

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-VII (NEW) EXAMINATION – WINTER 2018

Subject Code: 2171910

Date: 06/12/2018

Subject Name: Power Plant Engineering

Time: 10:30 AM TO 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 Mollier chart and steam table is permissible.**

- Q.1** (a) Explain the function of following equipments in a thermal power plant : **03**
Reheater, control room and air-preheater.
- (b) Explain the principle of fluidized bed combustion. **04**
- (c) Name two indirectly heated high pressure boilers and explain construction and working of any one of them. **07**
- Q.2** (a) What are the requirements of a good ash handling plant. **03**
- (b) Describe the unit pulverized coal handling system. **04**
- (c) Explain cyclone burner with neat diagram. **07**
- OR**
- (c) Write a short note on electrostatic precipitator. **07**
- Q.3** (a) Derive the expression for the velocity in terms of enthalpy drop for a flow through the nozzle. **03**
- (b) With a neat diagram explain balanced draught. Also explain pressure distribution in balanced draught. **04**
- (c) Steam at a pressure of 15 bar and dryness fraction 0.95 is discharged through a convergent-divergent nozzle to a back pressure of 0.5 bar. The mass flow rate is 9 kg/kwhr. If the power developed is 200 kW, determine : **07**
- (i) Throat pressure
- (ii) Number of nozzles required if each nozzle has a throat of rectangular cross-section of 4 mm × 8 mm.
- (iii) If 10% of overall isentropic enthalpy drop reheats by friction the steam in divergent portion, find the cross-section of the exit rectangle
- OR**
- Q.3** (a) Explain the principle of operation of steam turbine. **03**
- (b) Differentiate between forced and induced draft. **04**
- (c) A single row impulse turbine develops 135 kW at a blade speed of 180 m/sec using 2 kg of steam per second. Steam leaves the nozzle at 400 m/sec. Velocity coefficient of the blades is 0.9. Steam leaves the turbine blades axially. Determine **07**
- (i) Nozzle angle
- (ii) Blade angles at entry and exit assuming no shock.
- Q.4** (a) Explain the working principle of plain Labyrinth glands used in steam turbine. **03**
- (b) Explain downflow surface condenser. **04**

(c) Write a short note on Zeolite ion exchange process. 07

OR

- Q.4 (a) What are the sources of air leakage in a condenser ? 03
(b) Write a note on fast breeder reactor. 04
(c) Differentiate between nuclear fusion and fission. 07

- Q.5 (a) What is the need of cooling gas turbine blades ? Explain transpiration cooling of gas turbine blades. 03
(b) What do you mean by thrust augmentation ? State the methods for thrust augmentation in a turbojet engine and discuss any one of them. 04
(c) A gas turbine operates on Brayton cycle. The temperature range is 1050 K and 288 K. Find pressure ratio for maximum power output. Also determine thermal efficiency, work ratio and power output, if the mass flow rate of air is 20 kg/sec. Take $C_p = 1.005 \text{ kJ/kg K}$ and $\gamma = 1.4$ for compression and expansion process. 07

OR

- Q.5 (a) State classification of rocket engines. 03
(b) State the advantages of combined gas and steam power plant. 04
(c) What do you understand by the term tariff ? State the various methods for calculation of tariff and discuss any three of them. 07
