

2025

(November--December)

3rd Semester (FYUGP)

Subject: Physics

Renewable Energy and Energy Harvesting

Paper: PHY-SEC-314

Marks: 30

Pass Mark: 09

Time: 1 $\frac{1}{2}$ Hours*The figures in the margin indicate full marks for the questions*

1. Choose the correct option: 1 × 3 = 3
- (a) Geothermal energy is the thermal energy from:
- (i) The sun's heat (ii) The Earth's interior
- (iii) Moving water in rivers (iv) The burning of fossil fuels
- (b) Which of the following is a disadvantage of geothermal energy?**
- (i) It does not work everywhere and requires a location with geothermal activity
- (ii) It is too expensive to use
- (iii) It only works when it is sunny
- (iv) It creates too much pollution
- (c) Which of the following factors does not affect the efficiency of a solar photovoltaic (PV) Cell?
- (i) Intensity of the incident light
- (ii) Temperature of the cell
- (iii) Angle of incidence of sunlight
- (iv) Colour of the supporting panel frame
2. Write short notes on (any two) 3 × 2 = 6
- (a) Piezoelectric Energy Harvesting
- (b) Solar Water Heater
- (c) Integration of Electromagnetic Energy Harvesting with Carbon Capture Technology
3. What are conventional and non-conventional energy sources? Describe the fossil fuel as a Conventional energy source. 1 + 1 + 3 = 5

4. Define Air-Mass ratio. A solar farm is located in a region where the solar zenith angle at solar noon varies throughout the year. On a particular day, the solar zenith angle is 45° . The solar panels at this site are designed to capture solar energy, and their efficiency depends on Air Mass Ratio (AMR). The baseline efficiency of the solar panels when the zenith angle is 0° is 25%. This efficiency decreases linearly with the increase in AMR. Specially for every unit increase in AMR above 1, the efficiency decreases by 1.5%.

(a) Calculate the AMR for the solar panel when the solar zenith angle is 45° .

(b) Determine the efficiency of the solar panel at this AMR.

(c) If the solar panels receive a total solar irradiance of 800 W/m^2 under the given conditions, what is the total power output per m^2 of the solar panels.

1+3=4

Or

On what principle Piezoelectric generator works? Define the following parameters in connection with piezoelectric materials- Piezoelectric Charge Constant, Piezoelectric voltage Constant and Dielectric constant.

5. What is solar cell? Discuss the principle and operation of solar cell.

1+3=4

Or

What do you mean by electromagnetic energy harvesting? Discuss application, advantages and limitations of electromagnetic energy harvesting.

1+3=4

6. What is wind energy? Write short notes on Vertical Axis Wind Turbines (VAWT).

1+3=4

7. Explain any two sources of Ocean energy.

2+2 =4
