BANGLADESH TECHNICAL EDUCATION BOARD
Agargaon, Dhaka-1207

4-YEAR DIPLOMA-IN-ENGINEERING PROGRAM
SYLLABUS (PROBIDHAN-2016)

ENVIRONMENTAL TECHNOLOGY

TECHNOLOGY CODE: **690**

7th SEMESTER

DIPLOMA IN ENGINEERING
PROBIDHAN-2016

ENVIRONMENTAL TECHNOLOGY (690)

7th SEMESTER

Sl. No	Subject Code	Name of the subject	T	P	C	Marks				Total
						Theory		Practical		
						Cont. assess	Final exam	Cont. assess	Final exam	
1	69071	Environmental Impact Assessment (EIA) & Environmental Regulation	2	3	3	40	60	25	25	150
2	69072	Solid and Hazardous Waste Management	2	3	3	40	60	25	25	150
3	69073	Industrial Pollution Control Engineering	2	3	3	40	60	25	25	150
4	69074	Application of Environmental Software and Project	0	6	2	0	0	50	50	100
5	69075	Disaster Management	2	0	2	40	60	-	-	100
6	69076	Environmental Hydrology & Water Resources Engineering	3	3	4	60	90	25	25	200
7	65853	Innovation & Entrepreneurship	2	0	2	40	60	0	0	100
Total			**13**	**18**	**19**	**260**	**390**	**150**	**150**	**950**

69071 Environmental Impact Assessment (EIA) & Environmental Regulation

T	P	C
2	3	3

AIMS

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

SHORT DESCRIPTION

Basic concept of environmental impact assessment (EIA), procedure of environmental impact assessment (EIA), Measurement procedure of environmental impact assessment, Environmental setting (affected environment), Air quality impact assessment, Water quality impact assessment, Soil and geological quality impact assessment, biotic impact assessment, Noise impact assessment, Socioeconomic impact assessment, Aesthetic environmental impact assessment, Environmental monitoring, Environmental rules and regulations in Bangladesh.

DETAIL DESCRIPTION

1 Basic concept of environmental impact assessment (EIA)

1.1. Define EIA terminology: environmental inventory, environmental assessment (EA), environmental impact, environmental impact assessment (EIA), significant impact, intensity, environmental impact statement (EIS), strategic environmental assessment (SEA) and initial environmental evaluation (IEE).
1.2. Mention the necessity of EIA.
1.3. State the national goals of environmental policy.
1.4. Describe the considerations of evaluating intensity.
1.5. Mention the types of EIS.
1.6. Categories the negative impacts on environment.
1.7. Describe the significant of environmental impacts.

2 Understand the procedure of environmental impact assessment (EIA)

2.1. Mention the different types of environmental variables.
2.2. Measure the physical environmental, social and economic variables.
2.3. Illustrate the environmental indices.
2.4. Outline the processes of EIA.
2.5. Mention the different types of impact assessment methods.
2.6. Express the ad hoc methods
2.7. Illustrate the checklist methods.
2.8. State the overlay method.
2.9. Describe the matrix method.
2.10. Describe the network method.

3 Understand the environmental setting (affected environment)

3.1. Define environmental setting.
3.2. Mention the purposes of environmental setting.
3.3. Write down initial list of factors.
3.4. Discuss selection process.
3.5. Describe documentation of selection process.
3.6. Point out data sources.

4 Understand the Air quality impact assessment.

4.1. Mention the conceptual approach for air quality assessment.
4.2. State the existing air quality conditions.
4.3. List out the national ambient air quality standards.
4.4. Describe planning of air impact assessment.
4.5. State the steps of emission inventory.
4.6. Describe the process of impact prediction and assessment.
4.7. Illustrate identification and incorporation of mitigation measures.

5 Understand the Water quality impact assessment.

5.1. Mention the conceptual approach for water quality assessment.
5.2. State the existing water quality conditions.
5.3. List out the national water quality standards.
5.4. State the water quality impact factors.
5.5. Describe the steps for water quality assessment.
5.6. Illustrate the models used in water quality impact prediction.

6 Understand the Soil and geological quality impact assessment.

6.1. Define Land degradation and soil infertility.
6.2. Mention the conceptual approach for addressing soil quality assessment.
6.3. Outline the causes of land degradation.
6.4. Describe the soil impact assessment.
6.5. Point out identification and incorporation of mitigation measures.

7 Understand the Biotic impact assessment.

7.1. Define habitat, biodiversity, ecological carrying capacity, endanger species, threatened species, scoping.
7.2. Mention conceptual approach for addressing biotic impacts.
7.3. Write down existing biotic conditions.
7.4. Outline the general steps of biotic impact assessment.
7.5. List the potential effects on the biological system.
7.6. Describe identification and incorporation of mitigation measures.

8 Understand the Noise impact assessment.

8.1. Define sound power, sound pressure level, sound level, equivalent sound level, L_{10}, L_{dn}, $L_{eq.}$, dBA, SEL, DNL,CNEL .
8.2. Mention the acceptable limit of sound for various places.
8.3. List out conceptual approach for addressing noise impact assessment.
8.4. Describe environmental impact of noise.
8.5. State existing noise environment conditions.
8.6. Illustrate noise impact assessment.
8.7. Point out identification and incorporation of mitigation measures.

9 Understand the Socioeconomic impact assessment.

9.1. Define socio-economic, resource exploitation, industrial expansion, migration, demographic migration, SIA.
9.2. List out conceptual approach for addressing socioeconomic impacts.
9.3. Point out the features of SIA.
9.4. Mention existing socioeconomic conditions.
9.5. State the steps of socioeconomic impact methodologies.
9.6. Explain the social benefit cost approach of a developing project.
9.7. Point out identification and incorporation of mitigation measures.

10 Understand the Aesthetic environmental impact assessment.

10.1. Define aesthetics, aesthetics resources, intrusion, visual impact assessment.
10.2. List out conceptual approach for visual impact assessment.

10.3. Mention delineation of the types of potential visual impacts.
10.4. Describe existing aesthetic visual resources.
10.5. Explain procurement of relevant institutional information.
10.6. Point out identification and incorporation of mitigation measures.

11 Understand the Environmental monitoring.

11.1. Define post project analysis, monitoring.
11.2. State the purposes of environmental monitoring.
11.3. Mention the types of monitoring.
11.4. State the typically used monitoring designs
11.5. Detection of changes using control charts and CUSUM charts
11.6. Describe planning considerations for a monitoring program.
11.7. Express guidelines and policies for monitoring.
11.8. Illustrate the environmental management plan (EMP).
11.9. Explain the environmental management system (EMS).

12 Understand the Environmental rules and regulations in Bangladesh.

12.1. Define Act, Rules, Ordinance, regulations and policy.
12.2. List out the existing environmental rules and regulations in Bangladesh (e.g., ECA'00, ECR '97 etc).
12.3. Mention the general objectives of environmental rules and regulations.
12.4. Outline the national environment policy-2013.
12.5. Write down the constitutional provision focusing sustainable development towards conservation of environment.

PRACTICAL

1. Prepare a questions related to significance determination in EIA.
2. Prepare checklist for EIS preparation.
3. Estimate potential environmental impacts resulting from construction practices.
4. Calculate typical impacts of dams and reservoirs.
5. Make a Leopold matrix for highway construction.
6. Make an interaction matrix for coastal sewerage project.
7. Make an interaction matrix for water resources reservoir projects.
8. Demonstration of network diagram for dredging project.
9. Make a graph or diagram for the primary impacts of a residential housing project.
10. Make checklist of biophysical and cultural environment factors for impoundment projects.
11. Perform a detail EIA for a process industry in Bangladesh.

REFERENCES

1. Barthwal R. R. , Environmental Impact Assessment, Age International (P) Limited, New Delhi.
2. Bram Noble. Introduction to Environmental Impact Assessment - Guide to Principles and Practice. Oxford University Press.
3. 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
4. Manly, B.F.J. Statistics for Environmental Science and Management. 2nd Edn., CRC press

69072 Solid and Hazardous Waste Management **T P C**
2 3 3

AIMS

- To understand the sources, classification, characteristics and collection methods of solid waste.
- To understand the basic concepts of solid and hazardous waste management.
- To understand the recovery process of resources from solid waste.
- To calculate the energy, materials and conversion products from solid waste.
- To understand the disposal methods of solid waste.

SHORT DESCRIPTION

Management of solid waste, Source and classification of solid waste, Properties of municipal, industrial and hazardous solid waste, Solid waste characteristics and compositions, Method of On-site storage and collection of solid waste, Solid waste Processing and Resource recovery, Reuse and Recycling of solid waste, Magnetic and electromagnetic separation of solid waste, Engineered systems for resources and energy recovery, Engineered system of composting and anaerobic digestion/fermentation, Disposal method of solid waste, Combustion of solid waste materials, Hospital and hazardous waste management.

DETAIL DESCRIPTION

1 Understand the management of solid waste.

1.1 Mention the key objectives of solid waste management.
1.2 Sketch the major activities associated with the management of solid waste.
1.3 Describe the major elements of solid waste management.
1.4 State the effects of solid waste mismanagement.

2 Understand the source and classification of solid waste.

2.1 Define solid waste, refuse, food waste, rubbish, demolition and construction waste, hazardous waste, e-waste, agricultural waste, plastic waste, 3R, 4R, recycling, material conversion and energy recovery.
2.2 List the sources of solid waste.
2.3 Classify solid waste.
2.4 Distinguish between garbage and rubbish with example.
2.5 Discuss industrial waste.
2.6 Illustrate pathological wastes.

3 Understand the properties of municipal, industrial and hazardous solid waste.

3.1 List out the general sources of municipal solid waste.
3.2 Mention the classification of materials comprising municipal solid waste.
3.3 Write down different types of industrial solid waste.
3.4 State the solid waste generated in the chemical process industries.
3.5 List out the characteristics of hazardous waste.
3.6 Describe hazardous waste with example.

4 Understand the solid waste characteristics and compositions.

4.1 Write down the physical characteristics of solid waste.
4.2 Mention the chemical characteristics of solid waste.

4.3 State the rate of generation of solid waste quantities.
4.4 Describe the solid waste composition.
4.5 Illustrate the typical composition of municipal solid waste.
4.6 Calculate the moisture content and density of solid waste.
4.7 Explain the proximate analysis of solid waste.
4.8 Estimate the ultimate analysis of solid waste.
4.9 Interpret the chemical content of solid waste.
4.10 Describe the energy content in solid waste.

5 Understand the method of storage and collection system of solid waste.

5.1 Define on-site handling and storage of solid waste.
5.2 Define communal collection, block collection, curbsite collection and house to house collection of solid waste.
5.3 List out the types of collection systems.
5.4 Illustrate hauled container system (HCS) and stationery container system (SCS) in collection of solid waste.
5.5 Design the determination of vehicle and labor requirements.
5.6 Sketch the collection routes of solid waste.
5.7 Explain transfer stations of solid waste.
5.8 Describe the solid waste transportation.
5.9 State the storage and collection of solid waste in Bangladesh.

6 Understand the solid waste processing and resource recovery.

6.1 Mention the objectives of solid waste processing.
6.2 List out the solid waste processing techniques.
6.3 Describe the method of screening solid waste.
6.4 Explain the recycling or salvaging of solid waste.
6.5 Express the air classifying method of solid waste.
6.6 Illustrate the resource recovery from solid waste.
6.7 Describe the recovering of electrical energy from solid wastes.

7 Understand the reuse and recycling of solid waste.

7.1 Define reuse and recycling
7.2 Write down the reused product of solid waste.
7.3 State significance of recycling.
7.4 Classify of recycling process.
7.5 Describe the recycling process practiced in Bangladesh.
7.6 Mention the recyclable product of solid waste.
7.7 Express the method of recycling of paper products.
7.8 Explain the method of recycling of glass and metals materials.
7.9 Illustrate the method of recycling of plastics.

8 Understand the magnetic and electromagnetic separation of solid waste.

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

9 Understand the engineered systems for resources and energy recovery.

9.1 Describe mechanical component separation of solid waste.
9.2 Describe mechanical size alternation of solid waste.
9.3 Describe drying and dewatering of solid waste.
9.4 Draw the flow sheet for recovery of materials from solid waste.
9.5 Define pilate, RDF.
9.6 Draw the flow sheet for the preparation of RDF.
9.7 Point out the recovery of biological conversion products.

10 Understand the engineered system of composting and anaerobic digestion/fermentation.

10.1 Define composting and fermentation.
10.2 Mention the characteristics of compost.
10.3 State the factors upon which composting of solid waste depend.
10.4 Explain aerobic composting processes.
10.5 Determine the important design consideration for aerobic composting processes.
10.6 Describe the method of vermi composting.
10.7 Express anaerobic digestion or anaerobic fermentation.
10.8 Determine the important design consideration for anaerobic digestion.
10.9 Illustrate the thermal processing for the recovery of products from solid waste.

11 Understand the disposal method of solid waste.

11.1 List out the disposal methods of solid waste.
11.2 Describe open dumping.
11.3 Discuss the land farming and deep-well injection of disposal of solid waste.
11.4 Define sanitary land filling.
11.5 Illustrate the sanitary land filling disposal method.
11.6 Mention the factors important for landfill site selection.
11.7 Describe the design of landfills.
11.8 Mention the occurrence of gases and leachate in land fill.
11.9 Describe the gases and leachate movement in landfill.

12 Combustion of solid waste materials.

12.1 Define combustion.
12.2 Estimate the combustion of waste materials.
12.3 Mention the heat losses in combustion of solid waste.
12.4 Describe incineration of solid waste materials.
12.5 Express the gasification of solid waste.
12.6 Discuss pyrolysis of solid waste.

13 Hospital and hazardous waste management.

13.1 Identify hospital waste.
13.2 Mention the characteristics of hospital waste.
13.3 Describe the collection system of different types of hospital waste.
13.4 Illustrate the disposal system of different types of hospital waste.
13.5 List the categories of hazardous waste.
13.6 Describe the hazardous waste management.

PRACTICAL:

1. Perform the component of solid waste material by automatic sorting machine.
2. Determine the moisture content of solid waste.
3. Estimate the density of solid waste sample.
4. Perform the ultimate analysis of solid waste.
5. Perform experiments on aerobic composting of solid waste.
6. Carry out experiments on vermi composting of solid waste.
7. Carry out experiments on biogas production from solid waste.
8. Perform experiments on drying of solid waste.
9. Draw a schematic diagram of a tunnel dryer used in solid waste drying.
10. Draw schematic diagram of a modern tromel screen.
11. Design and demonstrate waste management system of your institute campus.
12. Perform a case study on solid waste and hospital waste management.

REFERENCE BOOKS

1. Ahmed F. & Rahman M. M. (2000) Water Supply and Sanitation-Rural and low income urban communities; ITN-Bangladesh, BUET, Dhaka.
2. Devis; Environmental Engineering
3. D K Asthara and Meera Asthara; Environmental Problems and solution
4. Peavy H. S., Rewe D. R. and Tchobnoglous g. (1985); Environmental Engineering
5. Rahman M. H., Muyeed A. (2010) Solid and Hazardous Waste management, ITN-BUET, Center for Water Supply and Waste Management.
6. Rao C. S; Environmental Pollution Control Engineering

69073 Industrial Pollution Control Engineering **T P C**
2 3 3

AIMS

- To understand the basic principles of pollution control in industries.
- To understand industrial pollution emission, removal of BOD from liquid waste; removal of chromium, mercury etc from industrial effluents.
- To understand the removal of sulphur dioxide and nitrogen oxides from industrial effluent gases.
- To understand the pollution control aspect in fertilizer, petroleum and petrochemical, pulp and paper, tanning, alcohol & sugar, textile, pesticide industries.

SHORT DESCRIPTION

Industrial pollution emissions, Removal of BOD from liquid wastes, Removal of chromium from industrial wastes, mercury from industrial waste, ammonia and urea from the wastes of fertilizer industries, SOx and NOx from gaseous effluents in industries, Pollution control in petroleum and petrochemical industries, pulp and paper industries, tanning industries, alcohol and sugar industries, textile industries, pesticide industries.

DETAIL DESCRIPTION

Theory

1 Understand the industrial pollution emissions

1.1 Define industrial emissions.
1.2 Describe liquid industrial effluent.
1.3 State gaseous industrial emissions.
1.4 List out the major environmental polluting industries.
1.5 Mention the different types of pollutant emitted from industries.

2 Understand the removal of BOD from liquid wastes

2.1 Define BOD.
2.2 Mention the biological oxidation method for reducing the organic matter from industrial liquid waste.
2.3 Explain activated sludge process for reducing organic matter from industrial liquid effluent.
2.4 Describe trickling or biological filters for reducing the organic matter for liquid waste of industries.
2.5 Illustrate waste stabilization ponds, aerated lagoons and oxidation ditch for removal of BOD.
2.6 Describe RBC for removal of organic matter from industrial liquid waste.
2.7 Express FBC for removal of organic matter from industrial liquid waste.
2.8 State the anaerobic treatment method for removal of organic matter from industrial liquid waste.

3 Understand the removal of chromium from industrial wastes

3.1 Define ion exchange, reverse osmosis, coagulation and absorption.
3.2 List out the occurrence of chromium in industrial liquid waste.
3.3 Mention the control method of chromium in industrial liquid waste.
3.4 Explain the reduction precipitation method for the removal of chromium from liquid waste.
3.5 Describe ion exchange method for the removal of chromium from liquid waste of industries.
3.6 Express reverse osmosis process for the removal of chromium from liquid waste of industries.
3.7 Describe lime coagulation and absorption process for the removal of chromium from the liquid waste of industries.

4 Understand the removal of mercury from industrial waste.

4.1 State the principles of measurement and monitoring of mercury in air.
4.2 List out the industries causes mercury pollution of air.
4.3 Discuss the method of removal of mercury from gaseous streams.
4.4 Describe the methods of removal of mercury from liquid effluents.
4.5 Illustrate the ion-exchange method of removal of mercury from the liquid stream.

5 Understand the removal of ammonia and urea from the wastes of fertilizer industries.

5.1 Define air stripping, steam stripping
5.2 Mention the source of nitrogenous wastes in fertilizer industries.
5.3 List out the method of removal of nitrogen from liquid waste of fertilizer industries.
5.4 Describe different physico-chemical processes of removal of ammonia from industrial effluent.
5.5 Express the biological methods of removal of ammonia from liquid effluent of industries.
5.6 Describe the method of algal-bacterial flocculating system for removal of ammonia from liquid waste of industries.
5.7 Describe the method of removal of particulate matter from the gaseous effluent of complex fertilizer plant.
5.8 Illustrate the method of removal of sulphur dioxide for the liquid effluent of complex fertilizer plant.
5.9 Describe the inplant measures to control ammonia and nitrogen from liquid waste.

6 Understand the removal of SOx and NOx from gaseous effluents in industries.

6.1 List out the main sources of sulphur dioxide in industries.
6.2 Mention the method of sulphur dioxide control in industries.
6.3 Describe the method of desulphurization of fuels.
6.4 Illustrate the method of reduction of sulphur dioxide concentration by wet processes.
6.5 Mention the major sources of oxides of nitrogen in air in industries.
6.6 Express the adsorption of method of controlling NOx in gaseous effluent in industries.
6.7 Describe the absorption method of NOx from the gaseous effluent in industries.
6.8 Explain the catalytic reduction of NOx for the gaseous effluent in industries.
6.9 State the method of NOx emission control for automobile exhausts.

7 Understand the pollution control in petroleum and petrochemical industries.

7.1 Mention the sources of water pollution in petroleum and petrochemical industries.
7.2 State the characteristics of liquid effluent from petroleum and petrochemical industries.
7.3 Describe the inplant measures of pollution control of effluent liquid in petroleum refinery.
7.4 Explain the steam stripping method of liquid waste treatment in petroleum industries.
7.5 Describe the method of removal of hydrogen sulphide from the gaseous effluent from petroleum and petrochemical industries.
7.6 Illustrate the method of hydrocarbon from the gaseous effluents from petroleum and petrochemical industries.

8 Understand the pollution control in pulp and paper industries.

8.1 Mention the sources of liquid wastes in pulp and paper industries.
8.2 State the characteristics of liquid waste of pulp and paper industries.
8.3 Describe the in plant measures of pollution control of liquid wastes in pulp and paper industries.
8.4 Describe the process change method of controlling pollution by liquid wastes of pulp and paper industries.
8.5 Illustrate the biological treatment of liquid effluents in pulp and paper industries.
8.6 Describe the sources of air pollution in pulp and paper industries.
8.7 Explain the control methods of air pollution in pulp and paper industries.

9 **Understand the pollution control in tanning industries.**

9.1 Mention the sources of pollutants in tanning process.
9.2 State the effects of untreated liquid effluents of tanning industries.
9.3 Describe the treatment processes of tannery effluent.
9.4 Illustrate the treatment of tannery waste waters by stabilization pond method.

10 **Understand the pollution control in alcohol and sugar industries.**

10.1 Mention the sources of pollutants in sugar industries.
10.2 Describe the treatment method of sludge of alcohol industry.
10.3 Illustrate the treatment processes of sugar industries effluent.

11 **Understand the pollution control in textile industries.**

11.1 List out the sources of pollutants in textile industries.
11.2 Mention the effects of pollutants of textile industries on environment.
11.3 State the characteristics of waste water of textile industries.
11.4 Describe the physico-chemical treatment method of waste water of textile industries.
11.5 Illustrate the method of biological treatment of waste water of textile industries.
11.6 Explain the method of treatment of waste water in synthetic textile mills with flowchart.

12 **Understand the pollution control in pesticide industries.**

12.1 List out the sources of pollutants in pesticide industries.
12.2 Mention the chemical characteristics of waste water of pesticides industries.
12.3 Describe the activated carbon treatment of waste water of pesticide industries.
12.4 Illustrate the biological methods for the treatment of waste water of pesticide industries.

PRACTICAL:

1. Determine biochemical demand (BOD) in a sample of waste water.
2. Determine the chemical oxygen demand (COD) in a sample of waste water.
3. Determine the CO_2 present in sample of waste water.
4. Field visit (case studies) of WTP/WWTP of Bangladesh.
5. Design a conventional water treatment plant.
6. Design different types of waste stabilization pond.
7. Design a standard rate anaerobic sludge digester.
8. Design a catalytic converter for the removal of SO_2 from the automobile effluents.
9. Perform case studies on water pollution by different types of industries (tannery, textile, fertilizer, sugar industries).
10. Field visit for identifying pollution routes of any industries near by the institute.

REFERENCE BOOKS

1. C. S. Rao; Environmental Pollution Control Engineering
2. H. S. Agad; Industrial Waste Water Management Handbook
3. Matcalf and Eddy; Waste Water Engineering; Treatment, Disposal and Reuse
4. S. P. Mahajan; Pollution Control in Process Industries
5. V. P. Kudesia; Industrial Pollution
6. Matcalf and Eddy; Waste Water Engineering; Treatment, Disposal and Reuse
7. Schroeder; Water and Waste water Treatment

69074 Application of Environmental Software & Project **T P C**
0 6 2

AIMS:

To be able to develop knowledge, skill and attitude in the area of environmental engineering projects specially on software application:

- 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:

Application of climate change projection (GCM) software, HYDRUS (2/3D) software, WEST software, SWAT software, DISPER software, CUSTIC software, DESCAR software, GPS-X software in developing environmental projects.

DETAIL DESCRIPTION:

1. Application of climate change projection (GCM) software.

1.1 Download the GCM software from website and install in your pc.
1.2 Go through to Software menu bar and knowledge gathering on operating tools.
1.3 To predict the future temperature in a specific location.
1.4 Finalized one of the projects from the operating tools and parameters.

2. Application of HYDRUS (2/3D) software.

2.1 Download the HYDRUS (2/3D) software from website and install in your pc.
2.2 Go through to Software menu bar and knowledge gathering on operating tools.
2.3 Interpolation the infiltration and redistribution profile of rain water using different intensity, duration, and frequency for various soil.
2.4 Finalized one of the projects from the operating tools and parameters.

3. Application of WEST software.

3.1 Download the WEST software for WWTP from website and install in your pc.
3.2 Go through to Software menu bar and knowledge gathering on operating tools.
3.3 Experiment on modeling and simulation of waste water treatment plant.
3.4 Finalized one of the projects from the operating tools and parameters.

4. Application of SWAT software.

4.1 Download the SWAT software for soil and water analysis from website and install in your PC.
4.2 Go through to Software menu bar and knowledge gathering on operating tools.
4.3 Experiment on land and watershed management.
4.4 Finalized one of the projects from the operating tools and parameters.

5. Application of DISPER software.

5.1 Download the DISPER software for air pollution dispersion model from website and install in your pc.
5.2 Go through to Software menu bar and knowledge gathering on operating tools.
5.3 Experiment on pollutant dispersion for a specific industry.

5.4 Finalized one of the projects from the operating tools and parameters.

6. Application of CUSTIC software.

6.1 Download the CUSTIC software for air pollution dispersion model from website and install in your pc.
6.2 Go through to Software menu bar and knowledge gathering on operating tools.
6.3 Experiment on noise dispersion for a specific industry.
6.4 Finalized one of the projects from the operating tools and parameters.

7. Application of DESCAR software.

7.1 Download the DESCAR software for air pollution dispersion model from website and install in your pc.
7.2 Go through to Software menu bar and knowledge gathering on operating tools.
7.3 Experiment on outfall and water pollution for a specific industry.
7.4 Finalized one of the projects from the operating tools and parameters.

8. Application of GPS-X software.

8.1 Download the GPS-X software for air pollution dispersion model from website and install in your pc.
8.2 Go through to Software menu bar and knowledge gathering on operating tools.
8.3 Determine the impact of increased organic and hydraulic loading on an existing plant.
8.4 Evaluate options for converting an existing plant that must meet new nitrifications guidelines.
8.5 Assess different diffused aeration design
8.6 Finalized one of the projects from the operating tools and parameters.

REFFERENCES:

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2. www.canaria.com
3. www.gcmsoftware.com
4. www.hydromantis.com
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69075 DISASTER MANAGEMENT **T P C**
2 0 2

AIMS:

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

- 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.; Disaster Risk Reduction (DRR), Community Risk Assessment (CRA), Plans and Prevention and Mitigation, Recovery and Post-disaster review, Training and Public awareness.

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 List out different types of disasters
1.4 Mention the historical occurrences of various disasters and hazards
1.5 Distinguish between disaster and hazard
1.6 Describe disaster and development policy.

2. Understand the hazard and Risk assessment.

2.1 Define hazard assessment and risk assessment.
2.2 Describe risk management processes.
2.3 Explain disaster crunch model.
2.4 State out the recovery and reconstruction framework of hazards.

3. Understand the flood as a natural disaster.

3.1 Definition of flood.
3.2 List the types of flood
3.3 Mention the causes and effect of flood.
3.4 Describe the magnitude of flood.
3.5 Describe the methods of flood control.
3.6 Explain the flood action plan.
3.7 Mention the indigenous flood preparedness techniques.
3.8 Describe the pre, during and Post preparedness strategy.
3.9 Describe human adjustment to coastal flooding.

4. Understand the cyclone as a natural disaster.

4.1 Definition of cyclone.
4.2 List the types of cyclone.
4.3 Describe the velocity and stages of cyclone.
4.4 Explain the risk analysis of cyclone.
4.5 Describe the warning signals of cyclone for maritime ports and inland river port.

4.6 State the RIR, RENA, S form & D form.
4.7 Describe contingency plan, objectives, usefulness, and characteristics.
4.8 Illustrate the mitigation strategies of cyclone.

5. Understand the earthquake as a natural disaster.
5.1 Define earthquake, seismology and seismograph.
5.2 Mention the causes and effects of earthquake.
5.3 List the types of seismic waves and earthquake.
5.4 Explain Time distance graph.
5.5 Describe the precursors of earthquake.
5.6 Describe the magnitude of earthquake and zoning of earthquake.
5.7 Mention the preparation for earthquake.
5.8 Measuring earthquake intensity and magnitude.
5.9 Describe Earthquake vulnerability to Bangladesh.

6. Understand the landslide as a natural disaster.
6.1 Definition of landslide.
6.2 List the types of landslide.
6.3 Mention the causes and effects of landslide.
6.4 Describe the techniques for reducing landslide hazard.
6.5 Describe landslide mitigation measures.
6.6 State the major preparedness for landslide.

7. Understand the draught, tornadoes, tidal floods, thunderstorms as natural disaster.
7.1 Definition of draught, tidal flood, tornadoes, lightning and thunderstorms.
7.2 Mention the causes and effects of draught.
7.3 List the types of draught.
7.4 Mention the draught prone areas in Bangladesh.
7.5 Describe the mitigation measures of draught.
7.6 Describe the formation and causes of tornadoes.
7.7 Describe causes and impacts of tidal flood.
7.8 Describe the mitigation strategies of tidal flood.
7.9 Describe the formation and mitigation of thunderstorms.

8. Understand the tsunami as a natural disaster.
8.1 Definition of tsunami.
8.2 Mention the causes and effects of tsunami.
8.3 Explain the formation of tsunami.
8.4 Describe the roles and responsibilities before, during and after to tsunami risk.
8.5 Mention the Symptom and mitigation strategies for tsunami.

9. Understand the salinity and water logging as natural disaster.
9.1 Definition of salinity and water logging.
9.2 Mention the causes and effects of salinity.
9.3 Describe the mitigation strategies of salinity hazard.
9.4 Mention the causes and effects of water logging.
9.5 Describe the mitigation measures of water logging.

10. Understand the disaster Risk Reduction (DRR) and Community Risk Assessment (CRA).
10.1 Define DRR, CRA, gender equality and equity.
10.2 List out the methods of identification of risk
10.3 Describe structural and non structural measures of risk reduction
10.4 State gender issues in DRR
10.5 Discuss Community Based Disaster Risk Management and Reduction

10.6 Mention obstacles to DRR
10.7 Describe the function of leadership in DRR
10.8 State the justification of CRA.
10.9 Discuss the Pre and post responsibilities about CRA.
10.10 Describe the risk and capacity of women in disaster management.

11. Understand the plans, prevention and mitigation

11.1 Define national disaster preparedness plan
11.2 Describe the role of Government, NGOs and Community Organization in disaster preparedness
11.3 Describe aspects for consideration during planning
11.4 Describe the planning process
11.5 State the needs to consider disaster prevention.
11.6 Mention the problem areas in prevention and mitigation.
11.7 Discuss guiding principles of mitigation
11.8 Describe requirements for effective mitigation
11.9 Illustrate major requirements for coping with disaster

12. **Understand the training and public awareness**

12.1 List out the needs for training and training policy
12.2 Mention the types and implementation process of training
12.3 Describe the responsibilities for public awareness programme
12.4 Illustrate effectiveness of information and maintenance of awareness levels.

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69076 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, evapotraspiration, rainfall runoff relation,
- To enable to select a suitable method for control of river erosion and flood in Bangladesh.
- To be enable 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; water logging and canal limning and water power engineering.

DETAIL DESCRIPTION

1 Basic concept of environmental engineering hydrology.

1.1 Define hydrology.
1.2 Illustrate hydrologic cycle.
1.3 Describe evaporation and transpiration.
1.4 Discuss precipitation and infiltration.
1.5 State surface runoff.
1.6 Draw a descriptive representation of hydrologic cycle.

2 Hydrometeorology.

2.1 Define hydrometeorology.
2.2 List out the global water budget.
2.3 Explain the role of practical applications
2.4 Mention the constituents of the atmosphere.
2.5 Describe the vertical structure of the atmosphere.
2.6 Describe the general circulation of wind.
2.7 Describe the transitory system on above the earth's surface.
2.8 Define hydrometeorology air mass, air front.
2.9 State the climate and weather conditions.
2.10 Demonstrate the meteorological observations.

3 Precipitation and its measurement methods.

3.1 Define precipitation.
3.2 Mention the condition for occurrence of precipitation.
3.3 Describe the formation of precipitation.
3.4 Explain the different types and form of precipitation.
3.5 List out the method of measurement of precipitation.
3.6 Describe non-recording and recording rain gauges.
3.7 Discuss the tipping bucket, weighing bucket and float type rain gauge.
3.8 Explain the radar measurement of rainfall.

4 Analysis and interpretation of rainfall data.

4.1 Mention rain gauge network.
4.2 Explain optimum number of rain gauges.

4.3 Computation of average depth of rainfall over an area.
4.4 Describe analysis and interpretation of rainfall data.
4.5 Illustrate rainfall mass curve and rainfall hyetograph.
4.6 Discuss the intensity-frequency-duration analysis of rainfall.

5 Evaporation, transpiration and evapotranspiration.

5.1 Define evaporation, sublimation, transpiration and evapotranspiration.
5.2 Explain evaporation process.
5.3 Mention the factors affecting evaporation.
5.4 Estimation of evaporation.
5.5 Describe the measurement of evaporation by evaporation pans.
5.6 Discuss the evaporation from soil surface.
5.7 Mention the factors affecting the process of transpiration.
5.8 Point out the factors affecting the evapotranspiration.
5.9 Describe the measurement of transpiration and evapotranspiration.

6 Rainfall- runoff relationship.

6.1 Define runoff.
6.2 Mention the unit of runoff.
6.3 List out the components of runoff.
6.4 Point out factors affecting runoff.
6.5 Describe basin yield.
6.6 Computation of runoff.
6.7 Explain rainfall runoff relationship.
6.8 Describe flow duration curve.
6.9 Illustrate flow mass curve.

7 Ground water-well irrigation.

7.1 Define aquifer, aquiclude, aquifuge, aquitard, specific yield, and specific retention.
7.2 Classify the division of sub-surface water.
7.3 Mention the types of aquifers.
7.4 Describe steady flow to a well in an unconfined and confined aquifer.
7.5 Describe the determination of aquifer constant T.
7.6 State the methods of lifting water.
7.7 Write down the advantage and disadvantage of well irrigation over canal irrigation.

8 Reservoir planning.

8.1 Mention the purposes of reservoir construction.
8.2 List out different types of reservoirs.
8.3 Describe the available storage capacity of a reservoir.
8.4 Point out the selection of site for a reservoir.
8.5 Define the basic terms of reservoir: 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.
8.6 Describe mass inflow curve and demand curve.
8.7 Describe the determination of the required and storage capacity.
8.8 Describe the determination of yield of a reservoir.
8.9 Describe the reservoir sedimentation.
8.10 Measure to control reservoir sedimentation.

9 Dam engineering.

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

10 River behavior and training

10.1 Classification of river.
10.2 State the meandering and cause of meandering.
10.3 Mention the basic factors controlling processes of meandering.
10.4 Explain the cut-off.
10.5 Define river training.
10.6 Mention the classification of river training works.
10.7 Describe guide bank system.
10.8 Explain groynes or spurs.
10.9 Define pitched bank bandalling and nalal plantation.
10.10 Illustrate marginal bund or levees and bank protection.

11 Water logging and canal lining.

11.1 Define water logging.
11.2 Describe the remedial measures for controlling waterlogged.
11.3 Illustrate losses in canal.
11.4 Discuss land drainage system.
11.5 Explain the design of open drain.
11.6 Describe lining of irrigation channels.

12 Water power engineering.

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

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. Prepare a model for a typical irrigation project.
5. Prepare a model for a typical drainage project.
6. Prepare a model for a typical flood control project.
7. Visit an irrigation project in Bangladesh and write a report.
8. Visit a drainage project in Bangladesh and write a report.
9. Visit a flood control project in Bangladesh and write a report.
10. Visit a hydro-power plant project in Bangladesh and write a report.

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65853 INNOVATION & ENTREPRENEURSHIP

T	P	C
2	0	2

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 insurance and premium.
- To be able to understand the MDG & SDG.

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; Concept of SDG; SDG 4,8 .

DETAIL DESCRIPTION

Theory :

1. Understand the basic concept of entrepreneurship & entrepreneur.

1.1 Define entrepreneurship & entrepreneur.
1.2 Discuss the characteristics and qualities of an entrepreneur.
1.3 Mention the classification of entrepreneur.
1.4 Discuss the necessity of entrepreneurship as a career.
1.5 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 the economic development process.
2.3 Discuss the capital accumulation or rate of savings.
2.4 Discuss the role of entrepreneur in the technological development and their introduction into production Process.
2.5 Discuss the entrepreneur in the discovery of new product.
2.6 Discuss the discovery of new markets.

3. Environment for entrepreneurship development:

3.1 Define the micro environment.
3.2 Discuss individual income, savings and consumption.
3.3 Define macro environment.
3.4 Discuss political, socio-cultural, economical, legal and technological environment.
3.5 Difference between micro and macro environment .

4. Understand the concept of entrepreneurship in the theories of economic growth.

4.1 Define entrepreneurship in the theories of economic growth.
4.2 Discuss the Malthusian theory of population and economic growth.
4.3 Discuss the stage theory of growth.
4.4 Discuss the Schumpeterian theory of economic development.
4.5 Discuss the entrepreneurship motive in economic development.

5. Understand the sources and evaluation of venture ideas in Bangladesh.

5.1 Define sources of venture ideas in Bangladesh.
5.2 Discuss different types of sources of venture ideas in Bangladesh.
5.3 Define evaluation of venture ideas.
5.4 Discuss the factors that influence the selection of venture idea.

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.

8. Understand the business plan and the concept of the environment for entrepreneurship.

8.1 Define business plan.
8.2 Describe the importance of business plan.
8.3 Discuss the contents of business plan.
8.4 Define environment of business.
8.5 Describe the factors which effect environment on entrepreneurship

9. Understand the concept of sources of assistance & industrial sanctioning procedure.

9.1 Define sources of assistance.
9.2 Describe different types of sources of assistance.
9.3 Discuss the aid of sources.
9.4 Discuss the industrial policy.
9.5 Define foreign aid.

10. Understand the insurance and premium.

10.1 Define insurance and premium
10.2 Describe the essential conditions of insurance contract.
10.3 Discuss various types of insurance.
10.4 Distinguish between life insurance and general insurance.

11. Understand the concept of Sustainable Development Goals (SDG)

11.1Define Sustainable development
11.2State UN targets of MDG
11.3State UN targets of SDG
11.4Describe the importance of SDG
11.5Explain the objectives of SDG
11.6State the Challenges to achieve SDGs
11.7Explain the actions to face the challenges of SDGs
11.8State the of 7^{th} 5 years plan
11.9Mention the link of 7^{th} 5 years plan with SDGs
11.10 Write down the 5 ps of sustainable development goals

12. Understand SDG 4,8 and 17

12.1 Describe SDG 4 and its targets
12.2 State the elements of Quality education for TVET
12.3 Describe the gender equality and equal access of TVET for economic growth
12.4 Describe SDG 8 and its targets
12.5 Explain Green development, Green Economy, Green TVET & Green Jobs
12.6 Explain the role an entrepreneur for achieving SDG

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