Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – II • EXAMINATION – WINTER • 2014

Subject code: 1722102 **Date: 03-12-2014**

Subject Name: Thermal Power Plant Engineering

Time: 02:30 pm - 05:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Use of steam table is permitted.**

Q.1 **(a)** Derive an expression for the optimum pressure ratio giving maximum specific output in simple cycle gas turbine. How is the expression modified when compressor and turbine efficiencies are taken into consideration? **07**

(b) A power plant has the following annual factors: Load factor = 0.75, capacity factor = 0.6, use factor = 0.65. Maximum demand is 60 MW. Estimate (1) The annual energy production, (2) The reserve capacity over and above the peak load, and (3) the hours during which the plant is not in service per year. **07**

Q.2 **(a)** Explain briefly fluidized bed combustion (FBC) system. **07**

(b) Discuss the different arrangements of burners in a pulverized coal fired furnace. **07**

OR

(b) In a cogeneration plant, the power load is 5.6 MW and the heating load is 1.163 MW. Steam is generated at 40 bar and 500 °C and is expanded isentropically through a turbine to a condenser at 0.06 bar. The heating load is supplied by extracting steam from the turbine at 2 bar, which condensed in the process heater to saturated liquid at 2 bar and then pumped back to the boiler. Compute (a) the steam generation capacity of the boiler in t/h, (b) the heat input to the boiler in kW, (c) the fuel burning rate of the boiler in t/h if a coal of calorific value 25 MJ/kg is burned and the boiler efficiency is 88%, (d) the heat rejected to the condenser, (e) the rate of flow of cooling water in the condenser if the temperature rise of water is 6 °C. Neglect pump work. **07**

Q.3 **(a)** Draw a neat sketch and describe working of a dual pressure heat recovery boiler for the steam power plant in a combine cycle power plant. Draw the T-h curves for the hot gases and steam in H.P. and L.P. circuits. Indicate the pitch points. **07**

(b) A gas turbine plant operates between 1 bar and 9 bar with minimum and maximum cycle temperature of 20 °C and 1227 °C respectively. The two stage compressor has perfect intercooling and ideal intermediate pressure. Gases are reheated to 1227 °C after the expansion in the HP turbine and are expanded in the LP turbine such that output power from each turbine is same. The isentropic efficiencies of the compressor and turbine are 0.83 and 0.85 respectively. Assume effectiveness of regenerator as 0.7. calculate **07**

(1) Efficiency of the cycle.
(2) Power Output for a mass flow rate of 5 kg/s.
(3) Work ratio.

OR

Q.3 **(a)** Discuss the effects of intercooling and reheating in a gas turbine plant. **07**

	(b)	Air at temperature of 15 °C enters a gas turbine plant working at pressure ratio of 15. Turbine inlet temperature is 1250 °C. Polytropic efficiency of compressor and turbine is 0.91. assume C_p = 1.005 and 1.128 for air and gases respectively and calorific value of fuel used = 42000 kJ/kg of fuel, calculate (a) overall efficiency (b) specific output (c) fuel to air ratio and (d) specific fuel consumption.	**07**
Q.4	**(a)**	What are the three stages in India s nuclear power development?	**07**
	(b)	Explain advantages, disadvantages and applications of diesel power plant	**07**
		OR	
Q.4	**(a)**	Draw and explain the schematic diagram of PWR and also explain the role of pressurizer in PWR.	**07**
	(b)	Explain the main features of supercharging with the help of P-v diagram. What do you mean by mechanical supercharging and turbocharging?	**07**
Q.5	**(a)**	Explain what do you understand by base load and peaking load. Why are base load plants loaded heavily?	**07**
	(b)	What do you understand by depreciation? How is the depreciation rate determined? Explain any one method with diagram.	**07**
		OR	
Q.5	**(a)**	Define thermal turnaround efficiency. On what factor does it depends? Enlist the various losses in a pumped hydro system.	**07**
	(b)	Write short note on pumped hydro storage plant.	**07**

□□□□□□□□□□□□□