MEC-501 MACHINE COMPONENT DESIGN

UNIT 1

Design Against Fluctuating Load : causes of stress concentration; stress concentration in tension, bending and torsion; Fluctuating Stresses, notch sensitivity, fatigue stress concentration factor, cyclic loading, endurance limit, S-N Curve, loading factor, size factor, surface factor. Design consideration for fatigue, Goodman and modified Goodman's diagram, Soderberg equation, Gerber parabola, Fatigue Design under Combined Stresses

UNIT 2

Design of components subject to static loads: riveted joints, welded joints threaded joints, pin, key knuckle, and cotter joints, Types of cotter Joint, Dimension of Various part of the knuckle Joint .

UNIT 3

Springs: Design of helical compression and tension springs, consideration of dimensional and functional constraints, leaf springs and torsion springs; fatigue loading of springs, surge in spring; special springs.

UNIT 4

Brakes & Clutches: Materials for friction surface, uniform pressure and uniform wear theories, Design of friction clutches: Disk , plate clutches, cone & centrifugal clutches. Design of brakes: Rope, band & block brake, Internal expanding brakes, Disk brakes.

UNIT 5

Spur and Helical Gears: Force analysis of gear tooth, modes of failure, beam strength, Lewis equation, form factor, formative gear and virtual number of teeth; Gear materials; Surface strength and wear of teeth; strength against wear; Design of straight tooth spur and Helical Gears. Bevel Gears: Application of bevel, formative gear and virtual number of teeth; Force analysis; Lewis equation for bevel gears; Strength against wear; Design of bevel gear.

References:

1. Shingley J.E; Machine Design; TMH
2. Sharma and Purohit; Design of Machine elements; PHI
3. Wentzell Timothy H; Machine Design; Cengage learning
4. Mubeen; Machine Design; Khanna Publisher
5. Ganesh Babu K and Srithar k; Design of Machine Elements; TMH
6. Sharma & Agrawal; Machine Design; Kataria & sons
7. Maleev; Machnine Design;

List of Experiments:-

Designing and sketching of components contained in the syllabus.

1. To study design procedure of Knuckle Joint with detailed drawing
2. To study design procedure of cotter joint with detailed drawing
3. To study design procedure of helical and torsion spring with detailed drawings

4. To study design procedure of brake with detailed drawings.
5. To study design procedure of clutch with detailed drawings.
6. To study design procedure of spur and helical gear with detailed drawings.

MEC–502 DYNAMICS OF MACHINES

UNIT 1

Dynamics of Engine Mechanisms: Displacement, velocity and acceleration of piston, turning moment on crankshaft, turning moment diagram .

UNIT 2

Governor Mechanisms: Types of governors, characteristics of centrifugal governors, gravity and spring controlled centrifugal governors, hunting of centrifugal governors, inertia governors.

UNIT 3

Balancing of Inertia Forces and Moments in Machines: Balancing of rotating masses, two plane balancing, determination of balancing masses (graphical and analytical methods), balancing of rotors, balancing of I.C. engine.

UNIT 4

Friction: Frictional torque in pivots and collars by uniform wear and uniform pressure, Boundary and fluid film lubrication, friction in journal and thrust bearings, rolling friction, Clutches.

UNIT 5

Belt : Belt drives; Velocity ratio, limiting ratio of tension; power transmitted; centrifugal effect on belts, maximum power transmitted by belt, initial tension, chain and rope drives; Brakes: Band brake, block brakes, Internal and external shoe brakes, braking of vehicles. Dynamometer types and uses. Analysis of Cams, Response of un-damped cam mechanism.

References:

1. Rattan SS; Theory of machines; TMH
2. Dr.R.K.Bansal& Dr.Brar; Theory of Machines LP
3. Ghosh and Mallik; Theory of Mechanisms and Machines; Affiliated East-West Press, Delhi
4. Norton RL; kinematics and dynamics of machinery; TMH
5. Grover; Mechanical Vibrations
6. Thomson; Theory of Vibrations

List of Experiment (Expandable)

1. Study of various models of governors.
2. Study of gyroscopic motion and calculation of value of gyroscopic couple.
3. Study of various types of Cams and followers.
4. Study of various first order vibration systems.
5. To study working of friction clutches using models
6. To study working of internal expanding brake

MEC-503 Metal Cutting & CNC Machines

UNIT I

Lathe: Classification of machine tools and their basic components; lathe- specification, components & accessories, various operations on lathes, capstan & turret lathes, tool layout,methods of thread production, machining time, single point cutting tools, tool signature andnomenclature

UNIT II

Grinding: Types of grinding machines, surface, cylindrical and internal grinding, grinding wheels, specifications, wheel turning and dressing without eccentricity, centre-less grinding.

UNIT III

Milling: Vertical, horizontal and universal type machines, specifications and classifications of milling machines, universal dividing head plain and different indexing, gear cutting, milling cutters.

Drilling & Broaching: Fixed spindle, radial and universal drilling machines, drilling time, broaching principle, broaches and broaching machines.

UNIT IV

Shapers: Classification and specifications, principle parts, quick return mechanism, shaper operations, speed feed, depth of cut, machining time. Surface qualities, equipment used for rating surfaces, rms. CLA value, causes for surface irregularities. **Gear Cutting**: Die casting, methods of forming gears, generating process, Gear shaping, gear shaving, gear grinding gear testing.

UNIT V

Mechatronics: Introduction to control systems, analog control, transfer function, procedure for writing transfer function, signal flow diagram, introduction to electronic components like switches, magnetic type, electromagnetic type, transducers and other sensors, servo motors, basics of CD-ROM players, PLC, applications, CNC machines.

References:

1. Rao PN; Manufacturing Technology vol I and II; TMH
2. Hazra Chadhary; Workshop Tech.II; Media Promoter and Pub
3. Lindberg RA; Processes and Materials of Manufacturing; PHI.
4. Raghuvanshi;BS; Work shop technology Vol-I, II; Dhanpat Rai Delhi
5. Alciatori DG, Histand MB; Introduction to Mechatronics and Measurement system; TMH
6. HMT; Production Processes; TMH

List of Experiment (Pl. expand it):

1. To make a job on lathe machine with all operations like turning, step turning, drilling , tapper turning ,
thread cutting and knurling .
2. Study of center less grinding machine/ tool and cutter type grinding machine.
3. Study of horizontal/ universal milling machine, diving head and indexing mechanism of it.

4. To cut a spur gear on milling machine using rapid indexing method.
5. Study of radial drilling machine and preparing a job on it.
6. To study a sapping machine to learn about working of quick return mechanism.

MEC-504 (A) MECHANICAL MEASUREMENT AND CONTROL

UNIT 1

Measurement : Significance of Mechanical Measurements, Classification of measuring instruments, generalized measurement system, types of inputs: Desired, interfering and modifying inputs. Static characteristics: Static calibration, Linearity, Static Sensitivity, Accuracy, Static error, Precision, Reproducibility, Threshold, Resolution, Hysteresis, Drift, Span & Range etc. Errors in measurement: Types of errors, Effect of component errors, Probable errors.

UNIT 2

Displacement Measurement : Transducers for displacement, displacement measurement, potentiometer, LVDT, Capacitance Types, Digital Transducers (optical encoder) **Strain Measurement :** Theory of Strain Gauges, gauge factor, temperature Compensation, Bridge circuit, orientation of strain gauges for force and torque, Strain gauge based load cells and torque sensors **Measurement of Angular Velocity:** Tachometers, Tachogenerators, Digital tachometers and Stroboscopic Methods, Acceleration Measurement.

UNIT 3

Pressure Measurement: Elastic pressure transducers viz. Bourdon tubes, diaphragm, bellows and piezoelectric pressure sensors, High Pressure Measurements. **Vacuum measurement:** Vacuum gauges viz. McLeod gauge, Ionization and Thermal Conductivity gauges. **Flow Measurement:** Bernoulli's flow meters, Ultrasonic Flowmeter, Magnetic flow meter, rotameter. **Temperature Measurement:** Electrical methods of temperature measurement Resistance thermometers, Thermistors and thermocouples, Pyrometers.

UNIT 4

Introduction to control systems, Classification of control system, Open loop and closed loop systems, Mathematical modelling of control systems, concept of transfer function, Block diagram algebra.

UNIT 5

Transient and steady state analysis of first and second order system. Time Domain specifications. Step response of second order system. Steady-state error, error coefficients, steady state analysis of different type of systems using step, ramp and parabolic inputs.

References:

1. Measurement Systems (Applications and Design) 5th ed.- E.O. Doebelin - McGraw Hill.
2. Mechanical Engineering Measurement - Thomas Beckwith, N.Lewis Buck, Roy Marangoni Narosa Publishing House, Bombay.
3. Mechanical Engineering Measurements - A. K. Sawhney - DhanpatRai& Sons, New Delhi.
4. Instrumentation Devices & Systems - C.S. Rangan&G.R.Sarrna - Tata McGraw Hill.
5. Instrumentation & Mechanical Measurements - A.K. Thayal.
6. Control System Engineering: by Nagrath IJ. and Gopal .

MEC-504 (B) Industrial Tribology

UNIT 1

Introduction: History, Industrial Importance. **Engineering Surfaces:** Properties and Measurement: Measurement Methods, Surface Profilometry, Statistical Description of Roughness.

UNIT 2

Surface Contact: Hertz contact theory, Greenwood-Williamson model, Elastic-plastic contact. **Adhesion**: Basic Models, Factors influencing Adhesion.

UNIT 3

Friction: Measurement Methods, Origin of Friction, Friction Theories – adhesion and ploughing, Mechanisms, Friction of Metals, Non-metallic Materials. **Wear:** Types: Adhesive, Abrasive, Corrosive, Fatigue, Minor Forms: Fretting, Erosion, Percussion, Delamination Theory, Wear Debris Analysis, Wear Testing Methods, Wear of Metals, Ceramics, Polymers.

UNIT 4

Surface Engineering: Surface Treatments: Microstructural and Thermochemical Treatments, Surface Coatings: Hard Facing, Vapour Deposition Processes: PVD, CVD, PECVD etc. **Nanotribology**: Measurement Tools: Surface Force Apparatus, Scanning Tunnelling Microscope, Atomic / Friction Force Microscope.

UNIT 5

Lubrication: Basic Equations for Fluid Film Lubrication. Hydrodynamic lubrication -Thrust and Journal bearings, Squeeze Film Bearings, Hydrostatic lubrication, Gas-Lubrication. Lubrication of rolling element bearings. Boundary lubrication – metal working lubrication, solid film lubrication, Hygiene of Lubricants.

References:

1. P. Sahoo, Engineering Tribology, Prentice Hall-India, New Delhi, 2009.
2. B. Bhushan, Introduction to Tribology, Wiley, 2002.
3. G W Stachowiak and A W Batchelor, Engineering Tribology, Butterworth-Heinemann, 2005.
4. S.K. Basu, S.N. Sengupta, B.B. Ahuja, Fundamentals of Tribology, Prentice Hall-India, 2005.
5. B C Majumdar, Introduction to Tribology of Bearings, S Chand & Co, 2012.

MEC-504 (C) Production & Operation Management

UNIT 1

Introduction : System concept of production; Product life cycle; Types and characteristics of production system; Productivity; Process and product focused organization structures; Management decisions – strategic, tactical and operational.

UNIT 2

Forecasting : Patterns of a time series – trend , cyclical, seasonal and irregular; Forecasting techniques : moving average, simple exponential smoothing, linear regression; Forecasting a time series with trend and seasonal component

UNIT 3

Materials Management and Inventory Control : Components of materials management; Inventory control : EOQ model, Economic lot size model, Inventory model with planned shortages, Quantity discounts for EOQ model; ABC analysis; Just-in-time inventory management. **Materials Requirement Planning** : MRP concept – bill of materials (BOM), master production schedule; MRP calculations.

UNIT 4

Machine Scheduling : Concept of Single machine scheduling – shortest processing time (SPT) rule to minimize mean flow time, Earliest due date (EDD) rule to minimize maximum lateness, Total tardiness minimizing model; Minimizing makespan with identical parallel machines; Johnson's rule for 2 and 3 machines scheduling.

UNIT 5

Project Scheduling : Activity analysis; Network construction; critical path method (CPM); Crashing of project network. **Quality Assurance** : Meaning of Quality; Quality assurance system; choice of process and quality; Inspection and control of quality; Maintenance function & quality; Process control charts : x-chart and Rchart, p-chart and c-chart; Acceptance sampling : Operating characteristic (O.C) curve, Single sampling plan, Double sampling plan, Acceptance sampling by variables; concept of Six Sigma.

References :

1. Buffa and Sarin, Modern Production/Operations Management, John Wiley & Sons.
2. R. Panneerselvam, Production and Operations Management, PHI.
3. Russell & Taylor, Operations Management, PHI.
4. Adam and Ebert, Production and Operations Management, PHI.
5. Production & Operations Management by Starr, Cenage Learning India.

MEC-505 (A) Turbo Machinery

UNIT 1

Energy transfer in turbo machines: Application of first and second laws of thermodynamics to turbo machines, Moment of momentum equation and Euler turbine equation, Principles of impulse and reaction machines, Degree of reaction, Energy equation for relative velocities.

UNIT 2

Steam turbines: Impulse staging: Velocity and pressure compounding, Include qualitative analysis, Effect of blade and nozzle losses on vane efficiency, Stage efficiency, Analysis for optimum efficiency, Mass flow and blade height. **Reactions staging:** Parson's stages, Degree of reaction, Nozzle efficiency, Velocity coefficient, Stator efficiency, Carry over efficiency, Stage efficiency, Vane efficiency, Conditions for optimum efficiency, Axial thrust, Reheat factor in turbines, Free and forced vortex types of flow, Governing and performance characteristics of steam turbines.

UNIT 3

Water turbines: Classification, Pelton, Francis and Kaplan turbines, vector diagrams and work done, draft tubes, governing of water turbines.

UNIT 4

Centrifugal Pumps: Classification, Advantage over reciprocating type, Definition of mano-metric head, Gross head, Static head, Vector diagram and work done. Performance and characteristics: Application of dimensional analysis and similarity to water turbines and centrifugal pumps, Selection of machines, Hydraulic, volumetric, Mechanical and overall efficiencies

UNIT 5

Compressors: Centrifugal Compressor – Vector diagrams, Work done, Temp and pressure ratio, Slip factor, Work input factor, Pressure coefficient, Dimensions of inlet eye, Impeller and diffuser. Axial flow Compressors Vector diagrams, Work done factor, Temp and pressure ratio, Degree of reaction.

References:

1.Venkanna BK; turbomachinery; PHI
2. Csanady; Turbo machines
3. Kadambi V Manohar Prasad; An introduction to EC Vol. III Turbo machinery
4. Bansal R. K; Fluid Mechanics & Fluid Machines;
5. Rogers Cohen &SarvanMulto Gas Turbine Theory
6. Kearton W. J; Steam Turbine: Theory & Practic

MEC-505 (B) Material Handling

UNIT 1

Introduction : Definition, importance and scope of materials handling (MH); classification of materials; codification of bulk materials ; utility of following principles of MH – (i) materials flow, (ii) simplification, (iii) gravity, (iv) space utilization, (v) unit size, (vi) safety, (vii) standardization, (viii) dead-weight, (ix) idle time, (x) motion.

UNIT 2

Unit load : Definition; advantages & disadvantages of unitization; unitization by use of platform, container, rack, sheet, bag and self contained unit load; descriptive specification and use of pallets, skids, containers, boxes, crates and cartons; shrink and stretch wrapping.

Classification of MH Equipment : Types of equipment – (i) industrial trucks & vehicles, (ii) conveyors, (iii) hoisting equipment, (iv) robotic handling system and (v) auxiliary equipment; Independent equipment wise sub classification of each of above type of equipment.

UNIT 3

Industrial trucks & vehicles : Constructional features and use of the following equipment – (i) wheeled hand truck, (ii) hand pallet truck, (iii) fork lift truck; Major specifications, capacity rating and attachments of fork lift truck.

UNIT 4

Conveyors : Use and characteristics of belt conveyor, constructional features of flat and troughed belt conveyor; Use and constructional features of Flg. types of chain conveyors –
(i) apron, car and trolley type; Construction of link-plate chains; Dynamic phenomena in chain drive; Use and constructional features of roller conveyors; Gravity and powered roller conveyor; Pneumatic conveyor-use and advantages; Positive, negative and combination system of pneumatic conveyors; constructional feature, application and conveying capacity of screw conveyor.

UNIT 5

Hoisting Equipment : Advantage of using steel wire rope over chain; constructional features of wire ropes; Rope drum design; Pulley system-simple vs. multiple pulley; Load handling attachments : hooks, grabs, tongs, grab bucket; Arrangement of hook suspension with cross piece and pulleys (sheaves); Use and constructional features of (i) hand operated trolley hoist,
(ii) winch; (iii) bucket elevator, (iv) Jib crane, (v) overhead traveling crane and (vi) wharf crane; Level luffing system of a wharf crane; Utility of truck mounted and crawler crane.

References :

1. S. Ray, Introduction to Materials Handling, New Age Int. Pub.
2. T. K. Ray, Mechanical Handling of Materials, Asian Books Pvt. Ltd.
3. T.H. Allegri, Materials Handling: Principles and Practices, CBS Publishers and Distributors.
4. J.A. Apple, Material Handling System Design, John Wiley & Sons.

MEC-505 (C) Supply Chain Management

UNIT 1

Building a Strategic Frame Work to Analyse Supply Chains: Supply chain stages and decision phases, Process view of supply chain: Supply chain flows, Examples of supply chains, Competitive and supply chain strategies, Achieving strategic fit: Expanding strategic scope, Drivers of supply chain performance. Framework for structuring drivers: inventory, transportation facilities, information obstacles to achieving fit.

UNIT 2

Designing the Supply Chain Network : Distribution Networking: Role, Design, Supply Chain Network(SCN): Role, Factors, Framework for design decisions. **Materials Management:** Scope, Importance, Classification of materials, Procurement, Purchasing policies, Vendor development and evaluation. Inventory control systems of stock replenishment, Cost elements, EOQ and its derivative modules.

UNIT 3

Dimensions of Logistics : Introduction: A Macro and Micro Dimensions, Logistics interfaces with other areas, Approach to analyzing logistics system, Logistics and systems analyzing: Techniques of logistics system analysis, factors affecting the cost and Importance of logistics.

UNIT 4

Warehouse and Transport Management: Concept of strategic storage, Warehouse functionality, Warehouse operating principles, Developing warehouse resources, Material handling and packaging in warehouses, Transportation Management, Transport functionality and principles, Transport infrastructure, transport economics and Pricing. Transport decision making.

UNIT 5

IT in Supply Chain

IT framework, Customer Relationship Management (CRM),internal Supply chain management, Supplier Relationship Management (SRM) and Transaction Management, Coordination in a Supply Chain. Lack of supply chain coordination and the Bullwhip effect, Obstacle to Coordination, Managerial levers, Building partnerships and trust. RFID systems.

References:

1. Supply Chain Management Strategy, Planning, and operations, Sunil Chopra and Peter Meindl
2. Materials Management & Purchasing, Ammer D.S. Taraporawala
3. Designing & Managing Supply chain, David Simchi Levi, Philip Kaminsky& Edith Smichi Levi
4. Supply Chain Redesign: Transforming Supply Chains into Integrated Value Systems, Robert B Handfield, Ernest L Nicholas
5. The Management of Business Logistics: A Supply Chain Perspective, Coyle, Bardi, Langley

MEC-506 (A) Work Study and Ergonomics

UNIT 1

Method study: purpose of work study, its objectives, procedure and applications; method study definition and basic procedure, selection of job, various recording techniques like outline process charts, flow process charts, man machine charts, two handed process charts, string diagram, flow diagram, multiple activity chart, simo, cyclographs and chrono-cyclographs; critical examination, development, installation and maintenance of improved method; principles of motion economy and their application in work design; micro motion study, memo motion study and their use in methods study.

UNIT 2

Work measurement: Introduction & definition, objectives and basic procedure of work measurement; application of work measurement in industries; time study: basic procedure, equipments needed, methods of measuring time, selection of jobs, breaking a job into elements; numbers of cycles to be timed; rating and methods of rating, allowances, calculation of standard time.

Work sampling: Basic procedure, design of work sampling study conducting work sampling study and establishment of standard-time.

UNIT 3

Job evaluation and incentive schemes: Starlight line, Tailor, Merrick and Gantt incentive plans

Standard data system; elemental and non-elemental predetermined motion systems, work factors system; Methods Time Measurement (MTM), MOST

UNIT 4

Human factor engineering: Definition and history of development of human factors engineering, types & characteristics of man-machine-system, relative capabilities of human being and machines; development and use of human factor data; information input and processing: Introduction to information theory; factors effecting information reception and processing; coding and selecting of sensory inputs.

UNIT 5

Display systems and anthropometric data: Display- types of visual display, visual indicators and warning signals; factorial and graphic display; general principles of auditory and tactral display, characteristics and selection.

References:

1. ILO; work-study; International Labour Organization
2. Khan MI; Industrial Ergonomics; PHI Learning
3. Barrnes RM; Motion and Time Study; Wiley pub
4. Megaw ED; Contenmprory ergonomics; Taylor & fracis
5. Sandera M and Mc Cormick E; Human Factors in Engg and design; MGHill
6. Currie RM; Work study; BIM publications
7. Mynard; Hand book of Industrial Engg;

MEC-506 (B) Industrial Safety Engineering

UNIT 1

Safety management

Need for safety, safety and productivity, planning for safety, formulation of safety policy, safety management techniques - job safety analysis, safety sampling technique, incident recalltechnique, plant safety inspection, safety organizations and its functions.

UNIT 2

Accident prevention

Nature and causes of accidents, accident proneness, cost of accidents, accident preventionmethods, accident reporting and investigation, personal protective equipment's, safety education and training, damage control and disaster control.

UNIT 3

Operational Safety

General safety considerations in material handling – manual and mechanical, safety in machine shop, safety in use of hand and portable (power) tools, safety in use of electricity, safety in welding and cutting, principles of guarding, safety in grinding, safety in heat treatment shop, safety in gas furnace operation

UNIT 4

Occupational Health and Hygiene

Concept and spectrum of health, levels of prevention, functional units of occupational health service, activities of occupational health unit, occupational and work related diseases such as silicosis, asbestosis, lead, nickel, chromium and manganese toxicity, prevention and control, gas poisoning, effects and prevention, hearing conservation programme - physical and chemical hazards - control measures.

UNIT 5

Fire engineering and explosion control

Fire triangle, classification of fires, fire properties of solid, liquid and gas, building evaluation for fire safety, fire load, fire resistance materials and fire testing, structural fire protection, exits and egress - industrial fire protection systems, sprinkler – hydrants, portable extinguishers - fire suppression systems, detection systems, principles of explosion - detonation and blast waves, explosion venting, explosion parameters, explosion suppression systems based on CO2 and halogen.

References:

1. Heinrich H. W, "Industrial accident prevention", McGraw Hill Company, New York, 1980
2. Frank P. Lees, "Loss prevention in process industries", Vol. I, II & III, Butterworth, London, 1980
3. Brown D. B, "System analysis and design for safety" Prentice Hall, New Jercy, 1976
4. Derek James, "Fire prevention hand book", Butter Worths and Company, London, 1986

5. “Accident prevention manual for industrial operations”, National Safety Council, Chicago, 1989
6. Clayton and Clayton, “Patty’s industrial hygiene and toxicology”, Vol. I, II & III, Wiley.

MEC-506 (C) Environmental Pollution Monitoring

UNIT 1

Air pollution: Definition, Sources and Classification of air pollutants. Transport and diffusion of pollutants. Gas laws governing the behavior of pollutants in the atmosphere. Meteorological parameters, scale of meteorology, Effect of temperature, precipitation, humidity, pressure, radiation and wind. Heat transferring processes, atmospheric stability, inversions and mixing heights, Plume behavior and Stack dispersion theories & models of monitoring & control of exhaust emissions. Effects of air pollution on man, animal, plants, inanimate objects and climate. Ambient air quality standards and air pollution indices.

UNIT 2

Air sampling and monitoring techniques - Settleable and suspended particulate matter - Dust fall jar and Impingement Method, RDS/HVS samplers (Ambient Air monitoring); Stack gas/dust Sampling technique and other techniques of air monitoring for pollutants. Automobile pollution in Indian cities. Monitoring and control of exhaust emissions. Noise Pollution: Definition, Sources and Terminology; types of noise; Measurement of noise; Noise indices; Effect of meteorological parameter on noise propagation. Noise exposure level and Standard Impact on biota and inanimate objects. Noise control and abatement measures.

UNIT 3

Aquatic Pollution: Definition; Sources and classification of aquatic pollutants. Cause and consequences of pollution on surface, subsurface and marine water sources. Coastal water intrusion. Oil leakage and industrial effluents. Water quality indices. Thermal pollution: Sources, causes and effects. Preventive and control measures.

UNIT 4

Soil Pollution: Definition, sources and classification of soil pollutants and their impacts on physico-chemical and biological properties of soil, plants, animals and man. Physico-chemical and bacteriological sampling and analysis of soil quality. Industrial waste effluents and heavy metals, their interactions with soil components, Soil microorganisms and their function, degradation of insecticides, fungicides and weedicides in soil. Interaction of fertilizer (NPK) with different components of soil. Soil pollution control Measures.

UNIT 5

Radioactive Pollution: Definition, Radioactivity, Radionuclide, Radiation emissions, sources, Radioactive decay and buildup. Biological effects of radiation. Radiation exposure Standards. Radioactive pollution impacts on ecosystem. Pollution control measures. Biological dosimetry.

References:

1. Nandini N, Sunitha N and Sucharita Tandon. (2007). Environmental Studies, Sapna Book House, Bangalore
2. Stern A.C. (1986). Air Pollution Vol.I-VIII, Academic Press.
3. Henry C. Perkins. (1974). Air Pollution, Mc Graw Hill.
4. William L. Donn. (1975). Meteorology 4th Ed., Mc Graw Hill.
5. Furry R, Baddel.R and Haurker L. (1985). Air Pollution and Lichens.

6. Mansfiels M.R. (1989). Effects of air pollutants on plants.
7. Lodge. (1994). Methods of air sampling and analysis.
8. Trivedy R.K and Goel P.K. (1995). An Introduction to air Pollution, Techno Science Publications Jaipur.
9. Kudesia V.P. (1993). Air Pollution, Pragati Prakashan, New Delhi.
10. Mishra P.C. (1989). Soil Pollution and Soil Organisms.
11. Goel P.K. (1997) Water Pollution-Causes, Effects & Control. Techno Science Pub., Jaipur.
12. Pratap Mowle P and Venkattasubbayya N. (1990). Air pollution and Control. Divyajyothi Prakashan, Jodhpur.