M.TECH. (ENVIRONMENTAL ENGINEERING)

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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


References:

5. Rao. S.S. – Optimization
6. Desai C.S. and John Fabel - 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]


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:

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 photchemical reactions, green house effects and ozone hole.

Chemical toxicology, co-agulation 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:

4. Benefield, L.D. and Randall C.W., Biological processes design for waste water, Prentice Hall
7. Dr. B.K. Sharma and Dr. H. Kaur, Environmental chemistry, Krishnaprakshan Mandir, AK De, Environmental Chemistry, New Age International Pvt. Ltd., New Delhi.
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:

5. Air Pollution - Sampling and Analysis - APHA.
CIE 527 SOLID AND HAZARDOUS WASTE MANAGEMENT [3 1 0 4]


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


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:

2. Integrated Solid Waste Management – George Tchobanaglous, Hilary Theisen and Samuel A. Vigil, (1993),
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.


References:

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:

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


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:

2. Kormondy- Conceptsof Ecology- Printcehall publication.
3. AnantakrishnaanT.N - Bio-resourcesEcology- Oxfordand IBM.
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


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 Diary Industries.

Design of complete treatment system disposal for industries: Distillery, Diary, 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:

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 - Spectrial Bands of Sensors. Sensors for UV, IR and Visible ranges.
Multi spectral scanners
Platforms - Aircrafts, Satelites.
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 liked 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-moduling of distribution systems and Ground water Vulnerability.

References:

1. Pater A Burraugh Rachal A Mc Donnas "Principle of GIS" (Oxford)
2. Christopher Jones "GIS and Computer Cartography"


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:

7. Hazen and Cherry, Ground Water Quality.
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:

 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:

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


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.


References:

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]

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.
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
4. R.B. Singh (Ed) Disaster Management, Rawat Publication, New Delhi, 2000
6. R.B. Singh, Space Technology for Disaster Mitigation in India (INCEDE) University of Tokyo, 1994
7. Dr. Satender , Disaster Management in Hills, Concept Publishing Co., NewDelhi, 2003
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 and 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 arid 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 Microbal 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:

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


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


Fire prevention and Protection - Fire Development and its Severity effects.


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:

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


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


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.


Green materials and LEED. Strategies for green homes.


References:

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:

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:

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:

2. Masten G.M. "Introduction to Environmental Engg and Science".
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:

4. AICTE Continuing Education Programme, "Quantitative Methods in Construction Management"