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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
Online End Semester Examination, May 2021

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

SECTION A

1. Each Question will carry 5 Marks
2. Instruction: Complete the statements or fill in the blank.

S. No.	Question	CO
Q1	Solar radiation reaches Earth's surface at a maximum flux density of about _____ in a wavelength band between _____ and _____, which includes visible region from ___ to ___.	**CO1**
Q2	Wind energy is special form of_____ in the air as it ____. Factors affecting the available power in the wind stream are____, _____ and _____. The most common wind turbine design is _____.	**CO1**
Q3	The power _____ is available in a deep-water wave (density= 1025 kg/m^3) of wavelength 100 m and amplitude 1.5 m.	**CO3**
Q4	The level of _____ in oceans rises and falls _____ as tides due to the relative positions of the Sun, ____ and _____.	**CO1**
Q5	Piezoelectric coefficient (d3i) is used to quantify the piezoelectric material performance, which is ratio of _____ to applied stress. Typically, _____ coefficient is higher than _____ coefficient. However, operation in _____ mode leads to the use of large ____ in 1-direction and thus is commonly implemented in PEH.	**CO2**
Q6	_____, also known pyrolysed biomass is obtained by pyrolysis process i.e. burning plant material at _____ temperatures under _____ oxygen levels.	**CO1**

SECTION B

1. Each question will carry 10 marks
2. Instruction: Write short / brief notes

Q1	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 $\eta_{pf} = 0.85$. The glass cover has transmittance $\tau = 0.9$ and the absorptance of the plate is $\alpha = 0.9$. Water enters at a temperature $T_1 = 40°C$. The ambient	**CO3**

	temperature $T_a = 20°C$ and the irradiance in the plane of the collector is $G = 750$ Wm^{-2}. Calculate the flow rate needed to produce a temperature rise of 4°C.	
Q2	Define and describe three kinds of solar tracker systems based on the types of drive and sensing motions.	**CO1**
Q3	How do you define a biomass? What are its advantages and disadvantages? Classify and elaborate the methods that convert biomass into energy.	**CO1**
Q4	Discuss piezoelectric effect. Write down piezoelectric constitutive equations for direct and converse piezoelectric effects.	**CO2**
Q5	a) Calculate the useful heat content per square kilometer of dry rock granite to a depth of 7 km. The geothermal temperature gradient G is constant at 40 ^{0}C/km. The minimum useful temperature for power generation is 140 K more than the surface temperature T_0. Density of rock (ρ_r) = 2700 kg/m^3, total thermal capacity of rock (C_r) = 820 J kg^{-1} K^{-1}. b) What is the time constant for useful heat extraction using a water flow rate of 1.0 m^3 s^{-1} km^{-2}? c) What is the useful heat extraction rate initially and after 10 years?	**CO3**

SECTION-C

1. Each Question carries 20 Marks.
2. Instruction: Write long answer.

Q 12	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?	**CO2**