Time: 3 hour   Max. Marks: 80

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Note:

1. Question No.1 is compulsory.

2. Attempt any three questions from the remaining.

3. Assume suitable data if required.

Q1.   **Solve any four out of five.**   **5 marks each**

a   Write short note on multi staging of reciprocating compressor.
b   Describe working of reheating gas turbine plant with the help of a T-S diagram.
c   Write the differences between Mountings and Accessories of boiler.
d   Write short note on air vessel with neat sketch.
E   Write short note on reciprocating pump with indicator diagram.

Q2.

a   The steam at 4.9 bar and 160°C is supplied to a single-stage impulse turbine at a
mass flow rate of 30 kg/min, from where it is exhausted to a condenser at a
pressure of 19.6 kPa. The blade speed is 300 m/s. The nozzles are inclined as 25°
to the plane of wheel and the outlet blade angle is 35°.
Neglecting friction losses, determine
Theoretical power developed by the turbine,
(b) diagram efficiency, and
(c) stage efficiency.   **10 marks**

b   Explain the construction and working of once through boiler with neat sketch.
                                                                              5 marks

c   Write the Function and location of Blow off cock, Fusible plug, pressure gauge &
water level indicator in boiler.   **5 marks**

Q3.

a   The air enters the compressor of an open cycle constant pressure gas turbine at a
pressure of 1 bar and temperature of 20°C. The pressure of the air after
compression is 4 bar. The isentropic efficiencies of compressor and turbine are
80% and 85% respectively. The air-fuel ratio used is 90: 1. If flow rate of air is
3.0 kg/s, find:
(i) Power developed.
(ii) Thermal efficiency of the cycle.
Assume Cp = 1.0 kJ/kg K and γ = 1.4 of air and gases
Calorific value of fuel = 41800 kJ/kg.   **10 marks**

b   Write short note on Francis turbine.   **5 marks**

c   Write short note on Turbojet engine.   **5 marks**

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Q4.

a Calculate the efficiency of (a) boiler, (b) economiser, and (c) whole plant having the following data:

(a) Boiler:

Mass of the feed water = 2060 kg/h

Mass of the coal burnt = 227 kg/h

Calorific value of coal = 30, 000 kJ/kg

Enthalpy of steam produced = 2750 kJ/kg

(b) Economiser:

Inlet temperature of feed water = 15°C

Exit temperature of feed water = 105°C

Atmospheric air temperature = 18°C

Temperature of flue gases entering = 370°C

Mass of flue gases = 4075 kg/h

Specific heat of flue gases = 1.3 kJ/kg.°C. **8 marks**

b Derive the condition for maximum blade efficiency of impulse turbine. **8 marks**

c What is the Classification of pumps? **4 marks**

Q5.

a A pump operates at a maximum efficiency of 82% and delivers 2.25 m^3/s under a head of 18 m while running at 3600 r.p.m speed. Compute the Power and specific speed of the pump. Also determine the discharge, head and power input to pump at a shaft speed of 2400 r.p.m. Cite the assumption made, if any.

10 marks

b Write short note on Centrifugal compressor. **6 marks**

c. What is specific speed for turbine and centrifugal pump? **4 marks**

Q6.

a A Pelton wheel has a mean bucket speed of 12 m/s and is supplied with water at a rate of 750 liters per second under a head of 35 m. If the bucket deflects the jet through an angle of 160°, find the power developed by the turbine and its hydraulic efficiency. Take the coefficient of velocity as 0.98. Neglect friction in the bucket. Also determine the overall efficiency of the turbine if its mechanical efficiency is 80%. **10 marks**

b What is multistaging of impulse turbine? and What is degree of reaction?

5 marks

c What do you mean by cavitation and its effect in turbine and pump? **5 marks**

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