

Total No. of Questions : 8]

SEAT No. :

P3594

[Total No. of Pages : 4

[4959]-1066

B.E. (Electrical Engineering) (End Semester)

RENEWABLE ENERGY SYSTEMS

(2012 Course) (Elective - I)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.
- 2) Draw neat diagram wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Use of calculator is allowed.
- 5) Assume suitable data if necessary.

- Q1)** a) Calculate the angle made by beam radiation with the normal to a flat-plate collector on December 1 at 9.00 h (Local Apparent Time). The collector is located in New Delhi (28°35'N, 77°12'E) and is tilted at an angle of 36° with the horizontal and is pointing due south. [8]
- b) List the different types of collectors. Explain any one in detail. [8]
- c) What are the different controls required in operation of wind turbine unit? [4]

OR

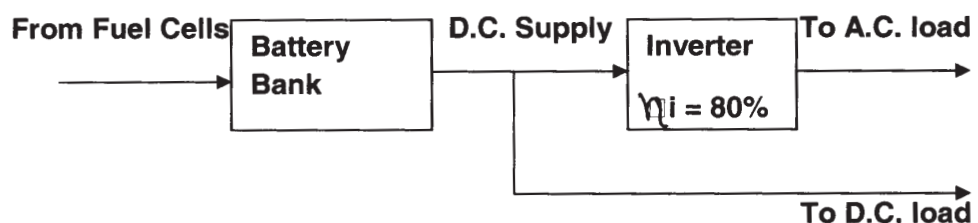
- Q2)** a) Calculate the hour angle at sunrise and sunset on June 21 and December 21 for a surface inclined at an angle of 15° and facing due south ( $\gamma=0^\circ$ ). The surface is located in Bombay (19°07'N, 72°51'E). [8]
- b) What are the different components of a solar PV system? Draw a single line diagram of a grid connected solar PV system? [8]
- c) Define any two : [4]
- i) Cut-in speed
  - ii) Cut-out speed
  - iii) Power coefficient of a wind turbine
  - iv) Hub.

P.T.O.

- Q3)** a) Which are the types and sub types of Biomass conversion processes? Explain any one in detail? [4 + 5 = 9]
- b) 800 kW Biomass Power Plant generates electricity by direct combustion process with daily plant load factor (PLF) of 83.33%. Efficiency of electrical generator is 95%, steam turbine is 30% and of Boiler is 65%. Rice husk is used as a biomass fuel, specific energy of which is 3.926 kWh/kg. Find :
- i) Total weight of Rice Husk required per day as a biomass fuel. [5]
- ii) Weight of the ash per day, if Rice Husk contains 25% ash of its weight. [2]

OR

- Q4)** a) Which factors affect the generation of biogas in a Biogas Plant? How?[5]
- b) What are the advantages of Biogas production? [4]
- c) A Landfill site produces Landfill Gas (LFG) to generate electricity through 3 MW plant with annual load factor of 80%. The LFG produced has energy density of 4.1677 kWh/Nm<sup>3</sup> and overall energy conversion efficiency from LFG to electricity is 95%. Each ton of wet Municipal Solid Waste (wet MSW) produces 90 Nm<sup>3</sup> of LFG annually. Find :
- i) Total volume of LFG required annually in Nm<sup>3</sup>. [5]
- ii) Total weight of wet MSW required annually in tons. [2]
- Q5)** a) Define and state the expressions of energy efficiency, voltage efficiency and coulomb efficiency of battery? [1 + 1 + 1 = 3]
- b) What is operating principle of fuel cell? What are fuel cell system characteristics? [3 + 3 = 6]
- c) The different household appliances consume total energy of 4000 Wh/day. The household appliances include A.C. Refrigerator, which uses 1000 Wh/day, 5 A.C. lights of 30 W each are ON for 4 h/day and other A.C. load. The fuel cells are feeding to Battery bank, and Inverter (having 80% efficiency) is used to supply A.C. loads.



Find D.C. energy supplied per day by battery bank. If,

- i) All loads are A.C. load? [3]
- ii) A.C. Refrigerator is replaced by D.C. Refrigerator which consumes energy of 800 Wh/day and A.C. lights are replaced by D.C. lights (i.e. 5 lamps, 20 W each, consumption 4 h/day). Other A.C. load remains unchanged? [4]

OR

- Q6)** a) State and explain (two each) construction and operating factors affecting lead acid battery performance. [3 + 3 = 6]
- b) Explain in detail about compressed air storage system. [3]
- c) A 100 Ah, battery with a rest voltage of 12.5 V is charged (at its current State of Charge) at a C/10 rate by applying charging voltage of 13.5V.
- i) Estimate the internal resistance of the battery. [3]
  - ii) Estimate % energy lost within internal resistance of the battery during charging. [4]

- Q7)** a) Define and state limitations of : [3 + 3 = 6]
- i) Payback Period Method
  - ii) Initial rate of return/ Return on Investment (ROI).
- b) Define and Explain with an example about Life Cycle Costing. [4]
- c) A co-generation system installation is expected to reduce the company's annual energy bill by Rs. 20 Lacs. If the capital cost of new co-generation installation is Rs. 90 Lacs and the annual operating and maintenance cost is Rs. 5 Lacs. [4 + 4 = 8]
- i) What will be the expected payback period for the project?
  - ii) What will be the Initial (Simple) Rate of Return/Return on Investment (ROI)?

OR

- Q8)** a) What is mean by Time Value of money? Why it should be considered? What is Net Present Value (NPV)? [2 + 2 + 2 = 6]
- b) Define and Explain with an example about Internal Rate of Return. [4]

- c) Using NPV analysis technique determine NPV of each proposed project shown in table and find which project shall be chosen for implementation, if the annual discount rate is 10% for each project? [8]

	Project 1	Project 2
Capital cost Rs.	15000	15000
Year	Net Annual saving at the end of the Year Rs.	Net Annual saving at the end of the Year Rs.
1	+ 6000	+ 6400
2	+ 6000	+ 6200
3	+ 6000	+ 6000
4	+ 6000	+ 5800
5	+ 6000	+ 5600
Total Net Saving at end of 5 years	+ 30000	+ 30000

