

SECOND SEMESTER EXAMINATION, 2009-2010

ENVIRONMENT & ECOLOGY

Time : 2 Hours

Total Marks : 50

Note. The question paper contains three sections. Section-A, Section-B and Section-C with the weightage of 10, 15 and 25 marks respectively. Follow the instructions as given in each question.

SECTION — A

This section contains 10 questions of multiple choice/Fill in the blanks/True, False/Matching correct answer type questions. Attempt all parts of this section.

Q.1. Write the correct answer of the following multiple choice questions: (1×10=10)

- (a) The part of environment where life forms of the earth, including human beings, live, is
- | | |
|-------------------|------------------|
| (i) atmosphere | (ii) lithosphere |
| (iii) hydrosphere | (iv) biosphere |

Ans. (iv)

- (b) The science that deals with the study of the individual organisms or an individual species is known as
- | | |
|------------------|-------------------|
| (i) anthropology | (ii) autecology |
| (iii) synecology | (iv) microbiology |

Ans. (ii)

- (c) The main cause of 'eutrophication' of lakes is the enrichment of lake water with
- | |
|---------------------------------|
| (i) carbonaceous organic matter |
| (ii) nutrients |
| (iii) chlorides |
| (iv) water hyacinth. |

Ans. (ii)

Fill in the following blanks with suitable words:

- (d) The part of atmosphere, where maximum concentration of ozone is generally found, is

Ans. Stratosphere

- (e) The transfer of food energy from the source in plants through a series of organisms with repeated eating and being eaten up is referred to as _____.

Ans. Food Chain

- (f) The unit of measurement of sound pressure level is _____

Ans. Decibel (dB)

Write true or false against following statements:

- (g) Anaerobic digestion of sludge takes place in the presence of oxygen. (True/False)

Ans. False

- (h) Gastroenteritis is a water borne disease. (True/False)

Ans. True

- (i) Match List I with List II and select the correct sequence of answers using the codes given below the lists:

	List I				List II			
	A.	B.	C.	D.	1.	2.	3.	4.
	Carbon monoxide	Carbon dioxide	Chlorofluorocarbon	Sulphur dioxide	Acid rain	Ozone layer depletion	Asphyxiation	Green house effect
Code	A	B	C	D				
(1)	3	4	1	2				
(2)	4	3	1	2				
(3)	3	4	2	1				
(4)	2	1	3	4				

Ans. 3

- (j) The atmosphere is divided into following four layers:

- (a) Mesosphere (b) Stratosphere
(c) Thermosphere (d) Troposphere

The correct sequence of these layers starting from the surface of earth upwards is

A	2	4	1	3
B	4	2	1	3
C	4	2	3	1
D	2	4	3	1

Ans. (b)

SECTION — B

Q.2. Attempt any three parts of the following:

(5×3=15)

(a) Define environment. Discuss the need for public awareness for the conservation and protection of the environment.

Ans. Environment mean the surroundings of the living organism, which usually refer to the biosphere. The biosphere is considered as a thin shell of many hundred km of radius that encapsulates the earth. It is made of three segments-Atmosphere, Hydrosphere, and Lithosphere. Thus we can conclude that environment is the physical, chemical, biological, socio-economical surrounding of living thing.

It is very essential to make the public awareness about the environmental challenges so that their all survival method should be eco-friendly. Some of the challenges are as under below that are required to be checked. These are

- (i) growing population
- (ii) poverty
- (iii) agricultural growth
- (iv) need to conserve ground water
- (v) deforestation
- (vi) degradation of land
- (vii) air and water pollution

Q.2. (b) What are the basic components of an ecosystem? Outline the concept of balanced ecosystem.

Ans. Ecosystem is the interaction of the living thing with the living and non-living surrounding. It consists the two basic components i.e. biotic and a-biotic. The biotic components include all types of living beings that are required for survival while the a-biotic components include non-living surrounding around the living organisms .

1. Biotic Components:

- (a) Producers (Autotroph : Auto= Self, Troph= Nourishment level) It includes all the green plants and photosynthetic bacteria who prepares their food themselves.
- (b) Consumers (Hetrotroph) Those who depends on others for food. These may be
 - Primary consumers (Herbivorous animals) who feeds on plants eg. Rabbit
 - Secondary consumers (Omnivorous) who feeds on plants as well as flesh eg. Fox
 - Tertiarycarnivorous (Carnivores) who feeds on flesh eg. Lion
- (c) Decomposers (Saprotropoh) Those who feeds on dead matter eg. Bacteria & fungi

2. Abiotic Components:

- (a) physicalsunlight, temperature, water, soil
- (b) chemical nutrients, salts, organic and in-organic substances

Balanced ecosystem: It is a dynamic system where a lot of events occur and if one of the component get disbalanced the whole ecosystem get disturbed and even get colapsed. Hence it is necessary to conserve all abiotic and biotic component of living organisms eg. increase in CO₂ level increases the threat of global warming hence we have to conserve the ecosystem where plants are eaten by animals, which in turn eaten by other animals.

This capacity of system to self regulate or self maintain is necessary for survival.

Q.2. (c) What is deforestation? Give main causes and adverse effects of deforestation.

Ans. Deforestation means complete clearing of tree or illegal falling of tree and their replacement by using land for other purpose.

Main causes: Demand for wood for industries, Shifting cultivation (movement of agricultural practices by clearing the forest) forest fires, population explosion, developmental projects, mining operations, over grazing by domestic animals etc.

Adverse effects: Decrease of rainfall, soil erosion, loss of fertile land, rise in climate temperature, global warming

Q.2. (d) Discuss some important issues relating to municipal solid waste management in India.

Ans. Municipal solid waste management in India: The government of India enacted a technology policy statement in 1983 on waste management with the objectives of 'Recycling waste material and make full utilization of products and ensures harmony with the environment that preserve the ecological balance and improve the quality of habitat.

The following are some of the techniques of solid waste management:

Incineration (Burning of the waste in presence of O₂ at higher temperature i.e 800-1000 °C), Pyrolysis (Burning of the waste in absence of O₂ at comparatively lower temperature i.e 250-300 °C) Sanitary landfills (Dumping of the waste in layer covered by true soil), Composting (All organic material of the waste get converted in to fertilizer), Anaerobic Digestion (By creating the less oxygen condition all waste get converted in to use full gasses and compost), recycling (Reuse of waste e.g recycling of plastics and paper), public Consciousness.etc.

Q.2. (e) Discuss how population, poverty and pollution are inter-related to one another.

Ans. A population of over thousands of millions is growing at 2% every year. It puts considerable pressure on its natural resources and polluted the environment. The vast majority of people of India are directly dependent on the natural resources of the country for their basic needs of food, fuel and shelter. Environment degradation has adversely affected the poor who depends upon the resources from their immediate surroundings.

Thus the challenge of the poverty and the challenge of environment degradation are two facets of the same challenges and the pollution growth is obviously a function of poverty.

SECTION — C

Note: All questions are compulsory.

(5×5=25)

Attempt any two parts from each question.

Q.3. (a) What are ecological pyramids? Explain the different types of ecological pyramids giving suitable examples.

Ans. Ecological pyramids are the diagrammatic representation of trophic level (nourishment level) in which the trophic level are showing the successive stage of life. These are:

Type: Pyramid of Number: It is based on number of species of living organism in any ecosystem and may be inverted and upright

Pyramid of biomass: It is based on dry weight of species of living organism in any ecosystem and may be inverted and upright

Pyramid of energy: It is based on movement of energy of living organism in any ecosystem and is always upright

Following are the basic characteristic features of pyramids

1. Base of the pyramid that shows the producer level(first trophic level)
2. Upper level of the pyramid showing the primary consumers i.e. the second trophic level.
3. Higher level of the pyramid showing the secondary consumers i.e. the third trophic level.

Apex of the pyramid showing the tertiary level i.e. the fourth trophic level i.e. fourth trophic level.

Q.3. (b) Give a brief account of environmental effects of modern agriculture.

Ans. Effect of modern agriculture can be broadly classified into three group viz. local, Regional and global changes

Local Changes These occur at or near the sites of farming. These changes/ Effects include soil erosion and increase sedimentation down stream in local rivers. Fertilizers carried by sediments can cause eutrofication of local water bodies. Polluted sediments can also transferred toxins and destroy local fisheries.

Regional Changes They generally results from the combined effect of farming practices in the same large region. It also includes deforestation, large scale pollution, Increase in sedimentation in major rivers and in the estuaries at the mouth of the rivers and change the chemical fertility of the soil over large areas. In tropical region sediments enter in the ocean can destroy coral reefs that are present in the oceans.

Global Changes: These includes climate changes as well as excessive change in global chemical cycle.

Q.3. (c) What is Environmental Impact Assessment? Discuss its importance in planning and implementation of engineering projects.

Ans. In common terminology Environment impact assessment is also called as E.I.A. It is the study of probable changes in the various socio-economic and bio-physical characteristics of the environment which may result from a proposed or in pending action

Definetions: It is the study of the range from the often coted and broad definition according to Munn (1979) the EIA is a activity designed to identify and predict the impact of the environment and on man's health and well being of the legislative proposals policy, project program, projects and operational procedures and to interperate the information to the international association for impact assessment (IAIA).

Type Rapid EIA: It requires the six month study of project to evaluate the positive and negative impact

Comprehensive EIA It requires the 24 month study of project to evaluate the positive and negative impact

Steps

1. Screening
2. Identification
3. Evaluation
4. Mitigation
5. Public hearing

Infect EIA is a tool that seeks to ensure sustainable development through the evaluation of those impacts arising from a major activity (policy/plan/program/project) that are likely to have significant environmental effects. Such impacts include both beneficial and adverse effects on natural environment. The principle adverse impacts include soil contamination, water pollution, air pollution, noise pollution and ecological disorders.

Q.4. (a) Discuss the adverse impacts of urbanization and industrialization and suggest suitable remedial measures.

Ans. Urbanization has degraded the environment owing to overcrowding. Its consequences are human health are dctrimental. These can be enumerated –

1. Poor living conditions and miseries.
2. increased illness accidents and crimes.
3. High rates of diseases and deaths in people of low income group.
4. Psychological health problems and depression owing to dirty and overcrowded surroundings.
5. Increased child and woman abuse.
6. Increased noise pollution.

7. Insanitation and lack of civic amenities.

Industrialization:

1. Union carbide holocaust that occurred on December 3 1984 at Bhopal has left thousands of people suffering from serious diseases for their whole life.

2. Chernobyl (USSR) nuclear power station accident has made a large number of people disable and thousand other to move gradually to their untimely death.

3. The power metallurgy industry, ore and mining industry, Coal and ash handling plants are responsible in inducing the following serious diseases and illness in people working in its vicinity. (Asthma, Tuberculosis, Liver Cancer, Skin Diseases etc.)

Remedial Measures - Villagers are migrated towards cities for education, health, employment etc. Government should provide facilities (Proper housing, proper electricity, proper education centre, proper water etc) in the villages.

Q.4. (b) Write a short note on sustainable development.

Ans. Sustainable development – It is the development that meets the needs of the present without compromising the ability of future generation to meet their own needs. **Two key concepts** are

1. The concept of needs in particular the essential need of the world's poor to which overriding priority should be given.

2. The idea of limitation imposed by the state of technology and social organization on the environment ability to meet present and future needs.

Main Stream- Sustainable development typically urges-

1. The maintenance of ecological integrity.

2. The integration of environment care and development.

3. The adoption of an internationalist stance.

4. The satisfaction of at least basic human needs for all.

5. Utilitarian conservation.

6. The application of science, technology and environmental knowledge to world development.

7. The acceptance of some economic growth.

Guidelines :

1. Shifting of the renewable resources instead of non renewable resources

2. Reuse of 60% matter

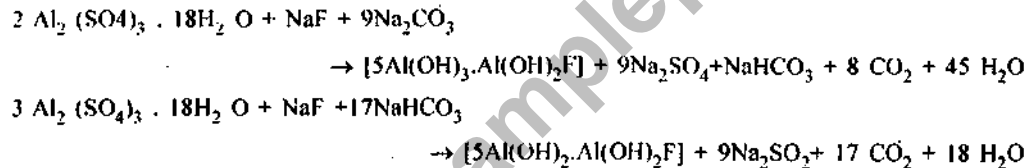
3. adaptation of ecofriendly strategies

Q.4. (c) Discuss the importance of fluoride in drinking water. Briefly discuss 'Nalgonda Technique' of defluoridation of water to control the problem of fluorosis.

Ans. Fluoride is one of the important elements which is essential for man as well as animals. Most adults ingest between 1.0 to 3.0 mg per day. The main source is drinking water which contains 1.0 ppm of fluoride will supply 1.0 to 2.0 mg per day. Defluoridation is removal of excess fluoride from water. Several methods have been suggested for removing excessive fluoride in water. The following method is based on chemical reaction

Nalgonda technique The Nalgonda technique (named after the village in India where the method was pioneered) employs flocculation principle. Nalgonda technique is a combination of several unit operations and the process involves rapid mixing, chemical interaction, flocculation, sedimentation, filtration, disinfection and sludge concentration to recover waters and aluminium salts. Alum (hydrated aluminium salts) - a coagulant commonly used for water treatment is used to flocculate fluoride ions in the water. Since the process is best carried out under alkaline conditions, lime is added. For the disinfection purpose bleaching powder is added. After thorough stirring, the chemical elements coagulate into flocs and settle down in the bottom. After stirring, the chemical elements coagulate into flocs and settle down in the bottom.

The reaction occurs through the following equations



Salient features of Nalgonda technique:

- No regeneration of media
- No handling of caustic acids and alkalis
- Readily available chemicals used in conventional municipal water treatment are only required
- Adaptable to domestic use
- Applicable in batch as well as in continuous operation to suit needs
- simplicity of design, construction, operation and maintenance
- Local skills could be readily employed
- Highly efficient removal of fluorides from 1.5 to 20 mg/L to desirable levels
- Simultaneous removal of colour, odour, turbidity, bacteria and organic contaminants
- Normally associated alkalinity ensures fluoride removal efficiency
- Sludge generated is convertible to alum for use elsewhere
- Little wastage of water and least disposal problem
- Needs minimum of mechanical and electrical equipment
- No energy except muscle power for domestic equipment

Q.5. (a) Enumerate various types of pollutants that cause pollution of water bodies. Also discuss how water bodies can be saved from ill-effects of uncontrolled discharge of wastewater into them.

Ans. The source and pollutant that cause the pollution of the water bodies

(i) **Sewerage and domestic waste water** these have mainly human and animal excreta, paper, soap, detergent, dust, dirt, oil, rotten vegetables etc.

(ii) **Industrial waste** chemical like tanneries, colour industries, petrochemical industries, thermal power plants, nuclear plants that produce waste water that may have Hg, Pb, Na, Cu, Cr, Cd and other heavy metals. Industrial waste water may also have oil, grease, and plastics, metallic waste suspended solids, phenols, acids, cyanides and DDT etc.

The quality of water will be affected adversely by the addition of these pollutants

(iii) **Agricultural Discharge** these have mainly fertilizers, pesticides, herbicides, weedicides. That may mix with the fresh water through irrigation, rainfall, drainage etc. and causes water pollution.

Remedial Measures to save the water bodies from pollutant waste water must be treated to remove the contaminants before discharging them in to river or other fresh water bodies.

Treatment method:

Primary treatment : that is also called mechanical treatment that have been done by screening, comminuting, grit removal, flocculation, floatation, sedimentation, neutralization and lime stone treatment and caustic soda treatment.

Secondary Treatment By using activated sludge process, trickling filters.

Tertiary Treatment: By removing the dissolved impurities which are present in waste water. It includes controlling of BOD, COD and disinfection process.

Q.5. (b) Discuss how switching over to a low carbon economy can help in our efforts towards fighting against the problem of 'global warming and climate change.'

Ans. Switching over to a low carbon economy can help in our efforts towards fighting against the problem of global warming and climatic change because Carbon is the main cause for global warming. The amount of total warming produced by the compound having carbon is very large.

The following diagram shows the components and contribution in global warming CO₂ 49%, CH₄ 18%, CFC's 17%, N₂O 6% and others 10%. So the total global warming produced by the carbon substance is 84%. So if we will reduce carbon dependency so definitely the above carbon substance will be reduced and hence the problem of global warming will be minimized.

Q.5. (c) Discuss the environmental aspects of animal husbandry.

Ans. Animal Husbandry:

(i) Nuisance and foul odor

- (ii) Disease due animal manure and urine
- (iii) water born disease due to stagnant water ponds means for livestock
- (iv) Degradation of surface and ground water due to disposal of organic waste and liquid effluents of live-stocks
- (v) Soil degradation due to excess harvesting of fodder and removal of the ground vegetation, trampling etc.
- (vi) Degradation of ecosystem due to destruction of forest for want of foddors and food.
- (vii) loss of biodiversity due to fast rate of species extinction
- (viii) Natural genetic characteristics are lost due to selective breeding.

Q.6. (a) Discuss the problem of 'ozone layer depletion' and present a summary of international efforts taken up so far to address the problem.

Ans. Electro-Magnetic Radiations coming from the sun are chiefly constituted by visible rays and UV-Rays. Visible rays reach the earth surface, while UV-rays are largely banned by ozone layer. There are three categories of UV radiation: UV-A (320-400 nm), UV-B (280-320 nm) and UV-C (200-280 nm).

- Out of these UV-A is the least damaging (longest wavelength) and reaches the Earth in greatest quantity. UV-B and UV-C radiations are most harmful to living beings. Most of these are absorbed by oxygen and ozone in the stratosphere, so they do not reach the Earth's surface.
- Due to depletion of ozone layer, UV rays (particularly UV-B) reach the earth surface and causes harmful effects like skin cancer, eye sight defect (eye cataract) and genetic disorder (DNA-damage) in man, animals and plants.

Ozone layer: natural formation and destruction:

- Ozone is created in the stratosphere by photolysis of oxygen in presence of UV radiation:
 - $O_2 + \text{UV-Rays (180-240 nm)} \rightarrow O + O$ (oxygen free radicals)
 - $O_2 + O \rightarrow O_3$
- Ozone is again broken down in oxygen by UV radiation:
 - $2O_3 + \text{UV-B Rays (200-300 nm)} \rightarrow O_2 + O$
 - $O_3 + O \rightarrow 2O_2$

These reactions absorb UV Rays (99% of UV-C, 50% of UV-B and little of the UV-A) and stops them from reaching to earth surface.

Scientists also found that ozone levels change periodically as part of regular natural cycles such as the changing seasons, sun cycles and winds.

At different temperatures and pressures (i.e. varying altitudes within the stratosphere), there are different formation and destruction rates.

International Efforts:

- Since 1970s, when ozone depleting effect of CFCs was discovered, worldwide scientists and policy makers started searching solution to this problem.
- It was concluded that in order to stop ozone layer depletion, use of ozone depleting chemicals has to be stopped or phased out.
- In this respect Montreal Protocol was agreed on 16 September, 1987. As a result of this, CFCs and other ozone depleting chemicals have been sequentially phased out by developed countries. Developing countries will be following this after a lag of about one decade.
- In order to spread awareness regarding saving ozone layer, 16 September is celebrated as "World Ozone Layer Day" every year.
- In developed nations, CFCs is gradually being replaced by the less damaging Hydro-chloro-fluoro-carbons (HCFCs) and Hydro-fluoro-carbons (HFCs).

Q.6. (b) Briefly discuss the problem of automobile pollution and suggest suitable ways and means to control it.

Ans. Emission from vehicles is responsible for more than 55% of air pollution. It accounts for about 60% of total CO emission, about 40% of total NO_x and hydrocarbon emission, about 20% of particulate matter and 5% of SO_x emission.

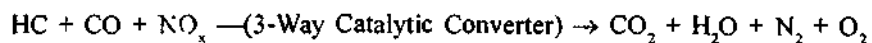
Sources and control measures

There are three major sources of emission in a motor vehicle. Brief description of emission process and related control measures are discussed below:

Crankcase emission: It accounts for about 20% of automobile pollution. This emission takes place when fuel mixture leaks from the walls of piston cylinder during expansion & compression in the process of internal combustion. The gases leaked in this way can be recycled by applying Positive Crankcase Ventilation (PCV).

Evaporative emission: It also accounts for about 20% of automobile pollution. It takes place as a result of spillage and evaporation of fuel in oil tank and carburetor. It can be prevented by using sealed fuel tank cap, overfill protector and adsorbing fuel vapour by carbon canister devise.

Exhaust emission: It accounts for about 80% of the automobile pollution. Exhaust gaseous emission consists of CO₂, CO, NO_x, Hydrocarbon (HC) and water vapour. Of these CO, NO_x, and HC are quite harmful. Hence they are converted to their less harmful forms, i.e., CO into CO₂; NO_x into N₂ and hydrocarbon (HC) into CO₂ and H₂O. This process is called catalytic conversion, for which metallic catalysts like Platinum and Rhodium are used (in three way catalytic converters).



The catalytic converter efficiently reduces the amount of these pollutants in the exhaust mission.

Emission Norms: Emission norms are prescribed CO (Carbon Monoxide), HC (Hydrocarbons) and NO_x (Nitrous oxide) levels set by the government which a vehicle would emit when running on roads. All the manufacturers of vehicles need to implement these norms.

Q.6. (c) Discuss the role of government in environmental protection highlighting legislative and legal aspects.

Ans. Major roles of government for environmental protection includes (for example in India):

- Making environmental laws/policies and implementing them
- Conserving forests, wildlife and different natural resources through institutional framework
- Monitoring pollution levels across the country through Pollution Control Boards
- Conducting large scale pollution control programs (e.g., Ganga Action Plan, Yamuna Action Plan)
- Running municipality, sewage system, solid waste dumping etc. for disposal of urban waste
- Promoting environmental education at all levels (at schools, colleges and universities) and promoting research and development in environmental field
- Creating awareness among public for their participation in environmental protection

LEGAL ASPECTS (OF ENVIRONMENTAL PROTECTION): Legal aspects include different environmental laws and their implementation.

Worldwide, a number of countries have well defined environmental laws to protect their environment. Countries like Sweden, the Netherlands, Canada, the USA, the UK, Australia and New-Zealand are very active to implement environmental laws.

India is the first country in the world which has provision for environmental protection in its constitution (Article 48-A and Article 51-A of the Constitution of India). These acts identify environmental conservation as one of the fundamental duties.

In India, there are more than 200 central/state laws for environmental protection. These are related to different aspects of environment. Some laws are widely applicable while others are limited to certain areas/zones/regions.

Objectives: Environmental laws help environmental protection in the following ways:

- Guidance for resource use and checking their overexploitation
- Regulating pollution and defining limits
- Resolving conflicts related to environment
- Punishing or imposing penalty on the violators of laws

Major Environmental Laws

Five major environmental laws are:

- Environment (Protection) Act, 1986
- Air (Prevention and Control of Pollution) Act, 1981
- Water (Prevention and Control of Pollution) Act, 1974
- Wildlife (Protection) Act, 1972
- Forest (Conservation) Act, 1980

Q.7. (a) Explain how the initiatives taken by Non-governmental organizations are helpful in creating the public awareness and implementation of environmental protection programmes.

Ans. A Non-Governmental Organization (NGO) is a legally constituted body, created by people, with no participation of government (particularly at management level).

- NGOs are often non-profit making (non-business oriented) units and they operate on the funds/donation given by the government, international agencies or business houses etc.
- NGOs are generally created when a group of people come together to take initiatives for a new work which is valuable for the general society or at least for a certain community. However, they get a formal NGO status only after registration (under Society Registration Act 21, 1860 in India).
- NGOs often work for social cause including environmental conservation. They particularly work in the areas which are not adequately served by the government or the corporate.

Environmental NGOs: Functions:

- Major work areas of Environmental NGOs (often called as ENGO) are:
 - Promotion of environmental education
 - Campaigning for eco-friendly lifestyle and conservation
 - Raising protest against anti-environment activities or projects
 - Community mobilization to ensure their participation in environmental programs
 - Providing training related to environmental conservation and livelihood to common people
 - Running projects on conservation of forest, wildlife, biodiversity and other natural resources
 - Promotion of renewable energy resources

Prominent NGOs at International and National Level

- Some prominent International NGOs working for environment are:

- World Wide Fund for Nature (WWF): Switzerland
- Greenpeace: Canada
- Conservation International (CI): USA
- The Nature Conservancy: USA
- Some prominent Indian NGOs working for environment are:
 - Bombay Natural History Society (BNHS)
 - Centre for Science and Environment (CSE)
 - Centre for Environmental Education (CEE)
 - Development Alternatives
 - Kerala Sastra Sahitya Parishad
 - Kalpavriksh
 - Narmada Bachao Andolon
 - Tarun Bharat Sangh
 - Vatavaran

Q.7. (b) Discuss the importance of 'women education' for the success of the schemes relating to environmental quality management and public health.

Ans. Historically, women have been discriminated due to their physical vulnerability, cultural reasons, lack of education and male domination in most of the societies. Certain facts supporting this are:

- In India Sati system, dowry system and different customs and religious codes have restricted the liberty of women since long.
- Women's participation in different profession has been generally less than that of men. However, the situation is improving day by day.
- The significant steps toward women education or empowerment are:
 - The 86th constitutional amendment has made elementary education a fundamental right for the children (both boys and girls) between the age group of 6 to 14.
 - Ministry of Human Resource Development (Department of Education), Ministry of Tribal Welfare, and Ministry of Social Welfare have launched a number of schemes to promote women education and their empowerment.
- Measures to promote girls education include creation of girls' hostels, provision of scholarships and other financial support, and preference in admission in schools, colleges and universities.
- Women education is highly relevant for environmental conservation and public health. Some of the arguments supporting this fact are:

- Women play major role in regulating household consumption pattern. If the woman is aware, she can save electricity, conserve water, minimize use of polythene, safely dispose household wastes, and as a consumer can give preference to clean/ecofriendly market products.
- Women are the best teacher for kids and play key role in their upbringing. If the woman is educated or aware, she can give long-lasting lessons, values, habits or culture of caring the environment to her kids.
- Awareness about hygiene and sanitation must be created among public so as to control water borne or similar contagious diseases.
- Healthcare programs must cover both urban and rural areas. Environmental condition must be taken into account while making disease control programs.
- Among tribal people and poor sections of society, women play almost equal role in earning livelihood. But women remain more backward in terms of education. There is need to make them aware so that they can contribute in saving natural resources as well as maintaining hygiene or cleanliness in their nearby environment.
- There are a number of case studies of HIGH ENERGY WOMEN LEADERS who have been great change-makers in our history. Women leaders like Gaura Devi, Medha Patekar, Vandana Shiva, Menaka Gandhi, Indira Gandhi, Sunita Narayan have significantly contributed for environmental protection. The humanity could not have enjoyed the fruits of their struggle if they too have remained restricted, uneducated or unaware like millions of other women.

Q.7. (c) What is rain water harvesting? Discuss its advantages and limitations.

Ans. Rainwater harvesting is the gathering, or accumulating and storing, of rainwater. Rainwater harvesting has been used to provide drinking water, water for livestock, water for irrigation or to refill aquifers in a process called groundwater recharge. Rainwater collected from the roofs of houses, tents and local institutions, or from specially prepared areas of ground, can make an important contribution to drinking water. In some cases, rainwater may be the only available, or economical, water source. Rainwater systems are simple to construct from inexpensive local materials, and are potentially successful in most habitable locations. Roof rainwater is usually of good quality and does not require treatment before consumption.

There are a number of types of systems to harvest rainwater ranging from very simple to the complex industrial systems. Generally, rainwater is either harvested from the ground or from a roof. The rate at which water can be collected from either system is dependent on the plan area of the system, its efficiency, and the intensity of rainfall.

- Ground catchment systems
- Roof catchment systems
- Subsurface dyke
- Groundwater recharge

Rainwater harvesting in urban areas can have manifold reasons. Some of the reasons rainwater harvesting can be adopted in cities are to provide supplemental water for the city's requirements, to increase soil moisture levels for urban greenery, to increase the ground water table through artificial recharge, to mitigate urban flooding and to improve the quality of groundwater. In urban areas of the developed world, at a household level, harvested rainwater can be used for flushing toilets and washing laundry. Indeed in hard water areas it is superior to mains water for this. It can also be used for showering or bathing. It may require treatment prior to use for drinking.

Rainfall harvesting has limitations not shared by graywater use. Rainwater harvesting lacks the dependability, relying instead on the variability and vicissitudes of climate for its water source.

Also, graywater is more readily stored than rainwater, with less cost. Since it is a dependable source, its storage system does not have to be very large. A typical residence could get by with about a 1200-gallon tank, the size of the standard concrete septic tank. Being infrequent, rainfall requires a larger storage capacity so supplies can carry over between desert rainfall events.

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