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Total No. of Pages : 02

Total No. of Questions : 09

B.Tech.(ME) (2011 Onwards) (Sem.-4)

**APPLIED THERMODYNAMICS – II**

Subject Code : BTME-404

Paper ID : [A1214]

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS 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 briefly :

- (a) When a multi-stage compression is used for air compressor?
- (b) Explain the terms : Free air delivery & swept volume.
- (c) Explain the term prewhirl.
- (d) Discuss the function of diffuser in a centrifugal compressor.
- (e) Explain the phenomenon of stalling in an axial flow compressor.
- (f) Write down the expression for degree of reaction for an axial flow compressor.
- (g) What is air motor? On what principle does it work?
- (h) Explain the difference between an ideal gas turbine plant and actual gas turbine plant.
- (i) What is bypass turbojet engine? What are its advantages?
- (j) What is the principle of operation of rocket propulsion?

## SECTION-B

2. Describe with sketch, the working of a vane blower compressor and show it on p-v diagram.
3. Derive the expression for the reversible (process) work of compression if the compression process is adiabatic.
4. Explain in detail the phenomena of surging and choking used in centrifugal compressor.
5. Show that an axial flow compressor has symmetrical blades for 50% reaction.
6. Give the advantages and disadvantages of Jet propulsion over other system.

## SECTION-C

7. What is the need of staging the compression process? Show that the optimum intermediate pressure of a two stage reciprocating compressor for minimum work is the geometric mean of the suction and discharge pressure.
8. A centrifugal compressor running at 16000 rpm takes in air at 290 K and compresses it through a pressure ratio of 4 with an isentropic efficiency of 82%. The blades are radially inclined and the slip factor is 0.85 guide vanes at inlet give the air an angle of pre-whirl of  $20^\circ$  to the axial direction. The mean diameter of the impeller eye is 200 mm and absolute air velocity at inlet is 120 m/s. Calculate the impeller tip diameter. Take  $C_p = 1.005 \text{ kJ/kg - K}$  &  $\gamma = 1.4$ .
9. A turbo-jet aircraft flies with a velocity of 300 m/s at an altitude where the air is at 0.35 bar and  $-40^\circ\text{C}$ . The compressor has a pressure ratio of 10, and the temperature of the gases at inlet is  $1100^\circ\text{C}$ . Air enters the compressor at a rate of 50 kg/s. Estimate :
  - a) Pressure & temperature of the gases at the turbine exit.
  - b) The velocity of gases at the nozzle exit.
  - c) The propulsive efficiency of the cycle.