

M.E DEGREE EXAMINATIONS: JANUARY 2011

First Semester

ENERGY ENGINEERING

EEG555: Waste Heat Recovery Systems

Time: Three Hours

Maximum Marks: 100

Answer ALL Questions: -

PART A (10 x 2 = 20 Marks)

1. Differentiate between path function and point function
2. Define waste heat
3. What is the need for energy storage?
4. Give two applications of thermal energy storage
5. What are heat wheels?
6. What are recuperators and regenerators?
7. Define operating cost
8. What are the direct and indirect benefits of waste heat recovery?
9. What do you mean by thermal discharge index?
10. What is an electrostatic precipitator?

PART B (5 x 16 = 80 Marks)

11. (a) Explain the working of a diesel power plant with a neat lay out
(OR)
(b) Explain in detail the classification, benefits and applications of waste heat recovery
12. (a) With the help of a neat sketch explain a simple adiabatic compressed air energy storage system
(OR)
(b) Explain the principle of energy storage by a flywheel in utilities. On what factors does energy storage depend?
13. (a) (i) Explain the principle of operation of a heat pipe with a neat sketch (8)
(ii) Explain the classification of different waste heat recovery system. (8)
(OR)
(b) (i) Explain the operating principle of a waste heat recovery boiler. (8)
(ii) Explain the working of a regenerator with a neat sketch. (8)
14. (a) It is proposed to supply a load with a maximum demand of 100 MW and a load factor of 0.4. Choice is to be made from nuclear, hydro and steam power plants. Calculate the overall cost per KWHR in each scheme

Cost	Nuclear Power Plant	Hydro Electric Power Plant	Steam Power Plant

Capital per KW installed	₹ 6000	₹ 4320	₹ 2160
Interest	10%	10%	12%
Depreciation	10%	8%	12%
Transmission and distribution cost/KWHR	0.24 paise	0.96paise	0.24 paise

(OR)

(b) The following data relate to a 15 MW power station

- (i) Cost of plant = ₹ 1500 per KW
- (ii) Interest, insurance and taxes = 5% per annum
- (iii) Depreciation = 5%
- (iv) Cost of primary distribution = ₹ 600000
- (v) Annual interest, insurance and taxes and depreciation on primary distribution = 5%
- (v) Cost of coal including transportation = ₹ 4.4 /kg
- (vi) Operating cost = ₹ 600000

Plant /maintenance cost

- (i) Fixed = ₹ 20000 per annum
- (ii) Variable = ₹ 30000 per annum

Installed plant capacity = 10000 KW

Maximum demand = 9000KW

Consumption of coal = 2, 65,000 kg for 15 MW

Determine the following

- (i) Cost of power generation per KW per year
- (ii) Cost per KWHR generated
- (iii) Total cost of generation per KWHR

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) (i) Explain briefly about thermal pollution (8)

(ii) Enumerate the ways to reduce thermal pollution? (8)

(OR)

(b) (i) Write briefly about pollution from nuclear power plants (8)

(ii) Discuss the various effects on environment due to cogeneration process (8)
