

# ENVIRONMENTAL SCIENCE (877)

## 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 written paper of three hours duration carrying 70 marks divided into two parts.

**Part 1 (20 marks)** will consist of **compulsory** short answer questions from the entire syllabus.

**Part 2 (50 marks)** will be divided into three sections. Each section will consist of **three** questions. Candidates will be expected to answer **five** questions choosing at least **one** from each section.

### SECTION A

#### 1. Modes of Existence

- (i) Modes of existence and resource use: hunting - gathering; pastoral; agricultural; industrial.

*Modes of existence and resource use: hunting - gathering; pastoral; agricultural; industrial. Two features defining each mode of existence.*

- (ii) Their impact on natural resource base: energy resources; material resources; scale of catchment; quantity of resources used.

*Impact of each mode on the available natural resources.*

- (iii) Their social organisation: size of group; kinship; division of labour; access to resources.

*Self-explanatory.*

- (iv) Their ideology and idiom of man-nature relationship.

*Self-explanatory.*

- (v) An appreciation of the coexistence of all four modes of existence in contemporary India.

*Self-explanatory.*

- (vi) Ecological conflicts arising therein.

*Self-explanatory.*

#### 2. Ecology

- (i) Concept of an ecosystem: definition; relationships between living organism, e.g. competition, predation, pollination, dispersal, food chains, webs; the environment - physical (soil, topography, climate); biotic - types of relationships (competition, mutualism, parasitism, predation, defence); soil types and vegetation; co-evolution and introduction of species.

*Definition of ecology and ecosystem. Structure of an ecosystem: biotic and abiotic components.*

*Trophic relationships: food chains and food webs. Biomagnification and bioaccumulation of toxic wastes.*

*Relationships between living organisms: competition, predation, mutualism, parasitism, commensalism. Examples of each type.*

*Coevolution - Definition and types with examples.*

- (ii) Habitats and niches: Gause's competitive exclusion principle; resource partitioning.

*Definition and a basic understanding of the above.*

- (iii) Flow of energy: efficiencies - photosynthetic - trophic - assimilation - production; trophic levels; generalised model of the ecosystem; ecological pyramid (numbers and biomass); food webs.

*An understanding that a small fraction of the sun's energy is captured by the primary producers and thereafter, at every trophic level, assimilation efficiency reduces. Pyramid of flow of energy.*

- (iv) Nutrient cycles: generalised model; a study of carbon, nitrogen cycles (biological and geological); man's intervention; pollution as disruption of these cycles; ecosystem as a source of material and sink waste for human societies; ecological succession - causes

(autogenic and allogenic) - patterns of successions.

*An understanding of hydrological, carbon, nitrogen and phosphorous cycles showing the linkages between the biotic and abiotic elements (An understanding that different species thrive under different conditions – a basic understanding of the Law of Tolerance).*

*Definition of Ecological succession. Classification as primary and secondary. Causes (autogenic and allogenic). Understanding of the stages of succession.*

### 3. Pollution

(i) Disruption of nutrient cycles and habitats: atmospheric pollution; human activities that change the composition of the atmosphere; connection between pollution and development; local and global effects (greenhouse effect, ozone depletion) and their impact on human life; burning of fossil fuel products - effect on ecosystem and human health.

- *Air pollution: definition and causes.*
- *Human activities that disrupt hydrological, carbon, phosphorus and nitrogen cycles. The effects of these disruptions. An understanding of how developmental activities lead to air pollution. A few examples at local and global level.*
- *An understanding of greenhouse effect. Human sources of greenhouse gases. Explanation of the local and global effects of:*
  - *burning fossil fuel products (any two)*
  - *global warming with particular reference to the ecosystem, human health, sea level, biodiversity and forests.*

(ii) Pollution control approaches - prevention and control: as applied to fossil fuel burning; the role of PCBs; industrial pollution control - principles - devices - costs - policy incentives; combating global warming.

- *Need for pollution control. Pollution prevention and control measures – Role of Pollution Control Boards; one example of a PCB in a metropolitan city.*

- *Approach: correction at source (prevention), pollution cleanup – study of any two common devices. [As applied to fossil fuel burning]*
- *Industrial pollution: removal of particulate pollutants (cyclone collector, electrostatic precipitator) – removal of gaseous pollutants by wet dry system.*
- *Indoor pollution: Common pollutants, sources and effect.*
- *Subsidies and incentives for green automobiles, green architecture, green energy and green technology in the Indian context.*
- *Problems related to combating global warming – lack of international cooperation, long term issue, effect not uniform, impact on lifestyle and economy as a reason for resistance.*

(iii) Water pollution: water cycle; pollution of surface water, ground water, ocean water; industrial pollution and its effects; soil pollution - sources - effects.

- *Definition of water pollution.*
- *Understanding water cycle.*
- *Causes of pollution of surface, ground and ocean water and their effects. Point and non-point sources of water pollution.*
- *Difficulty in dealing with ground water pollution.*
- *Industrial pollution – heat and radioactive substances and their effects – early hatching of fish eggs, failure to spawn, decrease in species diversity, migration of aquatic forms.*
- *Soil pollution – sources, effects and mitigation.*

## SECTION B

### 4. Legal Regimes for Sustainable Development

(i) National legislative frameworks for environment protection and conservation; survey of constitutional provisions (including

directive principles); national laws; state laws in India.

- *Constitutional provisions- the Article 48A and 51 A of Directive Principles of State Policy. 73<sup>rd</sup> and 74<sup>th</sup> constitutional amendment act (Main objectives of the above).*
- *Legislative framework:*
  1. *Environmental Protection Act 1986.*

*The Bhopal Gas Tragedy and how it influenced Environmental Legislation in India – The passing of an Umbrella Environmental Legislation - The Environmental Protection Act 1986;*
  2. *Forest (Conservation) Act 1981;*
  3. *Wildlife Protection Act 1972;*
  4. *Biological Diversity Act 2002;*
  5. *Water (Prevention and Control of Pollution) Act 1974;*
  6. *Air (Prevention and Control of Pollution) Act 1981.*

*Two main objectives of each of the above Acts to be studied.*

- (ii) International institutions (UNEP, UNCTAD, WHO, UNDP, etc.); international initiatives (Earth Summit, Agenda 21).

*International institutions (UNEP, UNCTAD, WHO, UNDP, etc.); international initiatives (Earth Summit, Agenda 21) – a brief understanding of their role in environmental protection.*

## 5. Technology and Environment

- (i) Interaction between technology, resources, environment and development; energy as a binding factor; the need for reorienting technology.
- *Definition of technology and its impact on natural resources.*
  - *Understanding the difference between appropriate and traditional technology.*
  - *Industrial revolution - genesis of ongoing technological revolution leading to development and degradation of*

*environment. Dependence on energy for all development.*

- *How technology can be used to generate a more equitable use of resources and build environmental sustainability.*
- (ii) Renewable energy: limitations of conventional sources; sources of renewable energy and their features (solar, wind, biomass, micro-hydel and muscle power).

*Limitations of conventional sources of energy such as - coal, natural gas and oil (extraction, transportation, storage, pollution and degradation of environment).*

*Renewable Energy: What is renewable energy; sources of renewable energy, their features and uses: biomass, solar energy, wind energy, hydel energy, geothermal energy – advantages and disadvantages of renewable energy sources.*

- (iii) Health: incidents of disease as an indicator of the health of the environment; prevention of diseases by better nutrition, sanitation, access to clean water, etc.; communicable and non-communicable diseases; techniques of low cost sanitation; policy and organisation to provide access to basic health service for all; the role of traditional and local systems of medicine.

- *Diseases as indicators of health of the Environment: Malaria – standing water, felling of trees. Enteric diseases – contaminated water. Respiratory diseases – air pollution.*
- *How diseases can be prevented by better nutrition, sanitation and access to clean water.*
- *Role of sanitation, water supply, good nutrition in maintenance of health and prevention of diseases: Prevention of deficiency diseases and water borne diseases.*
- *Definition of communicable and non-communicable diseases.*
- *Communicable diseases: HIV/AIDS, Tuberculosis, Malaria, Hepatitis as*

*examples. Causative agents, transmission and prevention of each of the above.*

- *Non communicable diseases: Cardiovascular disease, diabetes, skin cancer, scurvy and rickets (mal nutrition), and Chronic Obstructive Pulmonary Diseases (COPD)- causes related to environment and lifestyle.*
- *Some techniques of low cost sanitation, eg. Decomposition system (pit latrine and ventilated improved pit latrines) and Dry sanitation method.*
- *Organization of health services in India. Facilities provided by the government for basic health services in India (to be covered briefly).*
- *A brief introduction to traditional systems of medicine, e.g.: ayurveda, unani and local health traditions. Their role in maintaining health of the community.*

(iv) Biotechnology: potential; limitations.

- *Explanation of the term “Biotechnology”.*
- *Use/potential of Biotechnology in the field of medicine, industry, manufacturing and agriculture.*
- *Any **five** limitations of biotechnology application.*
- *Bioremediation.*

### SECTION C

#### 6. Design and Planning for Environmental Conservation and Protection

- (i) Human environment interactions: quantity of life vs. quality of environment; environmental issues and problems; role of belief and values; analysing brief statements for underlying values.
  - *Understanding the state of the environment and the major environmental problems of the 21st century.*

- *The role of beliefs and values in creating maintaining and solving environmental problems.*

(ii) Evaluation and assessment of impacts: approaches and techniques of environment and social impact assessment; environment impact assessment as a planning tool and a decision making instrument; interpreting environment impact assessments.

- *Definition and objectives of ‘Environment Impact Assessment’ (EIA).*
- *EIA framework –*
  - *Necessity- screening*
  - *Key issues- scoping and focusing*
  - *What to study – assessment*
  - *Impact/ identification/evaluation of significance – evaluation*
  - *Identification of mitigating means – mitigation*
  - *Report preparation – documentation*
  - *Reviewing - monitoring*

*[Interpret the EIA as a good planning and decision making tool].*

(iii) Design of solutions: generating solution options; overcoming blocks in thinking; generative and lateral thinking.

*Self-explanatory.*

*To be taught through case studies only. Students should be encouraged to think creatively and develop solutions for environmental problems. (For better understanding, not for testing).*

### PAPER II - PRACTICAL/PROJECT WORK

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