Roll No ....

MMTP-302(C)

M.E./M.Tech. III Semester

Examination, June 2016

Pumps, Blowers and Compressors (Elective-II)

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt any five questions.

ii) All questions carry equal marks.

1. a) Differentiate between (i) Power producing and power generating turbo machines. (ii) Incompressible and compressible flow machines.

b) Derive the basic equation of energy for the flow machines Define stagnation state and derive equations for (i) stagnation enthalpy (ii) stagnation temperature and (iii) stagnation velocity of sound.

2. a) Explain the performance characteristics of pumps compressors, fans and blowers.

b) Explain various forms of corrosion occurred in hydrauli machines.

3. a) Define specific speed of a centrifugal pump. Derive a expression for the same.

b) A four stage centrifugal pump has four identical impellers, keyed to the same shaft. The shaft is running at 400 rpm and the total manometric head developed by the multistage pump is 40 m. The discharge through the pump is 0.2 m³/s. The vanes of each impeller are having outlet angle as 45°. If the width and diameter of each impeller at outlet is 5 cm and 60 cm respectively, find the manometric efficiency.

4. a) What are the main causes of noise generation in operation of fans and blowers? What are the methods of reducing their noise?

b) A centrifugal blower takes in 180 m³/min of air at 1.013 bar and 43 °C and delivers it at 750 mm W.G. Taking the efficiencies of blower and drive as 80% and 82% respectively, determine the power required to derive the blower and the state of air at exit.

5. An axial fan stage consisting of rotor with upstream guide vanes for negative swirl and to eliminate outlet swirl, has the following data : rotor blade air angle at inlet 86°; tip diameter 60 cm; hub diameter 30 cm; rotational speed 960 rpm; power required 2 kW; flow co-efficient 0.245. The inlet pressure and temperatures are 1.02 bar and 316 K respectively. Determine the rotor blade angle at exit, the flow rate, stage pressure rise, overall efficiency, degree of reaction and specific speed.

6. a) Explain briefly the function of inlet guide vanes and inducer blades in a centrifugal compressor stage. Why radial-tipped impeller is most widely used?

b) A centrifugal compressor has a pressure ratio of 4:1 with an isentropic efficiency of 80% when running at 15000 rpm and inducing air at 293 K. Curved vanes at inlet give the air a pre-whirl of 25° to the axial direction at all radii and the mean diameter of eye is 250 mm. The absolute air velocity at inlet is 150 m/s. impeller tip diameter is 600 mm. Calculate the slip factor.

7. a) What is the work done factor for an axial compressor stage? How does it vary with the number of stages?

b) A 50% reaction axial flow compressor runs at a mean blade speed of 250 m/s. The pressure ratio developed by the machine is 1.3. Determine the blade and air angle if the mean flow velocity was 200 m/s. Consider conditions at inlet are 1 bar and 300 K.

8. Write short notes on any three of the following :

a) Cavitation in centrifugal pump

b) Surging and stalling in axial flow compressor

c) Losses in centrifugal compressor stage

d) Dust erosion of centrifugal impeller

e) Cascade variables

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