R09

Code No: C2105

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.TECH I SEMESTER EXAMINATIONS APRIL/MAY-2012
TURBO MACHINES
(THERMAL ENGINEERING)

Time: 3hours **Max.Marks:60**

Answer any five questions
All questions carry equal marks

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1.a) Prove that the turbine overall efficiency is greater than the turbine stage efficiency.

b) Derive the polytropic compression efficiency through an infinitesimal compression stage.

2.a) Discuss the effect of back pressure during flow through a converging diverging nozzle . Show variation of pressure, velocity and P exit as a function of back pressure.

b) The inlet condition to a steam nozzle is 10 bar and $250^0 C$ .The exit pressure is 2 bar. Assuming isentropic expansion and negligible inlet velocity, calculate the throat area, exit velocity and exit area of the nozzle.

3. A stage of an impulse turbine has two rows of moving blades separated in a row of fixed guide blades. The moving blades have tip angle of 38^0, the velocity of discharge from the nozzle is 540 m/s. The relative velocity of steam drops by 10 % during passage through each ring of blades and the final discharge is axial. Calculate the blade speed and blade efficiency.

4.a) Compute the minimum values of Mach number M_1 for which the oblique shock remains attached to the wedge for deflection angles at 20^0, 30^0 and 40^0.

b) Calculate the maximum deflection angles for which the oblique shock remains attached to the wedge when M_1=2 and 3.

5.a) Write the four basic equations that satisfy the state points before and after abnormal shock . Show the shock on enthalpy and entropy diagram.

b) A Centrifugal impeller has 17 radial blades in the impeller of 45 cm diameter. The tip diameter of the eye is 25cm. Calculate the slip factor making use of the two different formulae.

6.a) Explain the concept of surging in an axial flow compressor.

b) An axial compressor has a mean dia of 60m and runs at 15,000 RPM. Actual temperature rise of 30^0 C and pressure ratio developed is 1.3; calculate the power required to drive the compressor while delivering 60 kg/sec of air, if initial temperature is 35^0 C and mechanical efficiency as 88 %, stage efficiency and degree of reaction if the temperature at the rotor exit is 56^0 C.

7.a) Explain the principle of outward flow radial cascade. Describe its effects.

b) What is matching of compressor and turbine performance in axial flow gas turbines?

8. Write short notes
a) Free vortex blades
b) Ship factor in centrifugal compressor
c) Thermodynamic analysis of steam turbines.

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