

THERMAL ENGINEERING – II

(Mechanical Engineering)

Time: 3 hours

Max Marks: 70

Answer any FIVE questions

All questions carry equal marks

(Use of steam tables is permitted in the examination hall)

- 1 A steam power plant operates on a theoretical reheat cycle. Steam at boiler at 150 bar, 550°C expands through the high pressure turbine. It is reheated at a constant pressure of 40 bar to 550°C and expands through the low pressure turbine to a condenser at 0.1 bar. Draw T-s and h-s diagrams. Find (i) Quality of steam at turbine exhaust. (ii) Cycle efficiency. (iii) Steam rate in kg/kWhr.
- 2 (a) What are the advantages of artificial draught over natural draught?
(b) What do you understand by steam jet draught? Where it is generally employed?
- 3 An injector is required to deliver 120 kg of water per minute from a tank, whose constant water level is 3 m below the level of injector, into a boiler in which the steam pressure is 15 bar. The water level in the boiler is 0.7 m above the level of the injector. The steam for the injector is taken from the same boiler and it is assumed to be dry and saturated. The pressure of steam leaving steam nozzle is 0.6 times that of the supply pressure. The temperature of the water in the feed tank is 25°C. If the velocity in the delivery pipe is 15 m/s, find (i) mass of water injector per kg of steam (ii) area of mixing cone (iii) area of steam nozzle and (iv) temperature of water leaving the injector.
- 4 Explain E with the help of a neat sketch a single-stage impulse turbine. Also explain the pressure and velocity variations along the axial direction.
- 5 A reaction turbine has drum diameter of 2.15 m at a speed of 750 rpm with 14.5 kg/s of steam consumption. The height of the blade at a certain location is 0.16 m while the discharging angle is 25°. The pressure at this place is 4 bar and dryness fraction is 0.97. Estimate the power developed in the particular ring by assuming the turbine efficiency of 75%. Also find the heat drop while the steam passing over the pair of blades.
- 6 (a) Compare various features of jet and surface condensers.
(b) Define the terms: (i) Vacuum efficiency. (ii) Condenser efficiency. (iii) Vacuum measurement.
- 7 In an oil-gas turbine installation, it is taken at pressure of 1 bar and 27°C and compressed to a pressure of 4 bar. The oil with a calorific value of 42000 kJ/kg is burnt in the combustion chamber to raise the temperature of air at 550°C. If the air flows at the rate of 1.2 kg/s. Find the net power of the installation. Also find air fuel ratio. Take $C_p = 1.05$ kJ/kgK
- 8 What are composite and homogeneous solid propellants? How do they work? State their merits and demerits.
