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BT-5/D-18 35039

STEAM GENERATION & POWER

ME-311-E

Time : Three Hours] [Maximum Marks : 100

Note : Attempt *Five* questions in all, selecting *one* question from each Unit.

Unit I

1. (a) Derive an expression to find the height of a chimney. Write at least five differences between forced draft and induced draft. **10**

(b) With neat diagram, explain the construction and working of locomotive boiler. **10**

2. (a) Give at least ten differences between water tube and fire tube boiler. **10**

(b) What is function of super heater ? Discuss its working with diagram. **10**

Unit II

3. A steam turbine working on Rankine cycle is supplied with dry saturated steam at 25 bar and exhaust takes place at 0.2 bar. For a steam flow rate of 10 kg/s, determine :

(a) quality of steam at the end of expansion

(b) turbine shaft work

(c) power required to drive the pump

(d) work ratio http://www.kuonline.in

(e) Rankine efficiency

(f) heat flow. **20**

4. A stream power plant operates on a theoretical reheat cycle. Steam at 25 bar pressure and 400°C is supplied to the high-pressure turbine. After its expansion to dry state, the stream is reheated at constant pressure to its original temperature. Subsequent expansion occurs in low pressure turbine to a condenser pressure of 0.04 bar. Considering feed pump work, make calculation to determine :

(a) quality of stream at entry of compressor

(b) thermal efficiency, and

(c) specific steam consumption. **20**

Unit III

5. Air flows through a nozzle with velocity 75 m/s, temperature, 300 K and pressure 650 kPa at the inlet section which has an area of 10 cm^2. If pressure at the nozzle exit is 250 kPa, calculate mass flow rate through the nozzle and the flow velocity at the exit section. Assume one dimensional isentropic flow. **20**

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6. Show that the maximum discharge of steam per unit area through a nozzle takes place when the ratio of stream pressure at the throat to the inlet pressure is $\left(\frac{2}{n+1}\right)^{\frac{n}{n-1}}$, where n is the index of adiabatic expansion. **20**

Unit IV

7. The following particular refers to a single row impulse turbine :

   Enthalpy drop in the nozzle and nozzle angle is 45 kJ/kg and 16°, Mean diameter of blade ring = 0.3 m, rotational speed of the wheel = 10,000 rev/min, Blade exit angle equals the blade inlet angle. Determine : (a) blade inlet angle for shock less entry, and (b) work done and axial thrust for steam flow rate of 1 kg/s. Neglect the effect of friction when passing through blade passages and obtain your solution form the geometry of velocity diagrams. **20**

8. (a) Derive an expression for degree of reaction for reaction turbine. **10**

   (b) What is the condition of maximum efficiency of an impulse turbine ? **10**

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