TWO YEAR MTECH PROGRAMME COURSE STRUCTURE
(Effective from Academic Session 2018-19)

ENVIRONMENTAL ENGINEERING			
SEMESTER I			
Course Code	**Subject Title**	**Credits**	**Contact Hours**
14M31CE111	Statistics for Environmental Engineers	03	03
14M31CE113	Water Supply and Treatment	03	03
14M31CE114	EIA and Risk Management	03	03
14M31CE115	Solid Waste Management	03	03
14M31CE116	Wastewater Treatment	03	03
	Elective - I	03	03
14M37CE171	Environmental Engineering Lab	02	04
	Total	**20**	**22**
SEMESTER II			
14M31CE211	Air and Noise Pollution Control	03	03
14M31CE112	Simulation and Modelling	03	03
14M31CE213	Industrial Wastewater Treatment	03	03
14M31CE214	Process Design in Environmental Engineering	03	03
	Elective-II	03	03
	Elective-III	03	03
14M37CE276	Software Lab.	02	04
	Total	**20**	**22**
SEMESTER III			
15M39CE391	Seminar	02	-
15M39CE392	Project Part - I	18	36
	Total	**20**	**36**
SEMESTER IV			
16M39CE492	Project Part - II	20	40
	Total	**20**	**40**

LIST OF ELECTIVES		
	Course Code	**Course Name**
Electives - I	17M1CE111	Environmental Chemistry and Microbiology
	16M3WCE331	Environmental Law and Policy
	17M1CE113	Environmental Health and Safety
Electives - II	14M31CE215	Surface Water Quality Management
	14M31CE216	Hazardous Waste Management
	17M21CE211	Environmental Nanotechnology
Electives - III	15M3WCE312	Environmental Geotechnique
	17M21CE212	Environmental Management
	17M21CE213	Independent Study

Syllabus for MTech in Environmental Engineering

Statistics for Environmental Engineers

Introduction to basic statistics and probability: Statistics in the context ofenvironmentalanalysis;Probability(includingconditionalprobability,distributions and Baye's Theorem)Introduction to data analysis: Uncertainty(Measurement: Precision and Accuracy); Error(Types, Normal error curve, Error propagation).Hypothesis Testing and Checks; Confidence intervals, Hypothesis testing (Equality of mean and standard deviation: t-test, chi-square test and F-test; Errors in hypothesis testing) Variance (Experiment design and analysis; ANOVA concepts; Significance of interaction between factors. Regression versus correlation; Autocorrelation in data; Linear versus non -linear regression models; Linear least-squares regression; Precision of parameter estimates, coefficient of determination: inherent limitations; Non-parametric statistics.

Water Supply and Treatment

Water Chemistry: Chemical Units and Conversion, Ionization, Conductivity, Activity and Activity Coefficients, Chemical Equilibria and Kinetics, Acid Base Equilibria, Solubility Equilibria, Water Stabilization (Alkalinity and pH relationship), Adsorption, Water Coagulation, Flocculation. Treatment Procedures: Sedimentation (including different types of suspension), Flocculation (including design of flocculator), filtration (RSF, SSF), Aeration (Henry Law, Two Film Theory, design of spray aerator)

EIA and Risk Management

NEPA and its implementation, Planning and Management of Impact Studies, Methodologies for Impact Identification, Environmental Indices and Indicators of Affected Environment, Prediction and Assessment of Impacts of Air, Water, Soil, Noise, Biological, Cultural Environments and Socioeconomic Environments, Public Participation.

Solid Waste Management

Solid Waste (Sources, Composition and Properties, Engineering principles, Generation, Onsite handling, storage and processing including segregation; Collection Transfer and transport; Processing technique and equipment; Recovery of resources; Conversion products and energy, Composting; Recycling; Incineration and pyrolysis; Disposal including sanitary landfill, planning, sitting, design, closure and post

Waste Water Treatment

Selection of proper treatment after matrix evaluation and cost effectiveness (including measures of effectiveness),design of Screens, Grit removal (including velocity control devices including Parshall chamber and design of grit chamber),Primary Sedimentation (rectangular and circular clarifier) loading rates (weir and solids),Influent and effluent structures of PST, calculation of sludge and scum quantities, design of digester and filter press, design of secondary clarifier, Biological Treatment of Waste Water: objectives of the treatment, steps of biological treatment, brief introduction of Microbiology (Enzymes, Endogenous state, Monod equation for specific growth rate, Michaeles- Mentens Relationship, Bacterial growth curve), carbon aqueous BOD removal, Design of Activated Sludge Process and modification of ASP. Kinetics of ASP, Fixed Film Bioreactor

(Trickling Filter, Biofilter, RBC, fluidized bed reactor

Environmental Engineering Lab

Water quality analysis: pH, Electrical Conductivity, Acidity, Alkalinity, Solids, Hardness, Chloride, Turbidity, Sodium, Potassium, Dissolved Oxygen (D.O), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Oil and Grease, Coliform, Nitrogen (NH_3– N)

Air and Noise Pollution Control

Introduction to Air Pollution, Greenhouse Effect, Effect of CO on human health, Effects of Air Pollution, Air Pollution Meteorology, Potential Temperature, Atmospheric Visibility, Air Pollution Monitoring (Stack Sampling, Grab Sampling, Ambient Air Analysis) Air Pollution Control Equipment (including different types of inertial separators, wet collection devices, bag house, electrical precipitators, Impingementseparators2.Introduction to air quality models; 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. Dispersion Modelling and Source Apportionment Methods

Noise Pollution– Introduction, Acoustical Concepts, Characterization and Sources of Noise, Traffic Noise Index, Measurement Techniques, Standards, Noise Control Techniques and Strategies.

Simulation and Modelling

Introduction to system modeling and simulation, Overview of Environmental Systems, Systems approach to environmental problems, Basic Modeling Concepts in EnvironmentalSystems,StrategiesforAnalyzingandUsingEnvironmental Systems Models, Modeling Surface Water, Ground-Water and Air Pollution Inventories, Simulation software tools, Continuous, Discreet Event, Combined and other modeling techniques, Validation and Verification

Industrial Waste Water Treatment

Classification of Different Industrial Wastes (like soluble organics, suspended solids, acid/alkali, thermal discharge, in organics, coloring substances, nutrients, heavy metal etc.) Industrial Waste Survey(possibility of minimization, variation of flow and characteristics, possibility of water conservation and reuse, strength to undergo) diff wastes like process, cooling, sanitary and in plant wastes. Techniques for ascertaining character(grab sample, composite sample etc.),Neutralization(equalization basin, limestone bed, lime stone tower) Equalization Basin (objective, function, design principles), Floatation technique (gravity and DAF methods).Oxidation(chlorine, ozone, hydrogen peroxide), removal of organics (ASP, TF, SBR, Lagoon, Anaerobic System), fundamentals of an aerobic process .Case study of Industry(like tannery, Pulp and paper industry, pharmaceutical, fertilizers, etc) to be presented by students in a seminar form.

Process Design in Environmental Engineering

Reactor Analysis (objectives, basis), Reactor types(complete mix batch reactor, complete mix continuous stirred reactor, PFR, PFR with dispersion, MFR, CFSTR, CFSTR in series). Design of water filter plant (RS Gravity filter and under drainage system, wash water trough, ASP, TF, hydraulic loading, organic loading, design of aeration system, design of nitrification and gentrification reactor, reverse osmosis and membrane filtration ,design of anaero bicsystem (including UASB)

Low-cost treatment systems (suspended growth culture system like OD, OP and A Land attached growth system like RBC), Design of stabilization pond (aerobic, facultative, anaerobic),Design of aerated lagoon, Design of oxidation ditch, design of RBC, design of combined system(activated Bio filter, TF followed by solids contactor, RF followed by an ASP, Bio filter followed by an ASP, TF followed by an ASP)

Software Lab

EPANET,Qual-2E,MODFlow,WATFOR,Plume,Groundwatercontaminationmodel

SYLLABUS FOR ELECTIVE COURSES

Surface Water Quality Management

Designated Best Use of water (DBU) adopted in India. Quality Criteria Standard, Standards of disposal, Self-purification of natural water body (including self-purification constant),Background of Streeter-Phelps Equation and its derivation, Modification of Streeter-Phelps Equation (Thomas Modification, O'Connor Modification), Thermal Stratification, System Analysis(linear, non-linear), Mass transport System (Continuity Equation, Momentum Equation) Mathematics of mass transport (diffusion, advection, advective diffusion –equation). Objective of water monitoring (including isolated station points and related station points and associated examples), Physical Characteristics and associated phenomenon in river and lateral mixing), Estuary, selection of sampling stations.

Hazardous Waste Management

Definition, History, Generation; Legal Framework – Environmental Law, RCRA, Superfund Toxicology– Exposure, Toxic Effects, Dose-Response Relationships, Carcinogens, Non-carcinogens, Eco toxicology Current Management Practices– Environmental Audits, Pollution Prevention, Facility Development and Operations

Treatment and Disposal Methods- Physico chemical Methods, Biological Methods, Stabilization and Solidification, Thermal Methods and Land Disposal Site Remediation– Quantitative Risk Assessment, Site and Subsurface Characterization, Remedial Technologies, Evaluation and Selection