Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH/AUE/SEM-8/AUE-818/2013

2013
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.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : $10 \times 1 = 10$

   i) In vapour compression cycle the condition of refrigerant is dry saturated vapour

      a) after passing through the condenser

      b) before passing through the condenser

      c) after passing through the expansion or throttle valve

      d) before entering the expansion valve

      e) before entering the compressor.

ii) The refrigerant should have

a) high sensible heat b) high total heat

c) high latent heat d) low latent heat

e) low sensible heat.

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) $T_1/(T_1 - T_2)$ b) $T_2/(T_1 - T_2)$

c) $(T_1 - T_2)/T_2$ d) $(T_1 - T_2)/T_1$

e) none of these.

iv) In vapour compression cycle, the condition of refrigerant is high pressure saturated liquid

a) after passing through the condenser

b) before passing through the condenser

c) after passing through the expansion or throttle valve

d) before entering the expansion valve

e) before entering the compressor.

v) In vapour compression refrigeration system, refrigerant occurs as liquid between

a) condenser and expansion valve

b) compressor and evaporator

c) expansion valve evaporator

d) compressor and condenser

e) none of these.

vi) Dew point is

a) the temperature at which condensation of steam in saturated air will start

b) the lowest attainable temperature for a mixture of air and steam

c) dependent on pressure of air

d) used in connection with airconditioning

e) none of these.

vii) Spray humidifying is the process of adding moisture to the air by passing it through

a) chiller b) air conditioning plant

c) washer d) any one of these

e) none of these.

viii) For unsaturated air, wet bulb temperature is

a) less than dry bulb temperature

b) less than dew point

c) more than dry bulb temperature

d) more than dew point

e) unpredictable.

ix) Airconditioning machine in Automobile is driven by

a) separate motor run by Engine crank shaft

b) directly taking power from gear box

c) engine crank shaft through belty pulley system

d) none of these.

x) The comfort conditions in air conditioning system are defined by

a) 22°C dry bulb temperature (DBT) and 60% relative humidity (RH)

b) 25°C DBT and 100% RH

c) 20°C DBT and 75% RH

d) 15°C DBT and 80% RH

e) 25°C DBT and 40% RH.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Explain with sketch how thermostat valve controls the car aircondition system.

3. Why is R-12 used as the refrigerant in automobile air conditioning system ?

4. What is the function of expansion valve ? Discuss the thermodynamic changes during its operation.

5. Write the leak detection methods in vehicle airconditioning system.

6. What do you mean by human comfort ? Explain the human comfort factor.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) By a schematic diagram show various components and their function of the car airconditioning system.

   b) Draw and explain the T-S and P-h diagram of simple vapour compression refrigeration system for dry saturated vapour after compression. 9 + 6

8. A cooler using R-12 works on the condensing and evaporative temperatures of 26°C and 2°C respectively. The vapour leaves the evaporator saturated and dry. The average output of the cold water is 100kg/hr cooled from 26°C to 6°C. Allowing 20% of useful heat into water cooler and the volumetric efficiency of the compressor as 80% and mechanical efficiency of the compressor and the electric motor as 85% and 95% respectively, find (a) volumetric displacement of the compressor, and (b) power of the motor. Data for R-12 is given below ;

Saturation temp. °C	Pressure bar	Enthalpy kJ/kg		Entropy kJ/kg/K		specific heat kJ/kgK		Specific volume of vapour m^3/kg
		Liquid	Vapour	Liquid	Vapour	Liquid	Vapour	
26	6.69	60.64	198.1	0.227	0.6865	0.996	0.674	0.026
2	3.297	37.92	188.39	0.1487	0.6956	1.067	0.62	0.052

9. a) Prove that $w = 0.622 \times (P_v / (P_b - P_s))$, where w is specific humidity, and P_v, P_b, P_s are vapour, barometric and saturation pressures respectively.

   b) A single psychrometer reads 32°C D.B.T. and 28°C W.B.T. Calculate the following by using psychrometric relation :

   (i) Specific humidity, (ii) Relative humidity, (iii) Vapour density in air, (iv) Dew point temperature, (v) Enthalpy of mixture per kg of dry air. 5 + 10

10. a) Discuss the common problems and their remedies in automobile air-conditioning system.

b) Explain how heat load in passenger car is estimated.

c) What is the purpose of a desiccant in the receiver drier ?

5 + 5 + 5

11. a) Explain the air distribution system with schematic diagram in a car.

b) How does the air distribution system differ in commercial vehicle (Bus) in comparison with passenger car. 7 + 8