

Course Curriculum
M.TECH
IN
ENVIRONMENTAL ENGINEERING



2016

Department of Civil Engineering
JAYPEE UNIVERSITY OF ENGINEERING & TECHNOLOGY
A.B. ROAD, RAGHOGARH, DT.-GUNA-473226 (M.P.), INDIA

2 year M.Tech. Course Curricula for Environmental Engineering

M.Tech. I semester-(M1)

S.No.	Subject Code	Subject	Core/Elective	L	T	P	Credits
1	14M12CL121	Environmental Chemistry and Microbiology	Core	3	0	0	3
2	14M12CL122	Environment and Development	Core	3	0	0	3
3	14M12CL123	Solid & Hazardous Waste Management	Core	3	0	0	3
4	14M1GXX14x	Elective-I	Elective	3	0	0	3
5		Bridge Course		3	0	0	3
	14M12CL124 OR 14M12CE121	for Civil Engineering Students: Material Balance & Reaction Engineering OR for Chemical Engineering Students: Water Supply & Sewage Treatment			0	0	3
6	14M18CL181	Environmental Chemistry and Microbiology lab	Core	0	0	4	2
		Total		15	0	4	17

List of Electives-I			Core/Elective	L	T	P	Credits
1	14M1GCL141	Industrial Waste Treatment	Elective	3	0	0	3
2	14M1GCE141	Environmental Rules and Laws	Elective	3	0	0	3
3	14M1GCE142	Environmental Management	Elective	3	0	0	3
4	14M1GCL142	Physicochemical Processes	Elective	3	0	0	3

2 year M.Tech. Course Curricula for Environmental Engineering

M.Tech. II semester-(M2)

S.No.	Subject Code	Subject	Core/Elective	L	T	P	Credits
1	14M12CL221	Air & Noise Pollution: Monitoring and Control	Core	3	0	0	3
2	14M12CL222	Wastewater Treatment	Core	3	0	0	3
3	14M12CE221	Environmental Impact Assessment and Audit	Core	3	0	0	3
4	14M12CL223	Modeling and Simulation in Environmental Systems	Core	3	0	0	3
5	14M1GXX24x	Elective - II	Elective	3	0	0	3
6	14M18CL281	Pollution Monitoring Lab	Core	0	0	4	2
		Total		15	0	4	17

List of Electives-II			Core/Elective	L	T	P	Credits
1	14M1GCL241	Membrane Separation Processes	Elective	3	0	0	3
2	14M1GCL242	Absorption and Adsorption Processes	Elective	3	0	0	3
3	14M1GCL243	Green Rating	Elective	3	0	0	3
4	14M1GCE241	Ground water Pollution	Elective	3	0	0	3

2 year M.Tech. Course Curricula for Environmental Engineering

M.Tech. III semester-(M3)

S.No.	Subject Code	Subject	Core/Elective	L	T	P	Credits
1	14M1GXX34x	Elective-III	Elective	3	0	0	3
2	14M1GXX34x	Elective-IV	Elective	3	0	0	3
3	14M19GE391	Project Seminar	Core	0	0	0	2
4	14M19GE392	Thesis	Core	-	-	-	12
		Total					20

List of Electives-III			Core/Elective	L	T	P	Credits
1	14M1GCL341	Waste Recycling and Reuse	Elective	3	0	0	3
2	14M1GCE341	Water Quality and Pollution in natural water systems	Elective	3	0	0	3
3	14M1GCL342	Analytical Chemistry and Environmental Instrumentation	Elective	3	0	0	3
List of Electives-IV			Core/Elective	L	T	P	Credits
1	14M1GCL341	Waste Recycling and Reuse	Elective	3	0	0	3
2	14M1GCE341	Water Quality and Pollution in natural water systems	Elective	3	0	0	3
3	14M1GCL342	Analytical Chemistry and Environmental Instrumentation	Elective	3	0	0	3

2 year M.Tech. Course Curricula for Environmental Engineering

M.Tech. IV semester-(M4)

S.No.	Subject Code	Subject	Core/Elective	L	T	P	Credits
1	14M1GXX44x	Elective-V	Elective	3	0	0	3
2	14M1GXX44x	Elective-VI	Elective	3	0	0	3
3	14M19GE491	Project Seminar	Core	0	0	0	2
4	14M19GE492	Thesis	Core	-	-	-	14
		Total					22

List of Electives-V			Core/Elective	L	T	P	Credits
1	14M1GCE441	Remote Sensing Applications in Environmental Engineering	Elective	3	0	0	3
2	14M1GCE442	Solid Waste management and Land Reclamation	Elective	3	0	0	3
3	14M1GCL441	Transport of Pollutants	Elective	3	0	0	3
List of Electives-VI			Core/Elective	L	T	P	Credits
1	14M1GCE443	Introduction to Urban and Rural Environmental Engineering	Elective	3	0	0	3
2	14M1GCL442	Energy Resources & Conservation	Elective	3	0	0	3
3	14M1GCL443	Process Analysis	Elective	3	0	0	3

2 year M.Tech. Course Curricula for Environmental Engineering

M.Tech. I semester-(M1)

S.No.	Subject Code	Subject	Core/Elective	L	T	P	Credits
1	14M12CL121	Environmental Chemistry and Microbiology	Core	3	0	0	3
2	14M12CL122	Environment and Development	Core	3	0	0	3
3	14M12CL123	Solid & Hazardous Waste Management	Core	3	0	0	3
4	14M1GXX14x	Elective-I	Elective	3	0	0	3
5		Bridge Course		3	0	0	3
	14M12CL124 OR 14M12CE121	for Civil Engineering Students: Material Balance & Reaction Engineering OR for Chemical Engineering Students: Water Supply & Sewage Treatment			0	0	3
6	14M18CL181	Environmental Chemistry and Microbiology lab	Core	0	0	4	2
		Total		15	0	4	17

List of Electives-I			Core/Elective	L	T	P	Credits
1	14M1GCL141	Industrial Waste Treatment	Elective	3	0	0	3
2	14M1GCE141	Environmental Rules and Laws	Elective	3	0	0	3
3	14M1GCE142	Environmental Management	Elective	3	0	0	3
4	14M1GCL142	Physicochemical Processes	Elective	3	0	0	3

Course Description

Title of the course: Environmental Chemistry and Microbiology

Course Code: 14M12CL121

L-T Scheme: 3-0

Course Credits: 3

Objective: The purpose behind this course is to make the students familiar with the concepts of chemistry and microbiology involved in the environment

Learning Outcomes: At the end of this course students will be able to:

- Understand chemistry involved in environment
- Identify the chemical reactions and changes in contaminants
- Understand the microbiology and its usefulness to environment
- 4. Perform experimental analysis of some properties of water and wastewater

Course Contents:

- Fundamentals of chemistry for environmental engineering
- Basic Concepts: General Chemistry, Physical Equilibrium, Organic Chemistry, Biochemistry, Colloidal Chemistry, Quantitative Chemistry
- Soil Chemistry: Acid-Base and Ion-exchange reactions in soils. Waste and pollutants in soil, Heavy metals and radio nuclides in soil, absorption in soils - forces and isotherms; soil as cation and anion exchanger; degradation of natural substances; remediation of metal contaminated soil.
- Introduction to instrumental techniques in environmental chemical Analysis
- Introduction to Microbiology Methods: Microscopy, Sterilization, Culture method
- Microbial Associations-Symbiosis, Viral and Bacterial diseases

Books:

1. Environmental Chemistry by Neill, Peter O. , Blackie Academic and Professional, London, 1998
2. Environmental Chemistry: Global Perspective by Vanloon, Gary W, Oxford University Press, New York, 2000
3. Environmental Chemistry by Stanley E. Manahan, 5th Ed., Lewis Publishers, 1995
4. Chemistry for Environmental Engineering and Sciences (5th Ed) by CN Sawyer, PL McCarty, Tata McGraw-Hill ed., New Delhi, 2003.
5. Microbiology by Michael J. Pelzer et.al. (5th ed), Tata McGraw Hill, New Delhi (1993).
6. Microbiology for Environmental Scientists and Engineers by Gaudy, AF and Gaudy, ET MGH, New York (1980).
7. Standard Methods for the Examination of Water and Wastewater (21st ed.)-AWWA

Course Description

Title of the course: Environment and Development

Course Code: 14M12CL122

L-T Scheme: 3-0

Course Credits: 3

Objective: This course is designed to explain the concepts behind the interrelations between environment and the development. It also includes the hazards and safety related issues.

Learning Outcomes:

- Understanding of earth and its environment
- Interactions between different spheres of environment
- Development and its effects on environment
- Understanding of natural and man-made hazards and related safety issues

Course Content:

- Energy budget, Climate and climate change, Chemical and Biological cycles, Study and significance of natural resources.
- Ecology, Wildlife Conservation, forestry, Global Climate and hazards
- Effect of development and population increase on environment, Global environmental issues, Concept of sustainability, strategies to implement sustainable development, measures /indices of sustainable development, sustainability in developing countries.
- Regulatory provisions: Environmental protection acts and regulations, regulations for storage and handling of hazardous substances and labeling
- Material Hazards, Process Hazards, Ignition Sources, explosions
- Hazard Identification & Hazard analysis, HAZOP and other methods of study
- Safety devices
- Disaster Management Plan: On site and off site plans

Books:

1. Understanding Environmental Pollution by Hill
2. Sustainable Development in Practice: Case studies for Engineers and Scientists, John Wiley & Sons, New York, 2004

Course Description

Title of the course: Solid and Hazardous waste Management

Course Code: 14M12CL123

L-T Scheme: 3-0

Course Credits: 3

Objective: This course is designed to explain solid and hazardous waste management

Learning Outcomes: Students will be able to identify the sources of solid and hazardous wastes and manage them.

Course Content:

- Introduction to solid waste
- Properties of Solid Wastes
- Management of Solid Wastes in India
- Engineered Systems of Solid Waste Management
- Disposal of Wastes

Books:

1. Solid Waste: Engineering Principles & Management Issues- G.Tchobanoglous, GH. Theisen & R. Eliassen, McGraw Hill Int. Ed. Singapore, 1977.
2. Environmental Engineering - HS Peavy, DR Rowe & G Tchobanoglous, McGraw-Hill Int. Ed., Singapore, 1985.
3. Quarry Reclamation - NJ Coppin and A.D. Bradshaw, Mining Journal Books, London, 1982
4. Hazardous Waste Management (2nd ed) - Lagrega, MD, PL Buchingham & JC Evans, McGraw Hill, NY, 2001.
5. Bioremediation Principles – Eweis, JB, Ergas SJ, Chang DYP and Schroeder ED, McGraw-Hill, Singapore, 1998.

Course Description

Title of the course: Industrial waste treatment

Course Code: 14M1GCL141

L-T Scheme: 3-0

Course Credits: 3

Objective: To explain the concepts behind Industrial waste characterization, treatment and disposal.

Learning Outcomes:

Students will be able to characterize the industrial waste and assess the degree of treatment required for the wastewater

Course Content:

- Sources and characteristics of industrial wastewater,
- Advanced wastewater treatment.
- Principles of reactor design; flow pattern in reactors, estimation of dispersion number.
- Sludge handling and disposal; Design and operation of sludge thickener.

Books:

1. Mahajan S.P. "Pollution Control in process industries" , Tata McGraw Hill Publishing Co Ltd, New Delhi, 1991.
2. Nemerow N.L., "Industrial Water Pollution ", Addison - Wesley Publishing Company Inc., USA, 1978.
3. Rao M.N. and Dutta A.K. "Wastewater treatment", Oxford & IBH publishing Co. Pvt. Ltd., New Delhi
4. Wesley Eckenfelder Jr.W, Industrial water pollution control, McGraw Hill book Co, New Delhi, 2000

Course Description

Title of the course: Material Balance and Reaction Engineering

Course Code: 14M12CL124

L-T Scheme: 3-0

Course Credits: 3

Objective: To explain the fundamentals of material balance and reactions involved in process.

Learning Outcomes: Students will be able to make material balance of the reactions involved in the process.

Course Content:

- Material Balance
- Effect of temperature on vapour pressure, vapour pressure plot, vapour pressures of miscible and immiscible liquids and solutions, Raoult's law and Henry's Law.
- Material balances for systems with and without chemical reactions.
- Analysis of systems with by-pass, recycle and purge.
- Reaction Engineering

BOOKS:

1. Stoichiometry by Bhatt, B. I. -TMH, New Delhi
2. Basic Principles and Calculations in Chemical Engineering by Himmelblau- PHI
3. Chemical Process Principles by Hougen - John Wiley, New Delhi
4. Chemical Reaction Engineering by Lvenspiel- John Wiley
5. Elements of Chemical Reaction Engineering by Fogler- PHI

Course Description

Title of the course: Water Supply and Sewage Treatment

Course Code: 14M12CE121

L-T Scheme: 3-0

Course Credits: 3

Objective: This bridge course is designed to explain the concepts behind water demand & supply and treatment of sewage

Learning Outcomes: Students will be able:

- To assess the water demand of area under consideration
- To plan and design water supply system
- To understand the various processes involved in sewage treatment

Course Content:

- Population forecasting and water demand estimation, variation in water demand
- Sources of water, Water Intakes, Water resources of India, components of water supply schemes
- Transportation of water & wastewater: pipes and pumps
- Water Quality: impurities, quality standards..
- Distribution systems
- Introduction to sewage, sewage systems, estimation of design sewage discharge, peak drainage discharge
- Quality and characteristics of sewage: Decomposition of Sewage (N,C & S cycles); physical, chemical & biological characteristics of sewage;
- Treatment of sewage: Basics of primary, secondary and tertiary treatment
- Thickening, digestion, dewatering and disposal of sludge
- Introduction to treatment of industrial wastewater
- Guidelines and Laws Governing water supply and sewage treatment

Books:

1. Environmental Engineering by Peavy Rowe, TMH
2. Basic Environmental Technology by Jerry A. Nathanson
3. Chemistry for environmental engineering and science, Maccarty TMH
4. Wastewater Engineering by Metcalf Eddy, TMH
5. Wastewater treatment for pollution control by Archievala, TMH

Course Description

Title of the course: Environmental Chemistry and Microbiology Lab

Course Code: 14M18CL181

L-T-P Scheme: 0-0-4

Course Credits: 2

Objective: The purpose behind this course is to make the students familiar with the concepts of chemistry and microbiology involved in the environment

List of Experiments

1. Determination of pH, acidity-alkalinity of water sample
2. Total suspended solids, total dissolved solids (TDS) of water sample
3. Total hardness (TSS) and Ca & Mg hardness of water sample
4. Chloride, sulphate, nitrate in water sample
5. Chlorine demand, break-point chlorination and free residual chlorine in water sample
6. Coagulation dose for water sample
7. Soil sampling, determination of soil pH conductivity and salinity soil
8. Sterilisation and Disinfection; Media preparation: semi-synthetic, synthetic media and semisolid; culture media –Nutrient agar; Enrichment media preparation; Gram staining.
9. Bacteriology of drinking water MPN techniques for total coliform; faecal coliform (thermotolerant coliform) MPN test; Membrane filtration techniques for faecal coliform and total coliform
10. Microbiology of Air: by exposure plate method;
11. Microbiology of soil- Heterotropic bacterial counts by colony counter (Nutrient agar medium)

Students will be required to perform the experiments in the laboratory. Evaluation of their performance will be done through regular assessment of practicals and viva-voce.

Book:

American Public Health Association (APHA), American Water Works Association (AWWA), Water Environment Federation (WEF), 1998. Standard Methods for the Examination of Water and Wastewater, 20th ed., American Public Health Association, Washington, DC.

Course Description

Title of the course: Industrial Waste Treatment

Course Code: 14M1GCL141

L-T Scheme: 3-0

Course Credits: 3

Objective: To explain the concepts behind Industrial waste characterization, treatment and disposal.

Learning Outcomes:

Students will be able to characterize the industrial waste and assess the degree of treatment required for the wastewater

Course Content:

- Sources and characteristics of industrial wastewater
- Advanced wastewater treatment
- Principles of reactor design
- Microbiology and bioenergetics of waste degradation
- Sludge handling and disposal
- Aerobic sludge digestion
- Wastewater reclamation and reuse. Sustainable sewage treatment.

Books:

5. Mahajan S.P. "Pollution Control in process industries", Tata McGraw Hill Publishing Co Ltd, New Delhi, 1991.
6. Nemerow N.L., "Industrial Water Pollution", Addison - Wesley Publishing Company Inc., USA, 1978.
7. Rao M.N. and Dutta A.K. "Wastewater treatment", Oxford & IBH publishing Co. Pvt. Ltd., New Delhi
8. Wesley Eckenfelder Jr.W, Industrial water pollution control, McGraw Hill book Co, New Delhi, 2000

Course Description

Title of the course: Environmental Rules and Laws

Course Code: 14M1GCE141

L-T Scheme: 3-0

Course Credits: 3

Objective: It gives in-depth information about the laws, the national policy, Acts related to environmental issue.

Learning Outcomes:

- After completion of the course students will have knowledge of various acts and laws and will be able to identify the industries that are violating these rules
- Students are able to understand importance of environmental rules for development of society.

Course Contents:

- Environmental Policies - National and International trends
- International treaties.
- Legal provisions for environmental protection
- Notifications issued under various Acts and Rules.
- Environmental standards
- Public Liability Insurance Act
- Introduction to Environmental Law and Regulations,
- Enforcers of Environmental Law, Clean Air Act, Clean Water Act (CWA)
- Occupational, Safety, and Health Act (OSHA)
- Pollution Prevention Act
- Safe Drinking Water Act
- Environmental Management Systems

Books:

1. Jadhav, H & Bhosale, Y.M. (1995). Environmental Protection and Laws. Himalaya Pub. House, Delhi

Course Description

Title of the course: Environmental Management

Course Code: 14M1GCE142

L-T Scheme: 3-0

Course Credits: 3

Objective: This course explains the concepts and strategies related to environmental management, sustainable development and various environmental systems

Learning Outcomes:

- Students are able to understand the meaning of environmental management.
- Students are also able to understand the importance of environmental management in development of society and country.
- It also explains how we can use natural resources in sustainable manner.

Course Content:

- Environmental Management
- Review of political, ecological and remedial actions
- Future strategies
- Life Cycle Assessment as EM Tool,
- Environmental Management Systems Standards: e.g. ISO 14000 (EMS),
- Related Issues in Environmental Management

Books:

1. Environmental Management by Wilson
2. Environmental Management in Organizations: The IEMA Handbook
3. Environmental Management by Krishnamoorthy, P. Hall PTR, New Jersey, 2005
4. "The ISO: 14000 Handbook" - Joseph Caseio (Ed), Published - CEEM Information Services. 2000
5. INSIDE ISO: 14000 – The Competitive Advantage of Environmental Management - Don Sayre, Vinity Books International, New Delhi, 2001.
6. A Guide to the Implementation of the ISO: 14000 Series on Environmental Management – Ritchie, I and Hayes W, Prentice Hall, New Jersey, 1998.

Course Description

Title of the course: Physicochemical Processes

Course Code: 14M1GCL142

L-T Scheme: 3-0

Course Credits: 3

Objective: To explain various physicochemical processes involved in water, wastewater and atmospheric chemistry.

Learning Outcomes:

The students will obtain the knowledge regarding the physical and chemical processes involved in water and waste water treatment.

Course Content:

- Structure and basic properties of water
- Sources of water impurities
- Solid-liquid-gas interaction
- Physical and chemical interactions due to various forces
- Chemical thermodynamics
- Reaction rates and catalysis.
- Surface and colloidal chemistry
- Settling of particles in water

Books:

1. Environmental Chemistry - Stanley E. Manahan, 5th Ed., Lewis Publishers, 1995.
2. Chemistry for Environmental Engineering and Sciences (5th Ed)- - CN Sawyer, PL McCarty and GFParkin, Tata McGraw-Hill ed., New Delhi, 2003.
3. Aquatic Chemistry -W.Stumm & JJ Morgan, John Wiley & Sons, Inc, 3rd Ed., NY-1995.
4. Water Chemistry - V.L.Snoeyine and D.Jenkins, John Wiley and Sons, Inc, NY-1980.
5. Principles and Application of Aquatic Chemistry - FMM Morel & JG Hering, John Wiley & Sons, Inc, NY, 1993.

2 year M.Tech. Course Curricula for Environmental Engineering

M.Tech. II semester-(M2)

S.No.	Subject Code	Subject	Core/Elective	L	T	P	Credits
1	14M12CL221	Air & Noise Pollution: Monitoring and Control	Core	3	0	0	3
2	14M12CL222	Wastewater Treatment	Core	3	0	0	3
3	14M12CE221	Environmental Impact Assessment and Audit	Core	3	0	0	3
4	14M12CL223	Modeling and Simulation in Environmental Systems	Core	3	0	0	3
5	14M1GXX24x	Elective - II	Elective	3	0	0	3
6	14M18CL281	Pollution Monitoring Lab	Core	0	0	4	2
		Total		15	0	4	17

List of Electives-II			Core/Elective	L	T	P	Credits
1	14M1GCL241	Membrane Separation Processes	Elective	3	0	0	3
2	14M1GCL242	Absorption and Adsorption Processes	Elective	3	0	0	3
3	14M1GCL243	Green Rating	Elective	3	0	0	3
4	14M1GCE241	Ground water Pollution	Elective	3	0	0	3

Course Description

Title of the course: Air And Noise Pollution: Monitoring And Control

Course Code: 14M12CL221

L-T Scheme: 3-0

Course Credits: 3

Objective: This course provides a comprehensive overview of air and noise quality and the science and technology associated with the monitoring and control

Learning Outcomes: Students will be able to:

- Identify the sources of air and noise pollution
- Monitor the ambient air quality
- Understand the concepts involved in control technologies

COURSE CONTENT:

- Sources of air pollution
- Atmospheric meteorology
- Air quality monitoring
- Dispersion of air pollutants and modeling
- Review of general principles of air pollution control
- Noise: elementary sound theory,
- Basics of acoustics and specification of sound
- Effects of noise on health
- Infra-sound, ultrasound, impulsive sound and sonic boom; noise standards and limit values; noise instrumentation and monitoring procedure.
- Noise indices, Methods of abatement of noise pollution.
- Guidelines and laws Governing air and noise pollution

Books:

1. Air Pollution: Its Origin and Control by Wark, Kenneth, Addison-Wesley, New York
1. Environmental Engineering – Arcadio P. Sincero and Gregoria A. Sincero, Prentice Hall of India, 1999.
2. Environmental Pollution Control Engineering- CS Rao, Wiley Eastern Ltd., New Delhi, 1996.
3. Environmental Noise Pollution – PE Cunniff, McGraw Hill, New York, 1987.
4. Handbook of Noise Measurement – APG Peterson & EE Gross PH, Englewood cliffs New Jersey, latest edition.
5. Air Pollution Control Equipment – H. Brauer and Y. B. G. Verma, Berlin Heidelberg, New York, latest edition.

Course Description

Title of the course: Wastewater Treatment

Course Code: 14M12CL222

L-T Scheme: 3-0

Course Credits: 3

Objective: To explain the concepts behind wastewater characterization, treatment and disposal.

Learning Outcomes: Students will be able to characterize the wastewater, assess the degree of treatment required for the wastewater.

Course Content:

- Source and character of wastes
- Biological processes for wastewater treatment
- Hydraulics of treatment plant
- Theory and design of wastewater disposal systems
- Sewage characteristics
- Sewage treatment process
- Principle of biological treatment
- Activated sludge process and its modification
- Aerated lagoon and Waste stabilization pond system
- Sanitation
- Concept of common effluent treatment plant (CETP).
- Sludge characteristics and disposal methods -design and operation of sludge drying bed.
- Guidelines and laws governing wastewater treatment.

Books:

1. Wastewater Engineering: Treatment, disposal, Reuse-Metcalf & Eddy Inc.4th ed.TMH, New Delhi, 2003.
2. Environmental Engineering- Peavy, HS, Donald RR & G. Tchobanoglous, MGH Int. Ed. New York, 1985.
3. Wastewater Treatment for Pollution Control - Soli J Arceivala, Tata McGraw Hill, 2nd ed.1998
4. Wastewater Treatment Plants: Planning, Design and Operation- S.R..Qasim, Holt, Rinehart & Winston, NY, 1985
5. Industrial Water Pollution Control –WW Eckenfelder, Jr., McGraw -Hill , 2nd Edition, NY 1989

Course Description

Title of the course: Environmental Impact Assessment And Audit

Course Code: 14M12CE221

L-T Scheme: 3-0

Course Credits: 3

Objective: This course presents a comprehensive introduction to the concepts and techniques of impact assessment and audit.

Learning Outcomes:

Students will be able to apply environmental impact assessment methods and audit to the developmental activities.

Course Content:

- Framework for environmental impact assessment.
- Impact assessment methodologies
- Concepts of environmental audit
- Life Cycle Approach.
- Principles & elements of successful environmental management
- Benefits of an environmental management system
- Legal and regulatory concerns; Integrating ISO 9000 & ISO 14000

Books:

1. Environmental Impact Assessment -Larry, W. Canter (2nd ed), McGraw Hill Inc. Singapore, 1996.
2. Strategic Environmental Assessment - Riki Therirvel, E.Wilson, S.Thompson, D.Heaney, D. Pritchard. Earthscan,London, 1992.
3. Environmental Impact Assessment-Cutting edge for the 21st century - Alan Gilpin, CUP, London, 1994.
4. Environmental Impact Assessment-Theory & Practice - Peter Wathern, Unwin Hynman, Sydeny, 1988.
5. A Practical Guide to Environmental Impact Assessment - Paul, A Erickson, Academic Press, 1994.
6. Renewable Energy Environment and Development-Maheswar Dayal Konark Pub. Pvt.Ltd. 1998
7. Planning and Implementation of ISO14001, Environmental Management System- Girdhar Gyani & Amit Lunia Raj Publishiong House, Jaipur, 2000.

Course Description

Title of the course: Modeling and Simulation in Environmental Systems

Course Code: 14M12CL223

L-T Scheme: 3-0

Course Credits: 3

Objective: This course is designed to explain the concept of modeling, optimization and simulation.

Learning Outcomes:

The students will be able to know environmental systems problem formulation, modeling and simulation.

Course Content:

- Systems approach - concept and analysis.
- Problems formulation, model construction and deriving solution from models.
- Modeling of wastewater management systems- model formation and solution.
- Modeling of pesticide management problems
- .Separable and integer programming- application to multi-objective planning.

Books:

1. Handbook of Environmental and Ecological Modelling, Halling-Sorensen B., Nielsen S.N. and Jorgensen, S.E., Lewis Publishers Inc., 1995.
2. Fundamentals of Atmospheric Modelling, Jacobson Mark Z., Kluwer Academic Press, 2002.
3. An Introduction to Water Quality Modelling, James A. (Ed), (2nd Ed.), 1992.
4. Techniques for Environmental System Analysis - R.H.Pantell Wiley, NY, 2001.
5. System Analysis and Design – RJ Aguilar, Prentice Hall, Englewood Cliffs, N.J., 1993.

Course Description

Title of the course: Pollution Monitoring Lab

Course Code: 14M18CL281

L-T-P Scheme: 0-0-4

Course Credits: 2

List of Experiments

1. Demonstration of air pollution monitoring instruments
2. Calibration of HVS by orifice method;
3. Determination of SPM; PM10
4. Determination of SO₂ in ambient air
5. Determination of NO_x and CO in ambient air;
6. Respirable dust monitoring by GDS,
7. Demonstration of stack monitoring kits; Wind rose diagram.
8. Sampling and analysis of inorganic and organic particulates, SO_x , NO_x, NH₃ etc.
9. Demonstration of noise pollution monitoring equipment; namely modular precision sound level meter,
10. noise dose meter, human vibration monitoring instrument, audiometer, etc.
11. Noise survey in a multiple noise sources situation in order to develop noise contour diagram for the entire locality
12. Noise monitoring at residential localities. Frequency spectrum analysis of machine noise.
13. Audiometry survey in order to assess present status of hearing acuity of the subject
14. Traffic noise situation monitoring;

Course Description

Title of the course: Membrane Separation Processes

Course Code: 14M1GCL241

L-T Scheme: 3-0

Course Credits: 3

Objective: To explain the student about concepts behind membrane separation process.

Learning Outcomes:

The students will be apply membrane process principles to environmental applications.

Course Content:

- Introduction to separation processes
- Materials and Material Properties
- Characterization of Membranes
- Transport in Membranes
- Membrane Processes
- Polarization phenomenon and fouling
- Module and process design

Books:

1. Membrane Separation Processes by Kaushik Nath, Publisher: Prentice-hall Of India Pvt Ltd
- Membrane Processes by R. Rautenbach and R. Albrecht , Publisher: John Wiley & Sons

Course Description

Title of the course: Absorption and Adsorption Processes

Course Code: 14M1GCL242

L-T Scheme: 3-0

Course Credits: 3

Objective: This subject will help the students to understand the principles of adsorption and absorption which is used in all water treatment processes.

Learning Outcomes:

The student can be able to analyze the adsorption of any liquid over solid or absorption of any liquid in solid.

Course Content:

- Description of adsorption processes and their application
- Adsorption equilibria and adsorption hysteresis
- Langmuir and Freundlich Isotherm
- Fixed Bed Adsorption
- Equipments, gas-liquid equilibria, Henry's law
- Absorption in packed columns
- Design equations for packed column
- Applications of absorption in removal of gaseous pollutants

Books:

1. Foust, A.S., Wenzel, L.A., Clump, C.W., Naus, L., and Anderson, L.B., " Principles of Unit Operations ", Second Edition, Wiley, 1980.
2. Treybal, R.E., " Mass Transfer Operations ", McGraw-Hill Kogakusha, 1980.
3. Sherwood, T.K., Pigford, R.L., and Wilke, C.R., " Mass Transfer ", McGraw-Hill, 1976.
4. McCabe, W.L., Smith, J.C., and Harriot, P., " Unit Operations in Chemical Engineering ", McGraw-Hill Edn, 1993.
5. Roman Zarzytci, Andrzej Chacuk, " Absorption: Fundamentals and Application ", Pergamon Press, 1993.

Course Description

Title of the course: Green Rating

Course Code: 14M1GCL243

L-T Scheme: 3-0

Course Credits: 3

Objective: The main objective of this course is to give basic ideas for determining various environmental rating and its identification.

Learning outcomes:

The Students will be able to do any environmental rating and analysis after this course. The procedures and methods will help them to perform individually.

Course Content:

- Industrial Activity In India:
- Sustainability Issues
- Life Cycle Analysis
- Credible Information System:
- Mandatory Information Dissemination
- Environmental Load Index
- Green Rating
- Corporate Environmental Policy and Management:
- Corporate Policy, Environmental Systems and Management, Approaches In Industry.
- Case Studies In Green Rating From India:
- Pulp & Paper Sector, Caustic and Chlorine Sector, Automobile Sector, Cement Sector

Books:

1. Organizing Industrial Activities Across Firm Boundaries (**Hardcover - Mar 1998**) by Anna Dubois
2. "Environmental Life Cycle Analysis" David F Ciambone CRC Press 1997.

Course Description

Title of the course: Ground Water Pollution

Course Code: 14M1GCE241

L-T Scheme: 3-0

Course Credits: 3

Objective: To understand the importance of groundwater and possible source of water contaminant.

Learning Outcomes:

- Importance of groundwater and its significance for living being.
- Groundwater is a major source of fresh water.
- To predict the future prospects of groundwater resource by using raw data and IT.
-

Course Content:

- Introduction to Groundwater Pollution and Hydrology
- Fundamental Principles and technical details of Groundwater Monitoring
- Illustrative Case Histories of Groundwater Contamination
- Monitoring and Remediation in Sedimentary Deposits and Fractured Hard Rock
- Theory and Practice of Mathematical Modeling in Groundwater Pollution and Hydrology
- Determine Aquifer Parameters from Pumping & Slug Test Methods
- Field Collection Techniques

Books:

1. Groundwater and Tubewells - S.P. Garg, Oxford & IBH, New Delhi, 1982.
2. Environmental Hydrology- Eds. Andy D. Ward & William J. Elliot, Lewis Publishers, p.995.
3. Hydrology and Quality of Water Resources - M.J. Hammer & KA MacKichan, John Wiley & Sons, NY, 1981

2 year M.Tech. Course Curricula for Environmental Engineering**M.Tech. III semester-(M3)**

S.No.	Subject Code	Subject	Core/Elective	L	T	P	Credits
1	14M1GXX34x	Elective-III	Elective	3	0	0	3
2	14M1GXX34x	Elective-IV	Elective	3	0	0	3
3	14M19GE391	Project Seminar	Core	0	0	0	2
4	14M19GE392	Thesis	Core	-	-	-	12
		Total					20

List of Electives-III			Core/Elective	L	T	P	Credits
1	14M1GCL341	Waste Recycling and Reuse	Elective	3	0	0	3
2	14M1GCE341	Water Quality and Pollution in natural water systems	Elective	3	0	0	3
3	14M1GCL342	Analytical Chemistry and Environmental Instrumentation	Elective	3	0	0	3
List of Electives-IV			Core/Elective	L	T	P	Credits
1	14M1GCE342	Modeling surface water Quality	Elective	3	0	0	3
2	14M1GCE343	Environmental Economics	Elective	3	0	0	3
3	14M1GCL343	Clean Technologies	Elective	3	0	0	3

Course Description

Title of the course: Seminar
Course Code: 14M19GE391

Course Credits: 2

Student will be given projects in the area of subjects taught upto that semester. The student will do a project based on literature review, small experiments wherever possible and prepare a report. There will be one mid term evaluation, a presentation at the end followed by a viva-voce examination.

Course Description

Title of the course: Project, Part-I
Course Code: 14M19GE392

Course Credits: 12

Students will complete project work in the area of environmental engineering under the supervision of guide. The students will do project based on literature review; experiments if possible and write a thesis report. Total credits assigned for project work are 26. Twelve credits will be evaluated in the third semester and will be carried over to fourth semester for final evaluation of project work.

Course Description

Title of the course: Waste Recycling and Reuse

Course Code: 14M1GCL341

L-T Scheme: 3-0

Course Credits: 3

Objective: The main objective of this course is to provide various techniques involved in Waste reduction and Energy recovery from waste and Recovery of various useful products from the waste materials.

Learning Outcomes:

The student can be able to identify the methods for Recycling, Recovery and Reuse of the materials considered to be waste.

Course Content:

- Waste as a resource
- Waste analysis
- System design
- Water reuse
- Energy recovery
- Metals recovery
- Reuse of industrial effluent
- Health aspects of water reuse

Books:

1. Recycling and Resource Recovery Engineering – Springer (1996), Springer – Verlag Berlin Heidelberg.
2. Proceedings of the International Symposium ICE: Reuse of Sewage Effluent (1985), Thomas Felford London.
3. Water Reuse Problems and Solutions – Dean R.B., and Lund E. (1981), Academic Press.
4. Waste Recycling for Energy Conservation – Kut D., and Hase G., John Wiley & Sons Inc.

Course Description

Title of the course: Water Quality and Pollution in Natural Water Systems

Course Code: 14M1GCE341

L-T Scheme: 3-0

Course Credits: 3

Objective: To learn significance of water quality and its importance for living being including human.

Learning Outcomes:

- Students are able to understand significance of water.
- Students are able to understand the meaning of point and non-point source.
- Students learn nutrient cycle and its importance for human being.

Course Content:

- Dissolved Oxygen, Pollution, Beneficial Uses and Assimilative Capacity.
- Waste Loads—Flow-Concentration Correlations and Averaging,
- Chemical, physical, and biological characteristics of aquatic system
- Eutrophication
- Lake stratification and de-stratification: influences on water quality
- Streeter-Phelps, BOD, DO, Nitrogen
- Characterization of water quality
- Toxicity models Disinfection
- Surface water pollution, surface water pollutants

Books:

1. Environmental Engineering - HS Peavy, DR Rowe & G Tchobanoglous, McGraw-Hill Int. Ed., Singapore, 1985.
2. Environmental Hydrology- Eds. Andy D. Ward & William J. Elliot, Lewis Publishers, p.995.
3. Hydrology and Quality of Water Resources - M.J. Hammer & KA MacKichan, John Wiley & Sons, NY, 1981

Course Description

Title of the course: Analytical Chemistry and Environmental Instrumentation

Course Code: 14M1GCL342

L-T Scheme: 3-0

Course Credits: 3

Objective: To give in depth knowledge of analytical chemistry and operations of instruments used.

Learning Outcomes:

This subject will give the students the total knowledge regarding the instruments utilized in analyzing the various variables which pollute the environment.

Course Content:

- Treatment of data in quantitative analysis
- Principles of instrumentation
- Spectro-chemical methods
- Electrochemical methods
- Chromatography
- Gas chromatography
- Ion chromatography.
- Physical & biological methods of monitoring.

Books:

1. Instrumental Methods of Analysis - HH Willard & LL Dean, John Wiley, 1976
2. Modern Methods of Chemical Analysis - RL .Recsok & LD Shields, John Wiley & sons, Inc, 1990
3. Instrumental Methods of Chemical Analysis -GW Ewing, McGraw Hill Book Company, Inc. 1975
4. Modern Methods of Chemical Analysis - RL Pecsok & LD Shields, John Wiley & Sons, Inc. 1986
5. Fundamentals of Molecular Spectroscopy - CN. Banwell, McGraw Hill, NY, 1990

Course Description

Title of the course: Modeling Surface Water Quality

Course Code: 14M1GCE342

L-T Scheme: 3-0

Course Credits: 3

Objective: To makes students more efficient in handling secondary data and primary data for future prediction with the help of information technology.

Learning Outcomes:

- Students are able to handle primary and secondary for multipurpose.
- Students are able to understand the meaning of hydrological cycle, mass balance, energy balance and nutrient budget and its significance in development of country.
- Students are able to understand the importance of surface water for not only human being but for other living beings also.

Course Content:

- Fundamentals of transport mechanisms
- Stream Ecology
- Oxygen Balance, Re-aeration Rate
- Distributed Load Model for Estuaries
- Nitrification
- Mathematical and numerical models of advection, diffusion, and dispersion

Books:

1. Environmental Hydrology- Eds. Andy D. Ward & William J. Elliot, Lewis Publishers, p.995.
2. Hydrology and Quality of Water Resources - M.J. Hammer & KA MacKichan, John Wiley & Sons, NY, 1981.
3. Hydrology - H.M.Ragunath, Wiley Eastern Limited,1990
4. Watershed Management- VVD Narayana, G.Sastry and US Patnaik, ICAR, New Delhi, 1990.
5. Introduction to Hydrology-W. Viessman (Jr), JW Knapp, GL Lewis & TE Harbaugh, Harper & Row, London,1977.

Course Description

Title of the course: Environmental Economics

Course Code: 14M1GCE343

L-T Scheme: 3-0

Course Credits: 3

Objective: This course introduces economic perspectives on modern environmental issues.

Learning Outcomes:

- Students will be able to understand meaning of environmental economics.
- Students are able to understand importance of environment in handling the economics of developed and developing country.
- Students are able to understand importance of natural resource in development of economy of country.

Course Content:

- Economy and Environment
- Broad aspects of environmental economics
- Environmental legislation
- Economics of Pollution
- Environmental Values Ethics
- Economics of Natural Resources
- Socio-economic Planning

Books:

1. Values for the Environment: A Guide to Economic Approach – Winpeny JT, Overseas Development Institute, London, HMOS, 1991.
2. Economic Analysis of Environmental Impacts – Dixon, John, A, Scura LF, Carpenter RA and Sherman PB, Earthscan Publications Ltd., London 1995.
3. Environmental Assessment Source Book (Vol – 1)- World Bank, Environment Department, Washington DC, TheWorld bank, 1991.
4. Valuing the Environment – Barde J and Pearce DW (ed), Earthscan Publication, London, 1991.

Course Description

Title of the course: Clean Technologies

Course Code: 14M1GCL343

L-T Scheme: 3-0

Course Credits: 3

Objective: The main objective of this subject is to provide cleaner production technologies to obtain a clean environment and to reduce the waste generation at the point of production itself.

Learning Outcomes:

The students will learn about various techniques to reduce the waste at the initial level itself.

Course Content:

- Tools for clean processes
- Unit operations in separation technology
- Thermodynamic constraints to waste minimization
- Environmental performance indicators
- Cleaner Production
- Cleaner Production Indicators

Books:

1. Paul.L. Bishop, 'Pollution Prevention: Fundamentals and Practice', McGraw-Hill International., 2000.
2. World Bank Group 'Pollution Prevention and Abatement Handbook – Towards Cleaner Production', World Bank and UNEP, Washington D.C., 1998.
3. Prasad modak, C.Visvanathan and Mandar parasnis, 'Cleaner Production Audit',
4. Environmental System Reviews, No.38, Asian Institute of Technology, Bangkok, 1995.
5. Handbook on Life Cycle Assessment: Operational Guide to the ISO Standards (Eco-Efficiency in Industry and Science) (Hardcover) by Jeroen B. Guinee (Editor) Kluwer Academic Publishers.

2 year M.Tech. Course Curricula for Environmental Engineering

M.Tech. IV semester-(M4)

S.No.	Subject Code	Subject	Core/Elective	L	T	P	Credits
1	14M1GXX44x	Elective-V	Elective	3	0	0	3
2	14M1GXX44x	Elective-VI	Elective	3	0	0	3
3	14M19GE491	Project Seminar	Core	0	0	0	2
4	14M19GE492	Thesis	Core	-	-	-	14
		Total					22

List of Electives-V			Core/Elective	L	T	P	Credits
1	14M1GCE441	Remote Sensing Applications in Environmental Engineering	Elective	3	0	0	3
2	14M1GCE442	Solid Waste management and Land Reclamation	Elective	3	0	0	3
3	14M1GCL441	Transport of Pollutants	Elective	3	0	0	3
List of Electives-VI			Core/Elective	L	T	P	Credits
1	14M1GCE443	Introduction to Urban and Rural Environmental Engineering	Elective	3	0	0	3
2	14M1GCL442	Energy Resources & Conservation	Elective	3	0	0	3
3	14M1GCL443	Process Analysis	Elective	3	0	0	3

Course Description

Title of the course: Project Seminar

Course Code: 14M19GE491

Course Credits: 2

Student will be given projects in the area of subjects taught upto that semester. The student will do a project based on literature review, small experiments wherever possible and prepare a report. There will be one mid-term evaluation, a presentation at the end followed by a viva-voce examination.

Course Description

Title of the course: Project, Part-II

Course Code: 14M19GE392

Course Credits: 14

Twelve credits will be evaluated in the third semester and will be carried over in this semester for final evaluation of project work.

Course Description

Title of the course: Remote Sensing Applications in Environmental Engineering

Course Code: 14M1GCE441

L-T Scheme: 3-0

Course Credits: 3

Objective: To understand the importance of satellite and information technology for solving out environmental problem.

Learning Outcomes:

- Students learn GIS and Remote-sensing.
- Students are able to project world problem on small scale and able to handle major problem with the help of satellite.
- GIS/Remote-Sensing is one of the advance technologies for solving major environmental problem.

Course Content:

- Principles of remote sensing.
- Physical basis of remote sensing.
- Spectral quantities
- Digital Image Processing
- Geographic Information System
- Integration of Remote sensing and GIS techniques and its applications

Books:

1. Remote Sensing and GIS - Anji Reddy M., The Book Syndicate, Hyderabad, 2000.
2. Principles of Geographical Information Systems - P A Burrough and R. A. McDonnell, OUP, Oxford, 1998.
3. Remote Sensing for Earth Resource- Rao, D.P., AEG Publication, Hyderabad, 1987.
4. Geographic Information System- Kang Tsung Chang, Tata Mc Graw Hill, Publication Edition, 2002.

Course Description

Title of the course: Solid Waste Management and Land Reclamation

Course Code: 14M1GCE442

L-T Scheme: 3-0

Course Credits: 3

Objective: To understand the importance of solid waste management, and how it helps to improve the economy of the state?

Learning Outcomes:

- Students learn about solid waste management.
- Students are able to understand how we can minimize pollution due to solid waste.
- Students are able to know how we can reclaim waste land.

Course Content:

- Municipal solid waste management
- Hydrologic aspects of solid waste
- Solid waste disposal
- Land Reclamation
- Factors affecting plant establishment

Books:

1. Solid Waste: Engineering Principles & Management Issues- G.Tchobanoglous, GH. Theisen & R. Eliassen, McGraw Hill Int. Ed. Singapore, 1977.
2. Environmental Engineering - HS Peavy, DR Rowe & G Tchobanoglous, McGraw-Hill Int. Ed., Singapore, 1985.
3. Quarry Reclamation - NJ Coppin and A.D.Bradshaw, Mining Journal Books, London, 1982
4. Hazardous Waste Management (2nd ed) - Lagrega, MD, PL Buchingham & JC Evans, McGraw Hill, NY, 2001.
5. Bioremediation Principles – Eweis, JB, Ergas SJ, Chang DYP and Schroeder ED, McGraw-Hill, Singapore, 1998.

Course Description

Title of the course: Transport of Pollutants

Course Code: 14M1GCL441

L-T Scheme: 3-0

Course Credits: 3

Objective: To explain concepts behind the transport of pollutant.

Learning Outcomes:

Students will be able to understand transport of pollutant taking place in the chemical process industry.

Course Content:

- Modeling of volatilization
- Concept of scale in natural system
- Transport of chemical constituents in surface and groundwater
- Water quality requirements for various beneficial uses.
- Emphasis is on the behavior of hazardous waste contaminants.

Books:

Environmental Modeling: Fate and Transport of Pollutants in Water, Soil and Air (Environmental Science and Technology): A Wiley Interscience Series of Texts and Monographs.

Course Description

Title of the course: Introduction to Urban and Rural Environmental Engineering

Course Code: 14M1GCE443

L-T Scheme: 3-0

Course Credits: 3

Objective: To understand the importance of rural and urban settlement in terms of environment.

Learning Outcomes:

- Students learn importance of environment during planning of urban or rural settlement.
- Students learn how environment is affected with a bad planning of settlement.

COURSE CONTENT:

- Urban Environmental Quality
- Land Use and Environmental Planning, indoor and ambient air pollution
- Urban planning
- Environmental Policy and Natural Hazards
- Urban Environmental Problems and Issues
- Rural Environment, Sanitation and water resources, rural environmental problems and remedies

BOOKS:

Rural and urban development in India by M.K.Dubey, commonwealth publishers, 2000.

Course Description

Title of the course: Energy Resources & Conservation

Course Code: 14M1GCL442

L-T Scheme: 3-0

Course Credits: 3

Objective: The Students will be able to analyze the energy requirement in the process and methods to conserve the energy in various processes.

Learning Outcomes: The student can be able to understand the various production process of energy and conservation of energy.

Course Content:

- Energy Crisis
- Non-conventional energy sources
- Solar Energy option
- Biomass Energy Storage
- Heat Energy recovery systems
- Non-conventional liquid fuels
- Heat recovery by Cogeneration.

Books:

1. Bewik M.W.M. - Handbook of organic waste conversion.
2. Bokris J.O. - Energy, the solar hydrogen alternative.
3. Rai G.D - Non-conventional Energy Sources.
4. Sukhatme S.P.- Solar Energy.
5. Kiang Y. H.- Waste Energy Utilization Technology.

Course Description

Title of the course: Process Analysis

Course Code: 14 M1GCL443

L-T Scheme: 3-0

Course Credits: 3

Objective: The Students will be able to analyze the energy requirement in the process and methods to conserve the energy in various processes.

Learning Outcomes: The student can be able to understand the various production processes of energy and conservation of energy.

Course Content:

- Engineering calculations
- Steady state material balances in non-reacting and reacting systems
- Steady- state energy balances in non- reacting and reacting systems
- Transient systems, flow-sheet analysis and process simulation

Books:

1. William L.Luyben and Leonard A. Wenzel Chemical Process Analysis: Mass and Energy Balances (Prentice Hall International Series, the Physical and Chemical Engineering Sciences)1st Edition

