Name: **Enrolment No:**	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2022

Course: Renewable Energy and Energy Harvesting **Semester: IV**
Program: B. Sc. (Physics H.) **Time: 03 hrs.**
Course Code: PHYS 2017 **Max. Marks: 100**

Instructions: All bold representations are vectors. Use of scientific calculator is permitted.

SECTION A
(5Qx4M=20Marks)

S. No.	**Each Question will carry 4 Marks. All questions are compulsory.**	**Marks**	**CO**
Q 1	What is Landfill gas and how it is recovered from waste dumps.	**4**	**CO1**
Q 2	Define Piezoelectric coefficients (d3i) and mentioned their importance.	**4**	**CO2**
Q 3	A wind generator produces 5.0 kW of power for a wind speed of 6.0 meter/sec. Estimate the best power produced for a wind speed of 12.0 meter/sec.	**4**	**CO3**
Q 4	What is greenhouse effect and how it can be reduced.	**4**	**CO1**
Q 5	What is meant by anaerobic digestion? What are the factors that affect bio-digestion?	**4**	**CO2**

SECTION B
(4Qx10M= 40 Marks)

	Each Question will carry 10 Marks. All questions are compulsory. Question 9 have an internal choice to attempt any one.		
Q 6	What are the main components of a flat plate solar collector? Explain the function of each.	**10**	**CO2**
Q 7	Consider the following two effects of global warming on sea (about 70% of the Earth's surface is ocean with an average depth of about 4 km) level rising: I. If the temperature of the whole ocean increased by 1 degree centigrade II. If the ice sheet over (average depth ~0.5 km and an area ~2 X 10^6 km^2) is fully melted. Calculate the sea level rising due to thermal expansion in statement I and statement II. (Take radius of Earth = 6.4×10^6 m, coefficient of thermal expansion of sea-water = 3×10^{-4} K^{-1}).	**10**	**CO3**

Q 8	Enlist advantages and disadvantages of tidal power production. What are the problems faced in exploiting tidal energy?	**10**	**CO2**
Q 9	Discuss piezoelectric effect. Write down piezoelectric constitutive equations for direct and converse piezoelectric effects. **Or** Briefly explain the CCS technology and its characteristics.	**10**	**CO1**
	SECTION-C **(2Qx20M=40 Marks)**		
	Each Question will carry 20 Marks. All questions are compulsory. Question 11 have have an internal choice to attempt any one.		
Q 10	A flat-plate collector measuring 2 m × 0.8 m has a loss resistance r_L = 0.13 m^2 KW^{-1} and a plate transfer efficiency η_{pf} = 0.85. The glass cover has transmittance τ = 0.9 and the absorptance of the plate is α = 0.9. Water enters at a temperature $T1$ = 40°C. The ambient temperature Ta = 20°C and the irradiance in the plane of the collector is G = 750 Wm^{-2}. **a)** Calculate the flow rate needed to produce a temperature rise of 4°C. **b)** Suppose the pump continues to pump at night owing to faulty control. Estimate the initial temperature decrease at each passage through the collector. Assume: G = 0, same pump rate, $T1$ = 40°C, Ta= 20°C.	**20**	**CO3**
Q 11	Mentioned most important benefits, associated environmental issues and risk factors associated with the hydropower technology. **Or** Explain and write notes on electromagnetic energy harvesting using linear generator. Why maximization of the electromagnetic damping is needed?	**20**	**CO2**