

(OLD COURSE)

QP Code : 3985

(3 Hours)

[Total Marks : 100

- N.B.
- 1) Question No. 1 is compulsory.
 - 2) Answer any four questions from question Nos.2 to 7
 - 3) Assume suitable data if necessary and state it clearly.
 - 4) Use of Mollier chart, gas table and Steam table is permitted.
 - 5) Answer should be written together and one below the other.

1. Attempt any four

20

- b) Distinguish between impulse and reaction turbines.
- c) Explain with neat sketch closed cycle gas turbine plant.
- d) Define volumetric efficiency of compressor and discuss factors affecting it.
- e) Explain the effect of air leakages in a condenser.
- f) Differentiate a water -tube boiler from a fire - tube boiler.
- g) State and explain Dalton's law of partial pressures.

2. a) Derive the expression for the critical pressure ratio (Discharge through nozzle will be maximum).

$$\frac{p_2}{p_1} = \left(\frac{2}{n+1} \right)^{\frac{n}{n-1}}$$

10

b) The nozzles of a steam turbine are supplied with dry saturated steam at a pressure of 9 bar. The pressure at the outlet is 1 bar. The turbine has two nozzles with a throat diameter of 2.5 mm. Assuming nozzle efficiency as 90% and that of turbine rotor 35%, find the quantity of steam used per hour and the power developed.

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3. a) Derive the condition for minimum work input in a two stage reciprocating air compressor with perfect intercooling and hence obtain the expression for minimum work.

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b) Following data relate to a performance test of single acting 14 cm x 10 cm (DxL) reciprocating compressor: Suction pressure = 1 bar, suction temperature = 25°C, Discharge pressure = 6 bar, Discharge temperature = 200°C, Speed of compressor = 1200 rpm, Shaft power = 6.25 kW, Mass of air delivered = 1.7 kg/min, Calculate a) The actual volumetric efficiency b) Indicated power c) Isothermal efficiency d) Mechanical efficiency e) Overall isothermal efficiency.

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4. a) Explain the working of reheat gas turbine plant with the help of a T-s diagram.

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b) Classify the surface condensers and explain with neat sketches any two of the following.

- 1) Down-flow type
- 2) Regenerative type
- 3) Evaporative type

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5. a) Discuss the effect of pressure ratio on the performance of Brayton cycle. Obtain an expression for optimum pressure ratio in terms of maximum and minimum cycle temperatures

8.

b) In a De Laval turbine steam issues from the nozzle with a velocity of 1200m/s. The nozzle angle is 20°, the mean blade velocity is 400m/s, and the inlet and outlet angles are equal. The mass of the steam flowing through the turbine per hour is 1000kg. Draw the vector diagram and calculate a) Blade angle b) Relative velocity of steam entering the blades. c) Tangential force on the blades. d) Power developed e) Blade efficiency. Take blade velocity co-efficient as 0.8.

12

6. a) Define 1) Enthalpy of Reaction 2) Enthalpy of formation 3) Adiabatic combustion temperature

6

b) Explain the procedure to determine the calorific value of gaseous fuel

4

c) Explain briefly Boiler Mounting and Accessories

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TURN OVER

7. Write short note on (any four)
- a) Organs of condensing plant with neat sketch
 - b) Regenerative cycle of gas turbine.
 - c) Heat losses in boiler.
 - d) Compounding of steam turbine
 - e) Applications of compressed air
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