

M.TECH. (ENVIRONMENTAL ENGINEERING)

Ist Semester					
SUBJECT CODE	SUBJECT	L	T	P	C
MAT 507	COMPUTATIONAL METHODS & OPTIMIZATION TECHNIQUES	3	1	0	4
CIE 521	ADVANCED WATER AND WASTE WATER TREATMENT	3	1	0	4
CIE 523	APPLIED ENVIRONMENTAL CHEMISTRY & MICROBIOLOGY	3	1	0	4
CIE 525	AIR AND NOISE ENVIRONMENT	3	1	0	4
CIE 527	SOLID AND HAZARDOUS WASTE MANAGEMENT	3	1	0	4
HSS 501	RESEARCH METHODOLOGY AND TECHNICAL PRESENTATION	1	0	3	2
CIE 531	ADVANCED ENVIRONMENTAL ENGINEERING LABORATORY	0	0	6	2
TOTAL		16	05	9	24
IIND SEMESTER					
CIE 522	ECOLOGY AND ENVIRONMENTAL IMPACT ASSESMENT	3	1	0	4
CIE 524	INDUSTRIAL WASTE WATER TREATMENT	3	1	0	4
CIE ***	PROGRAM ELECTIVE I	3	1	0	4
CIE ***	PROGRAM ELECTIVE II	3	1	0	4
CIE ***	PROGRAM ELECTIVE III	3	1	0	4
*** **	OPEN ELECTIVE	3	0	0	3
CIE 532	COMPUTER LABORATORY	0	0	6	2
CIE 514	SEMINAR	0	0	3	1
TOTAL		18	05	09	26
IIND YEAR					
CIE 669	PROJECT WORK	0	0	0	40
Total					90

ELECTIVE COURSE – 1

CIE 572 REMOTE SENSING AND GIS IN ENVIRONMENTAL ENGINEERING
CIE 573 TRANSPORT PROCESS AND MODELING IN AQUATIC SYSTEM.
CIE 574 EARTH AND ENVIRONMENT

ELECTIVE COURSE – 2

CIE 575 ENVIRONMENTAL QUALITY AND POLLUTION MONITORING
TECHNIQUES
CIE 576 ENVIRONMENTAL MANAGEMENT
CIE 577 DISASTER MANAGEMENT

ELECTIVE COURSE – 3

CIE 578 MEMBRANE PROCESS FOR WATER AND WASTE WATER
TREATMENT
CIE 579 OCCUPATIONAL SAFETY AND HEALTH
CIE 580 REUSE, RECYCLE AND GREEN TECHNOLOGY

OPEN ELECTIVE

CIE 554 ADVANCED STRENGTH OF MATERIALS
CIE 556 NON - DESTRUCTIVE TESTING OF MATERIALS
CIE 558 ENERGY AND ENVIRONMENT

I SEMSTER

MAT 507 COMPUTATIONAL METHODS AND OPTIMIZATION TECHNIQUES [3 1 0 4]

Statistics and Probability: Frequency Distribution - Characteristics of Distributions: Central Tendency and Dispersion, Concepts of Probability- Binomial, Poisson and Normal Distribution - Applications - Method of Least Square and Regression -Multiple Regression -The Chi- squared test, F test, t-test. Analysis problems using Computer Programming.

Numerical Methods: Newton - Raphson method for solution of simultaneous equations. Numerical solutions of partial differential equations. Finite difference, Finite element method and method of characteristics. Explicit and implicit methods to solve simple parabolic differential equations, convergence, Boundary value problems and successive over relaxation methods.

Optimization: Definition and classification of optimization problems. Its importance in Environmental Studies. Single and multivariable optimization without and with constraints.

Linear Programming - standard form of problems - pivotal reduction of equations. Single and Two phase simplex methods. Piece wise linear approximation of non - linear optimization.

Numerical search methods for 1-D Non - linear problems - Dichotomous, Fibonacci and Golden section methods. Quadratic and cubic interpolation methods, Solutions of linear programming problems using computer programming.

References:

1. Antony Raiston Philip Rabinowitz - A First Course in Numerical Analysis.
2. Brice, Luther N.A. and James O. Wilkes - Applied Numerical Methods.
3. Stanton. R.G.- Numerical Methods for Science and Engineers.
4. Beveridge- Optimization techniques.
5. Rao. S.S. – Optimization
6. Desai C.S. and John F. Abel - Introduction to the Finite Element Method
7. Sienkiowics O.C. - The Finite Element Method
8. Statistical Hydrology
9. Ram . S. Gupta, Hydrology and Hydrological Systems
10. Taha, Optimization

CIE 521 ADVANCED WATER AND WASTEWATER TREATMENT [3 1 0 4]

Water Quality, Physical, chemical and biological parameters of water, Water Quality standards, Water quality indices. Water purification systems in natural systems

Physical and Chemical processes

Biological processes in waste water treatment – Activated sludge process and its modification, Biological Nitrification and de-nitrification, attached growth biological treatment systems, sludge and effluent disposed.

Primary, Secondary and Tertiary treatment.

Unit operations, unit processes. Aeration and gas transfer, Sedimentation, Filtration, Adsorption, Disinfection.

References:

1. MetCalf and Eddy. Waste water Engineering, Treatment, Disposal and Reuse, Tata McGraw-Hill
2. Peavy, H.S., Rowe, D.R., Tchobanoglous, G. Environmental Engineering, McGraw - Hill.
3. Weber, W.J. Physicochemical Processes for Water Quality Control, John Wiley.

CIE 523 APPLIED ENVIRONMENTAL CHEMISTRY & MICROBIOLOGY

[3 1 0 4]

Environmental Chemistry – Basic concepts from general chemistry, qualitative chemistry, quantitative chemistry, physical chemistry, colloid chemistry, biochemistry, radio chemistry.

Instrumental methods of analysis

Environmental biochemistry – proteins, carbohydrates, lipids, enzymes, nucleic acid, metabolic processes

Atmosphere – Composition of air, chemical and photochemical reactions, green house effects and ozone hole.

Chemical toxicology, coagulation and water softening

Microbiology – scope and introduction, characterization, classification and identification of microorganisms, pure cultures and cultural characteristics, enzymes and their regulations, microbial metabolism, control of microorganisms.

Microbiology of domestic water and wastewater, industrial microbiology, epidemiology of infectious diseases, microbial agents of diseases.

References:

1. Sawyer, C.L. McCarty P.L. and Parkin, G.F., Chemistry for Environmental Engineering, McGraw-hill.
2. Peleazar, M.J., Chan E.C.S and Hrieg, N.R., Microbiology, Tata McGraw Hill.
3. Julia Levy, Campbell, J.J.R and Henry Blackburn, T, Introductory Microbiology, JhonWiley.
4. Benefield, L.D. and Randall C.W., Biological processes design for waste water, Prentice Hall
5. Quasim S.R., Waste water treatment plants Planning design and operation, CBS Publication.
6. Metcalf and Eddy. Inc., Waste water Engg. Treatment, disposal reuse, Tata McGraw Hill Publishing Company Ltd., New Delhi.
7. Dr. B.K. Sharma and Dr. H. Kaur, Environmental chemistry, Krishnaprakshan Mandir, AK De, Environmental Chemistry, New Age International Pvt. Ltd., New Delhi.

CIE 525 AIR AND NOISE ENVIRONMENT [3 1 0 4]

Air Pollution – Definitions – Significance in general. Air pollutants, Sources, classification, emission, Behaviour of air pollutants, chemical reactions in atmosphere - smog

Meteorology variables, primary and secondary lapse rate, Inversions, stability conditions, general characteristics of stack plumes, estimation of plume rise and stack height

Effects of air pollution - on human health, animals, vegetation, materials and atmosphere, Reactions of pollutants in the atmosphere and their effects

Industrial plant location and planning.

Sampling, analysis and control - Measurement of gaseous and particulate pollutants, stack sampling, smoke and smoke measurement, Particulate emission control, and other removal methods like absorption, adsorption, precipitation etc. Control methods - different types.

Global effects of air pollution - Acid rain, Greenhouse effect, Ozone layer depletion. Air quality and Emission standards, Air pollution act, Air pollution index.

Noise Pollution- Definitions – Significance in general - sources, effects and control measures.

Air and noise legislations

References:

1. Rao H.V.N. and Rao M.N, (1989), “Air pollution”, Tata Mc Graw Hill, New Delhi.
2. Rao C.S., (1995), “Environmental Pollution control”, Wiley Eastern Ltd. Delhi.
3. Wark Kenneth and Wamer C.F, Air Pollution its Origin and Control. Harper and Row, Publ.
4. Sincero. A. P.and Sincero G.A. Environmental Engineering. Prentice Hall.
5. Air Pollution - Sampling and Analysis - APHA.

CIE 527 SOLID AND HAZARDOUS WASTE MANAGEMENT [3 1 0 4]

Introduction: Solid waste - Definition, Sources of wastes, classification, Characterization, Composition and Properties of solid Wastes.

Hazardous waste- Definition, landmark episodes, properties and classification of hazardous waste, legal frame work, Cradle to grave concept, Waste manifest system.

Waste generation Collection and transportation: Solid waste generation, Methods to estimate waste quantities, Waste handling, Separation, Storage and Processing at source, Material recovery facility collection rate Collection system, Equipments used, manpower requirement, collection routes optimization, Transfer station, Method and means of transportation. Transportation of Hazardous Waste - Bulk and Non-bulk Transport.

Processing and recycling: Unit operations for separation and processing, size reduction, separation, density separation, biological processing- composting, biomethanation, Incineration-process, heat recovery, incineration products, other methods of processing – combustion, pyrolysis, gasification, energy recovery system. Types of incinerators- Liquid injection, Rotary kiln and fluid bed, Multiple-Hearth furnaces, fluidized and catalytic incinerators. Hazardous waste treatment, physicochemical process-Air stripping, stream stripping, Chemical oxidation, Supercritical fluids, Biological methods-Exsitu and Insitu Treatment

Disposal: Methods, Landfills- types, design of landfills, operation of landfills Generation, movement, control and treatment of landfill gases and leachates, standards for leachate disposal, landfill emissions ,closure of landfill, monitoring of landfill. Land fill disposal for hazardous waste.

Siting of wastes management facilities: Siting guidelines, Planning and developing a site for solid waste management. Site Remediation - site assessment and inspection, the hazardous system and the national priority list. Remedial Action.

Radio Active Wastes treatment

References:

1. Solid Waste Management in Developing Countries – Bhide and Sundaresan (2000), Indian National Scientific Documentation Centre. New Delhi.
2. Integrated Solid Waste Management – George Tchobanaglou, Hilary Theisen and Samuel A. Vigil, (1993),
3. Environmental Engineering – A Design Approach Sincero, A.P., and Sincero, G.A., (1999), Prentice Hall of India Pvt. Ltd., New Delhi.
4. Solid Waste Engineering – Vesilind, A, Thompson Books.
5. Solid Waste Management – CPHEEO Manual
6. Hazardous Waste Management- Wentz C.A., McGraw Hill, 1989.
7. Hazardous Waste Management- LaGrega M.D., Mercer, 2ndEdition, McGraw Hill 2001.

HSS 501 RESEARCH METHODOLOGY AND TECHNICAL PRESENTATION [1 0 3 2]

Mechanics of Research Methodology: Types of research, Significance of research, Research framework, Case study method, Experimental method, Sources of data, Data collection using questionnaire, Interviewing, and experimentation.

Research formulation: Components, selection and formulation of a research problem, Objectives of formulation, and Criteria of a good research problem.

Research hypothesis: Criterion for hypothesis construction, Nature of hypothesis, Need for having a working hypothesis, Characteristics and Types of hypothesis, Procedure for hypothesis testing.

Sampling Methods: Introduction to various sampling methods and their applications. Data Analysis- Sources of data, Collection of data, Measurement and scaling technique, and Different techniques of Data analysis.

Thesis Writing and Journal Publication: Writing thesis, Writing journal and conference papers, IEEE and Harvard styles of referencing, Effective presentation, Copyrights, and avoiding plagiarism.

References:

1. Dr Ranjit Kumar(2005) “Research Methodology: A Step-by-Step Guide for Beginners”, SAGE.
2. Geoffrey R. Marczyk, David DeMatteo & David Festinger(2004), “Essentials of Research Design and Methodology”, John Wiley & Sons.
3. John W. Creswel(2004) , “Research Design: Qualitative, Quantitative, and Mixed Methods Approaches”, SAGE.
4. Suresh C. Sinha and Anil K. Dhiman(2006), “Research Methodology (2 Vols-Set), Vedam Books.
5. C. R. Kothari(2008), “Research Methodology: Methods and Techniques”, New Age International Publisher.
6. Donald R Cooper & Pamela S Schindler(2007), “Business Research Methods”, McGraw Hill International.
7. R. Pannershelvam(2006), “Research Methodology”, Prentice Hall, India.
8. Manfred Max Bergman(2006), “Mixed Methods Research”, SAGE Books.
9. Paul S. Gray, John B. Williamson, David A. Karp, John R. Dalphin(2007), “The Research Imagination”, Cambridge University press.
10. Cochrain & Cox(2006), “Experimental Designs”, II Edn. Wiley Publishers.

CIE 531 ADVANCED ENVIRONMENTAL ENGINEERING LABORATORY
[0 0 6 2]

Determination of water quality parameters. Examination of Microorganisms. Reactor design and operation - demonstration, session: laboratory biochemical reactor, coagulation, chlorination of water, heavy metal removal, colour removal, Absorption studies using activated carbon. Estimation of suspended particulate matter / NO_2 / NO_3 / SO_2 / SO_3 in air using High volume sampler.

Study and use of various instruments used for analysis of water – Gas chromatography, High Performance Liquid chromatography (HPLC), Ion chromatography, Atomic Absorption Spectrometer, UV Spectrometer, CO- HC Analyzer, Smoke meter, Stack monitoring kit.

References:

1. American Public Health Association et al. 'Standard Methods for the Examinations of Water and Waste Water' APHA.
2. Aneja, K.R. 'Experiments in Microbiology, Plant Pathology and Tissue Culture'. Wishwa Prakashan, New Delhi.
3. Manual of methods of General Bacteriology, ASM Publication.

II SEMESTER
CIE 522 ECOLOGY AND ENVIRONMENTAL IMPACT ASSESSMENT[3 1 0
4]

Ecology: Classification of Ecosystem, terminology concepts of Ecology, Sub-divisions in Ecology. Biotic and Abiotic components, Structure and functions of ecosystems. Energy flow in Ecosystems. Measurement of primary production. Ecological Niche and succession. Population Ecology community Ecology, Habitat Ecology. Biochemical cycles, Ecological pyramids

Aquatic and Terrestrial Ecosystems, Dominance and Diversity Indices Adaptations, Biogeography, Systems Ecology and Ecosystem modeling, Oligotrophy, Eutrophic status, Nutrient enrichment - Analysis of Eutrophication - Vollenweider and Dillon models of Phosphorous loading on lakes. Control of Eutrophication.

Environmental Impact Assessment: Developmental Activity and Ecological factors. EIA, EIS, FONSI, Need for EIA studies, Base line information, step by step procedure for conducting EIA, limitations of EIA

Frame work of Impact Assessment development projects in environmental setting. Objective and scope of EIA. Contents of EIA, Methodologies techniques of EIA

Assessment and Prediction of impacts on Attributes air, water noise, land ecology soil, cultural and socio- economic environment, IAA guidelines for development projects, REIA-CEIA

Public participation in environmental decision making. Practical considerations in preparing Environmental Impact Assessment and Statements.

Salient features of the project activity – Environmental parameter- Activity relationships matrices

EIA for water resource development projects, Nuclear power plant project, Mining project, (Coal, Aluminum, iron ore, Bauxite) Thermal Power Plant (Coal Based) project, Pharmaceutical industries etc.

References:

1. Odum - Fundamentals of Ecology - Addison Co.
2. Kormondy- Concepts of Ecology- Prenticehall publication.
3. Anantkrishna T.N - Bio-resources Ecology- Oxford and IBM.
4. Krebs J. - Ecology - The experimental analysis of distribution and abundance-II Edition Harper international.
5. Momm R.E. (ed) Environmental Impact Assessment John Willey.
6. Canter L - Environmental Impact Assessment McGraw Hill 1977.
7. Clark B. C., Bisett and Tomlinson P - Perspective on environmental Impact Assessment - Allied Publishers – 1985
8. Mall C.A.S. and Day J.W - Ecosystem modeling in theory and practice: An introduction with case study stories - John Willey.
9. Heer and Hagerty, Environmental Impact Assessment and statements. Van Nostrand and Reinhold Co. 1977.
10. Jain, et al Environmental Impact Assessment. Van Nostrand.

CIE 524 INDUSTRIAL WASTEWATER TREATMENT [3 1 0 4]

INTRODUCTION: Effects of Industrial Wastes on sewerage system and sewage treatment plants and receiving water bodies. Effluent standards and receiving water quality standards. Different aspects and choices of various alternatives

Industrial Waste survey-Process flow charts, condition of waste stream. Material balance, Sampling – Grab, Composite and integrated samples. Continuous monitoring – pH, Conductivity, Bio- monitoring.

Pretreatment of Industrial Wastewater – Volume reduction, Strength reduction, Neutralization, Equalization and Proportion, Removal of Organic and inorganic dissolved solids.

Wastewater Treatment in specific industries: Distillery, Sugar, Pulp and paper, Cement, Textile, Dairy, Fertilizer, Pesticides, Pharmaceutical, Ultimate disposal of Industrial Wastewater, effects of waste additions on physical and chemical properties of soil, Bio-Remediation of Distillery, Sugar, Refinery and Dairy Industries.

Design of complete treatment system disposal for industries: Distillery, Dairy, Textile, paper and pulp mill to meet CPCB norms.

Environmental Auditing introduction Cost of Pollution, Environmental audit solutions, Financial and Managerial opportunities. Criminal and Regulatory liabilities.

References:

1. Nelson N Nemerow – “Liquid Waste of industry theories, “Practices and Treatment. Addison Willey New York.
2. Nardam S Azad – “Industrial Wastewater Management Hand Book” McGraw Hill book Co., Newyork.
3. Ross R.D. – “Industrial Waste Disposal”, Reinhold Environmental Series – New York.
4. Dickinson - Practical Waste Treatment and Disposal Applied Science publication, London.
5. Mahajan (1984) –” Pollution control in Process industries”. TMH, New Delhi.
6. Self N.J – Industrial pollution Control.
7. Eckenfelder- “Industrial Water pollution Control”- McGraw hill Company, New Delhi American Chemical Society, Washington D.C. USA/
8. Gaynor W Dawson, et al – “Hazardous Waste Management”- A Wiley-Interscience Publication, New York.
9. James F parr et al – “Land Treatment of Hazardous Wastes”- Noyes Data Corporation, Parkridge, New Jersey, USA.

PROGRAM ELECTIVE I

CIE 572 REMOTE SENSING AND GIS IN ENVIRONMENTAL ENGINEERING [3 1 0 4]

Definition, Remote sensing in Environmental Engineering
Basics of Remote sensing Techniques - Radiation Sources, Physics of remote sensing
- Transmission Paths - Target and Sensors
Sensors - Types and Classification - Spectral Bands of Sensors. Sensors for UV, IR
and Visible ranges.
Multi spectral scanners
Platforms - Aircrafts, Satellites.
Data Acquisition and Interpretation - Visual and digital interpretation - Brief
Discussion only
Application of remote sensing techniques to management of Water resources.
Monitoring of quality of environment, land use pattern studies.
GIS - Concepts and spatial Methods - introduction spatial information, temporal
information
GIS - functionality - introduction, Data acquisition, Data processing, storage and
retrieval
Computer Fundamentals of GIS and data storage character files and binary files, file
origination linked list, chains trees.
GIS and Remote sensing data integration techniques in spatial Decision support
system, land suitability, New work analysis virtual GIS.
Hardware and software requirements for GIS.
GIS in solid waste transport, re-modelling of distribution systems and Ground water
Vulnerability.

References:

1. Peter A Burroughs Rachel A Mc Donnas "Principle of GIS" (Oxford)
2. Christopher Jones "GIS and Computer Cartography"
3. Lillie Sand and Keifer, "Remote sensing and Image interpretation, John Wiley
and Sons.

CIE 573 TRANSPORT PROCESSES AND MODELING OF AQUATIC SYSTEMS [3 1 0 4]

Introduction: Models as Comprehensive tools in Environmental Management. Waste load allocation principles, Diffusion and dispersion - Definition, Molecular turbulent and shear diffusion, Derivation of Fick's laws of diffusion and convective - diffusion equations for turbulent and shear flow regimes.

Rivers, streams and lakes: Derivation of Steady state stream equation. Models for decaying pollutants (bacteria, phenol, ammonia) in rivers. 1-D Oxygen balance models - Streeter- Phelps equation, critical point method. Data collection specialized water quality surveys based on statistical average concepts. Estimation of parameters - decay and recreation rates. Calibration and verification of 1-D Oxygen model. Error measures. Mixing Zones in rivers - definition, steady state 2-D analysis with pipe and diffuser outfalls using solutions based on method of images for conservative and decaying pollutants field study methodology. Parameter estimation - Lateral Mixing co-efficient - critical point method - derivation and examples. Dissolved Oxygen models for lakes under completely mixed and stratified conditions.

Estuaries, Bays and Harbors: Physical aspects of Estuaries. Distribution of Water quality in Estuaries. Estimation of tidal dispersion coefficient. Slack Tide sampling. Derivation of Estuary Equation.

Ground water quality modeling concepts - formulation of 1-D and 2-D models with decay and retardation for instantaneous sources, Non point sources of pollution, Analytical modeling for plume delineation studies from point sources. Field data gathering and parameter estimation.

Eutrophication models - simplified nutrient loading models for rivers and lakes.

References:

1. Rich L.G. Environmental Systems Engineering McGraw Hill-1972.
2. Thoman R.V. - Systems Approach to water quality management McGraw Hill-1980. .
3. Biswas A.K. - Models for water quality management- McGraw Hill 1980.
4. Rinaldi S.D. and Soncini, R- Modelling and Control of river water quality McGraw Hill-1979.
5. Gower A.M. - Water quality in catchment ecosystems John Wiley- 1980.
6. Thomann and Mueller 1986., Principles of water quality management and control- Harper and Row pubs.
7. Hazen and Cherry, Ground Water Quality.
8. Velz L.Z. Applied Stream Sanitation.

CIE 574 EARTH AND ENVIRONMENT [3 1 0 4]

Planet Earth: Evolution and constitution – Earth and solar system, internal structure of the earth, earth as a magnet

Minerals and Rocks: Earth's basic ingredients- minerals and their forms, relationship to crystals, rocks and their types

Surface features of the Earth: Continents and oceans – features on continents and ocean floors; Landforms, weathering and erosion

Plate tectonics and sea-floor spreading

Economic Geology: Study of Geological resources and their origin- Metallic and non-metallic minerals, petroleum and coal, groundwater, gemstones

Earth hazards: Earthquake and seismicity, tsunami, landslides

Importance of biodiversity to mankind and its preservation

Natural resources: Renewable and non-renewable resources - Alternatives to fossil fuels (wind, wave, ocean, solar, hydropower, fuel cells, biofuels)

Pollution of air, water and soil and its control- discussion of several case studies

Climate change: Reasons for climate change, effects of climate change on the environment, mitigation, geo-engineering techniques

References:

1. A B Roy (2010) Fundamentals of Geology, Narosa Publishing House, New Delhi
2. Gerard Kiely (2007) Environmental Engineering, Tata McGraw Hill Education Private Ltd., New Delhi

PROGRAM ELECTIVE – II

CIE 575 ENVIRONMENTAL QUALITY AND POLLUTION MONITORING TECHNIQUES [3 1 0 4]

Monitoring water and wastewater: General principles of sample collection and data analysis. Gravimetric methods for solids analysis in water and wastewater, analysis of common cations and anions in water/wastewater, determination of nitrogen, phosphorus and chemical oxygen demand (COD). Titrimetric methods; Electrochemical methods; Spectrophotometric methods; Nephelometric methods; Atomic Absorption spectroscopy; Biological methods and microbiology; Biochemical oxygen demand (BOD), MPN test for microbial pollution, plate counts; confirmatory tests.

Monitoring of air pollution: Sampling techniques for air pollution measurements; analysis of particulates, odors, visibility, acidic deposition and other gaseous pollutants.

Monitoring of soil and groundwater pollution: Objectives and scale of monitoring, monitoring strategy, ground water monitoring plan, Monitoring by sampling in unsaturated/ vadose zone, monitoring the saturated zone, Data acquisition and processing.

References:

1. Sawyer, C.L., McCarthy, P.L. and Parkin, G.F. Chemistry for Environmental Engineering. McGraw-Hill.

CIE 576 ENVIRONMENTAL MANAGEMENT [3 1 0 4]

Environment and Sustainable Development - carrying capacity, relationship with quality of life, carrying capacity and resource utilization.

Environmental Laws and Policies –Water Act, Air Act, Environment Protection Acts , Solid Waste management Rules, Hazardous and Biomedical waste Rules, Related Policies –Importance in Management

Environmental Protection - Economic development and social welfare consideration in socio economic developmental policies and planning.

Environmental Economics: Introduction, economic tools for evaluation, Cleaner development mechanisms (CDM) and their applications.

Environmental Audit – methods, procedure, reporting and case studies.

Environmental management system and Techniques – Environmental Safety and ISO 14000 ISO series of standards, ISO 14001 Standards, Environmental Management systems. (EMS) Total quality Management (TQM) and Total safety Management (TSM). ISO 9000, and 18000 series of standards.

References:

1. Lohani B.N (1984)., “Environmental Quality Management”, South Asian Publishers, New Delhi
2. Chanlett, (1973)“Environmental Protection”, McGraw Hill Publication, Newyork.
3. Danoy G.E., and Warner R.F., (1969), “Planning and Design of Engineering Systems”,Unwin Hyman Publications.
4. MOEF, Government of India, “Carrying Capacity Based Developmental Planning Studies for the National Capital Region”, 1995-96.
5. NEERI, Nagpur, Annual Reports 1995 & 1996.
6. UNEP / UNDP – “Environmental Sustainable Development”.
7. Environmental Laws-MOEF, Government of India
8. T.V. Ramachandra & Kulakarni, Environmental management

CIE 577 DISASTER MANAGEMENT [3 1 0 4]

Principles of Disaster Management, Natural Disasters, Hazards, Risks and Vulnerabilities.

Assessment of Disaster Vulnerability of a location and vulnerable groups.

Preparedness and Mitigation measures for various Disasters, Preparation of Disaster Management Plans

School Awareness & Safety Programme

Issues in Environmental Health, Water & Sanitation. Earthquake Mitigation, Floods, Fire, Landslides and other natural calamities. Post Disaster Relief & Logistics Management

Emergency Support Functions and their coordination mechanism, Resource & Material Management, Management of Relief Camp, Information systems & decision making tools

Voluntary Agencies & Community Participation at various stages of disaster management

Integration of Rural Development Programmes with disaster reduction and mitigation activities.

Role of Remote Sensing, Science & Technology.

Rehabilitation Programmes, New initiatives

References:

1. R.B.Singh (Ed) Environmental Geography, Heritage Publishers New Delhi, 1990
2. Savinder Singh Environmental Geography, Prayag Pustak Bhawan, 1997
3. Kates, B.I & White, G.F The Environment as Hazards, Oxford, New York, 1978
4. R.B. Singh (Ed) Disaster Management, Rawat Publication, New Delhi, 2000
5. H.K. Gupta (Ed) Disaster Management, Universities Press, India, 2003
6. R.B. Singh, Space Technology for Disaster Mitigation in India (INCED) University of Tokyo, 1994
7. Dr. Satender, Disaster Management in Hills, Concept Publishing Co., New Delhi, 2003
8. A.S. Arya Action Plan For Earthquake, Disaster, Mitigation in V.K. Sharma (Ed) Disaster Management IIPA Publication New Delhi, 1994
9. R.K. Bhandani An overview on Natural & Man made Disaster & their Reduction, CSIR, New Delhi
10. M.C. Gupta Manuals on Natural Disaster management in India, National Centre for Disaster Management, IIPA, New Delhi, 2001

PROGRAM ELECTIVE – III

CIE 578 MEMBRANE PROCESS FOR WATER AND WASTE WATER TREATMENT [3 1 0 4]

Introduction to membrane separation processes, Membrane filtration, dead end filtration, Cake filtration, Reverse osmosis, Nanofiltration, Ultrafiltration, Microfiltration, Membranes and modules, MF/UF experimental set up, Laws of MFIUF, Limiting Phenomena, Economic study, Applications, Case studies.

Introduction: Metabolism - Stoichiometry and Energetics, Thermodynamic Principles, Metabolic Reaction and Coupling, EMP Pathway and other Carbohydrate Catabolic Pathways.

Respiration and Photosynthesis, Biosynthesis, Transport across Cell Membranes, End Products of Metabolism

Biotechnology: Introduction to Microbial Biotechnology, Uses of Enzymes, isolation and Purification of Enzyme Engineering, Protein Engineering, immunotoxins, Metabolic Engineering for Over Production of Metabolites.

Uses of Microbes: Isolating and Culturing of Microorganisms, Production of Organic Compounds like, Ethanol and Acetone by Microbial Fermentation, Production of Enzymes by Microorganism, Production of Antibiotics, Single Cell Protein, Sewage Treatment using Microbial Systems.

Biotechnology and Environment: Pollution Control, Restoration of degraded lands, biodiversity and its conservation, Biosensors, immobilized Cell Technology for Wastewater Treatment.

References:

1. Bailey and Ollis, Biochemical Engineering and Fundamentals, McGraw Hill International, 1986.
2. Smith, Principles of Biochemistry, 7th Edition, McGraw Hill international.
3. Agarwal's A Text book of Biochemistry, Goe\ Publishing House, Meerut.
4. P.K. Gupta, Elements of Biotechnology, Restogi Publishers, Meerut. S.
5. American Water Works Association Research Foundation, Water Treatment-membrane processes, Mc. Graw Hill.

CIE 579 OCCUPATIONAL SAFETY AND HEALTH [3 1 0 4]

History and Development, Occupational safety and Health act. Occupational Safety and Health Administration, Right to know Laws.

Accident Causation - Need for Accident Investigation, Accident investigation plan, Methods of Acquiring Accident Facts, Correcting Missing Skills, Investigator Tendencies and Characteristics,. Supervisory. Role in Accident investigation. Human Error Model, Petersew's Model, Epidemiological Models.

Ergonomics - Ergonomics at work place, Ergonomic Task Analysis, Preventing Ergonomic Hazards, Setting up of Ergonomics Programme.

Occupational Hazard and Control - Hazard Analysis, Fault Tree Analysis, Human Error Analysis in Causation with Hazard Analysis, Emergency Response. Decision for Action, Purpose and Considerations, Hazard Control Measures, Hazards and their Control in Pharmaceutical, Construction, Textiles, Petroleum Refineries and LPG Bottling, Iron and Steel industries.

Fire prevention and Protection - Fire Development and its Severity effects. Enclosure, need for early Detection of Fire, Extinguishing Fire, Electrical Safety, Product Safety, Technical Requirements of Product Safety Programme.

Occupational Health - Health and Safety Considerations, Personal Protective Equipments, Effects of Exposure and Treatment for Metal Working Trades, Municipal Solid Waste, Epoxy Resins, Foundries. Occupational Health and Safety Considerations in Wastewater Treatment

References:

1. David L. Goetsch. "Occupational Safety and Health" for Technologists, Engineers and Managers 3Mediton. Prentice hall.
2. David. A. Calling - Industrial Safety Management and Technology, Prentice Hall, New Delhi.
3. Della D. E. and Giustina, Safety and Environmental Management. Van Nostrand Reinhold International Thomson Publishing Inc, 1996.
4. Trevethick R. A. Environmental and Industrial Health Hazards, William Heinemann Medical Books Ltd., London (1973).

CIE 580 REUSE, RECYCLE AND GREEN TECHNOLOGY [3 1 0 4]

Waste as a Resource Economics, Disposable Materials, Recycling Collection, Processing, Governmental Role in Waste Management, Potential for Reuse.

Water reuse - Direct and indirect Reuse, intentional Reuse, groundwater Recharge, Examples of Water reuse, Close Cycle and Open Cycle Reuse Recreational Reuse. Uses of Sewage in Pisciculture, Groundwater recharge of Sewage Effluents.

Reuse of Industrial Effluent - Urban Effluent Reuse for Agriculture in Arid and Semiarid Zones.

Health Aspects of Water Reuse - Guidelines for Evaluating recreational Water Reuse, Resource Conservation and Recovery Act.

Source reduction and waste minimization, establishing P2 and waste minimization programme, waste to energy.

Metals Recovery - Ferrous Metals, Prosperities, Principles of Magnetic field- Ferrous Material Interactions, Magnetic Separation Equipment, Non-Ferrous Metal Separation,

Green Technology - Definition of green building, benefits and challenges, public policies and market-driven initiatives, effective green specifications.

Overview to Site Design: Site planning and analysis: biophysical, social, economic factors. Market analysis vs. site analysis. Basic steps of site analysis. Site assessment, strategies for optimizing land use; transportation fundamentals. Smart growth.

Energy Efficient Design (Energy & Lighting): Overview of the Building Energy System Design Process. Assessing human functional and physiological needs, local climate and free energy resources. Design scenarios. Passive solar design. Building Envelope. Plug Loads. Domestic Hot Water. HVAC. Daylighting. Electric Lighting. Green Power.

Green materials and LEED. Strategies for green homes.

Water and Site Design: problems and issues with water and site practices. Nature as a model approach. Overview of site and landscape solutions.

References:

1. Springer, "Recycling and Resource Recovery Engineering"- Springer – Verlag Berlin Heidelberg (1996)
2. ICE: Reuse of Sewage Effluent, Proceedings of the International Symposium, Thomas Felford London (1985)
3. Dean R.B. and E., "Water Reuse Problems and Solutions" Academic Press (1981)
4. Kut D., and Hase G. "Waste Recycling for Energy Conservation, "John Wiley and Sons Inc.
5. Green Building Rating System for New Construction and Major Renovations (LEED-NC), Version 2.2, October 2005, 81 pp.
6. LEED-NC for New Construction Reference Guide, Version 2.2, Second Edition, September 2006, 416 pp. On reserve at the DuBois Library, Third Floor, Call Number HW 90.
7. Matthiessen, Lisa Fay, and Morris, Peter, "Costing Green: A Comprehensive Cost Database and Budgeting Methodology", 2003, 27 pp.
8. Roberts, Don V., "Sustainable Development-A Challenge for the Engineering Profession", FIDIC Annual Conference, Oslo, Norway, 18 June 1990, 23 pp.

OPEN ELECTIVES

CIE - 554 ADVANCED STRENGTH OF MATERIALS [3 0 0 3]

Torsion : Torsion of non-circular sections - Torsion of thin walled sections.

Unsymmetrical bending of straight beams - stress distribution - shear centre - shear flow in thin walled beam cross sections - shear centre for thin walled sections.

Bending of Curved Beams: Crane hooks, closed rings - correction factor for flanged cross sections.

Bending of beams curved in plan.

Beams on Elastic foundation - Infinite beams - Semi - infinite beams - short beams.

References:

1. Srinath L.S (2000), Advanced Solid Mechanics TMH., New Delhi. Boresi A.P., and Sidebottom O.M., (1985),
2. Advanced Mechanics of Materials, John Wiley and sons in N.Y.
3. Den Hartog, (1952), Advanced Strength of Materials, McGraw Hill, N.Y.
4. N.Krishnaraju and D.R. Gururaja, (1997), Advanced Mechanics of solids and structures, Narosa Publishing House, New Delhi.
5. William F. Riley, Leroy D. Sturges and Don H. Morris, (2001), Mechanics of Materials, John Wiley & Sons, New Delhi.

CIE-556 - NON- DESTRUCTIVE TESTING OF MATERIALS [3 0 0 3]

Introduction, Need, Tensile test, Fatigue test, creep test, hardness test, impact test, Basic elements of NDT, Rebound hammer test, Magnetic particle test, liquid Particle test, ultrasonic test, Radiography, Acoustic Emission Test, Eddy current test, Leak test, New methods, reliability, case studies.

References:

1. Barry Hull & Vernon John(1989), “ Non-destructive Testing”, ELBS edition., Macmillan, London.
2. R. Halmshaw(1991), “Non-destructive Testing”, 2nd edition., Edward Arnold, London.
3. McGonnagle W. J.,(1983) “Non-destructive testing”, Gordon & Beach Science, New York,.
4. George E. Dieter,(1998) “Mechanical Metallurgy” McGraw Hill Publication.
5. Warren J. McGonnagle,(1961/latest edition)) “ Non Destructive Testing” ” McGraw Hill Publication.
6. ASME Metals Hand Book.
7. TMEH Hand Book.

CIE 558 ENERGY AND ENVIRONMENT [3 0 0 3]

Introduction: Global energy, Environmental resources, energy needs, energy crisis.

Indian scenario - Energy consumption, needs and crisis.

Energy production, utilization, Laws and Principles

Renewable sources of energy and Environmental aspects - Bio gas, Bio- Mass,

Hydro power, ocean energy, solar energy, geothermal energy, wind energy

Urban waste derived energy, agricultural waste derived energy.

Non-renewable sources of energy and Environmental aspects – energy norm, coal, oil , natural gas, Nuclear energy,

Global temperature, Green house effects, global warming.

Acid rain - Causes, effects and control methods.

Regional impacts of temperature change.

References:

1. Wilber L.C. "Hand book of Energy Systems" Engg Wiley and Sons 1989
2. Masten G.M. "Introduction to Environmental Engg and Science" .
3. Sincero and Sincero, Environmental Engg - A design approach, Prentice Hall of India (1999)
4. Rao and Parulekar B.B. Energy Technology- Non-conventional Renewable and Conventional, Second Edition Khanna Publication 1977

CIE 532 COMPUTER LABORATORY [0 0 6 2]

Introduction to C++ programming language: Input and output statements, logical statements, iterative loops. Simple examples. Functions and classes examples. Spread sheet programming. Programming management problems such as price forecasting, regression analysis, inventory models OR/and project management problems. Use of packages on Environmental Engineering

References:

1. Balaguruswamy E., (2006) 'Object Oriented Programming with C++', Tata McGraw Hill, New Delhi.
2. Ang and Tang, (1984) "Probability concepts in engineering planning and design", Vol. I and II, Wiley International.
3. Kottegoda N.T., Rosso Renzo, (1998) "Statistics, Probability and Reliability for Civil and Environmental Engineers", Mc-Graw Hill International.
4. AICTE Continuing Education Programme, "Quantitative Methods in Construction Management"
