B H GARDI COLLEGE OF ENGINEERING & TECHNOLOGY

GTU MID SEM TEST

Subject: ELEMENTS OF MECH. ENGG. **Date: 25/03/2009**

Total Marks: 40 **Sem/Branch: 2nd IT/CE**

Student Id No._____ **Time: 8:30 to 10:00am**

Instructions:
(1) Digits to the right indicate full marks.
(2) Draw neat & clean diagrams.
(3) Assume suitable data whenever necessary.
(4) Start new question from new page.

Q.1 (a) Derive an expression for efficiency of Carnot cycle. **03**

or

Q.1 (a) What are the various forms of energy? List the non conventional sources of energy. **03**

Q.1 (b) In an Otto cycle the compression ratio is 8.The temperatures at the beginning of Compression and at the end of heat supply are 310 K and 1600 K respectively. Assume $\gamma = 1.4$ and $C_v = 0.717$ kJ/kg K . Find :(i) Heat Supplied (ii) Efficiency of the cycle. **04**

or

Q.1 (b) For heating a house in winter it requires 204820kJ/h. the heat is supplied by a heat pump which absorbs heat from cold air outside in winter to supply heat to house. 28424kJ/h. is needed by the heat pump for its operation. Calculate the C.O.P. of heat pump and the heat abstracted from outside. What will be the C.O.P. of the heat pump when it serves to cool the house in summer requiring same 204820 kJ/h of heat rejection? **04**

Q.1 (c) The compression ratio of an oil engine working on Diesel Cycle is 15. Cut off takes place at 12 % of the working stroke. The air is drawn in to cylinder at 100 kPa and 27^0C. Assume C_p=1.006 kJ/kg K and C_v =0.717 kJ/kg K. **07**

Calculate:
(i) Temperature at the end of compression
(ii) Pressure at the end of compression
(iii) Air std. efficiency of the cycle.

or

Q.1 (c) A single stage, single cylinder reciprocating air compressor with negligible clearance takes 1 m^3 of air per minute at 1.013 bar and 15^0C. The delivery pressure is 7 bar. Assuming law of compression $PV^{1.35} = C$, R=0.287 kJ/kg K. **07**

Calculate:
(i) Mass of air delivered per minute
(ii) Delivery temperature
(iii) Indicated Power
(iv) Isothermal efficiency

Q.2 (a) Define and classify Air Conditioning. **02**

or

Q.2 (a) What is refrigeration? What is one ton refrigeration? **02**

Q.2 (b) Describe Vapour Compression Refrigeration System with the help of schematic diagram **04**

Q.3 (a) Find out the Mayer's equation. **05**

or

Q.3 (a) To prove that the law of reversible adiabatic process is $PV^{\gamma}=C$,
Where $\gamma = Cp / Cv$. **05**

Q.3 (b) A cylinder contains 0.5 m3 of gas at pressure of 1 bar and 90° C. the gas is compressed to a volume of 0.15 m3. The final pressure is 5 bars. **05**
Find out: -

- The mass of gas
- The value of index 'n' for compression
- The increase in I.E. of the gas.
- The heat received or rejected by the gas during compression.

Take $\gamma = 1.4$ and R= 0.294 KJ/kg K

Q.4 (a) Differentiate between C.I. and S.I. engine. **03**

or

Q.4 (a) Draw the temperature-enthalpy diagram for a constant pressure heating process to represent on it the following **03**

- Sensible heat region & Latent heat region
- Superheat region
- Dryness fraction 0.70

Q.4 (b) Determine specific enthalpy, volume and internal energy of 1 kg of steam at 8 bar pressure when (I) dryness fraction is 0.9 (II) when steam is superheated to a temperature of 280˚C. Assume specific heat of superheated steam is 2.1 KJ/kg K. **07**

or

Q.4 (b) A two cylinder four stroke petrol engine has swept volume of 1.1×10^{-3} m^3. It runs at 950 rpm and consumes 2.2 kg of petrol per hour having calorific value of 43000 KJ/kg. The mean effective pressure in both cylinder is 7.5 bar. Determine indicated thermal efficiency and relative efficiency if clearance volume is 15% of swept volume. **07**

Harder You Work Luckier You Are
All The Best