Code No: R5210305 **R5**

II B.Tech I Semester(R05) Supplementary Examinations, May/June 2010
THERMODYNAMICS
(Mechanical 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 piston and cylinder machine contains a fluid system, which passes through a complete cycle of four process. During a cycle, the sum of all heat transfer is - 150 KJ and the system completes 100 cycles per minute. Complete the following table and calculate the net rate of work output. [16]

Process	Q (KJ/MIN)	W (KJ/min)	dU(KJ/min)
1-2	0	2150	——
2-3	20,000	0	——
3-4	-2,000	——	-36,000
4-1	——	——	——

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 super heated steam and specify the advantages by using super heated steam .
   (b) Steam from the boiler is supplied to a turbine at the rate of 50 kg/sec. The steam leaves the boiler at 20 bar and 300^0C.water at the rate of 5 Kg /sec is sprayed into the steam when the steam is passing through a desuper heater. The temperature of the water is 30^0C Determine the quality of steam leaving the super heater Assume there is steam and no pressure loss in the system. [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) Sate Daltons law of Additive pressure and Amagats law of additive volumes.
   (b) The volumetric analysis of a dry flue gas in a boiler trail is given in percentage as 12% CO_2, 2% CO and 3% O_2 and 83% N_2.Determine the percentage gravimetric analysis also find specific gas constant of the mixture [7+9]

7. A closed cycle ideal gas turbine plant operates between temperature limits of 800C and 30C and produces a power of 100kW. The plant is designed such that there is no need for a refrigerator. A fuel of calorific value 45000kJ/kg is used. Calculate the mass flow rate of air through the plant and rate of fuel consumption. (Take c_p = 1.0 kJ/kgK andγ =1.4.). [16]

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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