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Total Number of Pages: 2

**M.TECH**  
**HTPC106**

**1st Semester Regular/Back Examination – 2015-16**

**Thermal and Nuclear power Plants**

**BRANCH(S): THERMAL POWER ENGINEERING, THERMAL ENGINEERING, HEAT POWER ENGINEERING, HEAT POWER & THERMAL ENGINEERING, MECHANICAL ENGINEERING (THERMAL & FLUID ENGINEERING), THERMAL & FLUID ENGINEERING**

**Time: 3 Hours**

**Max Marks: 70**

**Q.CODE-1232**

**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: (2 x 10)
- What do you mean by pinch point and write its significance?
  - What is repowering and give example of it?
  - What is the basic difference between Proximate analysis and Ultimate analysis?
  - Define Boiler blowdown and what is % blowdown?
  - What is pendant superheater?
  - What do you mean by curie in related to radiation energy?
  - Write the two reason why not all the fission neutrons cause further fission
  - What is 1/V law and 1/V region?
  - Which reactor has been selected under India's nuclear power programme and why?
  - What is an HTGR? Why is it called magnox?
- Q2 a) A typical modern gas turbine used in combined cycle application would have an exhaust temperature of around 600°C and a thermal efficiency of about 34%. The stack temperature is 120°C when the fuel was natural gas, high has a very low sulphur content. A single pressure steam cycle might give around 32% thermal efficiency. Assume ambient temperature is 15°C. calculate the overall efficiency. (5)
- b) Derive the Formula you have used for above problem (5)
- Q3 a) The ultimate analysis of a fuel oil is given to be: carbon 83.7%, hydrogen 12.7%, sulphur 0.7%, nitrogen 1.7%, & oxygen 1.2%. The combustion air has a dry bulb temperature of 27°C and a wet bulb temperature of 21°C. With 30% excess air and assuming complete combustion, find (a) the total volume of combustion products at 200°C and 1.013bar, and (b) the dry flue gas analysis based on CO<sub>2</sub>, O<sub>2</sub> and N<sub>2</sub> (6)
- b) Discuss the mechanism of solid fuel combustion (4)
- Q4 a) A 15m high down comer-riser circuit operates at 160 bar. The riser (5)

receives uniform heat flux and saturated water. The exit quality is 50%. Calculate the pressure head developed due to natural circulation. Take the slip factor as 1.2.

$v_f$ in $m^3/kg$	$v_g$ in $m^3/kg$
0.001711	0.009306

- b) Discuss about steam generator control in detail (5)
- Q5 (a) What do you mean by once through systems and write its contribution towards environment aspects of power generation (5)
- (b) Explain the operation of an elastic precipitator. (5)
- Q6 (a) A reactor is fuelled with 100 tonnes of natural uranium (atomic mass 238.05) in which the average thermal neutron(2200 m/sec)flux is  $10^{13}$  neutrons/cm<sup>2</sup>s, the 2200 m/sec cross section of U-235(atomic mass 235.04) are;  $\sigma_f = 579barns$  and  $\sigma_f = 101barns$ . the energy release per fission is 200MeV and 0.715% of natural uranium is U-235. Calculate (a) the rating of the reactor in MW/tonne, (b) the rate of consumption of U-235 per day (5)
- (b) Discuss detail about Neutron Life cycle and Neutron flux (5)
- Q7 (a) Draw the schematic of liquid metal fast breeder reactor power plant and discuss. (7)
- (b) Explain the characteristic features of a BWR. What do you mean by external and internal circulation? (3)
- Q8 Explain any two of the following (5 x 2)
- Coal liquefaction Vs Coal Gasification
  - Economizer
  - Acid rain and acid snow
  - Neutron Scattering