Calculate:

i) The mean rotor blade speed

ii) The rotor blade angles at inlet and exit

iii) Power input to the system.

Unit - V

9. a) Explain the working of torque converter.

   b) A hydraulic intensifier supplying water to a hydraulic press gets water from supply main at a pressure of 50 bar. It has to intensify the pressure to 200bar. If the stroke of intensifier in 1m and cubic capacity is 20 Litre. find the dimensions of rains of intensifier.

OR

10. Write short notes on :

    i) Fluid coupling

    ii) Hydraulic intensifier.

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 Roll No .....

ME - 502

B.E. V Semester

Examination, December 2013

Turbo Machinery

Time : Three Hours

Maximum Marks : 70

Note: Attempt five questions selecting one from each unit. All questions carry equal marks. Assume suitable missing data, if any.

Unit - I

1. a) Air flows steadily at the rate of 0.4kg/sec through an air compressor entering at 6m/sec with a pressure of 1 bar and a specific volume of 0.85 m^3/kg and leaving at 4.5m/sec with a pressure of 6.9 bar and a specific volume of 0.016m^3/kg. The internal energy of the air leaving in 83kJ/kg greater than that of air entering. Cooling water in a jacket-surrounding the cylinder absorbs heat from the air at the rate of 59kg/sec. Calculate the power required to drive the compressor and inlet and outlet pipe cross-sectional areas.

   b) Derive the Euler-turbine equation.

OR

2. a) Define the degree of reaction and derive a general expression for degree of reaction.

b) The following data refers to a turbo machine Inlet
velocity of whirl = 16m/sec
velocity of flow = 10m/sec
Blade speed = 33m/sec
Exit blade speed = 8m/sec
Discharge is radial with an absolute velocity of 16m/sec. If water is the working fluid flowing at the rate of $1m^3/sec$. Compute the following
i) Power in kW.
ii) Change in total pressure in bar
iii) Degree of reaction.

Unit - II

3. Derive the expression for work done per stage of an impulse turbine. Also show that the maximum efficiency is given by $\cos^2\alpha$ where α is the nozzle angle. States the assumptions made. Find maximum efficiency for a single stage impulse turbine with equiangular blades having row of wheel nozzle 18 degree and ratio of relative velocity as 0.85.

OR

4. Following data refers to a reaction turbine Speed = 3000 rpm, Power developed = 1MW, Rotor speed = 225m/sec, Nozzle angle = 20°, Steam speed = 350m/sec, Specific volume of steam at nozzle inlet = $4.5m^3/kg$, Specific volume of steam at nozzle exit = $5m^3/kg$, Blade height = 0.15m, carry over efficiency = 0.9, Nozzle efficiency = 0.93.
Calculate:
i) Enthalpy drop in each stage
ii) Degree of reaction
iii) Stage efficiency.

Unit - III

5. a) Briefly explain the working of a pelton wheel.
b) Following data refers to a centrifugal pump.
Impeller inlet dia = 0.4m
Impeller outlet dia = 0.7m
Velocity of flow at exit = 2.5m/sec
Exit vane angle = 40°
Manometric efficiency = 75%
Calculate the minimum speed.

OR

6. In a power station, a pelton wheel produces 15,000kW under a head of 350m while running at 500 rpm. Assume a turbine efficiency of 0.84, coefficient of velocity for Nozzle as 0.98, speed ratio 0.46 and bucket velocity coefficient 0.86. Estimate
i) Number of jets
ii) Diameter of each jet.
iii) Tangential force exerted on the buckets of the bucket deflects the jet through 165°.

Unit - IV

7. a) Compare the axial flow and centrifugal compressors.
b) Explain the various losses which occur in compressors.

OR

8. An axial flow compressor with 50% reaction is having a flow coefficient of 0.54. Air enters the compressor at stagnation condition of 1bar and 30°C. The total to total efficiency across the rotor is 0.88 and pressure ratio across rotor is 1.26. The pressure coefficient is 0.45 and work done factor is 0.88. The mass flow rate in 15kg/sec.