GROUP-63

Env.Engr. (Level of Exam- Diploma in Civil/Chemical/Environmental Engineering)

1) General awareness, Reasoning, Mathematics, Science, History including Haryana related history, current affairs, literature, Geography, Civics, Environment, Culture etc.-

Weightage 20%

2) Computer terminology, Fundamentals, word software, excel software, Power point, internet, web browsing, Communication, emails, downloading and uploading data on websites etc**. -** **Weightage 10%**

3) Subject related syllabus- **Weightage 70%**

Environmental Ecology and Ecosystem

Concepts in Ecology:• The terms- ecology, environment, multidisciplinary approach, place in other branches of learning. • Taxonomy and ecology. • Levels of organizations in environment, the ecosystem concept. • Structure and functions in an ecosystem. • Organisms- environment relationships and principles. • Relationships between organisms. • Atmosphere- origin, composition, altitudinal expanse. • Hydrosphere- geographical distribution, estimated quantities of water in different places, natural composition of fresh and marine water, important physiochemical properties of water. • Lithosphere- weathering and sedimentation cycles in time and space physical and chemical properties of soils major plant nutrients and other minerals in soil and their mineralization. • Biosphere- origin and distribution on land, in water and in air. Broad nature of chemical composition of plants and animals. • Nature of interface between different spheres. • Nature cycles- general path of materials in bio- geochemical cycles.

Ecological Factors:• Ecological Factors affecting ecosystem. • Temperature- temperature regimes & survival of organization, temperature belts, cardinal point- maxima, minima, optima. • Solar radiations- intensity, duration related effects, photoperiodism, effect on photosynthesis, compensation point, impact on vegetative and reproductive growth. • Water- Water is a limiting factor, excess and deficient water, rains quantity duration (i.e., distribution of rainfall in a year) now, dew, role of water in the metabolism of plants and animals' growth medium, types of habitats according to water availability. • Land- topography, mineral status, physical and chemical nature. Land use- capability and determinants.

Lithosphere and its Characteristics:• Rocks and their classification. • Minerals and their classification. • Weathering and soil formation. • Soil profiles, their characteristics and classification. • Classification of soils in India.

Hydrological Cycles:• Natural water cycle. • Water cycle in human habitat. • Ground water. • Water logging and soil sodality. • Exploitation of ground water and its effects.

Natural Disasters:• Floods. • Droughts. • Desertification. • Earthquakes. • Volcanoes. • Landslides. • Cyclones and Tsunamis. • Forest fires. • Lightning: Why these occur and their effect on Environmental degradation and preventive measures to avoid or to minimize damage.

Environmental Pollution

Air Pollution:• The atmosphere, composition of atmospheric air. • Air Pollution- concepts, sources of air pollution- natural and anthropogenic. Air quality standards, emission standards. • Primary and secondary air pollutants. Atmospheric reactions, mechanism of transformations and their relationship. • Particulate matter- Sources, classification and composition, particulate dynamics, viable and nonviable particles. • Effects of air pollution on human health, animals and vegetation. • Pollution related phenomena and their consequences- greenhouse effect, global warming, temperature inversion, CFCs and ozone depletion, photochemical smog. • Meteorological aspects: Lapse rates and atmospheric stability, temperature inversions. Plume behaviour, Meteorological parameters: wind roses, dispersion models. • Global climatic changes and future trends. International protocols.

Water Pollution:• Characteristics of natural water, aquatic environment. Sources of potable water. • Water quality standards- WHO, EPA and BIS. Industrial water quality standards. • Types of water pollution- physical, chemical, biological and physiological. Sources of water pollution. • Waste waters- domestic, industrial waste waters, their compositions, discharge standards and effects on receiving

bodies. • Fate of pollutants in water- metals, non-metals and their specifications. •Pesticides, oils, greases, organic matters, biodegradation, bioaccumulation and their effects on water bodies. • Marine, thermal and radioactive pollution in water and their consequences. Transport of pollutants, pollutant cycle in environment (land, air and water).

Soil Pollution:• Soil formation, inorganic and organic components of soil, soil profile. • Sources of soil pollution- agricultural, industrial, mining and dumping. • Absorption of chemicals and toxic metals by soil and effects. Detrimental effects of soil pollution toxicity, diseases caused, impact on air and water bodies.

Noise Pollution and Control:• Sources of noise pollution, measurement of noise and indices. • Effects of meteorological parameters on noise propagation. Noise exposure levels and standards. Impact of noise on human health. • Control of Noise Pollution: Control of industrial and transport noise at source. Noise control in the transmission path, Noise barriers, enclosures and silencers. Protection of the receiver. • Noise Pollution Standards and Legal Framework.

Analytical and Instrumental Techniques of Monitoring

Concepts of Environmental Monitoring and its relevance:• concepts, descriptions & applications • Ambient air monitoring • Workplace monitoring • Fugitive emission • VOC/HC • Process vents • Stacks/chimney.

Sampling: • Sampling: Protocol and methods of sampling, sampling devices, • Preservation, storage and processing of air, water and soil samples.

Methods of determining physical Characteristics of Samples: Water: Potable water, industrial effluents, domestic effluent Solid: Municipal Solid Waste Hazardous Solid Waste Study of :• Physical appearance •Colour•Odour• Viscosity • Density /Specific gravity.

Basic Methods of Chemical Analysis:•Titrimetric: Theory and applications of acid-base, complex metric, redox and precipitation titrations. • Gravimetry: Principle of gravimetric analysis. Precipitation methods. Drying and ignition of precipitates. Organic precipitants. Applications.

Instrumental Methods of Environmental Analysis: -• Theory, instrumentation and applications of Conductometry, Potentiometry, Voltammetry. • Colorimetry and Spectrophotometry: Electromagnetic radiation Interaction of radiation with matter. Beer-Lambert's law. Types of errors and their sources. Colorimeters and Spectrophotometers. Applications. • Principles, instrumentation and applications of Nephelometry and Turbidimetry, Flame photometry. Infra-Red spectroscopy. • Conventional microscopy and electron microscopy. • Chromatographic Methods in Environmental Analysis • Calibration of instruments. Quality assurance. Statistical interpretation and data validation • Advancement in instrumental monitoring and analysis.

Pollution Control and Waste Management

Water and Wastewater Treatment:• Quality requirements of water for Human and Habitat and different industrial use. Treatment with UV, H202, Ozonisation. Examples of industries with specific water quality requirements: pharmaceutical industries, General scheme for the treatment of water for drinking purpose. • Characteristics of municipal sewage and various industrial wastewaters. Planning for wastewaters treatment and disposal. Preliminary, primary, secondary (Biological and chemical) and tertiary treatments. • Unit processes in treatment of water and wastewater, •Physio-chemical treatment processes: Screening, grit removal, aeration/stripping, oil removal, coagulation and flocculation, sedimentation, filtration, floatation, equalization, neutralization, oxidation-reduction, chemical precipitation, disinfection, adsorption, softening, desalination/demineralization, membrane processes.• Biological treatment processes- aerobic processes: Suspended floc type- the activated sludge process. Extended aeration. Aerated lagoons. Waste stabilization ponds. Attached film type and the rotating disc biological contact system, the trickling filter process. • Biological treatment processes-anaerobic processes: Flow through systems and contact systems. UASB reactors and modifications. Expanded- bed and fluidized- bed reactors. • Nature, type and characteristics of sludge of different origins: Sludge treatment and disposal. Processing of sludges- conditioning, thickening, de-watering, drying, incineration, disposal. Land application. Sludge stabilization. Radiation sterilization. Digester gas utilization.• Concept of Common Effluent Treatment Plant (CETP), their importance and advantages, role in waste water treatment, Unit processes involved. Designing aspects of CETPs. • The nitrification and

denitrification processes for nitrogenous effluents, removal of phosphates, cyanide and heavy metals from wastewaters. • Wastewater treatment for the effluents from major industries such asfertilizers, pharmaceuticals, petroleum refining and petrochemicals, pesticides, pulp and paper, sugar, textiles and power generation. A comparison of end-of-the pipe treatment and in-plant treatment. Waste minimization and resource recovery as part of process control. • Effluent discharge standards, concepts of dilution in receiving waters, industry specific, minimum and national standards.

Control Measures for Air Emissions:• Various types of Air emissions. Characteristics and composition of gaseous emissions at the point of origin from major industriesfertilizers, oil refining, chemical-petrochemicals, coal/oil/gas-fired power plants/boilers and smelters. • Gravitational settling chambers; cyclone separators; fabric filters; electrostatic precipitators; wet collectors and scrubbers. Absorption in liquids, adsorption on solids. Combustion: flaring, thermal incineration, catalytic oxidation. Control of other gaseous pollutants, odours, VOCs, oxides of sulphur and nitrogen emissions. • Indoor Air quality management, principles and control measures, steps for improving indoor air quality. • Auto-exhausts, its components. Control of auto-exhausts emissions, emission specific control options; use of after burners, catalytic converters, engine modifications/tuning; Importance of good maintenance and driving habits. Alternative fuels.

Waste Management: Management of municipal solid waste (MSW): Sources of generation, physical composition and characteristics. Methods of sampling, Proximate and ultimate analysis. Collection, storage, transport and disposal methods; Open-dumping and sanitary landfills. Reduction, reuse and recycling of materials. Optional technologies for processing of MSW: Incineration, palletisation, gasification, pyrolysis.

Hazardous Waste: Sources and characteristics, Classification. Health and environmental effects. Safe storage, transport and storage of hazardous waste. Stabilization and disposal of hazardous waste. Criteria for selection of secured and unsecured landfill disposal sites. Introduction to biomedical waste.**Radioactive Waste:** Sources, Classification, Health and safety aspects. Management of radioactive waste.

Environmental Chemistry and Micro Biology

Environmental Chemistry: Introduction to Environment Chemistry; Contamination and Pollutants, Medium and Organisms as a receptor and sink as a chemical medium; Environmental Indicators; Applications; MethodsEnvironmental Indicators : • Freshwater environmental quality parameters: Chemical measures of water quality include dissolved oxygen (DO), chemical oxygen demand (COD), biochemical oxygen demand (BOD), total dissolved solids (TDS), pH, nutrients (nitrates and phosphorus), heavy metals (including copper, zinc, cadmium, lead and mercury), and pesticides. • Heavy metal contamination of land by industry. • Nutrients leaching from agricultural land into water courses • Urban runoff of pollutants washing off impervious surfaces (roads, parking lots and rooftops) during rain storms. Typical pollutants include gasoline, motor oil and other hydrocarbon compounds, metals, nutrients and sediment (soil). • Organ metallic compounds.

Environmental Microbiology: • Microbial Ecology & Environmental Microbiology: Concepts, principles, and definitions. • Microbial Habitats: Effect of Extreme Environments, Environmental, Human and Animal Biota • Microbial Processes: Definitions and effects of Microbial Ecology-Interactions, Biogeochemical Cycles and Global Warming, Plant Microbe Interaction- Symbiotic Nitrogen Fixation, Microbial Ecology Techniques, Water Microbiology- habitat, processes & techniques.

Environmental Biotechnology and Health: Biomedical Waste, Definition, types, sources and categories, generation in different clinical areas in hospitals. Classification, segregation and color-coding for storage containers. Code of practice for proper handling and management of biomedical wastes. Treatment of biomedical wastes: Disinfection/Sterilization, autoclaving, microwave treatment and incineration. Disposal methods. Preventive and control measures for biomedical wastes.Environmental and Human Health:Environmental change and health: Changing environment and changing pattern of disease, ailment of respiratory tract, waterborne diseases, heavy metal induced diseases. Vector borne diseases. Epidemiological approach, dose response curves, costs externalities, impact externalities.

Environmental and Industrial Hygiene and Occupational Health & Safety

Industrial Hygiene: a) Definition, scope, significance and applications. b) Occupational environmental stresses. (i) Physical stresses- Noise, vibration, illumination, ventilation, heat stress. (ii) Chemical

stresses- Toxic chemicals, hazardous chemicals, flammable chemical, explosive chemicals, etc. Inhalation and ingestion risks.

Airborne Chemicals: - Dust or aerosols (respirable, non-respirable, inhalable and total dust), gases, fumes, vapours, mist or smoke. Concept of threshold limiting values (concentration) TLVs, Time Weighted Average (TWAs); Short term exposure limits (STELs); International and National regulatory agencies like ACGIH, OSI {A, Factory Act 1948 & 1987 amendment. Concepts of Minimum National Standards (MINAS), suggested by organization like CPCB.

Occupational Health:• Toxicology: Basic principles of toxicology assessment including LD5O and LC5O; Invitro and in vivo studies. Natural detoxification, biochemical mechanism. Basic hazards of airborne chemicals, route of entry into human body, mode of action, metabolism, dose-response relationship. Bio chemical action of toxic substances and TLVs. • Exposure to toxic chemicals, acute and chronic effects, occupational disorder; allergens; mutagenicity, teratogenicity and carcinogenicity. • Occupational diseases: Pneumoconiosis, silicosis, asbestosis, byssinosis, metal poisoning (lead, mercury, manganese, copper etc.) • Notifiable diseases; possible symptoms and target organs. • Synergistic effects: enhancement in toxic effects to extraneous factors, reversible and irreversible effects, synergism.

Safety and Personal Protective Equipment

a. Safety in Chemical Industry: Definition and concepts; Criteria for siting and layout of chemical plants, precautions in the processes and operations involving explosives, flammables, toxic substances, dust, vapours, cloud formation and combating. Chemical compatibility considerations. Safety precautions for transportation of hazardous chemicals. Handling and storage of hazardous chemicals. Safety in pipelines and colour coding. Risk assessment and on site and off-site emergency planning. Safety audit in chemical industry. Accidents and unusual occurrences reporting.

b. Personal Protective Equipment: Respiratory Personal Protective Equipment (RPPE) & Non-Respiratory Personal Protective Equipment (NRPPE): Selection, use, care, and maintenance of non-Respiratory protective equipment.

Environmental Management

Principles of Environmental Management: Environmental Management perspectives: Development and environmental linkages. Environmental concern in India. The need for sustainable development. Actions for environmental protection: National and international initiatives, ISO framework, ecosystem approach, emerging environmental management strategies, Indian initiatives. Environmental Management tools, the role of professionals in environmental management. Emerging basis of environmental management in 21st century, e.g. fresh water availability global crisis. Case studies: International Conventions and Treaties: Stockholm Conference 1972, Rio Earth Summit 1992, Montreal Protocols, Agenda 21 Prominent NGOs and their contributions. International organizations; World Environment Day- Concept and themes.

Policies and Legal Aspects of Environmental Management and Legislations: Environmental Protection Acts. Rules and amendments thereof. Philosophy and major provisions of Act. Indian Forest Policy 1987. Policy Statement on Environment and Development and on Abatement of Pollution. The National Tribunal Bill 1992; The Forest Act, 1948. The Wildlife (Protection) Act, 1972. Ministry of Environment and Forest-notifications related to hazardous microorganisms and genetically modified organisms or cells. Biomedical Waste (Management and Handling) Rules, 1998. Environmental Clearances and Prevention & Control of Pollution Acts. Projects requiring clearances. Guidelines for industries. Statutory obligations of industries. Public Liability Insurance Act, 1991. Coastal Zone Regulations 1991 and modifications thereafter. Pollution Control Boards and their functions. Legislation for control of noise pollution. Judicial interventions in environmental management.

Environmental Hazards and Disaster Management: Introduction, definitions, Natural hazards; nature, causes, impacts and occurrences. Earthquakes, volcanic activity, landslides, cyclones, floods, droughts, forest fires; their mitigation. Industrial and technological hazards: types and causes of industrial accidents, physical, chemical, biological, electrical. Nature of accidents: fire, explosion, toxic release and dispersion. Disaster Management: Components of disaster management plan- on site and off-site emergency plans. Technical hazards control system-incident reduction, incident management. Techniques of hazards assessment: PHA, HAZOP, HAZAN, MCAA.

Environmental Impact Assessment (EIA): Concept of EIA. Its scope, EIA study procedures, requirements for the same. Resources needed for EIA. Report preparation. Legal aspects.

Important Note: The Weightage as mentioned against the syllabus is tentative & may vary.