Roll No. | | | | | | | | | | | | | Total No. of Pages : 02

Total No. of Questions : 09

B.Tech.(AE) (2011 Onwards) (Sem.–3)

APPLIED THERMODYNAMICS

Subject Code : BTAE-302

Paper ID : [A1115]

Time : 3 Hrs. Max. Marks : 60

INSTRUCTION TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students has to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students has to attempt any TWO questions.**

SECTION-A

1. Write short notes on :

a) Define volumetric efficiency of a compressor.

b) What is surging in centrifugal compressor?

c) Define term slip factor and power input factor.

d) Define propulsive power and propulsive efficiency.

e) Name different methods of cooling the turbine blades.

f) State the assumptions made for thermal efficiency of gas turbine plant.

g) Define degree of reaction.

h) What is a turbojet engine?

i) What is meant by perfect cooling?

j) Draw Brayton cycle.

SECTION - B

2. Why is prewhirl provided at the vanes of a centrifugal compressor? Draw the velocity triangles at inlet and exit of the vanes.

3. Discuss the working of vane type blower with neat sketch.

4. Free air of 30 m^3/min is compressed from 101.3 kPa to 2.23 bar in roots blower. Determine the power required and isentropic efficiency.

5. What is rocket propulsion? Compare the working of liquid and solid propellant rockets.

6. With the help of a neat sketch explain the working of axial flow compressor.

SECTION-C

7. A centrifugal compressor runs at 16000 rpm and power required to run the compressor amounts to 2300 kW. The outer diameter of the impeller is 50 cm. The uniform width of the casing of vortex chamber between impeller and diffuser is 4 cm. Static conditions at a radius of 27 cm were measured and these were equal to 2.4 bar and 390 K. Surrounding pressure is 1 bar. Assuming slip factor of 0.94, find the mass flow rate of gas, the resultant velocity and temperature at the given radius of 27 cm. Assume c_p = 1.005 kJ/kg K and γ = 1.4.

8. An axial flow compressor of 50% reaction design has blades with inlet and outlet angles of 44° and 13° respectively. The compressor is to produce a pressure ratio of 5:1 with isentropic efficiency of 87% when the inlet temperature is 290 K. The mean blade speed and axial velocity are constant throughout the compressor. Assuming the blade velocity is 180 m/s and work input factor is 0.85, find the number of stages required.

9. In a gas turbine plant, operating on Brayton cycle, air enters the compressor at 1 bar and 27° C. The pressure ratio in the cycle is 6. Calculate the maximum temperature in the cycle and the power developed by the turbine. Assume the turbine work 2.5 times the compressor work. Take γ = 1.4.