

# GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-VII EXAMINATION – SUMMER 2025

Subject Code:2171910

Date:27-05-2025

Subject Name:Power Plant Engineering

Time:02:30 PM TO 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. Simple and non-programmable scientific calculators are allowed.
5. Use of steam table permitted.

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|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| <b>Q.1</b> (a) Explain in brief about site selection criteria for thermal power plant.                                                                                                                                                                                                    | 03    |
| (b) Discuss about presents status of power generation in India.                                                                                                                                                                                                                           | 04    |
| (c) Explain in detail about general layout of modern thermal power plant with neat sketch.                                                                                                                                                                                                | 07    |
| <b>Q.2</b> (a) Explain in brief about unique features of high pressure boiler.                                                                                                                                                                                                            | 03    |
| (b) Discuss corrosion in boilers and its prevention.                                                                                                                                                                                                                                      | 04    |
| (c) Explain construction and working of La-Mont boiler with neat sketch.                                                                                                                                                                                                                  | 07    |
| <b>OR</b>                                                                                                                                                                                                                                                                                 |       |
| (c) Explain construction and working of Schmidt-Hartmann boiler with neat sketch.                                                                                                                                                                                                         | 07    |
| <b>Q.3</b> (a) Explain in brief about necessity of ash disposal.                                                                                                                                                                                                                          | 03    |
| (b) Compare forced and induced draught.                                                                                                                                                                                                                                                   | 04    |
| (c) Explain construction and working of electrostatic precipitator with neat sketch.                                                                                                                                                                                                      | 07    |
| <b>OR</b>                                                                                                                                                                                                                                                                                 |       |
| <b>Q.3</b> (a) Explain in brief about various types of steam nozzles.                                                                                                                                                                                                                     | 03    |
| (b) Derive an expression for the velocity in terms of enthalpy drop for a flow through nozzle.                                                                                                                                                                                            | 04    |
| (c) The pressure and temperature of steam entering nozzle are 12 bar and 200°C and steam leave nozzle at 1 bar. The diameter of the nozzle at the throat is 10 mm. Calculate the mass flow rate of steam in a nozzle. Comment on type of nozzle required.                                 | 07    |
| <b>Q.4</b> (a) State the requirements of good condenser.                                                                                                                                                                                                                                  | 03    |
| (b) Explain necessity of cooling ponds and cooling towers in steam power plant.                                                                                                                                                                                                           | 04    |
| (c) Derive an expression for maximum efficiency for a single stage impulse steam turbine.                                                                                                                                                                                                 | 07    |
| <b>OR</b>                                                                                                                                                                                                                                                                                 |       |
| <b>Q.4</b> (a) Explain in brief about necessity of feed water treatment.                                                                                                                                                                                                                  | 03    |
| (b) With help of neat sketch and chemical reactions explain working of Zeolite ion exchange process.                                                                                                                                                                                      | 04    |
| (c) A mean blade ring diameter of a single stage impulse turbine is 1.3 m. It runs at 3200 rpm. The nozzle angle is 15° and blade speed ratio is 0.45. The blade friction factor is 0.9 and discharge is axial. Calculate blade inlet and outlet angles and power output per kg of steam. | 07    |

- Q.5 (a)** Explain Diversity factor and its importance. **03**
- (b)** The effective jet velocity from a rocket engine is 2900 m/sec. The forward velocity is 1450 m/sec and the propellant consumption is 78 kg/sec. Calculate thrust, thrust power and propulsive efficiency. **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 mass flow rate of air is 20 kg/sec. Take  $C_p=1.005$  kJ/kg K and  $\gamma=1.4$  for compression and expansion process. **07**
- OR**
- Q.5 (a)** Explain load curve with neat sketch. **03**
- (b)** Explain construction and working of Ramjet engine with neat sketch. **04**
- (c)** Describe with sketch construction and working of CANDU type reactor. State its advantages and disadvantages. **07**

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