

## ENVIRONMENTAL SCIENCE (877)

### Aims:

1. To help the student appreciate man's place in the natural systems.
2. To provide a wide understanding of knowledge resources relevant to environment protection and conservation.
3. To provide an in-depth study of certain environment related areas.
4. To place environmental concerns in a technological, social, political and economic context.
5. To provide a context for understanding the role of individual values in conservation.
6. To provide a context for the individual student to reflect on his/her beliefs and values in relation to the environment.
7. To provide an opportunity to acquire interdisciplinary skills, knowledge and understanding and to apply this logically and coherently in the field of environmental conservation.
8. To encourage student initiative and resourcefulness in action leading to environmental protection and conservation.
9. To present environmental concerns in a challenging way and thereby encourage students to consider careers in the environmental field.

### 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. Students 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 ecological impact: land transformation; habitat; diversity; modification of biogeochemical cycles; modification of climate; substantial use.

*The scale of catchment; quantity of resources used, land transformation; impact on habitat, biodiversity, modification of biogeochemical cycles, modification of climate, substantial use to be taught only to create a better understanding and **not for testing***

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

*Self-explanatory.*

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

*Self-explanatory.*

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

*Self-explanatory.*

- (vii) 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.*

- (v) Biomes: terrestrial; fresh water; marine; a survey of the biomes of India and their inhabitants.

*Examples of Biomes - Tropical rain forests, deserts, grasslands, coral reefs, lakes. Any five biomes to be explained with reference to climate, topography, flora, fauna and their adaptations.*

## 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; the international political dimensions; third world interest; impact on economic growth.

- *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.*
- *International political dimensions – developing countries not prepared to take steps at the cost of development, demand for cheap green technology to reduce emissions.*

(iii) Water pollution: water cycle; pollution of surface water, ground water, ocean water; industrial pollution and its effects; domestic sewage and its treatment - techniques and appropriate technology; marine ecosystem protection and coastal zone management; 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.*
- *Domestic sewage treatment – primary and secondary treatment and treatment by working with nature.*
- *Protective measures taken for conserving marine ecosystems and coastal zone management.- establishment of protective marine sanctuaries, integrated coastal management, regulated coastal development, ban on dumping waste and sewage in coastal water, ban on dumping sludge in oceans, protection of sensitive areas from oil drilling, double hull for oil tankers.*
- *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 legal regimes: on trade and environment (GATT, WTO, IPR, TNC's, regional arrangements and preferential trade arrangements); on climate; on common resources (forests, bio-diversities, oceans and space); international institutions (UNEP, UNCTAD, WHO, UNDP, etc.); international initiatives (Earth Summit, Agenda 21).

*GATT: historical perspective (origin and objectives and transformation into WTO); WTO: Principles and functions (Case study of disputes, examples); IPR : Types: (a) Patents (Products vs Process), (b) Trademark, copyright, geographical indicators and industrial designs; Transnational Corporations (TNC) – definition, impact of TNC on the environment, use of resources, waste disposal, manmade ecological disaster. Case study of EXXON and BP oil spills*

*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) Technological evolution and models: hi-tech; low-tech; intermediate; appropriate; traditional; interaction between technology, resources, environment and development; energy as a binding factor; the need for reorienting technology.
- *Definition of technology, a brief overview of the evolution of technology and its impact on human societies.*
  - *Definitions of hi-tech, low-tech. and intermediate technology – their impacts 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) Ecosystem analysis: understanding complex systems; critical and state variables as system indicators; indicators of inter-relationships; successions and systems resilience; predicting and assessing system responses to impacts and their interventions; rapid appraisal methods.

- *Understanding of the term Ecosystem analysis.*
- *Composition of the ecosystem – multiple biotic and abiotic factors that influence each other. Understanding of limiting factors and zone of tolerance. Various factors which are considered as critical variables.*
- *Definition and components of state variables.*
- *Succession: primary and secondary – system resilience.*
- *What are indicator species – examples, trouts as indicators of water quality, butterflies as indicators of habitat loss and fragmentation.*

(ii) 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; issues analysis - separating symptoms from problems; problem identification; identifying the players and their positions; understanding interacting problems and identifying critical control points; problems analysis; identifying variables (human behaviours, values, ecological, etc.); determining the relationships between variables; formulating questions for research; planning research; generating problems, solution, briefs and specifications.

- *Understanding the state of the environment and the major environmental problems of the 21st century.*
- *The role of belief and values in creating maintaining and solving environmental problems.*

*A case study to be done by the students based on the following points:*

- *Identification of an environmental issue in their city/ town/ village.*
- *Identification of the factors/ people responsible for this issue.*
- *Contribution of the local authority / government to curb this problem.*

- *Identification to the critical points that have led to the problem.*
- *Urban and rural variations.*
- *Steps to be followed in doing an 'Action Research' on any environmental problem.*

(iii) 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*
- *Designing an EIA for the following:*
  - *Proposed construction of a dam (Social impact, Ecological impact).*

– *Proposed resort by the sea (Ecological impact).*

– *Proposed residential complex close to a forested area / national park in India (Ecological impact).*

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

(iv) Design of solutions: generating solution options; overcoming blocks in thinking; generative and lateral thinking; using criteria (social, political, ecological, technological, economic) to rank and prioritise solution ideas; check solutions for economic, social and technical viability; collation of solution into coherent plans; planning sequence and cost.

*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.

## CLASS XII

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### PAPER I - THEORY

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**Project work** will carry **30 marks**. The project needs to be done under the supervision of the teacher. The project work will be evaluated by a **Visiting Examiner** (who has expertise in that specific area), appointed locally and approved by the Council.

### SECTION A

#### 1. Human Beings and Nature

- (i) Modern schools of ecological thought.
- (ii) Deep ecology (Gary Snyder, Earth First) vs. shallow ecology.
- (iii) Stewardship of land (e.g. Wendell Berry).
- (iv) Social ecology [Marxist environmentalism and socialist ecology (Barry Commoner)].
- (v) Feminism.
- (vi) Green Politics (e.g. Germany and England).
- (vii) Sustainable Development.

*Modern schools of ecological thought; definition and basic understanding of Deep Ecology as opposed to Shallow Ecology; Stewardship, Social Ecology - Marxist environmentalism and Socialist Ecology, Eco feminism, Green political movements of Germany and England and Sustainable Development (basic concepts).*

*A brief look at the above in terms of definition, origin, basic principles and environmental orientations.*

*Special reference to principles of Deep Ecology (Gary Snyder) and Laws of Ecology (Barry Commoner)*

*Gary Snyder, Barry Commoner, Wendell Berry - a short biographical sketch particularly with reference to their work on the environment.*

*Earth First – a brief understanding of the organization's ethos and work.*

*World Wide Fund for Nature – organisation, mission, strategy for conservation.*

*Greenpeace – organisation, mission statement, core values, objectives and strategy.*

#### 2. Population and Conservation Ecology

- (i) Population dynamics: factors causing population change (birth, death, immigration and emigration); relation between the factors; age structure and its significance; population pyramids; survivorship curves; three general shapes r and K strategies.

*Factors causing population change (birth, death, immigration and emigration); relation between the factors; Age structure and its significance; Population Pyramids – interpretation and implications. Rate of change of population – the three general shapes of Survivorship Curves, r and K strategies and differences between the two.*

- (ii) Human populations (Malthusian model and demographic transition).

*Definition of Carrying Capacity; Malthusian view: concept of 'over-population' and shortage of resources; Questioning Malthus. Population Growth vs. Disparate Consumption of resources within and amongst nations. Definition and understanding of Demographic Transition; Factors influencing demographic transition.*

- (iii) Population Regulation: growth without regulation (exponential); simple population regulation (logistic growth curve); factors regulating population size (space, food and water, territories, predators, weather and climate, parasite and diseases, disasters and self-regulation).

*Basic understanding of the Exponential growth curve (J – shaped) and Logistic growth curve (S - shaped); Factors regulating population size (space, food and water, territories, predators, weather and climate, parasite and diseases, disasters and self-regulation).*

- (iv) Human population control: family planning; education; economic growth; status of women.

*Strategies for human population control with emphasis on women's empowerment. (Details of methods of family planning **not required**.)*

- (v) Threats to the ecosystem: habitat destruction; genetic erosion; loss of diversity; expanding agriculture; impound water; waste from human societies; increasing human consumption.

*Only a brief understanding of the causes and consequences of threats to provisioning and regulatory functions of the ecosystem with suitable examples.*

- (vi) Conservation: importance; the critical state of Indian forests; conflicts surrounding forested areas - populations and tribals and their rights - tourism - poaching - roads - development projects - dams; scientific forestry and its limitations; social forestry; the role of the forest department; NGOs; joint forestry management; wild life - sanctuaries, conservation and management in India; Project Tiger as a case study in conservation.

*Definition of: Conservation, in situ and ex situ conservation. Importance of Conservation.*

*In-situ conservation: Wildlife sanctuaries, National parks, Biosphere reserves (definition, objectives, features, advantages and disadvantages).*

*Ex-situ conservation: zoos, aquaria, plant collection (objectives, features, advantages and disadvantages).*

*Conflicts in managing and conserving Forests: India's forest cover, issues concerning people living in and around forests with particular reference to tribal rights; threats to forests: poaching,*

*developmental projects like roads and dams, over exploitation of forest resources (direct and indirect).*

*The role of the forest department and NGOs in managing forests.*

*Some management measures: scientific forestry, social forestry (various types of social forestry), Joint Forestry Management (JFM), ecotourism.*

*Definition, scope, advantages and disadvantages of each of the above.*

*Project Tiger as a case study in conservation: Origin, aims, and objectives, successes, failures.*

### **3. Monitoring Pollution**

- (i) Pollution monitoring.

*Primary and secondary pollutants. Importance of monitoring air pollution including Ambient Air Quality Monitoring (gaseous and particulate). Concept of carbon credits and carbon trading in regulating emissions. Causes for excessive vehicular pollution and various steps taken to regulate pollution-emission standards for new vehicles, implementation of CNG programme, inspection & maintenance programme for in-use vehicles, phasing out of old commercial vehicles and promotion of public transport.*

- (ii) Monitoring the atmosphere: techniques.

*Monitoring at emission source and of ambient air quality, criteria for monitoring stations, types of stations, number of stations, frequency of data collection, characteristics of ambient air sampling, basic consideration for sampling (to be dealt with in brief). Classification of techniques- manual and instrumental. Manual-Passive samplers, High Volume Samplers and Bubbler Systems. Instrumental-photometric techniques-NDIR, Chemiluminescence - principle and use.*

- (iii) International and national air quality standards.

*National Ambient Air Quality Monitoring (NAAQM); the main functions of the Central Pollution Board and the State Pollution*



*Control Board, objectives of air quality standards, New name of NAAQM, National Air Monitoring Programme (NAMP) objectives of the NAMP.*

*Definition of air quality standards and importance; National air quality standards for gases/particulate matter covered under WHO guidelines.*

- (iv) Water testing: indicators of water quality.

*Indicators (electrical conductivity, turbidity, pH, dissolved oxygen, faecal waste, temperature, hardness, nitrates and sulphates) the significance of each and their interpretations. B.O.D. and C.O.D., theoretical concept only (lab work for better understanding and not for testing)*

- (v) Soil testing: indicators of soil type and quality and laboratory work.

*Soil indicators- the characteristics of a good soil indicator, the three basic types of soil indicators- biological, physical and chemical, two examples of each. The information provided by each of these types of indicators. Definitions, effects and experiments to find out soil respiration, soil pH, soil aggregate, infiltration rate and simple methods of controlling each of these.*

## SECTION B

### 4. Third World Development

- (i) Urban-rural divide: urbanisation - push and pull factors; consequences on rural and urban sectors; future trends and projections.

*Causes of migration - push and pull factors, consequences on rural and urban areas and ways to reduce migration. Future trends and projections.*

- (ii) A critical appraisal of conventional paradigm of development from the viewpoints of sustainability, environmental impact and equity.

*Definition of Development.*

*An understanding that development has become synonymous with growth. This approach has the following impacts on the environment: (a) Ignoring negative*

*environmental impacts; (b) Changing patterns of resource use due to market pressures; (c) Overuse and exploitation of resources; (d) Diversion of scarce resources to luxury goods; (e) Disparate access to resources; (f) Increasing wastes and pollution.*

*The above to be explained with suitable examples.*

- (iii) A case study of Gandhian approach in terms of its aims and processes.

*Local self-governance – basic principles behind village policy, Antodaya, Sarvodaya, Panchayati Raj; local self-sufficiency, local markets and environmental sustainability. Village as the basis of development; promotion of cottage industries and intermediate technologies; focus on employment.*

*The above to be contrasted with today's paradigm of growth.*

- (iv) Urban environmental planning and management: problems of sanitation; water management; transport; energy; air quality; housing; constraints (economic, political) in tackling the problems; inapplicability of solutions that have worked in the First World and the need for indigenous approach to urban environment.

*A basic understanding of the following urban environmental problems: problems of sanitation, water management, transport, energy; air quality and housing.*

*Awareness of some indigenous solutions: Rainwater harvesting, garbage segregation, composting, energy from solid and liquid wastes, sewage management (dry toilets, Decentralized Water Management System (DEWATS))*

*Features of new urbanism, goals of smart growth. The following examples of urban planning and management from the third world to be studied:*

- *Bogota – Bolivia (Traffic Management);*
- *Cuba (Urban agriculture using organic methods);*

- *Curitiba – Brazil (Traffic planning and urban renewal using innovative measures);*
- *Cochabamba – (Water management and protests against privatisation of water supply).*

## 5. Sustainable Agriculture

- (i) Traditional Agriculture in India: irrigation systems; crop varieties; techniques for maintaining soil fertility; impact of colonialism; Indian agriculture at independence - food scarcity - food import - need for increasing production - the need for land reform; green revolution - HYVs - fertilizers - pesticides - large irrigation projects (dams); critical appraisal of the green revolution from the viewpoints of agro-bio diversity; soil health; ecological impact of pesticides; energy (petroleum and petrochemicals); ability to reach the poorer sections of the rural communities; sustainability - need for sustainable agriculture - characteristics for sustainable agriculture; techniques of water soil and pest management.

*Definition of the following terms: traditional agriculture, natural farming, organic agriculture, modern agriculture (use of hybrid seeds, high yielding varieties, chemical fertilizers and pesticides), gene revolution (genetically modified seeds) and sustainable agriculture.*

*Irrigation systems:*

*Macro vs micro irrigation systems - canal irrigation/dam as compared to sprinkler/ drip/trickle drip/dug wells. Basic features, advantages and disadvantages of each kind. Traditional rainwater harvesting- tankas, khadins, ahar, pynes, zings, johads and eris (suitability of each type in the particular region).*

*Features of pre-colonial agriculture in India: growing for sustenance rather than market; multi-cropping, management of soil health, diversity in seed.*

*Colonial influence: punitive taxation, commercial crops for export and British industry, devaluation of sustainable traditional practices. Bengal famine. Comparative study of pre-colonial, colonial*

*and post- colonial agriculture and their impact.*

*Green Revolution: Origin (food scarcity - food import - need for increasing production).*

*Basic principles of Green Revolution- Development of High Yielding Varieties (HYV); introduction of fertilizers and pesticides; mono cropping.*

*Environmental, social and economic impacts - advantages and disadvantages (from the viewpoints of agro-bio diversity; soil health; ecological impact of pesticides; energy use; input costs; benefits to small and medium farmers, community level and household level food security).*

*Land reform – need, advantages, failures and successes.*

*Elements of sustainable agriculture: Mixed farming, mixed cropping, inter-cropping, crop rotation, use of sustainable practices of water soil and pest management for improving soil fertility (organic fertilizers, bio-fertilizers, green manure, with two examples) and pest control (bio pesticides). Integrated Pest Management (IPM); eating local foods*

- (ii) Food: the twin problems of production and access; food situation in the world; integrated and sustainable approach to food security for the Third World. Food Security.

*Meaning of Food Security, need for food security. The problems in attaining food security - those of production, storage and access. Integrated and sustainable approach to food security for the Third World including working for environmental sustainability and social and economic sustainability through land reform, credit support to farmers, market support to farmers, inadequacies in the present marketing system, ways to improve marketing system, improving access to food, ownership of seeds.*

*An understanding that national level food security may not translate into household and community level food security or long term environmental sustainability unless the above factors are addressed. Main features of the Food Security Law 2013.*

## SECTION C

### 6. Environmental and Natural Resource Economics

- (i) Definition: resources; scarcity and growth; natural resource accounting.

*Classification of natural resources - on the basis of origin (abiotic and biotic), on the basis of renewability (renewable and non-renewable), on the basis of development (potential and actual), on the basis of distribution (ubiquitous and localized); scarcity and growth, natural resource accounting.*

*Classification of resources as renewable and non-renewable.*

*Definition, basic principles, advantages and disadvantages of Physical accounting.*

- (ii) GNP vs. other forms of measuring income.

*GDP, GNP – definitions, advantages and disadvantages of using them as tools for measuring growth.*

- (iii) Economic status and welfare (net economic welfare, nature capital, ecological capital, etc.)

*A broad overview of the purpose of environmental economics.*

*Definition and classification: Defensive expenditure (its classification); natural/ecological capital.*

- (iv) Externalities: cost benefit analysis (social, ecological).

*Externalities – definition, kinds (positive and negative), impacts.*

*Cost Benefit analysis - Definition, the process in brief, advantages and disadvantages.*

- (v) Natural capital regeneration.

*What is natural capital? Kinds of natural capital; classification of ecosystem services, causes of degradation (acid deposition, air pollution, deforestation, loss of biodiversity and emission of carbon dioxide), ecological footprint and man's disproportionate use of natural resources, importance of preserving and regenerating natural capital.*

### 7. International Relations and the Environment

- (i) Trans-national characteristics of environmental issues using case study of Amazonia, Trade in Wild Life and Ozone Depletion.

*Case study of Amazonia - causes for exploitation of forests, reasons for acceleration of deforestation, effects of government policies, ecological value of rainforests and possible solutions to the problem.*

*Case study of ivory trade in Africa - reasons for flourishing trade of ivory in the past, steps taken to curb the trade and the consequences of ban in trade.*

*Case study of ozone depletion - what is meant by ozone layer and how does it get depleted, (Chapman's cycle), potential effects of ozone depletion, common ozone depleting substances (halons, carbon tetrachloride, CFCs, methyl chloroform, methyl bromide and HCFCs) and their life span in the atmosphere; Ozone hole; steps taken to control ozone depletion.*

- (ii) Impact of international politics, national sovereignty and interest.

- (iii) International trade: a theoretical perspective; free trade vs. protectionism; import barriers; domestic industry vs. free trade; transnational companies - a historical perspective (colonialism and its lasting impact today); trade between the first and the third world - characteristics - terms of trade; India's international trade - characteristics - major imports and exports - foreign exchange crises - the export imperative and its impact on the environment; the case study of aquaculture in India; diversion of scarce resource from production of subsistence needs to commercial products; toxic waste trade - extent and impact; Globalisation - trade regimes (WTO, GATT, IPR) and their impact on third world.

*Definition, advantages and disadvantages of globalization, free trade, protectionism.*

*Transnational Companies (TNCs) – definition; TNCs and environment – conflict of interest.*

*History of third world countries' trade with the developed countries (with special reference to India) with regards to composition and terms of trade (export of primary goods and import of finished goods at higher cost- tapping of primary goods leading to environment degradation- open cast mining, agriculture, aquaculture, etc.).*

*Case study of aquaculture in India to understand the impact of free trade.*

*Economic allocation of scarce resources and its impact on environment.*

*Toxic waste trade – definition, origin, factors sustaining, impact on third world countries (example – health and environmental impacts) and steps to mitigate it (Bamako and Basel Conventions).*

*GATT – the organization and its metamorphosis into WTO.*

*Principles and functions of WTO: creating a level playing field for international trade through MFN (Most Favoured Nation), NT (National Treatment) and reduction of import barriers - tariff and non tariff barriers and trading to comparative advantages.*

*Full forms of and areas addressed in the WTO GATT, TRIPS, TRIMS, Agreement on Agriculture (AOA). A brief understanding of how these agreements impacted India's trade, food security, economic well-being, environmental sustainability.*

*Definition of IPR and its categories: copyrights, patents, trademarks, industrial design rights, geographical indicators and trade secrets.*

*A brief understanding of each of the above categories.*

- (iv) International aid: agencies; advantages; limitations; need for re-orienting aid; aid vs. self-reliance.

*International aid – advantages and disadvantages; Types of Aid: Tied and Untied Aid - advantages and limitations of each.*

## PAPER II

### PRACTICAL/PROJECT WORK – 30 MARKS (FOR CLASSES XI & 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.

The project work could take **one** of the five forms:

1. Address a current environmental problem (preferably at local or regional scale) and should include problem identification and analysis, use of secondary data as well as some collection of primary data, design of solution, documentation of the entire process in the form of a solution proposal.
2. Design and conduct an environment impact assessment. The candidates may use secondary data, demonstrate their capacity to collect and analyse primary data by incorporating some primary data collected and use it in a few sectors of their work.
3. Systematic monitoring of an aspect of the local environment over a period of at least six months. The candidate must use quantitative techniques of monitoring, sampling scientifically. The data collected must be interpreted and presented in the report.
4. Field work and training in an environmental organisation (NGOs, Industrial Pollution Control Firms, Testing Laboratories, etc.) for a period of not less than one month. This work should be focused on one area in the syllabus. The candidate will produce a paper on the area of his/her work and training which will include his/her experience and the special expertise that she/he has acquired.
5. Conduct a study on the density and population of plants growing in a particular area using the quadrat method.

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