

ENVIRONMENT SUSTAINABILITY

SOLID WASTE MANAGEMENT

Subject Code	10CV757	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT - 1

INTRODUCTION: Definition, Land Pollution – scope and importance of solid waste management, functional elements of solid waste management.

SOURCES: Classification and characteristics – municipal, commercial & industrial. Methods of quantification.

08 Hours

UNIT - 2

COLLECTION AND TRANSPORTATION: Systems of collection, collection equipment, garbage chutes, transfer stations – bailing and compacting, route optimization techniques and problems.

06 Hours

UNIT - 3

TREATMENT / PROCESSING TECHNIQUES: Components separation, volume reduction, size reduction, chemical reduction and biological processing problems.

6 Hours

UNIT - 4

INCINERATION: Process – 3 T's, factors affecting incineration process, incinerators – types, prevention of air pollution, pyrolysis, design criteria for incineration.

7 Hours

PART - B

UNIT - 5

COMPOSTING: Aerobic and anaerobic composting, factors affecting composting, Indore and Bangalore processes, mechanical and semi mechanical composting processes. Vermicomposting.

6 Hours

UNIT - 6

SANITARY LAND FILLING: Different types, trench area, Ramp and pit method, site selection, basic steps involved, cell design, prevention of site pollution, leachate & gas collection and control methods, geosynthetic fabrics in sanitary land fills.

8 Hours

UNIT - 7

DISPOSAL METHODS: Open dumping – selection of site, ocean disposal, feeding to hogs, incineration, pyrolysis, composting, sanitary land filling, merits and demerits, biomedical wastes and disposal.

6 Hours

UNIT - 8

RECYCLE AND REUSE: Material and energy recovery operations, reuse in other industries, plastic wastes, environmental significance and reuse.

5 Hours

REFERENCES

1. **Integrated Solid Waste Management:** Tchobanoglous : M/c Graw Hill.
2. **Solid Waste Management in developing countries.** Bhide and Sunderashan
3. **Hand book on Solid Waste Disposal.:** Pavoni J.L.
4. **Environmental Engineering.:** Peavy and Tchobanoglous
5. **Environmental Engineering – Vol II. :** S.K. Garg
6. **Biomedical waste handling rules – 2000.**
7. **Solid Waste Engineering by** Vesilind.Pa Worrell & Reinhart.D. – 2009, Cengage Learning India Private Limited, New Delhi.

AIR POLLUTION AND CONTROL

Subject Code	10 CV765	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT - 1

INTRODUCTION: Definition – Classification and Characterization of Air Pollutants, Emission Sources, Behavior and Fate of air Pollutants, Chemical Reactions in the Atmosphere, Photo-chemical Smog, Coal-induced smog, Air Pollution Inventories.

6 Hours

UNIT - 2

EFFECTS OF AIR POLLUTION: On Human Health, Animals, Plants and Materials – Major Environmental Air Pollution Episodes – London Smog, Los Angeles Smog & Bhopal Gas Tragedy.

6 Hours

UNIT - 3

METEOROLOGY: Introduction – Meteorological Variables, Primary and Secondary Lapse Rate, Inversions, Stability Conditions, Windrose, General Characteristics of Stack Plumes, Meteorological Models.

8 Hours

UNIT - 4

Factors to be considered in Industrial Plant Location and Planning Noise pollution – sources, measurement units, effects and control

4 Hours

PART - B

UNIT - 5

SAMPLING, ANALYSIS AND CONTROL: Sampling and Measurement of Gaseous and Particulate matter, Stack Sampling, Analysis of Air Pollutants, Smoke and Smoke Measurement, Air Pollution Control Methods – Particulate, Emission Control, Gravitational Settling Chambers, Cyclone Separators, Fabric Filters, Electrostatic Precipitators, Wet Scrubbers, Selection of a Particulate Collecting Equipment, Control of Gaseous Emissions, Adsorption by Liquids, Adsorption by Solids, Combustion Odours and their control.

16 Hours

UNIT - 6

AIR POLLUTION DUE TO AUTOMOBILES: Air Pollution due to Gasoline Driven and Diesel Driven Engines, Effects, Direct and Indirect Methods of control.

5 Hours

UNIT - 7

BURNING ENVIRONMENTAL ISSUES:

1. Acid Rain
2. Global Warming
3. Ozone Depletion in Stratosphere
4. Indoor Air Pollution

4 Hours

UNIT - 8

ENVIRONMENTAL LEGISLATION: Environmental Policy, Environmental Acts, Water, Air and Noise Pollution Standards.

3 Hours

REFERENCES

1. Boubel, R.W., Donald, L.F., Turner, D.B., and Stern, A.C., (1994), **Fundamentals of Air Pollution** –Academic Press.
2. Crawford, M., (1980), **Air Pollution Control Theory** –TMH Edition, Tata Mc Graw Hill Publishing Co. Ltd., New Delhi.
3. Henry. C. Perkins, (1980), **Air Pollution** –McGraw Hill.
4. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G., (1986), **Environmental Engineering** –Mc Graw Hill Book Co.

5. Sincero, A.P and Sincero, G.A., (1999), **Environmental Engineering - A Design Approach** –Prentice Hall of India.
6. Wark, K., Warner, C.F. and Davies, W.T., (1998), **Air Pollution- Its Origin and Control** –Harper & Row Publishers, New York.

ENVIRONMENTAL IMPACT ASSESSMENT

Subject Code	: 10CV847	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Development Activity and Ecological Factors EIA, Rapid and Comprehensive EIA, EIS, FONSI. Need for EIA Studies, Baseline Information,

6 Hours

UNIT - 2

Step-by-step procedures for conducting EIA, Limitations of EIA.

6 Hours

UNIT - 3

Frame work of Impact Assessment. Development Projects-Environmental Setting, Objectives and Scope, Contents of EIA, Methodologies, Techniques of EIA.

8 Hours

UNIT - 4

Assessment and Prediction of Impacts on Attributes Air, Water, Noise, Land Ecology, Soil, Cultural and Socio-economic Environment. EIA guidelines for Development Projects, Rapid and Comprehensive EIA.

6 Hours

PART - B

UNIT - 5

EIA guidelines for Development Projects, Rapid and Comprehensive EIA.

6 Hours

UNIT - 6

Public Participation in Environmental Decision making. Practical Considerations in preparing Environmental Impact Assessment and Statements.

6 Hours

UNIT - 7

Salient Features of the Project Activity-Environmental Parameter Activity Relationships- Matrices.

4 Hours

UNIT - 8

EIA for Water resource developmental projects, Highway projects: Nuclear-Power plant projects, Mining project (Coal, Iron ore), Thermal Power Plant, Infrastructure Construction Activities.

10 Hours

REFERENCES

1. **Environmental Impact Analysis**-Jain R.K.-Van Nostrand Reinhold Co.
2. **Environment Impact Assessment.**- Anjaneyalu. Y.
3. Guidelines for EIA of developmental Projects Ministry of Environment and Forests, GOI.
4. **Environment Impact Assessment** - Larry W. Canter - McGraw Hill Publication.

INDUSTRIAL WASTEWATER TREATMENT

Subject Code	: 10CV835	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT - 1

INTRODUCTION: Difference between Domestic and Industrial Wastewater, Effect on Streams and on Municipal Sewage Treatment Plants. Stream Sampling, effluent and stream Standards and Legislation to Control Water Pollution.

5 Hours

UNIT - 2

Stream Quality, Dissolved oxygen Sag Curve in Stream, Streeter– Phelps formulation, Numerical Problems on DO prediction.

6 Hours

UNIT - 3

TREATMENT METHODS-I: Volume Reduction, Strength Reduction, Neutralization, Equalization and Proportioning.

5 Hours

UNIT - 4

TREATMENT METHODS-II: Removal of Inorganic suspended solids, Removal of Organic Solids, Removal of suspended solids and colloids. Treatment and Disposal of Sludge Solids.

6 Hours

PART - B

UNIT - 5

COMBINED TREATMENT: Feasibility of combined Treatment of Industrial Raw Waste with Domestic Waste, Discharge of Raw, Partially Treated and completely treated Wastes to Streams.

6 Hours

UNIT - 6

TREATMENT OF SELECTED INDUSTRIAL WASTE: Process flow sheet showing origin / sources of waste water, characteristics of waste, alternative treatment methods, disposal, reuse and recovery along with flow sheet. Effect of waste disposal on water bodies

THE INDUSTRIES TO BE COVERED ARE:

1. Cotton Textile Industry
2. Tanning Industry
3. Cane Sugar Industry & Distillery Industry

10 Hours

UNIT - 7

TREATMENT OF SELECTED INDUSTRIAL WASTE-I:

1. Dairy Industry
2. Canning Industry
3. Steel and Cement Industry

7 Hours

UNIT - 8

TREATMENT OF SELECTED INDUSTRIAL WASTE-II:

1. Paper and Pulp Industry
2. Pharmaceutical Industry
3. Food Processing Industry

7 Hours

REFEENCES

1. **Industrial Waste Water Treatment-** Nelsol L. Nemerow.
2. **Industrial Waste Water Treatment.-** Rao MN, and Dutta A.K.

3. **Waste Water Treatment, Disposal and Reuse** - Metcalf and Eddy inc - Tata McGraw Hill Publications, 2003.
4. **Industrial Wastewater Treatment** – Patwardhan A.D., PHI Learning Private Ltd., New Delhi, 2009
5. **Pollution Control Processes in industries-** Mahajan S.P.
6. Relevant IS Codes.

AIR POLLUTION AND CONTROL

Professional Elective-1

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER:V

Subject Code	15CV551	IA Marks	: 20
No. of Lecture Hours/Week	: 03	Exam Hours	: 03
Total No. of Lecture Hours	: 40	Exam Marks	: 80
CREDITS – 03		Total Marks-100	

Course Objectives: This course will enable students to

- Study the sources and effects of air pollution
- Learn the meteorological factors influencing air pollution.
- Analyze air pollutant dispersion models
- Illustrate particular and gaseous pollution control methods.

Module -1

Introduction: Definition, Sources, classification and characterization of air pollutants. Effects of air pollution on health, vegetation & materials. Types of inversion, photochemical smog.

8 hours

Module -2

Meteorology: Temperature lapse rate & stability, wind velocity & turbulence, plume behavior, measurement of meteorological variables, wind rose diagrams, Plume Rise, estimation of effective stack height and mixing depths. Development of air quality models-Gaussian dispersion model

8 Hours

Module -3

Sampling: Sampling of particulate and gaseous pollutants (Stack, Ambient & indoor air pollution), Monitoring and analysis of air pollutants (PM_{2.5}, PM₁₀, SO_x, NO_x, CO, NH₃)

8 Hours

Module -4

Control Techniques: Particulate matter and gaseous pollutants- settling chambers, cyclone separators, scrubbers, filters & ESP.

8 Hours

Module -5

Air pollution due to automobiles, standards and control methods. Noise pollution- causes, effects and control, noise standards. Environmental issues, global episodes, laws, acts, protocols

8 Hours

Course Outcomes: After studying this course, students will be able to:

1. Identify the major sources of air pollution and understand their effects on health and environment.
2. Evaluate the dispersion of air pollutants in the atmosphere and to develop air quality models.
3. Ascertain and evaluate sampling techniques for atmospheric and stack pollutants.
4. Choose and design control techniques for particulate and gaseous emissions.

Program Objectives:

- Engineering knowledge

- Problem analysis
- Interpretation of data

Question Paper Pattern:

- The question paper will have 5 modules comprising of ten questions. Each full question carrying 16 marks
- There will be two full questions (with a maximum of three subdivisions, if necessary) from each module.
- Each full question shall cover the topics as a module
- The students shall answer five full questions, selecting one full question from each module. If more than one question is answered in modules, best answer will be considered for the award of marks limiting one full question answer in each module.

Text Books:

1. M. N. Rao and H V N Rao, "Air pollution", Tata Mc-G raw Hill Publication.
2. H. C. Perkins, "Air pollution". Tata McGraw Hill Pu blication
3. Mackenzie Davis and David Cornwell, "Introduction t o Environmental Engineering" McGraw-Hill Co.

Reference Books:

1. Noel De Nevers, "Air Pollution Control Engineering" , Waveland Pr Inc.
2. Anjaneyulu Y, "Text book of Air Pollution and Contr ol Technologies", Allied Publishers

SOLID WASTE MANAGEMENT

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER:VI

Subject Code	15CV651	IA Marks	: 20
No. of Lecture Hours/Week	: 03	Exam Hours	: 03
Total No. of Lecture Hours	: 40	Exam Marks	: 80
	CREDITS – 03	Total Marks-100	

Course objectives: This course will enable students to

1. Study the present methods of solid waste management system and to analyze their draw backs comparing with statutory rules.
2. Understand different elements of solid waste management from generation of solid waste to disposal.
3. Analyze different processing technologies and to study conversion of municipal solid waste to compost or biogas.
4. Evaluate landfill site and to study the sanitary landfill reactions.

Module -1

Sources: Sources of Solid waste, Types of solid waste, Physical and Chemical composition of municipal solid waste. Generation rate, Numerical Problems.

Collection: Collection of solid waste- services and systems, equipments,

Transportation: Need of transfer operation, transfer station, transport means and methods, route optimization. Solid waste management 2000 rules with, 2016 amendments.

8 hours

Module -2

Processing techniques: Purpose of processing, Chemical volume reduction (incineration) – Process description, 3T's, principal components in the design of municipal incinerators, Air pollution control, Mechanical volume reduction (compaction), Mechanical size reduction (shredding), component separation (manual and mechanical methods).

8 hours

Module -3

Composting Aerobic and anaerobic method - process description, process microbiology, design consideration, Mechanical composting, Vermicomposting, Numerical Problems.

Sanitary landfilling: Definition, advantages and disadvantages, site selection, methods, reaction occurring in landfill- Gas and Leachate movement, Control of gas and leachate movement, Design of sanitary landfill. Numerical Problems

8 hours

Module -4

Sources, collection, treatment and disposal of :- Biomedical waste, E-waste, Hazardous waste and construction waste

8 hours

Module -5

Incineration -3Ts factor affecting incineration, types of incinerations, Pyrolysis, design criteria for incineration Energy recovery technique from solid waste management

8 hours

Course outcomes: After studying this course, students will be able to:

1. Analyse existing solid waste management system and to identify their drawbacks.
2. Evaluate different elements of solid waste management system.

3. Suggest suitable scientific methods for solid waste management elements.
4. Design suitable processing system and evaluate disposal sites.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Question paper pattern:

- The question paper will have 5 modules comprising of ten questions. Each full question carrying 16 marks
- There will be two full questions (with a maximum of three subdivisions, if necessary) from each module.
- Each full question shall cover the topics as a module
- The students shall answer five full questions, selecting one full question from each module. If more than one question is answered in modules, best answer will be considered for the award of marks limiting one full question answer in each module.

Text Books:

1. George Tchobanoglous, Hilary Theisen , Samuel A Vigil, Integrated Solid Waste Management : Engineering principles and management issues, M/c Graw hill Education . Indian edition
2. Howard S Peavy, Donald R Rowe and George Tchobanoglous, “Environmental Engineering”, Tata Mcgraw Hill Publishing Co ltd.,

Reference Books:

1. Municipal Solid Wastes (Management and Handling) Rules, 2000.Ministry of Environment and Forests Notification, New Delhi, the 25th September, 2000. Amendment – 1357(E) – 08-04-2016
2. Municipal Solid waste management manual, Part II published under Swachh Bharat Mission, Central Public Health And Environmental Engineering Organization (CPHEEO), 2016, Ministry of Urban Development, Government of India.
3. Handbook of Solidwaste management, second edition, George Tchobanoglous, Frank Kreith, published by M/c Graw hill Education, 2002, ISBN-13 978-0071356237 ISBN -10 0071356231

WATER RESOURCES MANAGEMENT

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER:VI

Subject Code	15CV661	IA Marks	: 20
No. of Lecture Hours/Week	: 03	Exam Hours	: 03
Total No. of Lecture Hours	: 40	Exam Marks	: 80
	CREDITS – 03	Total Marks-100	

Course objectives: This course will enable students

1. To judge surface and ground water resources.
2. To address the issues of water resources management.
3. To learn the principles of integrated water resources management.
4. To understand the legal framework of water policy.
5. To know the different methods of water harvesting.

Module -1

Surface and Ground water Resources: Hydrologic Cycle, Global water resources and Indian Water resources, Surface Water Resources, Water Balance, Available Renewable Water Resources, Water Scarcity, The Water Balance as a Result of Human Interference, Groundwater Resources, Types of Aquifers, Groundwater as a Storage Medium

8 hours

Module -2

Water Resources Planning and Management: Necessity, System components, planning scales, Approaches, planning and management aspects, Analysis, Models for impact prediction and evaluation, Adaptive Integrated Policies, Post Planning and management Issues.

8 hours

Module -3

Integrated Water Resources Management: Definition of IWRM, Principles, Implementation of IWRM, Legislative and Organizational Framework, Types and Forms of Private Sector Involvement.

8 hours

Module -4

Water Governance and Water Policy: Legal Framework of Water – Substance of National Water Laws – Other key issues – Changing incentives through Regulation - National Water Policy – National-Level Commissions – Irrigation Management Transfer Policies and Activities – Legal Registration of WUAs – Legal Changes in

Water Allocation, – Role of Local Institutions – Community Based Organizations – Water Policy Reforms: India.

8 hours

Module -5

Water Harvesting and Conservation: Water Harvesting Techniques – Micro-catchments - Design of Small Water Harvesting Structures – Farm Ponds – Percolation Tanks – Yield from a Catchment, Rain water Harvesting-various techniques related to Rural and Urban area.

8 hours

Course outcomes: After studying this course, students will be able to:

1. assess the potential of groundwater and surface water resources.
2. address the issues related to planning and management of water resources.
3. know how to implement IWRM in different regions.
4. understand the legal issues of water policy.
5. select the method for water harvesting based on the area.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Question paper pattern:

- The question paper will have 5 modules comprising of ten questions. Each full question carrying 16 marks
- There will be two full questions (with a maximum of two subdivisions) from each module.
- Each full question shall cover the topics as a module
- The students shall answer five full questions, selecting one full question from each module. If more than one question is answered in modules, best answer will be considered for the award of marks limiting one full question answer in each module.

Text Books:

- 1) K. Subramanya, "Engineering Hydrology", Tata McGraw Hill Publishers, New Delhi.
- 2) H.M. Raghunath, "Ground Water", Wiley Eastern Publication, New Delhi.
- 3) Daniel P. Loucks and Eelco van Beek, "Water Resources Systems. Planning and Management", UNESCO Publication.
- 4) Mollinga, P. et al, "Integrated Water Resources Management", Water in South Asia Volume I, Sage Publications, 2006.
- 5) Singh, Chhatrapati "Water Rights in India," Ed: Chhatrapati Singh. Water Law in India: The Indian Law Institute, New Delhi, 1992.
- 6) Dhruva Narayana, G. Sastry, V. S. Patnaik, "Watershed Management", CSWCTRI, Dehradun, ICAR Publications, 1997.

Reference Books:

- 1) Lal, Ruttan. "Integrated Watershed Management in the Global Ecosystem". CRC Press, New York.
- 2) Heathcote, I. W. Integrated Watershed Management: Principles and Practice. 1988. John Wiley and Sons, Inc., New York.

POLLUTION PREVENTION AND CONTROL ENGINEERING

Subject Code	: 10CH55	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT

1:

Introduction: Importance of environment for mankind. Biosphere and layers of atmosphere. Hydrological cycle and nutrient cycles. Types of pollution. Damages from environmental pollution. Need of environmental legislations and environmental Acts in India. Functions of central and state pollution control boards. 6

Hours

UNIT 2:

Sources, Sampling and Analysis Of Wastewater: Water resources. Origin of wastewater. Evaluation, classification and characterization of wastewater. Physical and chemical characteristics. BOD, COD and their importance. Types of water pollutants and their effects. Sampling, and methods of analysis. 7

Hours

UNIT

3:

Wastewater Treatment: Preliminary, primary, secondary and tertiary treatments of wastewater. Sludge treatment and disposal. Advanced wastewater treatment. Recovery of materials from process effluents. 7 Hours

UNIT

4:

Applications To Industries: Norms and standards of treated water. Origin, characteristics, and treatment methods in typical industries – petroleum refinery, pulp and paper, fertilizer, distillery, tannery, and textile processing. 6

Hours

PART -

B UNIT 5:

Air Pollution Aspects: Nature of air pollution. Classification of air pollutants. Sources of air pollutants. Air quality criteria and standards. Plume behaviour and dispersion of air pollutants. Effects of air pollution on health, vegetation, and materials. 7 Hours

UNIT

6:

Air Pollution Control: Sampling of pollutants. Methods of estimation of air pollutants. Automobile pollution. Control methods for particulates and gaseous pollutants. Origin, control methods, and equipment used in typical industries – Thermal power plants, metallurgical industries, and cement industries.

Hours**UNIT****7:**

Solid Waste Treatment: Origin, Classification and microbiology. Properties and their variation. Engineered systems for solid waste management – generation, onsite handling, storage, collection, transfer and transport, composting, sanitary land filling.

6 Hours**UNIT****8:**

Noise Control: Sources and definitions. Determination of noise levels. Noise control criteria and noise exposure index. Administrative and engineering controls. Acoustic absorptive materials.

6 Hours**Text Books:**

1. **Environmental Pollution Control Engg**, C.S. Rao, 2nd Edition, New Age International Reprint, 2002.
2. **Pollution Control in Process Industries**, S.P. Mahajan, Tata Mc Graw Hill, 22nd Reprint, 1999.

Reference Books:

1. **Principles and Practices of Air Pollution Control and Analysis**, J.R. Mudakavi, I.K. International Publishing Home Pvt. Ltd., New Delhi, 2010.
2. **Air Pollution**, H.C. Perkins, McGraw Hill, 1974.
3. **Solid Waste Management**, D.J. Hagery et.al., Van Nostrand Reinhold, 1973.
4. **Industrial Pollution Control Handbook**, Lund, H.F., 6th Edition, Vol.1, McGraw Hill, 1971.
5. **Noise Abatement**, Duerden, Butterworth, 1970.
6. **Introduction to Environmental Engg**, Davis., 3rd Edition, McGraw Hill, 1998.
7. **Waste Water Engineering Treatment Disposal Reuse**, Metcalf and Eddy, 4th Edition, Tata McGraw Hill, 2003.
8. **Environmental Engineering**, G.N. Pandey and G.C. Carney, Tata McGraw Hill, 11th Reprint, 2002.
9. **Integrated Solid Waste Management**, George Tchobanoglous et al, 2nd Edition, McGraw Hill & Co, 1993.

ENERGY TECHNOLOGY

Subject Code	: 10CH64	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A**UNIT****1:**

Introduction To Energy Sources: Conventional energy sources; non-conventional energy sources; advantages; limitations.

4**Hours****UNIT**

2:

Solar Energy: Solar radiation and its measurement – solar constant, solar radiation at earth's surface, solar radiation geometry, solar radiation measurement. Introduction to solar energy. Applications – solar water heating, space heating, space cooling, solar thermal electric conversion. Agriculture and industrial process heating, solar distillation, solar pumping, solar cooking. **8 Hours**

UNIT

3:

Energy from Biomass (Bio-Energy): Introduction. Biomass conversion Technologies. Wet processes. Dry processes. Biogas generation. Factors affecting bio digestion or generation of gas. Classification of biogas plants. Advantages and disadvantages of floating drum plant. Advantages and disadvantages of fixed dome type plant. Types of biogas plants (KVIC model & Janata model). Selection of site for biogas plant. **8 Hours**

UNIT

4:

Bio-Energy (Thermal Conversion): Methods of obtaining energy from biomass. Biodiesel, Thermal gasification of biomass. Classification of biomass gasifiers. Chemistry of gasification process. Applications of the gasifiers. **6 Hours**

PART -

B UNIT 5:

Wind Energy: Introduction. Basic components of WECS (wind energy conversion system). Classification of WECS. Types of wind machines- horizontal axis machines, vertical axis machines. Applications of wind energy. **8 Hours**

UNIT

6:

Energy Form The Oceans: Introduction. Ocean thermal electric conversion (OTEC). Methods of ocean thermal electric power generation. Open cycle OTEC system. Closed or Anderson OTEC cycle, hybrid cycle. Application of energy from oceans. **6 Hours**

UNIT

7:

Energy From Tides: Basic principles of tidal power. Components of tidal power plants. Operation methods of utilization of tidal energy. Advantages and limitations of tidal power generation. Applications of tidal energy. **6 Hours**

UNIT 8:

Fuels: Introduction. Classification of fuels. Calorific value. Characteristics of good fuels. Comparison between solid, liquid and gaseous fuels. **6 Hours**

Text Books:

1. **Non-Conventional Energy Sources**, G.D. Rai, 4th Edition, Khanna Publications, Second Reprint, 1997.
2. **Engineering Chemistry**, P.C. Jain & M. Jain, 10th Edition, Dhanpat Rai & Sons, 3rd Reprint, 1995.

Reference Books:

1. **Solar Energy, Second Edition**, S.P. Sukhatme, 3rd Reprint, Tata McGraw Hill, New Delhi,

1998.

2. **Solar Energy Utilization**, G.D. Rai, 4th Edition, Khanna Publications, 2006.

SOLID WASTE MANAGEMENT

Subject Code	: 10CH842	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	:
	03		
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART –

A UNIT 1:

Introduction: Definition, characteristics and perspectives of solid waste. Types of solid waste. Physical and chemical characteristics. Variation of composition and characteristics. Municipal, industrial, special and hazardous wastes. **6 Hours**

UNIT 2:

General Aspects: Overview of material flow in society. Reduction in raw material usage. Reduction in solid waste generation. Reuse and material recovery. General effects on health and environment. Legislations. **7 Hours**

UNIT 3:

Engineered Systems: Typical generation rates. Estimation and factors effecting generation rates. On site handling. Storage and processing. Collection systems and devices. Transfer and transport. **7 Hours**

UNIT 4:

Processing Techniques: Mechanical volume reduction. Thermal volume reduction. Component separation. Land filling and land forming. Deep well injection. **6 Hours**

UNIT 5:

PART – B

Material Recovery: Mechanical size alteration. Electromagnetic separation. Drying and dewatering. Other material recovery systems. Recovery of biological conversion products. Recovery of thermal conversion products. **7 Hours**

UNIT

6:

Energy Recovery: Energy recovery systems and efficiency factors. Determination of output and efficiency. Details of energy recovery systems. Combustion incineration and heat recovery. Gasification and pyrolysis. Refuse derived fuels (RDF). **7 Hours**

UNIT

7:

Hazardous Wastes: Classification. Origin and reduction at source. Collection and handling. Management issues and planning methods. Environmental Acts. **6 Hours**

UNIT

8:

Case Studies: Major industries and management methods used in typical industries – Coal fired power stations, textile industry, oil refinery, distillery, sugar industry, and radioactive waste generation units. **6 Hours**

Text Books:

1. **Integrated Solid Waste Management**, George Tchobanoglous et al, 2nd Edition, McGraw Hill & Co, 1993.
2. **Industrial Solid Waste Management and Land Filling Practice**, Dutta et al, Narosa Publishing House, 1999.

Reference Books:

1. **Waste Treatment Plants**, Sastry C.A. et al, Narosa Publishing House, 1995.
2. **Hazardous Waste Management**, Lagrega, McGraw Hill, 1994.

SOLID WASTE MANAGEMENT IN PROCESS INDUSTRIES

Subject Code: 15CH563

IA marks:20

No. of Lecture Hrs/Week: 03

Exam Hours:03

Total No. of Lecture Hours:40

Exam Marks: 80

Credits: 03

Course Objectives:

The students will

1. Understand solid waste management from an environmental public health perspective.

Identify and discuss the public health, regulatory, planning, technical, and economic principles that influence the solid waste management system.

MODULE-1

Introduction: Definition, characteristics and perspectives of solid waste. Types of solid waste. Physical and chemical characteristics. Variation of composition and characteristics. Municipal, industrial, special and hazardous wastes.

General Aspects: Overview of material flow in society. Reduction in raw material usage. Reduction in solid waste generation. Reuse and material recovery. General effects on health and environment. Legislations.

MODULE-2

Engineered Systems: Typical generation rates. Estimation and factors effecting generation rates. Onsite handling. Storage and processing. Collection systems and devices. Transfer and transport.

MODULE-3

Processing Techniques: Mechanical volume reduction. Thermal volume reduction. Component separation. Land filling and land forming. Deepwell injection

MODULE-4

Material Recovery: Mechanical size alteration. Electro magnetic separation. Drying and dewatering. Other material recovery systems. Recovery of biological conversion products. Recovery of thermal conversion products.

Energy Recovery: Energy recovery systems and efficiency factors. Determination of output an deficiency. Details of energy recovery systems. Combustion incineration and heat recovery. Gasification and pyrolysis. Refuse derived fuels(RDF).

MODULE-5

Hazardous Wastes: Classification. Origin and reduction at source. Collection and handling. Management issues and planning methods. Environmental Acts.

Case Studies: Major industries and management methods used in typical industries– Coalfired power stations, textile industry, oil refinery, distillery, sugar industry, and radioactive waste generation units.

Course outcomes:

After studying this course, students will be able to:

1. Have the working knowledge of all unit operations involved in solid waste management.

Will be familiar with design and policy considerations regarding alternatives for solid waste management

TEXT BOOKS:

1. **Integrated Solid Waste Management**, George Tchobanoglous et al, 2nd Edition, McGraw Hill & Co, 1993.
2. **Industrial Solid Waste Management and Land Filling Practice**, Dutta et al, Narosa Publishing House, 1999.

PROCESS WASTE WATER MANAGEMENT

Subject Code: 15CH5631

IA marks:20

No. of Lecture Hrs/Week: 03

Exam Hours:03

Total No. of Lecture Hours:40

Exam Marks: 80

Credits: 03

Course Objectives:

The students will

1. Understand the mechanisms and processes used to treat waters that have been contaminated in some way by anthropogenic, industrial or commercial activities prior to its release into the environment or its re-use.

Understand various terms used in industrial wastewater treatment and to acquaint with different steps involved in treatment of industrial wastewater.

MODULE 1

Effects of Industrial Wastes on sewerage system and sewage treatment plants and receiving water bodies. Effects of waste additions on physical and chemical properties of soil.

Effluent standards and receiving water quality standards. Different aspects and choices of various disposal alternatives.

MODULE 2

Industrial Wastes survey-Process flow charts, condition of waste stream. Material balance, Sampling – Grab, Composite and integrated samples. Continuous monitoring – pH, Conductivity, Bio monitoring.

MODULE 3

Pretreatment of Industrial Wastewater – Volume reduction, Strength reduction, Neutralization, Equalization and Proportion, Removal of Organic and inorganic dissolved solids. Wastewater Treatment in specific industries: Distillery, Sugar, Pulp and paper, Cement, Textile, Dairy, Fertilizer, Pesticides, Pharmaceutical.

MODULE 4

Design of complete treatment systems & disposal for industries: Distillery, dairy, textile, paper and pulp mill to meet P.C.B. norms. Radioactive wastes treatment- Low activity and high activity radiation, application of radioactive techniques for wastewater treatment. Bio- Remediation of contaminated soils.

MODULE 5

Environmental Auditing: Cost of Pollution, Environmental audit solutions, Financial and Managerial opportunities. Criminal and Regulatory liabilities.

Course outcomes:

After studying this course, students will be able to:

1. Develop physical/chemical/biological characteristics of and the evaluation technique for various industrial wastewater

Express concepts in the theory, engineering application, and design technique for the industrial wastewater treatment unit processes.

TEXT BOOKS:

1. **Liquid Waste of industry theories, Practices and Treatment**, Nemerow N.N., Addison Willey New York.
2. **Industrial Wastewater Management Hand Book**, Azad N. S., McGraw Hill book Co., New York.

Industrial Waste Disposal, Ross R.D. Reinhold Environmental Series – New York.

REFERENCE BOOKS:

1. **Practical Waste Treatment and Disposal**, Dickinson, Applied Science publication, London.
2. **Pollution control in Process industries**, Mahajan S P, TMH, New Delhi.

Industrial Water pollution Control, Eckenfelder, - McGraw hill Company, New Delhi American Chemical Society, Washington D.C. USA.

PROCESS AIR POLLUTION & CONTROL

Subject Code: 15CH5632

IA marks:20

No. of Lecture Hrs/Week: 03

Exam Hours:03

Total No. of Lecture Hours:40

Exam Marks: 80

Credits: 03

Course Objectives:

The students will

1. Understand knowledge on the principles and design of control of indoor/ particulate / gaseous air pollutant and its emerging trends.

MODULE-1

INTRODUCTION: Structure and composition of Atmosphere – History of Air pollution and episodes, Causes of air pollution and types, Introduction to meteorology toxicology and transport of air pollution, Sources and classification of air pollutants - Effects of air pollutants on human health, vegetation & animals, Materials & Structures – Effects of air Pollutants on the atmosphere, Soil & Water bodies – Long- term effects on the planet – Global Climate Change, Ozone Holes – Ambient Air Quality and Emission Standards – Air Pollution Indices – Emission Inventories

MODULE-2

AIR POLLUTION MONITORING AND MODELLING:

Physicochemical processes governing the spread of pollutants from point, non-point, line, and area sources; Generation, transport and decay of air pollutants; Mathematical Modeling of dynamics of pollutants, Ambient and Stack Sampling and Analysis of Particulate and Gaseous Pollutants-Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns- Transport & Dispersion of Air Pollutants - Modeling Techniques– Air Sampling and monitoring methods.

MODULE-3

CONTROL OF PARTICULATE CONTAMINANTS: Factors affecting Selection of Control Equipment - Gas Particle Interaction, Working principle, Design and performance equations of Gravity Separators, cyclones, Fabric filters, Particulate Scrubbers, Electrostatic Precipitators - Operational Considerations - Process Control and Monitoring - Costing of APC equipment - Case studies for stationary and mobile sources

MODULE-1

CONTROL OF GASEOUS CONTAMINANTS: Control Equipments, Factors affecting Selection of Control Equipment - Working principle, Design operation and performance of absorption, Adsorption, condensation, Incineration, Bio scrubbers, Bio filters - Process control and Monitoring - Operational Considerations - Costing of APC Equipment - Case studies for stationary and mobile sources.

MODULE-1

AUTOMOBILE AND NOISE POLLUTION: Vehicular Pollution: Automobile emission - Types of emissions - Exhaust emissions, evaporative emissions, crank-case emissions- Prevention and control of vehicular pollution. Noise Pollution: Sources and Effects of Noise Pollution - Measurement - Standards - Control and Preventive measures. Sources types and control of indoor air pollutants, sick building syndrome types - Radon Pollution and its control. Air pollution legislation and regulations. Case studies of a few industrial pollution control systems.

Course outcomes:

After studying this course, students will be able to:

1. Apply sampling techniques

Suggest suitable air pollution prevention Equipments and techniques for various gaseous and particulate pollutants.

TEXT BOOKS:

1. **Air Pollution Control Engineering**, Lawrence K. Wang, Norman C. Pareira, Yung Tse Hung, Tokyo, 2004.

2. **Air Pollution Control Engg**, Noel de Nevers, Mc.Graw Hill, New York, 1995.

Air Pollution, David H.F. Liu, Bela G. Liptak, Lewis Publishers, 2000.

**HUMAN
VALUES &
PROFESSION
AL ETHICS**

CONSTITUTION OF INDIA, PROFESSIONAL ETHICS & HUMAN RIGHTS (2015 scheme)

Subject Code	15CPH18/15CPH28	IA Marks	10
Number of Lecture Hours/Week	02	Exam Marks	40
Total Number of Lecture Hours	25	Exam Hours	02

Course objectives:

- To provide basic information about Indian constitution.
- To identify individual role and ethical responsibility towards society.
- To understand human rights and its implications

Module 1

Introduction to the Constitution of India, The Making of the Constitution and Salient features of the Constitution. **2 Hours**

Preamble to the Indian Constitution Fundamental Rights & its limitations. **3 Hours**

Module 2

Directive Principles of State Policy & Relevance of Directive Principles State Policy
Fundamental Duties.

Union Executives – President, Prime Minister Parliament Supreme Court of India.

Module 3

State Executives – Governor Chief Minister, State Legislature High Court of State. Electoral Process in India, Amendment Procedures, 42nd, 44th, 74th, 76th, 86th & 91st

Amendments.

Module 4

Special Provision for SC & ST Special Provision for Women, Children & Backward Classes

Emergency Provisions. Human Rights – Meaning and Definitions, Legislation Specific Themes in

Human Rights- Working of National Human Rights Commission in India **3 Hours**

Powers and functions of Municipalities, Panchyats and Co - Operative Societies. **2 Hours**

Module 5

Scope & Aims of Engineering Ethics, Responsibility of Engineers Impediments to Responsibility.

2 Hours

Risks, Safety and liability of Engineers, Honesty, Integrity & Reliability in Engineering.

3 Hours

Course outcomes:

After study of the course, the students are able to

- Have general knowledge and legal literacy and thereby to take up competitive examinations
- Understand state and central policies, fundamental duties
- Understand Electoral Process, special provisions
- Understand powers and functions of Municipalities, Panchayats and Co-operative Societies, and
- Understand Engineering ethics and responsibilities of Engineers.
- Have an awareness about basic human rights in India

Text Books:

1. Durga Das Basu: “**Introduction to the Constitution on India**”, (Students Edn.) Prentice –Hall EEE, 19th / 20th Edn., 2001
2. Charles E. Haries, Michael S Pritchard and Michael J. Robins “**Engineering Ethics**” Thompson Asia, 2003-08-05.

Reference Books:

1. M.V.Pylee, “An Introduction to Constitution of India”, Vikas Publishing, 2002.
2. M.Govindarajan, S.Natarajan, V.S.Senthilkumar, “**Engineering Ethics**”, Prentice –Hall of India Pvt. Ltd. New Delhi, 2004
3. Brij Kishore Sharma, “**Introduction to the Constitution of India**”, PHI Learning Pvt. Ltd., New Delhi, 2011.
4. Latest Publications of Indian Institute of Human Rights, New Delhi.

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CONSTITUTION OF INDIA, PROFESSIONAL ETHICS & HUMAN RIGHTS(2010 Scheme)

Subject code 10CIP28

Unit-1	4 hours
Preamble to the constitution of India. Fundamental rights under Part– III – details of Exercise of rights, Limitations & Important cases.	
Unit-2	3 hours
Relevance of Directive principles of State Policy under Part – IV.Fundamental duties & their significance	
Unit-3	3 hours
Union Executive – President, Prime Minister, Parliament & the Supreme Court of India.	
Unit-4	3 hours
State executive – Governors, Chief Minister, State Legislator and High Courts.	
Unit-5	4 hours
Constitutional Provisions for Scheduled Castes & Tribes, Women &Children & Backward classes. Emergency Provisions	
Unit-6	3 hours
Electoral process, Amendment procedure, 42nd, 44th, 74th, 76th,86th and 91st Constitutional amendments.	
Unit-7	3 hours
Scope & aims of engineering Ethics. Responsibility of Engineers.Impediments to responsibility.	
Unit-8	3 hours
Honesty, Integrity and reliability, risks, safety & liability in engineering	

CONSTITUTION OF INDIA, PROFESSIONAL ETHICS & HUMAN RIGHTS(2014 Scheme)

Subject code 14CIP28

Module 1

Introduction to the Constitution of India, The Making of the Constitution and Salient features of the Constitution. **2 Hours**

Preamble to the Indian Constitution Fundamental Rights & its limitations. **3 Hours**

Module 2

Directive Principles of State Policy & Relevance of Directive Principles State Policy

Fundamental Duties. **2 Hours**

Union Executives – President, Prime Minister Parliament Supreme Court of India. **3 Hours**

Module 3

State Executives – Governor Chief Minister, State Legislature High Court of State. **2 Hours**

Electoral Process in India, Amendment Procedures, 42nd, 44th, 74th, 76th, 86th & 91st Amendments.

3 Hours

Module 4

Special Provision for SC & ST

Special Provision for Women, Children & Backward Classes Emergency Provisions. Human Rights –Meaning and Definitions, Legislation Specific Themes in

Human Rights- Working of National Human Rights Commission in India **3 Hours**

Powers and functions of Municipalities, Panchyats and Co - Operative Societies.

Module 5

Scope & Aims of Engineering Ethics, Responsibility of Engineers Impediments to Responsibility.

2 Hours

Risks, Safety and liability of Engineers, Honesty, Integrity & Reliability in Engineering.

3 Hours

Workplace Ethics syllabus for MBA 4 Sem 2014 scheme | Vtu

14MBAHR408 Syllabus

SubjectCode:14MBAHR408

IA Marks : 50

No. of Lecture Hours / Week : 04

Exam Hours : 03

TotalNumberofLectureHours : 56

Exam

Marks : 100

Practical Component: 01 Hour / Week

Objectives:

- To make students understand the meaning of good ethics, doing things right and the obstacles to making good ethical decisions
- To enable students to identify and critically assess the principles and values they personally embrace and use in addressing the ethical issues which arise in their working lives.
- To acquaint students with some of the major kinds of ethical problems encountered while performing work assignments and some possible ways of responding to them.

Module 1: (8 Hours)

Workplace Ethics: Introduction, Needs, Principles, Development of Personal Ethics, Workplace Ethics for Employees-Ethical behaviour in workplace- Professionalism, Ethical violations by employees, Employee Attitude and Ethics, Employee Etiquettes. Benefits of ethics in Workplace-employee commitment, investor loyalty, customer satisfaction, profits.

Module 2: (8 Hours) Professionalism at Workplace: Unethical Conduct for employees and employers. Factors leading to Unethical Behaviours. Different unethical behaviours. Measures to control unethical behaviours. Rewarding ethical behaviour

Module 3: (10 Hours) Business Ethics and Corporate Governance: Overview of Business Ethics, Corporate Governance, Ethical issues in human resource management- The principle of ethical hiring, Firing, worker safety, whistle blowing, Equality of opportunity, Discrimination, Ethics and remuneration, Ethics in retrenchment. Ethical Dilemmas at workplace, Ethical issues in global business, corporate responsibility of employers.

Module 4: (8 Hours) Workplace Privacy & Ethics: Watching what they say and what they do in the workplace, Hardware, Software and Spyware, Plagiarism and Computer Crimes, Convenience and Death of Privacy, Defence of employee privacy rights.

Module 5: (8 Hours) Teamwork in the Workplace & Ethics: Teams, Elements of team, Stages of team development, team meetings, team rules, and team work and professional responsibility, rules of professional responsibility, ASME code of ethics.

Module 6: (8 Hours) Managing Change in Workplace through Ethics: Introduction to Change Management, Models of change, the Ethics of Managing Change, the role of ethics and responsibilities in leading innovation and change, ethics based model for change management, ethics and risks of change management.

Module 7: (6 Hours) Ethics, Discrimination and Harassment at Workplace: Discrimination, sexual harassment, Creating awareness about workplace harassment, Vishaka Dutta vs. State of Rajasthan – Supreme Court directions, Compulsory workplace guidelines.

Practical Components:

- To solve case studies on Workplace Ethics
- To visit organizations and find out the problems and causes for unethical behavior at workplace.
- To visit organizations and find out the measures adopted to control unethical behavior of employees.
- To compare and contrast the various ethical codes of conduct practiced in organizations.
- To study the recent cases on breach of workplace privacy.

RECOMMENDED TEXT BOOKS:

- Ethical Theory and Business, Tom L. Beauchamp, Norman E. Bowie and Denis Arnold, 8 th Edition.
- Business Ethics, O.C. Ferrell, John Fraedrich, and Linda Ferrell, 9th Edition, Cengage Learning.
- How technology is compromising Workplace Privacy, Fredrick S Lane 111, AMACOM Div American Mgmt Assn, 2003
- Ethics in the Workplace, Dean Bredeson, Keith Goree, Cengage Learning, 2011

REFERENCE BOOKS:

- Ethics in 21st Century, Mary Alice Trent, Oral Roberts University, longman.
- Ethics in workplace, Elizabeth P Tierney, Oak tree press
- Ethics in Workplace: System Perspective, William F Roth, Pearson, 2014.
- Ethics in the Workplace: Tools and Tactics for Organizational Transformation - Craig E. Johnson - SAGE Publications, 2007
- Business Ethics: Fairness and justice in the workplace - Volume 2 of Business Ethics, Fritz Allhoff, ISBN 1412902541, 9781412902540 - SAGE Publications, 2005