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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

May 2023 Semester End Make-Up Examinations

Programme: B.E. **Semester: V**
Branch: Mechanical Engineering **Duration: 3 hrs.**
Course Code: 20ME5DERES **Max Marks: 100**
Course: Renewable Energy Sources **Date: 17.05.2023**

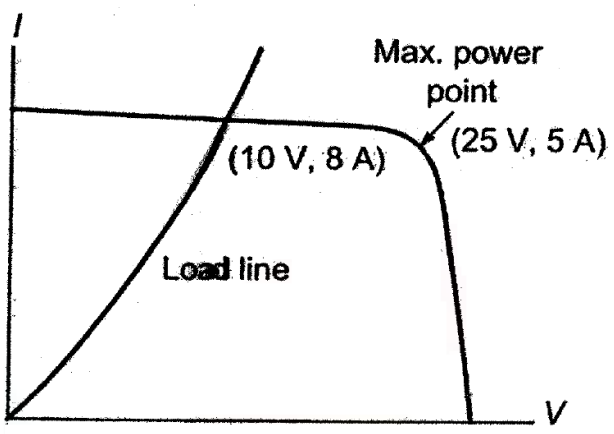
Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may suitably be assumed.

UNIT - I

1	a)	Explain the general principles of energy conservation.	**05**
	b)	Explain the salient features of Energy Conservation Act 2001.	**05**
	c)	What is Clean Development Mechanism (CDM)? Explain the five main steps of CDM project process.	**10**

UNIT - II

2	a)	Explain with neat sketches, the effect of partial shadowing of a cell in an open-circuited series string of cells and complete shadowing of one cell in a short circuited, series string of cell.	**05**
	b)	Draw the schematic diagram of a general grid-interactive solar PV system.	**05**
	c)	A PV source having IV characteristics as shown in the below figure is supplying power to a load whose load line intersects the characteristics at (10 V, 5 A). Determine the additional power gained if an MPPT is interposed between the source and the load. If the cost of MPPT is Rs. 4000/-, for how long does the system need to operate in order to recover the cost of MPPT?. Assume the cost of the electricity to be Rs. 3/- per kWh and efficiency of MPPT to be 95%.	**10**



UNIT - III

3	a)	Explain the major impacts of Wind turbines on the environment.	**05**

b) Explain any five main design considerations of Horizontal Axis Wind Turbine with relevant plots, formulas and sketches. **05**

c) With a neat sketch, explain the working principle of a horizontal axis two blade type wind mill. **10**

OR

4 a) Draw a neat labelled vector diagram of all the forces acting on an elemental blade section of an aero-turbine and list all the notations used. **05**

b) Represent the basic components of wind Energy Conversion System in the form of a block diagram. **05**

c) Wind at 1 standard atmospheric pressure and 15 °C is blowing at an initial velocity of 15 m/s. Calculate: **10**
i) Total power density in the wind stream.
ii) Maximum obtainable power density.
iii) Reasonably obtainable power density, assuming efficiency to be 35%.
iv) The total power.
v) Torque and Axial thrust.
Given: Turbine diameter = 120 m, turbine operating speed = 40 rpm at maximum efficiency of propeller type turbine

UNIT - IV

5 a) Sketch and label the common circular fixed dome type biogas digester. **05**

b) Explain any five site selection considerations for setting up a biogas plant. **05**

c) The following data are given for a family biogas digester suitable for the output of five cows: the retention time is 20 days, temperature 30 ° C, dry matter consumed per day is 2 kg, biogas yield is 0.24 m^3 per kg. The efficiency of burner is 60 %, methane proportion is 0.8. Heat of combustion of methane = 28 MJ/ m^3, **10**
Assuming the standard data for designing, Calculate: The volume of biogas digester and the power available from the digester.

OR

6 a) Represent the process of ethanol production from wood by acid hydrolysis in the form of a block diagram. **05**

b) Explain the major problems associated with the development of gasifier technology. **05**

c) With a neat sketch, explain the down draught type of gasifier depicting various temperature zones and reactions. **10**

UNIT - V

7 a) List and explain the common fuels used in fuel cells. **05**

b) Draw the schematic diagram of Polymer Electrolyte Membrane Fuel Cell with all the relevant reactions. Also list the desired properties of the membrane. **05**

c) A hydrogen-oxygen fuel cell in which the following reaction occurs, operates at 25 °C. **10**
$H_2 + 2OH^- \rightarrow 2\ H_2O + 2e^-$
Calculate the voltage output of the cell, the efficiency and the electric work output per mole of H_2 consumed and per mole of H_2O produced. Also compute the heat transferred to the surroundings. Assume at 298 °K, $\Delta G° = -237191$ kJ/kg mole and $\Delta H° = -285838$ kJ/kg mole.

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