Second Semester M.Tech. Degree Examination, June 2012
Advanced Power Plant Cycles

Time: 3 hrs.   Max. Marks:100

Note: *Answer any FIVE full questions.*

1 a. With a neat sketch explain the function of the deaerator. Why is deaerator installed at larger height from the basement? **(10 Marks)**

b. In a steam Rankine cycle using one stage of reheating between two turbine cylinders. The steam at inlet to high pressure cylinder is at 100 bar and 500 'c'. The steam at exit of low pressure is at 0.07 bar and is quality is 85%. Determine the cycle thermal efficiency. **(10 Marks)**

2 a. Derive the efficiency of thermachinamics of Brayton-Rankine combined cycle plant when two cyclic plants operating in parallel. **(10 Marks)**

b. Explain the principle of thermionic power generations. **(10 Marks)**

3 a. Write a short note on:
  i) Coal-oil mixture (com)   ii) Synthane coal gasification process. **(10 Marks)**

b. Propane gas is reacted with air in such a ratio that an analysis of the dry products of combination gives CO_2 11.5% O_2 2.7% and CO 0.7%. What is the percentage excess air used. **(10 Marks)**

4 a. What are the conditions to be satisfied by pulverized coal burners? Explain distributed burner mixing concept. **(10 Marks)**

b. Explain the IGCC plant with the help of certain relevant blocks. What is the unique characteristic of an IGCC plant? **(10 Marks)**

5 a. Explain with a neat sketch the following:
  i) Feed water and drum level control   ii) Tubular air preheater. **(10 Marks)**

b. Explain with a neat sketch, bubbling fluidized bed (BFB) boiler. What are its merits? **(10 Marks)**

6 a. Explain the following with a neat sketch:
  i) Hyperbolic cooling tower   ii) Indirect dry cooling tower with an open type condenser. **(10 Marks)**

b. Water at $30^°$C flows into a cooling tower at the rate of 1.15 kg per kg air. Air enters the tower at dbt of $20^°$C and a relative humidity of 60% and leaves it at a dbt of $28^°$C and 90% relative humidity. Make up water is supplied at $20^°$C. Determine:
  i)   The temperature of water leaving the tower
  ii) The fraction of water evaporated.
  iii) The approach and range of the cooling tower. **(10 Marks)**

7 a. Explain with a neat sketch, liquid metal fast breeder reactor (LMFBR) power plant. **(10 Marks)**

b. A city requires 1500 MWh of electric energy per day. It is to be supplied by a reactor which converts into electric energy with an efficiency of 20 percent. If reactor used nuclear fuel of U^{235}, calculate the mass of U^{235} needed for one day′s operation. **(10 Marks)**

8 a. Explain with neat sketch working of a Kaplan turbine. **(10 Marks)**

b. From the investigation of a hydro-site the following data is available:
  Available head = 45 m   Total catchment area = 60 sqkm
  Rainfall per annum = 140 cm   Percentage of rainfall utilized = 68%
  Turbine efficiency = 82%   Generator efficiency = 90%
  Percentage efficiency = 74%.
  Calculate the suitable capacity of a turbo-generator. Assume load factor as 55%. **(10 Marks)**

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