Registration no: | | | | | | | | | | |

Total Number of Pages: 02 **M.TECH**

HTPE106

1st Semester Back Examination 2016-17
THERMAL AND NUCLEAR POWER PLANTS
Branch: HEAT POWER & THERMAL ENGINEERING
Time: 3 Hour
Max Marks: 70
Q Code:Y989

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) Draw T-S diagram of Rankine cycle.
b) What is the function of Deaerator?
c) What is the necessity of draught in a power plant?
d) Define the location of economizer in a water tube boilers.
e) Write two ash removal systems in a boiler.
f) What is the advantage of regenerative feed water heating?
g) Calculate the binding energy of 0.5 a.m.u. mass of nucleus.
h) Calculate the decay constant of Thorium 233 if the half life is 22.1 min.
i) Define life cycle of a neutron.
j) What is the function of a pressurizer?

Q2 (a) Calculate the overall efficiency of a power plant using the efficiencies of boiler, cycle, turbine and generator. (5)

(b) A textile factory requires 10 ton/h of steam at 37.3 bar and 344 ^{0}C for process heating at 3 bar saturated and 1000 KW of power for which a back pressure turbine of 70% internal efficiency is to be used. Find the steam condition at the exit of the turbine. (The enthalpy of steam at 3 bar saturated condition is 2725.3 kj/kg and at 37.3 bar 344 ^{0}C, the enthalpy is 3085.3 kj/kg). (5)

Q3 (a) Calculate the overall efficiency of Rankine-Rankine series cycles working with two different fluids mercury and steam. (5)

(b) Describe briefly different types of furnaces used for burning pulverized coal. (5)

Q4 (a) Distinguish between fire-tube and water tube boilers. (5)

(b) With neat sketch describe different types of superheaters used for boilers. (5)

Q5 a) Describe different methods of controlling the superheater temperature. (5)

b) With neat sketch explain the working principle of air-preheater. (5)

Q6 (a) Explain the working principle of boiling water reactor with suitable diagram. (7)

(b) Calculate the binding energy per nucleon for the Helium atom given below. (3)

$2\ {}_0n^1 + 2\ {}_1p^1 \rightarrow\ {}_2He^4$

Atomic masses of Helium = 4.00387 a.m.u., proton = 1.00759, neutron = 1.00898 a.m.u. and electron = 0.0055 a.m.u.

Q7 (a) Explain the working principle of neutron life cycle. (7)

(b) Calculate the microscopic absorption cross-section of natural Uranium, which consists of 98% U-237 and 2% U-236. The microscopic cross sections for 0.025eV are: U-237: $\sigma_c = 2.70$ barns, $\sigma_f = 0.02$ barns and U-236: $\sigma_c = 103$ barns, $\sigma_f = 580$ barns. (3)

(10)

Q8 Write short notes on any three of the following

a) Pass-out turbine

b) Pressurizer

c) Environmental aspect of power generation.

d) Energy scenario in India.