GUJARAT TECHNOLOGICAL UNIVERSITY

BE-4 SEMESTER – S22 TO W25 – QUESTION BANK SOLUTION

Subject Name & Code:

ENVIRONMENTAL SCIENCE, SUSTAINABILITY AND RENEWABLE ENERGY- BE04000101

Note on Question Sources: This question bank is compiled from old GTU subjects (3110007 Environmental Sciences & 3161914 Renewable Energy Engineering) and the ESSRE list. Since the new syllabus (BE04000101) started in 2024-25, no direct previous papers exist. These questions are the **best available match** to the new syllabus topics and sub-topics.

Unit 1 – Introduction to Environment

Q. Discuss the significance of environmental sciences to different engineering disciplines. (7 marks – appeared 3+ times)
Ans:

- **Real-world importance:** Every engineering project interacts with the environment (air, water, land, ecosystems).
- **Discipline-wise significance:**

Engineering Branch	Role of Environmental Science
Civil	Design sustainable drainage, waste treatment plants, green buildings, EIA for dams/highways.
Mechanical	Reduce emissions from engines, improve energy efficiency, design renewable energy systems.
Electrical	Manage e-waste, promote green energy grids, reduce electromagnetic pollution.
Chemical	Handle hazardous substances, design cleaner production processes, treat effluents.
Computer/IT	Green computing, e-waste tracking, simulation of pollution dispersion.
Production/Industrial	Minimize industrial waste, adopt 4R, comply with environmental regulations.

- **Common GTU application example:** A civil engineer designing a flyover must study noise pollution and air quality impacts – environmental science provides the tools.

Q. Explain the various components of the environment. (4 marks – appeared 4+ times)
Ans:

- **Atmosphere:** Gaseous envelope (N_2, O_2, CO_2, etc.) – protects from UV, maintains temperature.
- **Hydrosphere:** All water bodies (oceans, rivers, lakes, groundwater) – covers 71% of

Earth.
- **Lithosphere:** Solid outer crust – soil, minerals, landforms.
- **Biosphere:** Zone where life exists – interaction of above three.

Example: A forest (biosphere) depends on rain (hydrosphere), air (atmosphere), and soil (lithosphere).

Q. Describe the objectives and guiding principles of Environmental Sciences. (7 marks)
Ans:
- **Objectives:**
  1. Understand environmental processes (energy flow, nutrient cycles).
  2. Identify and control pollution.
  3. Conserve biodiversity and natural resources.
  4. Promote sustainable development.
  5. Educate and create public awareness.
- **Guiding principles:**
  - **Interdisciplinary approach** – uses biology, chemistry, physics, sociology.
  - **Precautionary principle** – act even if scientific certainty is lacking.
  - **Polluter pays** – responsible for remediation.
  - **Sustainable use** – meet present needs without harming future.
- **Real-world application:** EIA (Environmental Impact Assessment) before any industry set-up follows these objectives.

Q. Analyze the causes of environmental degradation in industrial areas and suggest preventive measures. (7 marks)
Ans:
- **Causes:**
  - Uncontrolled release of toxic effluents into water bodies.
  - Air emissions (SO_2, NOx, PM) from chimneys and fugitive dust.
  - Improper solid waste disposal (hazardous sludge, e-waste).
  - Noise from heavy machinery and transport.
  - Deforestation for industrial expansion.
- **Preventive measures:**
  - Install **CSTPs/ETPs** (Common/Effluent Treatment Plants).
  - Use **bag filters, scrubbers, ESP** for air pollution control.
  - Adopt **4R principle** (Reduce, Reuse, Recycle, Recover).
  - Green belt development around industry.
  - Regular environmental audits and ISO 14001 certification.

Case example: Gujarat's GIDC estates now mandate zero liquid discharge (ZLD) – reduces water degradation.

Q. Assess the role of engineers in conserving the environment. (7 marks)
Ans:
- **As designers:** Create energy-efficient machines, green buildings, low-emission vehicles.
- **As operators:** Optimize industrial processes to minimize waste and resource use.
- **As innovators:** Develop renewable energy tech (solar PV, wind turbines, biogas plants).
- **As managers:** Supervise waste treatment plants, recycling facilities, pollution control devices.
- **As educators:** Train workers about environmental compliance and sustainability.

Example: A chemical engineer redesigning a distillation column to reduce volatile organic compound (VOC) emissions directly conserves air quality.

Q. How does our interaction with the environment impact the world, and what can we do to promote sustainability? (7 marks)
Ans:

- **Negative impacts:**
  - Over-extraction of groundwater → land subsidence.
  - Burning fossil fuels → global warming, acid rain.
  - Plastic waste → ocean pollution, microplastics in food chain.
  - Deforestation → loss of biodiversity, soil erosion.
- **Promote sustainability:**
  - Shift to renewable energy (solar, wind, biomass).
  - Practice 4R at individual & community level.
  - Use public transport, EV, or bicycle.
  - Plant native trees, conserve water with rainwater harvesting.
  - Support circular economy – buy recycled products.
- **Real-world initiative:** India's "Lifestyle for Environment (LiFE)" campaign promotes small sustainable actions.

Q. Discuss the scope of environmental sciences. (3 marks)
Ans:

- **Scope includes:**
  - Natural resource conservation (water, air, land, biodiversity).
  - Pollution monitoring & control (air, water, noise, soil, e-waste).
  - Environmental impact assessment (EIA) for projects.
  - Climate change mitigation and adaptation.
  - Environmental legislation and policy making.

Example: A typical environmental scientist studies how a new dam will affect fish migration and water quality.

Q. What is environmental science? (3 marks)
Ans:

- Environmental science is the **interdisciplinary study** of the environment, its living and non-living components, and the interactions between human activities and natural systems.
- It integrates **biology, chemistry, geology, physics, and social sciences** to solve environmental problems.

Example: Investigating the cause of a fish kill in a river – tests water chemistry, studies algal blooms, examines nearby factories.

Q. Define: Atmosphere, Hydrosphere, Biosphere. (3 marks)
Ans:
(i) Atmosphere: The gaseous layer surrounding Earth, composed mainly of nitrogen (78%), oxygen (21%), and trace gases. It protects from UV radiation and maintains climate.
(ii) Hydrosphere: All water on Earth – oceans (97%), ice caps, rivers, lakes, groundwater. Essential for all life.
(iii) Biosphere: The global ecological system integrating all living organisms and their interactions with lithosphere, hydrosphere, and atmosphere.

Q. Explain the role of an environmental engineer. (4 marks)
Ans:

- Design and operate **water/wastewater treatment plants**.
- Monitor and control **air pollution** (scrubbers, ESP, bag filters).
- Manage **solid & hazardous waste** (landfills, incineration, recycling).
- Conduct **environmental impact assessments** (EIA) for new projects.
- Remediate **contaminated sites** (soil washing, bioremediation).

Example: An environmental engineer designing a landfill liner to prevent leachate from contaminating groundwater.

Q. Explain the importance of environmental awareness for engineers. (3 marks)
Ans:

- Helps engineers **comply with laws** (Environment Protection Act, 1986).
- Reduces **industrial accidents** (e.g., Bhopal gas tragedy – lack of awareness).
- Promotes **sustainable design** (green buildings, renewable energy systems).
- Saves **costs** through waste minimization and energy efficiency.

Example: A production engineer aware of e-waste rules will plan for proper disposal of old circuit boards.

Q. Describe the importance of environmental awareness for engineers. (4 marks)
Ans:

- **Legal compliance:** Avoid penalties from CPCB/SPCB.
- **Risk reduction:** Prevent spills, emissions, and occupational hazards.
- **Resource efficiency:** Reduce water, energy, and raw material consumption.
- **Public image:** Industries with green certifications attract investors.
- **Innovation:** Drives development of cleaner technologies (e.g., electric vehicles).

Example: Awareness of carbon footprint leads a civil engineer to use fly-ash in concrete instead of cement – reduces CO_2.

Q. Define: Environment, Ecology, Pollution. (3 marks)
Ans:

- **Environment:** The sum total of all external conditions (living and non-living) surrounding an organism or community.
- **Ecology:** The scientific study of interactions among organisms and their physical environment.
- **Pollution:** Introduction of contaminants (pollutants) into the natural environment that cause adverse change.

Q. Define environmental pollution. (3 marks)
Ans:
Environmental pollution is the **undesirable change** in physical, chemical, or biological characteristics of air, water, or land that may harm human life, other living organisms, or property.
Example: Release of untreated dye factory effluent into a river – kills fish and makes water unfit for drinking.

Q. What is environmental degradation? List out causes of environmental degradation. (4 marks)
Ans:

- **Definition:** Deterioration of the environment through depletion of resources (air,

water, soil), destruction of ecosystems, and extinction of wildlife.

- **Causes:**
  - Deforestation (for agriculture, urbanization).
  - Overpopulation (exceeds carrying capacity).
  - Industrialization (emissions, effluents, solid waste).
  - Over-exploitation of groundwater (lowering water table).
  - Use of fossil fuels (air pollution, climate change).

Example: Mining in forest areas leads to soil erosion, water pollution, and loss of biodiversity.

Q. List any three principles of Environmental Science. (3 marks)
Ans:

1. **Everything is connected to everything else** – ecosystems are interdependent.
2. **Everything must go somewhere** – no waste disappears; it only moves (e.g., landfill leachate enters groundwater).
3. **Nature knows best** – human interventions often cause unintended harm (e.g., pesticides killing pollinators).

Q. Describe/illustrate with examples how technology impacts the environment. (4 marks)
Ans:

- **Positive impacts:**
  - Solar panels → reduce fossil fuel dependence.
  - Electric vehicles → lower tailpipe emissions.
  - Waste-to-energy plants → reduce landfill volume.
- **Negative impacts:**
  - Plastic manufacturing → non-biodegradable waste.
  - Coal power plants → fly ash, SO_2, CO_2.
  - Mobile phones → e-waste containing lead, mercury.

Example: The green revolution (high-yield crops, chemical fertilizers) increased food production but caused groundwater nitrate pollution.

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