Roll. No. ____________________

B.E. / B. TECH. (FULL TIME) DEGREE END SEMESTER EXAMINATIONS, NOV / DEC 2012
MECHANICAL ENGINEERING BRANCH
VIII SEMESTER
ME 9031 TURBO MACHINERY
(REGULATION 2008)

30

TIME : 3 hr

Max. Mark : 100

Instructions : 1. Answer ALL Questions as directed.
2. State clearly any Assumptions made, with justification.

PART – A (10 x 2 = 20 Marks)

1. How does energy transfer in a work producing machine differ from a work consuming turbomachine?
2. Write the Euler's equation in expanded form and identify the significance of each term.
3. What are the advantages and disadvantages of a diffuser in a compressor?
4. What are the selection criteria for the fans?
5. What is meant by slip factor?
6. What are the losses in the diffuser of the centrifugal flow compressor?
7. What is meant by a stage of an axial flow compressor?
8. What do you understand by an isentropic efficiency of a compressor?
9. Define blade loading coefficient?
10. What is meant by degree of reaction?

PART – B (5 x 16 = 80 Marks)

11. a) (i) Explain the significance of a Specific Speed. (6)

(ii) Draw the stage velocity triangles of a Turbomachine and hence deduce the relation for their work transfer and efficiency. (10)

12) a) (i) List the design parameters of a fan with their importance. (6)

(ii) Give a detailed flow analysis of air in a stage of a centrifugal fan with the changes in pressure and temperature. (10)

(OR)

b) (i) Explain the methods for reducing fan noise. (6)

(ii) b) Explain the performance of a centrifugal blower with suitable characteristic curves, showing stable and unstable operating zones. (10)

13) a) (i) Explain the flow at exit in radial, forward and backward curved impellers, with suitable velocity triangles. (6)

(ii) A single-inlet centrifugal compressor running at 18000 rpm handles 10 kg/s of air at ground level where the pressure is 100 kPa and temperature is 27^0C. It raises the stagnation air pressure to 480 kPa. The air enters axially at 150 m/s. For an isentropic efficiency of 78% and slip factor of 0.95, find the change in stagnation temperature, power required and impeller outer diameter. (10)

(OR)

b) (i) Explain the methods for reducing fan noise. (6)

(ii) b) A radial-tipped centrifugal compressor of 500 mm tip diameter running at 18000 rpm handles 9 kg/s of air at ground level where the pressure is 105 kPa and temperature is 33^0C. The eye tip diameter and eye hub diameter are equal to 250 mm and 125 mm respectively. Assuming stage efficiency of 78% and slip factor of 0.93, find a) the blade angles at the hub, mean and tip sections of the inducer b) blade width at outer and c) power consumed. (10)

14) a) (i) Draw h – s diagram for a stage of an axial flow compressor. (6)

(ii) An axial flow compressor has a blade tip diameter of 0.75 m and operates at 10,000 rpm and delivering 20 kg of air per sec. The air leaves the first stage stator blades at a mean velocity of 155 m/s at an angle of 45 deg to the axis of rotation. If the mean state of the air at this point is assumed to be 9800 Pa and 290 K, calculate the inner diameter of the compressor at this point. If the outside diameter and the axial velocity remain constant throughout the machine, obtain the hub diameter at exit, if the static pressure ratio is 5.5 : 1 with an adiabatic efficiency of 85%. Ambient temperature is at 101325 Pa and 288 K. (10)

(OR)

b) (i) Derive the expression for the stage pressure ratio of an axial flow compressor. (6)

(ii) Draw the performance curves of an axial flow compressor and explain how its performance varies under various conditions. (10)

15) a) (i) Derive the expression for the Degree of reaction of an Axial Flow turbine. (6)

(ii) Find the temperature drop coefficient, blade gas angles and degree of reaction of an axial flow turbine and power output of single stage axial flow turbine on mean diameter basis. If mass flow arte is 20 kg/s, the inlet temperature is 1000 K, axial velocity is 300 m/s, mean blade speed is 375m/s, nozzle exit angle is 65° and stage swirl angle 10°. (10)

(OR)

b) (i) List the major design principles for an axial flow gas turbine. (6)

(ii) Explain the cause for various losses in the axial and radial flow turbines, with corresponding coefficients, and suggest suitable measures to reduce them. (10)