Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech(AUE)/SEM-8/AUE-818/2012

2012

AUTOMOTIVE AIR CONDITIONING

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Psychrometric chart and steam table are allowed.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : 10 × 1 = 10

i) In vapour compression cycle, the condition of the refrigerant is very wet vapour

a) after passing through the condenser

b) before passing through the condenser

c) after passing through expansion or throttle valve

d) before entering the expansion valve.

ii) The vapour compression refrigerator employs which of the following cycles ?

a) Rankine

b) Carnot

c) Reverved Carnot

d) Reversed Rankine.

iii) If T_1 and T_2 be the highest and lowest absolute temperatures encountered in a refrigeration cycle working on a reversed Carnot cycle, then COP is equal to

a) $\frac{T_1}{T_1 - T_2}$ b) $\frac{T_2}{T_1 - T_2}$

c) $\frac{T_1 - T_2}{T_2}$ d) $\frac{T_1 - T_2}{T_1}$.

iv) The leaks in a refrigeration system using feron are detected by

a) halide torch b) sulphur sticks

c) using reagents d) smelling.

v) The coefficient of performance is the ratio of refrigerant effect to the

a) heat of compression

b) work done by compressor

c) enthalpy increase in compressor

d) all of these.

vi) Dehumidification is the process of removing moisture from air with dry bulb temperature

a) increasing

b) decreasing

c) remaining constant

d) changing in any direction.

vii) The psychrometric chart in air conditioning determines the

a) wet bulb temperature

b) dry bulb temperature

c) saturation temperature

d) moist air conditions.

viii) Air is dehumidified by

a) heating

b) cooling

c) chemical absorption

d) both (b) and (c).

ix) On psychrometric chart relative humidity lines are

a) horizontal b) vertical

c) curved d) none of these.

x) If S is the sensible heat and L the latent heat, then sensible heat factor is given by

a) $\frac{S}{S+L}$ b) $\frac{L}{S+L}$

c) $\frac{S+L}{S}$ d) $\frac{S+L}{L}$.

xi) In sensible heating which of the following parameters remains constant ?

a) DBT b) WBT

c) Humidity ratio d) Relative humidity.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Define COP of a refrigerator. Derive an expression for the COP of a Carnot refrigerator.

3. An automotive air conditioning works on reversed Carnot cycle between 20°C and 38°C. Find the coefficient of performance (COP).

4. Explain the following terms :

   a) Wet bulb temperature

   b) Dew point temperature

   c) Relative humidity.

5. Derive the relation $w = \frac{0{\cdot}0622\, P_u}{(P_b - P_v)}$, where P_v = partial vapour pressure, P_b = barometrie pressure.

6. Discuss the important properties of a good refrigerant used in automobile.

GROUP – C
(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. A car air conditioning system using *R*-12 as refrigerant operates between the pressure 2′19 bar and 7′45 bar in a vapour compression refrigeration cycle. The vapour is in dry saturated condition at the beginning of the compression. Determine

   a) Refrigerating effect per kg.

   b) Mass of refrigerant circulated per minute

   c) Power required to run the compressor.

   Take liquid and vapour specific heats as 1·235 kJ/kg-K and 0·733 kJ/kg-K.

Saturation temp. (*k*)	Pressure (bar)	Enthalpy (kJ/kg)		Entropy (kJ/kg-K)		V_g(m^3/kg)
		Liquid	Vapour	Liquid	Vapour	
263	2·19	26·9	183·2	0·1080	0·7020	0·0767
303	7·45	64·6	199·6	0·2399	0·6854	0·0235

8. a) Explain with the help of flow diagram and on T-S & P-h diagram the working principle of vapour compression cycle system used in automobile.

   b) Describe the different types of compressor used on a passenger car. 10 + 5

9. a) What do you understand by load on air condidionor ? Explain in brief the different cooling loads in summer on the car air conditioner.

   b) State the various factors that determine the human comfort. 10 + 5

10. A bus of 50 seating capacity is to be air conditioned for summer conditions with the following data :

    Outdoor condition 35°C DBT and 55% RH, required condition 22°C DBT and 60% RH. Amount of air supplied : 0·25 m^3/min/person.

    Find the sensible heat, Latent heat removed from the air per minitue and sensible heat factor for the system.

11. a) What are the preliminary checks that must be made when checking the refrigerant system.

    b) Explain the different types of leak detection methods used in automobile air conditioning system. 7 + 8