Printed Pages : 4

EME-042

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 140758

Roll No.

B. Tech.

(SEM. VII) (ODD SEM.) THEORY EXAMINATION, 2014-15

THERMAL TURBOMACHINES

Time : 3 Hours] [Total Marks : 100

1 Attempt any FOUR parts : 5×4=20

a) With help of velocity diagram describe about the reaction turbine.

b) Summarize various loss take place due friction by taking account of overall blade loss coefficient.

c) Describe the velocity diagram for single stage impulse turbine.

d) What do you understand by compounding of steam turbines? Compare different types of compounding of steam turbines with one another.

e) Draw a indicator diagram, considering the effect of acceleration and friction in suction and delivery pipes.

f) Classify pumps based on the working and explain any one type in detail with neat sketch.

2 Attempt any TWO parts : **10×2=20**

a) What are the conditions to be satisfied for the Euler's energy equation to be valid? Discuss the physical meaning of Euler's energy equation.

b) By means of a thermodynamic analysis develop an expression for the energy transfer in a rotating machine.

c) Define the various performance parameters and coefficients used in turbo machinery in detail.

3 Attempt any TWO parts : **10×2=20**

a) A Centrifugal compressor runs at 10000 rpm and delivers 600 m^3/min of free air at a pressure ratio of 4:1. The isentropic efficiency of compressor is 82%. The outer radius of impeller (which has radial blades) is twice the inner one and neglects the slip coefficient. Assume that the ambient air condition are 1 bar and 293 K. The axial velocity of flow is 60 m/s and its constant throughout. Determine

I. The power input to the compressor

II. Impeller diameter at inlet and outlet and width at inlet

III. Impeller and diffuser blade angles at inlet.

b) An axial compressor stage has an mean diameter of 60 cm and runs at 15000 rpm. If the actual temperature rise and pressure ratio developed are 30° C and 1.(respectively, determine

I. the power required to drive the compressor while delivering 57 kg/s of air: assume mechanical efficiency of 86.0% and an initial temperature of 35 °C.

II. the stage loading coefficient

III. the stage efficiency

c) I. Define degree of reaction related to axial compressor and derive its equation.

II. Define slip factor related to Centrifugal compressor and derive its equation.

4 Attempt any TWO parts : 10x2=20

a) A single stage impulse turbine the nozzle discharges the fluid on to the blade at an angle of 65° to the axial direction and fluid leaves the blade with an absolute velocity of 300 m/s at an angle of 30° to the axial direction. If the blades have equal inlet and outlet angles and there is no axial thrust, estimate

I. blade angle

II. power produced per kg/s of the fluid

III. blade efficiency

b) Classify blade profiles of axial flow turbine and write short note on vortex theory.

c) An axial flow turbine operating with an overall stagnation pressure of 8 to 1 has a polytrophic efficiency of 0.85. Determine the total-to-total efficiency of the turbine. If the exhaust Mach number of the turbine is 0.3, determine the total-to-static efficiency. If, in addition, the exhaust velocity of the turbine is 160 m/s, determine the inlet total temperature.

5 Attempt any TWO parts : **10×2=20**

a) Write short note on starting and ignition system used in gas turbine. Explain Surface discharge igniter in detail.

b) Compare and evaluate different cooling techniques in detail.

c) Name some of the traditional materials used in the gas turbine design.
