

**Course Structure and Syllabi for
M. Tech. (Environmental Engineering)**



**National Institute of Foundry & Forge Technology
Hatia, Ranchi - 834 003 (Jharkhand)**

FIRST YEAR FIRST SEMESTER

Course No.	SUBJECT	L	T	P	Credits
ENE-111	Advanced Numerical Methods and Applied Statistics	4	0	0	4
ENE-112	Water Supply and Treatment	3	0	2	4
ENE-113	Environmental Chemistry	3	0	2	4
ENE-114	Air Pollution and Noise Pollution	3	1	0	4
ENE-115	Environmental Policies, Laws and Impact Assessment	3	1	0	4
ENE-116	Elective – I 3-0-2=4/	3	1	0	4
ENE-116(a)	Instrumental Techniques in Environmental Science and Engineering	3	0	2	4
ENE-116(b)	Environmental Ecology and Microbiology	3	1	0	4
ENE-116(c)	Energy conservation and Environment	3	1	0	4
TOTAL					24

FIRST YEAR SECOND SEMESTER

Course No.	SUBJECT	L	T	P	Credits
ENE-121	Solid and Hazardous Waste Management	3	1	0	4
ENE-122	Waste Water Engineering	3	0	2	4
ENE-123	Air Pollution Control Technologies	3	0	2	4
ENE-124	Risk Analysis and Disaster Management	3	1	0	4
ENE-125	Remote Sensing and GIS	3	0	2	4
ENE-126	Elective – II 3-0-2=4/	3	1	0	4
ENE-126(a)	Thermal and Noise Pollution control Eengineering	3	1	0	4
ENE126(b)	Environmental System modelling	3	1	0	4
ENE126(c)	Geoenvironmental Engineering	3	1	0	4
ENE-126(d)	land Reclamation and Planning	3	1	0	4
E-127	Departmental Seminar				2
TOTAL					26

SECOND YEAR THIRD SEMESTER

Course No.	SUBJECT	L	T	P	Credits
ENE-231	Seminar				2
ENE-231	Inplant training / Mini project				3
ENE-232	End semester presentation on dissertation				8
TOTAL					13

SECOND YEAR FOURTH SEMESTER

Course No.	SUBJECT	L	T	P	Credits
ENE-241	Comprehensive viva-voce				2
ENE-242	Dissertation evaluation				15
TOTAL					17

TOTAL**80**

FIRST YEAR FIRST SEMESTER

ENE-111 Advanced Numerical Methods and Applied Statistics (4-0-0)

Advanced Numerical Methods: Review of solution of system of linear simultaneous equation. Solution of tridiagonal system, III conditioned system and iterative method to improve accuracy of an III conditioned system. Evaluation of double and triple integrals by numerical method and its application, solution of non-linear simultaneous equations, numerical solution of integral equations, Advanced method of interpolation, Spline interpolation, Numerical solution of simultaneous first order ordinary differential equations (ODE) and higher order ODE. Initial and Boundary value problems, Numerical solution of partial differential equations: Laplace and Poisson equation, Introduction of finite element methods and finite different method.

Statistics: Review of binomial, negative binomial, Poisson, normal and log normal distributions. Tests of significance for mean, variance, correlation and regression coefficients. χ^2 -test for goodness of fit, attributes and contingency table, F-test, test of proportions, tests of significance under large sample approximations.

Books and References

1. Numerical Methods for Scientific & Engg. Computation - MK Jain, SRK Iyenge and RK Jain, 1999.
2. Numerical Methods for Mathematics, Science and Engineering - John H Mathews 2000.
3. Applied Numerical Analysis - CF Gerld and PO Wheatley, 2002.
4. Fundamentals of Applied Statistics – S.C. Gupta and V. K. Kapoor, Sultan Chand & Sons, 2002.
5. Miller & Freunds's Probability and Statistics for Mngineers (fifth edition) - Richard A. Johnson.
6. Numerical Methods in Science & Engineering (A Practical Approach),S.Rajeshwaran, Willey Publication.

Ene-112 Water Supply (3-0-2)

Water Resources and Water Supply - Introduction; Rainfall and Run-off; Aquifers properties and ground water flow; Hydrological characteristics of aquifers, porosity, permeability, transmissivity, specific retention, diffusivity. Laws of ground water movement, Darcy's law. Collection basic, design and distribution of Water; Quality of Supply Water . Effect of Pollutants on water quality, water pollution sources, self- purification of water, Basic Principles of water treatment. Primary treatment- screening, equalization, neutralization, coagulation, settling basins - types. Operation. Practical consideration. Filtrations- Sand filter, pressure filter, Multilayer filter, Floation principle, practice and design, oil and grease separation, biological treatment, process. Oxidation ditch- Design

and operation, principle and practice of aeration-surface and diffused aeration water Pollution modeling.

Books and References

1. Water Resources Engineering – Larry W Mays, Wiley Text Books, 2000.
2. Water Quality and Treatment Handbook -American Water Works Association, McGraw-Hill Pub. 1999.
3. Water Treatment plant Design – American Society of Civil Engineering, McGraw-Hill Publisher, 1997.
4. Water Supply and Sewerage - Steel and McGhee, McGraw Hill NY, latest ed.
5. Manual of Water Supply and Treatment (3rd ed) - Ministry of Urban Development, New Delhi, 1991.
6. Environmental Engineering - HS Peavy, DR Rowe and G Tchobanoglous, McGraw-Hill Int. Ed., Singapore, 1985.

ENE-113 Environmental Chemistry (3-0-2)

Environmental Chemistry of Water: The principles and application of aqueous chemistry to the environmental systems. Unique properties of water, Water quality parameters: physico-chemical, biological, bacteriological; Xenobiotics, Water quality criteria and standards; water quality monitoring and management aspects, Chemical methods involved in treating water and wastewater. Removal of dissolved organics and inorganics. Heavy metal pollution and its abatement. Natural water pollution: eutrophication; Detergents and phosphates; Removal of nitrogen and phosphates; Water disinfection.

Atmospheric Chemistry: Structure and properties of atmosphere, Classification and chemistry of major air pollutants and their control. Types and sources of air pollution-natural, combustion and other combustion sources. Thermodynamics and kinetics of air pollutants. Atmospheric photochemistry, chemical and photochemical reactions in atmosphere. Atmospheric pollution due to automobile emissions and its control, smogs, PAH, VOCs, Acid rain, Depletion of stratospheric ozone. Control devices for gaseous pollutants with especial emphasis on adsorption, absorption, mass transfer, condensation, and combustion.

Soil Chemistry: The nature and importance of soil; soil in the natural and man-made environment, soil properties; Acid-Base and Ion-exchange reactions in soils. Macro- and micro-nutrients. Fertilizers and other soil amendments. Waste and pollutants in soil, Heavy metals and radionuclides in soil. Colloidal chemistry of inorganic constituents, clays; Organic matter and soil humus, absorption in soils - forces and isotherms; soil as cation and anion exchanger; degradation of natural substances; remediation of metal contaminated soil.

Books and References

1. Environmental Chemistry - Stanley E. Manahan, 5th Ed., Lewis Publishers, 1995.

2. Chemistry for Environmental Engineering and Sciences (5th Ed) - CN Sawyer, PL McCarty and GFParkin, Tata McGraw-Hill ed., New Delhi, 2003.
3. Aquatic Chemistry -W.Stumm & JJ Morgan, John Wiley & Sons, Inc, 3rd Ed., NY-1995.
4. Water Chemistry - V.L.Snoeyine and D.Jenkins, John Wiley and Sons, Inc, NY-1980.
5. Principles and Application of Aquatic Chemistry - FMM Morel & JG Hering, John Wiley & Sons, Inc, NY,1993.

ENE-114 Air and Noise Pollution (3-1-0)

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 predictions.

Atmospheric meteorology, wind profiles, turbulent diffusion, topographic effect, separated flows, temperature profiles in atmosphere, stability, inversions, plume behavior.

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 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, Box model, The Gaussian dispersion model point, area and line source, Features and application of regulatory models, e.g., screening model, FDM, ISCST-3, Caline-4 and AERMOD Models.

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.

Noise Pollution: Basics principle of noise pollution; sound power, sound intensity and sound pressure levels; plane, point and line sources, multiple sources; outdoor and indoor noise propagation; 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.

Book 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 Hil, 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.
6. Environmental Pollution Control Engineering , C.S.Rao, New Age International.

ENE-115 Environmental Policies and Impact Assessment (3-1-0)

Environmental Policies- National and International; International treaties, Carbon management- Kyoto Protocol and Clean Development Mechanism (CDM), Carbon Neutrality.

Environmental Legislations-Acts, Rules, Regulations and Notifications. Environmental standards, Criteria for standard setting.

Framework for EIA; Screening, Scoping, and baseline studies; Techniques fro assessment of impacts on physical resources, human use values and quality of life value.

Impact assessment methodologies – various methods, their applicability. Strategic Environmental Assessment. Cumulative impact assessment. Risk and uncertainty in EIA; Environmental Management Planning; Disaster management planning.

Environmental audit, objectives, types, features, planning of audits; Organisation of Audition Programme, pre-visit data collection. Audit Protocol; Onsite Audit; Data Sampling- Inspections- Evaluation and presentation; Exit interview; Audit Report- Action Plant- Management of Audits; Waste Management Contractor Audits. Life Cycle Approach.

Introduction and Formulation of ISO Guidelines in Environmental Management Systems; ISO 14001 Series, Principles; Accreditation Process, Environmental Auditor Criteria, Benefits of EMS; Aspect-Impact Analysis, Continual Improvement, Environmental Performance, Environmental Policy, Vision and Mission Objective and Target Environmental Management Planning, Implementing EMS, Plan-Do-Check-Act (PDCA), Preventive and Corrective Action, Internal and External Audits, Documentation, Roles and Responsibilities, Management Reviews & Improvements; Legal and Regulatory Concerns; Integrating ISO 9000 & ISO 14000. Preparation of ISO Manuals for Industry; Integrating ISO 9000, ISO 14001 and OHSAS 18001; Case Studies

Quality Assurance (QA) and Quality Control (QC). Life Cycle Approach. OHSAS 18001.

Book and References:

1. Environmental Impact Assessment – Larry, W. Canter (2nded), McGraw Hill Inc. Singapore, 1996.

2. Strategic Environmental Assessment – Riki Therirvel, E. Vilson, S. Thompson, D. Heaney, D. Pritchar. Earthscan, London, 1962.
3. Environmental Impact Assessment- Cutting edge for the 21st century-Alan Gilpin, CUP, London, 1994.
4. Environmental Impact Assessment- Theory & Practice- Peter Wathern, Unwin Hynman, Sydeny, 1988.
5. Renewable Energy Environment and Development – Maheswar Dayal Konark Pub. Pvt. Ltd.. 1998.
6. Planning and Implementation of ISO14001, Environmental Management System- Girdhar Gyani & Amit Lunia Raj Publishoing House, Jaipur, 2000.
7. ISO 14001 Auditing Manual Gayle Woodside and Patrick Aurrichio, McGraw-Hill.
8. An Introduction to Environmental Audit, R. D. Tripathi, Alpha Publications, 2009.
9. “The ISO:14000 Handbook” Joseph Caseio (Ed), Published – CEEM Information Services. 2000
10. INSIDE ISO:14000 The Competitive Advantage of Environmental Management- Don Sayre, Vinity Books International, New Delhi, 2001.
11. A Guide to the Implementation of the ISO: 14000 Series on Environmental Management Ritchie, I and Hayes W, Prentice Hall, New Jersey, 1998.
12. OHSAS & SA Guidelnes.

ENE-116 Elective – I

ENE116(a) Instrumental Techniques in Environmental Science and Engineering (3-0-2)

Treatment of data in quantitative analysis: Accuracy, precision, standard deviation, and types of errors, minimization of error, significant figures, criteria for rejection of data.

Principles of instrumentation; advantages, calibration of instruments, applications, and limitations of the following analytical techniques: Spectrochemical methods: spectrophotometry, FTIR, NMR, atomic absorption and emission spectrophotometry, flame photometry, fluorimetry, nephelometry, Inductively coupled plasma spectrometry and MS.

Electrochemical methods: Polarography, pulse polarography, Ion selective electrodes oscilloscopic polarography, cyclic voltametry, anodic stripping voltametry.

Chromatography: Classification, general ideas about adsorption, partition, and column chromatography, paper and thin layer chromatography. Gas chromatography (GC), High performance liquid chromatography (HPLC), Ion chromatography.

Physical and biological methods of monitoring.

Books and References:

1. Instrumental Methods of Analysis - HH Willard & LL Dean, John Wiley, 1976.

2. Modern Methods of Chemical Analysis – RL. Recsok & LD Shields, John Wiley & sons, Inc, 1990.
3. Instrumental Methods of Chemical Analysis -GW Ewing, McGraw Hill Book Company, Inc. 1975.
4. Modern Methods of Chemical Analysis - RL Pecsok & LD Shields, John Wiley & Sons, Inc. 1986.
5. Fundamentals of Molecular Spectroscopy - CN. Banwell, McGraw Hill, NY, 1990.

ENE-116(b) Environmental Ecology and Microbiology (3-1-0)

Ecology and Ecosystem; Ecosystem stability -inertia and resilience. Fragile ecosystem. System ecology. Energy flow in ecosystem; productivity; ecological efficiency; Bio-geo-chemical cycles; Limiting factors; Population ecology; Community ecology; ecological niche and ecotone. Ecological successions. Biological diversity and indices. Aquatic ecology. Wetland, marine and estuarine ecosystem. Biological conservation. Ecotoxicology. Toxic units. WWF models. Eutrophication: kinetics, indicators, control, phosphorous model. Pesticides and bio-accumulation. Models in Ecology.

Microbiology: Classification of microorganisms, Prokaryotic and Eukaryotic cells; general properties, distribution of microbes, applied fields of microbiology. Enumeration of microbes. Bacteria - cell structure, spore, morphology, classifications and reproductions. Environmental importances of Fungi, Algae, Protozoa, Actinomycetes and viruses. Growth of bacteria, batch culture; specific growth rate and doubling time; continuous culture; synchronous growth. Effects of environmental factors on growth. Control of microbes by physical agents and chemical methods. Bacterial nutrition; culture media and culture characteristics. Microbial metabolisms; Monod and Halden kinetics. aerobic and anaerobic respiration. stream pollution; drinking water microbiology; water borne pathogens, MPN test; faecal coliform and faecal streptococci, MF techniques, IMVIC test; Composting; Aeromicrobiology; Soil microbiology - biofertilizer, VAM fungi, N-fixations, degradation of natural substances.

Books and References:

1. Fundamentals of Ecology (3rd ed). Eugene P. Odum. WB Sanders Company, Philadelphia (1971).
2. Fundamentals of Ecology- MC Dash. Tata-McGraw Hill, New Delhi (1996).
3. Introduction to Environmental Engg. – G.M.Masters. Prentice Hall of India (1991).
4. Microbiology - Michael J.Pelzer et.al., (5th ed), Tata McGraw Hill, New Delhi (1993).
5. Microbiology for Environmental Scientists and Engineers -Gaudy, AF and Gaudy, ET MGH, New York (1980).
- 6.

ENE-116(c) Energy Conservation and Environment (3-1-0)

Inter linkages of energy and environment.

Principles of energy conversion methods: thermal, nuclear, hydro, solar.

An introduction to fuels, combustion fundamentals, thermodynamics, kinetics and properties of combustion products; combustion principles for gases, liquids and solids.

Formation of pollutants, measurements and control.

Automobile engines, operation and design, emissions. power production and emissions from waste incineration.

Energy policies, economics related to energy along with cost factor, the renewable energy sources and conversion processes and sustainable energy.

Energy externalities, Energy and climate change global issues.

Alternative energy sources (BioGas Plant)-Waste Utilization economics, sustainability.

Basic of CDM life cycle assessment and Green Production Assessment. Energy Saving and recycling.

Books and References

1. International Energy Markets: Understanding Pricing, Policies and Profits by Carol A.Dahl, PennWell Corporation (2004) ISBN: 978-0-87814-799-1.
2. Energy: Technology and directions for the future by John R. Franchi, Elsevier Academic Press (2004). ISBN: 0-12-248-291-3.
3. Principles of Sustainable Energy by Frank Keith and Jan F Kreider, CRC press (Taylor and Francis group) (2011), ISBN: 978-1-4398-1407-9.
4. Energy Economics: A Modern Introduction by Ferdinand E Banks. Kluwer Academic Publishers. 2nd ed. (2003), ISBN: 0-7923-7700-1.
5. Flagan, R.C., Seinfeld, J.H., Fundamentals of Air Pollution Engineering, Prentice Hall, New Jersey, 1988.
6. Kanury, A.M., Introduction to Combustion Phenomena, Gordon and Breach Science Publishers, New York, 1992.

FIRST YEAR SECOND SEMESTER

ENE-121 Solid and Hazardous Waste Management (3-1-0)

Solid and Hazardous Waste Management: Municipal solid waste management: Engineering principles; Sources, nature and characteristics; quantitative and qualitative; Solid waste problems: Industrial, mining, agricultural and domestic (urban) wastes. Hydrologic aspects of solid waste. Regulatory aspects of solid waste management.

Solid waste disposal: Sanitary landfill planning, site selection, design and operation, equipment, costs, Aerobic landfill stabilization. Biological oxidation. Composting, optimum conditions for composting

Pyrolysis; Incineration(Design & principles) - waste characterization, combustion calculation, unit operations, supply of air, products of combustion, furnace temperature, furnace calculation, storage of refuse, waste reduction and environmental control.

Biomedical waste categorization, generation, collection, transport, treatment and disposal.

Hazardous waste – landmark episodes, classification, generation. Guidelines for HWM. Regulatory framework in the USA, EU and India, Basal Convention and other international statistics. Treatment and disposal; remediation of contaminated sites.

Books and References

1. Solid Waste: Engineering Principles & Management Issues- G.Tchobanoglous, GH. Theisen & R. Eliassen, McGraw Hill Int. Ed. Singapore, 1977.
2. Environmental Engineering - HS Peavy, DR Rowe & G Tchobanoglous, McGraw-Hill Int. Ed., Singapore, 1985.
3. Quarry Reclamation - NJ Coppin and A.D.Bradshaw, Mining Journal Books, London, 1982.
4. Hazardous Waste Management (2nd ed) - Lagrega, MD, PL Buchingham & JC Evans, McGraw Hill, NY, 2001.
5. Bioremediation Principles – Eweis, JB, Ergas SJ, Chang DYP and Schroeder ED, McGraw-Hill, Singapore, 1998.

ENE-122 Waste Water Treatment (3-0-2)

Sewage characteristics, Quantity and 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.

Wastewater treatment for small communities - Oxidation ditch, extended aeration system, SBR; Process design and operation of mechanically aerated lagoon and Waste stabilization pond system.

Design and operation of biological nitrification - denitrification system; luxurious phosphorus uptake.

Aerobic attached growth process - Process design and operation of trickling filter, RBC, Biofilter.

Anaerobic treatment: process microbiology and biochemistry; application for treatment of sewage, advantage and disadvantages.

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.

Industrial Water Pollution Control: 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.

Books and References:

1. Wastewater Engineering: Treatment, disposal, Reuse - Metcalf & Eddy Inc.4th 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, 2nd 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, 2nd Edition, NY 1989.

ENE-123 Air Pollution Control Technologies (3-0-2)

Air Pollution standards,Particulate Pollutant Control: Settling chambers – laminar and turbulent flow; Filtration – interception; Impaction; Convective diffusion; Collection of particles by cylindrical fibres and granular beds; Electrostatic precipitation – field and diffusion charging; Electrical migration velocity; Cyclones – laminar and turbulent flow; Wet collectors; Design and drawing of various particle control devices.

Gaseous Pollutant Control: Gas absorption in tray and packed towers; Stage efficiency; Liquid/gas rates; Equilibrium number of stages/packed height; Absorption with/without chemical reaction; Adsorption in fixed beds; Wet scrubbers; Condensation and combustion; Design and drawing of various pollutant control devices.

Control of specific pollutants: Control technologies for removal of SO₂, NO_x, VOC.

Control technologies for motor vehicles.

Books and References:

1. McCabe, W. L., Smith, J.C., and Harriott, P. W. L., Unit Operations of Chemical Engineering, McGraw Hill, New York, 1993.
2. Buonicore, A.J., and Davis, W.T., Air Pollution Engineering Manual, van Nostrand-Reinhold, New York, 1992.
3. Flagan, R.C., and Seinfeld, J.H., Fundamentals of Air Pollution Engineering, Prentice Hall, New Jersey, 1988.
4. Reynolds, J.P., Jeris, J., and Theodore, L., Handbook of Chemical and Environmental Engineering Calculations, Wiley Interscience, New Jersey, 2007.
5. Mycock, J.C., McKenna, J.D. and Theodore, L., Handbook of Air Pollution Control Engineering and Technology, CRC, LEWIS Publishers, Boca Raton, Florida, 1995.
6. Cooper, C.D., and Alley, F.C., Air Pollution Control – A Design Approach, Waveland Press Inc., Prospect Heights, IL, 1986.

ENE-124 Risk Analysis and Disaster Management (3-1-0)

Hazards- Physical hazards and health hazards- Evaluation, Legislation, Regulations, Standards, Risk management-Toxic Pollutants- Transport in the body, Dose and response, Threshold limit values,. Hazardous mixtures and permissible exposure levels. Personal protective, Protection and management.

Fire Hazard - Materials, identification fire control and management, Noise hazards and control, Radiation hazard and control, container and Spill management, Electrical hazards and safety management, Explosive hazards control and management, Dust explosion, Combustion explosion, Pressure vessel explosion, Chemical reactor explosion. Disaster prevention management, System safety analysis in process design, Failure modes and effect analysis, equipment and system analysis, Fault free analysis, Event free analysis, Safety audit analysis, computerized safety data system management,- Industrial application of hazard and disaster management in Foundry, Forge and other manufacturing industries.

Books and References:

1. Standard Handbook of Hazardous Waste Treatment and Disposal, Freeman, HW, McGraw Hill, NY, 1989.
2. Hazardous Waste Management Engineering, Martin EJ and Johnson JH, Van Nostrand-Reinhold, NY, 1987.
3. Hazardous Waste Management (2nd ed) Wentz, CA, McGraw Hill, NY, 1995
4. Solid Waste Management Mantell, CL, John Wiley, NY, 1975.

ENE-125 Remote Sensing and GIS (3-0-2)

Introduction, Types, Application and Importance of Remote Sensing; Physics of Remote Sensing; The Electromagnetic spectrum; Spectral Reflectance Curves; Spectral Signatures; Resolutin.

Remote Sensing Platforms: Gound, airborne and satellite based platforms; Some important Remote Sensing Satellites.

Sensors: Passive and Active Sensors; Major Remote Sensing Sensors; Satellite band designations and principal applications; Colour/False Colour, Aerial Photography/Aerial Photo Interpretation.

Digital Image Processing: Pixels and Digital Number; Digital Image Structure; Format of Remote Sensing Data;

Image Processing functions: Image Restoration, Image Enhancement, Image Transformation, Image Classification and Analysis; Image Interpretation strategies.

Geographic Information System; Introduction; Preparation of thematic map from remote sensing data; Co-ordinate systems; GIS components; Hardware, software and infrastructures; GIS data types: Data input and Data Processing; DEM/DT, generation.

Integration of GIS and Remote Sensing Application of Remote Sensing and GIS Water resources Urban Analysis Waterhed Management Resources Information Systems.

Global Positioning System an introduction.

Books and References:

1. Remote Sensing and GIS- Anji Reddy M., The Book Syndicate, Hyderabad, 2000.
2. Principles of Geographical Information Systems-P A Burrough and R. A. McDonnell, OUP, Oxford, 1998.
3. Remote Sensing for Earth Resource – Rao, D.P., AEG Publication, Hyderabad, 1987.
4. Geographic Information System- Kang Tsung Chang, Tata Mc Graw Hill, Publication Edition, 2002.

ENE-126 Elective – II

ENE-126(a) Thermal and Noise Pollution Control Energy (3-1-0)

Thermal pollution sources and effect ,control of thermal pollution,standards and case history.

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 Vibration- whole body vibration problems in open cast mines, health effects and control measures.

Ground vibration and air blast, Environmental and health effects; strategic control and abatement measures.

Books and References:

1. Industrial Noise Control and Acoustics – Randall F Barron, Marcel Dekker, Inc., New York, 2003.
2. Engineering Noise Control: Theory and Practice – David Bies et. al., Routledge Publishers, 2003.
3. Vibrations – Balakumar Balachandran and Edward B. Magrab, Thomson Asia Pte. Ltd., Singapore, 2003.
4. Vibrations from Blasting – by David Siskind, 2000.
5. Noise control: Principles and Practice - Bruel & Kjaer, 2nd ed. B & K Pub., Denmark, 1986.

ENE-126(b) Environment System Modelling (3-1-0)

Definition; Classification; Examples of models for environmental systems.

Introduction to air quality models; Meteorology; Atmospheric stability and turbulence; Gaussian plume model and modifications; Numerical models, Urban diffusion models, Calibration and sensitivity analysis; Applications of public domain models and software, Global radiation balance and climatic changes.

Transport and fate of pollutant in aquatic systems; Introduction to river, estuarine and lake hydrodynamics; Stratification and eutrophication of lakes; Dissolved oxygen model for streams; Temperature models.

Transport and fate of pollutants in soils and ground water; Utility of environmental models for forecasting.

Applications of standard environmental soft wares

Books and References

1. Seinfeld, J.H., and Pandis, S.N., Atmospheric Chemistry and Physics, John Wiley and Sons, Inc., New York, 1998.
2. Schnoor J.L., Environmental Modelling, Inter Sc. Publ., 1996.
3. Boubel, R.W., Fox, D. L., Turner, D. B., and. Stern, A.C., Fundamentals of Air Pollution, Academic Press, New York, 1994.
4. Thomann, R.V., and Muller, J.A., Principles of Surface Water Quality Modelling and Control, Harper International Edition, N.D., 1987.

5. Tchobanoglous, G., Schroeder, E.D., Water Quality, Addison – Wesley Publishing Company, Reading, Massachusetts, 1987.

ENE-126(c) Geoenvironmental Engineering (3-1-0)

Geo-environmental Engineering – Effect and Control, Genesis, Coal ash and their engineering properties, Introduction & design of tailing pond and waste pond, Contamination of slurry waste, Vertical barriers of contaminants, Geotechnical reuse of waste material, Use of geo-synthetic material in ground water pollution control, Disposal: Slurry deposition of tailing Sitting layout, Sub aerial and sub aqueous deposition, Tailings pounds and their stability. Tailing as back fill, Tailing dams and Ash embankments: Design, construction and operation of tailings dams and ash embankments and ash ponds. U/s, D/s and Centre line methods Aspects of slope stability and seepage control, River bank filtration.

Books and References:

1. Geotechnical Engineering, S. K. Gulhati, M. Dutta, Tata Mc. Graw Hill Co
2. Environmental Geotechniques, Robert Sarshy, Thomas Telford Books
3. The nature and Properties of Soil, Nyle c Brandy, Eurasian Publishing House (P) Ltd.
4. Basic and Applied Soil Mechanics II Edition, Gopal Ranjan and A.S.R. Rao, New Age Publishers.
5. Hydrology – H.M. Rangunath, Wiley Eastern Limited, 1990

ENE-126(d) Land Use & Reclamation

Introduction to Environmental geology. Reclamation planning -pre-project land use models planning, post project land use monitoring; physical reclamation-regrading and recon touring, terracing, slope preparation, segregation and burial of toxic substances, reclamation alternatives, reclamation equipment, scheduling and costs.

Factors affecting plant establishment. Soil characteristics: physical, chemical and biological; soil amendments; selection of species, ecological succession theory, top soil conservation, mine spoil evaluation, nitrogen fixation, mycorrhiza, financial aspects of reclamation.

Current bioremediation practice and application; factors influencing bioremediation, bioremediation system and process, In situ bioremediation.

Books and References:

1. Quarry Reclamation - NJ Coppin and A.D. Bradshaw, Mining Journal Books, London, 1982

2. Hazardous Waste Management (2nd ed) - Lagrega, MD, PL Buchingham & JC Evans, McGraw Hill, NY, 2001.
3. Bioremediation Principles – Eweis, JB, Ergas SJ, Chang DYP and Schroeder ED, McGraw-Hill, Singapore, 1998.