Roll No. | | | | | | | | | | |

26/11/13

B.E / B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, NOV / DEC 2013

MECHANICAL ENGINEERING

VII SEMESTER

ME9031 TURBO MACHINERY

INSTRUCTIONS

Assume any data required suitably with proper justification

Time : 3 Hours | Answer All Questions | Max Marks : 100

PART A (10 X 2 = 20 Mark)

1) How do you classify Turbomachines?
2) What is degree of reaction?
3) What is the role of volute in blowers?
4) What are the various fan drives used in fans?
5) What is slip factor?
6) What is surging?
7) What is meant by work input factor?
8) What are the factors that affect the stage pressure ratio in AFC?
9) What is blade loading coefficient?
10) Why is combustion chamber temperature limited in gas turbines?

PART B (5 x 16=80 Mark)

11. (i) Explain the working of a turomachine with a suitable velocity triangles and derive the Euler's equation for turbomachines (8).

(ii) Describe various efficiencies used in turbo-machines with their significance. (8)

12. a) Derive the don-dimensional numbers used in fans and blowers and explain their importance. (16)

(OR)

b) Describe the criteria of selection for fans and blowers and explain their performance & the methods of noise reduction. (16)

13. a) (i) Draw the outlet velocity triangles for various vanes of CFC and explain their differences. (8)

(ii) A single sided centrifugal flow compressor is to deliver 15 kg/s of air when operating at a pressure ratio of 6:1 and a speed of 12000 rpm. The inlet stagnation pressure is 1 bar and temperature 15°C. The number of vanes in the impeller is 20. The power input factor is 1.05. Find the overall diameter of the impeller. (8)

(OR)

b) (i) Explain the performance curves of the centrifugal flow compressors (8)

(ii) A centrifugal flow compressor has a total pressure ratio of 4:1 when drawing air from atmosphere at 3.6km altitude; where ambient temperature and pressure are 264.5°K and 64448N/m2. The inlet eye to the compressor impeller is 0.30m in diameter, where the axial velocity is 122 m/s and the mass flow 8.86kg of air per sec; the velocity in the delivery duct of the compressor is 107 m/s. The tip speed of the impeller is 440m/s and runs at 16500 rpm with an adiabatic efficiency of 0.78, pressure co-efficient of 0.72. Calculate the total static pressure ratio, Mach no of the flow over the tip of the inlet vane where the radius is 0.15m.

14. a) Explain the geometric features and working of axial flow compressor (8)

(ii) The entry of an axial flow compressor has a stagnation temperature of 300 K and initial pressure of 101 kPa. At the inlet to the stage, the air velocity vector is inclined at an angle of 12° to the axial direction and the axial component to the velocity has constant value of 110 m/s throughout the stage. The rotor blade speed at mid-radius is 225 m/s and the outlet blade angle is 32° less than the inlet blade angle. The work done factor is 0.9. Calculate the air and blade angles and stage work. (8)

(OR)

b) (i) Draw the enthalpy – entropy diagram for axial flow compressor. (8)

(ii) Discuss various losses in the compressors with their reasons and possible remedies. (8)

15. a) (i) Compare geometric and performance features of compressors with turbines. (8)

(ii) Draw the velocity triangles for the axial flow turbines and explain the process of energy transfer between the fluid and rotor. (8)

(OR)

b) (i) Derive the expression for the maximum utilization factor of a single stage turbine. (8)

(ii) A single stage turbine has been designed for following parameters:

Mass flow	: 20 kg/s
Inlet temperature	: 1000K
Axial velocity	: 260 m/s
Mean Blade speed	: 360 m/s
Nozzle efflux angle	: 65°
Stage swirl angle	: 10°

Find the temperature drop coefficient, blade gas angles and degree of reaction of an axial flow and power output of single stage turbine on mean diameter basis. (8)

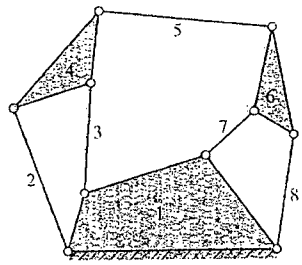

Fig 1

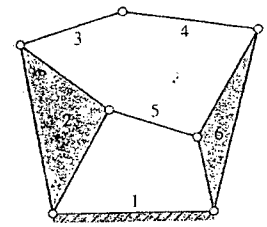

Fig 2

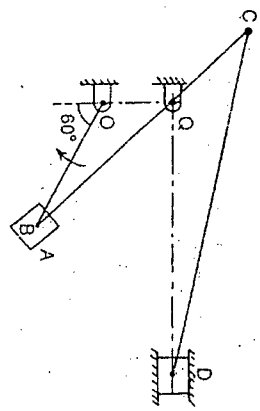

Fig 3