**SUMMER– 18 EXAMINATION**

**Model Answer**

**Subject Name: Automobile Engineering** **Subject Code:** 17526

**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 |
|---|---|---|---|
| 1 | (A) | **Attempt ant THREE of the following:** | 12 |
| | (a) | **Give the classification of Automobile.** | 04 |
| | Ans | **Classification of Automobile: (Enlist any 8 of the above mentioned each of ½ Marks)**<br>**[1] According to Purpose (Use)**<br>1.1.1 Passenger Cars<br>1.1.2 Goods Carriage<br>1.1.3 Special Purpose<br>1.1.4 Earth Moving<br>1.1.5 Motor Cycle (Bikes)<br>1.1.6 Mopeds<br>**[2] According to Fuel Used:**<br>2.1.1 Petrol Vehicles<br>2.1.2 Diesel Vehicles<br>2.1.3 LPG/CNG Vehicles<br>2.1.4 Electric Cars<br>2.1.5 Hybrid Cars<br>2.1.6 Solar Cars<br>2.1.7 Fuel Cell<br>**[3] According to Load Carrying Capacity:**<br>3.1.1 Heavy Motor Vehicle<br>3.1.2 Medium Motor Vehicle<br>3.1.3 Light Motor Vehicle<br><br>**[4] According to Drive Used:**<br>4.1.1 Left and Right Hand Drive | |

| | | | |
|---|---|---|---|
| | | 4.1.2 Two Wheel and Four Wheel Drive<br>**[5] According to Engine Location and Mounting:**<br>5.1.1 Front Engine Front Wheel Drive<br>5.1.2 Rear Engine Rear Wheel Drive<br>5.1.3 Front Engine Rear Wheel Drive<br>5.1.4 Bus Chassis<br>5.1.5 Full Forward Chassis<br>5.1.6 Semi Forward Chassis<br>**[6] According to Body Styles:**<br>**A. Passenger Cars:**<br>6.1.1 Sedan/Saloon<br>6.1.2 Hardtop<br>6.1.3 Lift back (Hatchback)<br>6.1.4 Station Wagon<br>6.1.5 Coupe<br>6.1.6 Limousine<br>6.1.7 Convertible<br>6.1.8 Estate Car<br>**B. Heavy Vehicles/Trucks:**<br>6.1.1 Truck Punjab Body<br>6.1.2 Truck Half Body<br>6.1.3 Truck Platform Type<br>6.1.4 Truck with Trailer<br>6.1.5 Dumper<br>6.1.7 Tanker<br>**[7] According to Wheel and Axle:**<br>7.1.1 Two and Three Wheeler<br>7.1.2 Four Wheeler and Six Wheeler<br>7.1.3 Single and Multi Axle | |
| | **(b)** | **What is the function of universal joint and sliding joint in propeller shaft?** | **04** |
| | **Ans** | ( Universal joint – 2 marks , Slip joint - 2 Marks)<br>**Function of Universal Joint:** Universal joint allows transmission of power and rotary motion at an angle which varies as a vehicle encounters a bump.<br>**Function of Slip Joint:** This joint allows variation in length of the propeller shaft when vehicle came across road irregularities. | |
| | **(c)** | **Define the following terms with the help of simple sketch:**<br>**(i) Caster (ii) King pin inclination** | **04** |
| | **Ans** | **(i)Caster:** Castor provides directional stability that is kept vehicle on straight path. 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 30 for good directional stability. | **01** |

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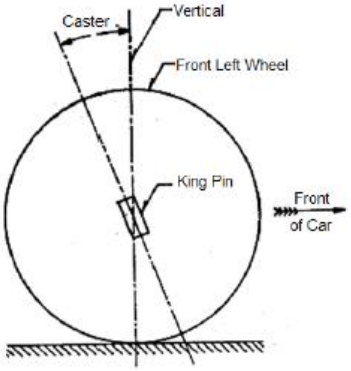


**(ii) King pin inclination:** It is the angle between vertical line and centre line of king pin or steering axis when viewed from the front of the vehicle.

**01**

**01**

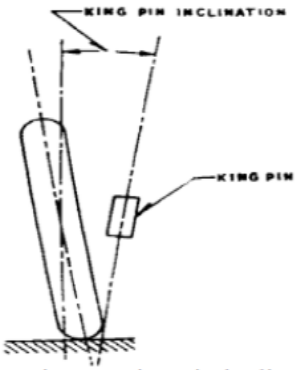


Figure: King pin inclination.

**01**

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| | **(d)** | **What are the major components mounted on vehicle chassis? State the purpose of each component.** | **04** |
| | **Ans** | **The main components of automobiles are: (Any 04)**<br>1. **The engine:** Function: It provides the motive power for all various functions which the vehicle or any part of it, may be required to perform.<br>2. **The Transmission system:** It consists of a clutch, a gearbox, a propeller shaft and differential. Function: To engaged or disengaged the power from engine to transmission system, to transmit the torque and to distribute the final torque equally between the driving wheels.<br>3. **The auxiliaries:** It consists of electrical systems. Function: To provide spark for ignition of charge, to start the engine by providing initial motive force, to provide electrical energy for lighting system.<br>4. **The controls:** It consist of steering system and brakes Function: to control direction of moving vehicle, to steer the vehicle according to drivers will.<br>5. **The body:** Function: To provide space for passenger and luggage. | |

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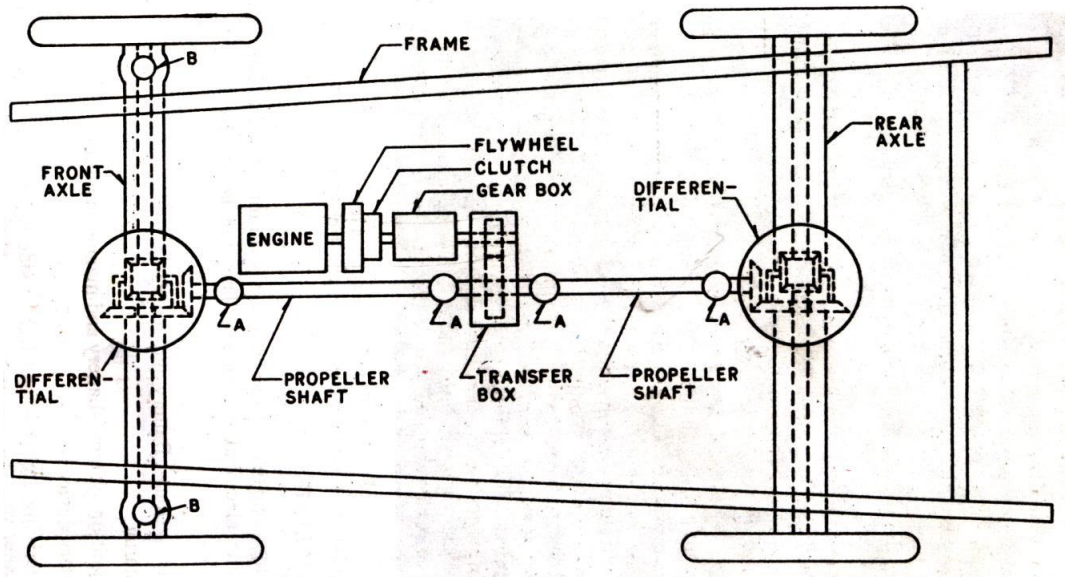
| | **(B)** | **Attempt ant ONE of the following:** | **06** |
| | **(a)** | **Draw the layout of four wheel drive vehicle. State the advantages and disadvantages.** | **06** |
| | **Ans** | **(Layout 02 Marks)**<br>  <br><br>**Advantages of 4-Wheel drive over 2-Wheel Drive:** *(any two merits)*<br>1. Better traction on smooth surface in all conditions (wet and wintry weather)<br>2. Increased drive off and climbing capacity irrespective of load.<br>3. Better acceleration in lower gear.<br>4. Reduced sensitivity to side wind.<br>5. Better stability.<br>6. More balanced axle load distribution.<br>7. Equal tire wear.<br><br>**Disadvantages of 4-Wheel drive over 2-Wheel Drive:** *(any two demerits)*<br>1. More weight of vehicle.<br>2. Lower maximum speed.<br>3. Increased fuel consumption by 5 to 10%.<br>4. As extra components are required manufacturing cost is more. | |
| | **(b)** | **Draw neat sketch of full-floating axle and explain its features.** | **06** |
| | **Ans** | The figure shows the full floating axle. The wheel is on the axle casing. Two roller bearings are between the wheel and axle casings. The axle end is fitted with the wheel by means of a flange, bolt and nut. There are two roller bearings between the wheel and axle casings. This is the advantage of the fully floating axle, over other two types of axles. To remove the axle the bolt and nut are first loosened. The flange and axle can then be very easily removed. The vehicle continues to be supported by the wheel and the axle casing. Fully floating rear axle is used in heavy commercial vehicles. | **02** |

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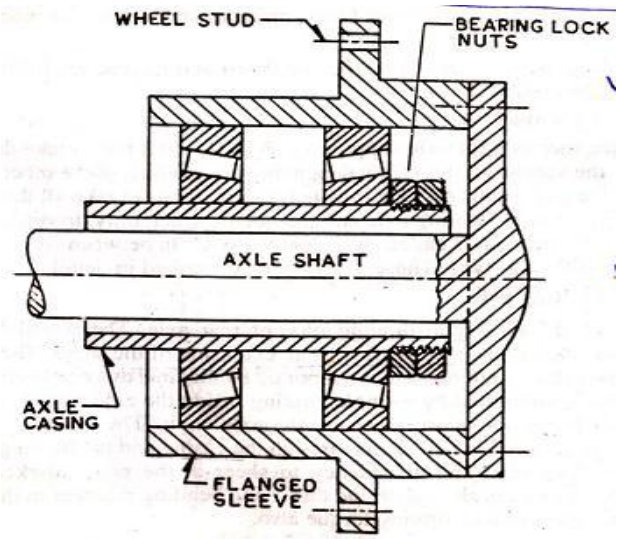
| | |  | 04 |
| | | **Attempt ant FOUR of the following:** | 16 |
| | **(a)** | **Differentiate between drum braking system and disc braking system.** | 04 |
| | **Ans** | **(Any 4 points)**<br>**Difference between Hydraulic and Pneumatic Braking System:**<br>S N \| Hydraulic Braking System \| Pneumatic Braking System<br>1 \| Braking Fluid used as a working medium \| Compressed air is used as a working medium<br>2 \| Simple in construction \| Robust (Heavy) in construction<br>3 \| Occupied less space as compared to Air brake \| Occupied more space as compared to Hydraulic brake<br>4 \| System is self lubricating \| Need to lubricate mechanical parts<br>5 \| Bleeding is necessary \| No need of bleeding<br>6 \| Increased braking effort, but less powerful than air brakes. \| Most powerful than Hydraulic brake | |
| | **(b)** | **Describe with neat sketch hotch-kiss-drive.** | 04 |
| | **Ans** | This drive is invented by Albert Hotchkiss. In the Hotchkiss drive two universal joints are used one at front and second at rear end of propeller shaft. Slip joint is used to accommodate change in length of propeller shaft. Leaf spring is shacked at the rear and bracketed at front end. Leaf spring takes Weight of body, driving thrust, side thrust, torque reaction and braking thrust. In the Hotchkiss drive, splines eliminate thrust transmitted back to the driveshaft from the wheels, | 02 |

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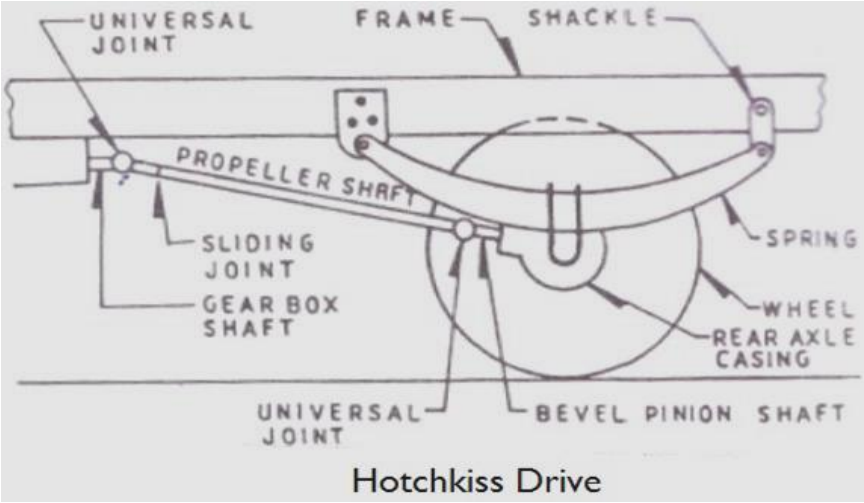
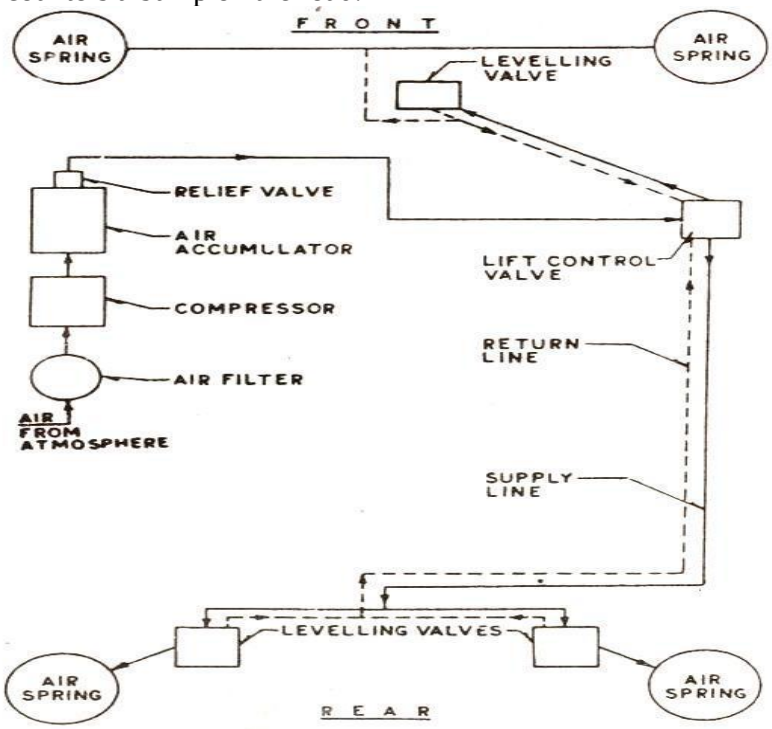
| | | allowing simple rear-axle positioning using parallel leaf springs. Due to torque reaction leaf spring deflects. It is used in heavy duty vehicles like bus and trucks   Hotchkiss Drive | 02 |
| | (c) | **How air suspension system works? Draw the layout.** | 04 |
| | Ans | **Working:** An air compressor 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.   **Figure: Layout of Air suspension system** | 02<br>02 |

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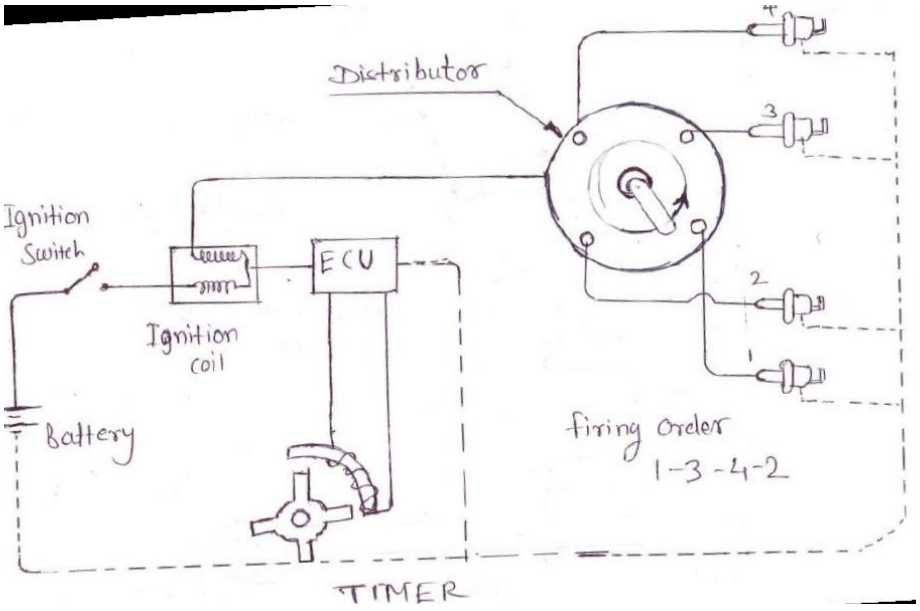
| | **(d)** | **Explain the working of electronic ignition system.** | **04** |
| | **Ans** | Electronics Ignition system is similar to conventional point type Ignition System with a small difference. Electronics Ignition system is provided with Electronic control unit which opens and close the primary circuit instead of contact breaker point as in Contact breaker point ignition system.<br>Electronics Ignition system is having two circuits Primary and Secondary circuit. Battery, primary winding, ECU and the timer forms primary circuit. Where as secondary winding, distributor and spark plug forms secondary circuit. A timer is employed in the distributor instead of contact breaker. This timer may be Pulse generator or Hall- effect switch which Triggers the Ignition module also called as electronic control unit. This control unit primarily contains transistor circuit whose current is triggered off and on by timer which results in the stopping and starting of the primary circuit. The secondary circuit worked in the similar manner as in conventional contact breaker type. i.e when the magnetic field collapses it induces current in the secondary winding having more number of turns. This results in development of very high voltage necessary to generate the spark at the spark plug.<br>  <br> | **02**<br>**02** |
| | **(e)** | **Draw neat sketch of leaf spring. State its function.** | **04** |
| | **Ans** | **Function of Leaf spring:** springs are placed between the road wheels and the body. When the wheel comes across a bump on the road, it rises and deflects the spring, thereby storing energy therein. On releasing, due to the elasticity of the spring material, it rebounds thereby expanding the stored energy. In this way the spring starts vibrating, of course, with amplitude decreasing gradually on account of internal friction of the spring material and friction of the suspension joints, till vibration die down.<br>Types of Leaf spring: (Any one type of leaf spring)<br>a. Semi elliptical leaf spring | **02** |

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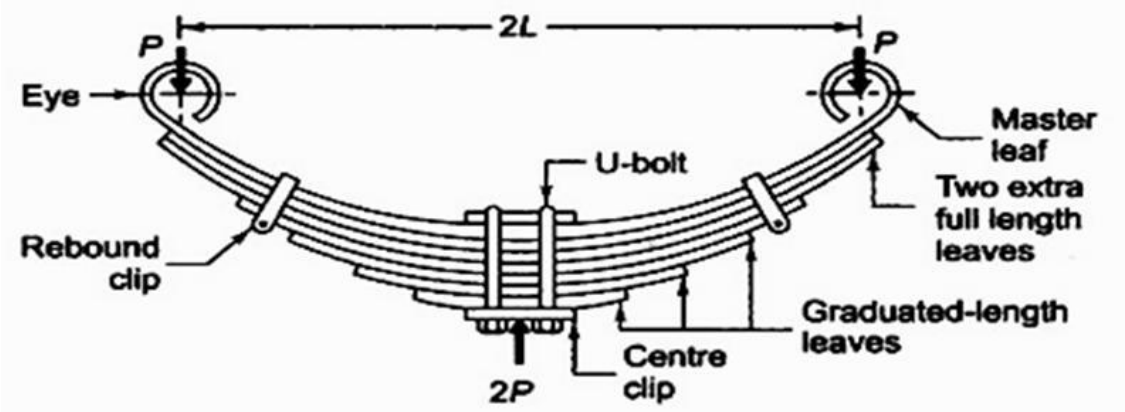
| | | b. Quarter elliptical leaf spring<br>c. Three Quarter elliptical leaf spring<br>d. Transverse spring<br>e. Full elliptical leaf spring<br>f. Platform type spring<br>  <br> | **02** |
| **3** | | **Attempt ant TWO of the following:** | **16** |
| | **(a)** | **Explain the necessity and working of single plate clutch** | **08** |
| | **Ans** | Answer: (Necessity- 2 marks, working-2 marks, Sketch-4 marks)<br><br>Necessity of Single plate clutch<br><br>1) To transmit large amount of torque single plate clutch required<br><br>2) Response time to operate is very less compared to multiplate clutch.<br><br>3) It generates low heat so no need of cooling media required.<br><br>4) It should be dynamically balanced and easy to operate.<br><br>**Working:**<br><br>**Disengaging the clutch:**<br><br>When clutch pedal is pressed down, it's linkage forces the thrust bearing to move towards the flywheels and pressing the pressure plate away from the flywheel thereby the compression springs are compressed. This action removes the pressure from the clutch plate and the driving shaft comes to stationary position.<br><br>**Engaging the clutch:**<br><br>On the other hand when the foot is taken off from the clutch pedal, the thrust bearing moves back by levers this action allows the springs to extend and thus pressure plate pushes the clutch plate back towards the flywheel. The clutch is engaged and power is transmitted from engine to gear box. | |

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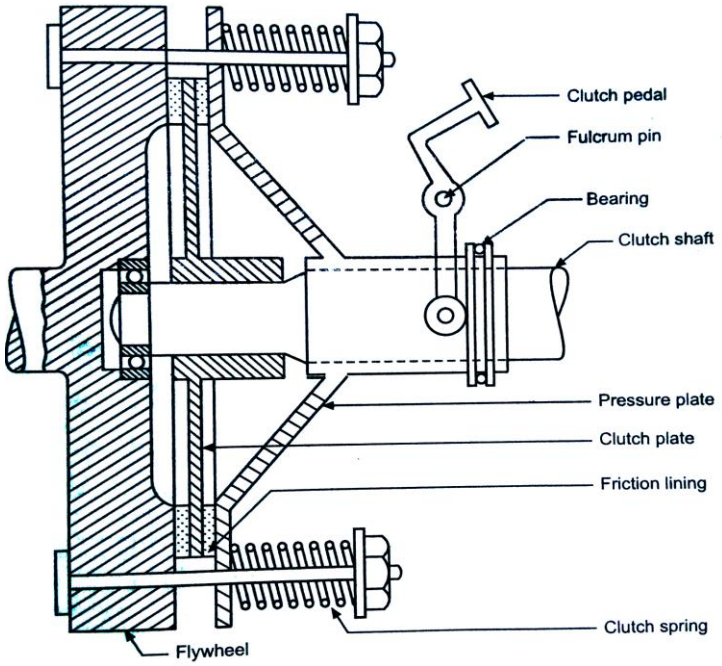
| | |  Figure: Single plate clutch | |
| | **(b)** | **Draw the layout of air-braking system. Explain its working.** | **08** |
| | **Ans** | **Answer: (sketch – 04 marks, Description –04 marks)**<br><br>**Air braking system:-** Compressor takes air from the atmosphere to the filter and the compressed air is sent to the reservoir through the unloaded valve ,which gets lifted at a predetermined reservoir pressure ( 900KPa) & relieves the compressor of load. From the reservoir the air goes to various accessories & also to the brake chambers located at each wheel. The control of brake valve is with driver who can control the intensity of braking according to the requirements. When pressure drops to 700 KPa, the governor again cuts in the compressor to raise system pressure. When air system pressure falls to 400 KPa, a warning in the form of a buzzer is sounded. | |

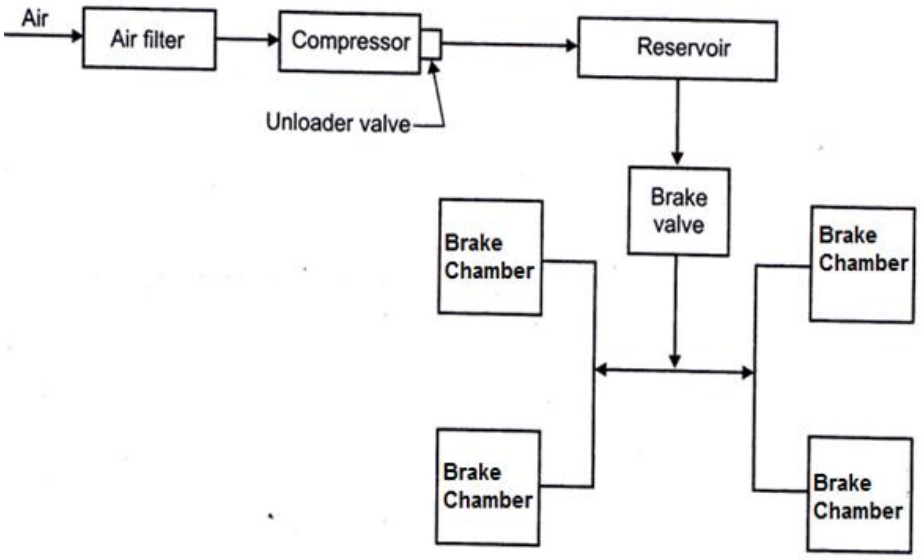



**Fig Layout of Air braking system**

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| | **(c)** | **Explain the construction and working of lead-acid battery with neat sketch.** | **08** |
| | **Ans** | Answer: (Construction-03 marks, working-03 marks, Equivalent Sketch-02 marks)<br><br>Battery Construction: Battery consists of – Container, Positive and negative plates, Separators, Cell cover, Electrolyte, Grids, Cell connectors, Taper terminals, sealing compounds etc. Positive and negative plates are arranged alternately and separated by separators. Negative plates are surrounded by spongy lead paste and positive plates are surrounded by lead peroxide. The entire container of battery is filled with an electrolyte. All positive plates are connected to positive terminal and all negative plates are connected to negative terminal.<br><br>Working: In the charged state, each cell contains a lead peroxide ($PbO_2$) on positive plate and spongy Lead (Pb) on negative plate. The chemical changes that takes place during discharging and charging processes are shown by the equation<br><br>Pbo2 + 2H2SO4 + Pb = PbSO4 + 2H2O + PbSO4 + Q<br><br>(+ Plate) Electrolyte (- Plate) (+ Plate) Electrolyte (- Plate) Energy<br><br>On discharging both PbO2 and Pb are converted to Lead Sulphate (PbSO4) and the Electrolyte losses its dissolved Sulphuric acid and becomes primarily water. During recharging the electrodes are converted. back to lead peroxide on positive plate and spongy lead on negative plate. The chemical activity inside the battery depends on the temperature of electrolyte. At higher temperatures, the activities are faster while at lower temperature are slower. | |

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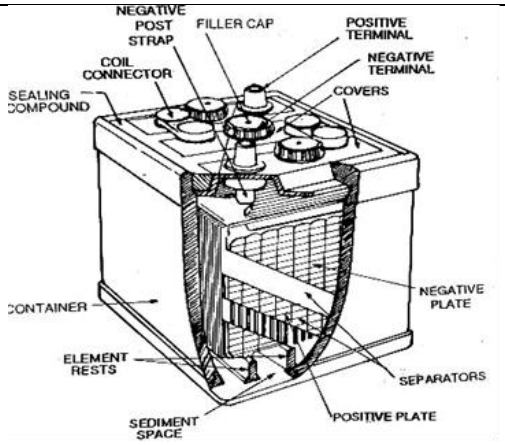
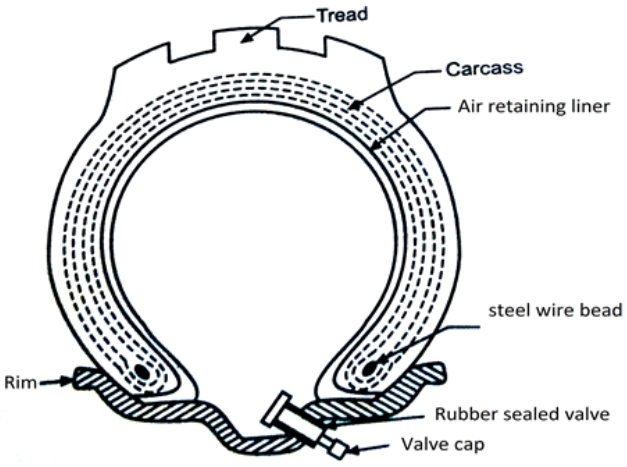
| | |  Figure: Cut section of Lead acid battery | |
| **4** | **(A)** | **Attempt ant THREE of the following:** | **12** |
| | **(a)** | **Describe tubeless tyre with neat sketch** | **04** |
| | **Ans** | Answer: (sketch – 02 marks, Description –02 marks)<br><br>This type of tyres does not separate tube, instead the air under pressure is filled in the tyre for which purpose a non-return valve is fitted to the rim. The inner construction of tyre is almost the same as that of tubed tyre, except that it is lined on inside with special air retaining liner. The tubeless tyre is lighter and runs cooler than the tube tyre.<br><br>  <br>Figure: Tubeless tyre | |

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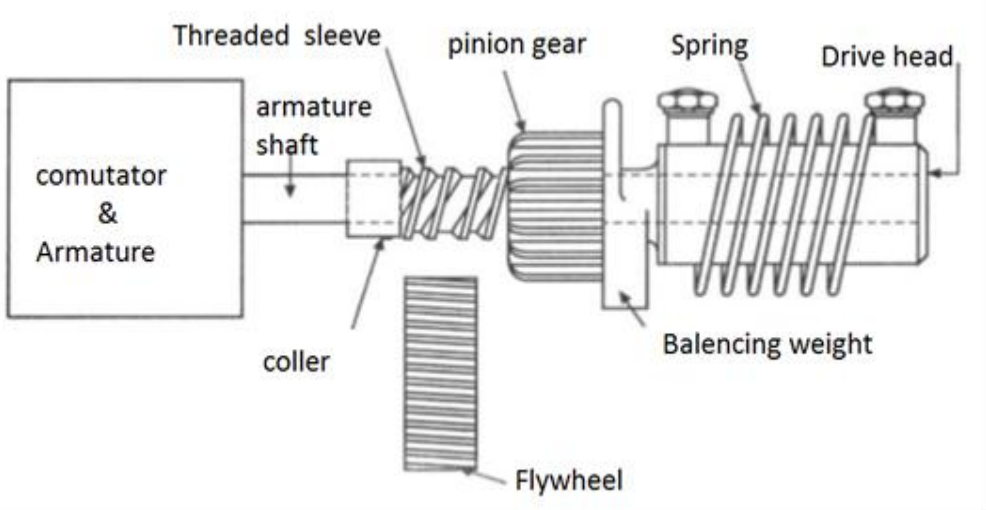
| | **(b)** | **State the procedure of wheel balancing.** | **04** |
| | **Ans** | Answer: ( Any one balancing procedure give 04 marks)<br>Wheel and tyre assembly is checked for wheel balance either on or off the vehicle. There<br>are two types of wheel balance.<br>1. Static balance<br>2. Dynamic balance<br>**1.Procedure of static balancing**<br>First remove wheel from the vehicle, place the wheel on bubble or static balancer If the wheel is heavier in one section, the bubble in the center of balancer will move off cetre. Balance the wheel by adding wheel weights to the rim until the bubble is centered. Steel wheel and aluminum wheels may require different types of clip on weight. Aluminium wheel may require adhesive or stock on weight.<br>OR<br>**2.Procedure of dynamic balancing**<br>Check recommended tyre pressure of the wheel, tyre condition/rim for any damage, don't balance, and replace it. If tyre –rim condition ok, mount wheel and lock it, remove stones & old weights from wheel. Set balance for size of tyre. Start balancing machine and stop after some specific rotations (200-300 revolutions). Read the value of imbalance on left & right wheel. Put respective weight on both the wheel. Start balancing machine once again, if reading is zero on both side with green colour, wheel is balanced. If reading does not show zero reading, with some numeric value with red color, repeat the procedure. Remove wheel after complete balancing. | |
| | **(c)** | **Write different colour codes used in automobile wiring system.** | **04** |
| | **Ans** | Answer: Color code with function 1mark (any Four) | |

| **Sr. No** | **Colour** | **Colour code** | **Function** |
|---|---|---|---|
| 01 | Brown | BR | Battery circuit |
| 02 | yellow | Y | Generator circuit |
| 03 | White | W | Ignition circuit |
| 04 | Green | G | Auxiliary circuit |
| 05 | Blue | BL | Head lamp circuit |
| 06 | Red | R | side lamp and tail lamp |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | circuit | |
| | | | 07 | Black | B | Earthed circuit | |
| | **(d)** | **Explain the working of bendix drive with neat sketch** | | | | | **04** |
| | **Ans** | Ans: (2 Marks for diagram, 2 Marks for Working)<br><br>Bendix drive used in starting system:<br><br>  <br><br><br>Figure: Bendix Drive<br><br>(Note: Equivalent credit shall be given to any other suitable sketch if drawn)<br><br>Bendix drive is an inertia based drive in which the pinion on the starter motor armature engages and disengages with the flywheel depending on the inertia of motor and flywheel. When the ignition switch is turned „ON", the starter motor armature starts spinning. This causes the sleeve to rotate while the pinion is stationary due to the unbalanced weight. The pinion hence moves axially towards the collar until it engages with the flywheel ring gear. Since the pinion cannot move further axially, its starts to rotate along with the sleeve thereby also rotating the flywheel. When the flywheel starts rotating at above 100 rpm the engine gets starts. After the engine has started the pinion gear is turned by the engine much faster than rotated by starting motor. This causes, the pinion gear to turn back on the threaded sleeve, making it disengaged with the flywheel | |

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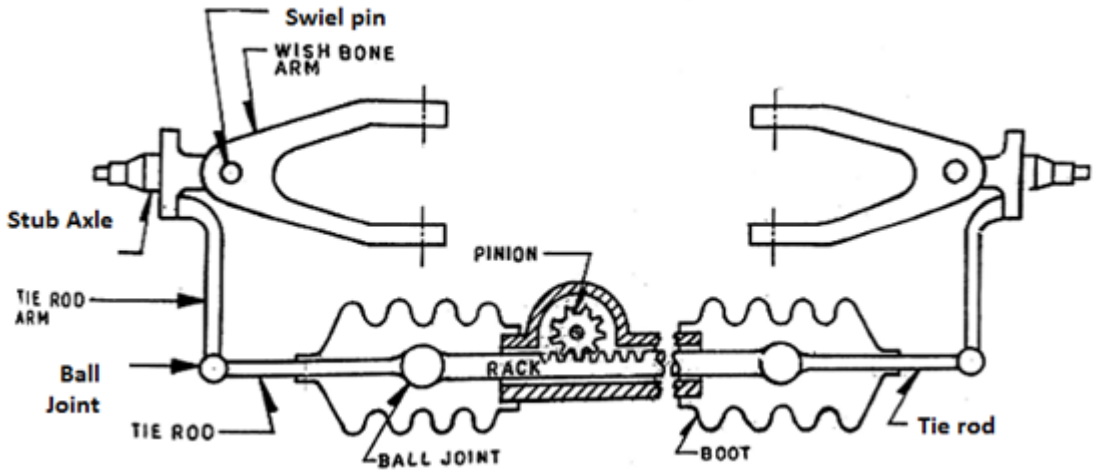
| | **(B)** | **Attempt ant ONE of the following:** | **06** |
| | **(a)** | **Explain working of Rack and pinion type steering gear system.** | **06** |
| | **Ans** |  **Figure: Rack and pinion steering gear box**<br><br>**Working:** The rack-and-pinion steering box has a pinion, connected to the steering column. This pinion runs in mesh with a rack that is connected to the steering tie rods. Both the pinion and the rack teeth are helical gears. Helical gearing gives smoother and quieter operation for the driver.<br><br>Turning the steering wheel rotates the pinion, and moves the rack from side to side. Ball joints at the end of the rack locate the tie-rods and allow movement in the steering and suspension. Mechanical advantage is gained by the reduction ratio. The value of this ratio depends on the size of the pinion. A small pinion gives light steering, but it requires many turns of the steering wheel to travel from lock, to lock. A large pinion means the number of turns of the steering column is reduced, but the steering is heavier to turn. | **03**<br><br>**03** |
| | **(b)** | **State and explain air conditioning parameters for human comfort** | **06** |
| | **Ans** | **Answer: ( Any three parameters each for 02 marks)**<br><br>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 210C to 250C. 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.<br><br>**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%. | |

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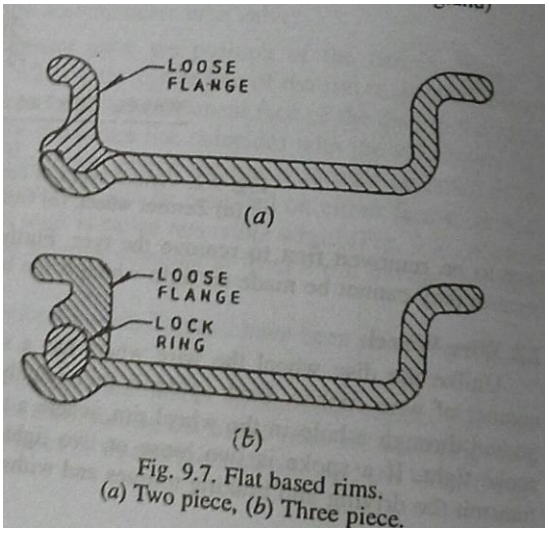
| | | **3) Purity of air:** A person does not feel comfortable when breathing in contaminated air even if temperature and humidity is within comfortable range. Therefore, proper filtration, cleaning and purification of air is necessary to keep it free from dust, dirt and other impurities. The proper percentage of oxygen in air is necessary to be maintained for human comfort. Therefore, proper filtration system is provided in HVAC system in automobiles.<br><br>**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. | |
| **5** | | **Attempt ant THREE of the following:** | **16** |
| | **(a)** | **Explain the types of Wheel Rims.** | **04** |
| | **Ans** | (Any suitable answer will get full credit.)<br><br>It is well type of structure in which the tyre is contained. Different types of rims used are well base, flat base three piece rim, semi-drop centre and flat base divided type.<br><br>For car tyre, well base or drop centre is the common tyre. The tyre is pressed into recess of the drop centre or well for leveling the opposite side over the rim flange. A slight taper of 5 degree is provided for riding up the bead due to air pressure in the tyre.<br><br>**Flat based three piece rim:** It has flat base and is in three pieces. The three pieces are fixed flange, loose flange and lock ring. In case of heavy vehicles tyres it difficult to break beads while putting a tyre on rim this kind of rims are used. They can be used only with tubed tyres Use : commercial vehicle<br><br>  <br>Fig. 9.7. Flat based rims.<br>(a) Two piece, (b) Three piece.<br><br>Semi- drop centre rim is two piece rims. It is a compromise between the well base and the flat base rim. It is suitable for light vehicles. Its removal is simplified by spilt, detachable flange while the tyre is locked to the rim by slight taper. When the tyre is being removed, the slight well may be used. | **04** |

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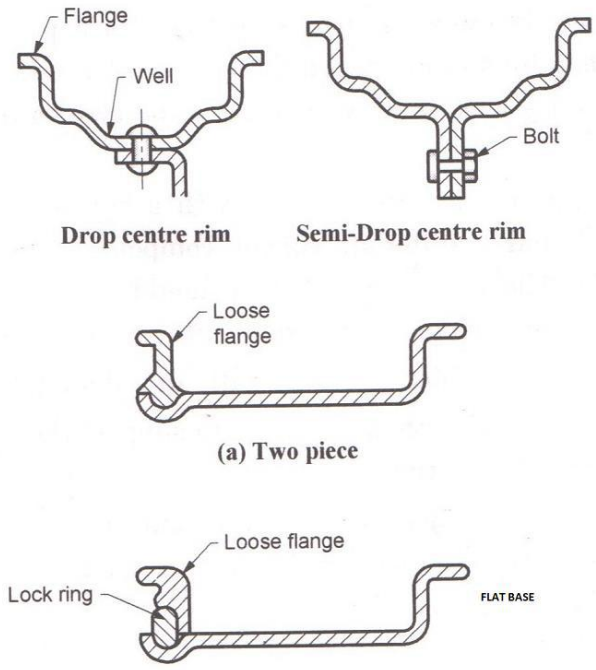
| | | Flat base divided rim is mainly used on military vehicles. It is made in two sections which are bolted together by a ring of nuts adjacent to the rim. While changing the wheel these nuts should be removed.<br>  | |
| | **(b)** | **Why differential is needed? Draw neat sketch of differential.** | **04** |
| | **Ans** | **Need of Differential in automobile:**<br>1) When vehicle is taking turn outer wheel will have to travel greater distance as compared to inner wheel.<br>2). If the vehicle has a solid rear axle only and no other device, there will be tendency to skid.<br>3. Hence wheel skidding is avoided by incorporating the mechanism i.e. differential.<br>4) Differential reduces the speed of inner wheel and increases the speed of outer wheel when vehicle is taking turn, at the same time keep the speed of rear wheel same when going straight ahead. | **02**<br><br>**02** |

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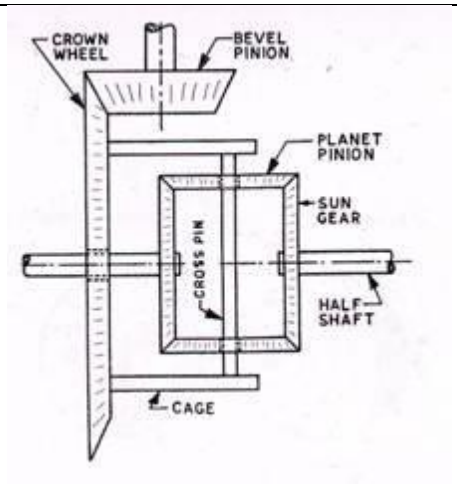
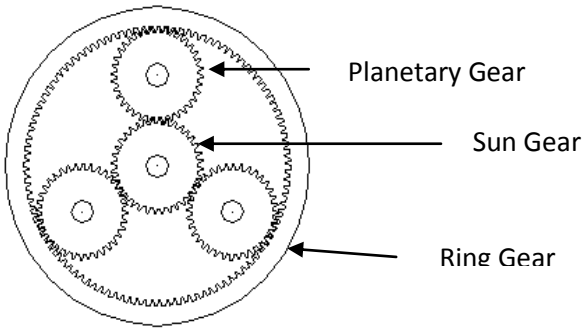
| | |  | |
| | **(c)** | **Explain the working of epicyclic gear box with neat sketch.** | **04** |
| | **Ans** | In epicyclic gear box epicyclic gear train is a very general term. Basically, it involves 3 gears: a sun gear, a planet gear and a ring gear, the underlying concept being many gear ratios can be obtained from a small volume as compared to other other types of gear trains which take up more space. Unlike simple gear trains, an epicyclic gear train requires defining more than one input to obtain a specific output, hence making the analysis a little difficult and non-intuitive. Their advantages include space efficiency, low transmission losses and flexibility. Many outputs can be obtained by fixing a gear, i.e making it stationary, giving input to another gear and taking output from the third gear. For eg: The ring gear can be made stationary by using a brake, input given to the sun gear, and output taken from the Planet gear by using a spider arrangement.<br>  <br>**Figure: Epicyclic gear box** | **02**<br>**02** |
| | **(d)** | **Explain the importance of aerodynamic shape of a car body** | **04** |
| | **Ans** | **Importance of aerodynamic body of car:** The body of vehicle is designed to protect the passenger as well as various components of the vehicle from the air. An aerodynamic shape of car body is the external shape of car body which will offer least resistance to air motion. Whenever car | |

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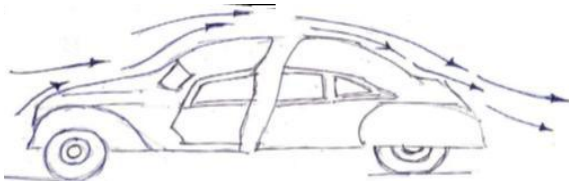
| | | is moving there is an air resistance to motion of car. This air resistance depends on (i) Size of car (ii) frontal shape and area (iii) speed and (iv) wind velocity. This air resistance is given by Ra= Ca.A.V2 Where, Ra - Air Resistance, Ca - coefficient of air resistance and V= Velocity of vehicle (speed) Now as frontal projected area of vehicle increases then vehicle air resistance increases & vice-versa. Figure shows the use of curved surfaces in modern vehicles instead of flat surfaces. Frontal area of car body is designed in such a way that front portion is made inclined & body is given smooth curves. This offers a least resistance to air and called as an aerodynamic shape. Thus, Aerodynamic shape of car body –<br>1. Reduces fuel consumption.<br>2. Air eddies are not formed behind the body.<br>3. Increases road traction.<br>4. Good on-road stability<br>  <br>**Figure: Streamlined car body** | **04** |
| | **(e)** | **State the advantages of LPG and CNG operated vehicles.** | **04** |
| | **Ans** | **Answer*: ( any 4-1 Mark for each )***<br>**Advantages of LPG & CNG operated engines:**<br>1. Low cost of fuel.<br>2. Less pollution and more efficiency.<br>3. It is safer for vehicle. The LPG/CNG fuel tank is made of thick wall so they can withstand dynamic explosion, crash test, and direct gunfire.<br>4. Increased life of lubricating oils, as LPG/CNG does not contaminate and dilute the crankcase oil. No need of oil change frequently which reduce vehicle maintenance.<br>5. Due to its antilock property, CNG can be used safely in engine with compression ratio as high as 12:1 compare to gasoline engine. Because CNG has a higher octane number than petrol, CNG engines operate at higher compression ratio without knocking.<br>6. CNG/LPG fuel systems are sealed, preventing fuel losses from spills or evaporation. | |
| **6** | | **Attempt ant TWO of the following:** | **16** |
| | **(a)** | **Explain the working of telescopic shock absorber with neat sketch.** | **08** |
| | **Ans** | **Working of Telescopic Shock Absorber:**<br>Below figure shows a simple Telescopic Shock absorber. There is a fluid in space above valve assembly (A), below (A) & also in annular space between cylinder (C) & tube (D), which is connected to the space below valve assembly (B). (H) is gland in head (J) & any fluid scrapped off by rod (G) is brought down into annular space through inclined passage shown in head. Eye (E) is connected to axle, while eye (F) is attached to chassis frame. Fluid generally used in shock absorbers is a mixture of 60 per cent Transformer oil & 40 per cent Turbine oil. When car has come across a bump**,** Eye (E) would move up & thereby the fluid will pass from lower side of valve assembly (A) to its upper side.Due to pressure of fluid through rod (G) fluid will be go to underside of valve (B). This passing of fluid through valve openings provides damping. Similarly | **04** |

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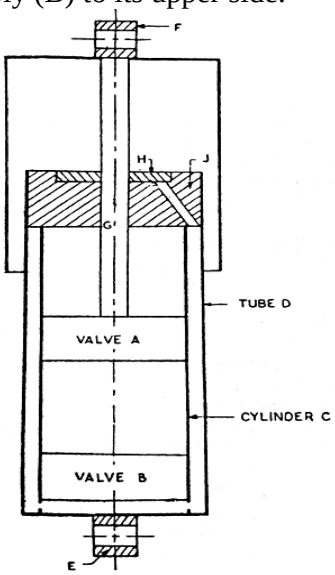
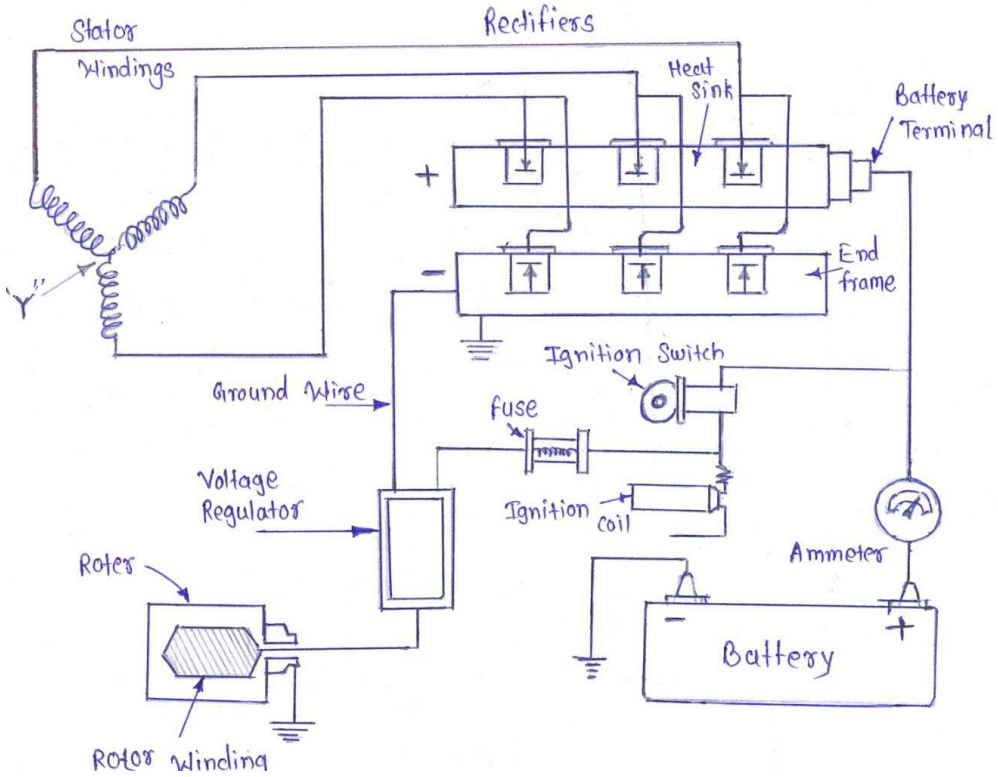
| | | for downward motion of eye (E), fluid will pass upper side of valve assembly (A) to lower side & also from lower side of valve assembly (B) to its upper side.<br>  <br><br>**Figure: Telescopic type shock absorber** | **04** |
| | **(b)** | **State the need of charging system. Explain construction and operation of charging system used in automobiles.** | **08** |
| | **Ans** | **Need of charging system**: - The battery is storage of direct current. The battery has to supply the current to the starter at the time of starting as well as to the various accessories of automobile. Due to prolonged use the charge of battery is decreased. Therefore to keep the battery always in charged condition there is a need of charging system.<br>**Construction**: The charging system consists of an alternator provided with rectifier to convert AC to DC and a voltage regulator to limit the generator voltage to a correct value .The alternator consist of stator , Rotor which is driven by fan belt.<br>**Operation**: - When the Ignition switch is turned on, the rotor receives the current from the battery through the voltage regulator. This current energizes the rotor field magnet, which induce a current in the stator windings as the rotor is turned by the pulley. The induced alternating current is changed to direct current by the rectifier.<br>When rotor speed increases, the DC voltage of the alternator increases as the battery gains in charge. To limit the generator voltage a voltage regulator is used. | **01**<br>**02**<br>**02**<br>**03** |

**SUMMER– 18 EXAMINATION**

**Model Answer**

**Subject Name: Automobile Engineering** **Subject Code:** 17526

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| | **(c)** | **Explain the working of car-conditioning system with neat layout.** | **08** |
| | **Ans** | Air Conditioning System in a Car works on Vapor compression cycle. It consists of compressor, condenser, evaporator, receiver, expansion valve, thermostat, blower fan and heating core.<br>In compressor during suction stroke low pressure vapor in dry state is sucked from evaporator. It is then compressed to high pressure and temperature. These vapors are then passed into condenser where heat is removed by cooling medium which converts vapor into liquid. The liquid is stored into receiver. The liquid from receiver is then passed to evaporator through expansion valve. Expansion valve reduces pressure. The low pressure liquid refrigerant enters evaporator, where it absorbs the heat from the warm air which is passed over the evaporator. The worm air gets cooled thereby cooling the passenger compartment. Due to heat absorption, liquid refrigerant gets converted into vapor and these vapors are passing to compressor. | **04**<br><br>**04** |

**SUMMER– 18 EXAMINATION**

**Model Answer**

**Subject Name: Automobile Engineering** **Subject Code:** 17526

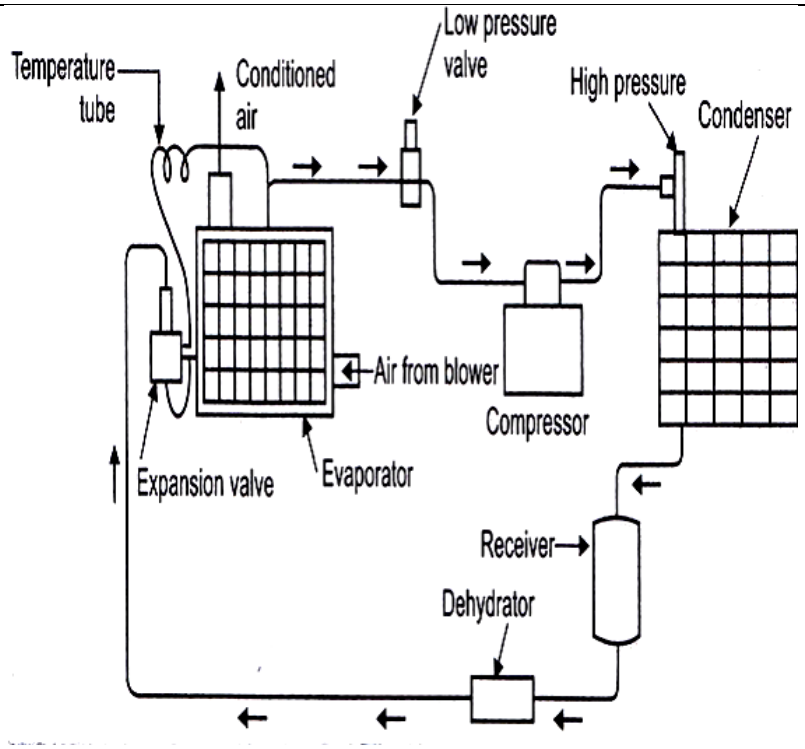


**Figure: Layout of car air-conditioning system**