Registration No.: | | | | | | | | | | |

Total Number of Pages: 02 **Course: IDD (B.Tech and M.Tech)**
Sub_Code: RME5D004

5th Semester Regular/Back Examination: 2024-25
SUBJECT: Non-Conventional Energy Sources
BRANCH(S): MMEAM, MECH, ME
Time: 3 Hours
Max Marks: 100
Q.Code: R383

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) Define energy chain.
b) What do you understand by energy audit?
c) What is solar time, and why is it different from the standard clock time of a country?
d) Write the importance of non-convectional energy sources.
e) Define principles of energy conservation.
f) Explain extraterrestrial and terrestrial radiations with a diagram.
g) Calculate the number of daylight hours in Odisha on December 14 $(20^{\circ}16' N)$.
h) Draw the I-V characteristics of a solar cell.
i) What are the factors responsible for the distribution of wind on the earth's surface?
j) Draw the OTEC plant with proper labeling.

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) On the basis of energy storage systems, explain that energy available in one form can be stored in another form with an example.
b) Write salient Features of 'Energy Conservation Act 2001'.
c) Explain the working principle of the solar dryer (with a diagram).
d) Calculate the angle of incidence of beam radiation on a plane surface, tilted by 45° from the horizontal plane pointing 30° west of south-located Odisha at 2.30 PM (IST) on December 14th. The longitude and latitude of Odisha $(85^{\circ}49'E, 20^{\circ}16'N)$ respectively. The standard longitude for IST is $(80^{\circ}30'E)$.
e) Describe the principle of solar photovoltaic energy conversion.

f) Explain the workings of the municipal solid waste incineration plant with a block diagram.

g) Describe various methods for the storage of hydrogen.

h) Write different types of geothermal resources, and explain the working of dry-steam hydrothermal systems with a proper diagram.

i) Explain the working principle of the Pyrheliometer with a neat sketch.

j) Write the advantages and disadvantages of concentrating collectors over flat-plate types of solar collectors.

k) A deep ocean wave of 2 m peak to peak appears at a period of 8 s. Find the wavelength, phase velocity, and power associated with the wave.

l) What is a Solar greenhouse? With a neat sketch, explain greenhouse for cold climate.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 **a)** Explain the working principle of the solar pond power plant in a neat sketch. **(8x2)**

b) Estimate the monthly average daily diffuse and beam radiation on a horizontal surface at Kolkata ($22^0 34'03''$ N, 88^0 22' 12" E). During the month of December, if the average sunshine hour per day is 6 hours. Use (a = 0.28, b = 0.42) and

$H_0 is\ equal\ to\ \overline{H_0}\ on\ December\ 10, H_0 = 3600 \times \frac{24}{\pi} \times I_{sc}\left(1 + 0.033\ cos\frac{360n}{365}\right) \times (\cos\emptyset \times \cos\delta \times \sin\omega_s + \omega_s \times \sin\emptyset \times \sin\delta)$, $and\ \ \frac{\overline{H_d}}{\overline{H_g}} = 1.354 - 1.57\overline{K_T}$

Q4 **a)** A propeller-type wind turbine has the following data: average free wind speed at a standard height of 10 m = 8 m/s, air density = 1.226 kg/m^3, α = 0.13, the height of tower = 80 m, the diameter of rotor = 60. Downstream, the wind velocity of the turbine is half of the upstream wind. Calculate a) Total power available in wind, b) Power extracted by the turbine, c) Axial force on the turbine when maximum power is extracted, and d) Axial force on the turbine at stall condition. **(8x2)**

b) Explain the working principle of a horizontal axis wind turbine with a neat sketch.

Q5 **a)** Explain different forms of biomass, their composition, and properties. **(8x2)**

b) Explain different biomass conversion technologies.

Q6 **a)** Write the classification of the fuel cells and explain the working principle of an alkaline fuel cell with a neat sketch. **(8x2)**

b) Explain the VI characteristics of a fuel cell.