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Total Number of Pages: 1

M.TECH  
HTPE106

**1st Semester Regular/Back Examination – 2014**  
**THERMAL AND NUCLEAR POWER PLANTS**  
**BRANCH(S): HEAT POWER & THERMAL ENGINEERING, THERMAL**  
**ENGINEERING, THERMAL POWER ENGINEERING**

Time: 3 Hours

Max Marks: 70

**Answer Question No.1 which is compulsory and any five from the rest.**  
**The figures in the right hand margin indicate marks.**



- Q1 Answer the following questions: (2x10)
- a) Differentiate between back pressure turbine and pass-out turbine.
  - b) What is pinch point? What is its effect on the size of the power plant?
  - c) Give comparative estimate of open and closed type feed heaters.
  - d) Sketch a CANDU reactor.
  - e) Define super critical boilers. Give examples.
  - f) Give comparative estimate of FD and ID fan.
  - g) What do you mean by moderating power and moderating ratio?
  - h) What is nuclear stability? Why are elements of higher mass number not stable?
  - i) Explain the term "fuel burnup" in nuclear power plant.
  - j) What are the fission fragments and fission products?
- Q2 Steam at 40 bar, 500°C flowing at the rate of 5500 kg/h expands in a hp turbine to 2 bar with an isentropic efficiency of 83%. A continuous supply of steam at 2 bar, 0.87 steam quality and a flow rate of 2700 kg/h is available from a geothermal energy source. The steam is mixed with adiabatically with h.p. turbine exhaust steam and the combined flow then expands in i.p turbine to 0.1 bar with isentropic efficiency of 78%. Determine the power output and the thermal efficiency of the plant. Assume that 5500 kg/h of the steam is generated in the boiler at 40 bar, 500°C from the saturated feed water of 0.1 bar. Had the geothermal steam not been added, what would have been power output and efficiency of the plant? Neglect pump work. (10)
- Q3 a) What are different types stokers used in thermal power plant. Explain one with diagram. (5)  
b) Propane gas is reacted with air in such a ratio that the analysis of the dry products of combustion gives CO<sub>2</sub> 11.5%, O<sub>2</sub> 2.7%, and CO 0.7%. What is the percentage of excess air used? (5)
- Q4 a) How is low NO<sub>x</sub> emission possible in CFB combustor? Explain the staged combustion process. (5)  
b) Describe any one, once through kind of boiler used with sketch (5)
- Q5 a) A furnace wall riser, 18 m long, 77 mm OD and 6 mm thick receives saturated water at 80 bar and 1.5 m/s velocity. Assuming a circulation ratio of 12.5 and slip ratio of 1.2, determine a) the pressure head developed b) the void fraction (5)  
b) Briefly discuss feed water treatment process used in thermal power plant (5)
- Q6 Briefly discuss on the following terms. (10)  
a) Conversion and breeding  
b) Neutron flux and reaction rates  
c) Reactor core design
- Q7 a) Write short notes on environmental aspects of power generation using fossil fuel based power plant. (5)  
b) Explain the functions of a cladding? What are factors of selecting a suitable cladding? (5)
- Q8 Write short notes (any two) (5+5)  
a) BWR and PWR  
b) Convective and radiant super heaters  
c) Indian nuclear power programme