

Roll No \_\_\_\_\_

**Examination May-2014**

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B.Tech.(A.E)

**APPLIED THERMODYNAMICS****Subject Code: BTAE-302****Time: 3 hrs**

Paper ID- A1115

**Max Marks: 60****NOTE: 1. Section A is compulsory consisting of 10 questions each carrying 2 marks.****2. Section B contains five questions each carrying 5 marks. Attempt any 4 questions.****3. Section C contains 3 questions each carrying 10 marks. Attempt any 2 questions.****Section-A****(2x10)**

Q1. Write briefly:

- a) Classify the compressors into different types.
- b) What is isentropic efficiency of a compressor.
- c) Why is intercooling done in multistage compressors.
- d) What is the function of a impeller in a centrifugal compressor.
- e) Why airfoil blading is needed for a axial flow compressor.
- f) What is stalling.
- g) What is power input factor.
- h) List four advantages of gas turbines over I.C engines
- i) What is work ratio of a gas turbine.
- j) What is the working principle of a turbo-jet compressor.

**Section-B****(4x5)**

Q2. A Single stage ,double acting air compressor has a free air delivery (F.A.D.)of  $14\text{m}^3/\text{min}$ . at 1.013 bar and  $15^\circ\text{C}$ . The pressure and the temperature in the cylinder during induction are 0.95 bar and  $32^\circ\text{C}$  .The delivery pressure is 7 bar and the index of compression and expansion is  $n=1.3$ .The clearance volume is 5% of the swept volume. Calculate(i)Indicated power required (ii)Volumetric efficiency.

Q3. Explain the phenomenon of surging and chocking in a centrifugal compressor.

Q4. With the help of a neat sketch discuss the working of a vane type blower.

Q5. State the merits and demerits of closed cycle gas turbine over open cycle.

Q6. What is rocket propulsion. Compare the working of liquid and solid propellant systems.

**Section-C**

**(2x10)**

Q7. A centrifugal compressor delivers 16.5 kg/s of air with a total head pressure ratio 4:1. The speed of the compressor is 15000 r.p.m. Inlet total head temperature is 20°C, slip factor is 0.9, power input factor is 1.04 and isentropic efficiency is 80%. Calculate (i) Overall diameter of the impeller (ii) Power input.

Q8. In a simple gas turbine plant air enters the compressor at 1 bar and 27°C and leaves at 6.2 bar. It is then heated in the combustion chamber then enters the turbine and expands to 1 bar. The isentropic efficiency of compressor and turbine are 88% and 90% respectively. The fuel has a heating value of 44186 kJ/kg and the fuel-air ratio is 0.017 kJ/kg of air. Determine the (i) the thermal efficiency (ii) the work ratio

For air,  $C_p = 1.005 \text{ kJ/kg-K}$ ,  $\gamma = 1.4$ . For combustion gases,  $C_p = 1.147 \text{ kJ/kg-K}$ ,  $\gamma = 1.33$

Q9. With the help of velocity diagrams derive the expression for work done of a stage of axial flow compressor.

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