

4-YEAR DIPLOMA IN ENGINEERING PROGRAM

# **Environmental Technology (90)**

SYLLABUS  
(COURSE STRUCTURE-2010)

SEVENTH & EIGHTH  
SEMESTER

## Environmental Technology (90)

### 7<sup>th</sup> Semester

Sl. No	Subject code	Name of the subject	T P C			MARKS				
						Theory		Practical		Total
						Cont. assess	Final exam.	Cont. assess	Final exam.	
1.	9071	Environmental Impact Assessment (EIA) & Environmental Regulation	2	3	3	20	80	25	25	150
2.	9072	Solid Waste Management	2	3	3	20	80	25	25	150
3.	9073	Air Pollution and Control Engineering	2	3	3	20	80	25	25	150
4.	9074	Environmental Engineering Projects	0	6	2	0	0	50	50	100
5.	9075	Disaster Management	3	0	3	30	120	0	0	150
6.	9076	Environmental Hydrology & Water Resources Engineering	3	3	4	30	120	25	25	200
7.	5853	Entrepreneurship	2	0	2	20	80	0	0	100
<b>Total</b>			<b>14</b>	<b>18</b>	<b>20</b>	<b>140</b>	<b>560</b>	<b>150</b>	<b>150</b>	<b>1000</b>

## Environmental Technology (90)

### 8<sup>th</sup> Semester

Sl. No	Subject code	Name of the subject	T P C			MARKS				
						Theory		Practical		Total
						Cont. assess	Final exam.	Cont. assess	Final exam.	
1.		Industrial Training			6			180	120	300
<b>Total</b>					<b>6</b>					<b>300</b>

## CONTENTS

### SEVENTH SEMESTER

<b>Sl No</b>	<b>Subject Code</b>	<b>Name of the Subject</b>	<b>Page</b>
1.	9071	Environmental Impact Assessment (EIA) & Environmental Regulation	4
2.	9072	Solid Waste Management	11
3.	9073	Air Pollution and Control Engineering	17
4.	9074	Environmental Engineering Projects	22
5.	9075	Disaster Management	24
6.	9076	Environmental Hydrology & Water Resources Engineering	29
7.	5853	Entrepreneurship	33

4-YEAR DIPLOMA IN ENGINEERING PROGRAM

# **Environmental Technology (90)**

**SYLLABUS  
(COURSE STRUCTURE-2010)**

**SEVENTH SEMESTER**

**9071 Environmental Impact Assessment (EIA) & Environmental Regulation**

<b>T</b>	<b>P</b>	<b>C</b>
<b>2</b>	<b>3</b>	<b>3</b>

**AIMS**

- This course provides students with a basic understanding of the content of environmental impact assessments and the role of environmental impact assessment in the planning, development and management of development projects, programs and policies.
- To make a good knowledge about various EIA methodologies and processes.
- To understand about identify the impacts on environment due to development works.
- To understand about documentation, alternative measures and monitoring policies.

**Short Description**

Basic concept of environmental impact assessment (EIA), procedure of environmental impact assessment (EIA), methods for impact identification, environmental setting (affected environment), environmental indices and indicators for describing the affected environment, prediction and assessment of impacts on the air environment, prediction and assessment of impacts on the surface water environment, prediction and assessment of impacts on the soil and groundwater environments, prediction and assessment of impacts on the noise environment, prediction and assessment of impacts on the biological environment, prediction and assessment of visual impacts, prediction and assessment of impacts on the socioeconomic environment, concept of decision methods for evaluation of alternatives, concept of public participation in environmental decision making, concept of preparation of written documentation, concept of environmental monitoring.

**Detail Description****1. Understand the basic concept of environmental impact assessment (EIA)**

- 1.1. Define environmental inventory, environmental assessment (EA), environmental impact, environmental impact assessment (EIA), significant impact, intensity, finding of no significant impact (FONSI), environmental statement, environmental impact statement (EIS), strategic environmental assessment (SEA), initial environmental evaluation (IEE).
- 1.2. Describe the need for EIA.
- 1.3. Describe the purpose of EIA.
- 1.4. Describe national goals of environmental policy.
- 1.5. Describe the considerations of evaluating intensity.
- 1.6. Describe the types of EIS.
- 1.7. Describe the categories of negative impacts.
- 1.8. Describe the rating the environmental impact of the action.

**2. Understand procedure of environmental impact assessment (EIA)**

- 2.1. Describe the conceptual framework for environmental impact studies.

- 2.2. Describe the phases of impact assessment.
- 2.3. Describe the outline processes of EIA
- 2.4. Describe the screening processes.
- 2.5. Describe the scoping processes.
- 2.6. Describe the checklist for EIS preparation.
- 2.7. Describe systematic approach for impact identification.
- 2.8. Describe the specialists relate to the EIA process.
- 2.9. Describe the general study management.
- 2.10. Describe fiscal control.

### **3. Understand the methods for impact identification**

- 3.1. Classify the EIA methods.
- 3.2. Describe the applications of methodologies in EIA process.
- 3.3. Describe the selection characteristics of EIA methods.
- 3.4. Describe the types of interaction-matrix methodologies.
- 3.5. Describe simple matrices.
- 3.6. Describe stepped matrices
- 3.7. Describe network methodologies
- 3.8. Describe checklist methodologies.

### **4. Understand the environmental setting (affected environment)**

- 4.1. Define environmental setting.
- 4.2. Describe the purposes of describing the environmental setting.
- 4.3. Describe conceptual framework.
- 4.4. Describe initial list of factors.
- 4.5. Describe agency guidelines or regulations.
- 4.6. Describe checklist of biophysical and cultural environment factors for impoundment.
- 4.7. Describe selection process.
- 4.8. Describe documentation of selection process.

4.9. Describe data sources.

4.10. Understand the environmental indices and indicators for describing the affected environment

4.11. Define environmental index, environmental indicator.

4.12. Describe the usefulness of environmental indices.

4.13. Describe the considerations about ecological indicators.

4.14. Describe preliminary set of national environmental indicators.

## **5. Understand the prediction and assessment of impacts on the air environment**

5.1. Describe conceptual approach for addressing air environment impacts.

5.2. Describe identification of the types and quantities of air pollutants and of their impacts.

5.3. Describe existing air quality conditions.

5.4. Describe procurement of relevant air quality standards and regulations.

5.5. Describe impact prediction.

5.6. Describe assessment of impact significance.

5.7. Describe identification and incorporation of mitigation measures.

## **6. Understand the prediction and assessment of impacts on the surface water environment**

6.1. Describe the examples of projects which create impact concern for the surface water environment.

6.2. Describe the land use – water quality relationship.

6.3. Describe conceptual approach for addressing surface water environment impacts.

6.4. Describe identification of surface water quantity or quality impacts.

6.5. Describe existing surface water resource conditions.

6.6. Describe procurement of relevant surface water quantity-quality standards.

6.7. Describe impact prediction.

6.8. Describe assessment of impact significance

6.9. Describe identification and incorporation of mitigation measures.

**7. Understand the prediction and assessment of impacts on the soil and groundwater environments.**

- 7.1. Describe the types of projects and associated impacts.
- 7.2. Describe the conceptual approach for addressing soil and groundwater environment impacts.
- 7.3. Describe identification of soil and/or groundwater quantity-quality impacts.
- 7.4. Describe existing soil and/or groundwater resources.
- 7.5. Describe procurement of relevant soil and/or groundwater quantity-quality standards.
- 7.6. Describe impact prediction.
- 7.7. Describe assessment of impact significance
- 7.8. Describe identification and incorporation of mitigation measures.

**8. Understand the prediction and assessment of impacts on the noise environment**

- 8.1. Define sound, noise, sound power, sound pressure level, sound level, equivalent sound level,  $L_{10}$ ,  $L_{dn}$ , dBA, SEL.
- 8.2. Describe the classification of sound.
- 8.3. Mention the acceptable limit for various places.
- 8.4. Describe conceptual approach for addressing noise environment impacts.
- 8.5. Describe identification of noise impacts.
- 8.6. Describe existing noise environment conditions.
- 8.7. Describe procurement of relevant noise standards and/or guidelines.
- 8.8. Describe impact prediction.
- 8.9. Describe assessment of impact significance.
- 8.10. Describe identification and incorporation of mitigation measures.

**9. Understand the prediction and assessment of impacts on the biological environment**

- 9.1. Describe conceptual approach for addressing biological environment impacts.
- 9.2. Describe identification of biological impacts.
- 9.3. Describe existing biological environment conditions.
- 9.4. Describe procurement of relevant legislation and regulations.

9.5. Describe impact prediction.

9.6. Describe assessment of impact significance.

9.7. Describe identification and incorporation of mitigation measures.

**10. Understand the prediction and assessment of visual impacts.**

10.1. Define aesthetics, visual impact assessment,

10.2. Describe conceptual approach for visual impact prediction and assessment.

10.3. Describe delineation of the types of potential visual impacts.

10.4. Describe existing visual resources.

10.5. Describe procurement of relevant institutional information.

10.6. Describe prediction of impacts on existing visual resources.

10.7. Describe assessment of significance of predicted impacts.

10.8. Describe identification and incorporation of mitigation measures.

**11. Understand the prediction and assessment of impacts on the socioeconomic environment.**

11.1. Define human environment.

11.2. Describe conceptual approach for addressing socioeconomic impacts.

11.3. Describe identification of socioeconomic impacts.

11.4. Describe existing socioeconomic conditions.

11.5. Describe prediction of socioeconomic impacts.

11.6. Describe assessment of socioeconomic impacts.

11.7. Describe human health impacts.

**12. Understand the concept of decision methods for evaluation of alternatives.**

12.1. List the categories of alternatives for projects.

12.2. Describe conceptual basis for trade-off analysis.

12.3. Describe scaling, rating or ranking of alternatives.

12.4. Describe the criteria for evaluating EIA methodologies.

**13. Understand the concept of public participation in environmental decision making.**

- 13.1. Define public participation.
- 13.2. Describe public participation in the environmental impact assessment process.
- 13.3. Describe objectives of public participation.
- 13.4. Describe techniques classification according to communication characteristics and potential for meeting stated objectives.

#### **14. Understand the concept of preparation of written documentation.**

- 14.1. Describe the principles for technical writing.
- 14.2. Describe the suggestions for overcoming common writing related errors in EISs.
- 14.3. Describe structure of an EIS topical outline.
- 14.4. Describe generic topical outline for an environmental impact report.
- 14.5. Describe general writing suggestions for an environmental impact report.

#### **15. Understand the concept of environmental monitoring.**

- 15.1. Define post project analysis, monitoring.
- 15.2. Describe the classification of monitoring.
- 15.3. Describe the purposes of environmental monitoring.
- 15.4. Describe planning considerations for a monitoring program.
- 15.5. Describe guidelines and policies for monitoring.

#### **Practical**

1. Study the guidelines for the content of environmental impact statements.
2. Make questions related to significance determination in EIA.
3. Make checklist for EIS preparation.
4. Make a systematic approach for impact identification.
5. Determine potential environmental impacts resulting from construction practices.
6. Determine typical impacts of dams and reservoirs.
7. Make a Leopold matrix for highway construction.
8. Make a interaction matrix for coastal sewerage project.
9. Make a interaction matrix for water resources reservoir projects.

10. Make environmental perturbations that may occur as a result of petroleum industry practices.
11. Make a network diagram for analyzing probable environmental impacts.
12. Make a network diagram for dredging project.
13. Make a graph or digraph of the primary impacts of the primary impacts of a residential housing project.
14. Make checklist of biophysical and cultural environment factors for impoundment projects.
15. Make potential environmental impacts resulting from construction practices.
16. Perform a detail EIA for a textile industry in Bangladesh.

**References**

1. Bram Noble. Introduction to Environmental Impact Assessment - Guide to Principles and Practice. Oxford University Press.
  2. Carroll, Barbara and Turpin, Trevor. Environmental Impact Assessment Handbook: A Practical Guide for Planners, Developers and Communities. Thomas Telford Publishing.
- Canter, Larry W. Environmental Impact Assessment. McGraw-Hill International

9072

**SOLID WASTE MANAGEMENT**

<b>T</b>	<b>P</b>	<b>C</b>
<b>2</b>	<b>3</b>	<b>3</b>

**AIMS**

- ❖ To be able to understand the basic concepts of solid waste and management.
- ❖ To be able to understand the sources, classification, characteristics and collections of solid waste.
- ❖ To be able to understand the processing and recovery of resources of solid waste.
- ❖ To be able to calculate the energy, materials and conversion products from solid waste.
- ❖ To be able to understand the disposal of solid waste.
- ❖ To be able to perform experiments in solid waste.

**SHORT DESCRIPTION**

Sources and classification of solid waste; Municipal, industrial and hazardous solid waste; Solid waste characteristics and composition; Storage and collection of solid waste; Solid waste processing and resource recovery; Disposal methods of solid waste; Recycling of solid waste; Magnetic and electromagnetic separation of solid waste; Engineered system for resources in energy recovery; Engineered system for composting and fermentation of solid wastes; Combustion of waste materials; Ultimate disposal of solid waste; Management of solid waste and hospital waste management.

**DETAIL DESCRIPTION****Theory:****1 Understand the source and classification of solid waste.**

- 1.1 Define solid waste, refuse, food waste, rubbish, demolition and construction waste, hazardous waste, agricultural waste, 3R, 4R, recycling, material conversion and energy recovery.
- 1.2 List the sources of solid waste.
- 1.3 Mention the classification of solid waste.
- 1.4 Describe garbage and rubbish with example.
- 1.5 Describe industrial waste.
- 1.6 Describe pathological wastes.
- 1.7 Describe hazardous waste with example.

**2 Understand the municipal, industrial and hazardous solid waste.**

- 2.1 List the general sources of municipal solid waste.
- 2.2 Mention the classification of materials comprising municipal solid waste.
- 2.3 Describe the garbage, rubbish and trash.
- 2.4 Mention the classification of different types of industrial solid waste.
- 2.5 Describe the solid waste generated in the chemical process industries.
- 2.6 Mention the characteristics of hazardous waste.
- 2.7 Describe the hazardous industrial solid waste.

**3 Understand the solid waste characteristics and compositions.**

- 3.1 Mention the physical characteristics of solid waste.
- 3.2 Mention the chemical characteristics of solid waste.
- 3.3 Describe the rate of generation of solid waste quantities.
- 3.4 Describe the solid waste composition.
- 3.5 Describe the typical composition of municipal solid waste.
- 3.6 Describe the moisture content of solid waste.
- 3.7 Describe the density of solid waste.
- 3.8 Describe the proximate analysis of solid waste.
- 3.9 Describe the ultimate analysis of solid waste.
- 3.10 Describe the chemical content of solid waste.
- 3.11 Describe the energy content in solid waste.
- 3.12 Solve problem involve moisture content, density, chemical content and energy content of solid waste.

**4 Understand the method of storage and collection of solid waste.**

- 4.1 Describe On-site handling and storage of solid waste.
- 4.2 Describe communal collection, block collection, curb site collection and house to house collection of solid waste.
- 4.3 List the types of collection systems.
- 4.4 Describe hauled container system (HCS) and stationery container system (SCS) in collection of solid waste.
- 4.5 Describe the determination of vehicle and labor requirements.
- 4.6 Describe the collection routes of solid waste.
- 4.7 Describe the layout of collection routes.
- 4.8 Describe transfer stations of solid waste.
- 4.9 Describe the solid waste transportation.
- 4.10 Describe the storage and collection of solid water in Bangladesh.
- 4.11 Solve problem involve collection routes of solid waste and layout of routes.

**5 Understand the solid waste processing and resource recovery.**

- 5.1 Mention the objectives of solid waste processing.
- 5.2 List the solid waste processing techniques.
- 5.3 Describe the recycling or salvaging of solid waste.
- 5.4 Describe the resource recovery from solid waste.
- 5.5 Describe the method of screening solid waste.
- 5.6 Describe the method of air classifying of solid waste.
- 5.7 Describe the recovery of materials from solid waste.
- 5.8 Describe the recovering of electrical energy from solid wastes.

## **6 Understand the disposal method of solid waste.**

- 6.1 List the disposal methods of solid waste.
- 6.2 Describe open dumping.
- 6.3 Describe sanitary land filling method of disposal of solid waste.
- 6.4 Describe the land farming and deep-well injection of disposal of solid waste.
- 6.5 Describe the incineration method of solid waste disposal.
- 6.6 Describe the method of composting.
- 6.7 Describe manual component separation of solid waste.
- 6.8 Describe the modern method of component separation of solid waste
- 6.9 Describe the mechanical volume reduction of solid waste.
- 6.10 Describe the chemical volume reduction of solid waste.

## **7 Understand the recycling of solid waste.**

- 7.1 Describe the utilization of solid waste.
- 7.2 Describe the method of recycling of paper products.
- 7.3 Describe the method of recycling of glass and metals materials.
- 7.4 Describe the method of recycling of plastics.
- 7.5 Describe the recycling process in Bangladesh.

## **8 Understand the magnetic and electro mechanical separation of solid waste.**

- 8.1 Define magnetic and electromagnetic separation of solid waste.
- 8.2 List the magnetic and electromagnetic separable materials of solid waste.
- 8.3 Describe the method of separation of magnetic and electromagnetic solid wastes.

## **9 Understand the engineered systems for resources and energy recovery.**

- 9.1 List processing technique used to recover material and to prepare waste for further processing.
- 9.2 Describe mechanical size alternation of solid waste.
- 9.3 Describe mechanical component separation of solid waste.

- 9.4 Describe magnetic and electromagnetic separation of solid waste.
- 9.5 Describe drying and dewatering of solid waste.
- 9.6 Describe the processing and recovering system of waste products.
- 9.7 Draw the flow sheet for recovery of materials from solid waste.
- 9.8 Draw the flow sheet for the preparation of RDF.
- 9.9 Describe the recovery of biological conversion products.
- 9.10 Solve problem involve biological conversion products of solid waste.

**10 Understand the engineered system for composting and fermentation of solid waste.**

- 10.1 Define composting of solid waste.
- 10.2 Mention the characteristics of compost.
- 10.3 Mention the factors upon which composting of solid waste depend.
- 10.4 Describe aerobic composting processes.
- 10.5 Describe the important design consideration of aerobic composting processes.
- 10.6 Solve problem involve aerobic composting of solid waste.
- 10.7 Describe anaerobic digestion or anaerobic fermentation.
- 10.8 Describe important design consideration for anaerobic digestion.
- 10.9 Solve problem involve anaerobic digestion or anaerobic fermentation of solid waste.
- 10.10 Describe the thermal processing for the recovery of products from solid waste.
- 10.11 Describe the method of vermicomposting.

**11 Understand the combustion of solid waste materials.**

- 11.1 Define combustion.
- 11.2 Describe combustion of waste materials.
- 11.3 Mention the heat losses in combustion of solid waste.
- 11.4 Solve problem involve combustion of solid waste.
- 11.5 Describe incineration of solid waste materials.
- 11.6 Describe water wall incineration.
- 11.7 Describe the use of refuse derived fuels.
- 11.8 Describe gasification of solid waste.
- 11.9 Describe pyrolysis of solid waste.
- 11.10 Describe the recovery of energy form conversion products.
- 11.11 Describe the efficiency factor form energy-recovery system.
- 11.12 Solve problem involve efficiency of energy-recovery system.
- 11.13 Describe the materials and energy recovery system.

**12 Understand the ultimate disposal of solid waste.**

- 12.1 Define sanitary land filling.
- 12.2 Describe basic aspects of landfills implementation.
- 12.3 Mention the factors important for landfill site selection.
- 12.4 Describe landfilling methods and operations of disposal of solid waste.
- 12.5 Describe the design of landfills.
- 12.6 Describe the occurrence of gases and leachate in land fill.
- 12.7 Describe the gases and leachate movement in landfill.
- 12.8 Solve problem involve land filling method of disposal of solid waste.
- 12.9 Describe the method of disposal of hazardous waste.

### **13 Understand the management of solid waste.**

- 13.1 Mention the key objectives of solid waste management.
- 13.2 Describe the major activities associated with the management of solid waste.
- 13.3 Describe the major elements of solid waste management.
- 13.4 Describe the effects of solid waste mismanagement.

### **14 Understand the hospital waste management.**

- 14.1 Identify hospital waste.
- 14.2 Describe the characteristics of hospital waste.
- 14.3 Describe the collection system of different types of hospital waste.
- 14.4 Describe the disposal system of different types of hospital waste.

### **Practical:**

1. Perform the proximate analysis of solid waste and estimate the volatile moisture, fixed carbon and ash in solid waste.
2. Determine the moisture content of solid waste.
3. Determine the density of solid waste sample.
4. Perform the ultimate analysis of solid waste.
5. Perform experiments on aerobic composting of solid waste.
6. Perform experiment on vermi composting of solid waste.
7. Perform experiments on drying of solid waste.
8. Draw a schematic diagram of a tunnel dryer used in solid waste drying.
9. Draw a container for collection of solid waste.
10. Draw schematic diagram of a modern tromel screen.
11. Draw schematic flow sheet of a typical solid waste separation facility.
12. Perform a case study on solid waste management.
13. Design solid waste management system of your college campus.

**REFERENCE BOOKS**

1. Peavy H. S., Rewe D. R. and Tchobnoglous g. (1985); Environmental Engineering
2. Ahmed F. & Rahman M. M. (2000) Water Supply and Sanitation-Rural and low income urban communities; ITN-Bangladesh, BUET, Dhaka.
3. Rao C. S; Environmental Pollution Control Engineering
4. D K Asthara and Meera Asthara; Environmental Problems and solution
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6. Baljeet S Kapoor; Environmental Problems and Solution

9073

**AIR POLLUTION AND CONTROL ENGINEERING**

<b>T</b>	<b>P</b>	<b>C</b>
<b>2</b>	<b>3</b>	<b>3</b>

**AIMS**

- ❖ To be able to understand the air pollution and its sources & management.
- ❖ To be able to understand the behavior, effect, sampling and measurement and analysis of air pollutants,
- ❖ To be able to understand air pollution control methods, control equipments or devices, gaseous control adsorbent, solvents
- ❖ To be able to perform experiments on air pollution.
- ❖ To be able to understand noise pollution, affects and control techniques.
- ❖ To be able to perform experiments on noise pollution.

**SHORT DESCRIPTION**

Air pollution, Sources, classification and properties of air pollutants; Behavior of air pollutants; Effects of air pollution; Effects of air pollution on vegetation and materials; meteorological and atmospheric dispersion of air pollutants; Air pollution sampling and measurement; Sampling system of air pollution; Analysis of air pollution; Air pollution control methods; Particulate control equipment; control of gaseous emission with control devices; Control of sulphurdioxide; Control of nitrogen oxide; Control of hydrocarbons; Control of principle pollutants from mobile sources; Green house effect and Photochemical smog; Noise pollution of air and its control.

**DETAIL DESCRIPTION****Theory:**

- 1 Understand the concept of air pollution.**
  - 1.1 Define air pollution.
  - 1.2 Describe the historical overview of air pollution.
  - 1.3 Describe the composition of the clean dry atmospheric air at ground level.
  - 1.4 Describe the units of measurement of air pollution.
  - 1.5 Solve the problem on volume, temperature and pressure of air pollutants.
  
- 2 Understand the sources, classification and properties of air pollutants.**
  - 2.1 Define air pollutants.
  - 2.2 Classification of air pollutants.
  - 2.3 Describe the properties of air pollutants.
  - 2.4 Mention the classification of anthropogenic air pollution sources.
  - 2.5 Describe the estimated global emissions of major air pollutants.

- 2.6 Describe the pollutant emission sources in Bangladesh.
  - 2.7 List the main air pollutants species with their major sources of generation.
  - 2.8 Describe the particulates of an air pollutant.
- 3 Understand the effect of air pollution.**
- 3.1 Describe the effects of air pollution on human health.
  - 3.2 Mention the major air pollution disasters mentioning location, condition and causes and symptoms and effects.
  - 3.3 Describe the observed relation between particulates and SO<sub>2</sub> levels on health effects.
  - 3.4 Describe major toxic metals and their sources and health effects.
  - 3.5 Mention the effect of sulphur dioxide on human health.
  - 3.6 Mention the effects of carbon monoxide on human health.
  - 3.7 Describe the effect of oxides of nitrogen on human health.
  - 3.8 Describe the effects of hydrocarbon and photo-chemical oxidants on human health.
- 4 Understand the effects of specific air pollution on vegetation and materials.**
- 4.1 Mention the effects of sulphur dioxide (SO<sub>2</sub>) on vegetables.
  - 4.2 Mention the effects of oxides of nitrogen (NO<sub>x</sub>) on vegetables.
  - 4.3 Describe the effect of ozone on vegetables.
  - 4.4 Describe the peroxyacetyl nitrate (PAN) on vegetables.
  - 4.5 Describe the effect of Hydrogen fluoride on vegetables.
  - 4.6 Describe the effect of ethylene on vegetables.
  - 4.7 Describe the damage caused by atmospheric pollution to materials.
  - 4.8 Mention the effects of sulfur dioxide (SO<sub>2</sub>) on metals.
  - 4.9 Mention the effect of ozone on fabrics and rubber.
- 5 Understand the meteorological and atmospheric dispersion of air pollutants.**
- 5.1 Describe the temperature, lapse rate and stability
  - 5.2 Describe the pressure, wind rose, moisture and relative humidity.
  - 5.3 Describe the lapse rates and dispersion.
  - 5.4 Describe the dispersion of air pollutant modeling.
  - 5.5 Describe the Gaussian dispersion model.
  - 5.6 Describe the evaluation of the standard deviations.
  - 5.7 Describe the calculation of effective stack height.
  - 5.8 Describe the effects of air pollution on meteorological conditions.
  - 5.9 Solve the problem on temperature, lapse rate dispersion model, stack height, standard deviations and distance of air pollutants concentration.
- 6 Understand the air pollution sampling and measurement.**
- 6.1 Describe ambient air sampling system.
  - 6.2 Describe the method of collection of air pollutions.
  - 6.3 Describe the method of collecting of samples by absorption of gaseous pollutants into a liquid medium.
  - 6.4 Describe the method of collecting of samples of air by absorption of solid.
  - 6.5 Describe the method of freeze out sampling.
  - 6.6 Describe the method of collection of particulate pollution.

- 6.7 Describe sampling system.
  - 6.8 Describe particulate sampling.
  - 6.9 Describe gaseous sampling.
- 7 Understand the analysis of air pollution.**
- 7.1 Describe the method for measuring sulphurdioxide.
  - 7.2 Describe the method for measuring nitrogen oxides.
  - 7.3 Describe the method of measuring carbon mono-oxide.
  - 7.4 Describe the method of measuring oxidants and ozones.
  - 7.5 Describe the method of measuring hydrocarbons.
  - 7.6 Describe the method of measuring particulate matter in stack.
- 8 Understand the air pollution control methods.**
- 8.1 List the air pollution control method.
  - 8.2 Describe the sources correction method for air pollution controlling.
  - 8.3 Describe the method of clearing of gaseous effluents for controlling air pollution.
  - 8.4 Describe the method of particulate emission control.
- 9 Understand the particulate control equipment.**
- 9.1 List the particulate control mechanism and controlling equipments.
  - 9.2 Describe gravitational settling chamber.
  - 9.3 Describe cyclone separator and its uses.
  - 9.4 Describe fabric filter and its uses.
  - 9.5 Describe typical bag house and its uses.
  - 9.6 Describe electrostatic precipitators (ESP) and its uses.
  - 9.7 Describe the advantages and disadvantages of electrostatic precipitator.
  - 9.8 Describe wet scrubber and its uses.
  - 9.9 Describe spray towers and its uses.
  - 9.10 Describe centrifugal scrubbers and its uses.
  - 9.11 Describe packed beds and plate columns.
  - 9.12 Describe venturi scrubbers.
  - 9.13 Solve the problem on gravitational settling chamber, cyclone separator, fabric filter (bag house), electrostatic precipitators (ESP).
- 10 Understand the control of gaseous emission with control devices.**
- 10.1 Mentioning use of particulate collectors in industry.
  - 10.2 Described the absorption for controlling gaseous emission in industry.
  - 10.3 List the suitable solvents for various gaseous pollutants.
  - 10.4 Describe the mass-transfer operations for gaseous emission controlling.
  - 10.5 Describe the absorption units for controlling gaseous pollutants.
  - 10.6 Described the adsorption for controlling gaseous emission in industry.
  - 10.7 Mention the types of adsorbents.
  - 10.8 Describe the adsorption equipment for controlling gaseous pollutants.
  - 10.9 Described the condensation for controlling gaseous emission in industry.
  - 10.10 Mention the representative applications of condensers in air pollution control.
  - 10.11 Described the combustion for controlling air pollution.
  - 10.12 Described the combustion for controlling emission.

- 10.13 Describe the catalytic converters for controlling emission.
- 10.14 Solve the problem on absorption tower.

**11 Understand the control of sulphur dioxide emission.**

- 11.1 Describe the control of sulphur dioxide emission.
- 11.2 Describe the extraction of sulphur for fuels.
- 11.3 Describe the method of hydrodesulphurization of coal.
- 11.4 Describe the method of desulphurization of fuel oil.
- 11.5 Describe the method of sulphur reduction during combustion.
- 11.6 Describe the method of desulphurization of flue gases.

**12 Understand the control of nitrogen oxide.**

- 12.1 Describe the sources of nitrogen oxide in the atmosphere.
- 12.2 List the methods by which air pollution by nitrogen oxide can be controlled.
- 12.3 Describe the low excess in combustion method for controlling air pollution due to nitrogen oxide.
- 12.4 Describe the two stage combustion method of nitrogen oxide controlling.
- 12.5 Describe the method of flue gas recirculation into the combustion chamber for reducing nitrogen oxide.
- 12.6 Describe the method of injection of water and steam into the combustion zone for reducing nitrogen oxide.
- 12.7 Describe the method of modification of design condition for controlling emissions of Nitrogen oxide.
- 12.8 Describe the effluent gas treatment for removal of nitrogen oxide.
- 12.9 Describe the method of catalytic reduction of controlling nitrogen oxide emission.

**12.10 Understand the control of hydrocarbons.**

- 12.11 List the major techniques used to control hydrocarbon emission.
- 12.12 Describe the method of incineration to control hydrocarbon emission.
- 12.13 Describe the absorption method of control hydrocarbon emission.
- 12.14 Describe the absorption method of controlling hydrocarbon emission.
- 12.15 Describe the condensation method of controlling hydrocarbon emission.

**13 Understand the control of principle pollutants from mobile sources.**

- 13.1 List the principle pollutant of interest emitted from mobile sources.
- 13.2 Describe the major sources of air pollution from automobile.
- 13.3 Describe the method of control of pollution emission from automobiles.

**14 Understand the Green House Effect and photo chemical smog.**

- 14.1 Define Green House Effect.
- 14.2 Describe the cause of green house effect.
- 14.3 Describe the effect of green house effect.
- 14.4 Describe the effective measure to be taken to minimize green house effect.
- 14.5 Describe photo chemical smog.
- 14.6 Describe the stages in development photo chemical smog with chemical reaction.

14.7 Describe photolytic cycle.

14.8 Describe the mechanism for the formation of photo chemical smog.

**Practical:**

1. Measure the particulate air pollution i. e. dust fall and suspended particles from different sites.
2. Monitor air quality by using air samples.
3. Estimate sulphur oxide (SO<sub>2</sub>) in air sample experimentally.
4. Estimate nitrogen oxide in air sample experimentally.
5. Estimate ammonia in air sample experimentally.
6. Estimate methane in air sample experimentally.
7. Collect air dust by cyclone separator and electrostatic precipitator.
8. Visit a steel and re-rolling mill to observe internal air pollution control procedure and write a report.
9. Visit a jute mill to observe internal air pollution control procedure and write a report.
10. Visit a cotton mill to observe internal air pollution control procedure and write a report.
11. Visit a particle board mill to observe internal air pollution control procedure and write a report.

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2. Peavy H. S., Rewe D. R. and Tchobnoglous g. (1985); Environmental Engineering; McGraw Hill Book Company, New York.
3. Chatterjee, A. K. (2010) Water supply, waste Disposal and Enviromental Engineering, Khanna Publishers, New Delhi-110002
4. V. P. Kudesia (1996); Air Pollution

9074

**ENVIRONMENTAL ENGINEERING PROJECT**

<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>6</b>	<b>2</b>

**AIMS**

To make the way for the students to develop their skill and attitude in the area of environmental engineering works specially emphasis on:

- Project work of the student in the field of environmental engineering related area.
- To cope with the tools, instrument and resources required for the project work.
- To develop a project proposal.
- Collect and handle the necessary literature, related document.
- To increase co-relation with industries and related organization in the time of performing of the project.
- Prepare the initial and final report of the project.
- To enable to multimedia power point presentation.

**SHORT DESCRIPTION**

Selection of the project; Initial report of the project; Develop methodology; Experiment / construction of the project; Result or the outcome of the project; Final report of the project and Multimedia power point presentation.

**DETAIL DESCRIPTION****1 Select the title of the project.**

- 1.1 Make a list of 15 projects related to environmental engineering.
- 1.2 Study the background literature, material required to perform the project work.
- 1.3 Select and query the equipment required to finish the project work.
- 1.4 Finalized one of the project from the list prepared earlier.

**2 Prepare the initial report of the project.**

- 2.1 Prepare the list of the raw materials needed for the project work maintaining quantity, quality and specification.
- 2.2 Prepare the list of the necessary equipment needed for the project work.
- 2.3 List all other required goods for the project work.
- 2.4 Manage and query the all relevant literature or document and information interlink to the project work.
- 2.5 Write the initial report of the project.

**3 Conduct the experiments / construction and analysis descriptions of the project.**

- 3.1 Develop an experiment schedule and perform the different work of the project according to time.
  - 3.2 Lay out the assigned project.
  - 3.3 Develop the experimental set up of the project work.
  - 3.4 Perform the experiments of the project.
  - 3.5 Show carefulness in operating tools, instruments and equipment.
  - 3.6 Select the modest procedure during laboratory work or workshop.
  - 3.7 Analyzing and sorting the analytical or practical output.
  - 3.8 Synthesis the result or output of the project.
- 4 Prepare the final report of the project.**
- 4.1 Evaluate the whole project work.
  - 4.2 Calculate the project work.
  - 4.3 Discussion the outcome / result of the defined project.
  - 4.4 Concluding and supporting remark of project.
  - 4.5 Write the final technical report of the project.
- 5 Prepare multimedia presentation of the project work.**
- 5.1 Make slide/power point presentation of the whole project work.
  - 5.2 Presentation of these slides with multimedia.
  - 5.3 Question-answer session.

## **REFERENCE BOOKS**

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2. Burgess, R. A. and White G. Building production and project management.
3. Peavy Rowe and Technologios (1985); Environmental Engineering
4. C S Rao; Environmental Pollution Control Engineering
5. A P Sincero & G A Sincero (1999); Environmental Engineering
6. D K Asthara and Meera Asthara; Environmental Problems and Solutions
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**9075 DISASTER MANAGEMENT**

<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**AIMS:**

To be able to develop knowledge, skill and attitude in the area of disaster management with special emphasis on:

- ❖ To develop an expert manpower to handle disaster related activities.
- ❖ To give knowledge about Bangladesh and internationally recognized disasters and their management techniques to the students.
- ❖ To make the student aware about risk reduction action plan.
- ❖ To be knowledgeable about Bangladesh and internationally policy for disaster management.
- ❖ To train the students about risk assessment and management.
- ❖ To be able to understand the humanitarian standards.

**SHORT DESCRIPTION:**

Basic concepts of disaster management; disasters in Bangladesh; hazard and risk assessment; disaster management in earthquake, flood, landslide, cyclone, draught, tornadoes, & tidal flood; tsunami, salinity and water logging etc.; survival skills, Community Risk Assessment (CRA); Bangladesh and international disaster management strategies and policy.

**DETAIL DESCRIPTION:****1. Understand the basic concept of Disaster Management.**

- 1.1 Define disaster, hazard and disaster management
- 1.2 Describe significance of studying disaster management
- 1.3 Describe different types of disasters
- 1.4 Describe historical occurrences of various disasters and hazards
- 1.5 Distinguish between disaster and hazard

**2. Understand the disasters in Bangladesh**

- 2.1 List the major disasters occur in Bangladesh.
- 2.2 Describe disaster and development policy.
- 2.3 Mention the history of disasters.
- 2.4 Brief description of major natural disaster/hazards in Bangladesh.
- 2.5 Describe disaster preparedness at personal, family, social, organization and institutions level.

**3. Understand the Hazard and Risk assessment.**

- 3.1 Describe Hazard assessment.

- 3.2 Describe Risk assessment.
- 3.3 Describe Risk management and processes.
- 3.4 Explain disaster crunch model.
- 3.5 State out the recovery and reconstruction framework of hazards.

#### **4. Understand the Flood.**

- 4.1 Definition of flood.
- 4.2 List the types of flood and causes of flood.
- 4.3 Describe the magnitude of flood.
- 4.4 Estimation of magnitude of flood.
- 4.5 Describe the methods of flood control, Long term and short term plan for flood control.
- 4.6 Describe the flood action plan.
- 4.7 Mention the indigenous flood preparedness techniques.
- 4.8 Describe the pre, during and Post preparedness strategy.
- 4.9 Describe human adjustment to coastal flooding.
- 4.10 Mention the main structural project and their generalized impacts.

#### **5. Understand the Cyclone.**

- 5.1 Definition of cyclone.
- 5.2 List the types of cyclone.
- 5.3 Describe the classification of cyclone.
- 5.4 Describe the stages of cyclone.
- 5.5 Describe the velocity of cyclone.
- 5.6 Explain the risk analysis of cyclone.
- 5.7 Describe the warning signals of cyclone for maritime ports and inland river port.
- 5.8 Describe the RIR, RENA, S form & D form.
- 5.9 Describe contingency plan, objectives, usefulness, and characteristics.
- 5.10 Describe the mitigation strategies of cyclone.

#### **6. Understand the Earthquake**

- 6.1 Define earthquake.
- 6.2 Mention the causes of earthquake.
- 6.3 Define Seismology and seismograph.
- 6.4 List the types of seismic waves.
- 6.5 Mention the classification of earthquake.
- 6.6 State out the effects of earthquake.
- 6.7 Explain Time distance graph.
- 6.8 Describe the precursors of earthquake.
- 6.9 Describe the magnitude of earthquake and zoning of earthquake.
- 6.10 Mention the preparation for earthquake.

- 6.11 Measuring earthquake intensity and magnitude.
- 6.12 Describe Earthquake vulnerability to Bangladesh.

## **7. Understand the Landslide.**

- 7.1 Definition of landslide.
- 7.2 List the most vulnerable homes in a landslide zone.
- 7.3 List the types of landslide.
- 7.4 Mention the causes of landslide.
- 7.5 Describe the factors for contributing landslide.
- 7.6 Describe the techniques for reducing landslide hazard.
- 7.7 Describe Landslide mitigation measures.
- 7.8 State the major preparedness for landslide.

## **8. Understand the draught, tornadoes, tidal floods, thunderstorms**

- 8.1 Definition and causes of draught.
- 8.2 List the types of draught.
- 8.3 Describe the draught prone areas in Bangladesh.
- 8.4 Describe the mitigation measures of draught.
- 8.5 Definition of tornadoes.
- 8.6 Describe the formation and causes of tornadoes.
- 8.7 Definition of tidal flood.
- 8.8 Describe causes and impacts of tidal flood.
- 8.9 Describe the mitigation strategies of tidal flood.
- 8.10 Definition of lightening
- 8.11 Describe the formation and mitigation of thunderstorms.

## **9. Understand the Tsunami.**

- 9.1 Definition of Tsunami.
- 9.2 Mention the causes and characteristics of Tsunami.
- 9.3 Explain the formation of Tsunami.
- 9.4 Describe the roles and responsibilities before, during and after to tsunami risk.
- 9.5 Mention the Symptom and mitigation strategies for Tsunami.

## **10. Understand the Salinity and Water logging.**

- 10.1 Definition of salinity and causes of salinity.
- 10.2 Mention the effects of salinity.
- 10.3 Describe the mitigation strategies of salinity hazard.
- 10.4 Definition of water logging and causes of water logging.
- 10.5 Mention the effects water logging.
- 10.6 Describe the mitigation strategies of water logging.

**11. Concept of Disaster Risk Reduction (DRR)**

- 11.1 Define Disaster Risk Reduction (DRR).
- 11.2 Describe methods of identification of risk
- 11.3 Describe structural and non structural measures of risk reduction
- 11.4 Describe Gender issues in DRR
- 11.5 Describe Community Based Disaster Risk Management and Reduction
- 11.6 Describe obstacles to DRR
- 11.7 Describe leadership in DRR

**12. Understand the Community Risk Assessment (CRA).**

- 12.1 Definition of Community Risk Assessment (CRA)
- 12.2 Describe the exercise location and time about CRA.
- 12.3 Describe the justification of CRA.
- 12.4 Describe the Pre and post responsibilities about CRA.
- 12.5 Explain the activities of CRA.
- 12.6 Describe consideration of gender in disaster management.
- 12.7 Explain gender equality and equity.
- 12.8 Describe the risk and capacity of women in disaster management.

**13. Plans and Preparedness**

- 13.1 Define national disaster preparedness plan
- 13.2 Describe the role of Government, NGOs and Community Organization in disaster preparedness
- 13.3 Describe aspects for consideration during planning
- 13.4 Describe the planning process
- 13.5 Describe critical areas in planning.

**14. Prevention and Mitigation**

- 14.1 Describe the needs to consider disaster prevention
- 14.2 Describe problem areas in prevention and mitigation
- 14.3 Describe positive approaches towards prevention
- 14.4 Describe guiding principles of mitigation
- 14.5 Describe requirements for effective mitigation
- 14.6 Describe major mitigation components
- 14.7 Describe major requirements for coping with disaster
- 14.8 Describe Formulation and implementation of mitigation programme

**15. Recovery and Post-disaster review**

- 15.1 Describe key points from disaster analysis
- 15.2 Describe the basis for recovery actions
- 15.3 Describe major requirements for effective recovery
- 15.4 Describe human factors in recovery
- 15.5 Describe resources relevant to recovery programmes
- 15.6 Describe the importance of post-disaster review
- 15.7 Describe reasons for omission of post-disaster review

**16. Training and Public awareness**

- 16.1 Describe the needs for training and training policy
- 16.2 Describe the types and implementation process of training
- 16.3 Describe the importance of public awareness
- 16.4 Describe the responsibilities for public awareness programs
- 16.5 Describe effectiveness of information and maintenance of awareness levels

**17. Disaster management system of Home & Abroad**

- 17.1 Describe administrative and legal system of disaster management
- 17.2 Describe organizational structure of disaster management at national and sub-national level
- 17.3 Describe disaster management model in Bangladesh
- 17.4 Mention some implemented and ongoing projects on disaster management in Bangladesh

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1. Abbott Patrick L., Natural Disasters, McGraw-Hill International
2. Ayala Irasema Alcantara & Goudie Andrew S., Geomorphological Hazards and Disaster Prevention, Cambridge University Press.
3. Sahni Pardeep & Ariyabandu Madhavi Malagoda, Disaster Risk Reduction In South Asia, Prentice-hall of India Pvt. Ltd. 2003.
4. CBSE (2006) A Textbook on Disaster Management, preet Vihar, Delhi-110092.
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6. Carter N. W. 1991. Disaster Management: A Disaster Manager's Handbook. Asian Development Bank, Manila, Philippines.
7. Blakie, P et al., 1994. At Risk: Natural Hazards, People's vulnerability and Disasters. London, Routledge
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**9076 ENVIRONMENTAL HYDROLOGY & WATER RESOURCES ENGINEERING**

T	P	C
3	3	4

**AIMS**

- ❖ To be able to understand the basic concept of environmental engineering hydrology
- ❖ To be able to understand hydrologic cycle, hydrometeorology, precipitation, evaporation, evapotranspiration, rainfall runoff relation,
- ❖ To enable to select a suitable method for control of rivers and flood in Bangladesh.
- ❖ To be able to select a suitable method for recovering energy from water resources in Bangladesh.

**SHORT DESCRIPTION**

Environmental engineering hydrology; Hydrometeorology; Precipitation and its measurement; Analysis and interpretation of rainfall data; Evaporation, transpiration and evapotranspiration; Rainfall runoff relationship; Ground water well irrigation; Reservoir planning; Dam engineering; River behavior and training; Waterlogging and canal limning and Water power engineering.

**DETAIL DESCRIPTION**

- 1 Understand the concept of environmental engineering hydrology.**
  - 1.1 Define hydrology.
  - 1.2 Describe hydrologic cycle.
  - 1.3 Describe evaporation and transpiration.
  - 1.4 Describe precipitation and infiltration.
  - 1.5 Describe surface runoff.
  - 1.6 Draw a descriptive representation of hydrologic cycle.
- 2 Understand the hydrometeorology.**
  - 2.1 Define hydrometeorology.
  - 2.2 Mention the constituents of the atmosphere.
  - 2.3 Describe the vertical structure of the atmosphere.
  - 2.4 Describe solar radiation.
  - 2.5 Describe the general circulation of the northern hemisphere.
  - 2.6 Describe the triple cell circulation at the earth's surface.
  - 2.7 Describe airmass, air front, cyclone, anticyclone, thunderstorm and tornado.
- 3 Understand the precipitation and its measurement methods.**
  - 3.1 Define precipitation.
  - 3.2 Describe the condition for occurrence of precipitation.
  - 3.3 Describe different types of precipitation.
  - 3.4 Describe forms of precipitation.

3.5 Describe the method of measurement of precipitation.

3.6 Describe non-recording rain gauges.

3.7 Mention recording rain gauges.

3.8 Describe with sketch the tipping bucket rain gauge.

3.9 Describe with sketch the weighing bucket rain gauge.

3.10 Describe float type rain gauge.

3.11 Describe the radar measurement of rainfall.

#### **4 Understand the analysis and interpretation of rainfall data.**

4.1 Describe rain gauge network.

4.2 Describe optimum number of rain gauges.

4.3 Computation of average depth of rainfall over an area.

4.4 Describe the annual rainfall in Bangladesh.

4.5 Describe analysis and interpretation of rainfall data.

4.6 Describe rainfall mass curve and rainfall hyetograph.

4.7 Describe the intensity-frequency-duration analysis of rainfall.

#### **5 Understand the evaporation, transpiration and evapotranspiration.**

5.1 Define evaporation, sublimation, transpiration and evapotranspiration.

5.2 Describe evaporation process.

5.3 Describe factors affecting evaporation.

5.4 Describe the estimation of evaporation.

5.5 Describe the measurement of evaporation by evaporation pans.

5.6 Describe the evaporation from soil surface.

5.7 Describe the factors affecting the process of transpiration.

5.8 Describe the factors affecting the evapotranspiration.

5.9 Describe the measurement of transpiration and evapotranspiration.

#### **6 Understand the rainfall- runoff relationship.**

6.1 Define runoff.

6.2 Mention the unit of runoff.

6.3 Describe the components of runoff.

6.4 Describe factors affecting runoff.

6.5 Describe basin yield.

6.6 Describe the computation of runoff.

6.7 Explain rainfall runoff relationship.

6.8 Describe flow duration curve.

6.9 Describe flow mass curve.

#### **7 Understand the ground water-well irrigation.**

7.1 Define aquifer, aquiclude, aquifuge, aquitard, specific yield, and specific retention.

7.2 Describe the division of sub-surface water.

7.3 Mention types of aquifers.

7.4 Describe steady flow to a well in an unconfined aquifer.

7.5 Describe steady flow to a well in a confined aquifer.

7.6 Describe the determination of aquifer constant T.

7.7 Describe the methods of lifting water.

7.8 Mention the advantage and disadvantage of well irrigation over canal irrigation.

**8 Understand the reservoir planning.**

- 8.1 Mention the purposes of reservoir construction.
- 8.2 List different types of reservoirs.
- 8.3 Describe the types of flood control reservoirs.
- 8.4 Describe the available storage capacity of a reservoir.
- 8.5 Describe the selection of site for a reservoir.
- 8.6 Describe the basic terms and definitions of full reservoir level, maximum water level, minimum pool level, useful storage, surcharge storage, dead storage, bank storage, valley storage, yield from reservoir, safe yield, and design yield.
- 8.7 Describe mass inflow curve and demand curve.
- 8.8 Describe the determination of the required capacity.
- 8.9 Describe the determination of yield of a reservoir.
- 8.10 Describe the analytical method for determination of storage capacity.
- 8.11 Describe the apportionment of total cost of a multipurpose reservoir.
- 8.12 Define flood routing.
- 8.13 Describe the method of flood routing.
- 8.14 Describe the reservoir sedimentation.
- 8.15 Useful life of reservoir.
- 8.16 Measure to control reservoir sedimentation.
- 8.17 Solve the problem on reservoir planning.

**9 Understand the dam engineering.**

- 9.1 Mention different classification for dams.
- 9.2 Describe the gravity dam; arch dams; buttress; steel dam; timber dam; earth and rockfill dam.
- 9.3 Describe the selection of type of a dam.
- 9.4 Describe the selection of site for a dam.

**10 Understand the river behavior and training.**

- 10.1 Mention different classification for river.
- 10.2 Describe the meandering and cause of meandering.
- 10.3 Mention the basic factors controlling processes of meandering.
- 10.4 Describe the aggrading type of river and degrading type of river.
- 10.5 Explain the cut-off.
- 10.6 Define river training.
- 10.7 Mention the classification of river training works.
- 10.8 List different types of training works.
- 10.9 Describe guide bank system.
- 10.10 Describe groynes or spurs.
- 10.11 Describe the repelling groynes, deflecting groynes, attracting groynes.
- 10.12 State out the length of groynes and spacing of groynes.
- 10.13 Describe marginal bund or levees.
- 10.14 Describe bank protection.
- 10.15 Define pitched bank bandalling and nalal plantation.
- 10.16 Solve the problem of river training and bank protection.

**11 Understand the waterlogging and canal lining.**

- 11.1 Define waterlogging.
- 11.2 Describe the effects of waterlogging.
- 11.3 Mention the causes of waterlogging.
- 11.4 Describe the remedial measures for controlling waterlogged.

- 11.5 Describe losses in canal.
- 11.6 Describe land drainage system.
- 11.7 Explain the design of open drain.
- 11.8 Describe lining of irrigation channels.
- 11.9 Solve the problem of drainage system and canal lining.

## **12 Understand the water power engineering.**

- 12.1 Mention different types of water power development.
- 12.2 List the types of hydropower plants.
- 12.3 Describe the principal component of hydroelectricity scheme.
- 12.4 Selection of suitable type of turbine.
- 12.5 Describe the power house.
- 12.6 Describe scroll casing, draft tube and tail race.
- 12.7 Assessment of power potential.
- 12.8 Basic terms and definitions: gross head, net head, operating head, capacity factor, firm power, power factor, utilization and diversity factor.
- 12.9 Solve the problem of hydro-power plant.

### **PRACTICAL:**

1. Measure rainfall by rain gage and determine the intensity of rainfall.
2. Prepare a rainfall map from analysis and interpretation of rainfall data.
3. Prepare a rainfall mass curve and rainfall hyetograph.
4. Draw neat sketch of cone of depression with draw down and circle of influence.
5. Draw the section of a dam of a reservoir with components.
6. Prepare a model for a typical irrigation project.
7. Prepare a model for a typical drainage project.
8. Prepare a model for a typical flood control project.
9. Visit an irrigation project in Bangladesh and write a report.
10. Visit a drainage project in Bangladesh and write a report.
11. Visit a flood control project in Bangladesh and write a report.
12. Visit a hydro-power plant project in Bangladesh and write a report.
13. Visit any multipurpose project in Bangladesh and write a report.

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1. Dr. P. Jayarami Reddi (1996), A Text Book of Hydrology; Laxmi Publication (Pvt) Ltd, New Delhi.
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3. Arora K.R. (2007), Irrigation, Water Power and Water Resources Engineering; Standard Publication Distributer, Delhi-110006.

*AIMS*

- **To be able to understand the concept of entrepreneurship & entrepreneur.**
- **To be able to understand the concept of environment for entrepreneurship.**
- **To be able to understand the sources of venture ideas in Bangladesh.**
- **To be able to understand the project selection.**
- **To be able to understand business planning.**
- To be able to understand the case study

## SHORT DESCRIPTION

**Concepts of entrepreneurship & entrepreneur; Entrepreneurship & economic development; Environment for entrepreneurship; Entrepreneurship in the theories of economic growth; Sources of ventures ideas in Bangladesh; Evaluation of venture ideas; Financial planning; Project selection; Self employment; Entrepreneurial motivation; Business plan; Sources of assistance & industrial sanctioning procedure.**

**Insurance ; case study.**

***DETAIL DESCRIPTION*****Theory :****1 Understand the basic concept of entrepreneurship & entrepreneur.**

- 1.1 Define entrepreneurship & entrepreneur.
- 1.2 Discuss the characteristics and qualities of entrepreneur.
- 1.3 Mention the classification of entrepreneur.
- 1.4 Discuss the case entrepreneurship and mass entrepreneurship.
- 1.5 Discuss the necessity of entrepreneurship as a career.
- 1.6 Discuss the function of entrepreneur in developing countries.
- 1.7 Discuss the prospect of entrepreneurship development in Bangladesh.

**2 Understand the concept of entrepreneurship and economic development.**

- 2.1 Define economic development.
- 2.2 Discuss that the economic development is a process.
- 2.3 Describe the entrepreneurship as a factor of economic development.
- 2.4 Discuss the capital accumulation or rate of savings.
- 2.5 Discuss the role of entrepreneur in the technological development and their introduction into production Process.
- 2.6 Discuss the entrepreneur in the discovery of new sources of resources.
- 2.7 Discuss the entrepreneur in the discovery of new product.
- 2.8 Discuss the discovery of new markets.

**3 Understand the concept of entrepreneurship in the theories of economic growth.**

- 3.1 Define entrepreneurship in the theories of economic growth.
- 3.2 Discuss the theory of need for achievement of Devid MacClelland.
- 3.3 Discuss the Malthusian theory of population and economic growth.
- 3.4 Discuss the labour theory of production and limit to growth.
- 3.5 Discuss the Keynesian theory of employment and output.
- 3.6 Discuss the stage theory of growth.
- 3.7 Discuss the Schumpterian theory of economic development.
- 3.8 Discuss the entrepreneurship motive in economic development.

#### **4 Understand the sources of vantage ideas in Bangladesh.**

- 4.1 Define sources of venture ideas in Bangladesh.
- 4.2 Discuss different types of sources of venture ideas in Bangladesh.
- 4.3 Discuss informal sources of venture ideas in Bangladesh.

#### **5 Understand the evaluation of venture ideas.**

- 5.1 Define evaluation of venture ideas.
- 5.2 Discuss the factors that influence the selection of venture ideas.
- 5.3 Discuss the evaluating financial aspects of business.
- 5.4 Discuss the determinants of the firm size.

#### **6 Understand the concept of project selection and financial planning.**

- 6.1 Define project.
- 6.2 Discuss the idea of project.
- 6.3 Describe the guide lines for project ideas.
- 6.4 Discuss the sources of project ideas.
- 6.5 Discuss the evaluation of project ideas.
- 6.6 Describe the technical aspect of project.
- 6.7 Define financial planning.
- 6.8 Discuss the long term financial plan.
- 6.9 Discuss the short term financial plan.

#### **7 Understand the concept of self employment.**

- 7.1 Define self employment.
- 7.2 Describe different types of employment.
- 7.3 Describe the importance of business as a profession.
- 7.4 Discuss the reasons for success and failure in business.
- 7.5 Discuss the self assessment of entrepreneurial qualities.

#### **8 Understand the concept of entrepreneurial motivation.**

- 8.1 Define entrepreneurial motivation.
- 8.2 Discuss the achievement motivation theory.
- 8.3 Describe the means of improving achievement motivation.
- 8.4 Discuss the background of high need achievement.
- 8.5 Describe the problems associated with high need achievement.

#### **9 Understand the business plan and the concept of the environment for entrepreneurship.**

- 9.1 Define business plan.
- 9.2 Describe the importance of business plan.
- 9.3 Discuss the contents of business plan.
- 9.4 Describe the business plan proforma.
- 9.5 Define environment of business.
- 9.6 Describe the factors which effect environment on entrepreneurship
- 9.7 Discuss the aspects of business environment

#### **10 Understand the concept of sources of assistance & industrial sanctioning procedure.**

- 10.1 Define sources of assistance.
- 10.2 Describe different types of sources of assistance.
- 10.3 Describe entrepreneurship development cycle.
- 10.4 Discuss the aid of sources.
- 10.5 Discuss the industrial policy.
- 10.6 Describe the technique of industrial policy.
- 10.7 Define foreign aid.

**11 Understand the insurance and premium.**

- 11.1 Define insurance and premium
- 11.2 Describe the essential conditions of insurance contract.
- 11.3 Discuss various types of insurance.
- 11.4 Distinguish between life insurance and general insurance.

**12 Understand the concept of case studies.**

- 12.1 Define case study.
- 12.2 Discuss the objectives of case study.
- 12.3 Describe the method of case analysis.
- 12.4 Discuss the importance of case study.
- 12.5 Mention the advantages and disadvantages of case study