

Code No: 156DX

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD****B. Tech III Year II Semester Examinations, July - 2023****NON-CONVENTIONAL ENERGY SOURCES****(Common to CE, EEE, ME, ECE, MMT, MIE)****Time: 3 Hours****Max. Marks: 75**

- Note:** i) Question paper consists of Part A, Part B.  
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.  
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

**PART – A****(25 Marks)**

- 1.a) What are the conventional and non-conventional energy sources? [2]  
b) Explain the terms: (i) Extraterrestrial radiation (ii) Terrestrial radiation. [3]  
c) How solar thermal collectors are classified? [2]  
d) Explain the primary and secondary fuel cells. [3]  
e) What are the different modes of operation of a tidal power plant? [2]  
f) Differentiate between solar cell, solar PV module and solar PV panel. [3]  
g) Plot the graph between power coefficient and tip speed ratio. [2]  
h) Classify HAWT based on rotors. [3]  
i) List any two merits and demerits of geothermal energy. [2]  
j) Explain the different forms of biomass available as bio-fuels. [3]

**PART – B****(50 Marks)**

- 2.a) Make use of construction, explain the working of Pyranometer.  
b) Calculate the angle made by beam radiation with the normal to a solar flat-plate collector, pointing due south location in Delhi ( $28^{\circ} 38' N$ ,  $77^{\circ} 17' E$ ) at 9 a.m. solar time on December 1, 2003. The collector is inclined at an angle of  $36^{\circ}$  with the horizontal. Also, calculate day length. [5+5]

**OR**

- 3.a) Derive an expression for solar day length.  
b) Estimate the monthly average daily global radiation on the horizontal surface at Vadodara ( $22^{\circ} 00' N$ ,  $73^{\circ} 10' E$ ) during the month of March 16, 2013, if the average sunshine hours per day is 9.5. Assume constants:  $a = 0.28$  and  $b = 0.48$ . [5+5]

- 4.a) Discuss the modified flat plate collector with a neat sketch .  
b) Analyze the working of a thermoelectric generator. [5+5]

**OR**

- 5.a) Explain the working of a compound parabolic collector.  
b) Make use of schematic diagram, explain MHD open cycle system. [5+5]

6.a) Discuss the advantages and disadvantages of sensible heat storage with water as storage media.

b) Find the expressions for potential energy, kinetic energy and total energy per width of wave front. [5+5]

**OR**

7.a) Explain how heat is extracted from the solar pond?

b) Discuss the technology of ocean thermal energy conversion plant. [5+5]

8.a) Explain Betz model of expanding air stream tube to determine extraction of wind energy by wind mill.

b) Derive the expression for maximum axial thrust experienced by a wind turbine and find the condition for such operation. [5+5]

**OR**

9.a) Prove that wind turbine cannot extract more than 59.3% wind energy.

b) Wind at one standard atmospheric pressure and 15<sup>0</sup> C and has a velocity of 10 m/s temperature. A 10 m diameter wind turbine is operating speed at 5 rpm with maximum efficiency of 40%. Calculate (i) the total power density in the wind stream, (ii) the maximum power density, (iii) the actual power density (iv) the power output of the turbine, and (v) the axial thrust on the turbine structure. [5+5]

10.a) Differentiate aerobic and anaerobic digestion processes.

b) Make use of schematic diagram explain the working principle of vapour dominated hydrothermal geothermal power plant. [5+5]

**OR**

11.a) Compare fixed dome type and floating drum type biogas plants.

b) Discuss the potential of geothermal resources in India. [5+5]

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