Code: 9A03501

R09

B.Tech III Year I Semester (R09) Supplementary Examinations June 2017

THERMAL ENGINEERING – II

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

Steam tables are permitted in the examination

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1 (a) What are the methods which can lead to increase in thermal efficiency of Rankine cycle?

(b) In a Rankine cycle the steam at inlet to turbine is saturated at a pressure of 30 bar and the exhaust pressure is 0.25 bar. Determine: (i) The pump work. (ii) Turbine work. (iii) Rankine efficiency. (iv) Condenser heat flow. (v) Dryness at the end of expansion.

2 (a) What is the function of blow-off cock? Where is it located?

(b) Estimate the height of the chimney to produce a static draught of 20 mm of water if the mean temperature of the hot gases is 250ºC and ambient temperature is 20ºC. Assume the density of air and hot gases as 1.293 kg/m^3 and 1.34 kg/m^3 respectively at NTP. Also estimate the mass of flue gases formed per kg of fuel. Barometer reads 760 mm of Hg.

3 Derive an expression for the mass flow rate through a nozzle.

4 One stage of an impulse turbine consists of arrow of nozzles and one row of moving blades. The steam enters the nozzles at a pressure of 15 bar, dry saturated, with a velocity of 130 m/s. The pressure drops along the nozzles to 9 bar. The nozzles have discharge angle of 20° and the steam passes into the blades without shock. If the velocity coefficient for nozzles is 0.9. Determine for maximum efficiency condition (i) The blade angles for equiangular blades. (ii) The blading efficiency. (iii) The stage efficiency.

5 Explain the working of a single-stage reaction turbine. Sketch pressure and velocity variations along the axis of the turbine. Show the expansion on h-s chart.

6 (a) Explain the working of a shell-and-tube type surface condenser.

(b) Explain the working of a cooling pond with a diagram.

7 (a) Explain the operating principle of Brayton cycle with a schematic diagram, p-v and T-s diagrams.

(b) Derive the thermal efficiency of Brayton cycle in terms of pressure ratio and polytropic index.

8 (a) Explain the analysis of rocket propulsion.

(b) A rocket flies at 2800 m/s with an effective exhaust velocity of 1400 m/s and the propellant flow rate of 5 kg/s. If the heat of reaction of the propellant is 6500 kJ/kg of the propellant mixture, determine propulsive efficiency and propulsive power, engine output, thermal efficiency and overall efficiency.

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