

GUJARAT TECHNOLOGICAL UNIVERSITY**M. E. - SEMESTER – II • EXAMINATION – WINTER 2012****Subject code: 1722102****Date: 31-12-2012****Subject Name: Thermal Power Plant Engineering****Time: 10.30 am – 01.00 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 & Mollier diagram is permitted.

- Q.1** (a) Explain the different methods by which the mean temperature of heat addition can be increased. **07**
- (b) What is the function of an economiser? What are steaming and non-steaming economizers? Why are the economiser tubes often finned or gilled on the gas-side? **07**

- Q.2** (a) What are the methods use to improve the work output of open cycle gas turbine plant? Explain any one. **07**
- (b) Derive an expression for the optimum pressure ratio giving maximum specific output in simple cycle gas turbine. **07**

OR

- (b) In a gas turbine plant, the air at 10°C and 1 bar is compressed to 4 bar with compression efficiency of 80 %. The air is heated in the regenerator and the combustion chamber till its temperature is raised to 700°C , and during the process the pressure falls by 0.14 bar. The air then expanded in the turbine and passes to regenerator which has 75 % effectiveness, and causes a pressure drop of 0.14 bar. If the isentropic efficiency of the turbine is 85 %, determine the thermal efficiency of the plant. **07**
- Q.3** (a) Explain a high pressure boiler which can carry higher salt concentration in feed water than any other type with neat sketch. **07**
- (b) In a combined power and process plant the boiler generates 21000 kg/h of steam at a pressure of 17 bar and temperature 230°C . A part of the steam goes to a process heater which consumes 132.56 kW, the steam leaving the process heater 0.957 dry at 17 bar being throttled to 3.5 bar. The remaining steam flows through an h.p. turbine which exhausts at a pressure of 3.5 bar. The exhaust steam mixes with the process steam before entering the l.p. turbine which develops 1337.5 kW. At the exhaust, the pressure is 0.3 bar and steam is 0.912 dry. Draw the line and T-s diagram of the plant and determine (a) the steam quality at the exhaust of the h.p. turbine (b) the power developed by the h.p. turbine (c) the isentropic efficiency of the h.p. turbine. **07**

OR

- Q.3** (a) Explain the dual-pressure steam cycle in combined plant. What are its thermodynamic advantage? **07**
- (b) What is Pressurized Fluidized Bed Combustor (PFBC)? Discuss its scope, advantages and disadvantages. **07**
- Q.4** (a) What is a CANDU – type reactor? Explain with a sketch its main features. **07**
- (b) Explain the main features of supercharging with the help of p – V diagram. **07**

What do you mean by mechanical supercharging and turbocharging?

OR

- Q.4 (a)** With the help of a schematic diagram, explain diesel power plant and discuss its operation. What are its merits and demerits. **07**
(b) What is the difference between GCGM and HTGC? **07**

- Q.5 (a)** Write short note on pumped hydro storage plant. **07**
(b) Explain the principle of economic scheduling. Show that for two units running in parallel, the combined energy input will be minimum if the incremental heat rate of unit 1 is equal to that of unit 2. **07**

OR

- Q.5 (a)** Define: Load factor, Diversity factor and plant use factor. When Load factor and capacity factor are numerically equal? **07**
(b) An industry with a maximum demand of 1500 kW has two options as follows: **07**
(a) To buy power from a public supply company which charges Rs. 1000/kVA demand per annum plus 80 per unit consumed.
(b) To generate own power by installing diesel sets.

Following data is known:-

Load Factor = 60 %

Number of working days per year = 300

Power Factor = 0.75

Capital cost of DG set = Rs. 2000/kVA

Interest rate/annum = 10 %

Depreciation rate/annum = 12 %

Cost of fuel = Rs. 3 per litre

Fuel consumption = 0.5 litre/kWh

Cost of lubricating = Rs. 6/litre

Lubricating oil consumption = 2 ml/kWh

Annual operating cost = Rs. 1,20,000

Annual maintenance cost = Rs. 80,000

Compare the overall cost/unit for above two alternatives.
