EVALUATION SCHEME & SYLLABUS

FOR

B. TECH. THIRD YEAR

(ENVIRONMENTAL ENGINEERING)

(Effective from session 2020-21)
### B. TECH ENVIRONMENTAL ENGINEERING, SEMESTER – V, SESSION 2020-21

<table>
<thead>
<tr>
<th>S. No</th>
<th>Subject Codes</th>
<th>Subject</th>
<th>Subjects</th>
<th>Periods</th>
<th>Evaluation Scheme</th>
<th>End Semester</th>
<th>Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L</td>
<td>T</td>
<td>P</td>
<td>CT</td>
<td>TA</td>
</tr>
<tr>
<td>1</td>
<td>KCE501</td>
<td>Geotechnical Engg.</td>
<td>3 1 0</td>
<td>30 20 50</td>
<td>100</td>
<td>150</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>KNE502</td>
<td>Air &amp; Noise Pollution Control Engineering</td>
<td>3 1 0</td>
<td>30 20 50</td>
<td>100</td>
<td>150</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>KNE503</td>
<td>Solid Waste Management</td>
<td>3 1 0</td>
<td>30 20 50</td>
<td>100</td>
<td>150</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Departmental Elective-I</td>
<td>3 0 0</td>
<td>30 20 50</td>
<td>100</td>
<td>150</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Departmental Elective-II</td>
<td>3 0 0</td>
<td>30 20 50</td>
<td>100</td>
<td>150</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>KNE551</td>
<td>Geotech Engg. Lab</td>
<td>0 0 2</td>
<td>25</td>
<td>25 50</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>KNE552</td>
<td>Air Pollution Control Lab</td>
<td>0 0 2</td>
<td>25</td>
<td>25 50</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>KNE553</td>
<td>Solid Waste Management Lab</td>
<td>0 0 2</td>
<td>25</td>
<td>25 50</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>KNE554</td>
<td>Mini Project or Internship Assessment*</td>
<td>0 0 2</td>
<td>50</td>
<td>50 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>NC</td>
<td>Constitution of India/Essence of Indian Traditional Knowledge</td>
<td>2 0 0</td>
<td>15 10 25</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>MOOCs (Essential for Hons. Degree)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total:** 17 3 6 950 22

*The Mini Project or Internship (4 weeks) conducted during summer break after IV semester and will be assessed during V semester.

**NOTE:**

1. Regular classroom interaction with industry experts is to be ensured in all theory courses (minimum two expert talks from relevant Industry).
2. Working on experiments using virtual labs is to be ensured in lab courses.
3. Student’s visit to Industry/Industry Expert’s project site must be arranged as & when possible.

### B. TECH ENVIRONMENTAL ENGINEERING, SEMESTER – VI, SESSION 2020-21

<table>
<thead>
<tr>
<th>S. No</th>
<th>Subject Codes</th>
<th>Subject</th>
<th>Subjects</th>
<th>Periods</th>
<th>Evaluation Scheme</th>
<th>End Semester</th>
<th>Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L</td>
<td>T</td>
<td>P</td>
<td>CT</td>
<td>TA</td>
</tr>
<tr>
<td>1</td>
<td>KNE601</td>
<td>Design of Wastewater Engineering System</td>
<td>3 1 0</td>
<td>30 20 50</td>
<td>100</td>
<td>150</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>KNE602</td>
<td>Industrial Pollution Control &amp; Management</td>
<td>3 1 0</td>
<td>30 20 50</td>
<td>100</td>
<td>150</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>KNE603</td>
<td>Environmental Impacts Assessment, Audit and Laws</td>
<td>3 1 0</td>
<td>30 20 50</td>
<td>100</td>
<td>150</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Departmental Elective-III</td>
<td>3 0 0</td>
<td>30 20 50</td>
<td>100</td>
<td>150</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Open Elective-I</td>
<td>3 0 0</td>
<td>30 20 50</td>
<td>100</td>
<td>150</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>KNE651</td>
<td>Wastewater Engg. Lab</td>
<td>0 0 2</td>
<td>25</td>
<td>25 50</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>KNE652</td>
<td>CAD Lab</td>
<td>0 0 2</td>
<td>25</td>
<td>25 50</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>KNE653</td>
<td>Eco Camp</td>
<td>0 0 2</td>
<td>25</td>
<td>25 50</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>NC</td>
<td>Essential of Indian Traditional Knowledge/Constitution of India</td>
<td>2 0 0</td>
<td>15 10 25</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>MOOCs (Essential for Hons. Degree)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total:** 17 3 6 900 21

**NOTE:**

1. Regular classroom interaction with industry experts is to be ensured in all theory courses (minimum two expert talks from relevant Industry).
2. Working on experiments using virtual labs is to be ensured in lab courses.
3. Student’s visit to Industry/Industry Expert’s project site must be arranged as & when possible.
Departmental Elective in 3rd Year

**Departmental Elective -I**
KNE 051- Earth and Environment  
KNE 052- Ecological and Biological Principles and Processes  
KNE 053- Environmental Biotechnology

**Departmental Elective II**
KNE 054- Science and Policy of climate change  
KNE 055- Environmental Policy & Legislation  
KNE 056- Environmental Economics

**Departmental Elective III**
KNE 061- Environmental Risk Assessment  
KNE 062- Disaster Management  
KNE 063- Integrated Impact Assessment
KCE 501 GEOTECHNICAL ENGINEERING

LTP
310

Course Outcomes: After completion of the course student will be able to:

CO-1 Classify the soil and determine its Index properties.
CO-2 Evaluate permeability and seepage properties of soil.
CO-3 Interpret the compaction and consolidation characteristics & effective stress concept of soil.
CO-4 Determine the vertical and shear stress under different loading conditions and explain the phenomenon of soil liquefaction.
CO-5 Interpret the earth pressure and related slope failures.

Unit 1
Origin and classification: Preview of Geotechnical field problems in Civil Engineering, Soil formation, transport and deposit, Soil composition, Basic definitions, Weight volume relationships, Clay minerals, Soil structure, Index properties, sensitivity and thixotropy,
Particle size analysis, Unified and Indian standard soil classification system. [8]

Unit 2
Soil Hydraulics: Stress conditions in soil- total, effective and neutral stresses and relationships. Permeability - Darcy's Law, hydraulic conductivity, equivalent hydraulic conductivity in stratified soil. Seepage, flow nets, seepage calculation from a flow net, flow nets in anisotropic soils, seepage through earth dam, capillarity, critical hydraulic gradient and quick sand condition, uplift pressure, piping. [8]

Unit 3
Soil compaction, water content - dry unit weight relationships. Factors controlling compaction. Field compaction equipment; field compaction control; Proctor needle method. Consolidation: Primary and secondary consolidation, Terzaghi's one dimensional theory of consolidation, Consolidation test, Normal and Over Consolidated soils, Over Consolidation Ratio, determination of coefficient of consolidation. [8]

Unit 4
Stress Distribution in soil: Elastic constants of soils and their determination, Boussinesq equation for vertical stress, The Westergaard equation, Stress distribution under loaded areas, Concept of pressure bulb, contact pressure. Shear Strength: Mohr-Coulomb failure criterion, shear strength parameters and determination; direct and tri-axial shear test; unconfined compression test; pore pressure, Skempton's pore pressure coefficients, and Soil liquefaction. [8]

Unit 5
Earth pressure: Classical theories, Coulomb and Rankine's approaches for frictional and c-φ soils, inclined backfill, Graphical methods of earth pressure determination.
Stability of slopes - finite and infinite slopes, types of slope failure, Culmann’s method & Method of slices, Stability number & chart, Bishop’s method.

Text & References Books

1. V.N.S. Murthy – Soil Mechanics and Foundation Engineering (Fifth Edition)
4. Alam Singh – Modern Geotechnical Engineering
5. Brij Mohan Das – Geotechnical Engineering, CENGAGE Learning
6. I.H. Khan – Text Book of Geotechnical Engineering
7. C. Venkataramaiah – Geotechnical Engineering
Course Outcomes: After completion of the course student will be able to:

CO-1 Understand air pollutants and their impacts.
CO-2 Explain air pollution chemistry and meteorological aspects of air pollutants.
CO-3 Demonstrate methods for controlling particulate air pollutants.
CO-4 Demonstrate methods for controlling gaseous air pollutants.
CO-5 Understand automotive emission standards.
CO-6 Apply methods for controlling noise pollution.

Unit I:

Unit II:
Air pollution chemistry, meteorological aspects of air pollution dispersion; temperature lapse rate and stability, wind velocity and turbulence, plume behaviour, dispersion of air pollutants, the Gaussian Plume Model, stack height and dispersion.

Unit III:
Ambient air quality and standards, air sampling and measurements; Ambient air sampling, collection of gaseous air pollutants, collection of particulate air pollutants, stack sampling. Design of gravitational settling chamber, cyclone separator, fabric filter, electrostatic precipitator.

Unit IV:
Introduction to air pollution control, control devices for particulate contaminants: gravitational settling chambers, cyclone separators, wet collectors, fabric filters (Bag-house filter), electrostatic precipitators (ESP).

Unit V:

References:
1. Peavy, Rowe and Tchobanoglous: Environmental Engineering.
2. Martin Crawford: Air Pollution Control Theory.
5. Nevers: Air Pollution Control Engineering.
7. C.S. Rao, Air pollution and control
KNE 503: Solid Waste Management

L T P
3 1 0

Course Outcomes: After completion of the course student will be able to:

CO 1 Explain the generation and disposal of solid waste.
CO 2 Apply engineering systems for handling of solid waste.
CO 3 Explain the composition and characteristics of landfill.
CO 4 Apply methods of composting for solid waste.

Unit-1
Solid waste: Public health and ecological impacts, Sources and types of solid wastes, material flow and waste generation, Functional elements: Waste generation, storage, collection, Transfer and transport, processing and recovery, disposal.

Physical and chemical composition of municipal solid waste, integrated solid waste management, hierarchy of waste management options, different methods for generation rates. Storage: movable bins, fixed bins. Collection: home to home collection, community bin system. Theory and design of hauled container system, stationary container system.

Unit-2
Transportation: handcart, tri-cycle, animal cart, tripper truck, dumper placer, bulk refuse carrier, railroad transport, water transport, conveyors, layout of routes. Engineering system for on-site handling and processing of solid waste: separators, size reduction equipments, screening equipments, densification, baling, cubing, pelleting equipments.

Unit-3:
Landfilling: Site selection criteria, landfill layout, landfill sections, Occurrence of gases and leachate in landfills: composition and characteristics, generation factors, initial adjustment phase, transition phase, acid formation phase, methane formation phase, maturation phase of gases and leachate.

Unit-4:
Composting, types of composting, process description, design and operational consideration of aerobic composting, process description, design and operational consideration of anaerobic composting. Thermal conversion technologies: incineration and pyrolysis system, energy recovery, system, Electronic waste and Biomedical waste. Overview of solid waste management practices in India.

References:
2. Solid Waste Engineering, Principle & Management issues by Ven Te Chow
3. Bhide, A.D., B.B. Sundaresan, Solid Waste Management in developing countries.
4. Manual on Municipal solid Waste Management, CPHEEO, Govt. of India.
5. Guidelines for Management and Handling of Hazardous wastes MOEF (1991), Govt. of India.
PART-A (To be performed in lab)

1. Determination of water content of a given moist soil sample by (i) oven drying method, (ii) pycnometer method.
2. Determination of specific gravity of a given soil sample by (i) density bottle, (ii) pycnometer method.
3. Determination of in situ dry density of soil mass by (i) core-cutter method, (ii) sand replacement method.
4. Determination of relative density of a given soil sample.
5. Determination of complete grain size distribution of a given soil sample by sieve analysis and sedimentation (hydrometer) analysis.
6. Determination of consistency limits (liquid, plastic and shrinkage limits) of the soil sample used in experiment no. 5 (grain-size analysis).
7. Determination of shear strength of soil by Direct shear test.
8. Determination of compaction characteristics (OMC & MDD) of a given soil sample.
9. Determination of permeability of a remoulded soil sample by constant head &/or falling head method.
10. Determination of consolidation characteristics of a remoulded soil sample by an odometer test.
11. Determination of shear strength characteristics of a given soil sample by U/U test from Triaxial Compression Machine.
12. Retrieving soil samples and conducting SPT tests by advancing boreholes through hand-held auger.

Note: Any 8 experiments are to be performed from the list of experiments.

PART B

It is mandatory to perform experiments using virtual lab where ever applicable.

References:

KNE 552: Air Pollution Control Engineering Lab

L T P
0 0 2

1. Stack monitoring.
2. Ambient air monitoring for PM$_{10}$, SO$_2$ and NO$_2$.
3. Measurement of meteorological parameters (wind velocity, wind direction, humidity, temperature, solar insolation, rainfall) and drawing wind rose diagram.
4. Determination of HC and CO.
6. Laboratory scale study on few air pollution control devices.

References:
2. Pandey and Carney: Environmental Engineering

KNE 553: Solid Waste Management Lab

L T P
0 0 2

1. Sample preparation and sampling techniques.
2. Coning and quartering method.
3. Profile sampling of municipal solid waste.
4. Analysis of solid waste/sludge for moisture content.
5. Analysis of solid waste/sludge for particle size.
6. Analysis of solid waste/sludge for calorific value.
7. Determination of N in the sample.
CO 1 Understand Earth's energy budget, Atmosphere, Climate and climate change.
CO 2 Explain significance of natural resources.
CO 3 Explain Ecological impacts of modern agriculture, Organic farming.
CO 4 Understand and explain major environmental concerns.
CO 5 Explain Effect of population increase on environment.

Unit 1
Understanding the earth, Atmosphere and processes governing environmental conditions, Biosphere, Earth's energy budget, Atmosphere, Climate and climate change, The geologic, tectonic, Hydrological and biogeochemical cycles.

Unit 2
Study and significance of natural resources, Renewable biological resources, Wildlife conservation/ management, Fisheries, Forestry, Energy resources, Energy consumption, Scarcity and conservation.

Unit 3
Mineral resources, Mineral availability and recycling, Air, water and soil resources, World food supply, Traditional agriculture, Green revolution, Aquaculture, Modern agriculture, Ecological impacts of modern agriculture, Organic farming.

Unit 4
Major environmental concerns, Natural hazards and processes, Environmental impacts, Dams and environment, Channelisation and environment, Global climate and hazards.

Unit 5
Effect of population increase on environment, Historical perspective of growing environmental concerns, Environmental and social issues, Case studies regarding local-national-international environmental problem, Causes of global warming, Water-treaties, International treaties.

Note: The students should be given a comprehensive problem at the end which requires inputs/ knowledge/ application from all the units of the syllabus. It may be evaluated as a part of TA.

Books
KNE 052- Ecological and Biological Principles and Processes

L T P
3 0 0

Course Outcomes: After completion of the course student will be able to:

CO 1 Explain Productivity and energy flow.
CO 2 Explain food webs, cycling of elements and population dynamics in ecosystem.
CO 3 Understand organization and dynamics of ecological communities.
CO 4 Understand microbiological concepts, cells, and characteristics of living organisms.
CO 5 Apply the knowledge of microbiology to environmental engineering field.

Unit 1
Ecosystems, Biotic and abiotic components, Production and consumption, Trophic levels, Productivity and energy flow, Imbalance of ecosystem: Causes and effects, Lotka-Volterra equations.

Unit 2
Food webs, Cycling of elements, Population dynamics, Ecology of population, Ecological niche, Mortality and survivorship, Community interactions, Changes in ecosystems, Succession, Long range changes, Long range stability.

Unit 3
The organization and dynamics of ecological communities, Description and study of typical natural and artificial ecosystems, Biochemistry, Photosynthesis and respiration, Important biological compounds, Enzymes.

Unit 4
Microbiological concepts, Cells, Classification and characteristics of living organisms, Characterization techniques, Reproduction, Metabolism, Microbial growth kinetics.

Unit 5
Applications of microbiology to environmental engineering; assimilation of wastes, Engineered systems, Concepts and principles of carbon oxidation, Nitrification, Denitrification, Methanogenesis, etc., Concepts of quantification of degradable pollutants.

Books
4. ICAR “Hand Book of Agriculture”, Indian Council of Agricultural Research
KNE 053- Environmental Biotechnology

L T P
3 0 0

Course Outcomes: After completion of the course student will be able to:
CO 1 Apply genetic engineering knowledge to explain genetic codes and protein synthesis.
CO 2 Apply novel methods of pollution control.
CO 3 Explain microbiology of waste water treatment.
CO 4 Measure air pollution and its control through biotechnology.
CO 5 Understand microbiology of degradation of xenobiotic in environment.

Unit 1
Concept of environmental biotechnology and environmental engineering, Scope and important, Genetic engineering structure of DNA, RNA, Replication of DNA, Genetic code, Transcription, Protein synthesis.

Unit 2
Bioremediation, Types of bioremediations, Bio augmentation for bioremediation, Bioreactors, Bioremediation of herbicides, pesticides, hydrocarbons, oil spills, Novel methods of pollution control – Vermi technology, Methane production, Root zone treatment, Membrane technology, Biodegradable plastics.

Unit 3

Unit 4
Air pollution and its control through biotechnology, Biotechnology in reduction of CO2 emission, Bioscrubbers, Biobeds, Biotrickling filters and their applications.

Unit 5
Microbiology of degradation of xenobiotic in environment—ecological consideratons, Decay behavior and degradative plasmids, Hydrocarbons, Substituted hydro carbons, Oil pollution, Surfactants, Pesticides, Biological detoxification of cyanide, oxalate, urea, petrochemical industry effluents, toxic organics, phenols.

Books
KNE 054- Science and Policy of Climate Change

**L T P**

3 0 0

**Course Outcomes:** After completion of the course student will be able to:

CO 1 Use modern general circulation models, changes in greenhouse gases and influence on models.
CO 2 Explain nature of storms like cyclones and hurricanes.
CO 3 Explain Internationally adopted emissions restrictions.
CO 4 Prepare active federal legislation on climate change.

**Unit 1**

**Unit 2**
Quantitative analysis of climate change, Case study: Hurricanes and global warming.

**Unit 3**
History of concern about climate change, 1970s (IIASA, DOE), 1980s, Startup of U.N. IPCC, Mission of the IPCC, Framework convention on climate change, Kyoto protocol to framework convention, Policy analyses, Internationally adopted emissions restrictions, State and local ordinances.

**Unit 4**
Class legislative proposals and discussion. Hearings on subject matter chosen by leaders, Testimony by staff, Continue hearings and testimony, Submission of legislation, Active federal Legislation on climate change.

**Books**
KNE 055- Environmental Policy & Legislation

L T P
3 0 0

Course Outcomes: After completion of the course student will be able to:

CO 1 Practice water acts for prevention and control of pollution.
CO 2 Practice air acts for prevention and control of pollution.
CO 3 Practice environmental acts for protection and management of environment.
CO 4 Practice public liability insurance act.

Unit 1

Unit 2

Unit 3

Unit 4

Books
1. Pollution Control Acts, rules and notifications issued by CPCB [Ministry of and Environment and forest, Goverment of India], Paryavaran Bhawan, CGO Complex, New Delhi-110003.
KNE 056- ENVIRONMENTAL ECONOMICS

L T P
3 0 0

Course Outcomes: After completion of the course student will be able to:

CO 1 Understand economic operation and environmental issues.
CO 2 Understand economic incentive and environmental protection.
CO 3 Understand pollution taxes and problems with pollution taxes.
CO 4 Understand Tradable pollution permits.

Unit 1
Economy and environment, Economic operation and environmental issues, Environmental pollution and sources, Adversities on the economy, Markets and environmental assets, Incomplete markets, Externalities, Non-exclusion, Non-rivalry and public good, Nonconvexities, Asymmetric information.

Unit 2
Economic incentive and environmental protection:
(i) Price rationing: Charges and subsidies.
(ii) Liability rules: Non-compliance fees, bonds and deposit refunds.
(iii) Quantity rationing: Marketable permits.
(iv) Evaluation criteria.
(v) Practical Conditions for use of economic incentives.

Unit 3
Pollution Taxes. Efficiency properties of a tax on emissions, problems with pollution taxes.

Unit 4

Books
KNE 601: Design of Wastewater Engineering Systems

LTP
3 0 0

Course Outcomes: After completion of the course student will be able to:

CO 1 Understand Preliminary, primary, secondary and tertiary wastewater treatment processes.
CO 2 Explain physio-chemical and biological treatment strategies and their evaluation.
CO 3 Explain anaerobic treatment process for treatment of waste.
CO 4 Understand Indian standards for disposal of treated wastewaters on land and in natural streams.
CO 5 Understand process flow sheets and treatment scheme for tannery, sugar, textile, steel, distillery, paper/pulp and oil refinery industry wastewater.

Unit 1

Unit 2
Physico-chemical and biological treatment strategies and their evaluation, Theory of activated sludge process (ASP), extended aeration systems, trickling filters (TF), aerated lagoons, stabilization ponds, oxidation ditches, sequential batch reactor, rotating biological contactor, etc., Mass balancing in ASP and TF and their design.

Unit 3
Anaerobic treatment process, Effects of pH, temperature and other parameters on anaerobic treatment, Concept of anaerobic contact process, anaerobic filter, anaerobic fixed film reactor, fluidized bed and expanded bed reactors and upflow anaerobic sludge blanket (UASB) reactor.

Unit 4
Indian standards for disposal of treated wastewaters on land and in natural streams, Agricultural irrigation, Ground water recharge, Treated wastewater reclamation and reuse, Introduction to duckweed pond, vermiculture and root zone technology for wastewater treatment, Special treatments, Recent technologies of treatment.

Unit 5
Study on wastewater generation points, wastewater characteristics, process flow sheets, treatment scheme for tannery, sugar, textile, steel, distillery, paper/pulp and oil refinery industry wastewater.

Note: The students should be given a comprehensive problem at the end which requires inputs/ knowledge/ application from all the units of the syllabus. It may be evaluated as a part of TA.

Books

KNE 602: Industrial Pollution Control and Management

L T P
3 0 0

Course Outcomes: After completion of the course student will be able to:

CO1 Understand sources and types of solid, liquid, gaseous wastes.
CO2 Control and removal of specific pollutants in industrial wastewaters.
CO3 Apply controlling measures for gaseous emissions and hazardous waste.
CO4 Apply concept of Life cycle analysis and Clean technologies.

Unit 1
Industrial wastes and their sources: Various industrial processes, Sources and types of solid, liquid, gaseous wastes, Noise & radiation emissions. Sources of industrial water usages and various industrial processes requiring water use and required water quality.

Unit 2
Processes responsible for deterioration in water quality, Various waste water streams, Control and removal of specific pollutants in industrial wastewaters, e.g., oil and grease, bio-degradable organics, chemicals such as cyanide, fluoride, toxic organics, heavy metals, radioactivity etc. Wastewater reuse & recycling, Concept of zero discharge effluent.

Unit 3
Control of gaseous emissions: Hood and ducts, Tall stacks, Particulate and gaseous pollutant control, Solid waste generation and disposal management.
Hazardous wastes: Definitions, concepts and management aspects.
Noise & radiation: Generation, control and management.

Unit 4
Recent trends in industrial waste management, Cradle to grave concept, Life cycle analysis, Clean technologies; Case studies of various industries, e.g., dairy, fertilizer, distillery, sugar, pulp and paper, iron and steel, metal plating, thermal power plants, etc.
Environmental audit: Definition and concepts, Environmental audit versus accounts audit, Compliance audit, Relevant methodologies, Various pollution regulations, Introduction to ISO and ISO 14000.
Note: The students should be given a comprehensive problem at the end which requires inputs/ knowledge/ application from all the units of the syllabus. It may be evaluated as a part of TA.

Books

KNE-603: Environmental Impact Assessment, Audit & Laws

L T P  3 0 0

Course Outcomes: After completion of the course student will be able to:

CO1 Understand environmental management planning.
CO2 Apply environmental impact assessment planning.
CO3 Conduct environmental audit.
CO4 Understand pollution prevention and control laws & acts.
CO5 Prepare detailed project report.

UNIT 1
Introduction to EIA & Audit, Environment & Industries, Input information, Plant operation, Environmental Management planning, Waste Streams impact on water bodies.

UNIT 2
Environmental Impact Assessment planning. Activities, Methodology for Environmental Impact Assessment, Role of Environmental Engineering firm, Role of Regulatory agencies & control boards, Role of the Public.

UNIT 3
Environmental Audit: Introduction, Environmental information Purpose & advantage of studies, General approach of environmental Auditing Environmental Audit, Audit programs in India, Auditing program in major polluting Industries, Reports of the Environmental audit studies.
UNIT 4
Pollution prevention and control laws & acts: Constitution of India & environment, Constitution protection to Environment laws, Administrative & legislative arrangement for Environmental production, Indian Standards, Pollution control acts in India, critical appraisal, fiscal incentives for environmental protection.

UNIT 5
Guidelines of preparation of project report and its evaluation, methods of clearance from the concern authorities at various labels.

References:
2. Environmental impact assessment by Canter.
4. Dying Wisdom: Rise, Fall, and potential of India’s Traditional rain water harvesting systems by Anil Agarwal & Sunita Narayan, CSE Publication. New Delhi.

KNE 651: Wastewater Engg. Lab

L T P
0 0 2
1. Determination of color and odor of wastewater sample.
2. Determination of BOD constants.
3. To determine the COD.
4. Sampling protocol of wastewater from an Industry.
5. Preservation of wastewater samples for different tests i.e., DO, BOD, Metals etc.
6. To determine the nitrogen content.

Books

KNE 652: CAD Lab

L T P
0 0 2
1. Design of water distribution system using available software.
2. Design of sewer line/wastewater drain network using available software.
3. Digitization of your city map using available software and showing pollution map.
4. Predicting concentration of air pollutant, emitted from stack, at any given location in ambient environment by using any dispersion modeling software.
KNE-653: Environment Camp

L T P
0 0 2

The purpose of the camp is to train students in applying modern techniques/equipment to prepare a detailed report of selected study area. The course will be run in the form of a camp for 7 working days and will involve one or more of the following components:

1. Study of the environmental problems in the study area.
2. Sampling work and analysis in the lab.
3. Field study and primary data collection.
4. Secondary data collection from agencies.
5. Statistical analysis of data, model development and estimating pollutant quantities.
6. Designing of system using software/model/data.
7. Preparing a map using GIS software and report writing.
KNE 061 - Environmental Risk Assessment

Course Outcomes: After completion of the course student will be able to:

CO1 Understand types of environmental risk and conduct modelling for the problem.
CO2 Understand environmental monitoring and health surveillance.
CO3 Conduct risk evaluation with help of national policies.
CO4 Understand emerging needs for common national problems.

Unit 1
Environmental risk, Definition, Types of environmental risk, Management risk, Need of environmental risk management, International collaborations in risk management.
   Establishing an overview of the problem, Models, Boundaries and contexts, Modeling the problem, Setting boundaries to the risk system, Putting the risk into comparative context.

Unit 2
Identifying and estimating risk selection of techniques, Environmental monitoring and health surveillance, Testing and screening, Modeling, Environmental models, Establishing the relationship between the dose and the effect.

Unit 3
Risk evaluation and national policies, Policy considerations, Legislative considerations, Legal considerations, Economic considerations, Managing environmental risks.

Unit 4
Developing a national risk profile, Institutional arrangements, Risk management tasks, Environmental links, Socio-economic links, Common national problems, Emerging needs and suggested actions.

Books
KNE 062- Disaster Management

L T P
3 0 0

Course Outcomes: After completion of the course student will be able to:

CO1 Understand about natural hazards and disasters.
CO2 Understand man made hazards and disasters.
CO3 Apply emerging approaches in disaster management.
CO4 Understand and apply disaster reduction and management.
CO5 Execute ecological planning for sustainability and sustainable development.

Unit 1

Unit 2

Unit 3
Emerging approaches in Disaster Management.
Pre-disaster stage (preparedness), Preparing hazard zonation maps, Predictability/ forcasting & warning, Preparing disaster preparedness plan, Land use zoning, Preparedness through (IEC) Information, Education & communication.
Pre-disaster stage (mitigation), Disaster resistant house construction, Population reduction in vulnerable areas, Awareness.
Emergency Stage, Rescue training for search & operation at national & regional level, Immediate relief, Assessment surveys.
Post Disaster stage-Rehabilitation, Political administrative aspect, Social aspect, Economic Aspect, Environmental aspect.

**Unit 4**
Natural disaster reduction and management, Provision of Immediate relief measures to disaster affected people, Prediction of hazards & disasters, Measures of adjustment to natural hazards, Mitigation.
Preparedness: Education on disasters, Community involvement, The adjustment of human population to natural hazards & disasters, Role of media, Application of geographical information system (GIS) in disaster risk management.

**Unit 5**
A regional survey of land subsidence, Coastal disaster, Cyclonic disaster and disaster in hills with particular reference to India, Ecological planning for sustainability and sustainable development in India, Sustainable rural development: A Remedy to Disasters, Role of panchayats in disaster mitigations, Environmental policies & programs in India: Institutional & National, Centres for natural disaster reduction.

**Books**
KNE 063 - Integrated Impact Assessment

**Course Outcomes:** After completion of the course student will be able to:

CO1 Understand concepts of integrated impact assessment.
CO2 Understand concepts of biodiversity and health impact assessment.
CO3 Apply social impact assessment (SIA) approach for handling social issues.
CO4 Apply the concepts of IIA in economic analysis.
CO5 Ensure public participation in IIA and its relevance to decision-making.

**Unit 1**
Introduction and an overview of integrated impact assessment (IIA), Definition, Sustainable development challenges and need for IIA, Key approaches of IIA: Environment, Social health and economic, Current practices, Changing perspectives and debate in IIA, Environmental impacts – Examples, need for assessment, difficulties; The EIA Approach –Background, Objectives, Components and techniques, Impact prediction and analysis, Treatment of risk and uncertainty, EIA inputs to the project cycle and development planning, EIA in India – Legislative aspects, Current practices and constraints, EIA case study.

**Unit 2**
Biodiversity and health impact assessment (BIA and HIA), Role of BIA in the existing EIA process, Identification, Prediction and evaluation of impacts on biodiversity, Techniques of biodiversity impact assessment and monitoring, Threat reduction methods, Case study, Impact of environment on health, Morbidity pattern in India, Developing framework for HIA analysis, Changing concept and approach in HIA, Health need assessment, Tools and techniques in HIA, HIA case study.

**Unit 3**
Handling social issues: the social impact assessment (SIA) approach, Overview and scope of SIA, SIA and community, Marginalized/ vulnerable groups, Indigenous people, Resettlement & rehabilitation and development, SIA and gender impact assessment, SIA and NRM, SIA case studies.

**Unit 4**
Integrated analysis of environmental, social and health impacts, Challenges for IIA: Removing inconsistencies and differences between different approaches, Other methodological and practical issues, Scope for integrated approach in economic analysis: Concept of economic analysis, Cost-benefit analysis (CBA), Social CBA, Cost Effectiveness analysis (CEA), The analytic hierarchy process (AHP) based approach to project appraisal.
Unit 5
Mapping tools and contribution of IIA in decision makings, Role and relevance of GIS Techniques in IIA, Public participation in IIA and its relevance to decision-making, Contribution of IIA to decision-making: Prospects & constraints, Stakeholder participation in IIA: Importance, Methodological and practical issues, Emerging dimensions and future directions, Strategic environmental assessment (SEA), Technology assessment, Risk assessment, IIA Case Studies.

Books