

**SCHOOL OF ENVIRONMENTAL & EARTH SCIENCES**

**CMJ University**

**M. Tech (Environmental Science and Tech.)**

**Semester I**

- MTE-101** Water & Wastewater Management
- MTE-102** Environmental System Optimization & Modeling
- MTE-103** Modern Tools in Environmental Technology
- MTE-104** Instrumental Techniques in Environmental Analysis
- MTE-105** Biotechnological Applications for Environmental Protection
- MTE-106** Principles of Air & Noise Pollution Management
- MTE-107** Practical Course

**Semester II**

- MTE-201** Industrial Pollution Control
- MTE-202** Environmental Impact Assessment & Audit
- MTE-203** Industrial Safety, Environmental Health and Disaster Management
- MTE-204** Solid & Hazardous Waste Management
- MTE-205** Environmental Geotechnology
- MTE-206** Natural Resource Management
- MTE-207** Practical Course

**Semester III**

- MTE-301** Seminars & Industrial visits
- MTE-302** Project

**Semester IV**

- MTE-401** Project work

## **SEMESTER I**

### **MTE-101: WATER & WASTEWATER MANAGEMENT**

#### **Unit I : CONSEQUENCES OF WATER POLLUTION:**

Biological uptake of pollutants and their effects on land, vegetation, animals and human health, bio-deterioration, bioaccumulation, bio-magnification and eutrophication, infectious microbial agents in water system and their consequences on human health.

#### **Unit II: SEWAGE TREATMENT**

Sewage characteristics, Quantity & Quality, flow rate, treatment flow –sheets. Sewage treatment process, reactor type, hydraulic characteristics, C-diagram. Preliminary treatment-design and operation of screening and grit chamber. Sedimentation, design and operation PST; Chemical precipitation. Principle of biological treatment-derivation of bacterial growth kinetics used in designing of wastewater treatment plant. Process design and operation of Activated sludge process and its modification. Bulking and rising sludge. Design of secondary settling tank.

#### **Unit III : WASTEWATER TREATMENT**

Wastewater treatment for small communities – Oxidation ditch, extended aeration system, SBR; Process design and operation of mechanically aerated lagoon and Waste stabilization pond system. Sanitation–rural sanitation, short term and long term control of insects, rodents, vectors and nuisance; municipal sanitary standards and regulation. Sewage disposal in isolated unsewered areas–septic tank, cesspools and their effluent disposal methods.

#### **Unit IV : DESIGN AND OPERATION**

Design and operation of biological nitrification – de-nitrification system; luxurious phosphorus uptake. Aerobic attached growth process –Process design and operation of trickling filter, RBC, Bio-filter. Anaerobic treatment: process microbiology and biochemistry; application for treatment of sewage, advantage and disadvantages.

#### **Unit V : CETP CONCEPT**

Concept of common effluent treatment plant (CETP). Floating aquatic plant system and its design and operation. Sludge characteristics and disposal methods –design and

operation of sludge drying bed. Design and operation of treatment plant. Trouble shooting and trouble free operation.

### **BOOKS AND REFERENCES**

1. Wastewater Engineering: Treatment, disposal, Reuse – Metcalf & Eddy Inc. 4<sup>th</sup> ed. TMGHI, New Delhi, 2003.
2. Environmental Engineering- Peavy, HS, Donald RR & G. Tchobanoglous, MGH Int. Ed. New York, 1985.
3. Wastewater Treatment for Pollution Control – Soli J Arceivala, Tata McGraw Hill, 2<sup>nd</sup> ed. 1998
4. Wastewater Treatment Plants: Planning, Design and Operation- S.R..Qasim, Holt, Rinehart & Winston, NY, 1985
5. Industrial Water Pollution Control –WW Eckenfelder, Jr., McGraw –Hill , 2<sup>nd</sup> Edition, NY 1989

## **MTE-102: ENVIRONMENTAL SYSTEM OPTIMIZATION AND MODELING**

### **Unit I : SYSTEMS APPROACH CONCEPT & ANALYSIS**

Model Classification, Terminology of Models, Model Building, Fundamental of Modeling, Transport Law, Chemical Equilibrium, Phase Equilibrium Routh's Law, Relative Velocity and Chemical Kinetics

### **Unit II: PROCESS MODELING**

Linear equilibrium system, Batch Reactor, pH system, Planning Models, Municipal solid waste management, Integrated Solid waste Management, Reuse and Recovery in paper, Plastic, glass and aluminum waste

### **Unit III : WATER MODELING**

Modeling of wastewater management systems. Modeling of pesticide management; Modeling of Modeling of municipal wastewater treatment, Model formulation and their solution, Numerical Techniques of Linear equations, Matrix inversion method, Gases elimination and gas sidal method.

### **UNIT IV : PROGRAMMING MODEL**

Silent feature of optimizations, Linear programming problem, Simplex method, Principles of problem in dual problem Direct simplex method, Graphical Method – Optimum solution and their analysis (Minimization & Maximization) At least one problem of each method along with optimum solution.

### **Unit V : AIR DISPERSION MODE**

Pollutant standard index criteria, toxic air pollutants, Motor vehical emission, The point source Gaussian Plume models, Transportation Models & Empirical Equations related to air pollution dispersion models.

### **BOOKS AND REFERENCES**

1. Handbook of Environmental and Ecological Modeling, Halling-Sorensen B., Nielsen S.N. and Jorgensen S.E., Lewis Publishers Inc., 1995.
2. Fundamentals of Atmospheric Modeling, Jacobson Mark Z., Kluwer Academic Press, 2002.
3. An Introduction to Water Quality Modeling, James A. (Ed), (2nd Ed.), 1992.
4. Techniques for Environmental System Analysis - R.H.Pantell Wiley, NY, 2001.
5. System Analysis and Design – RJ Aguilar, Prentice Hall, Englewood Cliffs, N.J., 1993.

## **MTE-103 MODERN TOOLS IN ENVIRONMENTAL TECHNOLOGY**

### **UNIT I: FUNDAMENTALS OF REMOTE SENSING**

Concepts and principles of Remote Sensing

The nature and generation of EMR

Interaction of EMR with the atmosphere and earth's surface features.

### **UNIT II: SATELLITE REMOTE SENSING:**

Satellite Remote Sensing – Data products and their specifications

Remote Sensing observations and platforms

Types of sensors, Data Resolution

Global and Indian Space missions

### **UNIT III: DIGITAL IMAGE PROCESSING AND IMAGE INTERPRETATION**

Digital Image Structure and Data recording formats

Image rectification and restoration

Image enhancement and classification

Image transformation and data fusion

Ground truths and training sets in image processing and in automated processing

Visual photo interpretation techniques based on 'photo elements' and 'terrain elements'

### **UNIT IV: GEOGRAPHIC INFORMATION SYSTEMS (GIS) AND GPS**

Principles and applications of GIS

Map Projections Systems, Map Visualization

Traditional maps, map scales and their interpretation

Components of GIS

GIS data models and structures

GIS analysis and GIS modeling

Integration of Remote sensing and GIS techniques and its applications in Environmental Sciences, Principles and applications of GPS

### **UNIT V: COMPUTER APPLICATIONS**

Basic concepts of computer, hardware, operating systems

Application software in Environmental sciences: word processing, spreadsheets, graphics and data base,

Introduction to web browsing software and search engines with special reference to online environmental

## **BOOKS AND REFERENCES**

1. Aerial photographic interpretation, Principles and applications - D.R.Leuder.
2. Photogeology - Miller, J.C.
3. Manual of colour aerial photography -Ed. Smith, J.T.Jr.
4. Manual of photogrammetry - Ed: Morrie M.Thompson.
5. Manual of Remote sensing - Ed: Robert G Reeves.
6. Theory of pattern recognition and modern forecasting - V.Karpin and Wright Pattern.
7. Remote sensing in Geology - Parry S. Siegal & Alan. R.Gillespie
8. Manual of photographic interpretation - Ed: Colwell, R.N.
9. Principles of Remote Sensing - Patel Singh; SP publication
10. Digital Remote Sensing - Pritivish Nag M Kudrat ; Concept publication
11. Principles of GIS for land and resources assessment, Burrough, P.A., 1986, Oxford.
12. Geographical information systems Vol 1 & 2. Edited by: Paul A.Longley, Michael F.Goodchild, David J. Maguire & David W.Rhind.
13. Geographical information systems and digital image processing – Muralikrishna1999. Allied Publication

## **MTE-104 INSTRUMENTAL TECHNIQUES IN ENVIRONMENTAL ENGINEERING:**

### **Unit I: TREATMENT OF DATA IN QUANTITATIVE ANALYSIS:**

Accuracy, Precision, Standard deviation, Types of errors, Minimization of errors. Significant figures, Criteria for rejection of data, Principles of instrumentation.

### **Unit II : SPECTROPHOTOMETRIC METHODS:**

Principles, applications, advantages & limitations of the following Spectrophotometric methods: Colorimetry & Spectrophotometry, FTIR, NMR, Atomic absorption spectrophotometry, Flame photometry, Fluorimetry, Nephelometry and Turbidimetry, Inductively coupled plasma spectroscopy & Mass spectroscopy.

### **Unit III : ELECTROCHEMICAL METHODS:**

Principles, applications, advantages & limitations of following electrochemical methods: Polarography, Pulse polarography, Ion-selective electrode oscilloscopic polarography, cyclic voltametry & anode stripping voltametry.

### **Unit IV : CHROMATOGRAPHY**

Principles, applications, advantages & limitations of following chromatographic methods: Adsorption, Partition, Column chromatography, Paper chromatography, Thin layer chromatography, Gas chromatography, High Performance Liquid Chromatography (HPLC), Ion-chromatography & size exclusion chromatography.

### **Unit V : PHYSICAL AND BIOLOGICAL METHODS**

Analytical methods in Biotechnology & bio-process control, Electrophoresis, X-ray crystallography, Bio-informatics tools, Bio-assay of pharmaceutical products, online & off line measurement systems, micro processor based control systems.

### **BOOKS & REFERENCES:**

1. Instrumental Methods of analysis, Willard H H& Dean LL, John Willey, 1976.
2. Modern Methods of chemical analysis Reesok RL, & Shields LD, John Willey & sons, Inc 1990.
3. Instrumental Methods of chemical analysis, Ewing GW, McGraw Hill Book Company, Inc. 1975.
4. Fundamental of molecules spectroscopy. Banwell CN, McGraw Hill, NY, 1990.
5. Vogels textbook of Quantitative chemical analysis, Third Ed.

## **MTE-105 BIOTECHNOLOGICAL APPLICATIONS FOR ENVIRONMENTAL PROTECTION**

### **Unit I : ENVIRONMENTAL BIOTECHNOLOGY: BASIC CONCEPT**

Principles and concepts of environmental biotechnology – usefulness to mankind.

### **Unit II : BIOTECHNOLOGY IN POLLUTION CONTROL**

Types of pollution, Methods for measurement of pollution, Methodology of environmental management, air pollution and its control through biotechnology. Water as a scarce natural resource, need for water management, measurement of water pollution, waste water collection, waste water treatment – Physical, chemical and biological treatment processes. Solid waste management (composting, wormiculture and methane production)

### **Unit III : MICROBIAL TECHNOLOGY FOR WASTE MANAGEMENT**

Degradation of high concentrated toxic pollutants, non-halogenated, halogenated petroleum hydrocarbons-metals. Mechanisms of detoxification-oxidation reactions, dehalogenation biotransformation of metals. Microbial cell/enzyme technology – adapted microorganisms – biological removal of nutrients microalgal biotechnology and applications in agriculture- role of extra cellular polymers.

Biotechnological remedies for environmental damages – decontamination of ground water systems subsurface environment – reclamation concepts – bioremediation. Production of proteins – biofertilizers. Biodegradation of solid wastes – physical, chemical and microbiological factors of composting – health risk – pathogens – odour management – technologies of commercial importance advances in biogas technology – case study.

### **Unit IV : FERMENTATION BIOTECHNOLOGY**

Anaerobic digestion, anaerobic filters, Up-flow unanaerobic sludge blanket reactors, treatment schemes for waste water of dairy, distillery, tannery, sugar, antibiotic industries.

Aerobic process, activated sludge, oxidation ditches, trickling filters, towers, rotating biological contractors, oxidation ponds.

### **Unit V : BIOTECHNOLOGY AND GLOBAL ENVIRONMENTAL PROBLEMS**

Ozone depletion UV-B, green house effect and acid rain, their impact and biotechnology approaches for management.

### **BOOKS AND REFERENCES**

1. Wainwright, M, “ An Introduction to Environmental Biotechnology “, 1999.
2. Martin, A.M., “ Biological Degradation of Wastes “, Elsevier Appl. Science, New York, 1991.



3. Sayler, Gray S. Robert Fox and James W. “ Blackburn Environmental Biotechnology for Waste Treatment “, Plenum Press, New York 1991.
4. Bruce E. Rittmann, Eric Seagren, Brian A. Wrenn and Albert J. Valocchi, Chittaranjan Ray, Lutgarde Raskin, Insitu Bioremediation (2<sup>nd</sup> Ed.) Naves Publ. U.S.A. 1994.
5. Old, R.W., and. Primrose, S.B., “Principles of Gene Manipulation (3<sup>rd</sup> Ed.) “, Blackwell Sci. Publ., Cambridge, 1985.

## **MTE-106 PRINCIPALES OF AIR & NOISE POLLUTION MANAGEMENT**

### **UNIT I : SOURCES OF AIR POLLUTION**

Stationary and mobile, fugitive emissions, secondary pollutants; Effects of air pollution in regional and global scale, air pollution episodes; Emission factors inventory and predictive equations.

### **UNIT II : ATMOSPHERIC METEOROLOGY**

Wind profiles, turbulent diffusion, topographic effects, separated flows, temperature profiles in atmosphere, stability, inversions, and plume behavior.

### **UNIT III : AIR QUALITY MONITORING**

Objectives, time and space variability in air quality; air sampling design, analysis and interpretation of air pollution data, guidelines of network design in urban and rural areas. Stack monitoring. Air pollution standards and indices. Dispersion of air pollutants and modeling, Basic concepts, inversion layer and mixing height, atmospheric stability classes, theory and application of acoustic sounding (SODAR) technique. Boxmodel, The Gaussian dispersion model point, area and line sources. Prediction of effective stack height physics of plume rise, Holland’s equation, Briggs equation, etc. modifications of Gaussian dispersion models; indoor air quality models. Air pollution control devices.

### **UNIT IV: EFFECTS OF AIR POLLUTION AND AIR MONITORING INSTRUMENTS:**

Human health, plants, animals and microbes, archeological monuments and aesthetics, Orsat apparatus, Respirable dust sampler and source monitors.

### **UNIT V: NOISE POLLUTION:**

Basics of acoustics and specification of sound; sound power, sound intensity and sound pressure levels; plane, point and line sources, multiple sources; outdoor and indoor noise propagation; psycho-acoustics and noise criteria, effects of noise on health, annoyance rating schemes; special noise environments: Infra-sound,

ultrasound, impulsive sound and sonic boom; noise standards and limit values; noise instrumentation and monitoring procedure. Noise indices.

## **BOOKS AND REFERENCES**

1. Environmental Engineering – Arcadio P. Sincero and Gregoria A. Sincero, Prentice Hall of India, 1999.
2. Environmental Pollution Control Engineering- CS Rao, Wiley Eastern Ltd., New Delhi, 1996.
3. Environmental Noise Pollution – PE Cunniff, McGraw Hill, New York, 1987.
4. Handbook of Noise Measurement – APG Peterson & EE Gross PH, Englewood cliffs New Jersey, latest edition.
5. Air Pollution Control Equipment – H. Brauer and Y. B. G. Verma, Berlin Heidelberg, New York, latest edition.

## **MTE-107: PRACTICAL COURSE ON ABOVE THEORY COURSES**

1. Calibration and Standardization Techniques
  - a. pH conductivity;
  - b. Nephelometer
  - c. and other water quality monitoring instrument;
2. Determination of pH, acidity-alkalinity,
3. Determination of total suspended solids, total dissolved solids (TDS),
4. Determination of total hardness (TSS) and Ca & Mg hardness,
5. Determination of chloride, sulphate, nitrate,
6. Determination of oil and grease,
7. Determination of DO,
8. Determination of COD,
9. Determination of BOD
10. Soil sampling, description of the soil horizon, determination of soil pH, conductivity and salinity from soil samples
11. Determination of organic carbon, from soil samples
12. Determination of nitrogen and phosphorus; from soil samples
13. Determination of sodium and potassium; CEC from soil samples
14. Study of traditional maps
15. Visual interpretation of earth's features from aerial photographs and satellite images
16. Stereo-photo interpretation
17. Photogrametric computation
18. Preparation of thematic maps in GIS
19. Operation of GPS
20. Drawing flow charts for the computer programs required in solving environmental problems.

## **SEMESTER II**

### **MTE-201: INDUSTRIAL POLLUTION CONTROL**

#### **Unit I: INTRODUCTION**

Industrial scenario – Uses of Water by industry – Sources and types of industrial wastewater – Industrial wastewater disposal and environmental impacts – Reasons for treatment of industrial wastewater – Regulatory requirements – Industrial waste survey – Industrial wastewater generation rates, characterization and variables – Population equivalent – Toxicity of industrial effluents and Bioassay tests – Preventing and minimizing wastes at the source – Individual and Common Effluent Treatment Plants – Joint treatment of industrial wastewater.

#### **Unit II: INDUSTRIAL WATER POLLUTION CONTROL AND TREATMENT**

Sources and characteristics of industrial wastewater, effects on environment. Standards related to industrial wastewater. Waste volume reduction, waste strength reduction, neutralization, equalization and proportioning. Advanced wastewater treatment. Industry specific wastewater treatment for chloro- alkali, electroplating, distillery, tannery, pulp and paper, fertilizer, etc. Treatment technology of coal washery and coke oven effluents. Acid mine drainage: occurrence, effects and treatment technologies. Equalization – Neutralization – Oil separation – Flotation – Precipitation – Heavy metal Removal – Refractory organics separation by adsorption – Aerobic and anaerobic biological treatment – Sequencing batch reactors – High Rate reactors. Chemical oxidation – Ozonation – Photocatalysis – Wet Air Oxidation – Evaporation – Ion Exchange – Membrane Technologies – Nutrient removal – Land Treatment.

#### **Unit III: AIR POLLUTION CONTROL SYSTEM DESIGN**

Review of general principles of air pollution control. Design and operation of gravity settling chambers. Design and operation of cyclones. Design and operation of wet dust scrubbers – column scrubbers, jet scrubbers, vortex scrubbers, rotating disc scrubbers, and venturi scrubbers. Design and operation of fabric filters. Design and operation of electrostatic precipitators design and operation of mist separators- baffled mist separators, pressure separators. Dust control and abatement measures in mines; role of green belts. Control devices for gaseous pollutants with special emphasis on adsorption, absorption, mass transfer, condensation, and combustion. Control of motor vehicle emissions. Indoor air pollution control.

#### **Unit IV: NOISE CONTROL ENGINEERING**

Noise measurement techniques and analysis: Worksite, ambient and road transport. Noise prediction and modelling, noise impact assessment: Scultz Fractional Impact method; Value function curves. Noise abatement measures - Sound absorption,

Acoustic barrier, Vibration Isolation, Vibration damping, Muffling, personal protector and green belt--principles and design considerations. Noise pollution and management in Mines, Washeries, Power plants, Fertilizer plants, Cement plants, etc. Human Vibrationwhole body vibration problems in opencast mines, health effects and control measures. Ground vibration and air blast, Environmental and health effects; strategic control and abatement measures.

#### **Unit V: CASE STUDIES**

Industrial manufacturing process description, wastewater characteristics and waste treatment flow sheet for Textiles – Tanneries – Pulp and paper – metal finishing – Petroleum Refining – Chemical industries – Sugar and Distilleries –Dairy – Iron and steel – fertilizers – Industrial clusters and Industrial Estates.

#### **BOOKS AND REFERENCES**

1. Eckenfelder, W.W., (1999) “Industrial Water Pollution Control”, Mc-Graw Hill.
2. Arceivala, S.J., (1998) “Wastewater Treatment for Poll. Control”, Tata McGraw Hill.
3. World Bank Group (1998)“Pollution Prevention and Abatement Handbook – Towards
4. Cleaner Production “, World Bank and UNEP, Washington D.C.

### **MTE-202: ENVIRONMENTAL IMPACT ASSESSMENT, POLICIES AND AUDIT**

#### **Unit I: INTRODUCTION**

Environmental Impact Assessment (EIA) – Environmental Impact Statement (EIS) – Environmental Risk Assessment (ERA) – Legal and Regulatory aspects in India – Types and limitations of EIA – Terms of Reference in EIA- Issues in EIA – national – cross sectoral – social and cultural.

#### **Unit II: COMPONENTS AND METHODS OF EIA**

Components – screening – setting – analysis – prediction of impacts – mitigation. Matrices – Networks – Checklists. Importance assessment techniques – cost benefit analysis – analysis of alternatives – methods for Prediction and assessment of impacts – air – water – soil – noise – biological – cultural – social – economic environments. Standards and guidelines for evaluation. Public Participation in environmental decision making

#### **Unit III: POLICIES AND QUALITY CONTROL**

Environmental Policies – National and International trends, changes in global perspective, International treaties. Legal provisions for environmental protection; various Acts, Rules and Regulations. Notifications issued under various Acts and Rules. Environmental standards, Criteria for standard setting. Public Liability Insurance Act and Acts relating to hazardous and toxic substances. Trends in EIA practice and

evaluation criteria – capacity building for quality assurance. Expert System in EIA – use of regulations and AQM

#### **Unit IV: AUDIT, DOCUMENTATION AND MONITORING**

Document planning – collection and organization of relevant information – use of visual display materials – team writing – reminder checklists. Environmental monitoring – guidelines – policies – planning of monitoring programmes. Environmental Management Plan. Post project audit.

Notification and guidelines for Environmental audit, scope, applicability and objective of environmental audit; procedure of environmental auditing; water, raw materials and energy balance; hazardous waste audit, safety audit; applicability of statutory environmental audit statement.

#### **Unit V: CASE STUDIES**

Case studies of EIA of developmental projects (Express highway, Petroleum Industry, Dam, etc.)

#### **BOOKS AND REFERENCES:**

1. Canter, L.W., “ Environmental Impact Assessment “, McGraw Hill, New York, 1996.
2. Petts, J., “ Handbook of Environmental Impact Assessment Vol. I and II “, Blackwell Science,London, 1999.
3. The World Bank Group., “ Environmental Assessment Sourcebook Vol. I, II and III “, TheWorld Bank, Washington, 1991.
4. Strategic Environmental Assessment – Riki Therirvel, E.Wilson, S.Thompson, .Heaney, D. Pritchard. Earthscan,London, 1992.
5. Environmental Impact Assessment-Cutting edge for the 21<sup>st</sup> century – Alan Gilpin, CUP, London, 1994.
6. Environmental Impact Assessment-Theory & Practice – Peter Wathern, Unwin Hynman, Sydeny, 1988.
7. A Practical Guide to Environmental Impact Assessment – Paul, A Erickson, Academic Press, 1994.

## **MTE-203: INDUSTRIAL SAFETY, ENVIRONMENTAL HEALTH AND DISASTER MANAGEMENT**

### **Unit I : DISASTER MANAGEMENT;**

Disasters: Natural- Earthquake, flood, volcanic eruption, cyclones, tornado. Manmade- Failure of dams, leakage, explosion, oil-spills and fire of hazardous chemical storage. Leakage in atomic reactor plants. Mining disaster. Monitoring of critical parameters/provide risk-analysis. HAZOP, Consequence Analysis. Fault Tree analysis and Event Tree analysis Emergency Management: Indian and foreign legislation's in respect of the above. Case studies.

### **Unit II : INDUSTRIAL SAFETY**

Organizing for Safety Organizing: Definition, need, nature and principles. Directing for Safety: Direction: Definition, process, principles and techniques, Leadership: Monitoring for Safety, Health & Environment: Occupational Safety, Health and Environment Management System, Bureau of Indian Standards on Safety and Health: 14489 –1998 and 15001- 2000, ILO and EPA Standards.

### **Unit III : ENVIRONMENTAL & OCCUPATIONAL HEALTH:**

Definition: As per WHO. Common Occupational Disease: Occupations involving risk of contracting these disease - mode of causation of the diseases and its effects - diagnostic methods. Biological monitoring - Method of prevention Compensation for occupational diseases. Evaluation of injuries, Occupational Health Management Services at the work place. Lung Function Test on Medspirator, Ear Testing on Audiometer & Demonstration of various models of Audiometer, Bakery Audiometer, BA-3, Arphi. Study of Notifiable Diseases by use of models. Study of various models of lungs (Sections of lungs). Demonstration of medical laboratory equipment such as tetanus vision tester, blood analyser, electrocardiography, etc. Explanation on the charts of Industrial Noise, Notifiable diseases, Physical Health Hazards, Chemical Health Hazards, Industrial Dermatitis, Prevention and Control. Explanation of various notifiable occupational diseases with photographic models. Explanation on the charts of control of noise in industry, noise levels in some industries and permissible level of exposure to noise in industry.

### **UNIT IV : PERSONAL PROTECTIVE EQUIPMENTS**

Personal protective equipments (respiratory and non-respiratory)

### **UNIT V : CASE STUDY ON SAFETY ASPECTS IN INDUSTRIES**

- Safety in chemical industry
- Safety in textile industry
- Safety in pharmaceutical industry
- Safety in food industry
- Safety in mine industry

## **BOOKS & REFERENCES:**

1. Industrial Safety and pollution control handbook: National Safety Council and Associate publishers Pvt. Ltd, Hyderabad(1993).
2. Handbook of Environmental Health and Safety: Herman Koren and Michel Bisesi, Jaico Publishing House, Delhi (1999).
3. Environmental Toxicology and Chemistry: Donald G. Crosby , Oxford University Press, USA (1998).
4. Handbook of Environmental Risk Assessment and Management: Peter Calow, Blackwell Science Ltd. USA (1998).
5. Principals of Environmental Toxicology: Ian C. Shaw and John Chadwick,Taylor and Francis, USA (1998).
6. The Factories Act-1948, Government Printing Press, Civil lines, Delhi (1994).
7. Risk Assessment and Environmental Management: D. Kofi Asvite-Dualy, John Willey & Sons, West Sussex, England (1998).
8. Introduction to Environmental Engineering & Science:Gilbert M. M., Pearson Education, Singapore (2004).

## **MTE-204: SOLID AND HAZARDOUS WASTE MANAGEMENT:**

### **Unit I: NATURE OF SOLID WASTES:**

Definition of solid waste, Industrial mining, Agricultural and domestic (urban) waste, Waste generation in Technological societies, Major legislations, Monitoring responsibilities, Sources & types of solid wastes, Sampling & characterization, Composition of MSW, Storage, Handling & future changes in waste composition

### **Unit II: COLLECTION & TRANSPORT OF SOLID WASTE :**

Collection of solid wastes, Types of solid wastes collection systems, Analysis of collection systems, Alternative Techniques for collection systems, Collection & Transformation of solid wastes, Unit operations used in separating and processing material recovery facility, Need for transfer operations, Transport means and methods, Transfer stations types & design.

### **Unit III: SOLID WASTE DISPOSAL:**

Sanitary landfill- planning, Site selection, Design and operation, Aerobic landfill stabilization, Biological oxidation, Composting, Vermicomposting, Pyrolysis, Incineration & Energy Recovery, Bioremediation Waste categorization, Land reclamation – pre & post project land use planning, Physical, Chemical & Biological reclamations.

### **Unit IV: HAZARDOUS WASTE MANAGEMENT:**

Definition & identification of Hazardous Wastes, Sources & Characteristics of hazardous wastes, Hazardous waste in municipal waste, Hazardous waste regulations & legislations, Minimization of Hazardous wastes, Handling & storage of Hazardous wastes, Landmark episodes.

### **Unit V: HAZARDOUS WASTE TREATMENT:**

Hazardous Waste Treatment technologies, Physical, chemical & thermal methods of stabilizations, Solidification, Chemical Fixation & encapsulation, Incineration of Hazardous waste landfills, Reclamation of Hazardous waste landfill sites.

### **BOOKS & REFERENCES:**

1. Solid wastes : Engineering Principles & Management Issues, Tchobanglous G, Thesien GH, Eliassen R, Mc Graw Hill Int. ED, Singapore, 1977
2. Solid waste management, Montell CL, John Willey, NY, 1975
3. Environmental engineering, Peavy HS, Rowe D R
4. Technobanglus G, Thesien GH, Mc Graw Hill Int. ED, Singapore, 1985
5. Hazardous waste management, Lagrega MD, Buckingham PL, Evans JV, McGraw Hill Int. Ed. NY, 2001
6. Bioremediation Principles, Eweie JB, Ergas SJ, Chang DYP & Schroder ED, McGraw Hill Int. Ed. Singapore, 1988



## **MTE-205: ENVIRONMENTAL GEO-TECHNOLOGY**

### **Unit I : INTRODUCTION**

Introduction to Environmental Geotechniques-Environmental cycles and their interaction-Soil water environment interaction relating to geotechnical problems-Effect of pollution on soil water behavior-Sources, production and classification of wastes-Environmental regulations in India-Case studies of foundation failures by ground contamination.

### **Unit II: SITE SELECTION AND METHOD OF DISPOSALS**

Criteria for selection of sites for waste disposal facilities-parameters controlling the selection of wastes disposal sites-current practices for waste disposal, subsurface disposal techniques-Passive contaminant systems-leachate contamination-applications of geomembrane and other techniques in solid and liquid waste disposal-rigid or flexible membrane liners.

### **Unit III: HYDROLOGY OF CONTAMINANTS**

Transport phenomena in saturated and partially saturated porous media-contaminant migration and contaminant hydrology-Hydrological design for ground water pollution control-Ground water pollution downstream for landfills Bearing capacity of compacted fills-foundation for waste fill ground-pollution of aquifers by mining and liquid wastes-protection of aquifers

### **Unit IV: HAZARDOUS WASTE DISPOSAL**

Hazardous waste control and storage system-Stabilisation /Solidification of wastes-Processes and Functions- Monitoring and performance of contaminant facilities-Environmentally safe disposal of solid and liquid waste

### **Unit V: REMEDIAL MEASURES**

Ground modification techniques in waste fill, Remedial measures for contaminated grounds-Remediation technology-Bio-remediation

### **BOOKS AND REFERENCES:**

1. Wentz,C.A., “ Hazardous Waste Management “, McGraw Hill, Singapore, 1989.
2. Daniel,B.E., “ Geotechnical Practice for Waste disposal “, Chapman and Hall, London, 1993.
3. “ Proceedings of the International symposium of Environmental Geotechnology (Vol.I and Vol.II) “,
4. Environmental Publishing Co., 1986 and 1989.
5. Ott, W.R., “Environmental Indices “, Theory and Practice, Ann, Arbor, 1978.
6. Fried, J.J., “Ground Water Pollution “, Elsevier, 1975.
7. ASTM Special Technical Publication 874, “Hydraulic Barrier in Soil and Rock “, 1985.
8. Westlake, K., (1995), “Landfill Waste Pollution and Control “, Albion Publishing Ltd., England, 1995.

9. Lagrega, M.D., Buckingham, P.L. and Evans, J.B., “ Hazardous Waste Management “,McGraw Hill, Inc., Singapore, 1994

## **MTE-206: NATURAL RESOURCE MANAGEMENT**

### **Unit I: MINERAL RESOURCES EVALUATION AND ITS ROLE IN NATIONAL ECONOMY:**

Methods of evaluation of minerals, rocks, water, soil and fossil fuels. Collection of data, sampling technique and instrumentation, preservation of samples, preparation of thematic and resource maps for rocks, ores and minerals. Quality and feasibility assessment of rocks and minerals for building, decorative, ornamental, and jewellery purposes. Evaluation of medicinal values of minerals.

Principles of mineral economics, significance of mineral resources in national economy, Production, demand, supply and substitution of natural resources in global context. Commercial grade Classification of ore reserves. Ore reserve estimation. Economic evaluation of ore deposit. Preparation of technical report.

### **Unit II: MARINE RESOURCES MANAGEMENT:**

Introduction to marine resources, Factors controlling abiotic resources and their distribution - polymetallic manganese nodules, phosphorites, hydrocarbons, beach placers evaporates, rare metals, corals, pearls and shells. Prospecting and mining of the ocean floor, Management of marine resources, demand, supply and production of marine resources. Policies and acts relating to ocean and land.

### **Unit III: LAND RESOURCE MANAGEMENT:**

Land as a natural resource, biotic and abiotic and their importance in sustainable developments. Classification of lands - techniques of terrain evaluation. Land use and land cover classification, Study of soils, their uses, components and profiles. Physical chemical and engineering properties of soils and classification of soils. Soil erosion and preventive measures.

### **Unit IV: WATER RESOURCE MANAGEMENT:**

Importance of water management, Concept of planning and design of percolation tanks, dry land farming and water management, watershed management and watershed programmes. Methods of rainwater harvesting and techniques, necessity of planned water supplies. Planning and execution of modern water supply schemes, India's water budget, demand and supply, state and central policies, acts and taxation system, water dispute and case studies.

### **Unit V: FOREST AND AGRICULTURE STUDIES:**

Crop type classification, area estimates, and spectral response of different crops. Crops diseases and Assessment, Crop and Water management and monitoring. Advances in Crop monitoring by RS, Soil Survey and mapping, soil conservation and watershed management Landuse/Landcover mapping and planning, Geomorphology in soil survey and mapping soil erosion, case studies.

### **BOOKS & REFERENCES:**

1. Introduction to oceanography. H.V. Thurman
2. Hand book of subsurface geology - C.A.Moore
3. Principles of Geomorphology - Thornburry
4. Petroleum stratigraphy - R.L.Breuner
5. World oil energy economics - H.A.,Kerklelin
6. Geology of petroleum - A.I.Levorsen.
7. Landform - Shall (1991).
8. Mining methods - R.N.P. Arogyaswamy

9. Introduction to India's economic minerals - Sharma, N.L. & Ram . K.S.
10. Non Fuel mineral deposits of India 1999: Mukerjee., Allied Publ.
11. Ground water hydrology - DK Todd
12. Hand Book of applied Hydrology - Ventechow
13. Hydrology - Davis and Dewiest

### **MTE-207:PRACTICAL COURSE ON ABOVE COURSES**

1. Demonstration of air pollution monitoring instruments; Calibration of HVS by orifice method;
2. Determination of SPM; PM10; Respirable dust monitoring
3. SO<sub>2</sub>; NO<sub>x</sub> and CO in ambient air;
4. Determination of chlorine demand, break-point chlorination and
5. free residual chlorine;
6. Na and K in sewage sample, wastewater and natural water;
7. Determination of Nitrate-nitrogen (NO<sub>3</sub>-N) concentration in domestic sewage, wastewater, surface water sample and underground water sample.
8. Determine chloride, acidity and alkalinity of raw sewage, wastewater, natural surface water and compare the results
9. MLSS and MLVSS. Sludge Volume Index (SVI) and development of sludge settling characteristics curve and design of PST based on settling curve.
10. Determine TS, TSS, TDS and settle able solids in domestic sewage.
11. Calculation of inorganic and organic portions. Determination of BOD<sub>5</sub>: TKN ratio and comment on the treatment process for biological removal of nitrogen. Derive the COD:BOD<sub>5</sub> ratio and use the same data for BOD<sub>5</sub>:TKN ratio estimation.
12. Jar-Test of filtered domestic wastewater and determination of optimum dose on the basis of COD and turbidity removal.
13. Computer programming for determination of wind profile.
14. Demonstration of UV-VIS spectrophotometer, Flame photometer, AAS, GC, TOC etc.
15. Bacteriology of drinking water and MPN techniques for total coliform; faecal coliform
16. Bacteriology of domestic sewage MPN techniques for total coliform; faecal coliform
17. Membrane filtration techniques for faecal coliform and total coliform
18. Microbiology of Air: by exposure plate method;
19. Use of nutrient agar medium, enumeration and identification of fungal mycelium and spores;

20. Microbiology of soil- Heterotropic bacterial counts by colony counter

### **SEMESTER III**

#### **MTE-301:SEMINARS AND INDUSTRIAL VISITS**

- Seminars on recent topics in environment management.
- Industrial visits to study the process and sources of waste generation and waste management.

#### **MTE-302**

The project pertaining to pollution control / safety audit / EIA / environmental audit / resource management can be under taken by the student.

### **SEMESTER IV**

#### **MTE-401: DISSERTATION & PROJECT WORK**

On the completion of project work each student has to submit for examination, a dissertation embodying the results of the research work carried out by him / her. The viva – voce examination will be conducted by the Board of Examiners to be constituted by CMJ University.