

30/11/2024 MECH SEM-VII C SCHEME RES QP CODE: 10069678

Duration: 3hours

[Max Marks: 80]

N.B. : (1) Question No 1 is Compulsory.

(2) Attempt any three questions out of the remaining five.

(3) All questions carry equal marks.

(4) Assume suitable data, if required and state it clearly.

- 1 Attempt ANY FOUR questions of the following. [20]
- a) State the role of non-conventional energy sources in the current energy scenario of the India. [5]
- b) Discuss the I-V characteristics of a solar PV cell. [5]
- c) State the factors considered for site selection to install wind power plant. [5]
- d) Discuss the different methods of hydrogen production and storage. [5]
- e) Explain the working of solar pond. [5]
- 2 a) Illustrate the working principle of KVIC biogas plant with the neat sketch. [10]
- b) Estimate the monthly average daily global radiation on a horizontal surface at Ratnagiri (16°59' N, 72°05' E) during the 16<sup>th</sup> march if the average sunshine hours per day is 9.5. Assume the value of  $a = 0.31$  and  $b = 0.43$ . (Assume  $I_{sc} = 1353 \text{ W/m}^2$ ) [10]
- 3 a) Discuss types of fuel cells briefly [8]
- b) Describe the working principle of natural circulation solar water heater system. [8]
- c) Calculate the sunset hour angle and day length at a location, latitude 28.6 °N on June 28. [4]
- 4 a) Wind at 1 standard atmospheric pressure & 15 °C has a velocity of 15 m/s, turbine diameter is 120 m & turbine operating speed is 40 rpm at maximum efficiency. Calculate: [10]
- (a) Total Power Density in wind stream.
- (b) Maximum Power Density.
- (c) Reasonably obtainable Power Density assuming  $\eta = 35\%$
- (d) Maximum Torque & Axial Thrust.
- b) Describe the working principle of liquid dominated geothermal power plant. [5]
- c) Describe the types of solar photovoltaic systems. [5]
- 5 a) Illustrate the working principle of Open and Closed OTEC system with the neat sketch. [10]
- b) Following data is given for a family biogas digester; C.V. of methane = 28 MJ/m<sup>3</sup>, Burner efficiency = 70 %, Number of cows = 8, Retention period = 20 days, Temperature of fermentation = 300 °C, Dry matter collected/cow/day = 2 kg, Density of matter in the fluid in the digester = 50 kg/m<sup>3</sup>, Biogas yield = 0.2 m<sup>3</sup>/ kg of dry input, Methane production in Biogas = 0.7. Determine volume of Digester and power available from biogas digester. [10]

- 6 a) Illustrate the working principle of single & double basin tidal system with neat sketch. [8]
- b) Solar thermal power plant system installation is expected to minimize the plant's annual energy bill by Rs. 14 lacs. If the capital cost of new solar thermal power plant installation is Rs. 89 lacs and the annual operating and maintenance cost is 5 lacs. Determine, (a) The expected payback period for the proposed project. (b) The initial rate of return/return on investment. [8]
- c) Differentiate between the vertical and horizontal axis wind turbine. [4]
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