

GANPAT UNIVERSITY**B. Tech. Semester: V (Mechanical Engineering)****CBCS Regular Examination November/ December-2016****Sub: 2ME502 –Energy Conversion& Utilization System****Time: 3 Hours****Total-Marks:-60****Instruction:** 1. *Attempt all Question.*2. *Don't write anything on the question paper.*3. *Use of non programmable scientific calculator is permitted.*4. *Use of steam table and mollier chart are allowed.*5. *Use of psychometrics chart and steam tables are permitted.***SECTION-I**

- Que. – 1 (a)** A regenerative air refrigeration system for an air plane has to take 30 ton of load, while the ambient conditions are 0.80 bar and 7°C. The ramming action leads to a pressure rise from 0.8 bar to 1.2 bar at constant entropy. The air is bled off the main compressor at 4.8 bar. The ram air heat exchanger is 60% effective. The air from the heat exchanger passes on to cooling turbine. Some portion of the air after expanding in the cooling turbine passes on the regenerative heat exchanger reducing the temperature of the main compressed air to 50°C. The cooling air from turbine gets heated to 100°C before discharging. The isentropic efficiencies of the compressor and turbine are 90% and 80% respectively. The cabin is pressurized to 1 bar and maintained at 25°C. 10

Determine:- (i) The ratio of the air extracted from cooling turbine for regenerative cooling of the ram air (ii) Power required for maintaining the cabin at required condition Assume the cooling turbine power developed to be used for ram air exhaust fan.

OR

- Que. – 1 (a)** For a sample of air having 22°C DBT, relative humidity 30% at barometric Pressure of 760 mm of Hg, calculate: 7

1. Vapour pressure, 2. Humidity ratio, 3. Vapour density, and 4. Enthalpy.

Verify your results by psychrometric chart.

- (b) Give a brief account of LPG being used as an alternate fuel in SI engines? 3

- Que. – 2 (a)** Derive an expression for change of internal energy and enthalpy during a process with variable specific heats. 5

- (b) 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 under-cooling of the liquid before the expansion valve. Determine: 5

1. C.O.P. of the cycle

2. Capacity of the refrigerator if the fluid flow is at the rate of 5kg/min.

Pressure (bar)	Saturation temperature (K)	Enthalpy(kj/kg)		Entropy(kj/kg K)	
		liquid	Vapour	liquid	Vapour
60 bar	295	151.96	293.29	0.554	1.0332
25 bar	261	56.32	322.58	0.226	1.2464

OR

- Que. – 2 (a)** Explain the following psychrometric processes with the help of psychrometric chart. (i) Sensible Heating and Sensible Cooling 5
(ii) Humidification and Dehumidification

- (b) In a test of four cylinder four stroke petrol engine of 75 mm bore & 100 mm stroke. 5
 The following results were obtained at full throttle at a constant speed and with a fixed setting of the fuel supply of 0.082kg/min.
 Brake power with all cylinder working=15.24 kW
 Brake power with all cylinder 1 cut off =10.45 kW
 Brake power with all cylinder 2 cut off =10.38 kW
 Brake power with all cylinder 3 cut off =10.23 kW
 Brake power with all cylinder 4 cut off =10.45 kW
 Estimate the indicated power of the engine under this conditions. If calorific value of fuel is 44 MJ/kg, find indicated thermal efficiency of the engine and compare it with air standard efficiency. The clearance volume of one cylinder is taken as 115cc.

- Que. - 3 (a) A single-cylinder engine running at 1800 rpm develops a torque of 8 N-m. The indicated power of the engine is 1.8 KW. Find the loss due to friction power as the percentage of brake power. 5
 (b) Discuss the working principle of practical vapour absorption system with H-C diagram. 5

SECTION-II

- Que. - 4 (a) A refrigerator working on Bell-Coleman cycle operates between pressure limits of 1.05 bar and 8.5 bar. Air is drawn from the cold chamber at 10°C, compressed and then it is cooled to 30°C before entering the expansion cylinder. The expansion and compression follows the law $pv^{1.3} = \text{constant}$. Determine the theoretical C.O.P. of the system 5
 (b) Explain the use of prony brake and rope brake in measuring the power output of an engine 5

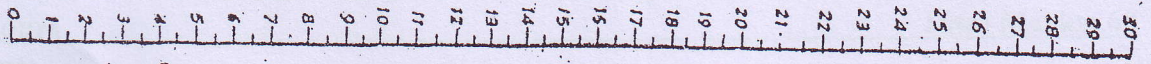
OR

- Que. - 4 (a) Discuss with the help of a suitable sketch the following. 5
 (i) Wet sump Lubrication system,
 (ii) Dry sump Lubrication system.
 (b) Describe with a sketch a regenerative air cooling system. 5
 Que. - 5 (a) Define Room sensible heat factor (RSHF). How Room sensible heat factor line is draw on psychrometric chart? 6
 (b) Explain the following: 4
 1. Rich mixture, 2. Stoichiometric mixture 3. Lean mixture.

OR

- Que. - 5 (a) Air at 10°C DBT and 90 % RH is to be brought to 35°C DBT and 22.5°C WBT with the help of winter air conditioner. If the humidified air comes out of the humidifier at 90%RH, draw the various processes involved on a skeleton psychrometric chart and find:
 1. The temperature to which the air should be pre-heated, and
 2. The efficiency of the air washer. 6
 (b) With a suitable sketch explain the starting circuit of solex carburetor. 4
 Que. - 6 (a) Determine the effect of percentage change in the efficiency of Otto cycle having a compression ratio of 8, if the specific heat at constant volume increases by 1.1 percent. 5
 (b) Explain Electrolux Refrigeration system with neat sketch and shortly explain its practical performance method. 5

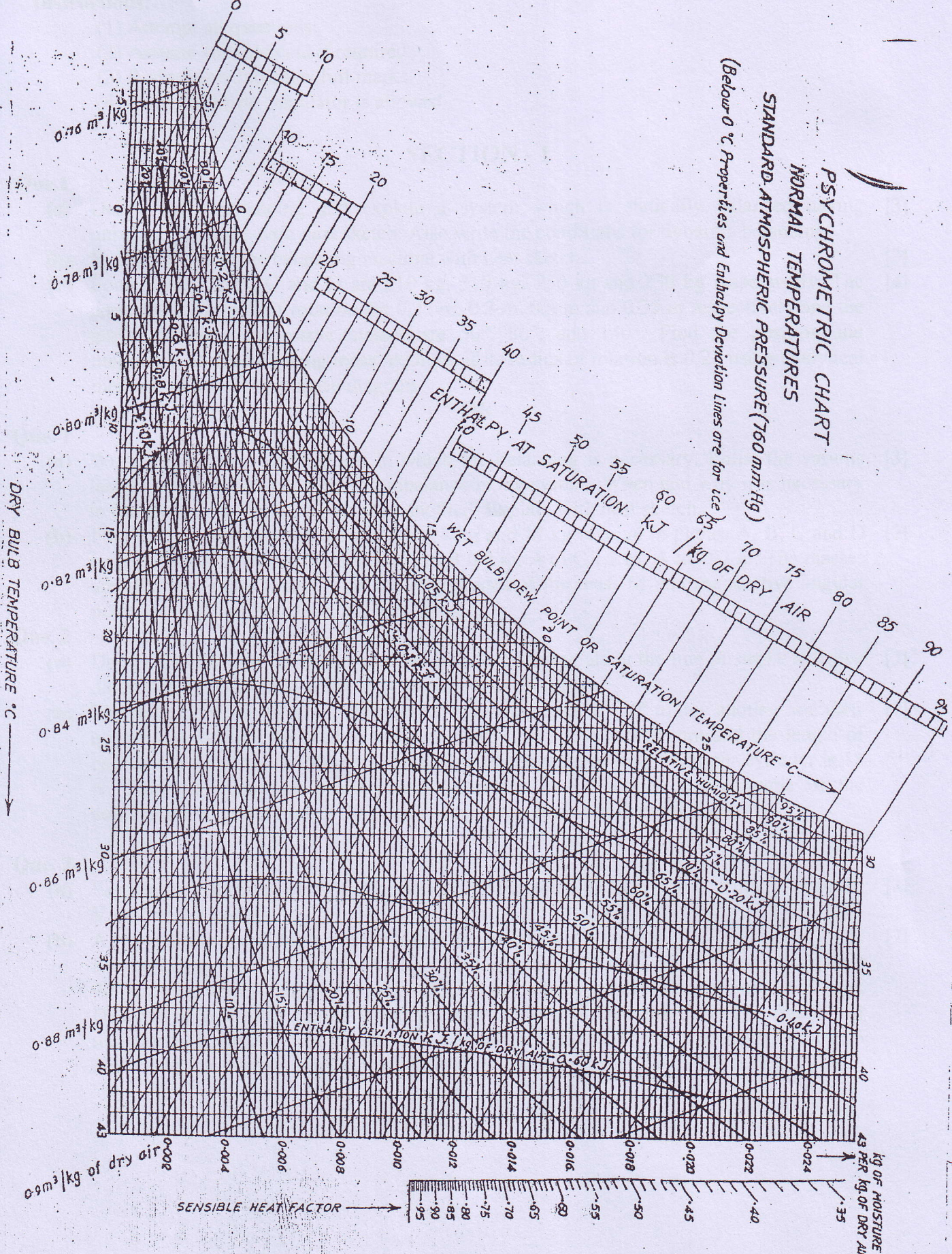
PRESSURE OF WATER VAPOUR IN mm OF Hg →



PSYCHROMETRIC CHART NORMAL TEMPERATURES

STANDARD ATMOSPHERIC PRESSURE (760 mm Hg)

(Below 0 °C Properties and Enthalpy Deviation lines are for ice)



DRY BULB TEMPERATURE °C →

SENSIBLE HEAT FACTOR →

kg OF MOISTURE
PER kg OF DRY AIR