



**SUMMER- 18 EXAMINATION**

**Model Answer**

**Subject Name: Automobile Air Conditioning**

**Subject Code: 17620**

**Important Instructions to examiners:**

- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills).
- 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
- 5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
- 6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
- 7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q. No.	Sub Q. N.	Answers	Marking Scheme
01	A)	<b>Attempt any three of the following:</b>	12
	1)	<b>Explain different mode of heat Transfer.</b>	04
		<p><b>1. Radiation heat transfer:</b> Conduction and convection heat transfer need some medium. In radiation there is no need of any medium for transfer of heat. It can take place in space also, from body at high temperature to body at low temperature in the form of electromagnetic waves emitted by vibrating electrons at surface of body. The quantity of heat radiated depends upon absolute temperature of body. <b>Example of radiation:</b> Energy emitted by sun reaches the earth through radiation</p> <p><b>2. Convection heat transfer:</b> When fluid flows over hot solid body, heat will be transferred from hot body to flowing fluid. Thus convection is transfer of heat due to fluid flowing or due to transfer of molecules. <b>Example of Convection:</b> Heat transfer in water tube boiler where water is heated by hot flue gases.</p> <p><b>3. Evaporation:</b> Evaporation is the process by which moisture becomes a vapour. As moisture vaporizes from a warm surface, it removes heat and thus cools the surface. This process takes place constantly on the surface of the body. <b>Example of evaporation:</b> Sweat appearing as drops of moisture on the body indicates that the body producing more heat than can be removed by convection, radiation, and normal evaporation.</p>	04
	2)	<b>Explain Scroll compressor with sketch</b>	04
		<p>Constructional features of scroll type compressors are as shown in the figure. It consists of refrigerant temperature sensor, moveable scroll, delivery port, intake port, low pressure service valve, front plate, needle bearing, stud pin, crankshaft, eccentric bushing, ball coupling, and fixed scroll etc.</p> <p>Scroll-type compressors have two metal scrolls, one fixed and one moveable, which provide an eccentric motion. As the compressor shaft rotates, an eccentric bushing on the shaft drives the moveable scroll, and refrigerant is forced against the fixed scroll, and towards its center. The motion creates an increase in pressure toward the center of the scroll. The refrigerant vapor moves in a circular pattern, and its pressure</p>	02

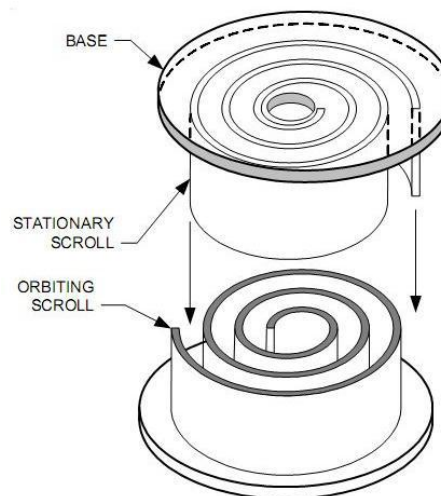
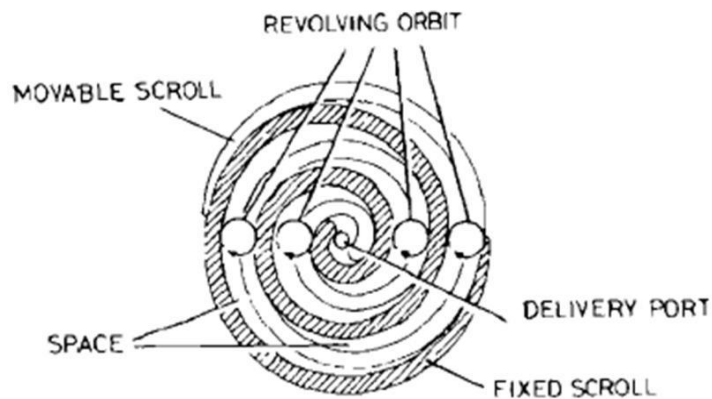
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is increased as it moves toward the center of the scroll. The high pressure refrigerant is released through a delivery port located at the center of the scroll. Scroll-type compressors provide a longer effective compression stroke, and a smoother start-up than other compressor designs, and they produce less vibration.



OR

Fig :- Scroll compressor

3) Explain air intake section with neat sketch.

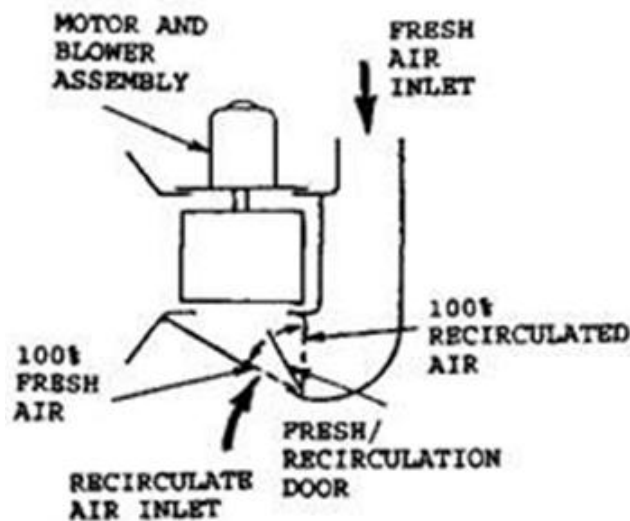


Fig:- Air Intake System

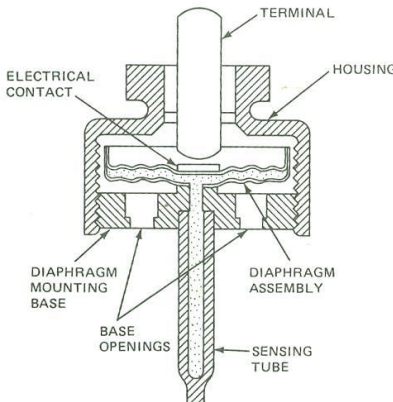
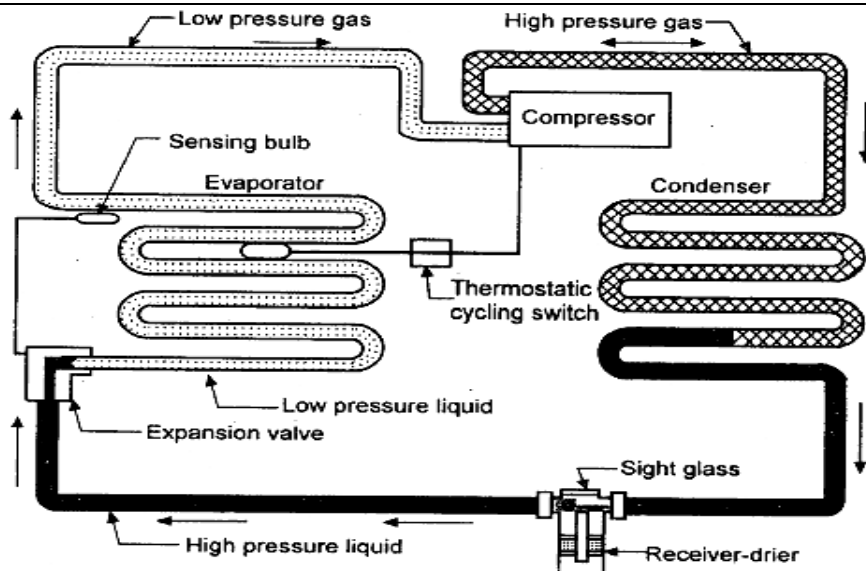
Figure shows schematic sketch of air intake or inlet section. It consists of fresh (outside) air inlet; re-circulate (inside) air inlet, a fresh re-circulate air door, a blower with motor, and an air outlet. The fresh air inlet provides the system with fresh outside air supply; the re-circulate air inlet provides re-circulated in-car air supply. The position of vacuum motor operated fresh/re-circulate door depends on system mode. Actually in all modes except maximum cooling, the air supply is from outside. In maximum cooling, the air supply is from inside. Even in the maximum cooling mode, some systems provide for up to 20% fresh air. This is to provide for a slightly positive in-car pressure.

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4)	<b>Explain function &amp; location of superheat switch with sketch.</b>	04
	<p><b>Function:</b> -This device is a temperature/pressure sensitive electrical switch which is normally in the open position. The switch remains open during the systems high pressure and high temperature conditions or low pressure and low temperature conditions. The switch closes when the system experiences high temperature and low pressure conditions. The high temperature and low pressure condition of the system is usually caused by loss of refrigerant. This loss may result in compressor or system damage if air conditioning system remains in operation. The superheat switch offers a failsafe method of stopping the compressor until the problem is corrected. When superheat switch closes, a circuit is completed through a heater of thermal fuse. The fuse blows, opens the clutch circuit and stops the compressor</p> <p><b>Location:</b> - The superheat switch is located in the rear head of some six cylinder compressors</p> 	01 01 02
B)	<b>Attempt any one of the following:</b>	06
1)	<b>Draw &amp; explain layout of “Automobile Air conditioning system”</b>	06
Ans	 <p><b>Figure: General layout of automotive A/c System</b></p> <p>Following are the basic components in every automobile air conditioning system.</p>	03 03

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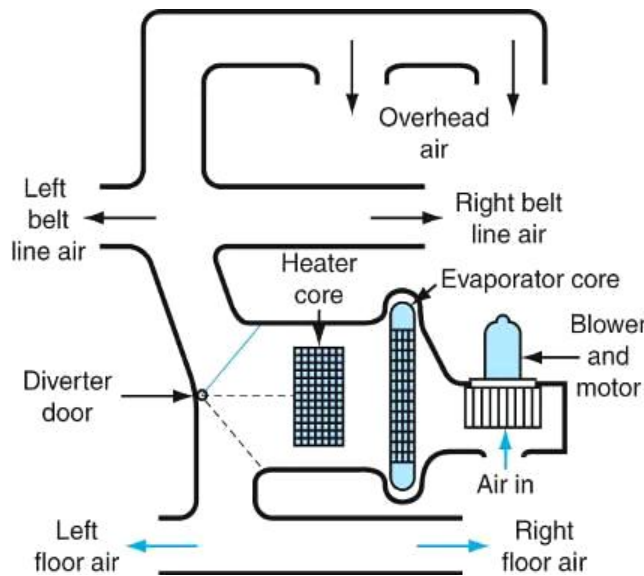
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- 1. Compressor:** It is used to compress vapor refrigerant coming from the evaporator and supply high pressure vapour refrigerant to condenser.
- 2. Condenser:** The function of the condenser is to condense vapour refrigerant into liquid.
- 3. Expansion valve:** The function of expansion valve is to meter and control the flow rate of liquid refrigerant and reduce the temperature of liquid refrigerant.
- 4. Evaporator:** The function of the evaporator is to give refrigerant effect by exchanging heat to the liquid refrigerant.
- 5. Accumulator or receiver drier:** The receiver drier act as storage tank for the liquid refrigerant and also absorbs the moisture from the refrigerant

2) **Explain construction, working & function of “Rear Heating system” with neat sketch.**

Ans



**Fig:- “Rear Heating system”**

**Construction:** Some trucks and vans are equipped with rear air distribution system to provide rear heating. A schematic sketch of rear heating system is as shown in figure. Depending on design it may have major components; blower and motor, temperature door, evaporator core with metering device, heater core with flow control, outlet mode door, control panel, and controller. In this system second heater core is located at the rear of passenger compartment.

**Working:** Driver controls overall operation. Some systems allow the rear passenger to control the temperature. For control of rear blower switch is provided at the front or at rear or sometimes at both places. In this system rear blower forces the air into the second heater core from where heated air enters into the distribution section and finally delivered to the rear compartment. In this system rear blower forces the air into the second heater core from where heated air enters into the distribution section and finally delivered to the rear compartment.

**Function:** To maintain the required warm temperature at rear compartment of vehicle during winter season.

**Attempt any four of the following:**

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a)	<b>Explain construction &amp; working of Electromagnetic Clutch with neat sketch.</b>	04
Ans	<div data-bbox="529 407 1214 850"> <p style="text-align: center;"><b>Fig:- Electromagnetic Clutch</b></p> <p><b>Construction and working of electromagnetic clutch:-</b>The air conditioning compressor has an electromagnetic clutch that can engage or disengage the compressor pulley. The compressor pulley always turns when the engine is running, but the compressor only runs when the pulley is engaged to the compressor driving shaft. When this system is activated, current runs through the electromagnetic coil. The current attracts it to the armature plate. The strong magnetic pull draws the armature plate against the side of the turning pulley. This locks the pulley and the armature plate together; the armature plate drives the compressor. When the system is deactivated, and current stops running through the electromagnetic coil, flat springs pull the armature plate away from the pulley. The magnetic coil does not turn since its magnetism is transmitted through the pulley to the armature. The armature plate and hub assembly are fastened to the compressor drive shaft. When it's not driving the compressor, the clutch pulley turns on a double row of ball bearings.</p> </div>	02
b)	<b>Explain “orifice tube “with neat sketch.</b>	04
Ans	<div data-bbox="412 1482 1245 1839"> <p style="text-align: center;"><b>Fig:- Orifice tube</b></p> <p>Fixed orifice tube has no moving parts. Tube is not adjustable and its failure is Usually a result of becoming clogged. Cleaning of clogged orifice tube is very difficult. After clogged orifice tube is</p> </div>	02





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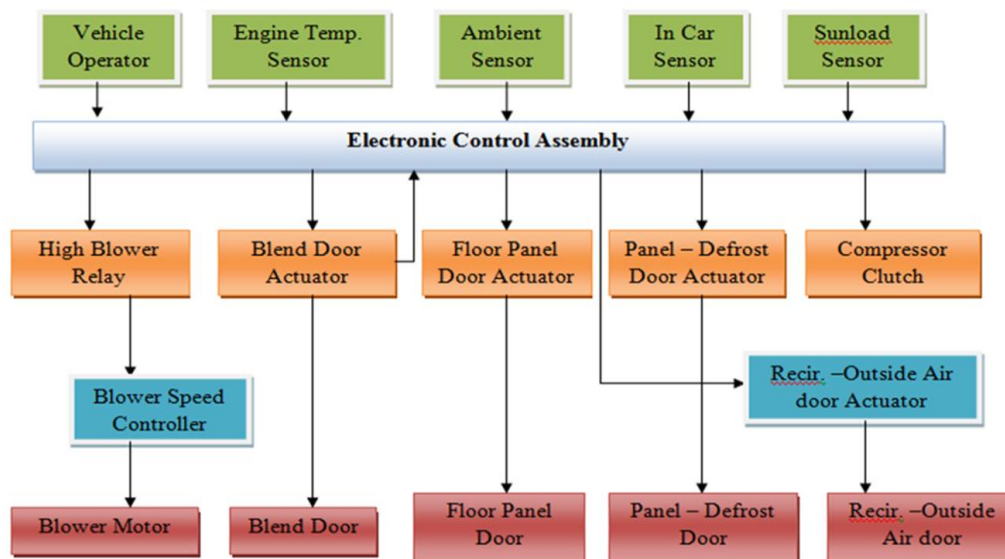


Fig:-Electronic Temperature control System

e) Draw the layout of comfort heating system & name important components. State the function of it.

Ans

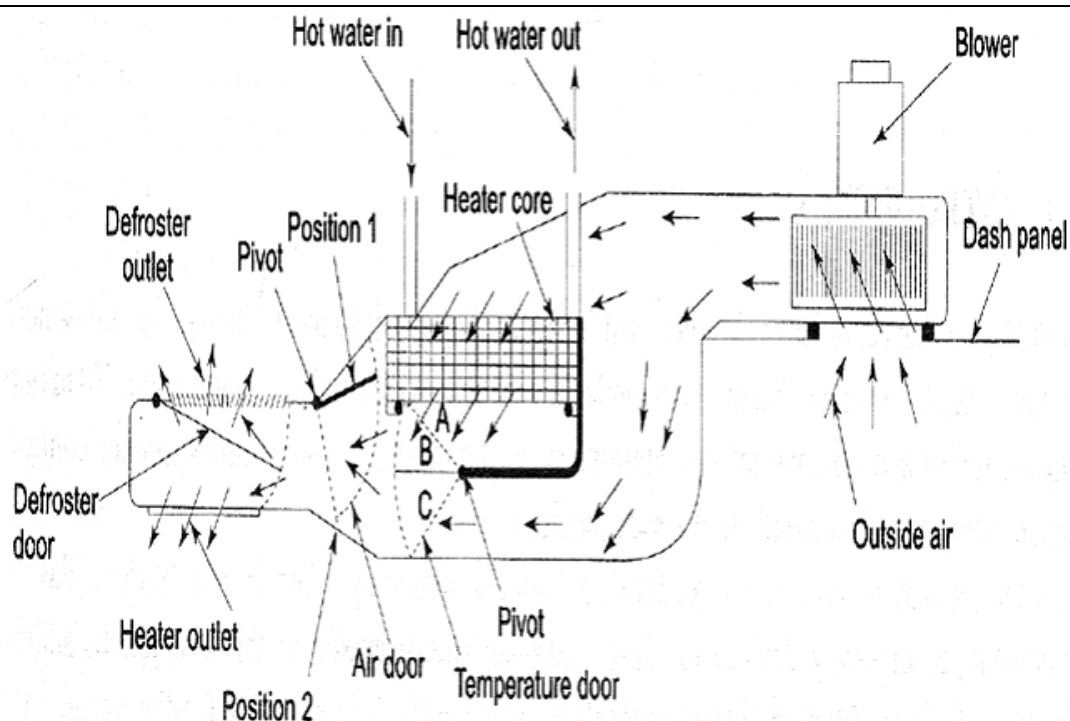
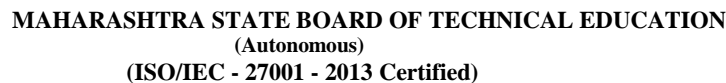


Fig:- Comfort heating System

**Function:** The comfort heating system in vehicle is able to provide desired air temperature inside the vehicle. It operates with ventilating system. Figure. Shows comfort heating system in a vehicle. It consists of heater core which is a small radiator as like engine radiator. Hot coolant from the engine is circulating through this heater core by using engine water pump. This heats the heater core. Air from the outside flows through the heater core air passages. This heats the air. This heating system has three doors:



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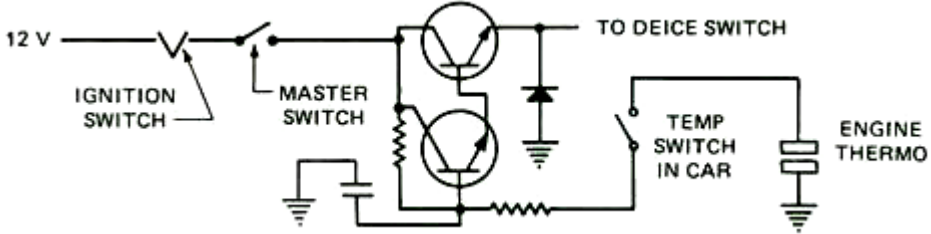


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		Therefore, the designer shall decide the proper averaging, especially including air speeds incident on unclothed body parts that have greater cooling effect and potential for local discomfort. While air movement can be pleasant and provide comfort in some circumstances, it is sometimes unwanted and causes discomfort. This unwanted air movement is called "draft" and is most prevalent when the thermal sensation of the whole body is cool. People are most likely to feel a draft on uncovered body parts such as their head, neck, shoulders, ankles, feet, and legs, but the sensation also depends on the air speed, air temperature, activity, and clothing	
c)		<b>Explain the working of time delay relay for heater control</b>	04
Ans	(Any suitable answer shall be given due credit ) <b>Working:</b> The time delay control unit is designed to prevent the heat cycle from coming on in the automatic unit until the engine coolant has reached temperature of 43.340C. The unit consists of two resistors, capacitors, and transistors. If the air conditioning system is already switched on prior to starting the vehicle, a time delay relay is sometimes used to delay the engagement of the compressor for a few seconds after engine start-up. Following figure shows time delay circuit of the wiring diagram.	02	
		02	
		<b>Figure: Time delay relay</b>	
d)		<b>State the function of Evaporator in A. C. system</b>	04
Ans	(Any suitable answer shall be given due credits) The function of the evaporator is to give refrigerant effect by exchanging heat to the liquid refrigerant. It is a device in a process used to turn the liquid form of a chemical substance such as water into its gaseous-form/vapor. The liquid is evaporated, or vaporized, into a gas form of the targeted substance in that process. Evaporator is an important component together with other major components in a refrigeration system such as compressor, condenser and expansion device. The reason for refrigeration is to remove heat from air, water or other substance. It is here that the liquid refrigerant is expanded and evaporated.	04	
e)		<b>How charging and discharging of refrigerant is carried out in Automobile Air Conditioning System?</b>	04
Ans	<b>Procedure of charging:</b> 1. Gauge set attached to the service valves. 2. Gauge valves closed. 3. System should be under vacuum. 4. Attach centre gauge hose to refrigerant supply. 5. Open valve on refrigerant container. 6. Purge air from centre hose by loosening the hose at gauge end. 7. With system off, open high pressure gauge valve. Refrigerant can be added as a vapour or liquid at this time. 8. As the gauge pressure both reach 60-80psi no further charging will occur. 9. Close high pressure gauge valve. 10. Place refrigerant supply upright so as to allow vapor to enter system. 11. Operate engine at 1500 rpm and turn on the air conditioner at maximum cooling and highest blower	04	



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speed.  
12. Open low side gauge valve which will admit refrigerant into the system.  
13. Charge until proper weight of refrigerant has been added and sight glass clears. Close low pressure gauge valve.  
14. Charge is complete and vehicle should be returned to idle speed and turned OFF.  
15. Remove gauge set carefully  
16. Install protective caps on valves.  
17. As final check use the leak detector and check for leaks.  
**Procedure of discharging:** When leaks or faulty components are found in refrigeration system, the system must be discharged before the repair work is starts. The procedure for discharging is as follows:  
1. Attach gauge set in place. 2. Place centre hose of gauge set into floor exhaust outlet or near the floor in well-ventilated area.  
3. Open high pressure gauge valve slowly so that refrigerant should escape through centre hose of gauge set.  
4. Regulate flow of discharge so that very little oil is observed coming out of the centre hose.  
5. Open low side gauge valve; regulate so as to control oil discharge also.  
6. When both gauges register zero and no gauge pressure can be felt within the centre hose by your finger outside the hose, then system can be serviced safely.

04

A)

**Attempt any three of the following:**

12

1)

**Explain 'Outside Temperature Sensor'**

04

Ans

**Outside temperature sensor:** It is usually located just behind the radiator grille and in front of condenser. Its purpose is to sense the outside temperature condition to provide data to processor. This sensor circuit has several programmed memory features to prevent false ambient temp data input during the period of low speed driving or when stopped such as when waiting for traffic control.

04



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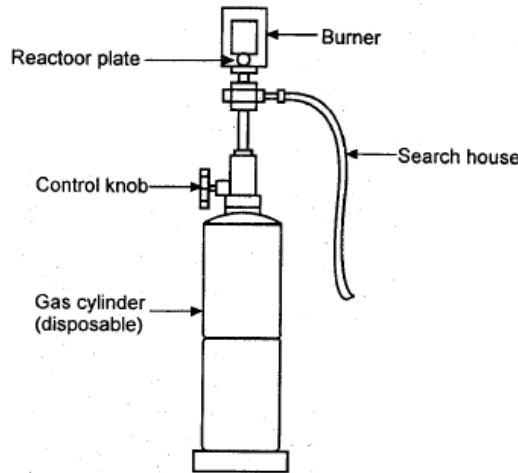
2)	<b>State any four faults and their remedies in compressor</b>			04
An s	<b>Answer: (Any four)</b>			
	<b>Fault</b>	<b>Causes</b>	<b>Remedies</b>	
	Noise in compressor	Loose Components	Tightening	
		Lack of oil	Replenish the oil level and check the bearings	
		Piston	Check debris on piston	
		Loose floor mounting	Tightening of bolts	
	Compressor not working	Broken belt	Replace belt	
		Broken clutch wire	Repair wire	
		Bad thermostat	Repair thermostat	
		Bad clutch coil	Repair	
	Low Compressor discharge pressure	Leakage system	Repair leakage	
		Defective expansion valve	Repair valve	
		Suction valve closed	Open it	
	High compressor discharge pressure	Air in system	Recharge system	
		Clogged condenser	Clean condenser	
		Discharge valve closed	Open valve	
	Low suction pressure	Refrigerant shortage	Add refrigerant	
		Worn compressor piston	Replace compressor	
		Compressor suction valve leaking	Change valve	
	High suction pressure	Loose expansion valve	Tighten valve	
		Overcharged system	Remove some refrigerant	
		Expansion valve stack open	Replace expansion valve	

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	3)	Compare controlled and uncontrolled ventilation			04
Ans		Sr.No.	Controlled Ventilation	Uncontrolled Ventilation	Any 04
	01	Forward movement of car and blower motor forces or rams air through the ducts and into the car.	Uncontrolled ventilation occurs when anyone opens window so that air can enter.		
	02	The air from outside enters the vehicle through openings in front grill.	The air from outside enters the vehicle through window.		
	03	This system does not provides any quantity of fresh air quickly	This system provides any quantity of fresh air quickly		
	04	This system does not allow wind, rain, dust and other airborne particles to enter inside the vehicle.	This system allows wind, rain, dust and other airborne particles to enter inside the vehicle.		
	05	Currently this method of ventilation is used in vehicles.	This method has been used for years		
	06	The entry of air is controlled by suitable valves or doors.	The entry of air is not controlled by suitable valves or doors.		
	07	This system includes heater and air conditioning system	This system does not include heater and air conditioner system.		
	4)	Explain 'Freon Leak Detector' with sketch			04
Ans					02

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Figure: Halide leak detector

**Halide (Freon) leak detector:** Halide leak detector as shown in figure can detect a leak as slight as 0.4536kg in ten years. This instrument is popular because of its low initial cost, ease of handling and simplicity in construction and operation. It consists of two major parts; the detector unit and the gas cylinder. The gas cylinder is a non refillable pressure tank containing a gas such as propane or butane. The detector unit consists of valve, the burner and the search hose. After igniting the gas and air mixture, the flow of gas is regulated until the flame burns about 6mm above the opening in the reactor plate. The plate is heated by flame to red hot temperature. When search hose comes into contact with leaking refrigerant, the refrigerant is drawn into the search tube and is brought to the receiver plate, where different colour flames are produced in the burner. If the flame colour is blue, there is no leak, if the flame colour is yellow-green the leak is small, if the flame colour is bright blue purple the leak is large. If the leakage is severe, the flame is put out.

02

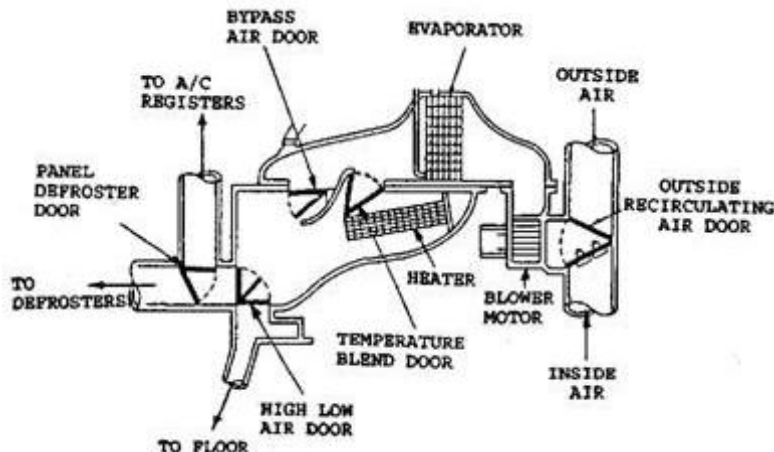
04 B) Attempt any one of the following:

06

1) Explain with figure 'Hybrid Case System'

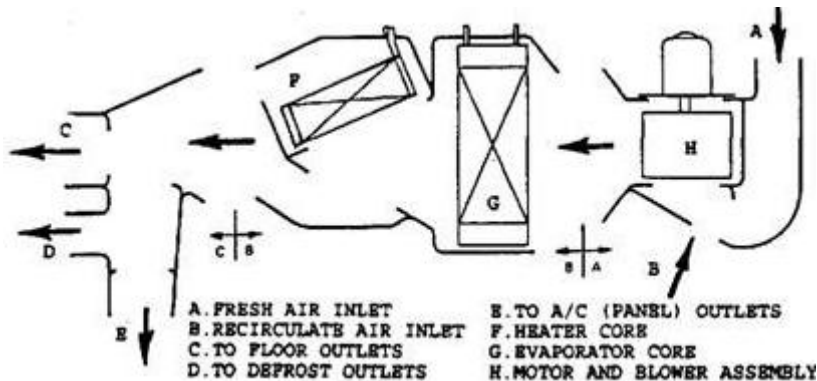
06

Ans (Any suitable sketch & figure shall be given due credit)



03

OR



A typical hybrid case/duct system is shown in figure. This system is divided into air intake section, the heater core and air-conditioning evaporator section, and the air distribution section. Air-flow is from right to left in the figure.

**Air Intake**

The air intake section or inlet section consists of a fresh air inlet, a recirculate (inside) air inlet, a fresh-



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recirculate air door, a blower with motor, and an air outlet. The fresh air inlet provides the system with fresh outside air and the recirculate air inlet provides recirculated in car air supply. Normally in max A/C mode inside air is recirculated.

**Core Section**

The core section, more appropriately called the plenum section is the centre section of the duct system. It consists of the heater core, the air-conditioning evaporator, and a blend door. The blend door, usually Bowden cable operated, provides full-range control of airflow either through or bypassing the heater core. All the air passes through the air-conditioning evaporator. In this section full-range temperature conditions are achieved for in-car comfort.

**Heating:** The heater water valve allows hot engine coolant to flow through the heater core. Cool and fresh air from outside is heated as it passes through the heater core. The air-conditioner is not operated and hence, it has no effect on the air temperature as the air first passes through the evaporator. The desired temperature is achieved by the position of the blend door, which allows a percentage of the cool outside air to bypass the heater core to temper the heated air. The heated air and cool air are then blended in the plenum to provide the desired temperature level before passing to the air distribution section.

**Cooling:** In the maximum cooling condition (max A/C), recirculated air passes through the air conditioner evaporator and is then directed back into the car. In other than max A/C, fresh outside air passes through the air-conditioning evaporator and is cooled before delivery into the car. The desired temperature level is achieved by the position of the blend door, which allows a percentage of cooled air to pass through the heater core for reheating. The cooled air passing through the evaporator and the reheated air passing through the heater core are blended in the plenum to provide the desired temperature level and then directed to the air distribution section.

**Air Distribution Section**

The air distribution section directs conditioned air to the floor outlets, the defrost outlets, or the dash panel outlets. Also depending upon the position of the mode doors, conditioned air may be delivered to any combination of outlets.

03





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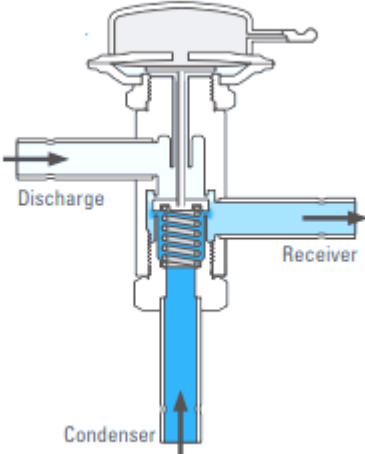
2)	<b>Differentiate between Thermostatic Expansion valve and Orifice Tube with six aspects</b>	06																					
Ans	<table border="1"> <thead> <tr> <th>Sr.</th><th>Thermostatic expansion valve</th><th>Fixed orifice tube</th></tr> </thead> <tbody> <tr> <td>01</td><td>It has moving parts</td><td>It has no moving parts</td></tr> <tr> <td>02</td><td>A system with thermostatic expansion valve has drier/receiver</td><td>A system with fixed orifice tube has no drier/receiver</td></tr> <tr> <td>03</td><td>The drying agent for the system is found in separate drier.</td><td>The drying agent for the system is found in an accumulator</td></tr> <tr> <td>04</td><td>Refrigerant flow through the thermostatic expansion valve is controlled by a spring-loaded valve</td><td>Refrigerant flow through the fixed orifice tube is controlled by a orifice tube</td></tr> <tr> <td>05</td><td>Refrigerant flow through spring loaded valve is controlled by pressure difference above and below the diaphragm</td><td>Refrigerant flow through fixed orifice tube is controlled by pressure difference and sub cooling characteristics of refrigerant.</td></tr> <tr> <td>06</td><td>High initial &amp; Maintenance Cost</td><td>Low initial &amp; Maintenance Cost</td></tr> </tbody> </table>	Sr.	Thermostatic expansion valve	Fixed orifice tube	01	It has moving parts	It has no moving parts	02	A system with thermostatic expansion valve has drier/receiver	A system with fixed orifice tube has no drier/receiver	03	The drying agent for the system is found in separate drier.	The drying agent for the system is found in an accumulator	04	Refrigerant flow through the thermostatic expansion valve is controlled by a spring-loaded valve	Refrigerant flow through the fixed orifice tube is controlled by a orifice tube	05	Refrigerant flow through spring loaded valve is controlled by pressure difference above and below the diaphragm	Refrigerant flow through fixed orifice tube is controlled by pressure difference and sub cooling characteristics of refrigerant.	06	High initial & Maintenance Cost	Low initial & Maintenance Cost	Any 06
Sr.	Thermostatic expansion valve	Fixed orifice tube																					
01	It has moving parts	It has no moving parts																					
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06	High initial & Maintenance Cost	Low initial & Maintenance Cost																					
05	<b>Attempt any four of the following:</b>	16																					
a)	<b>Explain pressure switch along with its location</b>	04																					
Ans	<p><b>There are two types of pressure switch:</b></p> <p><b>Low pressure switch:</b> It is located in the low side of air conditioning system, usually on accumulator. This switch is normally closed and opens when low side pressure drops below 13.8-55.2kPa. It Provides data to processor to disengage compressor clutch circuit to prevent compressor operation during low pressure conditions. Low pressure condition may result due to loss of refrigerant or clogged orifice tube.</p> <p><b>High pressure switch:</b> It is located in between Condenser outlet &amp; Expansion valve or orifice tube inlet. It is a thermocouple and its resistance varies according to temperature of liquid refrigerant. As it is temperature sensing device, provides temperature data to the processor of temperature controller which further controls electromagnetic clutch of compressor.</p>	02 02																					
b)	<b>Explain throttling and modulating action of thermostatic expansion valve</b>	04																					
Ans	<p><b>1. Throttling action:</b> The expansion valve separates the high side of the air conditioning system from low side. Since there is pressure drop across the valve, the flow of refrigerant is restricted, or throttled. The state of liquid entering the valve is high pressure liquid. The refrigerant leaving the valve is low pressure liquid. A drop in refrigerant pressure is accomplished without changing the state of refrigerant.</p> <p><b>2. Modulating action:</b> A thermostatically-controlled valve located inside the expansion valve body fluctuates toward an open or closed position as required to control the liquid refrigerant passing through the orifice. This ensures that the evaporator receives the proper amount of refrigerant. The low pressure</p>	02 02																					

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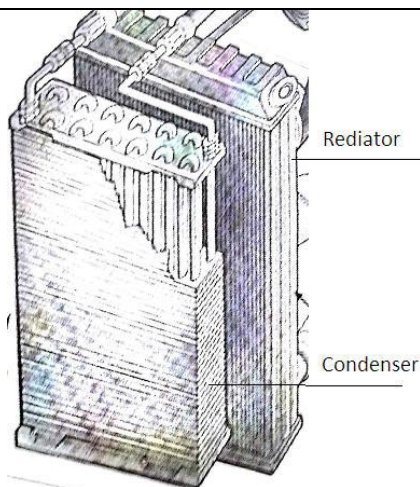
		created at the expansion valve makes it possible for the liquid refrigerant to vaporize as it passes through the evaporator or coils, absorbing heat from the vehicle's interior.	
	c)	<b>Explain construction of ‘Ambient Switch’ with neat sketch</b>	04
	Ans	<p>(Any suitable sketch and diagram shall be due credits)</p> <p>The ambient temperature switch measures the outside air temperature, and is used in some systems to prevent compressor operation when the outside air temperature is low. If the compressor is operated in extremely cold conditions, it can cause poor oil circulation, damaging the compressor seals, gaskets and/or valves. If the ambient temperature drops below the range suitable for compressor operation, the switch opens, preventing current flow to the compressor, which stops the compressor. When the ambient temperature reaches the preset minimum operating temperature, the switch contacts close, and the compressor is started again. The switch is usually located at the front of the engine compartment, behind the front grille panel, where it can quickly and accurately sense outside air temperature.</p> 	02
	d)	<b>Explain construction and working of condenser</b>	04
	Ans	<p><b>Construction:</b> Sketch shows the construction of condenser used for automobile air condition. It is the other heat exchanger used in automobile air conditioning. These are usually made of aluminium or sometimes made of copper or brass. It look very much like radiator, just little thinner and since they also depend on air flowing through them, they are usually located in front of radiator as shown in the figure above. Condensers can be constructed as a series of tubes with fins around them.</p> <p><b>Working:</b> Its main function is to condense the refrigerant vapour from compressor. The refrigerant enters the condensers as a high pressure vapour, but as it flows through the condenser refrigerant rejects the heat to flow air over it and gets converted into high pressure refrigerant liquid.</p> <p>(Any suitable figure should get full marks)</p>	02

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**Figure: condenser**

**e) Explain 'Visual and Acoustic check'**

**04**

**Ans** *(Any suitable sketch and diagram shall be due credits)*

**Perform a visual inspection**

1 Inspects the condition of the compressor drive-belt. If it's damaged or worn, replace it. Inspect the condition of the condenser fins. If they're bent or clogged up with bugs or dirt, clean and straighten them. Verify that the fan operates correctly. Check the engine coolant level.  
2 Carefully inspect the condition of the refrigerant hoses. If they're in good condition, they should work fine with R-134a. But if there's any doubt about their condition, replace them. Make sure that the new hoses are approved for R-134a. Remember, new R-12 hoses which have never had any R-12 run through them will probably leak if installed in an R-134a system because they lack the protective barrier of the old mineral oil that coats the inside of used R-12 hoses.

**Do a performance/leak check**

3 Start the engine and let it warm up. Turn on the air conditioning system and let it get as cold as it can. Using a thermometer, measure the evaporator output temperature at the dash vent nearest the evaporator (usually one of the center vents) and jot down. You'll want to compare this value with the evaporator output temperature after the system has been converted to R-134a.  
4 If you have a set of R-12 gauges, measure the high and low side pressures of the system. Again, jot down these numbers for future reference. If you don't have a set of gauges, ask the technician at your local air conditioning shop to make these measurements for you.  
5 If you have a leak detector, check for leaks now. Mark any obvious leaks or suspicious areas and make a note to inspect and repair them once the system is opened up. If you don't have a leak detector, make sure that the air conditioning shop checks for leaks before recovering the R-12 in the system.

**OR**

It means to check 1. Insufficient Cooling 2. Noise in compressor 3. Compressor not working 4. Low Compressor discharge pressure 5. High compressor discharge pressure 6. Low suction pressure 7. High suction pressure 8. Evaporator Pressure too High 9. Evaporator Pressure too Low

**04**



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06		Attempt any four of the following:	04
	a)	Explain the function of high pressure switch and low pressure switch	04
	Ans	<p><b>Function of:</b></p> <p><b>High pressure switch:</b> It is a thermocouple and its resistance varies according to temperature of liquid refrigerant. As it is temperature sensing device, provides temperature data to the processor of temperature controller which further controls electromagnetic clutch of compressor.</p> <p><b>Low pressure switch:</b> It provides data to processor to disengage compressor clutch circuit to prevent compressor operation during low pressure conditions.</p>	02 02
	b)	Write the general faults occurred in comfort heating system (any four)	04
	Ans	<p>(Any suitable answer shall be given due credit)</p> <p><b>General faults occurred in comfort heating system</b></p> <p><b>Little or no heat: Causes:</b> a. Air circulation not enough. b. Air in the heater core. c. Heat core is clogged d. Thermostat of engine cooling system is stuck open.</p> <p><b>Remedies:</b> a. Blower motor or switch is at fault. Temperature door or cable may be adjusted. Leakage of air from heater housing may be stopped. b. Bleed air out. c. Core should be repaired or replaced. d. Replace the thermostat.</p> <p><b>2. Defrosting insufficient: Causes:</b> a. Control cable of defrost door is out of adjustment. b. Defrost outlets blocked.</p> <p><b>Remedies:</b> a. Cable should be readjusted. b. Remove the obstructions</p>	
	c)	What are the effects of humidity on human comfort?	04
	Ans	<p>(Any suitable answer shall be given due credit)</p> <p><b>Effects of humidity;</b> - Moisture in the air is measured in terms of humidity. Relative Humidity (RH) is the ratio of amount of water vapor in the air to the amount of water vapor in the air at specific temperature and pressure. The control of humidity is not only necessary for human comfort but it is also important from point of view of efficiency of driver. For human comfort, relative humidity is kept within a range of 35% to 60%. A RH more than 60% will lead to sweating, while a RH below 35% will cause dry sensation and affect the mucous membranes, leading to extreme discomfort.</p>	04



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	d)	List four refrigerant with their colour code				04
Ans		Refrigerant No.	Colour Code	Chemical Name	(Any 4)	
	R-13B1	Coral	Bromotrifluoromethane			
	R-124	Deep Green	Chlorotetrafluoroethane			
	R-12	White	Dichlorodifluoromethane			
	R-114	Dark Blue	Dichlorotetrafluoroethane			
	R-123	Light Gray	Dichlorotrifluoroethane			
	R-22	Light Green	Monochlorodifluoromethane			
	R-13	Light Blue	Monochlorotrifluoromethane			
	R-404A	Orange	R-125 + R-143a + R-134a			
	R-402A	Light Brown	R-22 + R-125 + R-290			
	R-402B	Green Brown	R-22 + R-125 + R-290			
	R-401A	Coral Red	R-22 + R-152a + R-124			
	R-401B	Mustard Yellow	R-22 + R-152a + R-124			
	R-410A	Rose	R-32 + R-125			
	R-407C	Chocolate Brown	R-32 + R-125 + R-134a			
	R-507	Light Brown	Refrig. 125/143a			
	R-500	Yellow	Refrig. 152A/12			
	R-502	Light Purple	Refrig. 22/115			
	R-503	Aquamarine	Refrig. 23/13			
	R-134a	Light Sky Blue	Tetrafluoroethane			
	R-11	Orange	Trichloromonofluoromethane			
	R-113	Purple	Trichlorotrifluoroethane			
	R-23	Light Gray	Trifluoromethane			



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	e)	<b>List different service equipments and tools used in Automobile Air Conditioning</b>	<b>04</b>
Ans		Service and diagnosis tools: <i>(any four : 4marks)</i> <ol style="list-style-type: none"><li>1. Manifold gauge set</li><li>2. Service adapters</li><li>3. Thermometers</li><li>4. Vacuum pumps<ol style="list-style-type: none"><li>a) Air power vacuum pump</li><li>b) Rotary vane type vacuum pump</li></ol></li><li>5. Charging tools and equipments</li><li>6. Leak testers<ol style="list-style-type: none"><li>a) Halide torch leak detector</li><li>b) Halogen leak tester</li></ol></li><li>7. Bubble detectors</li><li>8. The sight glass (non-accumulator systems)</li></ol>	