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

II B.Tech I Semester Supplimentary Examinations, February 2008
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 gas expands according to the equation PV=100, where P is the pressure in KPa and V is the specific volume in m^3/kg. The initial pressure of the gas is 1000 KPa and the final pressure is 500 KPa. The gas is then heated at constant volume back to its original pressure of 1000 KPa. Determine the work of combined process. Also sketch the process on P-V coordinates. [16]

2. (a) What do you understand by thermometric property and thermometric substance?
   (b) Establish the correlation between centigrade and Fahrenheit temperature scales. [6+10]

3. (a) State and prove Carnot theorem
   (b) A reversible heat engine operating between the thermal reservoirs at 900 K and 300 K is used to drive a reversible refrigerator for which the temperature limits are 300 K and 250 K. The engine absorbs 1800 KJ of energy as heat from the reservoir at 900 K and the net output from the engine refrigerator system is 360 KJ. Make calculations for the heat extracted from the refrigerator cabinet and the net heat rejected to the reservoir at 300 K. [6+10]

4. (a) Draw and explain P-T diagram for H_2O and label various phases.
   (b) Dry saturated steam at 100 bar expands isothermally and reversibly to a pressure of 10 bar calculate the heat supplied per kg of steam [7+9]

5. (a) Deduce the relationship between absolute temperature and absolute pressure in an adiabatic process.
   (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 [7+9]

6. (a) A gas mixture consists of 0.4 Kg of carbon monoxide,1.1 kg of carbon dioxide and 1.5 Kg of nitrogen. Determine
      i. Mass fraction of each component
      ii. Mole fraction of each component
      iii. Average molar mass of the mixture and
      iv. Gas constant of the mixture.

(b) Explain: partial molal properties [9+7]

7. (a) Drive an expression for the mean effective pressure of Diesel cycle.
   (b) Define the following terms with respect to Dual cycle
      i. Compression ratio
      ii. Cut-off ratio
      iii. Expansion ratio
      iv. Network of cycle. [8+8]

8. (a) Explain about the re-heating and refrigeration of a steam cycle with help of neat diagrams?
   (b) Obtain an expression for Joule's cycle in terms of pressure ratio. [8+8]

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

II B.Tech I Semester Supplimentary Examinations, February 2008
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 gas undergoes two processes that are in series. The first process is an expansion that is carried out according to the law PV = constant, and the second process is a Constant pressure process that returns the gas to the initial volume of the first process. The start of the first process is at 400 KPa and 0.025 m^3 with the expansion to 200 KPa. Sketch the process on a P-V diagram, and determine the work of the combined process. [16]

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) Determine entropy of 5 kg of steam at 2 MPa and 300^0C ,Take specific heat of super heated steam as 2.1KJ/Kg.K

   (b) Throttling colorimeter has steam entering to it at 10Mpa and coming out of it at 0.05 MPa and 100^0 C. Determine dryness fraction of steam. [8+8]

5. CO_2 flows at a pressure of 10 bar and 180^0C into a turbine, located in a chemical plant, and there it expands reversibly and adiabatic ally to a final pressure of 1.05 bar. Calculate the final specific volume, temperature and increase in entropy. Neglect changes in velocity and elevation. If the mass flow rate is 6.5 kg/min. Evaluate the heat transfer rate from the gas and the power delivered by the turbine. Assume CO_2 to be a perfect gas and $C_v = 0.837kj/kg.K$ [16]

6. (a) Explain Avagadro'ss laws of additive volumes.
   (b) A psychrometric reads 36^0C WBT and 40^0C DBT. Find the humidity ratio, relative humidity, dew point temperature, specific volume and enthalpy of air. [7+9]

7. (a) For the same compression ratio, show that the efficiency of Otto cycle is greater thanthat of Diesel cycle.
   (b) What is meant by Hot air Engine? Which air-standard cycle is used in studying an Hot air engine? Explain it in detail. [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. 3**

II B.Tech I Semester Supplimentary Examinations, February 2008
THERMODYNAMICS
(Common to Mechanical Engineering and Automobile Engineering)
Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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1. (a) What is a thermodynamic system? What is the difference between a closed system and an open system? Give few examples for closed and open systems.
   (b) An engine cylinder has a piston of area 0.12 m^2 and contains gas at a pressure of 1.5 MPa. The gas expands according to a process which is represented by a straight line on a pressure-volume diagram. The final pressure is 0.15 MPa. Calculate the work done by the gas on the piston if the stroke is 0.30 m.[8+8]

2. A fluid is contained in a cylinder by a spring loaded, frictionless piston so that the pressure in the fluid is linear function of volume (p = a+bv). The internal energy of the fluid in kJ is given by the expression u = 32 + 3pv, where p is in kPa and v is in m^3. The initial and final pressures are 150 KPa and 350 KPa and the corresponding volumes are 0.02m^3 and 0.05m^3. Make calculations for the direction and magnitude of work and heat interactions. [16]

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) Deduce claperyron equation and give its significance.
   (b) A vessel having a capacity of $0.05m^3$ contains a mixture of saturated water and saturated steam at a temperature of 245^0C .The mass of liquid present is 10 Kg. Find the following.
      i. The pressure
      ii. The mass
      iii. The specific volume
      iv. The specific enthalpy
      v. The specific entropy and
      vi. the specifi internal energy [7+9]

5. (a) Deduce the relation ship between absolute temperature and pressure in an polytropic process.
   (b) $0.3m^3$ of air at pressure 8 bars expands to $1.5m^3$. The final pressure is 1.3 bar. Assuming the expansion to be polytropic, calculate the heat supplied and change of internal energy. Take γ= 1.4 [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) Show that the efficiency of the Diesel cycle is lower than that of Otto cycle for the same compression ratio. Comment why the higher efficiency of the Otto cycle compared to Diesel cycle for the same compression ratio is only for a academic interest and not practical importance.

   (b) A Diesel engine has a compression ratio of 18 and cut-off takes place at 6% of the stroke. Find the air-standard efficiency. Assume $\gamma = 1.4$. [8+8]

8. (a) Explain about the re-heating and refrigeration of a steam cycle with help of neat diagrams?

   (b) Obtain an expression for Joule's cycle in terms of pressure ratio. [8+8]

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

II B.Tech I Semester Supplimentary Examinations, February 2008
THERMODYNAMICS
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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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1. A gas undergoes two processes that are in series. The first process is an expansion that is carried out according to the law PV = constant, and the second process is a Constant pressure process that returns the gas to the initial volume of the first process. The start of the first process is at 400 KPa and 0.025 m^3 with the expansion to 200 KPa. Sketch the process on a P-V diagram, and determine the work of the combined process. [16]

2. (a) What is mechanical equivalent of heat?
   (b) State the first law of thermodynamics applied to
      i. a cycle and
      ii. a process
   (c) A system undergoes a cycle composed of four processes. The heat transfers in each process are: 400 KJ, - 365 KJ, -200 KJ and 250 KJ. The respective work transfers are 140 KJ, 0, -55 KJ and 0. Is the data consistent with first law of thermodynamics? [2+6+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) Explain entropy of evaporation?
   (b) Find the enthalpy and entropy of steam when the pressure is 2 MPa and the specific volume is $0.09 m^3/Kg$ [7+9]

5. (a) Derive an expression for heat transfer in a non-flow constant volume process.
   (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. [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) What is a cycle? What is the difference between an ideal and actual cycle.
   (b) Derive an expression for efficiency of Brayton cycle in terms of pressure ratio. [8+8]

8. A 1 ton air compression refrigeration plant is to ge maintained at a temperature of -12^0C in the cold room when the atmospheric temperature is 30^0C. Assume reversible heat transfer in the cold room. Compressor pressure at inlet is 1.3 bar abs and at discharge is 6.5 bar abs. Find the temperature at other two state points, mass of air flow hour, net work required, coefficient of performance and refrigerating effect. [16]

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