T E. Sem VI | mech | C-scheme | Dt 15/12/25 | QPC:. 95302 (1/2)

Time: 3 hour

Max. Marks: 80

Instructions:

- **Question No.1 is compulsory.**
- Solve **ANY THREE** questions from the **remaining** five questions.
- Figure to the right indicates full marks.
- Assume suitable data wherever required, but justify the same.
- Use of steam table is permitted.

Q. 1 Solve **ANY FOUR** questions from following. **(Each question carries 5 marks)** **(20)**

a) Describe construction and working of Economizer with neat sketch.

b) Explain the different methods of improving efficiency of steam turbine?

c) Describe construction and working double acting reciprocating pump with neat sketch.

d) What is the necessity of multistage compression? and why intercooling required between stages?

e) Explain construction and working of closed cycle gas turbine power plant.

Q. 2 a) A Pelton wheel is to designed for the following specification: Power (Brake or Shaft) = 9560 kW, Head = 350 m, Speed = 800 RPM, Overall efficiency = 85%, Jet Diameter is limited to $1/6^{th}$ of the wheel diameter. Determine the wheel diameter, diameter of jet and number of jet required. Take C_v=0.985 and speed ratio = 0.45. **(10)**

b) Differentiate between fire tube and water tube boiler. **(05)**

c) Explain the construction and working of Ramjet Engine with sketch. **(05)**

Q. 3 a) In a gas turbine plant , the pressure ratio, through which air at 15 °C is compressed, is 6. The same air is then heated to a maximum possible temperature of 750 °C first in a heat exchanger which is 75% efficient and then in the combustion chamber. The same air at 750 °C is expanded in two stage such that expansion work is maximum. The air is reheated to 750 °C after the first stage.. Determine the cycle thermal efficiency, work raio and net shaft work per kg of air. Assuming the isentropic efficiency of compressor stage as 80% and that of turbine as 85%. Assumed that C_p = 1.005 kJ/kgK and γ = 1.4. **(10)**

b) Draw a general layout of a hydroelectric power plant using a Pelton turbine and define the following: (a) Gross head, (b) Net head, (c) Mechanical efficiency (d) Overall efficiency of the Pelton turbine. **(05)**

c) What is cavitation? How it is avoided in reciprocating pumps? **(05)**

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Q. 4 a) Calculate equivalent evaporation and efficiency of the boiler for the following data: Pressure of steam =9 bar, Quality of steam = 0.97 dry, Quantity of steam = 5600 kg/hrs., Temperature of feed water = 36 °C, Coal consumption = 700 kg/hrs., Calorific value of coal = 31380 kJ/kg of fuel. (At P=9 bar, take h_f =742.6 kJ/kg and h_{fg} =2029.5 kJ/kg.) **(10)**

b) Draw an indicator diagram, considering the effect of acceleration and friction in suction and delivery pipes. **(05)**

c) What is surging and chocking in compressor. **(05)**

Q. 5 a) A centrifugal pump impeller has diameters at inlet and outlet as 350 mm and 700 mm respectively. The flow velocity at outlet is 2.3 m/s and vanes are set back at an angle of 45° at the outlet. If the manometric efficiency is 75%, calculate the minimum starting speed of the pump. **(10)**

b) Describe Pressure-velocity compounding of Impulse turbine ? **(05)**

c) Describe construction and working of once through boiler with neat sketch. **(05)**

Q. 6 a) In an inward flow reaction turbine the head on the turbine is 31 m. The external and internal diameters are 1.4 m and 0.7 m respectively. The velocity of flow through the runner is constant and is equal to 3.3 m/s. The guide blade angle is 11° and the runner veins are radial at inlet. If the discharge at the outlet is radial determine: (i) The speed of the turbine, (ii) The vane angle at outlet of the runner and (iii) Hydraulic efficiency. **(10)**

b) Explain construction and working of Turboprop engine with neat sketch. **(05)**

c) What is mean by priming? Explain its necessity in centrifugal pump? **(05)**

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