



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 belt 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. $3 \times 5 = 15$

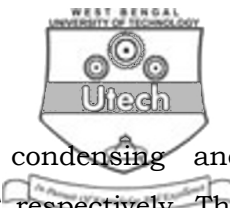
2. Explain with sketch how thermostat valve controls the car aircondition system.
3. Why is R-12 used as the refrigerant in automobile air conditioning system ?
4. What is the function of expansion valve ? Discuss the thermodynamic changes during its operation.
5. Write the leak detection methods in 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. $9 + 6$

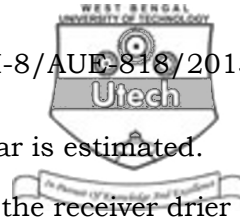


8. A cooler using R-12 works on the condensing and evaporative temperatures of 26°C and 2°C respectively. The vapour leaves the evaporator saturated and dry. The average output of the cold water is 100kg/hr cooled from 26°C to 6°C. Allowing 20% of useful heat into water cooler and the volumetric efficiency 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

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