

**B.E. (FULL-TIME) DEGREE END SEMESTER EXAMINATIONS - NOV. / DEC. 2012**

**MECHANICAL ENGINEERING – VII SEMESTER (R-2008)**

26

**ME 9401 – POWER PLANT ENGINEERING**

Time : 3 Hours

Max. Marks : 100

**PART – A ( 10 X 2 = 20 Marks)**

1. Expand the abbreviation of "MHD" and "OTEL" with respect to power plant.
2. What do you understand by the term "co-generation" in a power plant?
3. State the function of Air pre heater and Electrostatic precipitator in a thermal power plant.
4. List out the functions of a control rod in a Nuclear Reactor.
5. State the functions of a draft tube in a water turbine.
6. Mention the applications of a Fuel Cell.
7. What is the purpose of Exhaust Gas analyzer in a power plant?
8. List out the different types of improving the thermal efficiency of an open cycle gas turbine.
9. Define demand factor and load factor.
10. What are the elements which contribute to the cost of electricity?

**PART – B ( 5 X 16 = 80 Marks)**

- 11 Explain with neat diagrams the four circuits of a modern steam power plant. ( 16 )
- 12.a) i) Explain with a neat diagram the boiling water reactor in a nuclear power plant. ( 6 )  
 ii) Explain with the diagrams induced draught system, forced draught system and balanced draught system. ( 6 )  
 iii) Draw the p-v, T-s diagram of a Rankine Cycle in a steam power plant. ( 4 )
- (OR)
- b) i) State the Law of disintegration of Radio activity and derive an equation for the same. ( 6 )  
 Also derive an equation for half life period and mean life period.
- ii) A steam jet turbo-generator develops 100 kW using 13.6 kg of steam per kWh. The exhaust steam pressure is of 14 bar and 680.4 kg of cooling water are passed throughout the condenser per minute. The inlet and outlet temperatures are respectively 15.6°C and 32.2°C. Estimate the dryness fraction of Exhaust steam. The temperature of hot well is 35°C. (10)
- 13.a) i) What do you understand the terms PAFC, MCFC, SOFC and PEM systems with respect to fuel cell and explain any two of them with neat diagrams. (10)
- ii) Calculate the specific speed of a turbine from the following data. ( 3 )  
 Speed of turbine : 532 rpm  
 Head of water : 150 metre  
 Power developed : 14000 kW
- iii) "Power Generation by gas turbine are more attractive these days". Justify this statement. ( 3 )

(OR)

..... : 2 :

- b) i) Draw a neat diagram of a free piston generation turbine power plant and indicate the various parts in the sketch with direction of flow. (6)
- ii) Compare impulse turbine and reaction turbine in a hydro electric power plant. (4)
- iii) List out the different types of Geothermal power plants and explain any one of them with a neat diagram. (6)
- 14.a) An unknown hydrocarbon fuel  $C_xH_y$  was allowed to react with air. An orsat analysis was made of a representative sample of the product of Gases with the following result.  $CO_2 = 12.1\%$ ,  $O_2 = 3.8\%$ ,  $CO = 0.9\%$  and remaining nitrogen. (16)
- Determine
- The chemical equation for the actual reaction.
  - The composition of fuel.
  - A/F ratio during the test.
  - Stoichiometric A/F ratio.
  - % of excess air.

(OR)

- b) i) Explain with a neat diagram the optical pyrometer. (7)
- ii) Explain the bourdon tube pressure gauge with a neat diagram. (6)
- iii) List out the impurities present in water. (3)
- 15.a) Two steam turbines each of 30 MW capacity take a load of 45 MW. The steam consumption rates per kg per hour for both turbines are given by the following equations (16)
- $$S_1 = 2400 + 12L_1 - 0.00012L_1^2$$
- $$S_2 = 1200 + 8.4L_2 - 0.00006L_2^2$$
- Where L represents the load in kW and S represents the steam consumption per hour. Find the most economical loading when the load is taken by both units is 45MW.

(OR)

- b) The monthly electricity consumption of a residence can be approximated as under. (16)

Light Load	: 6 tube lights, 40 watts each working for 4 hours daily.
Fan Load	: 6 fans, 100 watts each working for 6 hours daily.
Refrigeration	: 2 kW for 1 hour daily.
Miscellaneous load	: 2 kW for 2 hour daily

Find the monthly bill at the following tariff :

First 20 units	: Rs.0.50/ kWh
Next 30 units	: Rs.0.40/ kWh
Remaining units	: Rs.0.30/ kWh
Constant charge	: Rs.2.50 per month
Discount for prompt payment	: 10%