OR

For a Axial flow compressor discuss the following :

Vector diagram, expression for work done temperature and pressure ratio.

5. a) What is the difference between a fluid coupling and fluid torque converter?

   b) Discuss the working principle of a hydraulic press.

   c) Write short notes on :

      i) Hydraulic intensifier

      ii) Hydraulic Accumulator

   d) Draw and describe the indicator diagram, considering the effect of acceleration and friction in suction and delivery pipes. Find an expression for the work done per second in case of single acting reciprocating pump.

OR

Find the maximum speed of a single acting reciprocating pump to avoid separation, which occurs at 3.0m of water (abs.) the pump has a cylinder of diameter 10cm and a stroke length of 20cm. The pump draws water from a sump and delivers to a tank. The water level in the sump is 3.5m below the pump axis and in the tank the water level is 13m above the pump axis. The diameter and length of the suction pipe are 4cm and 5m while of delivery pipe the diameter and length are 3cm, 20m respectively. Take atmospheric pressure head = 10.3m of water.

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ME - 502

B.E. V Semester

Examination, December 2015

Turbo Machinery

Time : Three Hours

Maximum Marks : 70

Note: i) Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.

ii) All parts of each questions are to be attempted at one place.

iii) All questions carry equal marks, out of which part A and B (Max.50 words) carry 2 marks, part C (Max.100 words) carry 3 marks, part D (Max.400 words) carry 7 marks.

iv) Except numericals, Derivation, Design and Drawing etc.

1. a) Define the term degree of reaction.

   b) State and elaborate the Euler Turbine Equation.

   c) Discuss the principle of impulse and reaction turbine in detail also state applications of impulse and reaction turbine.

   d) Obtain the energy equation for relative velocities for one dimension and explain its significance.

OR

How is the First and Second law of Thermodynamics applicable to turbo machines discuss in detail.

2. a) What is the significance of Reheat Factor in turbines?

   b) List the different losses in a steam turbine.

   c) Discuss with neat sketches the methods of governing a steam turbine.

d) A turbine is supplied with steam at 30 bar and 450°C. The expansion in high pressure turbine is carried out to the stage when steam is dry and saturated. The steam is then reheated to superheated temperature in a reheater and expanded in low pressure turbine to 0.04 bar. Neglecting feed pump power requirements, calculate : intermediate reheat pressure, dryness fraction of steam as it flows to the condenser, ideal cycle efficiency and steam consumption.

OR

An Impulse turbine has one nozzle per stage. The angle of inclination of nozzles is 22° and the tip angles of blades are 35°.

i) If the velocity of steam at exit of nozzle is 800m/s, find the blade speed so that the steam shall pass on without shock. Also find diagram efficiency neglecting losses if the blade run at this speed.

ii) If the relative velocity of steam to the blade is reduced by 15% while passing through the blade ring find the end thrust on the shaft and efficiency when turbine develops 750 kW.

3. a) What is a Draft Tube? Explain the functions of a draft tube.

b) Define the following : Mano-metric Head, Gross Head, Static Head and work done for a centrifugal pump.

c) For a Kaplan Turbine with runner diameter 4m, discharge is $60m^3/s$ and the hydraulic and mechanical efficiency are stated to be 90 and 94 percent respectively. The diameter of the boss is 0.3 times the runner diameter and speed ratio is 2.0. Assuming that discharge is free and there is no swirl at outlet, calculate the net available head on the turbine, the power developed and specific speed.

d) A Pelton wheel of 1.2m mean diameter works under a head of 650m. The jet deflection is 165° and its relative velocity is reduced over the buckets by 15% due to friction. If the water is to leave the bucket without any whirl, find the following : rotational speed of the wheel, ratio of bucket speed to jet velocity, impulsive force and the power developed by the wheel, available power and the power input to the buckets and efficiency of the wheel with the power input to the buckets as reference input. Take $K_v = 0.97$.

OR

The Impeller of a centrifugal pump is of 30cm diameter and 5 cm width at the periphery, and has blades whose tip angles incline backwards 60° form the radius. The pump delivers $17m^3/min$ and the impeller rotates at 1000 rpm. Assuming that the pump is designed to admit radially, calculate :

i) Speed and direction of water as it leaves the impeller,

ii) Torque exerted by the impeller on water,

iii) Shaft power required, and

iv) Lift of the pump.

4. a) Discuss the Fan law and characteristics of centrifugal blowers.

b) Define Slip Factor and explain its significance.

c) Discuss in detail the classification of centrifugal and axial flow machines on the basis of pressure rise.

d) For a centrifugal compressor discuss the following :

Vector diagram, expression for work done temperature and pressure ratio.