

June : 2026

PHYSICS

Paper: SEC-PHY-201

Renewable Energy and Energy Harvesting

Time: 1½ Hours

Total Mark: 30

(The figures in the right margin indicate full marks of the questions)

1. Choose the correct option: 1×3=3
- a) Which of the following gases is the primary constituent of biogas produced in a biogas plant?
- (i) Carbon dioxide (CO_2) (ii) Hydrogen sulphide (H_2S)
- (iii) Methane (CH_4) (iv) Nitrogen (N_2)
- b) What does the term 'Insolation' stand for in the context of solar energy?
- (i) Instantaneous Solar Radiation
- (ii) Internal Solar Radiance
- (iii) Incident Solar Radiation
- (iv) Isolated Solar Radiation
- c) In the electrical equivalent circuit of a piezoelectric generator, it is typically modeled as an AC source in series with:
- (i) An inductor and a resistor
- (ii) A capacitor and a resistor
- (iii) Only an inductor
- (iv) Two capacitors
2. Answer the following questions: 2×3=6
- a) Write two environmental impacts of wind energy.
- b) What is Air mass ratio? What is the mathematical expression for the Air Mass Ratio?

Or

Identify the four main components of a solar water heater.

- c) Distinguish between the direct and reverse piezoelectric effects.

Or

State Faraday's Law of Induction as applied to electromagnetic energy harvesting.

3. a) State any three limitations of fossil fuels. 3
b) Explain the primary differences between Extraterrestrial and Terrestrial Solar Radiation. Enumerate the key factors that cause Terrestrial Solar Radiation to vary widely at the Earth's surface. 1+2=3

Or

What do you mean by conversion efficiency of solar cell? A solar cell receives an incident solar radiation of 1000 W. If it produces a maximum electrical power of 150 W, calculate the conversion efficiency of the solar cell. 1+2=3

- c) What are the two basic sources of wind? Briefly explain them. 1+2=3
d) Discuss how electromagnetic energy harvesting can be integrated into carbon capture technologies to improve efficiency. 3

Or

State Faraday's Law of Induction as applied to electromagnetic energy harvesting. Draw the electrical equivalent circuit for an electromagnetic energy harvester, clearly indicating the coil's resistance, inductance, and the induced voltage source. 1+2=3

4. Explain wet process methods used to generate energy from Biomass. 4
5. Explain the working of an open-cycle OTEC plant with a neat diagram. Write its advantages and disadvantages. 4+1=5

Or

What do you mean by Tidal and wave energy. explain briefly about Mini-hydel power plants. 1+1+3=5