GOVT. COLLEGE OF ENGINEERING, AMRAVATI

M. TECH. (CIVIL) Part Time
Environmental Engineering
CURRICULUM

Department of Civil Engineering
2010-11
Govt. College of Engineering, Amravati  
Department of Civil Engineering  
M.Tech. (Environmental Engineering) Part Time  
First Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Name of the Course</th>
<th>Theory Hrs/week</th>
<th>Tutorial Hrs/week</th>
<th>Practical Hrs/week</th>
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<th>CT1</th>
<th>CT2</th>
<th>ESE</th>
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Note: The ESE duration for all theory courses shall be 2 hrs. 30 min.  
# Environmental Lab Practice-I will consist of practicals / assignments based on theory of first semester subjects

Second Semester

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Note: The ESE duration for all theory courses shall be 2 hrs. 30 min.  
# Environmental Lab Practice-II will consist of practicals / assignments based on theory of second semester subjects  
* Seminar-I to be delivered by the students on general topic related to Environmental engineering to be evaluated by three members committee, headed by HOD wherein guide should be one of the members.
# M.Tech. (Environmental Engineering) Part Time

## Third Semester

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**Total** 9 3 6 18 375 15

*Note: The ESE duration for all theory courses shall be 2 hrs. 30 min.

*Environmental Lab Practice-III will consist of practicals / assignments based on theory of third semester subjects

*Seminar-II to be delivered by the students on general topic related to Environmental engineering to be evaluated by three members committee, headed by HOD wherein guide should be one of the members.

**Elective I**
1) Hazardous Waste management
2) Environmental Statistics
3) Environmental Geotechnology

**Elective II**
1) Environmental System Modeling
2) Rural Water Supply and Sanitation
3) Water and Wastewater Engineering Structures
4) Water Distribution systems and Optimization

## Fourth Semester

<table>
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**Total** 3 1 8 12 225 15

*Note: The ESE duration for all theory courses shall be 2 hrs. 30 min.

*Environmental Lab Practice-IV will consist of practicals / assignments based on theory of fourth semester subjects

Dissertation (Phase-I) & Seminar: Student has to submit the report and deliver the seminar based on 20% or more work on Dissertation topic. It is to be evaluated internally by three members panel of examiners headed by HOD wherein guide should be one of the members of the panel.

Last date of submission of report shall be two weeks before the end of semester.
Dissertation (Phase-II) & Seminar: Student has to submit the report and deliver the seminar based on 30% or more work on Dissertation topic. It is to be evaluated internally by three members panel of examiners headed by HOD wherein guide should be one of the members of the panel. Last date of submission of report shall be two weeks before the end of semester.

Dissertation (Phase-III): Internal assessment of dissertation (complete work) is to be carried out by the guide for 75 Marks. External assessment of Dissertation (complete work) is to be carried out by panel of examiner consisting of internal (guide) and external examiner for 175 marks. Candidate shall present the entire work on Dissertation, followed by viva-voce. Last date of submission of dissertation will be the end of the semester. Please see Appendix-C of Rules & Regulation for further information.
CEP131 ENVIRONMENTAL SCIENCE AND CHEMISTRY

Teaching Scheme : 03 L + 1T Total 04 Credit : 04
Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE Total Marks :100
Duration of ESE: 2hrs.30 min.

Ecology:
Introduction, Energy flow in Ecosystems, food chain and trophic levels, Nutrient cycles, elements of limnology, Eutrophication.

Global Atmospheric Change:
The green house effect and stratosphere ozone depletion, Global temperature, the green house effect, carbon dioxide, chlorofluorocarbon, the green house gases, Regional effects of green house gases, perspective on global atmospheric change.

General Chemistry:- Law of mass action, Stoichiometry, Gas Laws

Physical Chemistry:- Types of solution, electrical conductivity and aqueous solution, ionic theory, electrical dissociation, Buffer solutions, Indicators, Solubility products, Common ion effect,
Amphoteric hydroxides, chemical equilibria and ways of shifting it.

Break down and synthesis of carbohydrates, fats, protein under aerobic and anaerobic reactions.
CNP cycle under aerobic and anaerobic reactions.
Colloidal Chemistry, Dispersion of Colloids, General and electrokinetic properties of colloids, colloidal solutions and mixtures.
Concept of B.O.D., C.O.D., T.O.C.

Environmental Chemistry:
Water structure and anomalous behavior of water,
Chemistry involved in water treatment processes like coagulation, disinfection, softening, fluoridation defluoridation, Iron and its control
Composition and characterisation of sewage, sewage sludge and gas analysis.

Chromatography:
Principles and uses in Environmental Engg.

Recommended Books:
1. Introduction to Environmental Engg. and Science, M Masters Gillbert, Prentice Hall Publication, New Delhi, 1995
5. Waste Water Treatment, Disposal and Reuse, Met Calf & Eddy, Tata McGraw Hill, 2004
CEP132 SOLID AND BIOMEDICAL WASTE MANAGEMENT

Teaching Scheme : 03 L + 1 T    Total 04
Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE   Total Marks :100
Duration of ESE: 2hrs.30 min.

Problems and impacts of solid waste in developing countries; Sources, types and composition of Municipal solid waste, quantity estimation and forecast, Management systems and planning.
Characteristics of solid waste – Sampling – physical, chemical and biological analysis. Sources, types and composition of industrial hazardous and toxic wastes, Treatment and disposal methods.
Collection of solid waste: On site handling and processing; Collection systems and service; Analysis of collection systems, collection routes; Management issues and concerns.
Transfer and transport, design requirements.
Composting – Process microbiology, Aerobic and anaerobic composting, parameters affecting, Design considerations, compost control, engineering design and operations.
Sanitary Landfill – Process mechanism, Classification, types, siting considerations, engineering design and operations.
Incineration – Process details, classification, types, siting considerations, Energy recovery, Pyrolysis, engineering design and operations.
Biomedical waste categorization; generation, collection, transport, treatment and disposal

Recommended Books:
5. Solid waste Management in developing Countries, Bhide A.D and Sudaresan B.B; INSDOC, New Delhi, 1983.
8. Management of Solid Waste in Developing Countries, Frank Flintoff; 2nd Edn, WHO publication, 1984

**CEP133 ADVANCED WATER TREATMENT**

<table>
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<td>2hrs.30 min.</td>
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</table>


**Pressure Filters.** Diatomaceous earth filters. Mico-strainers. Filterability Index.


**Industrial** water treatment: Boiler feed water. Softening of water. Langlier, Ryzner and other indices. Reuse of water and conservation of water in industry.

**Methods** of Iron and Manganese removal. Use of aeration, oxidation, ion-exchange and other methods and their control.

Theory of corrosion, and corrosion control.

Design of Conventional Water Treatment Plant

**Recommended Books:**
1. Water and Waste water Engineering, Fair Geyer and Okun, John Willy and Sons, 1966
2. Water and Waste water Technology, Mark J. Hammer, John Willy and Sons, 1986

CEP134 ENVIRONMENTAL ENGINEERING LABORATORY I
Teaching Scheme : 06 P Total = 06 Credit : 03
Evaluation Scheme: Internal = 25; External = 25 Total Marks : 50

It is a representative list of practicals. The instructor may choose experiments as per his requirements (so as to cover entire contents of the course) from the list or otherwise.


Design Problems based on CE532 and CE533

CEP231 ENVIRONMENTAL MICROBIOLOGY & BIOLOGICAL PROCESSES
Teaching Scheme : 03 L + 1 T Total 04 Credit : 04
Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE Total Marks :100
Duration of ESE: 2hrs.30 min.

Introduction to Microbiology
Classification of microorganisms, procaryotic cells, eucaryotic cells.
Characterization of microorganism, microorganism of importance.
Distribution of biological forms, interrelationship application in the field of Environmental Engineering.

Bacteria: Distribution, cytology, forms size, morphology and file structure of bacteria, nutritional requirements, metabolism, growth of bacteria, growth patterns, food microorganism relationship, Aerobic, Anaerobic growth.
Factor affecting growth, generation time.

Bacteriology of Water:
Pathogens and indicator of pollution, method of isolation, enumeration and differentiation. Presumptive, confirmative and completed test for E-coli, most probable
number, Membrane filter technique, indicators of pollution, sampling method, frequency, precautions.

**Microbiology of Food:** Microorganisms associated with milk and food, diseases transmitted, food poisoning,
Enzymes Nature of enzymes, mode of actions, effect of temperature, pH, salts and heavy metal, extra cellular and intracellular enzymes classification, source of enzymes, enzymes formation.

**Fresh Water Biology:**
Flora and fauna in rivers, distribution, limnology, biological cycles, oxygen concentration, nutrient concentration, oxygen depletion, oxygen sag reaeration, Lake eutrophication and its prevention.

**Algae, Fungi Protozoa and Viruses:**
General, introduction to these groups, their role in environmental Engineering and their classification, identification, observation nutrition, reproductions, their control.

**Viruses:**
Occurrence, special features, diseases caused by them, culturing, control of viruses.

**Bacterial Culture:**
Isolation of microorganisms, staining procedures, pure and mix cultures, culture characteristics, different medias, selective methods, interference, gram positive and negative bacteria laboratory culturing techniques, equipments used, microscope, autoclave, incubator, test chamber.

**Microbiology of Waste Water Treatment:**
Microorganisms, fundamental theory, theory of operations, oxygen requirements and environmental factors associated with following waste treatment methods.
- Activated sludge process
- Trickling filter
- Oxidation pond
- Sludge digestion
- Cesspools, septic tank and imhoff tank

**Air Microbiology:**
Types of microorganisms, Air borne diseases, sampling of air, microbial content of air, control of airborne diseases.
Control of microorganisms Death of bacteria
Pattern of death, effect of temp, pH, toxic substances on growth of bacteria, Antagonism and synergism.
Control of microorganisms by physical agents, Control of microorganisms by chemical agents.

**Recommended Books:**
Introduction: Objectives of waste water treatment, Purpose of advanced wastewater treatment, Wastewater quantity and transport and waste water characteristics. Alternative flowcharts, function and basic principles involved in different units of conventional wastewater treatment plant.

Process Analysis: Reaction and reaction kinetics, Mass balance, Reactors and their hydraulic characteristics, Practical aspects of reactor design.

Physical and Chemical Treatment: Screening, Grit removal, flow equalizations and mixing. Flocculation, sedimentation, flotation. Detailed principles and design aspects of Screening, Grit chamber and Sedimentation tank.


Sludge Treatment and Disposal: Aerobic and Anaerobic digestion of sludge, sludge stabilization, dewatering, conditioning and disposal.


Design of Conventional Sewage Treatment Plant

Recommended Books:
3. Wastewater Treatment and disposal, S.J. Arceivalla, Marcel Dekker, 1981.
CEP233 ENVIRONMENTAL IMPACT ASSESSMENTS AND MANAGEMENT

Teaching Scheme : 03 L + 1 T Total 04 Credit : 04
Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA + 60 ESE Total Marks :100
Duration of ESE: 2hrs.30 min.

Environmental Impact Assessment
Evolution of EIA; EIA at project; Regional and policy levels; Strategic EIA; EIA process; Screening and scoping criteria; Rapid and comprehensive EIA; Specialized areas like environmental health impact assessment; Environmental risk analysis; Economic valuation methods; Cost-benefit analysis; Expert system and GIS applications; Uncertainties. Legislative and environmental clearance procedures in India and other countries, Siting criteria; CRZ; Public participation; Resettlement and rehabilitation. Practical applications of EIA; EIA methodologies; Baseline data collection; Prediction and assessment of impacts on physical, biological and socio-economic environment; Environmental management plan; Post project monitoring, EIA report and EIS; Review process. Case studies on project, regional and sectoral EIA.

Case Study of Environmental Impact Assessment on any project nearby the town

Recommended Books:
1. Environmental Impact Assessment: Rau and Woofes

CEP234 ENVIRONMENTAL ENGINEERING LABORATORY II

Teaching Scheme : 04 P Total = 04 Credit : 02
Evaluation Scheme: Internal = 25; External = 25 Total Marks: 50

It is a representative list of practicals. The instructor may choose experiments as per his requirements (so as to cover entire contents of the course) from the list or otherwise.

Study of instruments, preparation of differential media isolation of bacteria by various methods, staining of bacteria, enumeration of bacteria by various methods, Heterotrophic plate count M.F. technique, Control of microorganisms.

Design Problems based on CE582 and Case study report based on CE583
CEP235 SEMINAR I

Teaching Scheme : 02 P    Total = 02    Credit : 01
Evaluation Scheme: Internal = 25    Total Marks : 25

Seminar-I to be delivered by the students on general topic related to Environmental Engineering to be evaluated by three members committee.

CEP331 INDUSTRIAL WASTEWATER TREATMENT

Teaching Scheme : 03 L + 1 T    Total 04    Credit : 04
Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA + 60 ESE    Total Marks : 100
Duration of ESE: 2hrs.30 min.

Problem of Industrial Waste Water:

Indian Standards for discharge of treated wastewater on land, into municipal sewer and natural water courses.

Sampling Procedure. Experimental evaluation of physico-chemical or biological treatment methods for treatment of the wastewater.

Approaches to Minimization of problem of industrial waste water, Good housekeeping, equalization, neutralization, precipitation, mixing of different effluent streams, recycle of effluent streams, process modifications in terms of raw materials or chemicals used general approach to planning of industrial waste water treatment and disposal. Cleaner Technologies of production for waste minimization.

Different Aspects and choices of various alternatives such as, Treating different effluent streams separately, Treating different streams jointly after mixing them partly or fully, Including/excluding domestic waste along with the industrial waste.

General Approach for handling and treatment of industrial wastewater with following special characteristics.

Shock Loads, presence of colours, toxic metal/ions, refractory substances, e.g. A B S and other detergents, growth inhibiting substances such as insecticides, waste rich in nutrients (N.P.K. etc.), waste rich in oil & grease, high suspended solids, high BOD, high temperature, acidity, alkalinity etc.

Experimental Evaluation of physico-chemical or biological treatment processes for treatment of the waste water.
Process Line Diagrams, characteristics and treatment of industrial waste of: -
Pulp and paper, textile, tannery, food, Cannings, sugar mill, distillery, dairy, pharmaceutical, electroplating etc. industries.

Design of Effluent Treatment Plant

Recommended Books:

CEP332 ELECTIVE I
A) HAZARDOUS WASTE MANAGEMENT

Teaching Scheme : 03 L + 1 T Total 04 Credit : 04
Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE Total Marks :100
Duration of ESE: 2hrs.30 min.

Introduction to Hazardous Waste: -

Hazardous Waste Characterization and site Treatment.

Transportation of Hazardous wastes
Hazardous Wastes (Handling, Storage & Management) Rules, 1989 of MoEF.
Introduction, container for Hazardous waste, bulk transport, Non bulk transport.

Groundwater Contamination: -
Effect on human health, Historical uses and abuses, hydrology, Detection , Control and Mitigation of groundwater contamination.

Process Techniques and Disposal: -
Selecting the process, siting the facility, integrated landfill system as Disposal sites, developing a new facility, and operating a landfill.
Basic Disaster Management Aspects:-
The significance of Disaster, the Disaster threat, National Disaster Management policy, major Requirement for coping with Disaster Management cycle, Disaster and National Development, Disaster legislation, counter disaster resources. International Disaster Organisation, utilisation of Resources.

Long-Term Measures: -
Prevention, Mitigation.
Major factors for occurrence of Disaster impact: -
Response to Disaster impact: -
Major post impact factors, Disaster management support requirements.

Recommended Books:

CEP332 ELECTIVE I
B) ENVIRONMENTAL STATISTICS

Teaching Scheme : 03 L + 1 T Total 04 Credit : 04
Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE Total Marks :100
Duration of ESE: 2hrs.30 min.

Stochastic Processes in the Environment: Probability concepts; Conditional probability and Bayes theorem. Environmental Data Analysis and QA/QC: Descriptive statistics; Averaging times; Sample size determination; Sampling frequency and duration; Measurement uncertainty; Accuracy and precision; Sample and dynamic blanks; Error propagation; Linear least-squares regression; Trend analysis; Non-parametric statistics. Experiment Design and Hypothesis: Testing: Factorial design of experiments; Confidence intervals; Equality of means; T-test; Analysis of variance (ANOVA); F-test; Significance of factor effects and their interactions.

Recommended Books:
2. Environmental statistics: Methods and Applications, V Barnett, John Wiley & Sons Ltd, 2004

CEP332 ELECTIVE I

C) ENVIRONMENTAL GEOTECHNOLOGY

<table>
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<td>2hrs.30 min.</td>
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Sources, Production and Classification of wastes,
Soil pollution process, Physical –chemical and biological interaction in soil;
Effect on Geotechnical properties and case studies
Waste Disposal Facilities such as landfills and impoundment, slurry walls etc.
Barrier systems, basic concepts, stability, compatibility and performance, geomembranes.
Monitoring subsurface contamination, Stabilization/Solidification of wastes

Recommended Books:

CEP333 ELECTIVE II

A) ENVIRONMENTAL SYSTEM MODELING

<table>
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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. Computational methods in environmental modeling.

**Recommended Books:**


**CEP333 ELECTIVE II**

**B) WATER AND WASTEWATER ENGINEERING STRUCTURES**

<table>
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<td>Total Marks</td>
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Duration of ESE: 2hrs.30 min.

Design of prestressed, mild steel pipes; underground rectangular sump and well stening; thrust block; durability aspects of water and wastewater retaining structures. Design of clarifloculator, elevated service reservoir; staging and circular ring girder; ferro cement tank

**Recommended Books:**

5. IS 3370 : Code of practice for concrete structures for the storage of liquids
6. IS 1343: Code of Practice for Prestressed Concrete
CEP333 ELECTIVE II
C) WATER DISTRIBUTION SYSTEMS AND OPTIMIZATION

Teaching Scheme : 03 L + 1 T Total 04 Credit : 04
Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE Total Marks :100
Duration of ESE: 2hrs.30 min.

Wastewater flows: Flow through sewers, Hydraulics of sewer, sewers layouts, sewerage system design, , sewer invert drop. Design of pumping mains, water hammer.
Optimization Techniques objects Analytic solutions by calculus lagrange Multipliers, Linear programming
Optimization of water distribution systems including branching, water hammer, causes and prevention, design of rising mains. Cost analysis and optimization of sewer system, Principles of Reliability analysis.

Recommended Books:

CEP334 ENVIRONMENTAL ENGINEERING LABORATORY III

Teaching Scheme : 04 P Total = 04 Credit : 02
Evaluation Scheme: Internal = 25; External = 25 Total Marks: 50

Design Problems based on CE631, CE632 and CE633

CEP335 SEMINAR II

Teaching Scheme : 02 P Total = 02 Credit : 01
Evaluation Scheme: Internal = 25 Total Marks :25

Seminar-II to be delivered by the students on general topic related to Environmental Engineering to be evaluated by three members committee.
CEP431 AIR QUALITY MONITORING AND CONTROL

Teaching Scheme : 03 L + 1 T  Total  04  Credit : 04
Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE  Total Marks :100
Duration of ESE: 2hrs.30 min.

**General Principles**, Biosphere, Air Environment, Air pollution, Primary and Secondary pollutants, Removal processes, sources of pollution, Averaging time air quality.

**Particulate Matter** : Natural & manmade, viable & nonviable, effects & removal mechanism, particle size distribution.

**Gaseous Pollutants** : CO, CO$_2$, Ozone, SO$_2$, H$_2$S, Sources and effects on vegetation materials and Humans, photo-chemical smog, secondary pollutants : NOx, Atmospheric reactions & Scavenging process.


**Atmospheric Stability** : Lapse rate, inversion : flume shape, Max mixing depth. Transport of air pollutants.

**Air Pollution Monitoring**: Sampling, monitoring equipments, stack monitoring, quality surveillance, source monitoring, Ambient air quality.

**Air Pollution Control**: Various methods of control of particulate matter in industries and design of gravity separator, cyclone separator, filters, electrostatic preceptor, absorption devices, scrubbers, combustion devices, control of gaseous emission and process emission controls.

**Air Quality Modeling** : Modelling, Air quality mathematical models, Gaussian Dispersion model, plume rise, application of models.

**Pollution** from mobile sources, problems, effects, testing and control, preventive measures.

**Other Types of Pollutions**:

**Recommended Books**:
CEP432 ENVIRONMENTAL ENGINEERING LABORATORY IV

Teaching Scheme : 02 P Total = 02 Credit : 01
Evaluation Scheme: Internal = 25; External = 25 Total Marks: 50
Duration of ESE: 2hrs.30 min.

It is a representative list of practicals. The instructor may choose experiments as per his requirements (so as to cover entire contents of the course) from the list or otherwise.

1. To measure CO % & NO % of the exhaust gases from vehicles or gasoline engine.
2. Determination of SPM, RSPM, SO2
3. Statistical Calculations of observed air pollution data.
4. Design of Bag filter for controlling dust pollution in particular industry – case study.
5. Design of cyclone separator.

CEP433 DISSERTATION (PHASE- I) & SEMINAR

Teaching Scheme : 06 P Total = 06 Credit : 10
Evaluation Scheme: Internal = 75 Total Marks : 75

Dissertation (Phase-I): Student has to submit the report and deliver the seminar based on 20% or more work on Dissertation topic. It is to be evaluated internally by three members’ panel of examiners headed by HOD wherein guide should be one of the members of the panel. Last date of submission of report shall be two weeks before the end of semester.

CEP531 DISSERTATION (PHASE-II) & SEMINAR

Teaching Scheme : 06 P Total = 06 Credit : 10
Evaluation Scheme: Internal = 75 Total Marks: 75

Dissertation (Phase-II): Student has to submit the report and deliver the seminar based on 30% or more work on Dissertation topic. It is to be evaluated internally by three members’ panel of examiners headed by HOD wherein guide should be one of the members of the panel. Last date of submission of report shall be two weeks before the end of semester.
CEP631 DISSERTATION (PHASE-III)

Teaching Scheme : 06 P       Total = 06       Credit : 20
Evaluation Scheme: Internal = 75; External = 175   Total Marks: 250

The external assessment of dissertation work is to be carried out by panel of examiners consisting of internal (guide) and external examiner. Candidate shall present the entire work on Dissertation, followed by viva-voce.

Last date of submission of dissertation will be the end of the semester. Please see Appendix-C of Rules & Regulation for further information.