Student Exam No._____

GANPAT UNIVERSITY

B. Tech. Semester: IV (Mechatronics Engineering)

Regular Examination/ May - June 2014

Energy Conversion Systems (2MC406)

Time: 3 Hours **Total Marks: 70**

Instruction:
1. Attempt All The Questions.
2. Use of Steam table and Psychrometric Chart is Allow
3. Use of Non-programmable scientific calculator is permitted.
4. Don't write anything on question paper.

SECTION - I

Que.– 1 (A) Explain the Vapour Compression Refrigeration system. Draw the P-H and T-S diagram for the same. **6**

(B) Explain Vapour Absorption Refrigeration System. Compare it with Vapour compression refrigeration system. **6**

OR

Que.– 1 (A) Enlist Various Components of Vapour Compression Refrigeration system and explain refrigerator condensers and its types. **6**

(B) Explain Electrolux Refrigerator with neat Sketch. **6**

Que.– 2 (A) Explains the following terms **5**
(i) Humidity (ii) Absolute Humidity (iii) Relative Humidity
(iv) Dew point temperature (v) Wet Bulb Depression

(B) Explain the following terms and also indicated on Psychrometry Chart. **6**
(i) Sensible cooling (ii) Sensible Heating
(iii) Humidification (iv) Dehumidification

OR

Que.– 2 (A) Write a short note on Nuclear Reactor with neat sketch. **5**

(B) Explain Otto Cycle with P-V chart and derive an expression for efficiency of Otto Cycle. **6**

Que.– 3 (A) Draw layout of modern thermal power plant and enlist various components of the same. **6**

(B) Enlist various circuits of thermal power plant and explain any one of them. **6**

SECTION – II

Que.– 4 (A) A Vapour Compression Refrigerator works between the pressure limits of 60 bar and 25 bar. The working fluid is just dry at the end of compression and there is no undercooling of the liquid before the expansion valve. If the fluid flow is at the rate of 5kg/min. determine **6**
(i) C.O.P of the system (ii) Capacity of the refrigerator

Pressure (bar)	Saturation Temperature (K)	Enthalpy (kJ/kg)		Entropy (kJ/kg-K)	
		Liquid	Vapour	Liquid	Vapour
60	295	151.96	293.29	0.554	1.0332
25	261	56.32	322.58	0.226	1.2464

(B) Derive an Expression for coefficient of Performance for Vapour absorption refrigeration system. **6**

OR

Que.– 4 (A) A R-12 Vapour compression Refrigeration System has a Condensing temperature of 50^0C and Evaporating temperature of 0^0C. The refrigeration Capacity is 7 tons. The liquid leaving the condenser is saturated liquid and compression is isentropic. Determine 6

(i) Refrigerant Flow rate (ii) Power required to run the Compressor
(iii) Heat rejected in the plant (iv) COP of the System.

(B) In a Vapour Absorption Refrigeration System, the heat is supplied to NH_3 generator by condensing steam at 2 bar and 90% dry. The temperature in the refrigerator is to be maintained at -5^0C. Find the maximum COP possible. 6

If the refrigeration load is 20 tones and actual COP is 70% of the maximum COP. Find the mass of steam required per hour. Take temperature of the atmosphere is as 30^0C.

Que.– 5 (A) The Humidity Ratio of atmospheric air at 28^0C dry bulb temperature and 760 mm of Hg is 0.016 kg/kg of dry air. Determine 5

(i) Partial Pressure (ii) Relative Humidity (iii) Dew Point Temperature
(iv) Specific Enthalpy (v) Vapour Density

(B) A 4-S 4 Cylinder diesel engine running at 2000 rpm develops 60 W with break thermal efficiency of 30% and CV of the fuel is 42 MJ/kg. Engine bore is 120 mm and stroke is 100 mm if density of air is 1.15 kg/m^3 with air fuel ratio of 15:1 with mechanical efficiency of 80%. Determine 6

(i) Fuel Consumption (kg/s) (ii) Air Consumption (m^3/s)
(iii) Indicating Thermal Efficiency (iv) Volumetric Efficiency
(v) Break Mean Effective Pressure (vi) Piston Speed

OR

Que.– 5 (A) On a Particular day atmospheric air was found to have a dry bulb temperature of 30^0C and wet bulb temperature of 18^0C. The barometric pressure was observed to be 756 mm of Hg. Using the table of Psychrometry properties of air, determine the relative humidity, specific humidity, dew point temperature, enthalpy of air per kg of dry air and volume of mixture per kg of dry air. 5

(B) An Engine working on Otto Cycle has a Clearance of 1% of stroke volume and Initial pressure of 0.95 bar and temperature 30^0C. if the pressure at the end of Constant volume heating is 28 bar. Find 6

(i) An air standard Efficiency
(ii) The maximum temperature in the cycle
(iii) Ideal mean effective Pressure

Que.– 6 (A) In a Rankine Cycle, the steam at inlet to turbine is saturated at a pressure of 30 bar and exhaust pressure is 0.25 bar. Determine pump work, Turbine Power, Rankine Efficiency, Condenser Heat Flow, dryness Fraction at the end of Expansion. Assume Flow Rate of 10 kg/s. 6

(B) A steam Power Plant operates at a boiler pressure of 50 kgf/cm^2 and condenser pressure of 0.05 kgf/cm^2, steam coming out of the boiler is dry and saturated. Calculate the thermal efficiency if it operates on Rankine Cycle. 6

ALL THE BEST