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 have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

1. Write briefly :

a. What are positive displacement compressors? Name two positive displacement compressors.

b. What is the effect of clearance volume on volumetric efficiency of a reciprocating compressor?

c. Explain surging and choking in reference to centrifugal compressors.

d. What is degree of reaction?

e. Define the term stage efficiency.

f. Explain the concept of overall efficiency.

g. What is the principle of jet propulsion?

h. What is dual turbine system?

i. Name various commonly used propellants.

j. What is work ratio?

SECTION-B

2. How the compressors are classified? Explain the construction and working of Lysholm compressor.

3. Using steady flow energy equation establish the relationship for work done by compressor.

4. A reciprocating air compressor has four stage compression with 2 m^3/min of air being delivered at 150 bar when initial pressure and temperature are 1 bar, 27°C. Compression occur polytropically following polytropic index of 1.25 in four stages with perfect intercooling between stages. For the optimum intercooling conditions determine the intermediate pressures and the work required for driving compressor.

5. Discuss the effect of reheat and regeneration on the efficiency and specific work out of a Rankine cycle.

6. A steam power plant uses steam as working fluid and operates at a boiler pressure of 5 MPa, dry saturated and a condenser pressure of 5 kPa. Determine the cycle efficiency for

   (a) Carnot cycle

   (b) Rankine cycle.

   Also show the T-s representation for both the cycles.

SECTION-C

7. Derive the relationship for thrust power, propulsive power, propulsive efficiency, thermal efficiency, overall efficiency and jet efficiency of jet propulsion system. Assume suitable parameter.

8. An air compressor has eight stages of equal pressure 1.35. The flow rate through the compressor and its' overall efficiency are 50 kg/s and 82% respectively. If the air enters the compressor at a pressure of 1 bar and temperature of 313 K, determine;

   (a) State of air at the exit of compressor

   (b) Polytropic or small stage efficiency

   (c) Efficiency of each stage

   (d) Power required to drive the compressor assuming overall efficiency as 90%.

9. Differentiate between axial and centrifugal compressors.