

**FURTHER DETAILS REGARDING MAIN TOPICS OF  
PROGRAMME NO. 10/2015 (Item No. 32)**

**ASSISTANT ENVIRONMENTAL OFFICER**

**ENVIRONMENT & CLIMATE CHANGE**

**(CATEGORY Nos. 105/2014)**

**PART I**

**Module 1 Fundamentals of Environmental Science**

Concept of environment and environmental health – multidisciplinary nature of environmental science - ecosystem structure, dynamics of communities, ecological interactions and population regulation, energy in ecological systems, concept of development and inclusiveness of environment in development, biodiversity as index of environmental health, ecosystem health and concepts in eco-toxicology, environmental economics and sustainable development, habitat degradation and ecosystems, remote sensing and GIS in environmental management, climate change and global warming, International environmental movement, environmental concerns in India, environmental policies and programmes in India, Environmental history of India, Environmental issues in India and Kerala; Environmental education and ethics.

**Module 2 Physical Processes in the Environment**

**Sun-Earth System** – Kepler’s laws of Planetary motion; Seasons, Solar radiation – Radiation laws; Global distribution of solar radiation, effect of atmosphere on solar radiation – Scattering, Absorption and Reflection, Earth’s albedo, Terrestrial Radiation, Greenhouse Effect, Global Warming.

**State & Structure of Atmosphere and Atmospheric Circulation** – Pressure, temperature, humidity, precipitation, radiation and wind - Vertical thermal structure of the atmosphere. Mean

heat balance of the earth-atmosphere system, General circulation of the atmosphere and Indian Monsoons. Tropical Cyclones, Anticyclones and Local winds.

**General Circulation of Oceans** – Winds and surface circulation, Ocean Gyres, causes of ocean currents - Characteristics of convergence, divergence, upwelling & sinking of ocean waters, Ekman spiral and Ekman transport; Deep-sea circulation - Vertical structure of oceans - Salinity, temperature and density variations - Bottom water formation and Thermohaline conveyor belt.

**Thermodynamics, Atmospheric Stability** – Composition of dry air and atmospheric water vapour content; Potential temperature, virtual temperature, isothermal and adiabatic processes, dry and saturated adiabatic lapse rates. Stable, unstable and neutral equilibria; Inversions.

**Atmospheric Boundary Layer** – Depth, structure, diurnal variations and their significance in pollutant dispersion; Meteorological factors affecting air pollutants – diffusion, turbulence and transportation, plume rise and stability conditions. – Wind Roses.

**Atmospheric Pollution** – Natural and anthropogenic sources of pollution - Primary and secondary pollutants; Effects of pollutants on human beings, plants, animals, materials and climate; Acid rain, Ambient air quality standards; Noise pollution and human health.

**Clouds and Precipitation** - Cloud formation and classification - Aerosols, condensation and ice nuclei, droplet growth – curvature and solute effects, water vapour diffusion, precipitation mechanisms; Weather modification.

**Weather and Climate** – Climatic zones, continental & maritime climates; Climate change and variability – Natural changes and anthropogenic causes of climate change, Climate feedbacks – Ice-albedo, cloud - albedo and CO<sub>2</sub> feedbacks; Present day Climate variability – El Nino and ENSO events.

**Hydrology** – Global water balance, Hydrological cycle - Inter-relationship of surface, groundwater and stream-flow; Stream hydrograph - Factors influencing surface water - Influence of geology on groundwater – porosity, specific retention and specific yield.

**Groundwater Quality** – Physical, biological and chemical properties; Groundwater exploitation and management - Safe yield, cone of depression and artificial recharge; Ground water pollution and salinity intrusion – Ghyben–Herzberg relationship.

**Properties and Structure of the Earth** – Crust, mantle, core, earth's magnetic field; Recycling of the Lithosphere – The rock cycle, weathering and erosion, sedimentation, metamorphism. Rock types – Igneous, metamorphic and sedimentary rocks; Soil formation - Concept of plate tectonics and continental drift. Geological time-scales; Geological Hazards - Floods, Landslides, Earthquakes, Volcanism, Avalanche.

### **Module 3 Chemical Processes in the Environment**

**Chemistry of Atmosphere** - Definition and importance of atmosphere, chemical composition of unpolluted air at sea level, thermal stratification of the atmosphere and chemical speciation in its different layers, chemical and photochemical reaction in the atmosphere, reactions of atmospheric nitrogen, oxygen, ozone and water, role of CO<sub>2</sub> in the atmosphere.

**Chemistry of Hydrosphere and Water Pollutants** - Definition of hydrosphere, importance of water, distribution of water in earth, Hydrological cycle, Characteristics of natural waters and process that affect their composition, unique properties of water and their environmental significance, solubility of gases in water, Henry's law, Acid-base, redox and complexation reactions in water.

**Chemistry of Geosphere and Soil** - Chemistry of geosphere, nature of solids in the geosphere, kinds of minerals and rocks, their properties, rock cycle, stages of weathering, physical, chemical and biological aspects of weathering, sediments, clays, ground water in the geosphere; Chemistry of soil: soil formation, soil horizon and soil profile, composition and physiochemical properties of soil; water, air, organic and inorganic components of soil, ion-exchange and acid-base reactions in soil, micro and macronutrients in soil.

**Instrumentation in Environmental Chemistry** - titrimetry, gravimetry, colorimetry, spectrophotometry, fluorimetry, nephelometry and turbidimetry, flame photometry, atomic absorption spectrophotometry, X-ray fluorescence and X-ray diffraction, potentiometry, gas solid

chromatography(GSC), gas liquid chromatography (GLC), high pressure liquid chromatography (HPLC), electrophoresis.

**Environmental Chemical Analysis** - Analysis of Air: Air sampling techniques and analytical methods for monitoring SO<sub>2</sub>, NO<sub>x</sub>, CO, H<sub>2</sub>S and suspended particulate matter (SPM), analysis of soil, water and wastewater - sampling, preservation, storage, pretreatment and analytical methods - color, turbidity, electrical conductivity, acidity, alkalinity, hardness, DO, BOD, COD, pH, redox potential, chloride, fluoride, nitrite, nitrate, ammonia, phosphate and metals; Analysis of Soil - Sampling and storage, pretreatment, extraction of organic contaminants, extraction of available ions, dissolution technique for the determination of total metal concentration in soil, determination of pH, cation exchange capacity (CEC), total and available metal ions, life cycle assessment.

#### **Module 4 Biological Processes in the Environment**

**Environmental Biology** - ecosphere and biosphere; Biomes and habitats – terrestrial, freshwater and marine; flora and fauna; biological diversity; ecological factors and variables; ecosystem dynamics – food chain, food web, ecological pyramids, ecological energetics, ecological succession and climax community; biological interactions : inter-specific and intra-specific; population regulation; carrying capacity; limiting factors – laws of minimum and tolerance.

**Microorganisms Interaction and Microbial Ecology** -Foundations of microbial ecology and microbial interactions – mutualism, cooperation, commensalisms, predation, parasitism, amensalism, competition, symbiosis in complex systems; Influence of environmental factors on growth – solute and water activity, pH, temperature, oxygen concentration, pressure, radiation; Microbial growth in natural environment – growth limitation by environmental factors, counting viable but non – cultivable cells, quorum sensing, and microbial populations; Nutrient cycling interactions – carbon cycle, sulphur cycle, nitrogen cycle, manganese cycle, microorganisms and metal toxicity; Microenvironment and niche, biofilm and microbial mats, microorganisms and ecosystems, microorganism movement between ecosystems; Methods in microbial ecology – Examination of microbial communities as complex assemblages – number, type, microbial community structure, and constituents; Stress and viability of microorganisms; Microbial activity

and turn over, recovery or addition of individual microbes; General perspectives on microbial communities in aquatic environment, terrestrial systems, plants and animals.

## **Module 5 Natural Resources and their Sustainable and Optimal Utilization**

**Natural Resources** : concept and major types of natural resources.

**Soil and Mineral Resources** : overview of major soil types and mineral deposits in India with special reference to Kerala.

**Forest Resource** : over view of major forest types in India with special reference to kerala – their characteristics; Social forestry; ecorestoration; Agroforestry – types and management; Role of forests in carbon sequestration

**Biodiversity** : Threats to biodiversity : Endangered, endemic species and threatened species; IUCN threatened species of plants and animals; Red data book; Biodiversity conservation, Biopiracy.

**Water Resource** : water resource types – surface water, ground water; water availability and uses, freshwater shortages, impact of climate change on freshwater resources, Management and conservation of water resources; Water harvesting and recycling; Watershed management.

**Energy Resources**: Conventional energy sources; Bioenergy; Nuclear energy; Solar energy; Wind energy; Geothermal energy, Wave & Tidal power; Alternative fuels: Natural Gas and Hydrogen.

## **Module 6 Impairment of the Environment through Anthropogenic Activities**

**Impairment of Atmosphere - Particles in the atmosphere:** Chemical process for formation of organic and inorganic particulate matter, composition of organic and inorganic particles, reactions involving particles in the atmosphere; **Gaseous inorganic air pollutant:** sources and chemical reactions of CO, NH<sub>3</sub>, SO<sub>x</sub>, NO<sub>x</sub>, fluorine, chlorine and their gaseous compounds and reduced sulphur gases (H<sub>2</sub>S, CS<sub>2</sub> and COS); **Organic Air Pollutants:** source and reactions of pollutant hydrocarbons, aldehydes, ketones, organohalogen, organosulphur and organonitrogen compounds; **Anthropogenic Changes in the Atmosphere:** acid rain, greenhouse effect and global warming, ozone layer depletion, photochemical smog.

**Impairment of Hydrosphere:** nature and types of water pollutants, point and non-point sources; elemental pollutants: heavy metals (Hg, Cd, Pb and Cr) and metalloids (As); inorganic species: algal nutrients and eutrophication - acidity, alkalinity and salinity, oxygen demanding materials, concept of BOD and COD, organic pollutants, pesticides and PCB's and radionuclides.

**Impairment of Geosphere:** NPK in soil, synthetic fertilizers (N, P and K), pesticides, heavy metals and wastes as soil pollutants, effect of mining and mineral extraction; effect of waste disposal in geosphere.

## **Module 7 Environmental Impact Assessment and Policies**

**Environmental Impact Assessment (EIA):** Definition, purpose and characteristics of EIA; global evolution of EIA; participants in EIA process, stages of EIA, types of EIA. Environmental Impact Statement (EIS) and Environmental Management Plan (EMP); methods of impact identification; impact prediction; impact evaluation (assessment) and impact mitigation - air, water, noise, vegetation and wildlife environment with case studies.

**EIA in India:** overview, current procedures, practices and guidelines; EIA of water resource projects, industries, mining and quarrying, highway construction, tourism developments.

**National Environmental Policy and Regulatory Frame Work :** Rules and regulations of Central and State Government and Pollution Control Boards for Environmental Protection; International and National Conservation agencies.

**Environmental Management :** systems and approaches, standards – international and national; Intellectual Property Rights; labeling environment friendly products (ecomark), Environmental Management Systems (EMS) - ISO 14000.

**Environmental Laws :** National and International - global warming, ozone depletion, acid rains, hazardous wastes, biodiversity.

## **Module 8 Abatement of Environmental Impairment**

**Bioremediation:** Current practices – bio-stimulation and bio-augmentation - microbes involved in bioremediation – bacteria and fungi; *in situ* and *ex situ* bioremediation; bioreactors; solid - state bioreactors - composting – different strategies; anaerobic digestion of waste;

bioremediation in marine and estuarine systems, phytoremediation: approaches and types, factors influencing phytoremediation - advantages and disadvantages; application of genetic engineering in bioremediation; future trend for bioremediation – nanotechnologies.

**Solid and Liquid Waste Management:** Physico – chemical and biological processes for waste water treatment.

**Air Pollution Control Strategies:** Automotive and industrial emission control, green house gases emission control.

**Green Technologies:** green buildings, green chemistry, zero effluent and zero emission technologies, social forestry, sanctuaries and protected areas, 3R in environmental protection, carbon sequestration, biofuel.

## **Part II: General Knowledge and Current Affairs**

### **Salient Features of Indian Constitution**

Salient features of the Constitution - Preamble- Its significance and its place in the interpretation of the Constitution.

Fundamental Rights - Directive Principles of State Policy - Relation between Fundamental Rights and Directive Principles - Fundamental Duties.

Executive - Legislature - Judiciary - Both at Union and State Level. - Other Constitutional Authorities.

Centre-State Relations - Legislative - Administrative and Financial.

Services under the Union and the States.

Emergency Provisions.

Amendment Provisions of the Constitution.

### **Social Welfare Legislations and Programmes**

Social Service Legislations like Right to Information Act, Prevention of atrocities against

Women & Children, Food Security Act, Environmental Acts etc. and Social Welfare

Programmes like Employment Guarantee Programme, Organ and Blood Donation etc.

## **RENAISSANCE IN KERALA**

### **Towards A New Society**

Introduction to English education - various missionary organisations and their functioning- founding of educational institutions, factories, printing press etc.

### **Efforts To Reform The Society**

#### **(A) Socio-Religious reform Movements**

SNDP Yogam, Nair Service Society, Yogakshema Sabha, Sadhu Jana Paripalana Sangham, Vaala Samudaya Parishkarani Sabha, Samathwa Samajam, Islam Dharma Paripalana Sangham, Prathyaksha Raksha Daiva Sabha, Sahodara Prasthanam etc.

#### **(B) Struggles and Social Revolts**

Upper cloth revolts, Channar agitation, Vaikom Sathyagraha, Guruvayoor Sathyagraha, Paliyam Sathyagraha, Kuttamkulam Sathyagraha, Temple Entry Proclamation, Temple Entry Act, Malayalee Memorial, Ezhava Memorial etc.

Malabar riots, Civil Disobedience Movement, Abstention movement etc.

### **Role Of Press In Renaissance**

*Malayalee, Swadeshbhimani, Vivekodayam, Mithavadi, Swaraj, Malayala Manorama, Bhashaposhini, Mathnubhoomi, Kerala Kaumudi, Samadarsi, Kesari, Al-Ameen, Prabhatam, Yukthivadi, etc*

### **Awakening Through Literature**

Novel, Drama, Poetry, *Purogamana Sahithya Prasthanam, Nataka Prashtanam*, Library movement etc

### **Women And Social Change**

Parvathi Nenmenimangalam, Arya Pallam, A V Kuttimalu Amma, Lalitha Prabhu, Akkamma Cheriyan, Anna Chandi, Lalithambika Antharjanam and others

### **Leaders Of Renaissance**

Thycaud Ayya Vaikundar, Sree Narayana Guru, Ayyan Kali, Chattampi Swamikal, Brahmananda Sivayogi, Vagbhadananda, Poikayil Yohannan (Kumara Guru), Dr Palpu, Palakkunnath Abraham Malpan, Mampuram Thangal, Sahodaran Ayyappan, Pandit K P Karuppan, Pampadi John Joseph, Mannathu Padmanabhan, V T Bhattathirippad, Vakkom Abdul Khadar Maulavi, Makthi Thangal, Blessed Elias Kuriakose Chavara, Barrister G P Pillai, TK Madhavan, Moorkoth Kumaran, C. Krishnan, K P Kesava Menon, Dr. Ayyathan Gopalan, C V Kunjuraman, Kuroor Neelakantan Namboothiripad, Velukkutty Arayan, K P Vellon, P K Chathan Master, K Kelappan, P. Krishna Pillai, A K Gopalan, T R Krishnaswami Iyer, C Kesavan, Swami Ananda Theerthan, M C Joseph, Kuttippuzha Krishnapillai and others



## **Literary Figures**

Kodungallur Kunhikkuttan Thampuran, KeralaVarma Valiyakoyi Thampuran, Kandathil Varghese Mappila. Kumaran Asan, Vallathol Narayana Menon, Ulloor S Parameswara Iyer, G Sankara Kurup, Changampuzha Krishna Pillai, Chandu Menon, Vaikom Muhammad Basheer. Kesav Dev, Thakazhi Sivasankara Pillai, Ponkunnam Varky, S K Pottakkad and others

## **GENERAL KNOWLEDGE AND CURRENT AFFAIRS**

### **General Knowledge and Current Affairs**

***NOTE: - It may be noted that apart from the topics detailed above, questions from other topics prescribed for the educational qualification of the post may also appear in the question paper. There is no undertaking that all the topics above may be covered in the question paper.***