

**M.E. DEGREE EXAMINATIONS: DECEMBER 2009**

First Semester

**ENERGY ENGINEERING**

EEG555: Waste Heat Recovery Systems

**Time: Three Hours**

**Maximum Marks: 100**

**Answer ALL the Questions:-**

**PART A (10 x 2 = 20 Marks)**

1. Define operating cost.
2. What is the function of an economizer?
3. What is the function of a heat pump?
4. What are the direct and indirect benefits of waste heat recovery?
5. How will go about developing a waste heat recovery system?
6. What do you mean by 'Thermal Pollution'?
7. What is 'Thermal Discharge Index' (TDI)?
8. What is particulate emission?
9. What is the object of energy storage in a utility system?
10. What is a fuel cell?

**PART B (5 x 16 = 80 Marks)**

11. (a) (i) Explain the working of a diesel engine power plant with a neat sketch

**(OR)**

(b) A reversible heat engine operating between reservoirs at 900K & 300K drives a reversible refrigerator operating between reservoirs at 300K & 250K. The heat engine receives 1800KJ heat from 900K reservoir. The net output from the combined engine refrigerator is 360KJ. Find the heat transferred to the refrigerator & the net heat rejected to the reservoir at 300K.

12. (a) What are the three modes in which electro chemical energy is stored? How are secondary batteries different from primary batteries?

**(OR)**

(b) How can compressed air be stored in compressed air energy storage system? What is adiabatic storage? What is a hybrid system?

13. (a) Explain the operating principle of a regenerator with a neat sketch.

(OR)

(b) Explain the operating principle of a waste heat recovery boiler with examples.

14. (a) Explain the principle of operation of a heat pipe. What are the typical applications of a heat pipe in heat exchangers?

(OR)

(b) The following data relate to a 10MW

Power station:

Cost of plant = Rs. 1200 per KW

Interest, insurances & taxes = 5% per annum

Depreciation = 5%

Cost of primary distribution = Rs500000

Interest, insurances, taxes & depreciation = 5%

Cost of coal including transportation = Rs. 4.4 per KN

Operating cost = Rs. 5, 00,000

Plant maintenance cost:

(i) Fixed: Rs. 20, 000 per annum

(ii) Variable: Rs. 30, 000 per annum

Installed plant capacity = 10,000 KW

Maximum demand = 9, 000 KW

Annual load factor = 0.6

Consumption of coal = 2, 55,000 KW

Determine the following:

(i) Cost of power generation per KW per year

(ii) Cost per KW h generated

(iii) Total cost of generation per KW hr

Transmission or primary distribution chargeable to generation. Waste heat recovery equipment is installed which saves 20% of the energy generated. Find the reduction in operating cost of the plant.

15. (a) What are the various methods of storage or disposal of radioactive waste materials?

(OR)

(b) Write a short note on Pollution from nuclear power plants.

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