

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**BACHELOR OF ENGINEERING – SEMESTER 7 – EXAMINATION – SUMMER 2026**

**Subject Code: 3171910**

**Date: 01/06/2026**

**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.**

- Q.1**
- (a) Enlist major subsystems of coal based thermal power plants and draw the air and gas circuit for modern thermal power plant. **03**
  - (b) Compare forced draught with induced draught **04**
  - (c) Draw a neat sketch of La-Mont boiler and explain its construction and working **07**
- Q.2**
- (a) Define: (i) Approach, (ii) Range, and (iii) Cooling efficiency of a cooling tower. **03**
  - (b) Explain the principle of pulverized coal firing system. **04**
  - (c) A gas turbine plant operates on Brayton cycle with air entering the compressor at 1 bar and 27°C. The pressure ratio is 6 and the maximum temperature is 800°C. The compressor and turbine efficiencies are 82% and 87% respectively. Mass flow rate of air is 2 kg/s. Determine the thermal efficiency and power output of the plant. Take  $C_p = 1 \text{ kJ/kg K}$  and  $\gamma = 1.4$  for air and gases. **07**
- OR
- Q.2**
- (c) Steam at 20 bar and 300°C expands through a convergent-divergent nozzle to 2 bar with a mass flow rate of 0.4 kg/s. The nozzle efficiency is 0.92 and initial velocity is negligible. Assuming critical pressure ratio as 0.546, determine the throat area, exit area, and exit velocity of steam. **07**
- Q.3**
- (a) Differentiate between impulse and reaction steam turbines. **03**
  - (b) Explain the effect of operating variables on the work ratio of a gas turbine plant. **04**
  - (c) In an open cycle gas turbine plant, air is compressed from 1 bar, 300 K to 5 bar with compressor efficiency of 80%. The turbine inlet temperature is 900 K with turbine efficiency of 85%. If the mass flow rate is 3 kg/s, calculate the net power output and thermal efficiency. Assume  $C_p = 1 \text{ kJ/kg K}$  and  $\gamma = 1.4$  for air and gases **07**
- OR
- Q.3**
- (a) Draw neat sketches of the profiles of steam pressure and steam velocity during velocity compounding of steam turbines **03**
  - (b) Explain the principle of fluidized bed combustion with a neat sketch. **04**
  - (c) Steam leaves the nozzle of a De Laval turbine at 1000 m/s with nozzle angle 20°. The mean blade speed is 300 m/s, and blade inlet and outlet angles are equal. Mass flow rate is 800 kg/hr. Assuming blade velocity coefficient as 0.85, determine: (i) Blade angles, (ii) Relative velocity at inlet, (iii) Tangential force, (iv) Power developed, (v) Blade efficiency. **07**
- Q.4**
- (a) Differentiate between nuclear fission and nuclear fusion. **03**

- (b)** Discuss the safety measures adopted in nuclear power plants in India. **04**
- (c)** Explain the layout, construction, and working of a Pressurized Water Reactor (PWR) with a neat sketch **07**

OR

- Q.4**
- (a)** Enlist at-least 6 factors that are considered for the site selection of a nuclear power plant **03**
  - (b)** Explain any one method of feed water treatment used in power plants **04**
  - (c)** Discuss the role of moderator and control rods in the nuclear power plant. Also discuss the effects if any of these two fails in its operation. **07**

- Q.5**
- (a)** Define: (i) Load factor, (ii) Diversity factor, (iii) Demand factor. **03**
  - (b)** Explain the principle and working of a single basin tidal turbine **04**
  - (c)** A 50 MW power plant has an annual peak load of 40 MW and average load factor of 0.55. It supplies loads with maximum demands: Domestic 15 MW, Commercial 20 MW, Industrial 25 MW. The overall diversity factor is 1.3. Calculate: (i) Annual energy supplied, (ii) Connected load, (iii) Plant capacity factor. **07**

OR

- Q.5**
- (a)** Enlist types of solar thermal power systems **03**
  - (b)** Compare horizontal axis wind turbine with vertical axis wind turbine **04**
  - (c)** Explain the construction and working of a solar photovoltaic (SPV) power system with a neat sketch. Discuss its merits and demerits. **07**

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