Code No: **R31034** **R10** **Set No. 1**

III B.Tech I Semester Supplementary Examinations, October/November -2017

THERMAL ENGINEERING – II

(Common to Mechanical Engineering and Automobile Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

*****

1 a) Explain the working of a simple Rankine cycle and derive the expression for its thermal efficiency. [7M]

b) One kg C_8H_{18} fuel is supplied to an engine with 13 kg of air. Determine the percentage by volume of CO_2 in dry exhaust gas considering exhaust gas to consist of CO_2, CO and N_2. [8M]

2 a) Explain the function of an Economiser and super heater in a steam boiler installation. Discuss its location and importance. [7M]

b) Derive the condition for maximum discharge through a chimney in natural draught. [8M]

3 a) Discuss the super saturated flow in steam nozzles and explain the physical significance of Wilson's line as referred to super saturated flow. [7M]

b) Steam at a pressure of 15 bar saturated is discharged through a convergent-divergent nozzle to a back pressure of 0.2 bar. The mass flow rate is 9 kg/kW-hr, if the power developed is 220 kW, determine number nozzles required if each nozzle has a throat of rectangular cross section of 4mm x 8mm. If 12% of overall isentropic enthalpy drop occurs in the divergent portion due to friction, find the cross section of the exit rectangle? [8M]

4 a) What is compounding of steam turbine? Explain about velocity compounding. [7M]

b) In a simple impulse steam turbine stage steam enters the nozzle at 15 bar, dry saturated with velocity of 150 m/s. Nozzle angle is 20° and steam leaves nozzle at 8 bar and enters into smooth blades. Considering nozzle velocity coefficient of 0.90 and blades to be equiangular determine the following for maximum diagram efficiency. (i) the blade angles, (ii) the blading efficiency, (iii) the stage efficiency. [8M]

5 a) Differentiate between impulse and reaction turbines. [6M]

b) The outlet angle of a parson's turbine is 20^0 and the axial velocity of flow of steam is 0.5 times the mean blade velocity. If the diameter of the ring is 1.25 m and the rotational speed is 3000 rpm, determine the inlet angles of the blades. Also determine the power developed if dry and saturated steam at 5 bar passes through the blades where height may be assumed as 6 cm. neglect the effect of blade thickness. [9M]

Code No: **R31034** **R10** **Set No. 1**

6 a) With a neat sketch explain the working of evaporative condenser. [7M]

b) A condenser has vacuum of 70 cm of Hg when barometer reading is 76 cm. Condenser has temperature of 30°C. Air leaks into condenser at the rate of 1 kg air per 2500 kg steam. Calculate (i) the capacity of air pump per kg of steam for removal of air from steam entering condenser, and (ii) the mass of water vapour accompanying this air. [8M]

7 a) Explain the working of open cycle gas turbine plant with reheat and regeneration. [7M]

b) In a gas turbine plant working on Brayton cycle, the air at inlet is 27°C, 0.1 MPa. The pressure ratio is 6.25 and the maximum temperature is 800°C. The turbine and compressor efficiencies are each 80%. Find compressor work, turbine work, heat supplied, cycle efficiency and turbine exhaust temperature. Mass of air may be considered as 1 kg. Draw T-s diagram. [8M]

8 a) Classify the jet propulsion engines and explain the working of any one jet propulsion engine. [7M]

b) With a neat line diagram explain the working of liquid propellant rocket engine. Write its advantages and applications. [8M]

*****