MTEV – 613 Environmental Impact Assessment and Management

Course Credits --3

	L	T	P
Internal Marks: 50			
External Marks: 100	**3**	**0**	**0**
Total Marks: 150			

Introduction: The Need for EIA, Indian Policies Requiring EIA , The EIA Cycle and Procedures, Screening, Scoping, Baseline Data, Impact Prediction, Assessment of Alternatives, Delineation of Mitigation Measure and EIA Report, Public Hearing, Decision Making, Monitoring the Clearance Conditions, Components of EIA, Roles in the EIA Process. Government of India Ministry of Environment and Forest Notification (2000), List of projects requiring Environmental clearance, Application form, Composition of Expert Committee, Ecological sensitive places, International agreements.

Identifying The Key Issues: Key Elements of an Initial Project Description and Scoping, Project Location(s), Land Use Impacts, Consideration of Alternatives, Process selection: Construction Phase, Input Requirements, Wastes and Emissions, Air Emissions, Liquid Effluents, Solid Wastes, Risks to Environment and Human, Health, Socio-Economic Impacts, Ecological Impacts, Global Environmental Issues.

EIA Methodologies: Criteria for the selection of EIA methodology, impact identification, impact measurement, impact interpretation & Evaluation, impact communication, Methods-Adhoc methods, Checklists methods, Matrices methods, Networks methods, Overlays methods, Environmental index using factor analysis, Cost/benefit analysis, Predictive or Simulation methods.

Reviewing The EIA Report: Scope, Baseline Conditions, Site and Process alternatives, Public hearing. Construction Stage Impacts, Project Resource Requirements and Related Impacts, Prediction of Environmental Media Quality, Socio-economic Impacts, Ecological Impacts, Occupational Health Impact, Major Hazard/ Risk Assessment, Impact on Transport System, Integrated Impact Assessment.

Review Of EMP And Monitoring: Environmental Management Plan, Identification of Significant or Unacceptable Impacts Requiring Mitigation, Mitigation Plans and Relief & Rehabilitation, Stipulating the Conditions, Monitoring Methods, Pre-Appraisal and Appraisal.

Case Studies: Preparation of EIA for developmental projects- Factors to be considered in making assessment decisions, Water Resources Project, Pharmaceutical industry, thermal plant, Nuclear fuel complex, Highway project, Sewage treatment plant, Municipal Solid waste processing plant, Tannery industry.

References:

1. Sadler, B. and McCabe, M., Environmental Impact Assessment: Training Resource Manual. UNEP (2002).
2. MOEF, India, EIA manual. Ministry of Environment and Forests, Government of India (http://www.envfor.nic.in/legis/eia/so195.pdf).
3. Canter, R. L., Environmental Impact Assessment, Tata McGraw-Hill (1981).
4. Rau J. G. and Wooten D. C., Environmental Impact Analysis Handbook, Tata McGraw-Hill (1980).

5. ISO 14001: 2004; ISO 14004: 2004; ISO 19011: 2002

MTEV – 619 Industrial Waste Management

Course Credits --3

	L	T	P
Internal Marks: 50			
External Marks: 100	**3**	**0**	**0**
Total Marks: 150			

Sources and types of industrial wastewater – Environmental impacts – Regulatory requirements – generation rates – characterization – Toxicity and Bioassay tests.

Prevention vs Control of Industrial Pollution– Source reduction techniques – Waste Audit- Evaluation of pollution prevention options.

Waste minimization - Equalization - Neutralization – Oil separation – Flotation – Precipitation – Heavy metal Removal – adsorption – Aerobic and anaerobic biological treatment – Sequencing batch reactors – High Rate reactors - Chemical oxidation – Ozonation – Photocatalysis – Wet Air Oxidation – Evaporation – Ion Exchange – Membrane Technologies – Nutrient removal

Individual and Common Effluent Treatment Plants – Zero effluent discharge systems - Wastewater reuse – Disposal of effluent on land – Quantification, characteristics and disposal of Sludge.

Industrial manufacturing process description, wastewater characteristics, source reduction options and waste treatment flow sheet for Textiles – Tanneries – Pulp and paper – metal finishing – Petrochemical -Pharmaceuticals – Sugar and Distilleries – Food Processing – fertilizers – Thermal Power Plants and Industrial Estates, ISO 14000:2003 – Waste Audit.

References:

1. Arceivala, S. J. and Asolekar, S. R., *Wastewater Treatment for Pollution Control*, 3rd ed., McGraw-Hill Education (India) Pvt. Ltd., New Delhi, 2006.
2. Eckenfelder, W.W., Industrial Water Pollution Control, McGraw Hill (2007)
3. Frank Woodard, *Industrial waste treatment Handbook*, Butterworth Heinemann, New Delhi, 2001.
4. *Industrial Pollution Prevention Handbook,* Freeman H.M., McGraw Hill Inc.
5. Patwardhan, *Industrial Waste water Treatment*, Prentice Hall of India, New Delhi (2008)

MTEV – 620 Pollution Monitoring Techniques

Course Credits --3

	L	T	P
Internal Marks: 50			
External Marks: 100	**3**	**0**	**0**
Total Marks: 150			

1. Measurement and Monitoring of Pollutants: Detection and Occurrence of Indicators Organisms and Pathogens, Geographic Information Systems.

2. Analytical methods: Gravimetric analysis, volumetric analysis, precipitation methods, oxidation reduction methods.

3. Principle, brief working and applications of different instrumental methods: U V I R spectrophotometer, flame photometry, AAS, chromatography, gas chromatography, Liquid chromatography , polarography, mass spectrometry, NMR & ESR spectroscopy, radio activity measurement, x-ray diffraction, thermal analysis techniques: DTA, TGA, DSC.

Refernces:

1. Willard, Merritt, Dean and Settle, *"Instrumental Methods of Analysis"*, Wadsworth Pub. Co., USA.

2. Sawyer, C.N., McCarty P.L. and Parkin, G.F., "Chemistry for Environmental Engineering and Science", Tata McGraw Hill, New Delhi.

MEV-116 Urban Stormwater Management

(Credits - 3:0:0 = 3)

Teaching Scheme
Lectures: 3 hrs/week

Course Outcomes:

On completion of the course, the student will have the ability to:

1. Identify factors affecting urban hydrological cycle.
2. Estimate urban water demand and urban stormwater quantity.
3. Investigation of resources for drainage master plan.
4. Plan and design stormwater control and disposal systems.
5. Develop integrated urban water management system.
6. Understand the operation and maintenance of urban drainage system.

Syllabus Content:

- General introduction to urbanisation and its effect on water cycle – urban hydrological cycle – Effect of urbanisation on hydrology.
- Urban Hydrological cycle – time of concentration – importance of short duration of rainfall and runoff data – methods of estimation of time of concentration for design of urban drainage systems.
- Typical contents of an urban drainage master plan – interrelation between water resources investigation and urban planning processes – planning objectives – comprehensive planning – use of models in planning.
- Basic approaches to urban drainage- Storm water Analysis – runoff quantity and quality – peak runoff determination-
- Design of storm water network systems- Elements of drainage systems – open channel – underground drains – appurtenances – pumping – source control.
- Stormwater Best Management Practices – Detention and retention facilities – swales, stormwater wetlands, infiltration trenches, sand filters, filter strip.
- Operation and maintenance of urban drainage system –Watershed models for stormwater management.

Reference Books:

1. Geiger W. F., J Marsalek, W. J. Rawls and F. C. Zuidema, Manual on Drainage in Urbanised area – 2 volumes, UNESCO
2. Hall M J , Urban Hydrology, Elsevier Applied Science Publisher
3. Stahre P and Urbonas B, Stormwater Detention for Drainage, Water Quality and CSO Management, Prentice Hall
4. Urban Hydrology for small Watersheds, TR-55, NRCS, US Deptt. of Agriculture
5. Iowa Stormwater Management Manual, Version-3
6. Hydraulic Design Manual, Texas Department of Transportation
7. McCuen, R.H., Hydrologic Analysis and Design, Pearson Education

LMEV-101 Advanced Water and Wastewater Laboratory

(Credits - 0:0:2 = 1)

Teaching Scheme
Lectures: 2 hrs/week

Course Outcomes:

On completion of the course, the student will have the ability to:

1. Understand the application of analytical equipment in water and wastewater analysis.
2. Develop the methods for the analysis of different pollutants in water and wastewater.
3. Perform the analysis of heavy metals using atomic absorption spectrometer, spectrophotometer.
4. Determine the BOD and ASP kinetic parameters for different types of wastewater.

Syllabus Content:

- Analysis of environmental samples by Spectrophotometer, Flame photometer, AAS, TKN analyzer, ion chromatograph, microbial enumeration by membrane filtration techniques.
- Coagulation and flocculation of water – Optimization of dose/pH/time of flocculation. Color removal from wastewater by adsorption
- Settling column tests for primary and secondary clarifiers, BOD kinetic parameters, ASP kinetic parameters, Determination of MLSS and MLVSS in ASP

Reference Books:

1. Standard methods for the examination of water and wastewater, 21st Edition, Washington: APHA
2. Sawyer, C. N., McCarty, P. L., and Perkin, G.F., Chemistry for Environmental Engineering and Science, McGraw-Hill Inc.
3. B. Kotaiah and Dr. N. Kumara Swamy, Environmental Engineering Laboratory Manual, Charotar Publishing House Pvt. Ltd.

MEV-117 Geo-environmental Engineering

(Credits – 3:0:0 = 3)

Teaching Scheme
Lectures: 3 hours/week

Course Outcomes:

After completing this course, the students will demonstrate the knowledge and ability to:

1. identify the causes and effects of subsurface contamination,
2. define contaminant transport mechanisms in soils and its detection and control,
3. plan a site for the landfill by monitoring the environmental conditions,
4. design landfill and liners for contaminants, and
5. categorize the reuse of solid waste materials.

Course Content:

Unit I
Subsurface Contamination and Contaminant Transport, Causes and effects of subsurface contamination, Detection, control and remediation of subsurface contamination.

Unit II
Characteristics of solid wastes, Waste Containment Principles, Waste disposal on Land and containment, Types of landfills, planning of landfills, Design of liners and covers for landfills, Environmental Monitoring around landfills.

Unit III
Geotechnical re-use of solid waste materials, Slurry ponds, Monitoring of subsurface contamination, Control and Remediation.

Unit IV
Engineering Properties of waste and geotechnical reuse, erosion control, sustainability, energy geotechnics.

Reference/Text Books:

- Reddy, L.N. and Inyang. H. I., "Geoenvironmental Engineering - Principles and Applications", Marcel Dekker (2000).
- Mohamed, A.M.O. and Antia, H.E., "Geoenvironmental Engineering", Elsevier (1998).
- Hsai Yang Fang and Daniels, J.L., "Introductory Geotechnical Engineering, an Environmental Perspective", Taylor & Francis (2006).
- Yong, R. N., "Geoenvironmental Engineering: Contaminated Soils, Pollutant Fate and Mitigation", CRC press LLC, Florida (2001).
- Fang, H.Y, "Introduction to Environmental Geotechnology", CRC Press (1997).

MEV-120 Water Distribution and Sewerage Network Design

(Credits – 3:0:0 = 3)

Teaching Scheme
Lectures: 3 hours/week

Course Outcomes:

After completing this course, the students will demonstrate the knowledge and ability to:

1. estimate water demand and analyze water quality,
2. design conventional water treatment systems,
3. design treatment systems for removal of dissolved solids,
4. analyze and design water distribution systems, and
5. assess methods employed for water reuse, wastewater reclamation and storm water control.

Course Content:

Unit I

General hydraulics and flow measurement: Fluid properties; fluid flow, continuity principle, energy principle and momentum principle; frictional head loss in free and pressure flow, minor heads losses, Carrying Capacity, Flow measurement.

Unit II

Water transmission and distribution: Need for transport of water and wastewater, Planning of Water System, Selection of pipe materials, Water transmission main design, gravity and pumping main; Selection of Pumps and its characteristics and economics, Specials, Jointing, laying and maintenance, water hammer analysis; water distribution pipe networks design, analysis and optimization, appurtenances, corrosion prevention, minimization of water losses, leak detection storage reservoirs.

Unit III

Wastewater collection and conveyance: Planning factors, Design of sanitary sewer; partial flow in sewers, economics of sewer design, Wastewater pumps and pumping stations- sewer appurtenances, material, construction, inspection and maintenance of sewers, Design of sewer outfalls-mixing conditions, conveyance of corrosive wastewaters.

Unit IV

Storm water drainage: Necessity, combined and separate system, Estimation of storm water run-off, Formulation of rainfall intensity duration and frequency relationships, Rational methods.

Reference/Text Books:

- Metcalf, Eddy, Tchobanoglous, G., Burton, F.L., Stensel, H.D., “Wastewater Engineering – Treatment, Disposal and Reuse”, 4th ed., Tata McGraw Hill (2002).
- Chanson H., Butterworth-Heinemann, “Environmental Hydraulics of Open Channel Flows”, 2nd ed., Oxford, UK: Elsevier (2004).

- Chow, V.T., Maidment, D.R. and Mays, L.W., “Applied Hydrology”, McGraw Hill Inc. (2010).
- “Manual on water supply and Treatment”, CPHEEO, Ministry of Urban Development, Government of India, New Delhi (1999).
- “Manual on Sewerage and Sewage Treatment”, CPHEEO, Ministry of Urban Development, Government of India, New Delhi (1993).

MEV-123 Industrial Wastewater Management and Reuse

(Credits – 3:0:0 = 3)

Teaching Scheme
Lectures: 3 hours/week

Course Outcomes:

After completing this course, the students will demonstrate the knowledge and ability to:

1. sample and analyze the characteristics of industrial wastewaters,
2. analyze the effects of disposal of industrial wastes,
3. identify and design treatment options for handling industrial wastewater,
4. implement the effective reuse of treated industrial wastewater, and
5. suggest waste minimising techniques to industries.

Course Content:

Unit I
Sources of Pollution: Physical, Chemical, Organic & Biological properties of Industrial Wastes, Difference between industrial & municipal waste waters, Effects of industrial effluents on sewers and Natural water Bodies.

Pre & Primary Treatment: Equalization, Proportioning, Neutralization, Oil separation by Floating, Waste Reduction, Volume Reduction, Strength Reduction.

Unit II
Waste Treatment Methods: Nitrification and De-nitrification, Phosphorous removal, Heavy metal removal, Membrane Separation Process, Air Stripping and Absorption Processes, Special Treatment Methods, Disposal of Treated Waste Water.

Unit III
Characteristics and Composition of wastewater and Manufacturing Processes of Industries like Sugar, Characteristics and Composition of Industries like Food processing Industries, Steel, and Petroleum Refineries.

Unit IV
Characteristics and Composition of Industries like Textiles, Tanneries, Atomic Energy Plants and other Mineral Processing Industries, Joint Treatment of Raw Industries waste water and Domestic Sewage, Common Effluent Treatment Plants (CETP): Location, Design, Operation and Maintenance Problems, Economical aspects.

Reference/Text Books:

- Metcalf, Eddy, Tchobanoglous, G., Burton, F.L., Stensel, H.D., "Wastewater Engineering – Treatment, Disposal and Reuse", 4th ed., Tata McGraw Hill (2002).
- Eckenfelder W.W. Jr., "Industrial Water Pollution Control", 3rd ed., McGraw Hill (2003).
- M.N. Rao and Dutta, "Waste Water Treatment", 3rd Edition, Oxford and IBH Publishers (2018).

- Mark J. Hammer, Mark J. Hammer, Jr., “Water & Wastewater Technology”, Prentice Hall of India (2008).
- Patwardhan, “Industrial Waste water Treatment”, Prentice Hall of India, New Delhi (2008).
- Nemerrow N.L., “Theories and practices of Industrial Waste Engineering”, Addison-Wesley Publishing Company (1955).
- C.G. Gurnham, “Principles of Industrial Waste Engineering”, Public Health Service Publications (1955).

MEV-126 Environmental Remote Sensing and GIS

(Credits – 3:0:0 = 3)

Teaching Scheme
Lectures: 3 hours/week

Course Outcomes:

After completing this course, the students will demonstrate the knowledge and ability to:

1. apply basic principles of remote sensing for resource mapping and evaluation,
2. understand and operate GIS softwares,
3. develop geospatial database of water resources and environmental engineering systems,
4. implement GIS models for hydrological simulation, and
5. enact GIS models for planning environmental engineering systems.

Course Content:

Unit I

Introduction: Concepts of Remote Sensing, Energy sources and radiation principles, Energy interactions in the atmosphere, Spectral reflectance of earth surface features, GIS concepts, Data analysis, GIS software.

Unit II

Water Resources: Rainwater harvesting systems, performance evaluation of irrigation systems, agricultural drought monitoring and impact assessment, watershed development & sustainable planning using RS & GIS, Water quality monitoring and modelling.
Land Resources: Soil survey and land evaluation, land use/land cover mapping and planning, case studies on mapping of wastelands and waterlogged areas of India using RS & GIS.

Unit III

Ecology and Forestry: Ecosystem analysis, monitoring of forest fires, Forest evapo-transpiration assessment, mapping of forest cover, RS based forest management plans, focus on Mangrove forests and wetlands.

Unit IV

Geological Applications: RS and GIS in ground water studies, mineral/oil exploration, air borne geophysical surveys.
Urban Studies: Spatial analysis of urban sprawl, impact of urbanization on vegetation and water bodies, urban heat islands condition assessment, urban road infrastructure development assessment, GIS based urban land use change detection.

Reference/Text Books:

- Barrett, "Introduction of Environmental Remote Sensing", Chapman and Hall, New York, USA (1992).
- Engman, "Remote Sensing in Hydrology", Chapman and Hall, New York, USA (1991).
- Siegel, "Remote Sensing in Geology" John Wiley, Inc, New York, USA (1980).
- Burrough P.A., "Principles of GIS for Land Resources Assessment", Oxford Science Publications (1998).