Roll No: ----------

UNIVERSITY OF PETROLEUMAND ENERGY STUDIES

End Semester Examination, December 2017

Program :	**M.Tech. – Energy System & REE**	**Semester**	**: I**
Course Name :	**Waste Heat Recovery & Cogen**	**Max. Marks**	**: 100**
Course Code :	**EPEC 7004**	**Duration**	**: 3Hrs**
No. of page/s :	**2**		

Section-A (4 x 5 = 20)

All questions are compulsory. The assigned marks are indicated against each question.

1. Write the criteria for designing a waste heat recovery device. (5)
2. Write a note for low grade waste heat recovery. (5)
3. What is the difference between Thermal power plant turbine & Cogen turbine? (5)
4. What should be main criteria for deciding about type of Cogen plant? (5)

Section-B (4 x 10 = 40)

5. Describe the "Radiation / Convective Hybrid recuperator" and "Plate heat exchanger". (10)
6. Explain Combined cycle and its T-S diagram (10)
7. Draw the schematic flow diagram of "Detailed Energy Audit Methodology". (10)
8. A shell and tube exchanger of following configuration is considered being used for oil cooler with oil at the shell side and cooling water at the tube side. (10)

   Tube Side : 460 Nos x 25.4mmOD x 2.11mm thick x 7211mm long, Pitch – 31.75mm 30^{o} triangular, 2 Pass
   Shell Side : 787 mm ID, Baffle space – 787 mm, 1 Pass
   The monitored parameters are as below:

Parameters	Units	Inlet	Outlet
Hot fluid flow, W	kg/h	719800	719800
Cold fluid flow, w	kg/h	881150	881150
Hot fluid Temp, T	^{o}C	145	102
Cold fluid Temp, t	^{o}C	25.5	49
Hot fluid Pressure, P	bar g	4.1	2.8
Cold fluid Pressure, p	bar g	6.2	5.1

Calculate the Capacity Ratio & Effectiveness of heat exchanger

Section-C (2 x 20 = 40)

9. Explain the classifications of various Cogen Systems (20)

10. A Gas Turbine Based Co-generation system is having following parameters (20)

Capacity of gas turbine generator : 4000 kW Plant
operating hours per annum : 8000 hrs. Plant load
factor : 90 %
Heat rate as per standard given by gas.trubine supplier: 3049.77 kCal / kWh
Waste heat boiler parameters – unfired steam output: 10 TPH
Steam temperature : 200 ^{0}C
Steam pressure : 8.5 kg /cm^2.
Steam enthalpy : 676.44 kCal / Kg.
Fuel used : Natural gas Calorific value –
LCV : 9500 Kcal/ sm^3
Price of gas : Rs 3000 /1000 sm^3
Capital investment for total co-generation plant : Rs. 1300 Lakhs

Calculate the Following:

a). Power Generation,

b). Heat input to generate above units

c). Natural gas quantity required per annum

d). Cost of fuel per annum

OR

Make a comparison of typical performance parameters of various cogen prime movers.

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UNIVERSITY OF PETROLEUMAND ENERGY STUDIES

End Semester Examination, December 2017

Program :	**M.Tech. – Energy System**	**Semester**	**: III**
Course Name :	**Energy Management & Audit**	**Max. Marks**	**: 100**
Course Code :	**MNEG 831**	**Duration**	**: 3Hrs**
No. of page/s :	**1**		

Section-A (4 x 5 = 20)

All questions are compulsory. The assigned marks are indicated against each question.

1. What are the options for waste heat recovery from glass & metal furnaces? (5)
2. Write a note about "Thermo compressor". (5)
3. Describe the significance of "Heat to Power Ratio" in Cogen (5)
4. Why and where Cogen is required? (5)

Section-B (4 x 10 = 40)

5. Describe the various recuperators and their application. (10)
6. What factors affect the "Effectiveness of Heat exchanger"? (10)
7. Explain schematic diagram and T-S diagram of a Cogen Cycle (10)
8. Explain the significance of LMTD in a heat exchanger. (10)

Section-C (2 x 20 = 40)

1. What are the advantages & Disadvantages (Relative Merits) of various Cogen Systems? (20)
2. A Gas Turbine Based Co-generation system is having following parameters (20)

Capacity of gas turbine generator : 4000 kW Plant
operating hours per annum : 8000 hrs. Plant load
factor : 90 %
Heat rate as per standard given by gas.trubine supplier: 3049.77 kCal / kWh
Waste heat boiler parameters – unfired steam output: 10 TPH
Steam temperature : 200 ^{0}C
Steam pressure : 8.5 kg /cm^2.
Steam enthalpy : 676.44 kCal / Kg.

Fuel used	:	Natural gas Calorific value –
LCV	:	9500 Kcal/ sm^3
Price of gas	:	Rs 3000 /1000 sm^3
Capital investment for total co-generation plant	:	Rs. 1300 Lakhs

Calculate the Following:

a). Natural gas quantity required per annum

b). Cost of fuel per annum

c). Overall cost of power from cogeneration Plant

d). Cost of power

OR

What are the Best practices recommended for a Cogen system?
