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

III B.Tech II Semester Supplementary Examinations, May - 2017
THERMAL ENGINEERING –II
(Mechanical Engineering)

Time: 3 hours **Max. Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
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1 a) Discuss the advantages of reheating the steam in high pressure steam plants. [7M]

b) The percentage composition of a sample of fuel was found to be C=85%,H_2=9%,S=3%,O_2=1.5%, ash=1.5%. for an air-fuel ratio of 12:1. Calculate: (i) The mixture strength as a percentage rich or weak. (ii)The volumetric analysis of the dry products of combustion. [9M]

2 a) Discuss briefly, the working of an economizer in a boiler plant giving a neat sketch. [8M]

b) Deduce a relation for the calculation of natural draught in a boiler plant and state the parameters on which the draught depends. [8M]

3 a) What is critical pressure ratio? Derive the expression for the maximum mass flow rate through a steam nozzle. [8M]

b) Dry-saturated steam at 11 bar is passed through a convergent-divergent nozzle and exit pressure is 2 bar. If the flow is isentropic, find exit velocity of the steam and ratio of cross-section at exit to throat. Take index of isentropic expansion of steam = 1.135. [8M]

4 a) What do you understand by the term `friction` in an impulse turbine? How does it affect the combined velocity triangle? [7M]

b) Steam with absolute velocity of 400m/s is supplied through a nozzle to a single stage impulse turbine. The nozzle angle is 25^0. The mean diameter of blade rotor is 1m and it has a speed of 2000r.p.m. find suitable blade angles for zero axial thrust. If blade velocity coefficient is 0.9 and the steam flow rate is 10kg/s, calculate the power developed. [9M]

5 a) Define the term Degree of Reaction used in Reaction Turbines. Prove that moving and fixed blades should have the same shape for 50% reaction. [8M]

b) Explain the essential differences in the manner of expansion of steam in impulse and reaction turbines. Illustrate your answer by sketches of the pressure ,velocity and specific volume changes which occur as the steam passes over successive blades. [8M]

6 a) What do you understand by the term vacuum efficiency of a condensing plant? On what factors does this efficiency depend? [8M]

b) Describe with a neat sketch the working of a surface condenser. [8M]

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7 a) What are the effects of the following factors on the specific output and thermal efficiency of the open cycle gas turbine at different pressure ratios? (i) Compressor inlet temperature, (ii) Isentropic efficiency of the compressor, (iii) Turbine inlet temperature, and (iv) Turbine isentropic efficiency. [7M]

b) In a open cycle gas turbine plant, air enters at 1 bar 20°C and compressed to 5 bar. Taking the following data, Max. temp in the cycle = 680°C, $\eta_{compressor}$ = 85%, $\eta_{turbine}$ = 80%, $\eta_{combustion}$ = 85%. Pressure loss in combustion chamber = 0.1 bar. Take C_p = 1.02 kJ/kg°C and γ = 1.4 for air and gas. Find (a) Air circulation if power developed by the plant is 1065 kW (b) Thermal η of the cycle. Neglect the mass of fuel. [9M]

8 a) With reference to a rocket engine, define the following terms: i) Thrust; ii) Propulsive efficiency ; iii) Specific Impulse. [8M]

b) Define and derive an expression for the thermal efficiency of turbo jet engine. [8M]

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