

## NOTE:

- Question No 1 is **COMPULSORY**.
- Attempt any **THREE** questions from question number 2 to 6.
- Assume suitable data wherever required.
- Illustrate answers with sketches wherever required.
- Use of steam table is permitted.

- Qu.1. Solve any four. 20
- Define equivalent evaporation of boiler. Distinguish between boiler mounting and accessories with examples.
  - What is the role of fusible plug in boiler? Explain working of fusible plug with neat diagram.
  - Classify different types of steam turbine.
  - Explain the nozzle efficiency and its significance.
  - Explain the working of a turboprop engine by means of a sketch.
- Qu. 2 a) The following observations were made on a boiler plant during one hour test. Steam pressure = 20 bar; Steam Temperature =  $260^{\circ}\text{C}$ ; Steam generated = 37500 Kg; Temperature of water entering the economizer =  $15^{\circ}\text{C}$ ; Temperature of water leaving the economizer =  $90^{\circ}\text{C}$ ; Fuel used = 4400 Kg; Calorific value of fuel = 33000 kJ/kg. Calculate: i) The equivalent evaporation per kg of fuel; ii) Thermal efficiency of plant; iii) The percentage heat energy of the fuel energy utilized by the economiser. 12
- Qu. 2 b) Describe the governing mechanism of reaction turbine with a neat sketch. 08
- Qu. 3 a) A 50% reaction turbine (with symmetrical velocity triangle) running at the 400 rpm has the exit angle of the blades as  $20^{\circ}$  and velocity of the steam relative to the blades at the exit is 1.35 times the mean blade speed. The steam flow rate is 8.33 kg/s and at a particular stage the specific volume is  $1.381 \text{ m}^3/\text{kg}$ , calculate for this stage :i) Suitable blade height, assuming the rotor mean diameter 12 times the blade height; ii) the diagram work. 10
- Qu. 3 b) Draw the layout of modern high pressure boiler and explain the unique features of this boiler compared to low pressure boiler. 10
- Qu. 4 a) Define Thomas cavitation coefficient and explain in conjunction with cavitation characteristics of rotodynamic projects. 10
- Qu. 4 b) What is NPSH? What is the difference NPSH available and NPSH required? 10

- Qu. 5 a) Obtain the expression for the force exerted by a jet of water on a fixed curved plate when jet strikes at the centre of symmetrical curved plate 10
- Qu. 5 b) Enumerate the various uses of gas turbine. Describe with neat sketch, working of simple constant pressure closed cycle gas turbine. 10
- Qu. 6 a) In a constant pressure open cycle gas turbine air enters at 1 bar and  $20^{\circ}\text{C}$  and leaves the compressor at 5 bar. Using the following data: Temperature of gases entering the turbine =  $680^{\circ}\text{C}$ , pressure loss in the combustion chamber = 0.1 bar, compressor efficiency = 85%, turbine efficiency = 80%, Combustion efficiency = 85%,  $\gamma = 1.4$  and  $C_p = 1.024$  kJ/kgK for air and gas, find a) The quantity of air circulation if the plant develops 1065 kW, b) Heat supplied per kg of air circulation c) The thermal efficiency of the cycle. Mass of the fuel may be neglected. 12
- Qu. 6 b) Explain the working of a turboprop engine by means of sketch. 08