II B.Tech I Semester Examinations,MAY 2011<br>THERMODYNAMICS<br>Common to Mechanical Engineering, Aeronautical Engineering, Automobile Engineering<br>Time: 3 hours

## Answer any FIVE Questions <br> All Questions carry equal marks

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 $C_{p}=1.004 \mathrm{~kJ} / \mathrm{kg}$.K and $C_{v}=0.718 \mathrm{~kJ} / \mathrm{kg}$.K for air. [6+10]
2. (a) Explain with a neat sketch P-V-T diagram.
(b) 2 kg of steam expands adiabatically from $20 \mathrm{bar}, 300^{\circ} \mathrm{C}$ 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 inteversibility.
3. (a) What is an equation of state?
(b) Air at $16^{\circ} \mathrm{C}$ and 1.02 bar occupies a volume of $0.03 \mathrm{~m}^{3}$. 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
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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 $T_{2}$. Te temperature of the working fluid is $\theta_{1}$ and $\theta_{2}$, where $\theta_{1}<T_{1}$ and $\theta_{2}>T_{2}$,
If $\theta_{1}=T_{1}-\mathrm{K} Q_{1}$ and $\theta_{2}=T_{2}+\mathrm{k} Q_{2}$
where k is constant, then show that efficiency of the engine is given by:
$\eta=1-\frac{T_{2}}{T_{1}-2 k Q_{1}}$.
6. (a) Derive steady flow energy equation and simplify the equation when applied to
i. Gas turbine
ii. Compressors
(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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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 $27^{\circ} \mathrm{C}$ initially they are separated by a partition wall. Determine the change in entropy when the partition wall is removed and the tyo gases mixes.
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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.
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