BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: IMSC **SEMESTER : III**
BRANCH: PHYSICS **SESSION : MO/2022**

SUBJECT: SEC307 RENEWABLE ENERGY AND ENERGY HARVESTING (REEH)

TIME: 3:00 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) What are the main advantages of renewable energy sources over non-renewable sources? [CO1] [BL2] [2]
Q.1(b) Briefly discuss the primary and secondary energy sources with examples. [CO1] [BL2] [3]
Q.1(c) Name a few of the renewable energy sources available. Discuss the advantages and disadvantages of fossil fuels (at least three). [CO1] [BL2] [5]

Q.2(a) Briefly describe the principle of working of a solar cell. [CO2] [BL2] [2]
Q.2(b) Draw the typical current-voltage and power-voltage characteristics of a single crystalline silicon solar cell. [CO2] [BL3] [3]
Q.2(c) Define and indicate the open circuit voltage and short circuit current in the above plot. Define the fill factor. [CO2] [BL3] [5]

Q.3(a) Discuss the advantages and disadvantages of tidal power. [CO3] [BL2] [2]
Q.3(b) Consider a tide with the tidal range of 10 m and the surface of the tidal energy harnessing plant of area 9 km^2. Calculate the total potential energy per day and average power generated. Assume the density of sea water and the power efficiency conversion to be 1025 kg/m^3 and 30%, respectively. [CO3] [BL3] [3]
Q.3(c) Deep water ocean waves on an Indian coast had an amplitude of 1.2 m with a period of 6 s measured at the surface water 110 m deep. Taking water density as 1025 kg/m^3, calculate the following: The (i) wavelength, (ii) wave velocity, (iii) energy density, and (iv) power density of the wave. [CO3] [BL3] [5]

Q.4(a) Explain the direct and the converse piezoelectric effects. [CO4] [BL2] [2]
Q.4(b) Based on the structural configurations what are the different designs of piezoelectric nanogenerators (PENG)? Briefly discuss them (with schematics). [CO4] [BL3] [3]
Q.4(c) Mention applications of piezoelectric energy harvesting in healthcare. What are the parameters/constants which affect the performance of any piezoelectric material? Briefly discuss two of them. [CO4] [BL2] [5]

Q.5(a) Discuss the basic principle on which all electromagnetic generators work. [CO5] [BL2] [2]
Q.5(b) Discuss the factors on which the induced emf in electromagnetic generators depend. [CO5] [BL2] [3]
Q.5(c) What are the main components of a battery? What is the basic difference between a primary battery and a secondary battery? Discuss the factors affecting the battery's performance and life. [CO5] [BL2] [5]

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