Mech.

College of Engineering, Pune

(Final Year B. Tech)- (Mechanical)

(Subject Code)- ME 405-4 (Energy Systems)

Date- 1 December 2012 **Timing: 3 hrs**
Academic Year: 2012- 13 **Max. Marks: 50**

End semester Examination

Instructions:
1. Attempt all questions
2. Figures to the right indicate full marks
3. Use of non-programmable calculator is permitted
4. Make suitable assumptions if necessary

Q. 1	A.	Draw a neat labeled sketch of a Flat plate collector showing its internal structure (No Description)	5
	B	Explain with a neat schematic arrangement how flat plate collectors are tested and characterized?	5
Q2.	D	Discuss different modes of tracking in Concentrating Collectors with respect to their arrangement, efficacy, technical feasibility and economic viability?	5
	A	Explain the following i. Declination ii. Solar Time iii. Heat removal Factor iv. Tilt Factor v. Solar Fraction	5
Q3.	A	Describe mechanisms of shading excess wind in horizontal axis wind machines	3
	C	A wind turbine with rotor diameter 8 m is installed at a certain location. The wind data for this location indicates Raleigh Winds with shape factor 2 and scale factor 8.Determine i. Average wind speed ii. No. of hours, wind speed will be below cut in speed of 8 m/s over a year iii. No. of hours, wind speed will be above cut off speed of 18 m/s over a year iv. No. of hours wind speed will generate power? v. If rated wind speed is 11m/s., how much energy in kWh the wind turbine will generate? (Power Coefficient of the turbine is 75% of the Betz limit) vi. What is the capacity factor for the location?	 1 1 1 1 2 1
Q4.		Design a complete solar photovoltaic system with an array of SPV modules, their configuration, lay out (parallel/ series), charge	10

		controller, battery type and size, inverter size, etc. to cater power requirement for an ATM room. 12 hours of autonomy per day is expected from the PV circuit Assume connected load of the ATM to be 1.3 kW with a diversity factor of 0.7. Take Inverter efficiency - 90% Battery efficiency - 80% Battery bank voltage – 48 V Nominal Battery voltage – 12 V Average solar radiation – 600 W/m^2 Average peak sunshine hours per day – 5.5 hrs. Average ambient temperature – 32°C Average values of solar data are applicable for 250 days in a year Nominal operating cell temperature – 45°C Select panels from Table 1.Make suitable assumptions if needed. Draw a neat lay out of the system Determine kWh generated by the array annually? What is SPP of the system if electricity rate is Rs. 12 per kWh	
Q5.	A	Explain briefly the routes of biomass energy conversion	3
	B	Describe with a neat sketch updraft gasifier. Compare the same with down draft gasifier.	4
	C	Explain with a neat sketch a basic thermionic generator	3

Table 1. Solar photovoltaic panel specifications and Brands

	BP	Shell	Sharp	Kyocera
No. of Cells per module	72	42	72	36
Rated power at STC, W	150	40	165	120
Voc, V	42.8	23.3	43.1	21.5
Isc, A	4.75	2.68	5.46	7.45
Width x Length x height mm	1587x790x50	1293x329x54	1587x790x50	1425x652x52
Voltage at maximum power, V	34	16.6	34.6	16.9
Current at Rated power	4.45	2.41	4.77	7.1
Module cost Rs.	5000	1800	6000	4000

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