SUMMER– 19 EXAMINATION

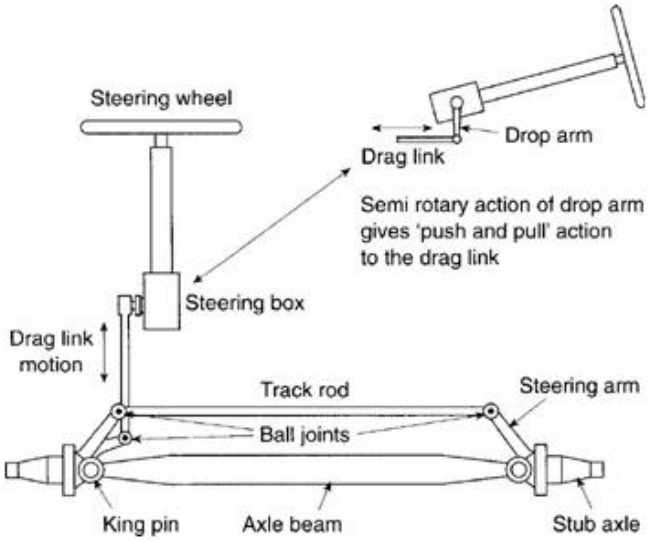
Model Answer

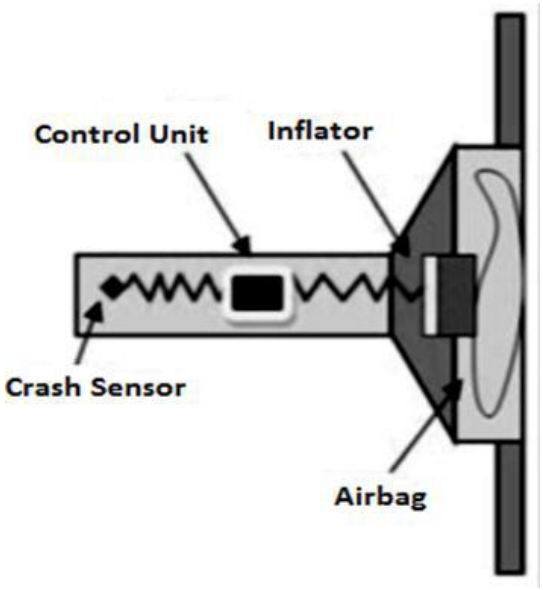
Subject Name: ASB **Subject Code:** 17409

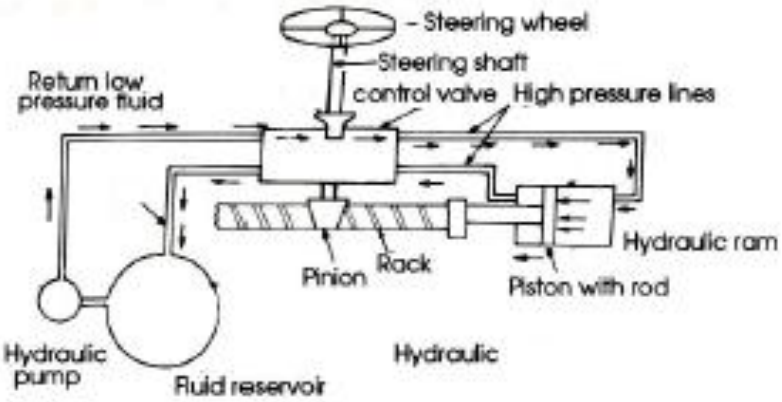
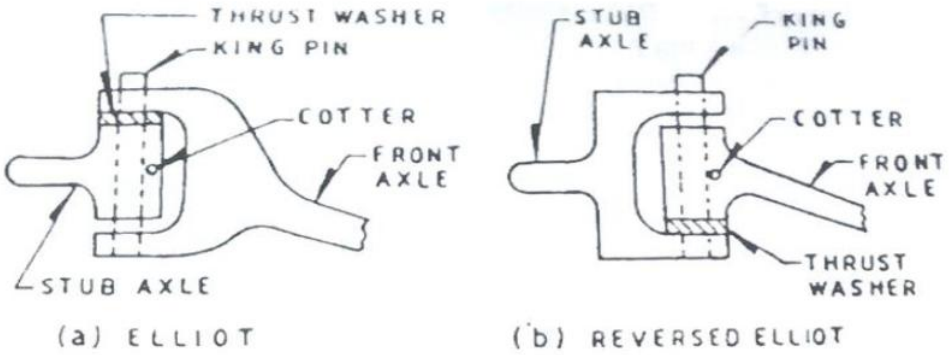
Important Instructions to examiners:

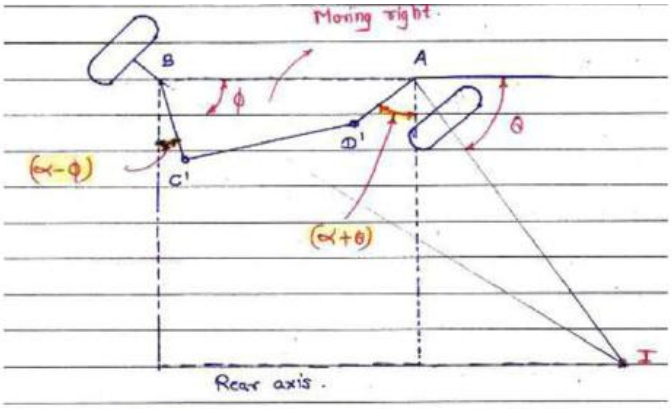
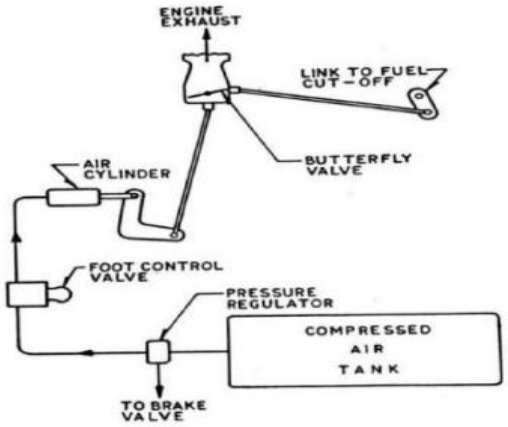
1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling 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.	Answer	Marking Scheme
1	a)	**Attempt any SIX of the following:**	12
	(i)	**Define live axle.**	02
		Definition: **Live axle:** It is axle which contains differential mechanism through which the engine power flows towards the front wheels.	02
	(ii)	**Define steering gear ratio.**	02
		Steering gear ratio: The steering ratio is the ratio of the number of degrees of turn of the steering wheel to the number of degrees the wheel(s) turn as a result.	02
	(iii)	**List any two types of brake liner material.**	02
		brake liner material: Asbestos, Ferodo, cork, leather (any two)	02
	(iv)	**Write any four components in automobile air conditioning system.**	02
		Answer: **Following are the Components in automobile air conditioning system (Any 4- ½ mark each)** i)Compressor ii)condenser iii)Receiver & Drier iv) Expansion valve v)Evaporator	02
	(v)	**State any two advantages of streamline shape of vehicle body.**	02
		Answer: Advantages of streamline shape of vehicle body(Any 2 -1 mark each) **1.** To reduce the air resistance during running. 2. Increase fuel efficiency.	02

		3) Reduce power consumption.	
	(vi)	**Define term "Brake fade" related with brake system.**	**02**
		Brake fade is indication of the partial or total loss of braking power used in a vehicle brake system. It occurs when the brake pad and the brake rotor no longer generate sufficient mutual friction to stop the vehicle at its preferred rate of deceleration. Number of severe stops, holding the brakes on a long down hilling results into brake fading.	**02**
	(vii)	**Draw general layout of mechanical steering system.**	**02**
		Answer: (Any suitable diagram shall be given due credit)  **Fig. General layout of mechanical steering system**	**02**
	(viii)	**Write any two functions of suspension system.**	**02**
		Answer: **Functions of suspension system. (Any two – 1 mark each)** 1) To prevent road shocks from being transmitted to the vehicle component and the Passengers. 2) To safeguard the occupants form road shocks. 3) To preserve stability of vehicle while in motion. 4) To maintain the road wheels in contact with road surface.	
	(b)	**Attempt <u>ANY TWO</u> of the following.**	**08**
	(i)	**Explain re-painting procedure for accidental vehicle.**	**04**
		Re-painting procedure: 1. Remove dent using denting tools and dent removing procedure. 2. Preparing the Surface: Begin by sanding the car's surface with a dual action sander and 120 grit sandpaper to remove old paint and primer. 3. Carryout any necessary masking so that paint remover may not fall on the finished surface. 4. Wipe the surface down with a proprietary sprit. 5. Primer coat: Spray a coat of primer on the entire car and allow it to dry for 30 minutes. Use a long block sander and 120 grit sandpaper to slowly sand the entire car, keeping the sanding block flat and level. Repeat the primer and block sanding steps until the body is smooth. 6. Painting: Wipe the car with wax and grease remover. Spray the car with automotive spray paint, starting at the roof and work your way to the hood, trunk and then the sides of the car. Spray a total of four thin coats of paint on the car, allowing 30 minutes of dry time between each coat.	**04**

		7. Polishing: Inspect the painted finish for runs and other imperfections. Use 800 grit sandpaper and water to sand the entire car. Once the car is sanded and looks dull use a mildly abrasive liquid rubbing compound and a dual action orbital polisher to polish the car. Use circular and back and forth motions until the entire car has been polished.	
	(ii)	**Define: Traction, 2) Pitching:** .	**04**
		1. Traction: The traction is the ability of the rear wheels to transmit the tractive effort without slipping. **2. Pitching:** Rotating action produced in the vehicle about transverse axis through C.G. parallel to ground is known as Pitching.	**02** **02**
	(iii)	**Explain construction and working of air bags in four wheelers.**	
		Answer: **Construction of air bag :** There are three parts to an airbag :- 1. The bag made of a **thin nylon fabric**, which is folded into the steering wheel or dash board or, more recently the seat or door. 2. The sensor is the device that tells the bag to inflate. A mechanical switch is flipped when there is a mass shift that closes an electrical contact, telling the sensor that a crash has occurred. The sensors receive information from an accelerometer built into a microchip. 3. The airbag's inflation system reacts **sodium azide (NaN3) with potassium nitrate (KNO3) to produce nitrogen gas.**	**02**
			
		Working of Air- bag As vehicle comes across, the sensor detects it and triggers the impact the inflator. Once the electrical circuit has been turned on by the sensor, a pellet of sodium azide (NaN_3) is ignited. A rapid reaction occurs, generating nitrogen gas (N2). This gas fills a nylon or polyamide bag at a velocity of 150 to 250 miles per hour. This process, from the initial impact of the crash to full inflation of the airbags, takes only about 40 milliseconds. Thus minimizing the injury to the passenger or driver. When N_2 generation stops, gas molecules escape the bag through vents. The pressure inside the bag decreases and the bag deflates slightly to create a soft cushion. By 2 seconds after the initial impact, the pressure inside the bag has reached atmospheric pressure.	**02**
2		**Attempt any <u>FOUR</u> of the following:**	

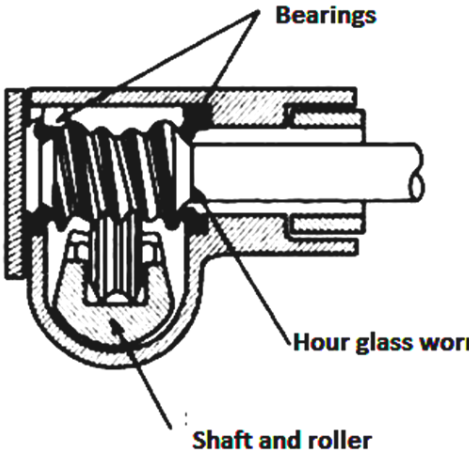
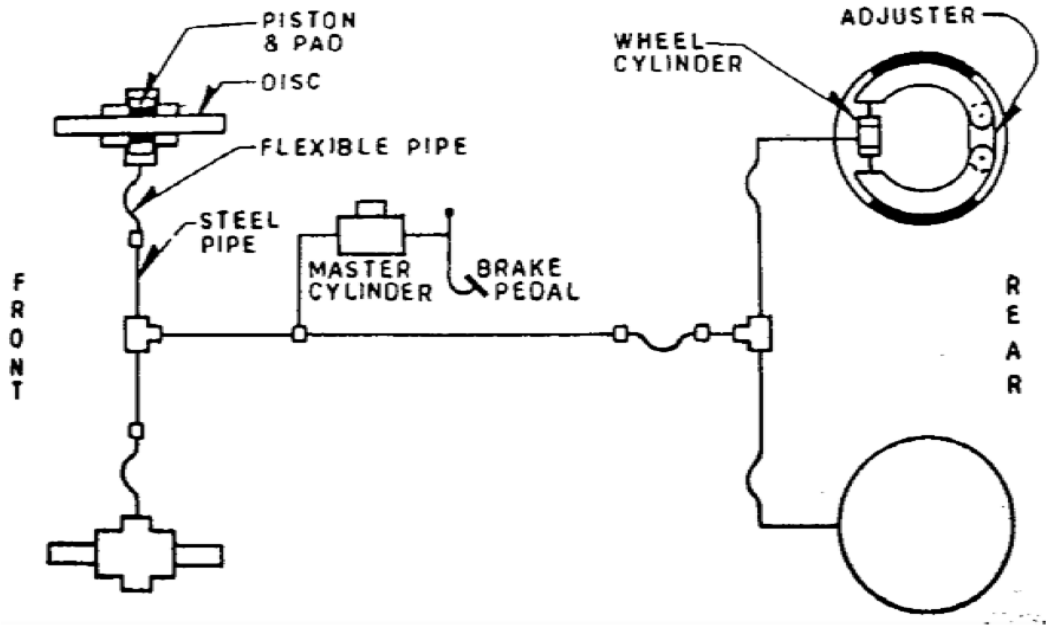
	a)	**Describe construction and working of hydraulic power assisted steering.**	
		Construction: The hydraulic power assisted steering system is shown in fig. It consists of hydraulic pump, hydraulic ram, hydraulic control valve, fluid reservoir, rack & pinion gear box, steering shaft, & steering wheel. The hydraulic fluid is stored into a reservoir to which a pump is connected. This pump lifts the fluid from reservoir & sends it to hydraulic control valve through the feed line. The steering wheel is connected to hydraulic control valve through the steering shaft. Working: When the steering wheel is at rest & the vehicle is going in straight ahead, at that time the both high pressure lines are open in position. So fluid exerts the same pressure on both sides of piston. So the rack does not operate the front wheels to turn in either side. As soon as the driver turn the steering wheel, the contact control valve operates hydraulic control valve which closes one of the port or pressure line, while the other remains open. So high pressure fluid from the pump goes to one side of the piston & operates the rack which in turn to operate the front wheels to turn in desired direction.  	
	b)	**Draw neat and label sketch of Elliot and Reverse Lamoine type stub Axle.**	**04**
		Answer:  	**02+02**
	c)	**Explain construction of Ackerman steering mechanism with diagram.**	**04**
		Answer: The Ackermann steering gear consists of turning pairs rather than sliding pairs. The whole of the mechanism is placed on the back of the front wheels. In Ackermann steering gear, the mechanism ABCD is a four bar crank chain. The shorter links BC and AD are equally inclined to the longitudinal axis of the vehicle. For the correct steering the following three positions are obtained: 1. When the vehicle moves along the straight path, the longer links AB and CD are parallel at Shorter links BC and AD are equally inclined to the longitudinal axis of the vehicle.	**02**

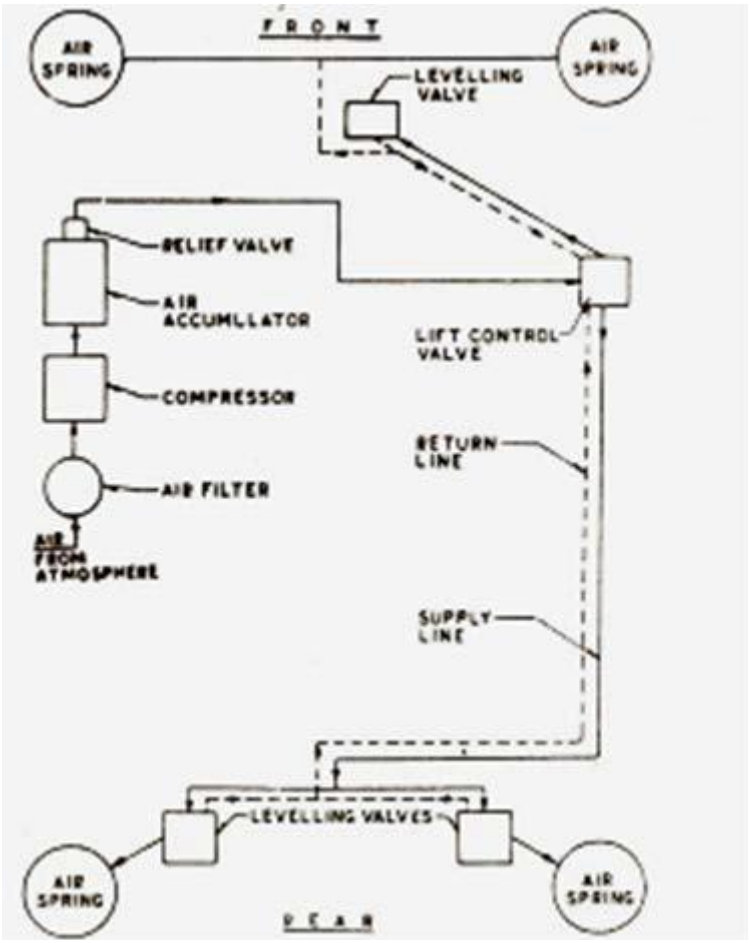
		2. When the vehicle is moving to the right or left, the lines of the front wheel axle intersect on the back wheel axle at I for correct steering  **Fig. Ackerman steering mechanism**	**02**
	d)	**List out any two properties of brake fluid and explain it.**	**04**
		Properties of brake fluid (any Two- 2mark each) **1) Boiling point:** Boiling point of fluid must be high because due to continue operation of brakes, generates the heat inside the drum, which increases the temperature of fluid in the wheel cylinder and lastly generates the vapour, which decreases the effectiveness of brakes. Therefore the boiling point should be high i.e. 250^0 C to 300^0 C. **2) Viscosity:** Viscosity of brake fluid should be such that the fluid should not lose its fluidity in any atmospheric condition. i.e., too cold or too hot temperature. Therefore, it is necessary that the viscosity of brake fluid should change adequately with the change in temperature to maintain its fluidity. **3) Lubrication properties:** The brake fluid should provide proper lubrication to the pistons in the master cylinder, wheel cylinder. Otherwise these components wear out quickly. **4) Effect on rubber**: A number of rubber seals are used in the hydraulic braking system, therefore the brake fluid should not have any effect on these seals. Otherwise it leads to leakage of fluid, loss of pressure in lines. **5) Corrosive action:** The brake fluid should not corrode the metal components with which it comes into contact. **6) Storage stability:** Brake fluid should have sufficient stability at least 3 years. During this period the fluid should not be spoiled.	**04**
	e)	**Describe working of exhaust brake in vehicle with neat sketch.**	**04**
		Answer:  Schematic diagram showing engine exhaust brake.	**02**

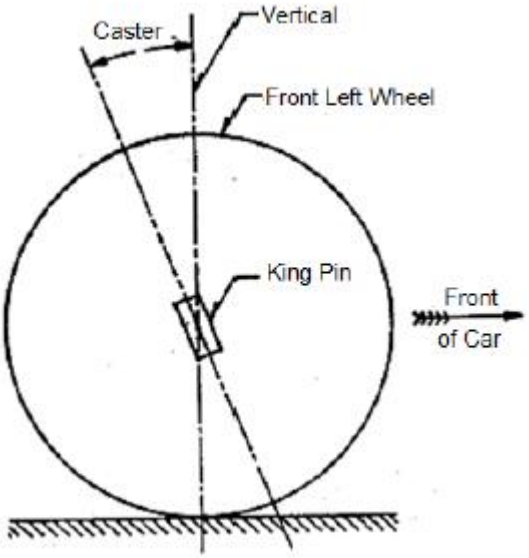
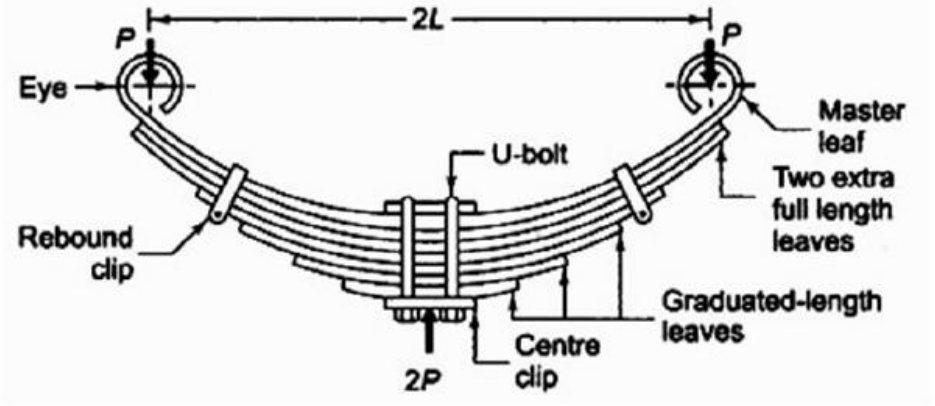
		Working:-It consists of pressure regulator, Foot control valve, Air cylinder, Butterfly valve and Linkages. In it, the pressure regulator is common with the air (service) brake When the exhaust gas brake is to be applied, the driver presses upon the control valve by his foot. This allows flow of compressed air from the air cylinder, which in turn operates the linkage to close the butterfly valve at the exhaust manifold. It prevents exit of the exhaust gas into atmosphere and diverts it to apply the brakes. As soon as the foot is taken- off the foot control valve, the brake is released. In this way, this type of brake effect fuel economy of vehicle.	**02**
	f)	**State the function and necessity of brake system.**	**04**
		Functions of brakes: (Any 02) 1) To stop or slow down the vehicle in the shortest possible distances in emergencies. 2) It is used to control the vehicle while descending along the hill. 3) To park the vehicle and held it in stationary position without the presence of driver. **Necessity of brake:** In an automobile, if the pressure from accelerator pedal is removed, the vehicle tends to slow up because of wind resistance, drag of engine and road friction. These forces, of course, would stop the vehicle but in present day traffic, this would be quite unpredictable and dangerous. The braking system provides added friction to overcome motion and to slow up or to stop the vehicle. The momentum or kinetic energy developed by the vehicle when in motion is converted to heat energy by the friction of brake shoes and drums which is dissipated into the surrounding air. Therefore the braking system is necessary to stop the vehicle or to retard the speed of vehicle within shortest interval of time with safety.	**02** **02**
3.		**Attempt any <u>FOUR of the following:</u>**	**16**
	a)	**Differentiate between Drum and Disc type brake system(any four points)**	**04**
		Answer: **Difference between disc-brake and drum-brake:** *(Any 04)* Sr. No. | Disc Brake | Drum brake 01 | Friction surfaces are directly exposed to the cooling air. | Friction occurs on the internal surfaces, therefore heat dissipated only by conduction through the drum. 02 | Flat friction pads are used. | Curved friction linings are used. 03 | There is uniform wear of friction pads. | Non uniform wear of friction linings. 04 | There is no loss of efficiency due to expansion. | There is loss of efficiency due to expansion. 05 | Weight is less so saving upto 20 % is possible. | Comparatively higher weight. 06 | Disc brakes have comparatively better anti-fade characteristics. | Comparatively poor anti-fade characteristics. 07 | Simple in design. | Complicated design. 08 | Comparatively easy to remove and replace friction pads. | Removal and replacement of brake linings is difficult and consumes more time. 09 | Less frictional area | More frictional area 10 | Pressure intensity is more | Pressure intensity is less	**04**
	b)	**Explain necessity of antilock brake system.**	**04**
		An **anti-lock braking system** (**ABS**) is a safety anti-skid braking system used on on land vehicles, such as cars, motorcycles, trucks and buses. ABS operates by preventing the wheels from locking up during braking, thereby maintaining tractive contact with the road surface. ABS operates at a much faster rate and more effectively than most drivers could	**04**

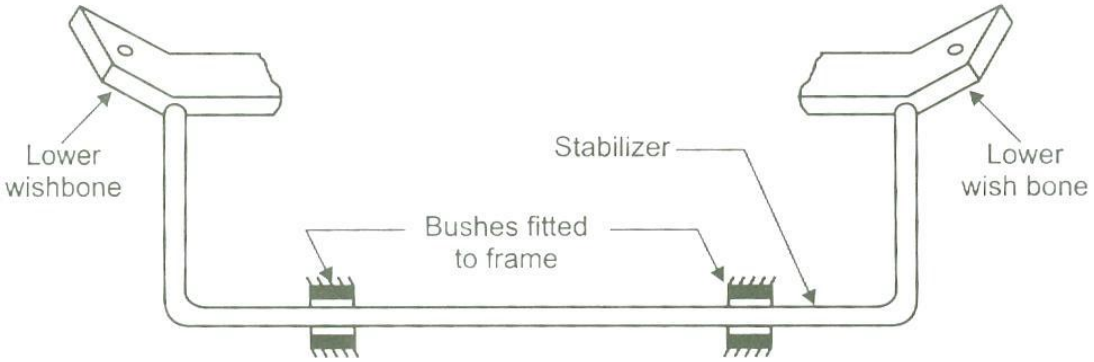
		manage. Although ABS generally offers improved vehicle control and decreases stopping distances on dry and some slippery surfaces, on loose gravel or snow-covered surfaces. ABS may significantly increase braking distance, while still improving steering control. Therefore the ABS anti-lock braking system is necessary to prevent the vehicle from skidding on wet or slippery surface and reducing stopping distance safely.	
	c)	**Explain the advantages of independent suspension system over rigid suspension (any four points)**	
		Answer: Advantages of independent suspension system over rigid system: (any 4 points- 1 Mark each) 1) More deflection of front wheels, no reaction to steering. 2) Greater resistance to rolling action. 3) Front axle improves road holding tendency of tyres. 4) Minimum vibrations. 5) Provides smooth and comfort ride. 6) Better Handling and Cornering 7) Better Stability and Steering 8) Lower weight 9) Lower height.	**04**
	d)	**Explain any two refrigerants used in automobile air conditioning system with their properties.**	**04**
		Answer: **Refrigerant used in car air conditioning:** 1) Dichloro difluro-methane or Freon -12 (R-12) **Dichlorodifluoromethane** (**R-12**) is a colourless gas usually sold under the brand name **Freon-12**, and a chlorofluorocarbon halo methane (CFC) used as a refrigerant. In earlier vehicles R-12 was used as a refrigerant due to following properties. 2) Tetra fluro-ethane or R-134a or HFC-134a - Refrigerant R134a is a hydro fluorocarbon (HFC) that has zero potential to cause the depletion of the ozone layer and very little greenhouse effect. - R134a is the non flammable and non-explosive, has toxicity within limits and good chemical stability. - It has somewhat high affinity for the moisture. - The overall physical and thermodynamic properties of refrigerant R134a closely resemble with that of refrigerant R12. Properties of refrigerants: 1) The refrigerant should have low freezing point. 2) It must have high critical pressure and temperature to avoid large power requirement. 3) It must have low specific heat and high latent heat. 4) It should have low specific volume to reduce the size of the compressor. 5) It must have high thermal conductivity to reduce the areas of heat transfer in evaporator and condenser. 6) It should be non-inflammable, non-explosive, non-toxic and non-corrosive. 7) It should give high C.O.P. in the working temperature range. This is necessary to reduce running cost of the system.	**02** **02**

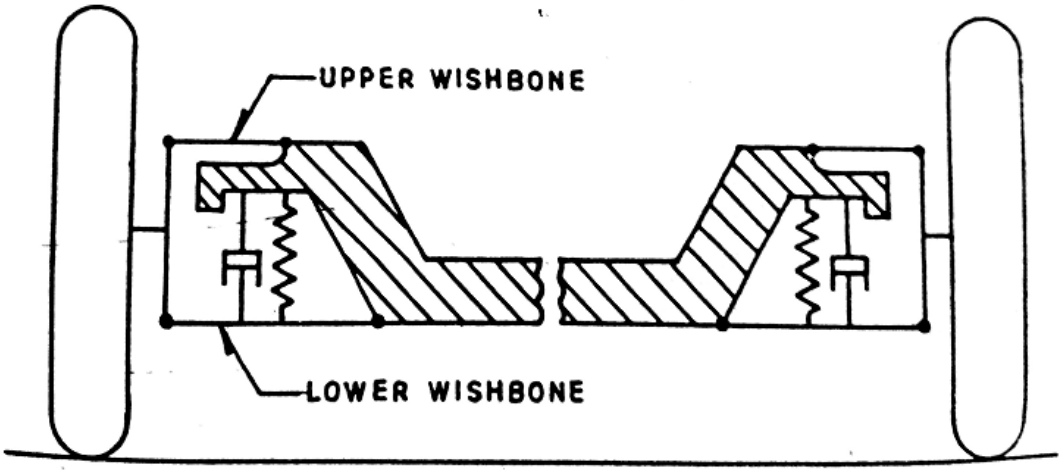
		8) It must be readily available and it must be cheap also.	
	e)	**Explain any two material used in body construction of vehicle.**	**04**
		Answer: Materials used for body construction: (Explain any 04 material, 02 mark each) **1. Steel sheets and high-strength, low-alloy steels:** The main factors of selecting material especially for body is wide variety of characteristics such as thermal, chemical or mechanical resistance, ease of manufacture and durability. Steel sheets are used for paneling over a timber frame work and also for press work such as roof, scuttle, door and wings. **2. Aluminum:** Aluminum is used as a body material because of its better formability, lightness and anti rusting qualities, though its main disadvantage is lesser stiffness and rigidity.e. g. Pillars, frame work and paneling are all made out of aluminum sections and sheets. **3. Plastic:** Plastic is also popular material in body work. Thermoplastics are often used for Components like boot coves, grills etc., where as thermosetting plastics are used for the body shells. The latest type of plastic used for body work is reinforced carbon fiber which is stronger that steel. **4. Glass -** fiber composites: It is lighter than steel and aluminum, easy to be shaped and rust-proof. It is cheap to be produced in small quantity. **5. Wood:** Timber in common forms like Log, balk, billet, plank, board, batten, pillars etc are used for commercial body building. Plywood also largely used due to its property like uniformity in strength along and across the grain. **6. Glass:** The wind screens and window panels, doors are made up of glass sheet. Toughened glass sheet, if broken into pieces in case of accident cause injury, but now a days laminated glass sheets are used which do not break into pieces. **7. Rubber:** Natural and synthetic rubbers are used in upholstery work as well as internal trimming of door and window panels. **8. Carbon-fibre epoxy composite:** It is because the composite structures are the high strength/low weight ratio. The most common materials used for racing cars are carbon (graphite), Kevlar and glass fibres. **9. Magnesium:** Magnesium is another light metal that is becoming increasingly common in automotive engineering. It is 33% lighter than aluminum and 75% lighter than steel/cast iron components.	**04**
	f)	**Describe protective treatment for new automobile body.**	**04**
		Answer:- 1. **Surface preparation:** **a. Degreasing:** It is a process by which organic deposits such as oil, grease, metallic soaps and inorganic matters like soil, dirt, and shop dust are removed from metal surface. **b. Descaling:** The process of removing scales on the ferrous surface. **c. Derusting:** If the metal is exposed to atmosphere or water, the oxides of iron are formed on the metal surface; these oxides are called as rust. This process of removing the rusting on the surface. 2. **Rinsing:** To remove all acids and acid salts, the work is passed through 2 or 3 successive rinse baths. 3. **Phosphate coating**: Phosphate coating is secondary metallic phosphate of iron, zinc or manganese deposited on steel surfaces. They provide a good anchorage to the paint film and prevent rust creep underneath the paint film. 4. **Passivation**: After Phosphate coating and rinsing, surfaces are given a final passivation rinse with solution of chromic acid to improve their corrosion resistance. 5**. Sealing**: After passivation and drying, the sealant is to be applied within 2 hours during monsoon and 6 hours during winter and summer months.	

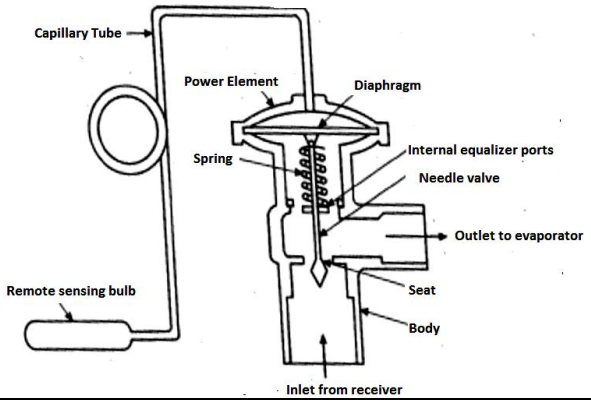
4.		**Attempt any <u>TWO</u> of the following.**	**16**
	a)	**Describe construction and working of worm and roller type steering gear box with diagram.**	**08**
			**04**
		Construction and Working: In the worm and roller type steering gear, a single or double roller is mounted between two arms integral with the inner end of the cross shaft, and this roller is meshed with the worm. The roller is free to turn on its shaft and moves in an arc, the correct mesh being obtained throughout its movement by the hour-glass shape of the worm. The worm is supported and located by two ball or taper roller bearings mounted in the case and its end float may be adjusted by shims placed between the outer bearing track and the end plate of the case. The roller shaft is eccentric and may be turned to compensate for wear between the roller and the worm. The upper end of the column is supported in the tube by a felt bush. As the steering wheel turns the worm, the roller turns with it, forcing the sector and pitman arm shaft to rotate.	**04**
	b)	**Describe construction and working of hydraulic brake system with diagram.**	**04**
		 Figure: Hydraulic braking system.	**02** **02**
		Working: When the brakes are not in operation, the system is filled with brake fluid under light pressure. When driver presses the brake pedal for applying the brake, the piston in the master cylinder moves forward and compresses the fluid in cylinder. It increases the pressure of the fluid in master cylinder and in entire hydraulic system. This	

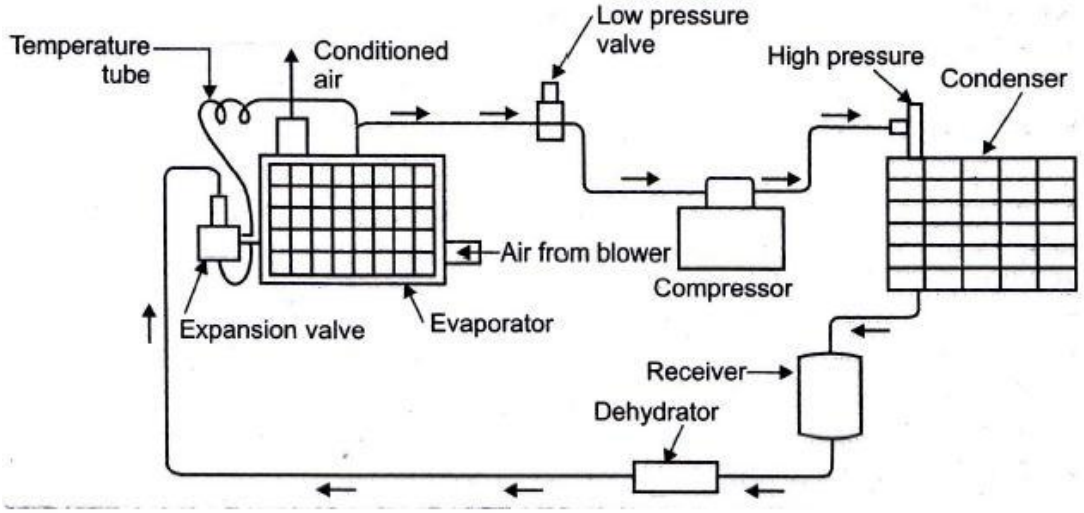
		pressure is instantly transferred to all four wheel cylinders (in case of disc brake this pressure is transferred to calipers). Thus the piston in wheel cylinders moves outward which moves brake shoes against brake drum to apply brakes. When driver releases the brake pedal, the master cylinder piston returns to its original position due to return spring and the pressure is dropped. It releases brake shoes from brake drum to their: original position and brakes are released.	
	c)	**Describe construction and working of air suspension system with diagram.**	**04**
		Answer:  **Air suspension system** **Construction:** The layout of an air suspension system has been shown in Fig. The four air springs, which may be either the bellows type or the piston type, are mounted on the same position where generally the coil springs are mounted. It also consists of air compressor, air accumulator, relief valve, lift control valve, leveling valve and pipeline. **Working:** An air compressor takes the atmospheric air through a filter and compresses it to a pressure of about 240 MPa, at which pressure the air in the accumulator tank is maintained, which is also provided with a safety relief valve. This high pressure air goes through the lift control valve and the leveling valves, to the air springs as shown. Each air spring is filled with compressed air which supports the weight of the vehicle. The air gets further compressed and absorbs the shock when the wheel encounters a bump on the road.	**02** **02**
5.		**Attempt any <u>FOUR</u> of the following.**	**16**

	a)	**Define following steering geometry term:** **(i) Correct steering angle** **(ii) Caster**	**04**
		Definitions: i)Correct steering angle: Equation for correct steering is $\cot\phi - \cot\theta = b/l$ Where, Ø = angle between line passing through front outer wheel center and instantaneous center and rear wheel and instantaneous center. θ = angle between line passing through front inner wheel center and instantaneous center and rear wheel and instantaneous center. *b* = distance between the pivots of front axle. *l* = wheel base The value of $\cot\phi - \cot\theta$ corresponds to the position when steering is correct. There are three values of angle θ which give correct steering of the vehicle, first while it is turning to right, second while it is turning to left and third while it is running straight. **ii) Caster:** It is the angle between the king pin center line & the vertical, in the plane of the wheel, when viewed from the side is called the caster angle. Directional stability i.e. straight line tracking is improved by caster. However, positive caster increases the effort required to turn the vehicle and high negative caster causes abnormal wobble. It is generally taken as 3^0 for good directional stability.  	**02** **02**
	b)	**Draw a labelled sketch of semielliptical leaf spring and state its two applications.**	**04**
		 	**02** **02**

		Applications: (any 2- 1 mark each) **1) Trucks** **2) Medium commercial vehicle.** **3) old cars** **4) Buses** **5) Tractor trolleys**	
	c)	**Explain working of Anti Roll Bar or Stabilizer Bar in vehicle.**	**04**
		Answer:  Figure: Anti roll bar or stabilizer bar for front axle independent suspension. **Working of Antiroll bar:** When both the wheels deflect up and down by the same amount, the stabilizer bar simply turns in the bearings. When only one wheel deflects, then only one end of the stabilizer bar moves, thus twisting the stabilizer bar which acts as a spring between the two sides of the independent suspension.	**02** **02**
	d)	**Define human comfort condition for occupants.**	**04**
		Answer: **Human comfort condition:** 1) **Temperature:** Temperature is the most important factor which affects human comfort to a great extent. Most of the human being feels comfortable at a temperature 21^{0}C to 25^{0}C. Generally human being feels comfortable at relatively higher temperature in winter season and feels comfortable at relatively lower temperature in summer season. The comfort temperature of individual person depends on his body structure, eating habits, the area in which he is to make familiar to live. 2) **Humidity:** 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%. 3) **Purity of air:** A person does not feel comfortable when breathing in contaminated air even if temperature and humidity is within comfortable range. Therefore, proper filtration, cleaning and purification of air is necessary to keep it free from dust, dirt and other impurities. The proper percentage of oxygen in air is necessary to be maintained for human comfort. Therefore, proper filtration system is provided in HVAC system in automobiles. 4) **Air motion and circulation:** Even if temperature, humidity and purity of air is satisfactory, certain amount of air motion is necessary for human comfort. We do not feel comfortable in dead or still air. It is therefore, necessary that there should be equi-distribution of air throughout the space to be air conditioned.	**04**

	e)	**Describe construction and working of wishbone type independent suspension system.**	**04**
		Answer:  Figure: Wishbone type suspension (Schematic) *(Note:Equivalent credit shall be given to any other suitable sketch if drawn)* **Construction:** It consists of upper and the lower wishbone arms provided to the frame. These arms resemble letter 'A'. The spring is placed in between the lower wishbone and the underside of the cross member. The vehicle weight is transmitted from the body and the cross member to the coil spring through which it goes to the lower wishbone member. A shock absorber is placed inside the coil spring and is attached to the cross member and to lower wishbone member. **Working:** When the vehicle came across a bump and wheel is tended to move up the lower and the upper arm moves up and the coils spring is compressed, so shock absorber (Damper) damps the vibrations setup in the coil spring due to road irregularities. After passing over a bump the lower arm comes to its original position with upper arm. This type of suspension resists up and down forces that develop after bump, acceleration, braking and cornering.	**02** **02**
	f)	**Explain how the temperature is controlled in automobile HVAC system.**	**04**
		Answer: **Temperature control in automobile HVAC:** The expansion valve is placed at the evaporator inlet tube. It is used to control refrigerant flow into the evaporator. The expansion valve contains a variable orifice that is controlled by a sensing bulb placed inside the evaporator cooling fins. The sensing bulb is a sealed tube containing a small amount of refrigerant. The changes in temperature of the evaporator cause the refrigerant inside the sensing bulb to expand or contract. The action of the internal pressure of the sensing bulb controls the amount of refrigerant that flows through the expansion valve by varying the size of the orifice.	**04**

			
6		**Attempt any <u>TWO</u> of the following:**	**16**
	a)	**Describe construction and working of central locking system and write two advantages and disadvantages of central locking system.**	**08**
		Answer: **Construction and Working of central locking system:** Central locking system is electromechanical system. A two-position solenoid actuator is installed in each door to electrically operate the door locking mechanism. It locks the doors when the current passed in it by the electronic control module (ECM) in one direction and unlock when the direction of current is reversed. In replacement of solenoid valve DC motor can be used as an actuator. Each door can be locked or unlocked individually or alternatively all the doors can be locked or unlock with one switch. *Note: Credit shall be given to any other suitable answer (i.e.Manually or electrically operated central locking system).* **Advantages of central locking system:** *(Any 02- 1 mark each)* **1)** All the doors and luggage compartments can be locked or unlocked simply by operating one key. 2) It Indicates open door with flash 3) Locking/ unlocking can be done by remote 4) In case of failure of electronic system, the manual locking is still possible. **Disadvantages of central locking system:** *(Any 02-1 mark each)* 1) It is not convenient in case of accident because occupant may not open the door in Emergency since all doors are centrally locked. 2) It's initial and maintenance cost is high	**04** **02** **02**
	b)	**Explain construction and working of automobile air conditioning with block diagram.**	**08**
		Answer: **Air Conditioning System in an Automobile:** **[1] Compressor:** The compressor is belt driven from the crankshaft. An electric clutch engages and disengages the compressor pulley from the shaft. The compressor receives R134 in gaseous from at the inlet and pressurizes the refrigerant to a high pressure. This pressure from the compressor causes the R134 to move through the air conditioning (A/C) system. It draws off gaseous refrigerant from the evaporator and compresses it. This causes the refrigerant gas temperature and pressure to rise rapidly. **[2] Condenser:** Through which the heated refrigerant gas gives off heat to the engine cooling air. The refrigerant gas cools off and once again becomes liquid. **[3] Receiver:** It removes any traces of moisture and filters out dirt's in the system. It also serves as a reservoir for excessive refrigerant.	**04**

		[4] Expansion Valve: It controls the liquid refrigerant into this evaporator core, causing a drop in pressure and consequently drops in temperature. **[5] Evaporator:** In which the released refrigerant expands and flows through the evaporator tubes. This removes heat from the air blowing across the fins and tubes and evaporates, causing the temperature inside the vehicle gradually to be lowered. **[6] Dryer:** The main purpose of dryer is to trap the moisture that may enter in the system during original assembly or charging. Moisture is an enemy of air conditioning system because it can react with the refrigerant and corrode the inside of the system.  **Fig. Car Air Conditioning**	**04**
	c)	**List out various resistances faced by the vehicle and explain any three in detail.**	**04**
		Answer: **various resistance faced by the vehicle** **1) Air resistance** **2) Gradient Resistance** **3) Rolling Resistance** **1) Air resistance :-**Resistance to the motion of vehicle when it moves on road due air is called as air resistance **Air resistance is directly proportional to square of speed of vehicle. $R_a=K_a$ A V^2** **Where** R_a =Air resistance (N) K_a =Coefficient of air resistance A=Frontal projected area in m^2 V= Vehicle speed in Km/Hr K_a= 0.02688 for passenger car K_a=0.023 Streamline car K_a=0.0314 average car K_a=0.045 for trucks & buses **Effect:** - as air resistance increase with square of speed of vehicle we need pay attention on frontal shape of high speed vehicle it should be stream line. **2) Gradient Resistance:-**Resistance to the motion of vehicle due to different gradient condition of road is called as Gradient resistance.	**01** **01** **01**

		Note:-it remains constant; component of vehicle gradient is parallel to plane of road & is responsible for gradient resistance. $R_g=WG=M_g G$ R_g=Gradient resistance(N) M=Mass of vehicle in Kg W=Weight of vehicle in (N) G=Gradient expressed as the unit rise divided by distance travelled. **Effect:-** as gradient resistance in constant maximum grade ability in India 30^0 for road however vehicle tested for 45^0 in fully rated condition. 3) **Rolling Resistance:-**Resistance to motion of vehicle due deformation of tyre & road & energy dissipated through the impact this resistance is termed as rolling resistance. Rolling resistance $R_r=K_rMg$ R_r=Rolling resistance N M=Mass of vehicle in Kg K_r=Constant of road resistance **Effect**:-Rolling resistance caused by road surface & its different types of constant for speed of 22 to 55Km/Hr for asphalt road it is 70 N/1000Kg & for sand road it is 1500N/1000Kg	**01**