

Code No: 07A3EC08

**R07****Set No. 2**

II B.Tech I Semester Examinations, MAY 2011

**THERMODYNAMICS**

Common to Mechanical Engineering, Aeronautical Engineering, Automobile Engineering

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions  
All Questions carry equal marks

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1. (a) What are the advantages associated with the diesel cycle as compared to the otto cycle?  
(b) A gas engine working on Otto cycle has a cylinder of diameter 220 mm and stroke 300 mm. The clearance volume is 1800 cc. Find the air-standard efficiency. Assume  $C_p = 1.004$  kJ/kg.K and  $C_v = 0.718$  kJ/kg.K for air. [6+10]
2. (a) Explain with a neat sketch P-V-T diagram.  
(b) 2 kg of steam expands adiabatically from 20 bar, 300°C to 0.5 bar in a steam turbine such that the steam is dry and saturated at the end of expansion. Calculate
  - i. the work done by steam, and
  - ii. work lost due to irreversibility. [8+8]
3. (a) What is an equation of state?  
(b) Air at 16°C and 1.02 bar occupies a volume of 0.03 m<sup>3</sup>. The air is heated at constant volume until the pressure is 4.3 bar and then cooled at constant pressure back to the original temperature. calculate
  - i. The net heat flow to or from the air and
  - ii. The net entropy change. [6+10]
4. (a) Explain with neat sketch the working of vapour compression refrigeration cycle  
(b) Describe a binary vapour cycle with the help of schematic diagram of the plant and T-S diagram of the cycle. [8+8]
5. An engine working on Carnot cycle absorbs  $Q_1$  units of heat from a source at  $T_1$  and rejects  $Q_2$  units of heat to a sink at  $T_2$ . The temperature of the working fluid is  $\theta_1$  and  $\theta_2$ , where  $\theta_1 < T_1$  and  $\theta_2 > T_2$ ,  
If  $\theta_1 = T_1 - kQ_1$  and  $\theta_2 = T_2 + kQ_2$   
where k is constant, then show that efficiency of the engine is given by:  
$$\eta = 1 - \frac{T_2}{T_1 - 2kQ_1}. \quad [16]$$
6. (a) Derive steady flow energy equation and simplify the equation when applied to
  - i. Gas turbine
  - ii. Compressors

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- (b) A fluid system under goes a non-flow frictionless process following the pressure volume relation as  $p=5/v + 1.5$  where  $p$  is in bar and  $v$  is in  $m^3$  and the system rejects 42 kJ of heat. Determine
- change in internal energy
  - change in enthalpy. [8+8]
7. (a) Describe the method of dehumidification by cooling and show it on psychrometric chart. Derive energy equation for this process.
- (b) A thermally insulated vessel contains 3 kg mole of  $H_2$  and 1.5 kg mole of  $N_2$  each at 1 bar  $27^\circ C$  initially they are separated by a partition wall. Determine the change in entropy when the partition wall is removed and the two gases mixes. [8+8]
8. (a) What are the different types of thermodynamic systems? Explain with examples.
- (b) Work done by a substance in a reversible non-flow manner is in accordance with  $= \left(\frac{150}{p}\right) m^3$ , where  $p$  is in bar. Evaluate the work done on or by the system as pressure increases from 10 to 100 bar. Indicate whether it is a compression or expansion process. [8+8]

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5. (a) Derive steady flow energy equation and simplify the equation when applied to
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- (b) A fluid system under goes a non-flow frictionless process following the pressure volume relation as  $p=5/v + 1.5$  where p is in bar and v is in  $m^3$  and the system rejects 42 kJ of heat. Determine
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6. An engine working on Carnot cycle absorbs  $Q_1$  units of heat from a source at  $T_1$  and rejects  $Q_2$  units of heat to a sink at  $T_2$ . The temperature of the working fluid is  $\theta_1$  and  $\theta_2$ , where  $\theta_1 < T_1$  and  $\theta_2 > T_2$ ,  
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- ii. The net entropy change. [6+10]
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