ENVIRONMENTAL EDUCATION (802)

Aims:

The learner

- To develop an in-depth understanding of various environmental issues and concerns of national and global importance.
- To develop a balanced view of the relationship between environment and development.
- To understand basic concepts related to sustainable development vis-à-vis improvement of quality of life.
- To develop a deeper concern for the environment and a sense of commitment and responsibility to take proactive action.
- To appreciate the variety in living organisms and recognize India as a mega- diversity nation.
- To appreciate the role of the individual, community, national and international agencies in resolving environmental problems.
- To practice ways of bringing about qualitative improvement in the environment by assuming leadership role.
- To identify self with one's environment with an attitude to personally contribute towards its improvement.
- To respect customs and traditions related to local conservation practices and accept indigenous eco-friendly technologies.
- To develop skills to undertake and participate in investigative studies on various environmental issues; and
- To motivate others and participate in social and community activities in dealing with environmental problems.

CLASS XI

There will be two papers in the subject:

Paper I: *Theory – 3 hours ... 70 marks*

Paper II: *Practical/Project Work – ... 30 marks*

PAPER I - THEORY

There will be one paper of three hours duration carrying 70 marks.

The paper will have two Sections:

Section A *(Compulsory) will contain short answer questions covering the entire syllabus.*

Section B *will consist of questions, which will require detailed answers. There will be a choice of questions in this section.*

1. Man and Environment

(i) Dimensions of environment - physical, biological and social.

Physical environment consisting of atmosphere, hydrosphere and lithosphere – importance of each.

Biological – plants and animals and their interdependence (producers, consumers, decomposers).

Social – populations, interaction in social hierarchies, territorialism and dominance.

(ii) Human being as a rational and social partner in environmental actions.

While human beings are responsible for the present state of the environment, they are also capable of acting intelligently and finding solutions (a general understanding of the above to be provided).

(iii) Society and environment in India; Indian traditions, customs and culture – past and present.

A brief look at some past traditions and customs which reflect a close understanding of nature and care for all living beings e.g. sacred groves, johads, eris [water tanks of South India], traditional fishermen not fishing in the spawning seasons, farmers-crops and growing season in complete harmony with the local environment and seasons, etc.

Present culture marked by rapid changing society and globalisation leading to demand on natural resources.

(iv) Population and environment.

Meaning of terminologies such as population, birth rate, death rate, population growth, carrying capacity, global distribution of population and resource use patterns. Increasing populations, destructive impact on environment – idea of ecological imbalance.

(v) Impact of human activities on environment:

- environmental problems of urban and rural areas.
- stress on civic amenities; supply of water and electricity, waste disposal, transport, health services.
- vehicular emissions.
- urbanization - land use, housing, migrating and floating population
- natural resources and their depletion.

Natural resources and their depletion to be studied with respect to land, water and air.

A close look at each of the above, with specific examples from the Indian context.

2. Environment and Development

(i) Economic and social needs - as basic considerations for development.

Concept of economic and social development; Economic - by the rise of per capita income, industrial and technology development; social – by education, health, sanitation, social services.

Factors affecting economic and social growth – a list only.

(ii) Agriculture and industry as major sectors of development.

Understanding the role of agriculture in economies – providing food security, adequate nutrition to the population, preserving biodiversity.

Understanding the role of agriculture in the economic development of India.

Role of industry in the overall growth of the country, the need to give importance to different kinds of industries e.g. cottage industry ensures that traditional artisan skills are not lost. It also provides employment to a number of people. Impact of industrial growth on agriculture – agribusiness.

(iii) Social factors affecting development - poverty, affluence, education, employment, child marriage and child labour; human health - HIV/AIDS, social cultural and ethical values.

Self-explanatory.

(iv) Impact of development on environment - changing pattern of land use; land reclamation, deforestation, resource depletion, pollution and environmental degradation.

Rural – forests being cut down for converting to farmland and cropland being used for urban settlements and industries.

Urban – small dwellings being converted into multi-storeyed complexes, parks and green belts being removed, municipal facilities becoming inadequate.

Reclamation of desert land, water logged land for forestry, vegetation, horticulture, rice cultivation, etc.

An understanding of how development is causing resource depletion, pollution and environmental degradation.

(v) Impact of liberalization and globalization on - agriculture and industries, dislocation of manpower and unemployment, implications for social harmony.

Understanding the concept of globalisation and liberalisation. The potential of globalisation and liberalisation.

The onus of agriculture shifting from farmers to companies selling seeds and chemicals.

Impact of multinational companies on small industries - closure of industries, unemployment, dislocation of workforce. Understanding the danger of creating a disparate / inequitable society.

(vi) Role of society in development and environment - public awareness through education, eco-clubs, population education programme, campaigns, public participation in decision-making.

To look at examples of places and issues where the above mentioned programmes have worked, examples like Chipko Movement, Appiko in Karnataka, Eco-clubs, etc.

3. Environmental pollution and Global Issues

(i) Air, water (fresh and marine), soil pollution - sources and consequences.

Looking at some important sources of pollution (vehicular, industrial and municipal) and serious consequences (carcinogens in the air, heavy metals in water, Persistent Organic Pollutants [POPS] in soil). Smog, acid rain, plastics in soil, DDT.

(ii) Noise and radiation pollution - sources and consequences.

Some major sources of noise like - construction sites (cutting of marble), generators in residential units/institutions, airports, industrial grinders. Effect of noise on people working in such places and on neighbouring communities.

Dangers of leakages of radiation, e.g. Chernobyl. Outcome of atomic bombs at Hiroshima and Nagasaki.

(iii) Solid, liquid and gaseous pollutants.

Looking at examples of some major pollutants under each category [e.g. PVC, detergents, oil spills, municipal waste, plastics, garbage, CO, SO_2, etc).

(iv) Handling of hazardous materials and processes; handling and management of hazardous wastes.

Understanding what hazardous materials are. Handling and management of hazardous waste by proper disposal.

(v) Ozone layer depletion and its effect.

Ozone Depleting Substances [ODS]; effect of depletion of the ozone layer. Montreal Protocol.

(vi) Greenhouse effect; global warming and climatic changes and their effects on human society, agriculture, plants and animals.

A brief understanding of the concept Greenhouse effect. Impact of global warming in terms of climatic changes, rise in sea levels, melting of ice caps, dramatic change in ice and permafrost in Arctic and Antarctic regions; impact on animals and plants due to climate changes. Mention of Kyoto Protocol (1997) for stabilising emission of GHG (Green House Gases).

(vii) Pollution related diseases.

A few major diseases caused by pollution - Minamata disease caused by mercury poisoning, heavy metal poisoning causing diseases like Parkinson's, pollutants in air causing respiratory disorders and lung cancer, Pesticides e.g. DDT causing problems in the reproductive system, nervous system, excretory system.

(viii) Disasters - natural (earthquakes, droughts, floods, cyclones, landslides) and manmade (technological and industrial): their impact on the environment: prevention, control and mitigation.

Natural disasters. Understanding that many natural disasters are caused by human action, e.g. dams causing earthquakes, deforestation leading to landslides and droughts; industrial – Bhopal disaster; technological – Chernobyl.

Understanding that natural and manmade disasters can be dealt with through appropriate processes of management.

(ix) Strategies for reducing pollution and improving the environment.

Strategies at individual, social and governmental levels.

A regular check of SPM (Suspended Particulate Matter); pollution control strategies such as use of low pollution fuels; setting up emission standards for factories and vehicles. Waste management and recycling of waste, reduction in waste production. Water – industrial effluents should be made harmless before discharge; recycle and recovery of waste; biological treatment of some effluents.

4. Energy

(i) Changing global patterns of energy consumption - from ancient to modern times.

Looking at varied sources and uses of energy over time: Ancient times - energy from fire for metal work [forging], glass work, cooking, etc., animal and human energy for transportation and other forms of work like drawing water from wells, etc. Post industrialization - increased importance of electrical energy, different sources of electrical energy; different applications - starting from specific uses like drawing water,

lighting, powering locomotives, power for industrial equipment, etc., to eventually, society being completely dependent on electric power for its functioning.

The above to be referred to briefly.

(ii) Energy consumption as measure of quality of life.

Use of diesel/ petrol in trains, buses, cars and other vehicles; use of LPG. Energy consumption as a measure of quality of life.

(iii) Rising demand for energy, gap between demand and supply (Indian context).

Industrial sectors being given priority in supply over agricultural sectors, cities being given priority over rural areas, etc.

(iv) Conventional energy sources - fossil fuels and firewood, potential (Indian context) and limitations of each source, methods of harnessing and environmental consequences of their use.

Conventional energy sources:

Firewood – for heating and cooking along with agricultural and animal waste.

Coal - thermal power - how much coal is left? What are the issues with thermal power? (global warming, thermal pollution in waters, fly ash, atmospheric pollution, etc.).

Petroleum - petrol, diesel, LPG; non-renewable, expensive.

(v) Non-conventional energy sources - types of non-conventional sources (bio-mass, solar, wind, ocean, hydel, geothermal, nuclear), potential (Indian context) and limitations of each source, methods of harnessing and their environmental consequences, need to promote non-conventional energy sources.

Advantages and limitations of each non-conventional energy source. Methods of harnessing these energy sources and their environmental consequences. Need to promote non-conventional energy sources.

(vi) Conservation of energy sources - efficiency in production, transportation and utilization of energy.

Understanding that with suitable selection and design of equipment and production processes, tremendous amounts of energy can be saved; tremendous amounts of energy gets lost in transportation due to use of outdated technology and also due to pilfering.

Methods of saving energy: in homes and institutions - use of energy saving bulbs, usage of solar cookers, heaters, biogas pipeline, etc; in transportation – use of car pools, public transport system.

(vii) Planning management of energy; future sources of energy - hydrogen, alcohol, fuel cells, biofuels.

Understanding ways of planning energy management - looking at a few real models. Current status and future potential. ***(only for the purpose of discussion and not for testing).***

(viii) Enhancing efficiency of the devices and optimizing energy utilization.

Understanding different ways of enhancing efficiency of the devices - energy saving devices like Compact Fluorescent Lamps, designing buildings that will make best use of natural light and suited to local climatic conditions, etc.

PAPER II – PRACTICAL/PROJECT WORK

Guidelines for Practical/Project Work are given at the end of this syllabus.

CLASS XII

There will be two papers in the subject:

Paper I: *Theory – 3 hours …70 marks*

Paper II: *Practical/Project Work – … 30 marks*

PAPER I - THEORY

There will be one paper of three hours duration carrying 70 marks.

The paper will have two Sections:

Section A *(Compulsory) will contain short answer questions covering the entire syllabus.*

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1. Biodiversity

(i) Concept and value of biodiversity.

Understanding the concept of biodiversity. To appreciate various reasons for valuing and conserving biodiversity (ethical, moral, economic, aesthetic).

(ii) Types of biodiversity - species, eco and genetic.

Understanding each of the above with a few examples of each type.

(iii) Balance in nature.

Understanding the criticality of maintaining balance in nature and the consequences of interfering with natural cycles; study of an example where the balance was disturbed due to human interference, e.g. trawling and its impact on marine ecosystems. The self sustaining quality of undisturbed ecosystems.

(iv) Biodiversity for sustenance of mankind.

The various roles played by biodiversity in sustaining mankind - as a source of food, medicine, pollution control.

(v) Resource limitations.

What are the various factors that are responsible for limiting the resource availability /consumption.

(vi) Ecological role of biodiversity.

Understanding that each and every species plays a unique role in the functioning of an ecosystem, the concept of ecological niche (producers, consumers in the food chain and food web).

(vii) Interdependence between different species.

A basic understanding of different kinds of relationships – predation, competition, symbiosis, mutualism, commensalism, parasitism.

(viii) India as a mega diversity nation.

Appreciating that India with its varied climate and landscape is home to a variety of unique ecosystems and endemic species e.g. the largest mangrove forest in the world - the Sundarbans, vast mountain forests in the Himalayas, tropical evergreen forests in the western ghats and the north east region, desert vegetation in Rajasthan, thorn and scrub forests in the plateaus, etc.

(ix) Economic potential of biodiversity.

Evaluating the economic potential of biodiversity from several view points such as food, medicine, clean air, water, etc.

(x) Loss of biodiversity - threatened, endangered and extinct species.

Understanding the implications of loss of biodiversity.

Categorizing species in different groups like - threatened, endangered and extinct. Examples of plants and animals.

(xi) Strategies for conservation of biodiversity - insitu and exsitu.

Looking at various in-situ and ex-situ strategies for their efficacy and viability. In-situ - protected areas (biosphere reserves, national parks, wildlife sanctuaries).
Ex-situ - captive breeding, zoo, botanical garden, gene banks.

(xii) Mitigating people- wild life conflict.

Evolving strategies to mitigate people-wildlife conflict, especially for the communities staying close to forests or even within forests - fences or trenches around communities, building waterholes within forests, providing food for animals during times of drought to prevent them from straying outside the forest areas, maintaining a buffer zone between forest and human habitation, preventing human encroachment into forests. Preventing poaching by creating or increasing livelihood opportunities, involving local people in conservation by providing suitable incentives.

2. Environmental Management

(i) Need for environmental management vis-à-vis development.

Understanding that from the development point of view, environment may mistakenly be seen as a 'resource' to be exploited, whereas, environment needs to be viewed as a 'capital' that needs to be managed carefully.

(ii) Aspects of environmental management - ethical, economic, technological and social.

Understanding different aspects of environmental management as mentioned above.

Ethical - e.g. ensuring inter and intra generational equity, gender equity, etc.

Economic - e.g. Extended Producer Responsibility [EPR] taken up by companies in several countries - the producer of a product takes responsibility for the product after its life is over e.g. battery companies taking back batteries after its life.

Technological - developing technologies that do not harm the environment - alternate technology products like solar cooker, solar car, biogas, etc.

Social - processes and policies that ensure social equity - use of commons and forests, urban land use, equitable representation and participation in local governing bodies.

(iii) Legal provisions for environmental management.

Understanding the role of legal provisions like – The Environment Impact Assessment [EIA] Notification; The Hazardous Waste (Management and Handling) Rules (1989), The Hazardous Bio-medical Waste (Management and Handling) Rules (1998), the Recycled Plastic Manufacture and Usage Rules (1999), The Ozone Depleting Substances (Regulations) Rules 2000. Ecomark scheme, Bharat standard for vehicular emissions.

Students are expected to be aware of existence of these Rules and the role they play in environmental management. They are not required to go into details of the Rules.

(iv) Approaches for environmental management - economic policies, environmental indicators, setting of standards, information exchange and surveillance.

Emphasis on ENVIS, ISO14000 and Environmental Indicators. Economic policies implemented by the government of India such as, penalties and subsidies.

3. Sustainable Development

(i) Concept of sustainable development.

Understanding the concept of sustainable development.

(ii) Concept of sustainable consumption.

Understanding the concept of sustainable consumption.

(iii) Need for sustainable development for improving quality of life for the present and future.

Developing an understanding of the need for sustainable development - looking at the deteriorating quality of air, water, food over time, developing an appreciation to sustain at least what exists for the generations to come.

(iv) Challenges for sustainable development - social, political and economic considerations.

Listing and understanding the challenges in each of the areas mentioned above, e.g. social - having to overcome resistance among people in the society to bring about changes in lifestyle (that will be needed for sustainable development to happen); political - to convince the Government to take hard unpopular decisions; economic - need for a change in economic viewpoint in order to implement sustainable development.

(v) Support base for sustainable development - political and administrative will, dynamic and flexible policies, appropriate technologies, comprehensive review and revision mechanism, humane approach.

Understanding the need for a support base. Study a few noteworthy examples of sustainable development e.g.- Barefoot College in Tilonia, the work of NGOs like DDS in Andhra Pradesh in promoting self-sustenance in rural communities through developing seed banks, cultivation of millets and through promoting microfinance in the Grameen bank model.

(vi) Developing skilled manpower.

Understanding that there is a need for skilled manpower in the fields of agriculture and industry in order to carry out sustainable development.

(vii) Role of individual and community.

Self explanatory. An example from the local community to be studied along with an inspiring story from across the country. ***(only for the purpose of discussion and not for testing).***

(viii) Role of national and international agencies. (both governmental and non-governmental).

Understanding the role of agencies in creating awareness, framing policies, implementing laws and mobilising people.

4. Sustainable Agriculture

(i) Need for sustainable agriculture.

Understanding that modern agriculture is causing increasing amounts of land to be desertified, through the need to produce ever increasing quantities of food to feed the growing population.

To understand that on the one hand the demand for food is increasing due to population growth and on the other hand the land available is decreasing due to the impact of modern chemical farming.

(ii) Green revolution - impact on environment.

Introduction to Green revolution - Development of High Yielding Varieties (HYV); introduction of fertilizers and pesticides; consequences of using fertilizers; consequences of using pesticides on population of living organisms; contamination of soil, water, food, impact on human health; long term effects - increased incidence of cancer, malfunctioning of endocrine system, etc. Study of the impact of DDT.

(iii) Importance of soil for crops.

Role of soil biota in maintaining health of soil.

(iv) Irrigation systems, use of manure and fertilizers.

The role of irrigation in traditional agriculture. Traditional irrigation systems (micro, indigenous systems) vs. modern systems like large dams with their vast canal systems. Advantages of such macro systems, (like larger areas of cultivation) and disadvantages (like water logging).

(v) Crop protection - measures for control of pests– agrochemicals.

Study of a few traditional methods of pest deterrence vis a vis modern methods of pest control - viability of traditional methods in today's scenario and limitations and dangers of modern methods.

Role of agrochemicals in increasing food production.

(vi) Impact of agrochemicals on environment.

Study of a few commonly used agrochemicals and their impact on soil, water and air.

(vii) Elements of sustainable agriculture -mixed farming, mixed cropping, crop rotation, biological and economic consideration, use of

bio-fertilizers and bio-pesticides, biological pest control, integrated pest management.

Self-explanatory.

(viii) Application of biotechnology in crop improvement.

The scope biotechnology offers in developing favourable traits in crops, like pest resistance, drought resistance, salinity resistance.

(ix) Management of agricultural produce - storage, preservation, transportation and processing.

Understanding the dynamic of movement of agricultural goods from producers to consumers - understanding that tremendous amount of grain is lost to rats and spoilage due to poor storage facilities; food processing increasingly seen as a favourable option as it has a larger shelf life and brings about more revenue.

PAPER II – PRACTICAL/PROJECT WORK

Classes XI and XII

The practical/project work carrying 30 marks needs to be undertaken under the guidance of the teacher. The project will be evaluated by a Visiting Examiner (who has specific expertise in the content of the project work) appointed locally and approved by the Council.(For Class XI, Project Work may be evaluated by the teacher).

Exemplar Projects and Activities

It is expected that the students will undertake at least two projects or activities in each year, one of which should be undertaken individually and prepare a report in each case. Projects and activities may be planned and designed depending upon the local situations, available resources and environmental issues of concern. The projects and activities given below are only suggestive and not prescriptive.

1. To study the changes that have taken place in a given land area of a city/village/locality/market during the last five years in respect of at least five parameters like number of houses, residents and families, food habits, number of household goods in a family, consumption of water, electricity and fuels including that for personal vehicles by a family, sources of noise (public address systems being used, television, radio and vehicles on the road), common facilities like number of schools, hospitals, shops, theatres, public convenience, public utilities, public transport; number of factories, industries and/or the facilities for, production and processing of goods, loss of water bodies, types and quantity of wastes, their disposal and treatment facilities with a view to discussing the patterns of changes and impact on the environment and quality of life. A specific project on these aspects may be:

- To study the changes that have taken place in a given land area during last five years in respect of number of houses, residents and families and prepare a report on their effects on civic amenities like availability of water, electricity and fuels; drainage-system, disposal of wastes including night soil.

2. To study the environmental profile of a town/locality/village in respect of population density, green cover, educational level of residents, social problems and sources of pollution and their effect on air, water and soil.
3. Improvise two models of greenhouses of same dimensions made from low cost / no cost materials. Place them in open under identical conditions and put some potted plants in one of them. Note the temperature inside and outside both the greenhouses every two hours from dawn to dusk for two weeks. Explain the reasons for the differences in temperature, if any, between the two green houses.
4. Collect data on monthly consumption of electricity and fuels from at least five families, any two commercial establishments and for public utilities in a given locality. Plan strategies to educate consumers to economize the consumption of electricity and fuel by reducing their over use, misuse and improper use.
5. To study for a period of one month the status of sanitary conditions and methods of waste disposal of a given locality vis-à-vis the role of Panchayat, Municipality or Corporation and prepare an action plan to make the conditions more environment friendly.
6. To investigate impact of an industry or a large manufacturing unit on local environment. The parameters could be land use, ratio of covered area and open space, raw materials used for production, inputs like electricity, water or any

other, types of waste generated and modes of waste disposal, use of environment friendly and efficient technology, types of pollutants emitted or discharged, average health status of the employees and residents in the area.

7. To study the impact of changes in agricultural practices or animal husbandry including poultry, piggery, fishery, apiculture over a period of time in a given locality or village on local environment. The components for analysis may include: types of crops, land area under cultivation, mechanization, use of electricity, mode of irrigation and agrochemicals, agro-wastes and their disposal, types of breeds and animal feed, types of shelter and health care, methods of preservation and processing of products, animal wastes and their disposal. Suggest an action plan to modify the prevailing practices so as to make them environment friendly and sustainable.
8. Collect samples of water from different sources and study their physical characteristics like turbidity, colour, odour; measure of pH, nature of suspended and dissolved impurities and pollutants, presence of toxic materials by testing presence of mercury, lead, arsenic, fluorine and presence of living organisms. Test the presence of toxic materials and living organisms with the help of local laboratory or institution may be taken, if available. Identify the most polluted sample of water and locate the sources of its pollution. Devise an action plan to mobilize public opinion for checking the pollution.
9. To study the practices followed in the region for storage, preservation, transportation and processing of perishable or nonperishable farm products and to assess the extent of wastage due to faulty practices.
10. To study the status of an endangered species listed for the region by collecting information through different sources and observation, if possible and to assess the reasons for its diminishing number. Suggest ways and means to protect the species.
11. To prepare a status report on prevalence of child labour in a given area through simple surveys on children engaged as domestic help and as workers in farms, commercial establishments and manufacturing units. The survey may be in respect of age group, education, wages, working hours, working conditions, safety in work place, health, handling hazardous materials and the like. Units dealing with hazardous materials and processes may be identified and an action plan to mobilize public opinion against practice of child labour may be prepared.
12. Conduct a survey of plants and trees in the locality and collect information about their cultural, economic and medicinal values from local people and available literature. Prepare an action plan for the propagation of trees that are most valuable in terms of their cultural, economical and medicinal use.
13. Prepare a flow chart to show different steps involved in the supply of tap water from source (river, bore well) to houses in the locality. Collect information from the concerned authorities about the quantity of water processed and the amount of energy required at each stage. Compute the energy spent for supplying 1 kilolitre of water to the consumer. Plan and execute a campaign to educate the community members about the implications of wastage of water in terms of energy.
14. Make a list of raw materials used by the family for preparing different types of dishes. Identify the plants and animals and their parts from which each food material is obtained. Also make a list of plants on which the animals in the list depend for their food. Name the processes, if any, in which action of microorganisms is made use of. Identify those plants and animals, which are found in the locality. Prepare a report supported with diagrams/photographs/pictures/graphs to focus on the importance of biodiversity in providing food to human population.

NOTE: No question paper for practical work will be set by the Council.