

GUJARAT TECHNOLOGICAL UNIVERSITY
ME - SEMESTER – I EXAMINATION – WINTER 2014

Subject Code:2712107**Date:12/01/2014****Subject Name:Thermal and Nuclear Power Plants****Time:2:30 to 5:30****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Compare thermal & nuclear power plant. **07**
Give the name of nuclear power plants in India.
- (b) Explain regeneration upto 3 stages of steam power plants. Also explain how quantity of live steam is found per Kg. of steam entering the turbine. **07**
- Q.2** (a) Draw the layout of modern thermal power plant of 210MW capacity with main four circuits. Label the major Equipments. **07**
- (b) What is pressurized fluidized Bed combustor ? Discuss its scope, advantages and disadvantages. **07**
- OR**
- (b) Explain nuclear power plant safety and give its Bi-Products. **07**
- Q.3** (a) Derive an expression for the optimum pressure ratio giving maximum specific output in actual cycle gas turbine. **07**
- (b) In a gas turbine air is taken at 15°C and is compressed with pressure ratio 4. The maximum temperature in the cycle is 600°C. The air is heated after compression in a heat exchanger. Efficiency of compressor and gas turbine are 0.82 and 0.70 respectively. Effectiveness of heat exchanger is 0.78. Find power output and efficiency of the cycle for mass flow rate of air 10 Kg. /sec. Take $C_p = 1.0 \text{ KJ/Kg K}$ and $\gamma = 1.4$ for air and gas. **07**
- OR**
- Q.3** (a) Draw Rankine cycle with T-S diagram. Derive Rankine cycle efficiency with and without pump work. **07**
- (b) Draw Rankine cycle with two stages reheating. Derive the expression for efficiency with and without reheating. **07**
- Q.4** (a) Explain the dual pressure steam cycle in combined plant. Give its thermodynamic advantages. **07**
- (b) Explain how you will find vacuum efficiency, condenser efficiency, mass flow rate of cooling water and air pump capacity in a steam condenser. **07**
- OR**
- Q.4** (a) Explain binary mercury-steam vapour cycle with T-S diagram. Derive its expression for efficiency. **07**

- (b) In a combined gas turbine- steam turbine power plant the exhaust gas from gas turbine is heated to 750°C in reheater and leaves the steam generator at 100°C. The steam is generated at 50 bar and 600°C and condenser pressure is 0.1 bar. The inlet temperature of air is 15°C and pressure ratio for gas turbine and compressor is 7.5. The maximum gas cycle temperature is 750°C. The total power output of the plant is 200MW. Take $C_p=1.11\text{KJ/Kg. K}$ and $\gamma=1.33$ for gases and $C_p=1.005\text{KJ/Kg.K}$ and $\gamma=1.4$ for air. 07
- Find (i) The flow rates of air and steam required
(ii) The thermal efficiency of combined plant
Neglect pump work and mass of fuel in calculation
- Q.5** (a) Explain the chain reaction and its rate of growth during nuclear fission. Give requirements of fission process. 07
- (b) Explain working of CANDU reactor with a neat sketch. Give its advantages and disadvantages over other types. 07
- OR**
- Q.5** (a) Define: diversity factor, use factor, capacity factor, demand factor, load factor, peak load and average load. 07
- (b) A power plant of 210 MW installed capacity has the following particulars 07
- Capacity cost = Rs. 18000/KW installed.
Interest and deprecation = 12%
Annual load factor = 60%
Annual Capacity factor = 54%
Annual running charges = Rs. 200 X 10⁶
Energy Consumed by power plant auxiliaries = 6%.
Calculate (i) the cost of power generation per KWh.
(ii) the reserve capacity.
