Code No: R059210304 **Set No. 1**

II B.Tech I Semester Supplementary Examinations, February 2007
THERMODYNAMICS
(Common to Mechanical Engineering and 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 different forms of work energy? Explain each briefly.
   (b) Why does free expansion have zero work transfer? [10+6]

2. (a) Make an energy analysis of the steam nozzle and heat exchanger.
   (b) Refrigerant vapour enters the condenser of a refrigeration plant with enthalpy 223.75 KJ/kg and leaves with enthalpy 64.6 KJ/kg. Cooling water enters at 15^0C and leaves at 20^0C. Calculate the mass flow rate of water per unit flow rate of refrigerant. Take for water Cp = 4.186 KJ/Kg-K. [8+8]

3. (a) Prove that entropy of an isolated system either increases or remains constant.
   (b) A lump of steel of mass 8 kg at 1000 K is dropped in 80 Kg of oil at 300 K. What is the entropy change of steel, the oil and the universe. Take specific heats of steel and oil as 0.5 KJ/Kg-K and 3.5 KJ/Kg-K respectively. [8+8]

4. (a) Explain Mollier diagram (h-s diagram)? [7M]
   (b) Find the specific volume, enthalpy and internal energy of wet steam at 18 bar dryness fraction 0.85. [9M]

5. (a) Deduce the relationship between absolute temperature and absolute pressure in an adiabatic process. [7]
   (b) 1.5 kg of air at pressure 6 bar occupies a volume of $0.2m^3$.If this air is expanded to a volume of $1.1m^3$. Find the work done and heat absorbed or rejected by the air for each of the following methods of trying one the process.
      i. isothermally
      ii. Adiabatic ally [9]

6. Dry bulb and wet bulb temperature of moist air are found as 29^0C and 20^0 C respectively. From the psychometric chart obtain:
   (a) Humidity ratio
   (b) Specific enthalpy
   (c) Dew point temperature
   (d) Specific volume of the mixture. [16]

7. In a gas turbine plant working on Brayton cycle, the air at inlet is 27C,0.1 MPa. The pressure ratio is 6.25 and the maximum temperature is 800C. The turbine and compressor efficiencies are each 80%. Find compressor work, turbine work, heat

supplied, cycle efficiency and turbine exhaust temperature. Mass of air may be considered as 1 kg. Draw T-s diagram. [16]

8. (a) Draw the line diagram of the Bell-Coleman refrigeration cycle. Explain with the help of a P-V diagram, different processses in the cycle.

   (b) Explain its advantages and disadvantages of Bell-Coleman cycle. [8+8]

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Code No: R059210304 **Set No. 2**

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THERMODYNAMICS
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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) How does classical thermodynamics differ from statistical thermodynamics ?
   (b) A gas contained in a piston cylinder arrangement expands from 0.75 m^3 volume to 1.25 m^3 volume while the pressure remains constant at 200 kPa. If the gaseous system receives 80 kJ of work from a paddle wheel, determine the net work done by the system. [6+10]

2. (a) A domestic refrigerator is loaded with food and the door closed. During a certain period the machine consumes 1 KW-hour of energy and the internal energy of the system drops by 5000 KJ. Find the net heat transfer for the system.
   (b) 1.5 kg of liquid having a constant specific heat of 2.5 KJ/kg-k is stirred in a well insulated chamber causing the temperature to rise by 15^0C. Find ΔE and W for the process. [8+8]

3. (a) State the limitations of first law of thermodynamics.
   (b) What is a thermal energy reservoir?
   (c) An engine operating on a Carnot cycle works with in temperature limits of 600 K and 300 K. If the engine receives 2000 KJ of heat, evaluate the work done and thermal efficiency of the engine. [6+2+8]

4. (a) Define and explain the concept of triple point.? [6]
   (b) Two boilers one with super heater and other without super heater are delivering equal quantities of steam into a common main. The pressure in the boilers and main is 20 bar. The temperature of steam from a boilers with a super heater is 350^0C and temperature of the steam in the main is 250^0C. Determine the quality of steam supplied by the other boiler. Take Cp(steam) = 2.25 KJ/Kg.K [10]

5. (a) Derive an expression for heat transfer in a non-flow constant volume process. [7M]
   (b) A spherical shaped of 14 M diameter contain 'H_2' at 33^0C and 1.3 bar. Find the mass of 'H_2' in the balloon using real gas equation. [9]

6. (a) Explain
      i. Heating and dehumidification
      ii. Cooling and dehumidification

(b) A Room of dimensions 6mX 3mX 3m contains an air water vapour mixture at 1 bar 30^0C and 70 % Relative humidity. Calculate

i. Mass of air

ii. Mass of water vapour

iii. Degree of saturation [10+6]

7. (a) Compare Carnot, Sterling and Ericsson cycles operating between the same source and sink temperatures and with equal changes in specific volume.

(b) An engine working on Otto cycle has the following conditions: pressure at the beginning of compression is 1 bar and pressure at the end of compressionis 12 bar. Calculate the compression ratio and air - standard efficiency of the engine. Assume $\gamma = 1.4$. [8+8]

8. (a) Describe the working of a Bell-Coleman refrigeration system with a neat sketch. what are its merits over other refrigeration systems?

(b) What are the various desirable properties of a refrigerant? Statte any two commercially used refrigerants? [8+8]

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Code No: R059210304 **Set No. 3**

II B.Tech I Semester Supplementary Examinations, February 2007
THERMODYNAMICS
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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Write the differences between system and control volume.
   (b) A gas undergoes a reversible non-flow process according to the relation P = (-3V+15)where V is the volume in m^3 and P is the pressure in bar. Determine the work done when the volume changes from 3 to 6 m^3. [6+10]

2. (a) State the zeroth law of thermodynamics. Explain how it forms the basis for temperature measurement?
   (b) A closed system undergoes a thermodynamic cycle consisting of four separate and distinct processes. The heat and work transferred in each process are as tabulated below.

Process	Heat Transfer in KJ/min	Work transfer in KJ/min
1-2	20,000	0
2-3	-10,000	30,000
3-4	0	20,000
4-1	15,000	-25,000

   Show that the data is consistent with the first law of thermodynamics. Also evaluate the net work output in KW and the change in internal energy. [6+10]

3. (a) Prove that entropy of an isolated system either increases or remains constant.
   (b) A lump of steel of mass 8 kg at 1000 K is dropped in 80 Kg of oil at 300 K. What is the entropy change of steel, the oil and the universe. Take specific heats of steel and oil as 0.5 KJ/Kg-K and 3.5 KJ/Kg-K respectively. [8+8]

4. (a) Explain the difference between internal energy and enthalpy of wet and dry steam
   - [7M]
   (b) 2 kg of steam initially at a pressure of 12 bar and a temperature of 250^0C expends polytropically to 1.2 bar. Find [9M]
      i. Final condition
      ii. Work done
      iii. Change in entropy ,assume the index of expansion as 1.25

5. (a) What is compressibility factor? Explain the basic construction of generalized compressibility chart.
   (b) Determine the pressure of air at 190^0C having a specific volume of 0.00295 m^3/kg by means of

i. Ideal gas equation

ii. Vander waal's equation.
$Takea = 135522Nm^4/(kg-mole)^2; b = 0.0362m^3/kg-mole; R = 8314J/kgmoleK$
[7+9]

6. A 2.2 kg mole of Carbon dioxide at a presser of 2 bar, 80^0C is mixed in a thermally insulated vessel with 3.2 kg-mol of Nitrogen is at equilibrium; Determine the final temperature and pressure and the change in entropy of the mixture. [16]

7. (a) With the help of P-V diagram and T-s diagram explain Otto cycle clearly showing the pressure during which the heat is supplied and rejected.

   (b) The minimum pressure and temperature in a Otto cycle are 100 kPa and 27°C. The amount of heat added to the air per cycle is 1500 kJ/kg. (i). Determine the pressure and temperatures at all points of air standard Otto cycle. (ii). Calculate the specific work and thermal efficiency of the cycle for a compression ratio of 8:1. [6+10]

8. (a) Explain the important components of a simple vapour compression refrigeration system. Also discuss the functions of each component.

   (b) Discuss the effect of sub cooling on C.O.P.of the vapour compression refrigeration cycle. Would you derive large sub cooling and why? [8+8]

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Code No: R059210304 **Set No. 4**

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THERMODYNAMICS
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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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1. (a) What do you understand by path function and point function?
   (b) State whether the following quantities are point functions or path functions? Explain briefly. (i) $\int_{\text{pdv}}$ (ii) $\int_{vdp}$ (iii) $\int_{(pdv+vdp)}$ and (iv) $\int_{dv}$ [6+10]

2. (a) State the zeroth law of thermodynamics. Explain how it forms the basis for temperature measurement?
   (b) A closed system undergoes a thermodynamic cycle consisting of four separate and distinct processes. The heat and work transferred in each process are as tabulated below.

Process	Heat Transfer in KJ/min	Work transfer in KJ/min
1-2	20,000	0
2-3	-10,000	30,000
3-4	0	20,000
4-1	15,000	-25,000

   Show that the data is consistent with the first law of thermodynamics. Also evaluate the net work output in KW and the change in internal energy. [6+10]

3. (a) State the limitations of first law of thermodynamics.
   (b) What is a thermal energy reservoir?
   (c) An engine operating on a Carnot cycle works with in temperature limits of 600 K and 300 K. If the engine receives 2000 KJ of heat, evaluate the work done and thermal efficiency of the engine. [6+2+8]

4. (a) Describe the process of formation of steam and give its graphical representation
   (b) Steam enters an engine at a pressure 10 bar absolute and 250^0C. It is exhausted at 0.2 bar. The steam at exhaust is 0.9 dry. Find
      i. Drop in enthalpy
      ii. Change in enthalpy. [7+9]

5. (a) What is compressibility factor? Explain the basic construction of generalized compressibility chart.
   (b) Determine the pressure of air at 190^0C having a specific volume of 0.00295 m^3/kg by means of
      i. Ideal gas equation

ii. Vander waal's equation.
$Takea = 135522Nm^4/(kg-mole)^2; b = 0.0362m^3/kg-mole; R = 8314J/kgmoleK$
[7+9]

6. A 1.8 kg mole of Carbon dioxide at a presser of 1.8 bar, 75^0C is mixed in a thermally insulated vessel with 2.8 kg-mol of Nitrogen is at equilibrium; Determine the final temperature and pressure and the change in entropy of the mixture. [16]

7. (a) Mention the various assumptions made in air-standard cycle analysis
   (b) The mean effective pressure of an ideal Diesel cycle is 8bar. If the initial pressure is 1.03 bar and the compression ratio is 12,determine the cut-off ratio and the air-standard efficiency. Assume ratio of specific heats for air to be 1.4. [6+10]

8. (a) Describe the working of a Bell-Coleman refrigeration system with a neat sketch. what are its merits over other refrigeration systems?
   (b) What are the various desirable properties of a refrigerant? Statte any two commercially used refrigerants? [8+8]

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