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Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)



END SEMESTER EXAMINATIONS, MAY 2016

SUBJECT: RENEWABLE ENERGY [ELE 322]

(PROGRAM ELECTIVE - I)

REVISED CREDIT SYSTEM

Time: 3 Hours

11 MAY 2016

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ANY FIVE FULL questions.
- Missing data may be suitably assumed.

1A.	Describe the construction & working principle of pyranometer with a neat diagram.	(03)
1B.	Explain the working of forced circulation solar water heater with a neat diagram. Mention its advantages.	(03)
1C.	Calculate the average value of solar radiation on a horizontal surface for June 19, at the latitude of 10° N. The constants a & b are 0.30 & 0.51 respectively. The average sunshine hours per day is 9.1. (Assume I_{sc} =1353 W/m ²)	(04)
2A.	Describe the working of compound parabolic concentrator with the help of neat diagram.	(03)
2B.	Calculate the angle made by the beam radiation with normal to a flat plate collector on November 30 at 9.00 A.M. solar time for a location at 27 ^o 30' N, the collector is tilted at an angle of latitude plus 12 ^o with the horizontal and is pointing due south.	(03)
2C.	Explain the working principle of solar cell with a relevant diagram. Mention its applications.	(04)
3A.	A hetro-junction solar cell of active area 8 cm ² gave the following results: Voc=500 mV, short circuit current is 250 mA under an insulation equal to 0.8 Sun. Calculate the energy conversion efficiency of the device? (Assume fill factor of 80% & 0.1 SUN=10mW)	(03)
3B.	A house has the following electrical appliance usage:	
	Four 18 watts fluorescent lamp with electronic ballast used 4 hours per day. Two 60 watts fan used for 3 hours per day. One 75 watts refrigerator that runs 24 hours per day with compressor running for 12 hours and off for 12 hours. The system will be powered by $12 V_{dc}$, 110 Wp PV module	

- a. Determine the power consumption demands
- b. Size of the PV panel
- c. Inverter sizing
- d. Battery sizing: So the battery should be rated 12 V, 600 Ah for 2 days.

(04)

3C.	Explain the site selection considerations for wind turbine installation & best site for wind energy conversion.					
4A.	Describe the working principle of Savonious rotor with a neat figure. Mention its advantages & disadvantages.	(03)				
4B.	Wind at 1 atm has a velocity of 8 m/s, & air density of 1.226 kg/m 3 calculate					
	a. Total power					
	b. Max power					
	c. Torque at maximum efficiency					
	d. Maximum axial thrust.					
	Assume the turbine diameter to be 60 m, turbine operating speed to be 30 rpm.	(04)				
4C.	Explain the working of Solar- wind hybrid system with storage battery, supplying various consumers with the help of neat diagram.	(03)				
5A.	Mention the different types of biogas plants. Explain the working of single & two stage continuous biogas plants with neat figures.	(04)				
5B.	Describe the following Biomass process					
	a. Pyrolysis					
	b. Anaerobic digestion					
	c. Fermentation.	(03)				
5C.	Calculate the following:					
	i. The volume of a biogas digester suitable for the output of 4 cows, and					
	ii. The power available from the digester.					
	Assume a retention time of 20 days, temperature of 30° c, dry matter consumed is 2 kg/day, biogas yield is 0.24 m ³ per kg. Burner efficiency is 70%, methane proportion is 0.8 H the heat of combustion of methane may be assumed to be 28 ML/m ³ at STP	(02)				
	$0.8. H_{\rm m}$, the near of combustion of methane may be assumed to be 28 MJ/m ³ at STP.	(03)				
6A.	With a neat diagram, explain the working of down drought gasifier. Mention its advantges.	(03)				
6B.	With a neat diagram explain the working of closed cycle ocean thermal energy conversion system.	(03)				
6C.	Describe the working principle of double basin tidal power generating system with a neat figure. Also, mention the advantages & disadvantages of tidal power generating system.	(04)				