codes.

UNIT-IV:

Rings(definition and examples): Integral domains ring homomorphisms, Ideals of Ring polynomial.

UNIT-V:

Graph Theory: Basic concepts of Graph Theory, Basic definitions, Paths and circuits. Reachability and connectedness, Matrix representation of graphs, Trees and their representation and operations, Rooted trees, Path lengths in rooted trees, Multi graphs and weighted graphs, Shortest paths in weighted graphs.

TEXT BOOKS:

1. Discrete Mathematics Structures with application to Computer Science by J. P. Tremblay & R. Manohar.
2. Discrete Maths for Computer Scientists & Mathematicians. (Chapter 2, 5, 7) by J. L. Mott, A. Kandel, T. P. Baker

REFERENCES:

Elements of Discrete Mathematics by C. L. Liu.
Discrete Mathematics by Lipschutz
Discrete Mathematics by R. Johnsonbaugh.

DEPARTMENT OF PHYSICS

22 1x01 PHYSICS

L-T-P : 3-0-3

Credit : 5

1. ELECTROSTATICS AND ELECTROMAGNETIC THEORY : Dielectrics -

The three electric vectors, Gauss's law in Dielectrics, Energy stored in Electrostatic field, Boundary Conditions. Continuity Equation for charge, Displacement current, Maxwell's Equations in Differential and Integral form and their Physical significance, Maxwell's Equations in free space and speed of plane electromagnetic waves travelling in vacuum. Poynting theorem and Poynting vectors, electromagnetic waves propagation in dielectrics and conductors.

Lecture : 9

2. OPTICS & LASER : Temporal coherence Michelson's interferometer for measurement of coherence length of source and line width, Spatial coherence, Measurement of spatial coherence using young's Interferometer Fraunhofer diffraction by single slit, double slit and grating.

Lasers and Laser light, Einstein A and B coefficient, Population inversion, Light amplification by optical resonator. Characteristics of Laser, Ruby laser, Working Principle of He-Ne Laser.

3. POLARISATION : Unpolarised light, Production of plane polarised light by Polaroid technique (Principle of action should be emphasized) Brewster's Law, Malus's Law, Double Refraction, Production of Plane, Circular and elliptical, Polarized Light, Analysis of unpolarised light and polarized light, Magneto-optic effect, electro optic effect and photo elastic effect.

Lecture : 7

4. QUANTUM PHYSICS : Planck's theory of black body radiation, Compton effect, Photo electric effect, Einstein photo electric equation and its experimental verification

Wave particle duality, De-Broglie waves, De-Broglie wave velocity, Wave and group velocity, Division and Germer experiment, Heisenberg's uncertainty principle, Application of uncertainty principle.

Wave functions and wave equation, physical interpretation of wave function and normalization condition, Expectation values, Schrodinger's wave equation (Time dependent and time independent i.e. steady, state form) in one dimension, quantum-mechanical operators, Particle in a box (Infinite Potential Well), Finite Potential barrier and tunneling.

5. **SPECIAL THEORY OF RELATIVITY** : Michelson-Morely experiment, Postulates of special theory of relativity, Consequence of special theory of relativity, Lorentz transformation and its application. (Length contraction and time dilation)
6. **NANO-PHYSICS** : Introduction and Basic definition of Nano Technology, Properties of Nano particles, Elementary ideas of Synthesis of Nano particles, Application of Nano Technology.

Text Books :

1. Concept of Modern Physics by Arthur Beiser: Publication: TMH
2. Elements of electromagnetics by Mathew N.O. Sadiku: Publication: Oxford University Press
3. Introduction to electrodynamics by David J. Griffiths; Pub.: Pearson Education.
4. Optics by Ajoy Ghatak Pub; TMH
5. Fundamentals of Physics extended volume by Resnick, Halliday and Walker; Pub.: John Wiley & Sons. Inc. Asian Edition.
6. Electromagnetic Theory (Electrodynamics) – Dr. K.K.Chopra & G.C.Agrawal, K.Nath & Co.
7. Engineering Physics – Hitendra K.Malik & Ajay Kumar Singh by TMH Publication.

Reference Books :

1. Modern Physics by G. Aruldas & P. Rajagopal; Pub: Prentice Hall of India.
2. Quantum Physics by H.C. Verma Pub.: Surya Publication .
3. Lasers and Non-Linear Optics by B.B. Laud; Pub: New Age International (P) Ltd.
4. Principles of electricity by Leigh Page and Normal Ilesley Adams, Pub.: Eurasia Publishing House, New Delhi.

22 1X01 PHYSICS LABORATORY

Minimum eight experiments are required to be performed in a semester :

1. To determine acceleration due to gravity by a Bar Pendulum.
2. To determine input & output characteristics of a PNP Junction Transistor in CE Mode or configuration.
3. To determine Planck's constant.
4. To determine capacitance and permittivity.
5. To measure the numerical aperture of an optical fiber.
6. To obtain the wave length of laser source using grating.
7. To obtain the particle size by Laser
8. To obtain forbidden energy gap of Semiconductor Diode.
9. To obtain loss of energy from transformer and ferrites.
10. To obtain Dielectric constant.
11. To obtain Curie temperature
12. To obtain focal length by Convex mirror using u-v method.

DEPARTMENT OF CHEMISTRY

23 1x01 ENGINEERING CHEMISTRY

L-T-P : 3-0-3

Credit : 5

1. **WATER TREATMENT** : Introduction, characteristics imparted by impurities in water, hardness of water, unit of hardness. Estimation of hardness of water. Disadvantage of hard water, scale and sludge formation in boilers. Caustic embrittlement, Boiler corrosion, Priming and Foaming, Softening methods (soda lime process). Numerical problems. **Lecture : 7**
2. **COLLIGATIVE PROPERTIES** : Osmosis, Osmotic pressure, Determination of osmotic pressure, Isotonic Soln., Hypertonic solution, Hypotonic solution Lowering of Vapour Pressure, Determination of molecular weight, Elevation in B.P., Depression in F.P. and their uses in the determination of molecular weight, Abnormal behavior. Numerical problems. **Lecture : 7**
3. **ELECTRO POTENTIAL AND CELLS** : Single electrode potential – definition, sign convention. Construction of Galvanic cell – Classification – Primary, Secondary and Concentration cell. E.M.F. of a cell, definition of Galvanic cell, notation and convention of Galvanic cell. Measurement of single electrode potential and standard electrode potential by Nernst equation. Numerical problems. **Lecture : 7**
4. **FUELS** : Definition, Classification,
ANALYSIS OF COAL : Proximate and ultimate analysis of coal.
SYNTHESIS OF PETROL : Bergius process and Fischer Tropsch process.
CALORIFIC VALUE : Definition, Gross and net calorific value, Determination of calorific value of solid/liquid fuel using Bomb calorimeter.
COMBUSTION CALCULATION : Analysis of flue gas by Orsat's apparatus.
 Numerical problems. **Lecture-7**

5. **HIGH POLYMERS** : Definition, Classification – Natural and synthetic polymers with examples.

POLYMERIZATION : Definition, Types of polymerizations, addition and condensation with examples,
Mechanism of Polymerization - Free radical mechanism (ethylene as an example),

Glass transition temperature, Compounding of resins synthesis – Property and application of Teflon, PMMPA and Phenol Formaldehyde Resin. **Lecture : 7**

6. **CORROSION SCIENCE** : Corrosion – Definition, Chemical corrosion and electro chemical theory of corrosion. Types of corrosion – Differential aeration corrosion, Pitting corrosion, Water line corrosion, Stress corrosion. Factors affecting the rate of corrosion. Protective measures against corrosion by (i) Modification of environment (ii) Modification of metals (iii) Use of protective coatings. **Lecture : 7**

23 1X01 CHEMISTRY LABORATORY

1. To determine the mol. wt. of a non-volatile substance *urea) by Lands Berger's method/Cottrells' method.
2. To determine the apparent molecular weight of a non-volatile substance (boric acid) in benzene and to determine its degree of association.
3. To determine the velocity constant of hydrolysis of methyl acetate catalysed by HCl
4. To determine the velocity constant of inversion of cane sugar by acids.
5. To determine the total order of reaction between oxalic acid and chromic acid.
6. To determine electrode potential (E^0) of Ag/Ag^+ or Cu/Cu^{2+} or Zn/Zn^{2+}
7. To study concentration cells and hence to determine the value of $2.303RTF=k$
8. To estimate Hardness of Water
9. To determine pH of Solution
10. Quantitative Analysis of different ions in inorganic salt mixtures.
11. Test of Adulteration in fat, butter, sugar, turmeric powder, chili powder and pepper.
12. Determination of Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD) of value of sewage volumetrically.
13. Organic Preparation: Preparation of Aspirin.
14. Test of different organic substances and their functional groups.
15. Analysis of flue gas by Orsat apparatus.
16. To determine the viscosity of a liquid or solution.

Text Books :

1. Chemistry in engineering and technology ; vol-I and II, by J. C. Kuriacose and J. Rajram; Pub.: TMH
2. Engineering chemistry; by Jain and Jain; Pub: Dhanpat Rai Publication
3. A text book of engineering chemistry by Shashi Chawla; Pub.: Dhanpat Rai & Co.
4. Engineering chemistry by B. K. Sharma; Pub.: Krishna Prakashan Media (P) Ltd.
5. Essentials of experimental engineering chemistry by Shashi Chawla, Pub.: Dhanpat Rai and Co.

DEPARTMENT OF HUMANITIES & SOCIAL SCIENCE

24 1301 ORGANIZATIONAL BEHAVIOR & INDUSTRIAL PSYCHOLOGY

L-T-P : 3-0-0

Credit : 3

1. **Concept of organization** & organizational Behavior.

Lecture : 2

- 2.
- (a) Personality : meaning, concept , determinants, personality theories (psychoanalytic Theory, Trait Theory and Self Theory).
- (b) Perception-meaning , concept, process of perception, significance of perception.
- (c) Learning- meaning, concept, nature, component of learning process.
- (d) Attitude- meaning, concept, factors in attitude formation, method of finding Employee's attitude.
- (e) Value - Meaning and types, value and attitude – similarity and difference.
- (f) Motivation- meaning, theory of motivation (Maslow's Theory & Herzberg's Theory).

Lecture : 11

3.

(a) Group & Group Dynamics - concept, importance, classification of groups , reason for group, formation, group cohesiveness.

(b) Team work :meaning , concept, types , creating, an effective team.

Lecture : 4

- 4.
- (a) Communication- concept, process, importance, barrier.
- (b) Organizational conflict- meaning, concept, types, stages of conflict, resolution of conflict.
- (c) Power & politics- nature and concept, Ethics of power & politics, types of power.
- (d) Leadership- concept, qualities and functions of a leader, approaches to the analysis of leadership

Lecture : 8

5. **Concept of organization theory**, concept of organization structure, form of organizational structure,form of organizational culture.

Lecture : 7

- 6.
- (a) Organizational effectiveness - concept , approaches, criteria of effectiveness.
- (b) Organizational change - meaning, factors in Organizational change, process of planned change.
- (c) Organizational Development - concept ,need of organizational development, difference between organizational development & management development.

Lecture : 7

Text Books :

1. Organizational behavior by Stephen P. Robbin & Seema Sanghi- pearson
2. Organizational behavior by L.M. Prasad-S Chand & sons

Reference Book :

1. Organization behavior: managing people and organization by Gregory moorehead – Biztantra
- 2.

24 1X02 PERSONNEL MANAGEMENT AND INDUSTRIAL RELATION

L-T-P: 3-0-0

Credits: 3

1. **Meaning, concept, function**, & importance of personnel management, role of a personnel manager, personnel policies - Need of a personnel policies, organization of personnel Department (functional basis, service basis and chentile basis)

Lecture : 5

2. **Manpower planning** : Meaning & concept, need for manpower planning, types of manpower planning, meaning and concept of job analysis, job description & job specification, uses of job analysis information, Recruitment, selection – meaning and steps of selection process, meaning of induction

Lecture : 8

3. **Training and develop** : Meaning, need & importance for training, method of training, development - meaning of development, method of development.

Lecture : 5

- 4.
- (a) Performance appraised : Meaning, Objective, method of performance appraisal .
- (b) Transfer : meaning objective, types.
- (c) Promotion : Meaning , policies, basis of promotion.

(d) Separation : Resignation, Discharge & Dismissal, Suspension & Retrenchment, Layoff.

Lecture : 6

5. Wages and salary administration :

- (a) Meaning purpose & principle of wage & salary administration, factors influencing wage & salary administration.
- (b) Meaning of wage & salary, minimum wage , fair wage & living , wage.
- (c) Meaning of money and real wage.
- (d) Methods of wage payment - time rate & piece rate.
- (e) Incentive- Financial Incentive & non financial Incentive, method of wage payment based on result.

Lecture : 7

- 6. (a) Health, safety and welfare facilities.
- (b) social security -
 - (i) meaning and concepts, objective.
 - (ii) form of social security- social insurance & social assistance.
- (c) Problem arising from disease , invalidity , accident, old age and unemployment.

Lecture : 5

- 7. (a) Industrial Relation : meaning & concept, changing concept of industrial relation, role played by the employer, trade union & government, current I. R. position in India, I.R. policies of government of India.
- (b) Trade Union : Meaning and concept, objective, functions, type, method of trade union.

Lecture : 6

Text Books :

- 1. Personal management by C.B. Memoria & G.V. Gankar- Himalaya
- 2. Personal management & industrial relation by P.C. Tripathi-S. Chand

Reference Book :

- 1. Industrial relation, Trade Union & Labour Relation by G.P. Sinha & PRN Sinha, Pearson.

24 1X03 SOCIOLOGY AND BUILDING ECONOMICS

L-T-P: 2-1-0

Credit : 3

- 1. **Definition scope and use of sociology**, its application in architecture. **Lecture : 2**
- 2. **Basic concept of sociology**, society, groups, community association, institution, culture, civilization and personality in terms of their characteristics and types. **Lecture : 5**
- 3. **Social structure of India** : Caste and class and marriage and family, their characteristics. **Lecture : 5**
- 4. **Rural and urban societies** : Their characteristics, features and problem , like crime, slum and poverty. **Lecture : 4**
- 5. **Social change** : Biological , technological, and cultural factors of social changes , social aspects of housing and neighbourhood in the context of changing society and growing populations. **Lecture : 4**
- 6. **Elements of economics** : Concept of utility, total utility, and avg. utility, law of equimarginal utility, concept of demand – factors governing demand for building . **Lecture : 4**
- 7. **Production** : Concept of production, factors of production, land, labour, capital, entrepreneur and organization, their characteristics, laws of diminishing returns, division of labours, efficiency of labour. **Lecture : 5**
- 8. **Distribution of national income** : Rent, wages, interest and profits-inequalities in income distribution causes and courses, roles of demand and supply in the determination of price and under perfect condition. **Lecture : 5**
- 9. **Money and Banking** : Function of money – inflation and deflation, and their affects on building industry , functions of central and commercial bank **Lecture : 5**
- 10. **Concept of economic planning**, objectives of the five years plans with special reference of housing. **Lecture : 3**

Text Books :

- 1. Modern Micro Economic Theory by H.L. Ahuja, S. Chand.
- 2. Advance Economic Theory by M.L. Jhinghan, Konark Publication

Reference Book :

- 1. A test book of Economic Theory by Stonier & Hague, Pearson.

24 1x04 ENGINEERING ECONOMICS AND MANAGEMENT

L-T-P: 3-0-0

Credit : 3

1. ENGINEERING ECONOMY :

Lecture : 7

- (a) Simple and compound interest, Annuities.
- (b) Basic methods for making economy studies - (i) Present worth method (ii) future worth method (iii) I.I.R. methods.
- (c) Comparison of alternative – (i) Present worth method (ii) future worth method.

2. **MANAGEMENT AND ORGANIZATION** : (a) Principle of management, (b) element of management, planning, organization direction and control (c) Organizational structure – line, line and staff, functional, divisional, project & Matrix Organizational.

Lecture : 7

3. **PERSONNEL MANAGEMENT** : (a) function, Recruitment, selection, Training promotion, discipline, (b) Job evolution, (c) Merit rating, (d) wedge and incentive.

Lecture : 8

4. **MARKING MANAGEMENT** : (a) Marking research and sale forecasting (b) Sales management (c) advertisement and sales promotion.

Lecture : 7

5. **ACCOUNTING** : Meaning, scope and role of accounting concept and convention, accounting as an information system, Recording of transaction in journal and ledgers, trial-balance preparation of final account.

Lecture : 9

6. **ENTREPRENEURSHIP DEVELOPMENT** : Introduction to entrepreneurship, rural entrepreneurship, women entrepreneurship, factor affecting entrepreneurship growth.

Lecture : 4

Text Books :

1. Engineering economics by Degarmo, Sullivan & Canada, McMillan
2. Double entry book keeping by T.S. Grewal- S. Chand.
3. Principles and practice of management by LM. Prasad - S. Chand & sons.
4. Personnel management by C.B. Memoria & G.V. Gankar- Himalaya
5. Development entrepreneurship by Udai parekh & T Venkateshwara.

Reference Book :

1. Marketing management by P. Kotler.

24 1x05 COMMUNICATIVE ENGLISH

L-T-P : 3-1-0

Credit : 4

1. **Basic Grammar**: Structural pattern, single word substitution: Editing tenses of Verbs.

Lecture : 6

2. Common errors, comparison, Syntax.

Lecture : 6

3. Antonyms, Homonyms, Comprehension based on topics of Science & Technology

Lecture : 4

4. Precis, Paragraph Writing, Technical description

Lecture : 4

5. Expansion (worked & phrase)

Lecture : 3

6. Official Correspondence, Memorandum, Circular letter.

Lecture : 3

7. Applying for a job, Resume

Lecture : 4

8. Business Correspondence, Report Writing, E-mail.

Lecture : 4

9. Phonetics (Symbol and Transcription), Pronunciation

Lecture : 4

10. Reading –developing Reading skill.

Lecture : 4

11. Group Discussion.

Text Book :

1. English grammar and Effective Business Communication by M.A. Pink & S.E. Thomas – S.Chand & Company Ltd.
2. English grammar by Dr. D .Thakur
3. Comprehensive English grammar by C.J.Joseph & EG Myall – Inter Univ. Press.
4. Technical English by Sharon j Garson and Steve M Garson
5. Gartside's Model Business Letters by Shirley Taylor – Pitman Publishing.

Reference Books :

1. Communication in English for Technical Student by Orient Longman
2. Business Correspondence & Report Writing by R.C. Sharma & Krishna Mohan - Tata McGraw Hill
3. English Pronouncing Dictionary by Daniel Jones. Revised by A.C.Gimson – Universal Book Stall, Delhi.
4. A Student's Grammar of the English Language by Sidney Greendaum & Randolph Quirk (Pearson Education)

24 1306 INDUSTRIAL ECONOMICS & ACCOUNTANCY

L-T-P : 3-1-0

Credit : 4

- 1. Various definitions of Economics :** Nature of Economic Problem, Relation between science, Engineering, Technology & Economics
Lecture : 3
- 2. Meaning of demand,** Law of Demand, Elasticity of demand, Practical importance & application of the concept of elasticity of Demand
Lecture : 5
- 3. Meaning of Production and factor of Production :** Land, labor, Capital ,Entrepreneur & Organization –their Characteristics law of variable Proportion .Return to Scale
Lecture : 5
- 4. Cost Analysis :** Various concept of cost, Cost function, Short & Long run cost. Concept of Revenue ,Break-Even Analysis
Lecture : 5
- 5. Meaning of Market :** Type of market – Perfect completion, Monopoly ,Oligopoly ,Monopolistic competition ,Main feature of these market), Meaning of Supply and Law of Supply, Role of Demand & Supply in price determination imperfect competition
Lecture : 7
- 6. Engineering Economy :**
(a) Simple and compound interest, Annuities, (b)Basic methods For making economy Studies - (i) Present worth method, (ii) Future worth method (iii)I.R.R method (c) Comparison of alternative – (i) Present worth method, (ii) Future Worth method (iii) I.R.R method.
Lecture : 7
- 7. Accounting:** Meaning Scope and Role of accounting , Accounting concept & Convention. Accounting as information System. Recording of transaction in journal and Ledgers. Trial –Balance, Preparation of final Account.
Lecture : 9

Text Book :

1. Modern Micro Economics by Theory - H.L.Ahuja-S.Chand
2. Advance Economic Theory by M .L.Jhingan- Konark Publication
3. Engineering Economics by Degarmo , Sullican & Canada –McMillan
4. Double Entry Book Keeping by T.S.Grewal –S .Chand

Reference Books :

1. Stonier & Hague by A test book of Economic Theory-Pearson
2. Industrial Organisation and Engg. Economics by Banga & Sharma

24 1x07 SUSTAINABLE DEVELOPMENT

L-T-P : 3-1-0

Credit : 4

- 1. Ecosystem:** Concept, Type, Structure, Function; Ecological succession, Pyramid, degradation and its remedies from Unsustainable development to sustainable development, Concept of sustainable development: Social and environmental issues (local, national and international), Need for studying the economics for sustainable development
10 lectures
- 2. Environment and Rehabilitation:** Mined area, Habitats, Water bodies, Mangroves; Global Changes, Biodiversity concerns and precautionary principles, Evaluation of sustainable development
10 lectures
- 3. Valuing Market and Non-Market Ecosystem:** Use of monetary valuation, Cost benefit analysis, Technique of monetary valuation, Definition of conventional and green GNP
10 lectures
- 4. International trade and sustainable development:** Free trade and globalization vs environment and community, obstacle of free trade
08 lectures
- 5. Strategic approaches and laws to sustainability:** New international institutional contexts, commission on sustainable development; Environmental ethics and laws, India's move towards sustainable development
04 lectures

Books Recommended

1. S. Deswal, A. Deswal, An Introduction to environmental science, Dhanpat Rai and Co.
2. N. Das Gupta, Environmental Accounting, Wheeler and co.
3. Daly H.E, Beyond Growth: The Economics of Sustainable Development, Beacon Press
4. D.K. Asthana, Meera Asthana, Environmental Science, S. Chand and co.
5. P.Rogers, K.F Jalal and J.A Boyd, An introduction to sustainable development, Earthscan

Referance Book

1. Willian P. Cunningham, Mary Ann Cunningham, Principles of environmental science, T.M.H

DEPARTMENT OF CIVIL ENGINEERING

01 1×01 ENGINEERING MECHANICS

L-T-P : 3-0-3

Credit : 5

Theory :

- 1. Statics** : Force System : Moment of a force about a point and an axis; Equivalent force and moment, Wrench
Lecture : 7
- 2. Equilibrium** : Free body diagram; equations of equilibrium; problems in two and three dimension; plane frames and trusses .
Lecture : 6
- 3. Friction** : Laws of Coulomb friction, impending motion problems involving large and small contact surfaces ; square threaded screw; principle of virtual work and stability.
Lecture : 8
- 4. Dynamics** : Kinematics and kinetics of particles dynamics in rectangular coordinates cylindrical coordinates and in terms of path variables.
Lecture : 6
- 5. Properties of areas** : Center of mass; Moments of inertia; kinematics of rigid bodies; Chasle's Theorem, concept of fixed vector; velocity and acceleration of particles in different frames of references. General plane motion; Euler's equation of motion.
Lecture : 8
- 6. Work & Energy** and impulse and Momentum methods for particles and rigid bodies : Conservation of momentum, coefficient of restitution, moment of momentum equation.
Lecture : 7
(vector approach to mechanics will be followed for all the topics)

Text Book :

1. Engineering Mechanics by Shames, Pearson's Education .
2. Mechanics for Engineers. Beer, F.P. and Johnston. Tata McGraw Hill. New Delhi
3. Engineering mechanics. Meriam Wiley pub.

Reference Books :

1. Engineering Mechanics. Timoshenko. McGraw Hill Inc.

Practical :

1. Practical based on mechanical advantage of different machines.
2. Moment of inertia.
3. Problem solving based on theory classes.

01 1×02 ENVIRONMENTAL SCIENCE

L-T-P : 3-0-3

Credit : 5

Theory :

- 1. Sustaining Resources** : Environmental Quality : Water & Air Pollution. Effects and control of air and Water pollution; Introduction to solid waste and its management. Pollution of groundwater. Surface water and soils. Noise pollution; Renewable and Nonrenewable energy source.
Lecture : 11
- 2. Toxicological Chemistry** and effects and risks of it on human health
Lecture : 6
- 3. Environmental Chemical Analysis**
Lecture : 6
- 4. Humans and Sustainability**, Ecology and Sustaining Biodiversity
Lecture : 7
- 5. Policy and legislation** for environmental protection. Current Environmental issues.
Lecture : 6
- 6. Policy and legislation** for environmental protection, Current Environmental Issues.
Lecture : 6

Text Books :

1. Introduction to Environmental Engineering and Science, G.M. Masters. Pearson Education
2. Environmental Science. Miller, Thomson Press .
3. Environmental Science, Wright, Pearson Education.
4. Principles of Environmental SCIENCE, W.P. Cunningham, Tata McGraw Hill.
5. Environmental Chemistry, Sawyer and McCarty, McGraw Hill
6. Environmental Chemistry, Manahan Stanley E. Lewis Publishers.

Practical :

1. Case Analysis based on theory.
2. Determination of simple environmental parameters in laboratory.
3. Paper Presentation on current environmental issues.

01 1303 BUILDING SCIENCE

L-T-P : 3-0-3

Credit : 5

Theory :

- 1. Building construction** : Overview of building process; Introduction to Building Law and IS Codes Different types of loads in Buildings, Load Combinations, IS Code provisions for Loads in Buildings.
Lecture : 7

01 1305 ENGINEERING GEOLOGY

L-T-P : 3-0-2

Credit : 4

Theory:

1. Basic Geology : General Geology, Mineralogy, Petrology (igneous, sedimentary and metamorphic), Structural geology, Crystallography. **Lecture : 06**

2. Engineering properties of rocks : Geomorphology (Geomorphic processes weathering, Erosion, Origin and formation of solids). **Lecture : 06**

3. Geological hazards (landslides, earthquakes and volcanoes), Groundwater, Recent concepts in Geology, Plate tectonics and Sea – floor spreading. **Lecture : 07**

4. Applied Geology : Geophysical mapping : seismic, resistivity, gravity, radar, geotomography, logging; Geological exploration of an engineering site. **Lecture : 08**

5. S. I. Desk Study : Site investigation Boreholes: Remote sensing, GIS and GPS: Basic principle and their applications in studying and monitoring Lithosphere, Hydrosphere, Cryosphere and Atmosphere. **Lecture : 08**

6. Cut Slopes in rocks and clays; Geological factors affecting the construction of dams, reservoirs and tunnels. Criteria and factors for site selection for Dam, tunnels, waste/radioactive disposal sites, Indian Geology, Outline of stratigraphy of India. **Lecture : 10**

Text Books:

1. Principles of Engineering Geology by Johnston. R. B. and DeGraff. J. V., John Wiley and Sons, New York.
2. Fundamental of Engineering Geology by Waltham, T., Spon Press, London.
3. A Textbook of Engineering and general Geology by Singh. P., S. K. Kataria and Sons, New Delhi.
4. A Textbook of Geology by Mukherjee P. K., Te world press Pvt. Ltd., Kolkata.
5. Engineering Geology by D V Reddy, Vikash Publishing House Pvt. Ltd.
6. Element of Mineralogy in Engineering Geology by Read, H. H. Rutley's, CBS Publisher.
7. Experiments in Engineering Geology by Gokhale, K. V. G. K. and Roa, D. M., Tata McGraw Hill.

Practical:

Mineralogy, Optics, Study of rocks in hand specimen and under microscope; Topographical maps; Structural Geological maps; Structural Geological problems; Engineering Geographical maps and Engineering Geological experiment; Geological fieldwork in and around Patna.

01 1X06 MECHANICS OF SOLID - I

L-T-P : 3-1-2

Credit : 5

Theory :

1. **Rigid and deformable solids**; Stress and strain : Tension, compression and shear. **Lecture : 4**
2. **Analysis of stresses**, Basic Equilibrium equations, analysis of Strain Deformation, Strain Displacement Relations, Normal and shear Strains. **Lecture : 7**
3. **Transformation**, principal stresses and strains, Maximum Stresses & Strains, Mohr's Circle, volumetric Strain, compatibility Equations and boundary conditions, Strain rosettes, Velocity Field and Strain Rates. Generalized Hook's Law & Constitutive Relations for Solids, Elastic constants and their relations. **Lecture : 6**
4. **Method of sections** for evaluating internal forces in bodies, review of free body diagrams; axial force, shear and bending moment diagram. **Lecture : 4**
5. **Axially loaded members force** and deflections; Thermal Stresses. **Lecture : 3**
6. **Bending & shear** : classical theory, various cross-sectional shapes and composite sections of beams, shear stresses in beams. **Lecture : 4**
7. **Deflection of beams** : Bending deflection of simple beams by direct integration, singularity function method, Moment – Area Methods, deflection due to shear. **Lecture : 4**
8. **Torsion** : torsion of circular shaft, close coiled helical springs, Torsion of thin walled open and closed sections and non-circular sections. **Lecture : 6**
9. **Combined stress**; principle of superposition and its limitations. **Lecture : 4**
10. **Introduction** to energy methods. **Lecture : 3**

Text Books :

1. Mechanics of Solids by E.P.Popov, Pearson Education Pub.
2. Solid Mechanics by S.M.A. Kazimi, Tata McGraw Hill, New Delhi.
3. Strength of Materials by Ryder, G.H., Macmillan Press Ltd.
4. Solid Mechanics by Bhavikatti Vikash, Publishing House Pvt. Ltd.

DEPARTMENT OF MECHANICAL ENGINEERING

02 1x01 ELEMENTS OF MECHANICAL ENGINEERING

L-T-P : 3-0-2

Credit : 4

- 1 ENERGY RESOURCES** : Renewable or non-conventional sources of energy, their origin forms – solar, wind, biogas and biomass energy, their merits & demerits, major applications. – Brief description. **Lecture : 4**
Non-renewable or conventional sources of energy, the fossil fuel, coal, petroleum and natural gas. **Lecture : 2**
- 2. REVIEW OF BASIC CONCEPTS OF THERMODYNAMICS** : Thermodynamics system, properties, state, processes and cycles, Heat, work and internal energy. **Lecture : 4**
- 3. STEAM GENERATORS** : Types of boilers, water-tube and fire-tube boilers – their merits and demerits, boiler mountings and accessories – simple description. **Lecture : 6**
- 4. PRIME MOVERS:** Simple steam turbine, gas-turbine, IC engines (SI and CI), their brief description and principles of working. **Lecture : 8**
- 5. POWER PLANT** : Principles of working of thermal, hydel and nuclear power plants, work output and efficiency. **Lecture : 6**
- 6. BASIC CONCEPT OF REF. AND AIR CONDITIONING** : Principles of working of vapour compression, vapour absorption and air refrigeration; Principles of air conditioning systems. **Lecture : 6**
- 7. ENGINEERING MATERIALS AND THEIR PROPERTIES** : Ferrous and non-ferrous metals : Mechanical properties e.g. strength, hardness, resilience etc. **Lecture : 4**
- 8. HEAT TREATMENT OF STEEL** : Annealing, tempering, quenching, case-hardening etc. **Lecture : 2**

Text Book :

- (1) Basic Mechanical Engineering by TJ Prabhu, V. Jaiganesh by Scitech.

02 1x02 ENGINEERING GRAPHICS

L-T-P : 2-0-4

Credit : 5

- 1. Introduction**, drawing instruments, sheet layout, lines, lettering, dimensioning, engineering curves (ellipse, parabola, hyperbola, spiral). **Lecture : 3**
- 2. Orthographic projection** : Projection of points, projection of straight line. **Lecture : 3**
- 3. Projection of planes.** **Lecture : 2**
- 4. Projection of solids** (Prism, Pyramid, Cone, Cylinder) Axis inclined to one reference plane. **Lecture : 3**
- 5. Section of solid** (Prism, Pyramid, Cone, Cylinder) Axis inclined to one reference plane. **Lecture : 3**
- 6. Development of surface.** **Lecture : 3**
- 7. Intersection of surfaces** : Axes of both solids at right angles. **Lecture : 2**
- 8. Isometric projection.** **Lecture : 3**
- 9. Conversion** of pictorial view into orthographic view : Simple cases. **Lecture : 4**
- 10. Introduction** to computer aided drawing. **Lecture : 2**

Practical

Understanding the AutoCAD windows and the drafting tools, drawing 2D objects.

Text Book :

1. Engineering Drawing by ND Bhatt
2. Engineering Drawing by KL Narayna & P. Kannaiah.

02 1x03 WORKSHOP

L-T-P : 0-0-6

Credit : 4

- 1. Black smithy shop** : Introduction, Study & use of smithy forging tools, anvil, swage block, chisels, punches, hammers, sledge hammer, study of air blower M/c & sheering M/c
Job making – (i) Eye Nail & Ring **Lecture : 7**
- 2. Carpentry shop** : Introduction, study & use of various tools like cutting tools, planning tools, striking tools, drilling and boring tools, holding tools etc., Study of wood turning lather machine,
Job making – (i) Half lap joint (ii) dovetail joint (iii) file handle **Lecture : 7**

3. **Fitting shop** : Introduction, study & use of different tools, cutting tools, marking tools, drill bit, die & tap & types of files
Job making – (i) Matching gauge (ii) Chipping & filing. **Lecture : 7**
4. **Foundry shop** : Introduction, study & use of cupola furnace, various tools, pattern making moulding boxes.
Job making – (i) Stuffing gland box (ii) Vee block. **Lecture : 7**

Text Book/Reference Book :

1. Workshop technology by Hazra Chaudhary
2. Workshop technology by Raghubansi
3. Manual on workshop Practice by Kannaiah
4. Workshop manual by Kannaiah

02 1x04 WORKSHOP PRACTICE – II

L-T-P : 0-0-6

Credit : 4

1. **Machine shop** : Introduction, study and use of lathe machine, shaper machine including operations, holding devices and materials for cutting tools.
Job making – (i) taper Stud (ii) angle block
2. **Welding shop** : Introduction, study and use of welding tools and devices, Study of electric arc welding machine.
Job making – (i) Lab Joint (ii) Other joints
3. **Sheet Metal shop** : Introduction, study and use of various tools, soldering and brazing.
Job making – Conical Funnel

02 1305 MATERIAL SCIENCE

L-T-P : 3-1-0

Credit : 4

1. Classification and application of engineering materials, recent development in metallic material – cermets. **Lecture : 4**
2. Phase rule, phase diagram, binary system, binary eutectic systems, eutectoid and peritectic reaction, The iron carbon system, the iron – iron carbide phase diagram. **Lecture : 10**
3. Phase transformation in metals – Isothermal transformation diagrams (or Time-Temperature-Transformation plots), Martensite, Continuous cooling transformation diagram – annealing, Normalizing, Tempered Martensite. **Lecture : 10**
4. Cast iron – grey cast iron, ductile (nodular) cast iron, white cast iron, malleable cast iron. **Lecture : 8**
5. Composite materials – Influence of fiber orientation and concentration, Continuous and aligned fiber composites, Tensile stress – strain behaviour – Longitudinal loading, Elastic behaviour – Longitudinal loading, Elastic behaviour – Transverse loading, Whiskers, Glass fiber – reinforced polymer (GFRP) composites. **Lecture : 10**

Text Book :

Material Science and Engineering : An Introduction by William D Callister, Jr (Wiley India Edition)

02 1306 STRENGTH OF MATERIAL

L-T-P : 3-0-3

Credit : 5

1. **Introduction and fundamental concept** : Introduction, purpose & scope of the subject, basic assumption, types of forces (external & internal forces), classification of materials, St. Venant's principles, principle of superposition, generalized hook's law for isotropic & elastic material. Simple stresses & strain – Axial loads – safety concepts : general concepts; stress analysis of axially loaded bar : axial strains and deformation in bars : Strains and deformation axially loaded bars – stress – strain relationship – Poisson's ratio, analysis of bars of varying sections. Composite bars, thermal stresses, Relationship between elastic constants. **Lecture : 13**
2. **Torsion** : Torsion stress and deformation in circular member, design of circular member in torsion. **Lecture : 4**
3. **Shear force and bending moment diagram** of the transverse section of the beam. **Lecture : 4**

4. **Deflection of beams** : Deflection of integration, deflection by moments – area method. **Lecture : 5**
5. **Two dimensional stress analysis** : Plane stress components on general plane at a point, Mohr's circle of stress. **Lecture : 5**
6. **Introduction to advance mechanics of solid** : thin cylinder, thick cylinder – radial and hoop stresses, application of compound stress theories, elastic strain energy and its application : Elastic strain energy of a rod under various kinds of loading elastic strain energy for various states of stress. Simple application, Castiglione theorem. **Lecture : 11**

Text Books :

- (1) Strength of material by GH Ry der
- (2) Mechanics of solids by Kazimi
- (3) Mechanics of solids by LS Srinath
- (4) Mechanics of solids by Singh & Jha

Reference Books :

- (1) Mechanics of solids by Timoshenko & Gere
- (2) Mechanics of solids by Popov

02 1307 THERMODYNAMICS

L-T-P : 3-1-0

Credit : 4

1. **Basic concept** : Thermodynamic system and their properties, thermodynamic equilibrium, quasi-static and non quasi-static process, zeroth law and temperature equilibrium concepts. **Lecture : 3**
2. **First law of thermodynamics** : concept of heat and work, first law applied to closed and open system, internal energy and enthalpy, flow work, laws of perfect gas, specific heat, first law applied to flow & non flow process. **Lecture : 5**
3. **Second law of thermodynamics** : concept of heat engine, refrigerator, heat pump and their range of working temperature, Kelvin-planck's and clausius' statements and their equivalence, Entropy, calculation of entropy change for processes, reversibility, entropy principles, in equality of clausius, available and unavailable energy. **Lecture : 8**
4. **Properties of pure substances** : Properties of steam and process with steam, Use of steam tables and mollier charts. **Lecture : 4**
5. **Helmhotz and Hibb's function**, Maxwell's relation. **Lecture : 3**
6. **Ideal cycles** : Air standard cycles, Otto, Diesel, Dual and Brayton cycle, Comparison of Otto, Diesel and Dual cycle. **Lecture : 6**
7. **Vapour cycle** : Carnot and Rankine cycle, Regenerative and reheat cycle. **Lecture : 6**
8. **Non reacting mixture** : Mixture of two ideal gases and their properties. **Lecture : 2**
9. **Psychometry** : Air and water-vapour mixture and their properties, adiabatic saturation, Use of psychrometry charts, Simple introduction to psychrometric process. **Lecture : 5**

Text Book/reference Book :

- (1) Engineering Thermodynamics by PK Nag
- (2) An introduction to thermodynamics by YVC Rao
- (3) Fundamental of thermodynamics by Van wylem, Wiley India
- (4) Thermodynamics by Cengel

02 1x08 KINEMATICS OF MACHINERY

L-T-P : 3-0-0

Credit : 3

1. **Velocity and acceleration in mechanism** : **Lecture : 8**
 - Relative velocity method and instantaneous center method
 - Acceleration diagram : Coriolis component of acceleration.
2. **Friction devices** :

- Belt drive
- Clutch
- Shoe brakes
- Bank and block brakes.

Lecture : 7

3. **Fundamental law of gearing**, basic terminology of gears, arc of contact and path of contact of involute gears, minimum number of teeth on the pinion to avoid interference, Gear trains-simple, compound and planetary, tooth load and torque. **Lecture : 10**
4. **Balancing** : balancing of evolving masses in the same plane by a single revolving mass – Balancing of revolving masses in different planes by two revolving masses in suitable planes. **Lecture : 7**
5. **Governors** : Watt, Porter, Proel & hartnell Governors, Effect of friction, controlling force, governor effort and power, sensitivity and isochronisms. **Lecture : 10**

Text Books :

- (1) Theory of Machine by Thomas Bevan
- (2) Theory of Machine by RS Bansal
- (3) Theory of Machine by Sadhu Singh

02 1x09 MANUFACTURING BY SHAPING AND JOINING

L-T-P : 3-0-3

Credit : 5

1. **Casting** : Principles of pattern making, allowances in patterns and core boxes, sand mould casting, constituents and properties of moulding sand and their tests, types of sand moulds, method and principles of gating, risering, use of cores and chills, cleaning of casting, defects in castings and their remedies, sand mould machines, melting and casting practices relating to cast iron, steel, aluminium and its alloys, copper and its alloys. Cupola, crucible and electric furnaces, metal mould casting, gravity casting, die casting, centrifugal casting, non-metallic mould casting-shell mould casting, Investment casting, plaster of paris mould casting. **Lecture : 12**
2. **Mechanical working of metals** : Hot and cold working of metals, their comparison and limitation, Hot working process – forging, roll forging, rolling piercing, extrusion, cold working processes – rolling, spinning, roll forming, cold heating, swaging, thread rolling, tube and wire drawing, coining, embossing, tube rolling. **Lecture : 8**
3. **Power metallurgy** : Principles, method of producing power, pressing, sintering and finishing operation, applications. **Lecture : 4**
4. **Welding, Brazing and Soldering** : Comparison of the processes and their application, welding classification, Gas welding equipment, filler metal and fluxes, classification, oxy-acytelene welding – their applications. Electric arc welding – equipment, electrodes and fluxes, classification, carbon arc welding, shielded metal arc welding, submerged arc welding. Inert gas shielded arc welding. atomic – hydrogen welding – their application, new welding and laser beam welding, plastic welding, thermit welding, welding of cast iron, Aluminium and its alloys, copper and its alloys, Testing of weld destructive and non-destructive tests. Flange cutting, soldering – fluxes solder, equipments, type and applications. Brazing and braze welding fluxes, filler metals, types and application. **Lecture : 12**
5. **manufacturing of plastic components** : Plastic and its past, present and future uses, injection moulding, Extrusion of plastic section, welding of plastics, Future of plastic & its application. **Lecture : 6**

Text Books :

1. Production technology by RK Jain
2. Manufacturing technology by PN Rao

02 1x10 FLUID MACHINERY

L-T-P : 3-0-3

Credit : 5

1. **Introduction** – classification of fluid machinery. **Lecture : 1**
2. **Dynamic action of fluid jet** – Impact of fluid jet on fixed and moving flat places, impact of jet on fixed and moving curved vanes, flow over radial vanes, jet propulsions. **Lecture : 4**
3. **Euler's fundamental equation**, degree of reaction. **Lecture : 2**

4. **Hydraulic turbines, introduction**, classification, impulse turbine, construction details, velocity triangles, power and efficiency calculations, reaction turbines; constructional details, working principle, velocity triangles, power and efficiency calculations, draft tube, cavitation, governing. **Lecture : 10**
5. **Principle of similarity in fluid machinery**; unit and specific quantities, testing models and selection of hydraulic turbines. **Lecture : 3**
6. **Positive displacement pumps** : Reciprocating pump; working principle, classification, slip, indicator diagram, effect of friction and acceleration, theory of air vessel, performance characteristics gas gear oil pump and screw pump. **Lecture : 4**
7. **Rotodynamic pumps** : Introduction, classification, centrifugal pump; main components, working principle velocity triangle, effect of shape of blade specific speed, heats, power and efficiency, calculations minimum steering speed, multi stage pumps, performance characteristic, comparison with reprobating pump. **Lecture : 7**
8. **Air compressor** : Reciprocating compressor, introduction, P-V diagram, calculation of isothermal and adiabatic work and efficiency, free air delivery, slippage, volumetric efficiency, effect of clearance, multistage compression, inter cooling. **Lecture : 5**
9. **Rotary compressor** : Introduction fans, blower and compressor, state and total head, centrifugal compressor, velocity triangles, slip factor, losses and efficiencies, performance characteristic. **Lecture : 6**

Text Books :

1. Hydrantic Machine by Jagdish Lal
2. Hydraulics & Hydraulic Machines by Vasandari
3. Hydrantic Machine by RD Purohit

02 1x11 MACHINE DRAWING

L-T-P : 1-0-3

- | | |
|--|--------------------|
| 1. Introduction to full section , Half section, revolved-section off-set section. | Credit : 3 |
| 2. Nut Bolts , Riveted joints, Thread profiles, Screw jack. | Lecture : 2 |
| 3. Bushed bearing , pedestal, bearing, foot step bearing. | Lecture : 3 |
| 4. Flanged coupling , flexible coupling, solid coupling. | Lecture : 2 |
| 5. Stuffing Box . | Lecture : 2 |
| 6. Eccentric . | Lecture : 1 |
| 7. Cross Head . | Lecture : 1 |
| 8. Assembly of disassembled parts . | Lecture : 1 |
| 9. Disassembly of assembly parts . | Lecture : 1 |

Text Books :

1. Engineering Drawing by ND Bhatt
2. Engineering Drawing by KL Narayna & Kannaiah

02 1x12 STEAM POWER SYSTEM

L-T-P : 3-0-3

- | | |
|---|---------------------|
| | Credit : 5 |
| 1. Analysis of steam power cycle , Reheat pressure and degree of regeneration process heat & power generation. | Lecture : 3 |
| 2. Boilers : Classification, boiler mounting & accessories, draft system, chimney height calculation, induced & forced draft fans, Boiler energy balance. Constructional details of boiler furnace, waterwall, Pulverized fuel burning. Different types of furnaces for burning coal, fuel oil & gas. Circulation theory. Feed water treatments. | Lecture : 14 |
| 3. Steam nozzles : Flow through nozzles shapes & flow area, Effect of friction supersaturated flow, Estimation of flow area, Effect of divergence. | Lecture : 5 |
| 4. Steam turbines : Construction & working of steam turbines, Impulse & reaction inlet & outlet velocity diagram. Work output & efficiencies. Pressure & velocity compounding regenerative feed heating cycle reheat cycle, reheat factor, governing of turbine, back pressure & pass out turbine. | Lecture : 12 |
| 5. Steam condensers : Types, cooling water requirement, air leakage & air pump capacity, vacuum & condenser, efficiency steam ejector, spray pond & cooling tower. | Lecture : 6 |

6. **Instrumentation** in steam turbine plan.

Lecture : 2

Text Books :

1. Thermal engineering by CP Gupta & R Prasad
2. Steam turbine theory & practice by WB Keaton
3. Heat Engines (Vol II) by R Yadav
4. Power Plant Engineering by PK Nag

02 1x13 DYNAMICS OF MACHINERY

L-T-P : 3-0-3

Credit : 5

1. **Force analysis of mechanism** : Dynamics of plane motion of a rigid body, dynamically equivalent two mass system, correction torque, forced in mechanism and machines. **Lecture : 3**
2. **Turning moment diagram** : Fluctuations of crankshaft speed and energy in a direct acting engine mechanism, flywheels. **Lecture : 3**
3. **Cams** : Classification of cams and followers, types of follower and retardation, cam profile and generation of concentric and offset radial cam profiles by graphical method. cams with specified contours tangent cam with roller follower, circular arc cam with flat follower. **Lecture : 8**
4. **Analysis of gyroscopic motion** : Principle of gyroscope, gyroscopic couple and gyroscopic reaction couple, Gyroscopic effects on the movement of ships, aeroplanes, two wheeled and four wheeled vehicles, gyro stabilizers. **Lecture : 7**
5. **Effects of inertia of reciprocating masses on engine frame** : Unbalanced primary and secondary forces and couples, balancing of primary and secondary forces, partial balancing of locomotives, balancing of multicylinder in line and radial engines, direct and reverse cranks methods for balancing of radial engines. **Lecture : 9**
6. **Mechanical vibrations** : Basic concepts degree of freedom, types of damping and viscous damping; natural free, damped free and damped forced vibrations of a single degree of freedom spring mass system, reciprocating and rotating unbalance, vibration isolation and transmissibility, whirling of shaft, elementary treatment of two degree of freedom systems torsional vibrations of single rotor and two rotor systems, transverse vibration of simply supported beam energy method, Rayleigh's and Dunkerley method. **Lecture : 12**

Text Books :

1. theory of machines by Thomas Bevan
2. Theory of machines by Shah and Jadhvani
3. Mechanical Vibration by William Thompson

02 1x14 MACHINE TOOLS AND MACHINERY

L-T-P : 3-0-3

Credit : 5

1. **Metal cutting and Machine Tools** : Metal cutting : Mechanics of metal cutting, Geometry of tool and nomenclature, Tool materials, Orthogonal vs oblique cutting. Mechanics of chip formations, types of chips, tools angles, shear angle, Merchant's force circle diagram, Cutting forces, power required, Cutting fluids/lubricants, Tools wear and tool life. **Lecture : 12**
2. **Machine Tools** :
 - (a) Lathe : Principle, types, operations, turret/capstan, semi/automatic, Tool layout.
 - (b) Shaper, slotted, planer, operation, drive.
 - (c) Milling, Milling cutter, up & down milling, dividing head indexing, Max chip thickness, power required.
 - (d) Drilling and boring, reaming tools, Geometry of twist drill, Grinding, Grinding wheel, Abrasive, cutting action, grinding wheel specification, Grinding wheel wear, alterations, wear, fracture wear, dressing and trimming. Max chip thickness and guest criteria, Flat and cylindrical grinding, Centreless grinding, Super finishing, Honing lapping, Polishing. **Lecture : 12**
3. **Computer controlled manufacturing process** : NC, CNC, DNC, part programming, Introduction to computer aided manufacturing and robotics. **Lecture : 10**
4. **Metrology** : Tolerance and limit systems, limit gauges, Measurement of surface roughness, Inspection of gears and screw threads. **Lecture : 4**
5. **Jigs and Fixtures** : Locating elements, clamping devices, principles of Jigs and fixtures design.

Lecture : 4

Text Books :

1. Manufacturing technology by PN Rao
2. Production technology by RK Jain

02 1x15 DESIGN OF MACHINE ELEMENTS

L-T-P : 3-0-3

Credit : 5

1. **Introduction** : Engineering material and their properties, Manufacturing consideration in machine design, factor of safety. **Lecture : 4**
 2. **Simple stresses in machine parts**, torsional and bending stresses, dynamic loads, stress concentration. **Lecture : 4**
 3. **Design of riveted joints**, welded joints, bolted joint, cotter joint, knuckle joint, pressure vessels and pipe joints. **Lecture : 12**
 4. **Design of keys**, couplings, shafts levers, columns, studs, power screw, belt drive, pulley **Lecture : 14**
 5. **Springs**, clutches and brakes. **Lecture : 8**
- Practical** : Minimum six design problems pertaining to theory paper syllabus.

Text Books :

1. Design of machine elements by VB Bhandari (TMH)
2. Design of machine elements by Sharma & Purohit (PHI)
3. Design data book by Mahadevan
4. Design data book by PSG institute of technology, Coimbatore
5. Design data book by Suresh Verma, Jadon

Reference Books :

1. Mechanical Engineering Design by Shigley
2. Machine Design by Black & Adams
3. Machine Design by Maleev & Hartman
4. Machine design by Sharma & Agarwal (SK Kataria)

02 1x16 HEAT AND MASS TRANSFER

L-T-P : 3-0-3

Credit : 5

1. **Introduction** : Basic concepts and modes of heat transfer. **Lecture : 1**
2. **Conduction** : General three dimensional heat conduction equation; one dimensional steady heat conduction through composite plane walls; cylinders and spheres; critical radius of insulation. **Lecture : 6**
3. **Extended surface** : Heat transfer from extended surfaces of uniform cross section. **Lecture : 4**
4. **unsteady heat conduction** : one dimensional unsteady heat conduction, lumped system analysis; use of Heisler chart, periodic changes of surface temperature. **Lecture : 6**
5. **Convection** : Free and forced convection, hydrodynamic and thermal boundary layer equation over flat plate, laminar boundary layer analysis, fully developed heat transfer through smooth pipes, relation between fluid friction and heat transfer forced convection correlations, laminar free convection on a vertical flat plate, empirical co-relations, application of dimensional analysis. **Lecture : 10**
6. **Heat exchange** : Types, LMTD, effectiveness, NTU method, single and multipass. **Lecture : 5**
7. **Radiation** : Physical mechanism, radiation properties, black body radiation, grey body, kirchoff's law, Wien's displacement law, view factor, radiation exchange between infinite planes, radiation shields. **Lecture : 6**
8. **Mass transfer** : Fick's law, analogy between heat and mass transfer, equimolar counter diffusion, isothermal evaporation of water through stagnant air. **Lecture : 4**

Text Books :

1. Heat and mass transfer by Cengel
2. Heat and mass transfer by JP Holman
3. Heat transfer by SP Sukhatme

4. Heat and Mass Transfer Data Book by CP Kothandaraman

Reference Books :

1. Heat and mass transfer by PK Nag
2. Heat and mass transfer by Incorpera Dewit
3. Heat transfer by PS Ghosdastidar

02 1x17 NON CONVENTIONAL MANUFACTURING

L-T-P : 3-1-0

Credit : 4

1. **Introduction** : Limitation of conventional manufacturing processes, need of unconventional manufacturing process and its classification. **Lecture : 2**
2. **Unconventional machining process** : Principle and working and applications of unconventional machining process such as electro – discharge machining, electrochemical machining, ultrasonic machining, abrasive jet machining etc. **Lecture : 12**
3. **Unconventional welding process** : Principle and working and applications of unconventional welding processes such as laser beam welding, electron beam welding, ultrasonic welding, plasma arc welding. **Lecture : 12**
4. **Explosive welding**, cladding etc. under water welding, metallising. **Lecture : 4**
5. **Unconventional forming processes**, principle, working and applications of high energy forming processes such as explosive forming, electromagnetic forming, electro-discharge forming, water hammer forming, explosive compaction etc. **Lecture : 12**

Text Books :

1. Manufacturing Technology by P.N.Rao
2. Production Technology by R.K.Jain

02 1x18 COMPETITIVE MANUFACTURING STRATEGIES

L-T-P: 3-1-0

Credit : 4

1. **The competitive environment in the market** : The WTO agreement and its effect on Indian Industries, Manufacturing as a competitive strategy, Competitive Advantages and Disadvantages. **Lecture : 6**
2. **Product Variety** : Modular Design, Design for manufacturability, Selection of manufacturing Technologies, Vendor Development, Vendor rating, Just in time manufacturing, Kanban system, and Agile Manufacturing. **Lecture : 8**
3. **Reengineering** : TQM, MRP, ERP and simulation as tools for competitive manufacturing, Intelligent Manufacturing. **Lecture : 8**
4. **Selection of manufacturing systems for different manufacturing scenarios** : Dedicated manufacturing system, Flexible manufacturing system (FMS), cellular manufacturing system (CMS), and Re-configurable manufacturing system (RMS); Elementary of DMS, FMS, CMS, and RMS. **Lecture : 14**
5. **Concept** : of CIM, FOF, Network based manufacturing, and E-Manufacturing. **Lecture : 5**

Text Books :

1. Manufacturing Excellence in Global Markets by W. Euershelm
2. Manufacturing Systems Design & Analysis by B. Wa.
3. Computer Automation in Manufacturing by T.O.Boucher
4. Intelligent Manufacturing Planning by P. Gu.

02 1x19 INSTRUMENTATION AND MEASUREMENT

L-T-P: 3-1-0

Credit: 4

1. **Functional elements of a basic measuring system**, configuration of a measuring system, Methods for correction for interfering and modifying inputs. **Lecture : 6**
2. **Static characteristics like accuracy**, precision, error sensitivity etc. Dynamic characteristics terms, Concepts of mechanical loading, order of the systems, Response of zero, First and second order systems to step, ramp and sinusoidal inputs, transfer function method. **Lecture : 8**
3. **Classification of errors** and statistical analysis of experimental data. **Lecture : 4**

4. **Description of various types of transduction principles**, transducers based on variable resistance, variable induction, variable capacitance and piezo-electric effects, Displacement transducer. **Lecture : 10**
5. **Microprocessor systems**, codes, Binary mathematics, Logic circuits. **Lecture : 6**
6. **Data acquisition systems**, via-computers DAS hardware. **Lecture : 4**
7. **Techniques for signal analysis.** **Lecture : 4**

Text Book: As recommended in class.

02 1x20 REFRIGERATION & AIR CONDITIONING

L–T–P: 3–1–0

Credit : 5

1. **Air refrigeration system** : Refrigeration machine, heat pump, coefficient of performance, ideal refrigeration cycle, Bell – Coleman, refrigeration cycle, open and closed systems, application of air- refrigeration in air-crafts. **Lecture : 6**
2. **Various compression systems** : Simple vapour compression refrigeration cycle, merits and Refrigerants demerits of this system over air refrigeration system, factors affecting the performance of a vapour compression refrigeration system, sub cooling and superheating of vapour, wet and dry compression, multistage vapour compression system, intercooler, flash chamber, accumulator and heat exchanger. **Lecture : 8**
3. **Vapour absorption system** : Simple and modified vapour absorption refrigeration system, Electrolux refrigerator, COP of heat operated refrigeration system. **Lecture : 5**
4. **Special refrigeration system**, absorption, cascade, vortex, thermoelectric and steam jet refrigeration system. **Lecture : 4**
5. **Refrigerants** : classification and nomenclature of refrigerants, primary and secondary refrigerants, properties of some common refrigerants, physical, chemical and thermodynamics properties, selection of refrigerants, leakage of refrigerants and methods of detection. **Lecture : 3**
6. **Equipment** : Elementary discussion of refrigerating equipment, ice plant and cold storage. **Lecture : 1**
7. **Psychrometry** : Properties of air vapour mixture, wet bulb, dew point & dry bulb temperatures, humidity, specific humidity, humidity ratio, degree of saturation, relative humidity, total heat psychrometric relation, psychrometric charts and its uses, psychrometric processes evaporative cooling. **Lecture : 5**
8. **Air conditioning** : General principle and requirement for comfort and air conditioning, thermodynamics of human body, estimation of heating and cooling loads, capacity of cooling coils, humidification and dehumidification unit and conditioner, central air conditioner, year around air condition, humidity and temperature control, industrial application of air conditioning system **Lecture : 10**

Text Book:

1. Refrigeration and air conditioning by C P Arora
2. Refrigeration and air conditioning by Manohar Prasad
3. Refrigeration and air conditioning by Jordon & Priester

Reference Book:

1. Refrigeration and air conditioning by Domkundwar
2. Refrigeration by Stoecker

02 1x21 MECHANICAL SYSTEM DESIGN

L–T–P: 3–1–3

Credit : 5

Design and IC Engine parts

1. Cylinder, trunk position, connecting rod, crank shaft, value gear. **Lecture : 15**
2. Design of centrifugal pump. **Lecture : 06**
3. Design of fly wheel. **Lecture : 02**
4. Design of hydraulic press. **Lecture : 02**
5. Bearing types, selection, design of journal, ball and roller bearing. **Lecture : 05**
6. Design of gears (spar and helical) & gear boxes. **Lecture : 07**
7. Chain drive and brackets. **Lecture : 05**

Text Book:

1. IC Engine by Maleev

2. Machine design by Maleev & Hartman
3. Design of M/C elements by V B Bhandari
4. Design of M/C elements by Sharma & Purohit
5. Design data book by PSG institute of Technology
6. Design data book by Kale
7. Machine design data book by Jordon, Suresh Verma

Reference Book:

1. Mechanical Engg. Design by Shigely
2. Machine Design by Black & Adams

02 1x22 INTERNAL COMBUSTION ENGINE AND GAS TURBINE

L-T-P: 3-0-3

Credit : 5

1. **Introduction** : classification : Two strokes, four stroke (SI and CI) engines, engines parts, engines working principle and valve timing diagram. **Lecture : 3**
2. **Engine performance-test** : purpose and types, measurement of power, Engine system & performance parameters evaluation. **Lecture : 3**
3. **Theory of combustion**, principle of combustion, S.I. & C. I. Engine combustion process & parameters their dependence on engine variables and operating parameters. **Lecture : 3**
4. **Adiabatic flame temperature**, combustion processes & combustion chamber for SI and CI engines pollutant formation and control, effect of engine variables on combustion processes, knowing in SI & CI engines. **Lecture : 5**
5. **Petroleum based fuel**, gasoline & diesel fuel and their properties. Chemically correct air-fuel ratio and load variation. **Lecture : 3**
6. **Carburetors & modern air fuel systems**, compensating devices, venture and jet dimension calculation, injection system. **Lecture : 6**
7. **Super charging**, engine lubrication and cooling. **Lecture : 2**
8. **Gas turbine** : Principle. Simple, open gas turbine cycle, effect of operating variables on thermal efficiency. **Lecture : 5**
9. **Regenerative reheat cycles**, gas turbine applications, closed cycle gas turbine. **Lecture : 5**
10. **Jet propulsion** : working principle, thrust power, propulsive force and efficiency. **Lecture : 4**
11. **Rocket engine** : theory of operation and its applications, propellant. **Lecture : 3**

Text Book:

1. Internal Combustion Engines by V Ganesan (Tata McGraw-Hill)
2. Internal Combustion Engines by Arcoumaris (Academic Press)
3. Internal Combustion Engines - Fundamentals by Heywood
4. Internal Combustion Engines by Theory and Practical – Taylor CF
5. Gas Turbine Theory by Cohen and Rogers
6. Fundamental of Gas Turbine by Bathie WW
7. Gas Turbine by V Ganesan (Tata McGraw-Hill)

02 1x23 OPERATION RESEARCH

L-T-P: 3-1-0

Credit : 4

1. Scope and application of operation research. **Lecture : 2**
2. Linear programming, graphical and simplex method. **Lecture : 4**
3. Transportation and assignment models. **Lecture : 4**
4. Simulation and Monte-Carlo techniques. **Lecture : 4**
5. Queuing theory (single and double channel). **Lecture : 4**
6. CPM and PERT and CPM-crashing networks. **Lecture : 4**
7. Dynamic programming. Sequencing model (n jobs-2 machines), Replacement problems and Reliability theory, Inventory models with probabilistic demands and area, quantity constraints, Game theory (competitive strategies). **Lecture : 12**

8. Non-Linear Programming (Kuhn and Tucker condition).

Lecture : 4

Text Book : As recommended in class.

02 1x24 AUTOMOTIVE MECHANICS

L-T-P: 3-1-0

Credit : 4

1. **Description of power unit** : Fuel supply system and engine lubrication. **Lecture : 6**
2. **Transmission requirements**, Fluid and automatic transmission system along with their performance requirements, tractive resistance. **Lecture : 5**
3. **Different types of steering systems** and performance requirements, Stability of vehicles on level road and curve path. **Lecture : 4**
4. **General braking requirements**, weight transfer during braking, different types of brakes. **Lecture : 5**
5. **General consideration of strength** and stiffness of vehicle frame, various suspension systems, shock absorber and engine mountage, Tyre pavement interaction forces, tyre wear & SAE terminology. **Lecture : 6**
6. **Various types of ignition systems with wiring diagram** **Lecture : 4**
7. **Testing of vehicles and handling characteristics.** **Lecture : 4**
8. **Preventive maintenance**, trouble shooting & tuning of power unit **Lecture : 4**
9. **Pollution due to vehicles emission**, Effect of design and operating condition on pollution. **Lecture : 4**

Lecture : 4

Text Book:

1. Automative Mechanics by Crouse
2. Automobile Engineering by KM Gupta

Reference Books:

1. Automobile Engineering by Newton & Steeds

02 1x25 EXPERIMENTAL STRESS ANALYSIS

L-T-P:3-1-0

Credit : 4

1. **Introduction to the theory of elasticity**, General principles governing the approach to experimental stress analysis techniques, Whole field and point per point information- **Lecture : 10**
2. **Photo elasticity** : Light and optics as related to photo elasticity, Theory of photo elasticity, stress optic relations, model materials, analysis techniques. Three dimensional photo elasticity. **Lecture : 12**
3. **Strain- gauge techniques**, Various type of strain gauges; Electrical resistance, strain gauges and semiconductor gauges. **Lecture : 8**
4. **Parameters influencing the behaviours**, Rosette analysis strain gauge circuits and Recording instruments for static and dynamic applications. **Lecture : 08**
5. **Introduction to digital photo - elasticity.** **Lecture : 08**

Text Book : As recommended in class.

02 1x26 TOTAL PRODUCTIVITY MAINTENANCE & VALUE ENGINEERING

L-T-P- 3-1-0

Credit : 4

1. **Work study** : Method Study- flow process charts, motion economy, Threbligs, work measurement- time study, activity sampling, synthesis, analytical estimating and PMTS, advantages an limitations. **Lecture : 10**
2. **Production, Planning and control** : Production planning and production control, functions of PPC, inventory control – EOQ- and buffer stock, Types of production. **Lecture : 10**
3. **TPM** : Introduction to total productivity maintenance productivity- major losses, measurement of overall performance, pillars of TMP , continuous improvements (Kaizen), Safety and Hygiene, preventive maintenance, predictive maintenance and time based maintenance.
4. **Value Engineering** : Definition and concept of VE, Type of value, Cost vs. quality, FAST diagram, phases of VE, general phase, information's phase, junction phase, oration phase, evaluation phase, application and benefits of VE,

Test Books:

1. Production, Planning and inventory control by Mcleavey and Bullington (Prentice Hall)
2. Industrial Engineering by A.P. Verma (SK Kataria & sons)
3. Industrial Engineering hand book by KB Zandin (TMH)

02 1x27 INDUSTRIAL POLLUTION**L-T-P: 3-1-0****Credit : 4**

1. **Introduction** : Environments and Human activities, Environments and Ecology, Consequences of population growth. Energy problem. **Lecture : 4**
2. **Population of Air**, water and land, Fossil fuel related pollutants in the environment- **Lecture : 4**
3. **Environmental Impacts of Hydro-electric**, Nuclear energy and chemicals forwards a solution. **Lecture : 4**
4. **Air Pollution** : Definitions and scales of concentration, classification and properties of air pollutants, Emission an sources and their classification. Air pollution laws and standards, Inversion Ambient air sampling, stack sampling, sampling system, analysis of air pollutants. Air pollution emission control, selection of a particulate: collector, control of gaseous emission, combustion- **Lecture : 10**
5. **Water Pollution** : Hydrologic cycle and water quality , origin of waste water and its composition, Type of water pollutants and their effects, water pollution laws: and standards, waste water sampling and analysis water quality standard, waste water treatment , Biological systems(Aerobic and Facultative ponds), Recovery of material from process effluents. **Lecture : 8**
6. **Noise pollution** : Different noise environments and their sources, measurement of noise and the equipments Noise pollution lows an, Vibration isolation and noise control in industries. **Lecture : 6**
7. **Solid waste management** : Sources and classification, Public health aspect, effluent treatment processes and solid waste management: sources and classification. Public health aspect, effluent treatment process and solid waste management, "Solid-Solid separation technique for recovery and reuse. **Lecture : 3**
8. **Case study** : Modern environmental assessment method, pollution control in steel plants and coal industries. **Lecture : 3**

Text Book :

1. Managing Industrial Pollution by SC Bhatia
2. Enviromental pollution by HM Dix
3. Chemistry for environmental engineering by SAWYER

02 1x28 HEAT EXCHANGER DESIGN**L-T-P : 3-1-0****Credit : 4**

1. **Heat exchanger** : Types and construction **Lecture : 3**
2. **Heat and fluid flow** fundamental general design consideration and approaches. **Lecture : 6**
3. **Computer aided design**, cost estimation, optimum design, design of single phase, liquid to liquid, liquid to gas and gas to gas heat exchanges. **Lecture : 10**
4. **Design of steam** generators and condensers. **Lecture : 4**
5. **Design of heat exchangers** for liquid metal and molten salts. **Lecture : 4**
6. **Design cooling tower.** **Lecture : 6**

Text Book :

1. Process heat transfer by Kern
2. Process heat transfer by Dass
3. Heat exchanger design- Ozsik

02 1x29 FINITE ELEMENT METHOD & APPLICATIONS**L-T-P:3-1-0****Credits : 4**

1. **Introduction to finite Elements Methods**, general descriptions, concept of finite elements: discretization and interpolation function, steps on finite element analysis' procedure **Lecture : 10**
2. **Calculus of Variation** : Function and functional, euler language equation, Boundary conditions, determinations of functional for plane and axisymmetric elastic problems, **Lecture : 10**
3. **Finite elements** : One , two and three dimensional elements, axisymmrrtric elements: generalize local and natural co-ordinate systems, isoprametric, Interpolation function, field variable model for displacement and temperature, Direct, Variational and Galerikan Methods. **Lecture : 10**
4. **Equation of single elements and solutions**, Application to plane and axisymmetric elastic problems, heat conduction, plates and shells problems. **Lecture : 12**

Text Book : As Recommended in class

02 1x30 COMPUTER AIDED DESIGN & MANUFACTURING

L-T-P: 3-0-3

- | | |
|---|--------------------|
| 1. Introduction concept of CAD/CAM | Credit : 4 |
| 2. Computer system , Hardware in computer – Aided Design system, Product cycle Automation, part programming. | Lecture : 4 |
| 3. Computer aided design system software , Transformation, geometric modeling, Drafting applications, | Lecture : 6 |
| 4. CAD/CAM technology to finite element data preparation, concept of data structures- | Lecture : 8 |
| 5. NC, CNC, DNC programming. | Lecture : 6 |
| 6. Introduction to AVG. | Lecture : 9 |
| | Lecture : 9 |

Text Books : As recommended in class

02 1x31 QUALITY ASSURANCE & RELIABILITY

L-T-P: 3-1-0

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|---|---------------------|
| 1. Probability and statistics concept and application. | Credit : 4 |
| 2. Production tolerance , tolerance analysis and allocation process capability. | Lecture : 5 |
| 3. Statistical process control : Economics of quality control, acceptance sampling, Plans and selection. Taguchi technique, Product reliability, reliability achievement, reliability evaluation, system assessment. | Lecture : 10 |
| 4. Quality circles ISO : quality awards- | Lecture : 22 |
| | Lectures : 5 |

Text Books :

1. Industrial Engg. And mngt by Dr. OP Khanna
2. Total quality management by S Raju SM
3. Industrial Engg. by AP Verma

02 1x32 ROBOTICS AND ROBOT APPLICATIONS

L-T-P: 3-1-0

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|--|---------------------|
| 1. History of development of industrial robots , fields of application and future scope. | Credit : 4 |
| 2. Anatomy and structural deigns of robot , manipulation, arm geometry, drives and control(Hardware) for motions End effectors and grippers, pickups etc. | Lecture : 7 |
| 3. Matching robots to the working place and conditions : interlock and sequence control. | Lecture : 7 |
| 4. Reliability maintenance and safety of robotic systems. | Lecture : 4 |
| 5. Application studies in manufacturing processes , e.g. casting, welding, painting, machine tools, machining, heat treatment and nuclear power stations etc. | Lecture : 10 |
| 6. Synthesis and evolution of geometry configurations , robot economics, educations, educating, programming and control of robots. | Lecture : 7 |

Text Book : As recommended in class.

02 1x33 MANUFACTURING PROCESS - I

L-T-P: 3-0-0

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|--|---------------------|
| 1. CASTING (Foundry) : Principles of pattern- making, allowances in pattern and core boxes, sand mould casting, constituents and properties of moulding sand and their tests, types of sand moulds, methods and principles of gating, risering, use of cores and chills, cleaning of castings defects in castings and their remedies, sand mould machines, melting and casting practices relating to cast iron, steel, aluminium and its alloys, copper and its alloys. Cupla, crucible and electric furnaces, metal- mould casting, gravity casting die casting, centrifugal casting, Non- metallic mould casting- shell mould casting. Investment casting, Plasters of paris mould casting. | Credit : 3 |
| 2. Mechanical working of Metals : Hot and cold working of metals, their comparison and limitation. Hot working Processes. Rolling, spinning, Roll Forming, cold heading, Thread Rolling, Tube and wire drawing, coining, Embossing, Tube Rolling. | Lecture : 12 |
| | Lecture : 12 |

3. **Power Metallurgy** : Principles, method of producing power, pressing, sintering and finishing operation, applications. **Lecture : 6**
4. **Welding, Brazing and Soldering** : Comparison of the processes and their application, welding classification, Gas welding equipment, filler metal and fluxes, classification, oxy- Acetylene welding – their applications, Electric and welding, equipment, Electrodes and fluxes, classification, Classification, Carbon Arc welding, shielded metal arc welding, submerged arc welding. Inert gas shielded arc welding, Ultrasonic welding,, Electroslag welding Electron beam welding and laser beam welding, plastic welding, Thermit welding, welding of cast iron, Aluminum and its alloys, Copper and its alloys, Testing of weld destructive and non- destructive tests. Flange cutting, soldering- fluxes solder, equipments, type and application. Brazing and braze welding fluxes, Filler metals, Types and application. **Lecture : 12**

Text Book : As referred by Teacher.

02 1x34 MANUFACTURING PROCESS – II

L-T-P : 3-0-3

Credit : 5

1. **Metal cutting and Machine Tools** : Metal cutting : Mechanics of metal cutting, Geometry of tool and nomenclature. Tool materials, Orthogonal vs oblique cutting, Mechanics of chip formations, types of chips, tools angles, shear angle, Merchant's force circle diagram. Cutting forces, power required, Cutting fluids/lubricants. Tools wear and tool life.
Machine Tools :
 - a. Lathe : Principle, types, operations, turret/capstan, semi/automatic, Tool layout.
 - b. Shaper, slotted, planer, operation, drive.
 - c. Milling, Milling cutter, up & down milling, dividing head indexing, Max chip thickness, power required.
 - d. Drilling and boring, Drilling, boring, reaming tools, Geometry of twist drill.
 - e. Grinding, Grinding wheel, Abrasive, cutting action, grinding wheel specification, Grinding wheel wear, alterations, wear, fracture wear, dressing and truing. Max chip thickness and guest criteria. Flat and cylindrical grinding. Centreless grinding.
 - f. Super finishing, Honing, Lapping, Polishing. **Lecture : 16**
2. **Non-conventional Machining process** : Benefits, application and survey of non-conventional machining process, Mechanics of metal removed, tooling and equipments, process parameters, working & applications of AJM, USM, EDM, ECM, ECG, EBM, LBM, PAM and chemical milling etc. **Lecture : 12**
3. **Metrology** : Tolerance and limit systems, limit gauges, Measurement of surface roughness, Inspection of gears and screw threads, Individual and commutative error measurement. **Lecture : 8**
4. **Jigs and Fixtures** : Locating elements, clamping devices, principles of jigs and fixtures design. **Lecture : 6**

02 1x35 SEMINAR

02 1x36 MINOR PROJECT

02 1x37 INDUSTRIAL TRAINING

02 1x38 CONTROL & MEASUREMENT

L-T-P: 3-0-3

Credit : 5

1. **Introduction concept of automatic controls** open loop and closed loop system- servomechanism block diagram transfer functions. **Lecture : 6**
2. **Representations of control component** and systems translational and rotational mechanical components electrical components. Series and parallel combinations comparator for rotational and linear motions integrating devices hydraulic servomotor temperature control, system response speed control system. **Lecture : 6**
3. **System response first and second order systems** response to step pulse ramp and sinusoidal input system with distance velocity lag. **Lecture : 4**
4. **Pressure use of monometers Bourdon gauge**, bellows type gauge, measurements of vacuum and pressure transducer, static and dynamics, response of pressure measuring instruments. **Lecture : 6**
5. **Flow use of obstruction type meters**, Variable and meters, Probes. Positive displacements type meters, How wire anemometry. **Lecture : 4**

6. **Temperature use of thermocouples**, resistance thermometer, pyrometer, thermistors static and dynamics response of temperature measuring instrumentation. Thermocouple errors and compensation. Neat flux measurements and meters. **Lecture : 6**
7. **Strain, use of strain gauge**, static and dynamic response, displacement, velocity, acceleration, Jerk linear and angular, piezoelectric pick /ups . inductive type pic/up. Force, torque, time, frequency and phase angle, use of CRO. Electronic counters, Density and viscosity of gauges and liquids, Calorific value of solid, liquid and gaseous fuels, noise, humidity flow visualization, demonstration of shadow and schlieren technique, introduction to metrology. **Lecture : 10**

Text Book : As referred by teacher:

02 1x39 INDUSTRIAL ENGINEERING & MANAGEMENT

L-T-P : 3-0-3

Credit : 5

1. **Material management inventory management**, inventory analysis and control- **Lecture : 3**
2. **Work study method study and work**, Measurement, work sampling, synthesis, analytical estimating predetermined motion and time system- **Lecture : 5**
3. **Production planning and control Batch size**, buffer stock, man machine chart, production control progressing feedback control charts. **Lecture : 4**
4. **Quality management SQC**, analysis of variance, OC CURVE, AOQL, PRODUCERS RISK , CONSUMERS RISK, LDPD Sampling plans ISO 9000 Series. **Lecture : 8**
5. **Elementary operation research industrial safety and pollution control :**
 - LPP graphical and simplex method, duality, TP and AP, queuing theory (single channel) **Lecture : 8**
 - Project management, CPM&PERT for small scale industry industry feasibility study, preparation of project report. **Lecture : 4**
 - Industrial safety – accidents, causes and costs, accident prevention , protective equipments **Lecture : 5**
 - Pollution control, air, water and land pollution, noise pollution, preventive, **Lecture : 5**

Text Book :

1. Industrial Engineering by AP Verma
2. Industrial Engineering & Management by Dr. OP Khanna
3. Industrial Engg, & Mgt by Dr. Ravi Shankar

02 1x40 PROJECT

L-T-P : 0-0-15

Credit : 10