*Name* : .....

*Roll No.* : .....

*Invigilator's Signature* : .....

**CS/B.TECH(AUE)/SEM-8/AUE-818/2010**

**2010**

# 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.*

Psychometric chart and stem table are allowed

## 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 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) 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) none of these.

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

a) halide torch which on detection flame lighting

b) sulphur sticks which on detection gives white smoke

c) using reagents

d) smelling.

iv) 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.

v) Relative humidity is

a) something concerned with air conditioning

b) the ratio of moisture present in air to the capability of air to hold the maximum moisture

c) the ratio of actual humidity to absolute humidity

d) representative of amount of moisture held in air.

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

a) increasing

b) decreasing

c) remain constant

d) changing in any direction

e) corresponding to saturation condition.

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

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

b) 25C DBT and 100% RH

c) 20C DBT and 75% RH

d) 15C DBT and 80% RH.

viii) Sensible heating is needed to

a) vaporize water into steam and vice versa

b) change temperature of liquid or vapour

c) convert water into stem and superheat it

d) measure dew point temperature.

ix) Enthalpy of air-vapour mixture consists of

a) sensible heat of dry air between 0C and dry bulb temperature

b) total enthalpy of the contained water vapour at saturation temperature

c) heat of superheat of the contained water vapour

d) all of these.

x) In sensible heating / cooling, which of the following parameter remains constant ?

a) dry web bulb temperature

b) Wet bulb temperature

c) Relative humidity

d) Enthalpy.

## GROUP – B

### ( Short Answer Type Questions )

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

2. Sketch the T-S and P-H diagram for the vapour compression cycle when the vapour after compression is

i) Dry saturated

ii) Wet.

3. What are the properties of good refrigerant oil used in an automobile ?

4. What is one of the most common causes of insufficient cooling ?

5. What is the purpose of a thermostat in the air conditioning system ?

6. What are the factors responsible for automobile compartment heating and heat absorption ?

## GROUP – C

### ( Long Answer Type Questions )

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

7. A refrigerating machine fitted with an expansion valve works between the temperature limits of – 10°C and 30°C. The vapour is 95% dry at the end of isentropic compression and the fluid leaving the condenser is at 30°C. Assuming the actual C.O.P. as 60% of the theoretical, calculate the actual refrigeration effect produced per kW hour.

| *Temperature* °C | *Liquid heat* (h) kJ/kg | *Latent heat* (L) kJ/kg | *Liquid entropy* (SI) | *Total entropy of dry saturated vapour* |
|---|---|---|---|---|
| 30 | 323.08 | 1145.8 | 1.2037 | 4.9842 |
| –10 | 135.37 | 1297.68 | 0.5443 | 5.477 |

8. A car of 25 persons capacity is provided air conditioning of a system with following data :

Outdoor conditions 34°C DBT and 28°C WBT, required comfort conditions 24°C DBT and 50% R.H. Outdoor air supplied 0.4 $m^3$ / min / person. Sensible heat load 125600 kJ/hr. Latent heat load 42000 kJ/hr. Find the sensible heat factor of the system.

9. The humidity ratio of atmospheric air at 28°C dry bulb temperature and 760 mm of Hg is 0.016 kJ/kg of dry air. Determine :

   i) partial pressure of water vapour

   ii) relative humidity

   iii) dew point temperature

   iv) specific enthalpy.

10. An air conditioning car is required to supply 60 $m^3$ of air per minute at a dry bulb temperature of 21°C and 55% R.H. The out side air at dry bulb temperature 28°C and 60% R.H. Determine the mass of water drained and the capacity of the cooling coil. Assume the air conditioning system first to dehumidify and then to cool the air.

11. a) What are the common problems and their remedies in automobile air-conditioning system ?

b) What are the preliminary checks that must be made when checking the refrigerant system ? 8 + 7