SIXTH SEMESTER DIPLOMA EXAMINATION IN
ENGINEERING/TECHNOLOGY OCTOBER-2013

ENVIRONMENTAL SCIENCE AND DISASTER MANAGEMENT

(Maximum Mark: 100) (Time:4 hr)

PART – A

I. (Answer the following questions in one or two sentences, Each question carries 2 marks)

1. Define the term ecology?

Ecology is the study of the relationship between organisms and the environment and the interrelationships between organisms.

2. What you understand by ecosystem?

An ecosystem is therefore defined as a natural functional ecological unit comprising of living organisms and their nonliving environment that interact to form a stable self supporting system .

E.g. Pond, lake, desert, grassland, forest, etc.

3. What is meant by environmental stress?

Environmental stress is defined as the minor irritations and frustrations of every day life that we all experience. Examples of environmental stress include trying to get things done amongst clutter and disorganization.

4. What are the constituent of solid waste?

- Food wastes
- Rubbish
- Ashes and residues
- Demolition and construction

5. State any two merits of wind energy?

- It does not cause any air pollution
- It is very cheap

PART – B

II. (Answer any five of the following questions, Each carries 6 marks)

1. What are the causes of air pollution?

- Industrialization
- Population growth
- Globalization

- The major constituents of air , N2, 0 2 and inert gases that comprises about 99.9% have not changed.
- But some minor and trace constituents such as sulphur dioxide (SO2), oxides of nitrogen N2O., NO, NO2 , (NOx), methane (CH4) chlorofluorocarbons (CFCs) along with carbon dioxide (CO2) unburnt hydrocarbon and suspended particulate matter (SPM) have increased.
- You know that these are the major air pollutants responsible for the deterioration of air quality.

2. List different sources of marine pollution.

- Municipal waste & sewage from residences and hotels in coastal towns are directly discharged into sea
- Pesticides and fertilizers from agriculture which are washed off by rain enter water courses & finally to sea..
- Petroleum & oil washed of from roads normally enter sewage system & finally into seas
- Ship accidents & accidental spillage at sea can therefore be very damaging to the marine environment.
- Off shore oil exploration also pollute the sea water to a large extent.
- Dry docking: All ships periodic dry docking servicing; cleaning the hulls etc. during this period when cargo compartments are emptied, residual oil goes into sea.
- Pollution due to organic wastes.
- Pollution due to oil: Crude oil is transported by sea after a tanker has unloaded its cargo of oil; it has to take on sea water ballast for return journey.
- Tanker accidents: In the natural process, a large no of oil tanker accidents happen every year. Sometimes this can results in major disasters.
- Volcanic eruptions in the sea.
- Deep sea mining is a relatively new mineral retrieval process that takes place on the ocean floor.

3. Briefly explain the different types of environmental hazards.

There are two types of hazards:

i. Natural hazard.

ii. Manmade hazard

Natural hazard

- Natural hazards are hazards which are caused because of natural phenomena (hazards with meteorological, geological or even biological origin).
- Examples of natural hazards are cyclones, tsunamis, earth- quake and volcanic eruption which are exclusively of natural origin.
- Landslides, floods, drought, fires are socio-natural hazards since their causes are both natural and man made.
- For example flooding may be caused because of heavy rains, landslide or blocking of drains with human waste.

Manmade hazards

- Manmade hazards are hazards which are due to human negligence.
- Manmade hazards are associated with industries or energy generation facilities and include explosions, leakage of toxic waste, pollution, dam failure, wars or civil strife etc.
- The list of hazards is very long. Many occur frequently while others take place occasionally.

4. Discuss various effect of earthquake.

The energy released from an earthquake can be up to 10,000 times more powerful than the first atomic bomb. Its side-effects can be:

Ground shaking

Shaking of the ground caused by the passage of seismic waves, especially surface waves near theepicentre of the earthquake are responsible for the most damage during an earthquake.

Landslides and ground subsidence

Avalanches, landslides, slumps and rock slides are triggered by ground shaking. These landslides are often more destructive than the earthquakes.

Damage to man-made structures

Damage to man-made structures, such as roads, bridges, dams and buildings from ground motion depends on the type of construction:

Flooding

Flooding can come from many sources such as broken water main pipes, dams that fail due to the earthquake and earthquake-generated tsunamis

Fires

Fires, often associated with broken electrical and gas lines, is one of the common side effects of earthquakes. Gas is set free as gas lines are broken

Faulting and Ground Rupture

When an earthquake event occurs, ground rupture is only where the fault zone moves. Those constructions built adjacent to the fault will survive while structures built across these zones will collapse.

5. List the negative impact of overgrazing on environment.

Impacts of Overgrazing

- India possesses a significant position in livestock population in the world.
- This livestock wealth plays a crucial role in the rural life of our country.
- Each type of grass land has a herbivore carrying capacity-the maximum numbers of herbivore supported by a given area. Carrying capacity is influenced by season, range, condition annuals, climatic condition, past grazing use, soil type, kinds of grazing animals and duration of animal graze in an area.
- Light to moderate grazing is necessary for the health of grass land. It maintains water and nutrient cycle needed for healthy grass growth and healthy root system.
- It hinders soil erosion and encourages build up of organic soil matter.

- However most often, the grazing pressure is so high that its carrying capacity is crossed and sustainability of the grazed land fails

6. What are the advantages of hydro power?

Advantages of Hydropower energy :

- Hydropower is fueled by water, so it's a clean fuel source, meaning it won't pollute the air like power plants that burn fossil fuels, such as coal or natural gas.
- Hydroelectric power is a domestic source of energy, allowing each state to produce their own energy without being reliant on international fuel sources.
- The energy generated through hydropower relies on the water cycle, which is driven by the sun, making it a renewable power source, making it a more reliable and affordable source than fossil fuels that are rapidly being depleted.
- Impoundment hydropower creates reservoirs that offer a variety of recreational opportunities, notably fishing, swimming, and boating. Most water power installations are required to provide some public access to the reservoir to allow the public to take advantage of these opportunities.
- Some hydropower facilities can quickly go from zero power to maximum output. Because hydropower plants can generate power to the grid immediately, they provide essential back-up power during major electricity outages or disruptions.
- In addition to a sustainable fuel source, hydropower efforts produce a number of benefits, such as flood control, irrigation, and water supply.

7. Write a short note on ecological succession.

ECOLOGICAL SUCCESSION

- Over the course of years it is observed that in nature one biotic community gradually gives way to a second, the second perhaps to a third, and even the third to a fourth.
- This phenomenon of transaction from one biotic community to another is called ecological or natural succession.
- Succession occurs because the physical may be gradually modified by the growth of the biotic community itself, such that the area becomes more favourable to another group of species and less favourable to the present occupants.

There are two types of ecological succession.

i. Primary succession

- If the area has not been occupied previously, the process of initial invasion and then the progression from one biotic community, to the next is termed "Primary Succession".
- An example is the gradual invasion of a bare rock surface by what eventually becomes a climax forest ecosystem

ii. Secondary Succession

When an area has been cleared by fire or by humans and then left alone, the surrounding ecosystem may gradually reinvade the area- not at once, but through a series of distinct stages termed secondary succession.

PART – C

(Answer one full question from each unit, Each question carries 15 mark)

Unit -1

III. (a) Enumerate the adverse effect of deforestation? 8

Effect of deforestation

1. Food problems
2. Ecological imbalance
3. Increasing CO2
4. Floods leading to soil erosion
5. Destruction of resources
6. Heavy siltation of dams
7. Changes in the microclimate
8. Loss of bio-diversity
9. Desiccation of previously moist forest soil
10. Heavy rainfall and high sunlight quickly damage the topsoil in clearings of the tropical rain-forests. In such circumstance, the forest will take much longer to regenerate and the land will not be suitable for agricultural use for quite some time.
11. Where forests are replanted, their replacement can mean a loss of quality
12. Loss of future markets for eco-tourism. The value of a forest is often higher when it is left standing than it could be worth when it is harvested.
13. Some indigenous peoples' way of life and survival are threatened by the loss of forests. Fewer trees results an insecure future for forest workers
14. Deforestation can cause the climate to become extreme in nature. The occurrence and strength of floods and droughts affecting the economy.
15. The stress of environmental change may make some species more susceptible to the effect of insects, pollution, disease and fire.
16. Most humid regions changes to desert
17. Environmental pollution

18. Global warming.

(b) What are the ecological significance of forests? 7

Ecological significance of forests are

- Balances CO2 and O2 levels in atmosphere.
- Regulates earth temperature and hydrological cycle
- Encourage seepage and reduces runoff losses, prevents drought
- Reduces soil erosion (roots binding), prevents siltation and landslides thereby floods
- Litter helps in maintaining soil fertility
- Safe habitat for birds, wild animals and organisms against wind, solar radiation and rain
- Forest has warm climate with adequate rain fall.
- Forest have well defined seasons of about equal length.
- Forest protect biodiversity.
- The soil of forest is rich in organic matter and nutrients.
- Forests provide various resources for human life.

OR

IV. (a) Write a short notes on non-renewable energy resources. 8

Non renewable resources (or) Conventional energy resources

- Nonrenewable resources are natural resources which cannot be regenerated once they are exhausted.
- They cannot be used again. Example: Coal, petroleum, natural gas, and nuclear fuels.
- They are exhaustible in nature because they are not replaced by natural processes.
- Nonrenewable are resources that are consumed much faster than nature can create them.
- Metals are prime examples of nonrenewable resources. In contrast, resources such as timber (when harvested sustainable) are considered renewable resources.
- These are also called as conventional sources of energy because they cannot be used again and again in an endless manner.
- Even our renewable resources can become nonrenewable if we exploit them to such extent their rate of consumption exceeds their rate of regeneration.
- Wood is renewable resources because we can get new wood by growing sapling into a tree within 15-20 years.
- But the formation of coal from trees has taken million of years and cannot be regenerated in our life time.

(b) What is mining and enumerate the environmental effect caused due to mining? 7

Mining

- Mining is the process of removing deposits of ores from substantially very well below the ground level.
- Mining is carried out to remove several minerals including coal.
- These mineral deposits invariably found in the forest region, and any operation of mining will naturally affect the forests.
- More than 80,000 ha of land of the country are presently under the stress of mining activities.Large scale deforestation due to mining has been reported nowadays.

Environmental impact of mining

- The environmental impact of mining includes erosion, formation of sinkholes, loss of biodiversity and contamination of soil, groundwater, surface water by chemicals from mining processes.
- In some cases, additional forest logging is done in the vicinity of mines to increase the available room for the storage of the created debris and soil.
- Besides creating environmental damage, the contamination resulting from leakage of chemicals also affect the health of the local population.
- Mining companies in some countries are required to follow environmental and rehabilitation codes, ensuring the area mined is returned to close to its original state.
- Some mining methods may have significant environmental and public health effects.
- The forest area has declined upto 33% due to mining activities.

Unit – 2

V. (a) List the general characteristic of features of forest ecosystem 8

Characteristics of a forest ecosystem

- Forest has warm climate with adequate rain fall.
- Forest has well defined seasons of about equal length.
- Forest protects biodiversity.
- Forest has tall and dense trees with many wild animals within ecosystem.
- The soil of forest is rich in organic matter and nutrients.
- Forest grows very slowly.
- Forests provide various resources for human life.

(b) Briefly explain the biotic component of an ecosystem. 7

Biotic component of an ecosystem

- The biotic component consists of all living things of the environment which constitute producers, consumers and decomposers.
- The plants and animals form communities that are specific to each forest type.

  Example :-
  Plants – trees, shrubs, climbers and ground cover.

Animals – mammals, birds, reptiles amphibians, fish insects and microscopic animals.

Producers of Forest ecosystem

- All living organisms intake energy in order to survive.
- In a forest ecosystem, trees and other plants get their energy from sunlight.
- Plants produce their own food, in the form of carbohydrates.

Consumers of Forest ecosystem

- Animals cannot produce their own food.They must consume food sources for the energy they need to survive.
- All animals, including mammals, insects, and birds are called consumers.
- Consumers rely on plants and other animals as a food source.
- Primary consumes only eat plants and are referred to as herbivores.
- Second consumers are referred to as carnivores and feed on herbivores.
- Tertiary consumers are carnivores that feed on other carnivores.

Decomposers

- Leaves, needless, and old branches fall to the forest floor as trees grow. Eventuality all plants and animals die. These materials are decomposed by worms, microbes, fungi, ants, and other bugs

OR

VI. (a) Write down the important abiotic factors of a lake. 8

Important abiotic factors of Lake are:-

- The abiotic factors do include acidity, turbidity (clarity), nitrogen nutrient concentrations plus dissolved oxygen concentration.
- These are affected by the catchments or volume of the pond or lake.
- Size of the input flow, the type of bedrock impact the pH, that in turn alters the nutrient composition.
- Nitrogen may enter by runoff, precipitation or be a result of a biotic process by fixation from the atmosphere by cyano bacteria.
- Temperature, light and wind turbulence are other abiotic factors but they are independent of the size of the drainage system since they can affect a larger region

(b) Write short notes on food chain. 7

FOOD CHAIN

In an ecosystem one can observe the transfer or flow of energy from one tropic level to other in succession.

A tropic level can be defined as the number of links by which it is separated from the producer, or as the position of the organism in the food chain.

The patterns of eating and being eaten forms a linear chain called food chain which can always be traced back to the producers.

Example

Grass ► Grasshopper ► Frog ► Snake ► Eagle

Kinds of food chain

1.Grazing food chain

- The grazing food chain begins with green plants at its base as producers.
- Therefore, plants act as the source of energy for the primary consumers. .

Eg:- Grass → Rabbit→ Fox

2. Detritus food chain

- The detritus food chains start from dead and decaying organic matter of animal and plant bodies known as detritus.
- Here, the detritus act as the source of energy for the primary consumers termed as detritus consumers.

Unit – 3

VII. (a) Briefly explain the effect of air pollution on human health. 8

Effects of Air pollution on human health

- Since the air pollutants are inhaled they attack various parts of the respiratory system on their route to air sacs.
- Once they reach the blood, they circulate throughout the body and reach the target organs.
- The extent of damage depends upon a particular pollutant, its concentration in the air and exposure time.
- Our body's defense mechanism helps to eliminate them.
- However, exposure to high level, overloads and degrades the body's defense mechanism.
- Evidences show that air pollutants are linked with respiratory and some other diseases in human beings.
- Sulphur dioxide is a major contributor to lung diseases.
- It causes irritation to nose and mucous lining. shortness of breath, tissue fluid accumulation, swelling (edema) and bronchospasm.

- These are the acute effects. Long term exposure may result in respiratory diseases like-chronic bronchitis, aggravated asthma, emphysema, pulmonary fibrosis and increased stress on heart.
- Particulate matter potentates the effect of S02.
- The gas settles on the particles and reaches the deeper parts of respiratory system. Hence the toxicity of low concentration of SO2 can significantly increase.

(b) Enumerate the different sources of water pollution. 7

Sources of Water Pollution

- There are natural sources of water pollutants such as mineral ores from rocks, chemicals, from mines and gases from atmosphere. But we will consider sources arising due to human activities only. These can be broadly grouped into the following categories :

1) Domestic effluents

2) Industrial effluents

3) Surface run-off

4) Waste heat

OR

VIII. (a) Briefly explain the sources of nuclear hazard? 8

SOURCES OF NUCLEAR HAZARDS

The sources of radioactivity include both natural and manmade.

Natural sources

- Cosmic rays from outer space.
- Emissions from radioactive materials in the earth's crust (rocks, marine sediments etc)

Man-made sources

It include the nuclear wastes produced during

- Mining and processing of radioactive ores
- Use of radioactive materials in power plants
- Use of radioactive isotopes in medical technology (x-ray machines, radioisotopes used in medicine)
- Industrial applications include wastes from nuclear reactors
- Research applications: radioactive fallouts during nuclear weapons testing.
- In a nuclear power plant, any leak or accident taking place emit nuclear radiation. In either case it results in nuclear hazard.
- Nuclear tests Conducted under the ground or under oceans which also release radiation.
- Uranium mining and milling, Nuclear reactors and reprocessing of nuclear fuel cause nuclear pollution.

(b) Discuss the role of an individual in the prevention of pollution? 7

ROLE OF AN INDIVIDUAL IN PREVENTION OF POLLUTION

- Try to plant trees wherever you can and more importantly take care of them. They reduce air pollution.
- Reduce the use of wood and paper products wherever possible. Manufacturing paper leads to pollution and loss of forests which releases oxygen and takes up carbon dioxide. Try to recycle paper products and use recycled paper wherever possible.
- From the mail you receive reuse as many envelopes that you can.
- Do not buy furniture, doors, window frames made from tropical hardwoods such as teak and mahogany. These are forest based.
- Help in restoring a degraded area near your home or join in an afforestation program.
- Use pesticides in your home only when absolutely necessary and use them in as small amounts as necessary. Some insect species help to keep a check on the populations of pest species.
- Advocate organic farming by asking your grocery store to stock vegetables and fruits grown by an organic method. This will automatically help to reduce the use of pesticides.
- Reduce the use of fossil fuels by either walking up a short distance using a car pool, sharing a bike or using public transport. This reduces air pollution.
- Shut off the lights and fans when not needed.
- Don't use aerosol spray products and commercial room air fresheners. They damage the ozone layer.

Unit -4

IX. (a) What are the adverse effect of draught? 8

Adverse effects of drought

Economic

- Loss of national economic growth, slowing down of economic development
- Damage to crop quality, less food production
- Increase in food prices
- Increased importation of food (higher costs)
- Plant disease
- Loss from dairy and livestock production
- Unavailability of water and feed for livestock which leads to high livestock mortality rates
- Disruption of reproduction cycles (breeding delays or unfilled pregnancies)
- Increased predation
- Range fires and Wildland fires
- Damage to fish habitat, loss from fishery production
- Income loss for farmers and others affected
- Unemployment from production declines
- Loss to tourism industry

- Loss of hydroelectric power
- Loss of navigability of rivers and canals.

(b) Write a short notes on cause and effect of Chernobyl disaster? 7

Chernobyl disaster

- The Chernobyl disaster was a nuclear accident that occurred on 26 April 1986 at the Chernobyl Nuclear Power Plant in Ukraine, which was under the direct jurisdiction of the central Moscow's authorities.
- An explosion and fire released large quantities of radioactive contamination into the atmosphere, which spread over much of Western USSR and Europe.
- It is considered the worst nuclear power plant accident in history, and is one of only two classified as a level 7 event on the International Nuclear Event Scale (the other being the Fukushima Daiichi nuclear disaster).
- The battle to contain the contamination and avert a greater involved over 500,000 workers and cost an estimated 18 billion rubles, crippling the Soviet economy.
- The disaster began during a systems test on Saturday, 26 April 1986 at reactor number four of the Chernobyl plant, which is near the city of Prypiat and within a close proximity to the inistrative border with Belarus and Dnieper river.
- There was a sudden power output surge, and when an emergency shutdown was attempted, a more extreme spike in power output occurred, which led to a reactor vessel rupture and a series of explosions.
- These events exposed the graphite moderator of the reactor to air, causing it to ignite.
- The resulting fire sent a plume of highly radioactive smoke fallout into the atmosphere and over an extensive geographical area, including Pripyat.
- The plume drifted over large parts of the western Soviet Union and Europe.
- From 1986 to 2000, 350,400 people were evacuated and resettled from the most severely contaminated areas of Belarus, Russia, and Ukraine.

OR

X. (a) Write short notes on disaster resistant house construction? 8

Disaster resistant house construction

- Be sure that proper structural design and engineering practices are followed while constructing a house/ building.
- Frequently evaluate the structural soundness of the buildings; strengthen / retrofit if necessary.

The mitigation strategy for disaster resistant house/ building construction can be listed as follws:

Mitigation strategy for Earthquake disaster

- The building should have a simple rectangular plan.
- Long walls should be supported by Reinforced Concrete columns.

- Large buildings having plans with shapes like T, L, U and X should preferably be separated into rectangular blocks by providing gaps in between.
- Buildings which are structurally strong to withstand earthquakes sometimes fail due to inadequate foundation design.
- Door and window openings in walls should preferably be small and more centrally located. Too many or large openings will make the wall vulnerable to collapse during earthquakes

Mitigation strategy for cyclonic disaster

- Engineering structures to withstand cyclonic wind forces.
- Suitable building codes for the area having wind load requirement,
- Better architectural design of buildings, taking winds speed and wind direction into account.

Mitigation strategy for flood disaster

- Avoid residing on river banks and slopes on river sides and the sides of gorges.
- Build at least 250 meters away from the sea coast/river banks
- Build proper drainage system in all flood prone areas, so that the water can be drained off quickly to prevent accumulation.
- Construct the building with a plinth level higher than the known high flood level.

(b) Explain how search and rescue operation are to be carried out in the case of disaster? 7

Search and Rescue

- Search, rescue and evacuation processes need to be carried out immediately after a disaster strikes a certain area or building.
- These are the most immediate critical operations that are usually performed by the local volunteers, voluntary organizations and the emergency agencies.
- Light Search and Rescue is a procedure carried out at primary stages, initially to find out persons with injuries in lightly damaged buildings, or even without any injuries and needing assistance, and to help them exit.
- If the condition worsens and the local groups are not able to control the situation, then the specialist groups within emergency agencies have to be called in for professional help, and at times even the Defense Forces including the Army, the Navy, the Air Force and the Coast Guard are called on for help.
- Primarily, Search and Rescue Operations are undertaken to save the maximum possible number of victims who are trapped in an area affected by a disaster.
- The basic aim of all such operations is to ensure the survival of the maximum possible number of affected people.
- A plan is worked out with the help of local people through surveys and then appropriate steps are taken by the various teams involved to carry out the operations.
- Besides physical rescue, the aim is also a systematic and organized approach in a post - disaster situation riddled with chaos and confusion.