**WINTER– 16 EXAMINATION**

**Model Answer**

**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 THREE of the following :** | 12 |
| | (a) | **Describe the ergonomic aspect for**<br>**i) Motorcycle Handle bar ii) Driver's seat (Motorcycle)** | 04 |
| | | **Answer :**<br>**i) Motorcycle Handle bar**<br>It gives rider a proper leverage to make the front wheel as his wish or as he required. The position of handle bar should be ergonomically correct. It is related to rider's driving comfort. The handle bar is fitted with controlled sleeves and handgrip on both sides. The handle bar it is made in different shapes and design keeping in mind the rider comfort and different views. The handle bar position is concerns with the shape of seat and foot rest. The location of foot rest & shape of seat as well the handle bar position differs as per manufacturers. It also depends upon the type of bike. Different type of bike has a body position, feet position and hands position The Handle bar position gives proper gesture to the rider. Improper selection of bike may create the back pain or other problems to the rider while long drive. The handle bar should be lighter and transmit less vibration.<br>**ii)Driver's seat (Motorcycle)**<br>The design of the motorcycle is limited by the physical constraints of making the machine work. Comfort and ease of use, and ultimately your safety, will be determined by the type of bike you choose and this should depend on how you plan to use it. The seat and footrests are the right height for you. The fit of the bike to the user can be critical in long term comfort. Riders, of course, are different shapes and sizes so a bike that works well for | **02**<br>**02** |

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| | | one person may not work for someone else. It is more convince to both rider & pillion rider to seat for long trip or tour. The tapper portion of raised seat supports the seating arrangement for rider. The taper portion of seat supports the back bone of rider. For pillion riders the design of seat at rear end is important. At the time of braking due to inertia effect the pillion rider should moves on front side pushing the rider at downward direction not in forward direction. It improves the comfort driving as well as seating. Now a day Instead of using separate seat for rider & pillion rider, combined seat is used for better comfort. It provides large space as compared to earlier (old) designed seat. The front side of seat should have narrow section which gives comfort zone to rider while driving. Seat should have good cushioning (use of helical tension spring & leather) to protect both rider & pillion rider from shocks & vibrations on road. | |
| | **(b)** | **Describe purpose of providing caster angle.** | **04** |
| | | **Answer :**<br>**Caster Angle** –<br>The angle between the vertical line and king pin centre line in the plane of the wheel is called the caster angle. It ranges from $2^0$ to $8^0$.<br>**purpose of caster angle (any 3 points)**<br>i) The positive caster produces directional stability by causing the wheels to lead or follow in the same direction as the vehicle travels.<br>ii) When the both front wheels have positive caster the vehicle tends to roll out or lean out on turns.<br>iii) But if front wheels have negative caster then the vehicle tends to back in on turn<br>iv) Positive caster increase the effort required to steer and tries to keep the wheels straight ahead.<br>**v)** In the heavy duty trucks negative caster is provided. This makes steering easier. | **01**<br><br>**03** |
| | **c)** | **Explain construction and working of expanding shoe type brakes.** | **04** |
| | | **Answer :**<br>In a motor vehicle the wheel is attached to an auxiliary wheel called drum. The brake shoes are made to contact this drum. In most designs, two shoes are used with each drum to form a complete brake mechanism at each wheel. The brake shoes have brake lining on their outer surfaces. Each brake shoes is hinged at one end by an anchor pin, the other end is created by some means so that brake shoes expand outwards. The brake linings come into contact with the drum. Retracting springs keeps the brake shoes into position when the brakes are not applied. The drum encloses the entire mechanism to keep out dust and moisture. When the pedal is pressed the cam moves the shoes outwards through linkages, thereby coming in frictional contact with the rotating drum. As soon as the brake pedal is released the retaining springs help the brake shoes to bring back and releases brakes. | **02** |

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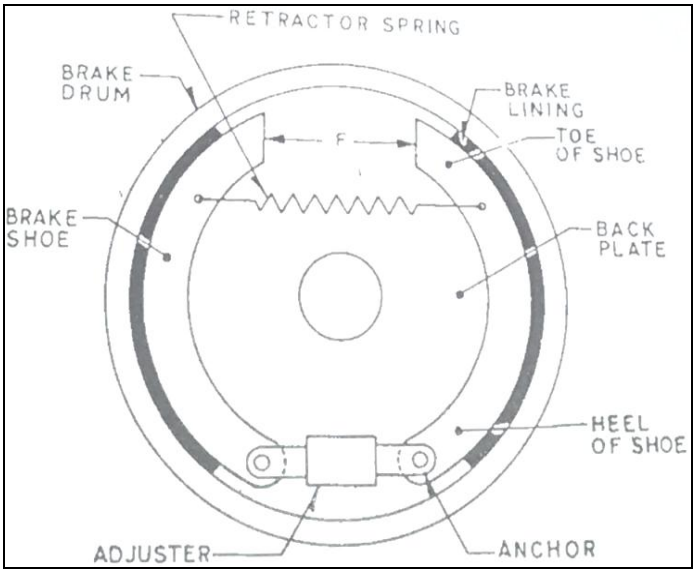
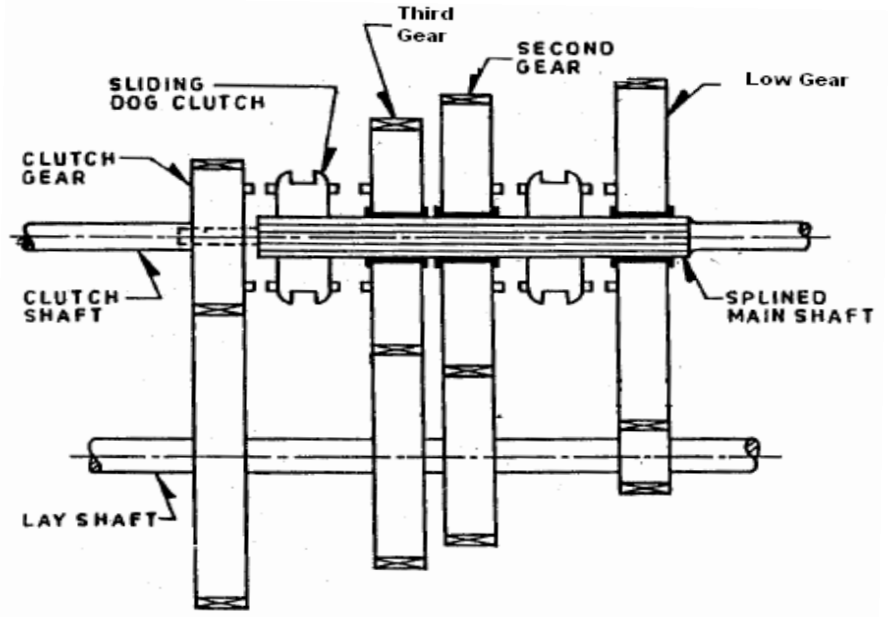
| | |  <br>Figure: Internal expanding shoe type of mechanical brake | **02** |
| | **(d)** | **Describe purpose of lubrication system.** | **04** |
| | | **Answer :**<br>*(any four points)*<br>i) Reduce frictional resistance of the engine to a minimum to ensure maximum mechanical efficiency.<br>ii) Protect engine against wear.<br>iii) Serves as cooling agent by picking up heat.<br>iv) Remove all impurities from the lubricated region<br>v) Form a seal between piston ring and cylinder wall to prevent blow by.<br>vi) To prevent overheating of engine. | **04** |
| **1** | **(B)** | **Attempt any <u>ONE</u> of the following :** | **06** |
| | **a)** | **Explain construction and working of constant mesh gear box with neat sketch.** | **06** |
| | | **Answer: Constant mesh gear box:**<br>**Construction:** A simplified diagram of constant mesh box has been shown in Figure. In this gear box, all gears on the main transmission shaft are constantly connected to corresponding gears on countershaft or lay shaft. In addition, two dog clutches are provided on the main shaft. One dog clutch is between the third gear and clutch gear and another is between the first (Low) gear and second gear. | **02** |

**Working:** Top or 4th speed gear is obtained when the left dog clutch is slides to left to mesh with clutch gear by using the gear shift lever. In this case, main shaft rotates at the same speed as that of clutch gear or engine crankshaft speed which is the maximum speed. Third gear is obtained when dog cutch (left side) meshes with third gear on main shaft. In this way by sliding the second dog clutch, second and first gears are obtained. **02**




**02**

**(b) Differentiate between two stroke and four stroke engine (any six points)** **06**

**Answer: Differentiate between two stroke engine and four stroke Engine:** *(Any six points)*

| Sr. | **Four Stroke Engine** | **Two Stroke Engine** |
|---|---|---|
| 1 | One **working stroke** for **every two revolutions** of the crankshaft. | One **working stroke** for **each revolutions** of the crankshaft. |
| 2 | Turning moment on the crankshaft is not even due to one working stroke for every two revolutions of the crankshaft. Hence **heavy flywheel** is required and engine runs unbalanced | Turning moment on the crankshaft is more even due to working stroke for each revolution of the crankshaft, hence **lighter flywheel** is required and engine runs balanced. |
| 3 | Engine is heavy. | Engine is light. |
| 4 | Thermodynamic cycle is completed in 4 strokes of piston or in two revolutions of crankshaft | Thermodynamic cycle is completed in 2 strokes of piston or in one revolutions of crankshaft |
| 5 | Volumetric efficiency is more. | Volumetric efficiency is less. |
| 6 | Thermal efficiency is more. | Thermal efficiency is less. |
| 7 | Engine design is complicated. | Engine design is simple. |
| 8 | Less mechanical efficiency due to more friction on many parts. | More mechanical efficiency due to less friction on few parts. |

**06**

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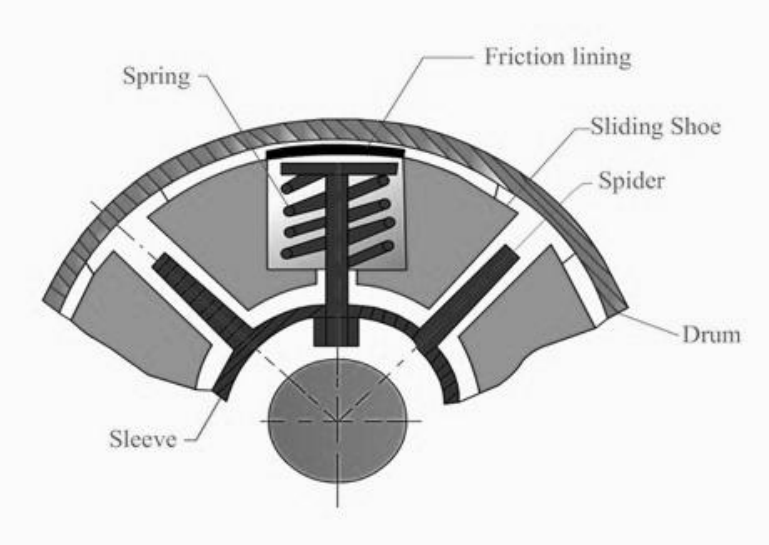
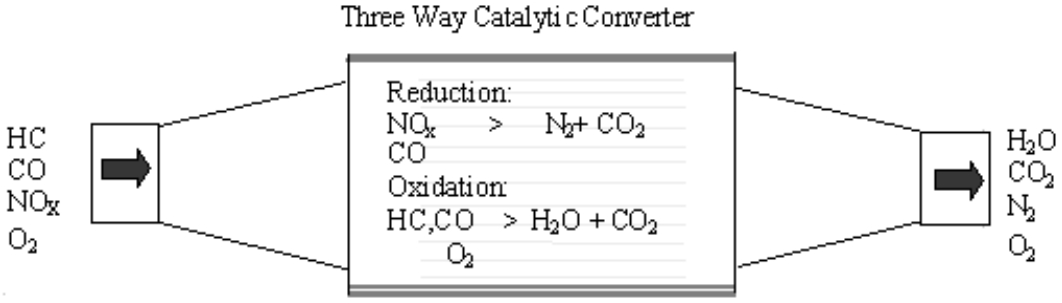
| | | 9 | More output due to full fresh charge intake and full burnt gases exhaust. | Less output due to mixing of fresh charge with burnt gases. |
| | | 10 | Engine runs cooler. | Engine runs hotter. |
| | | 11 | Engine requires more space. | Engine requires less space. |
| **2** | | **Attempt any FOUR of the following** | | **16** |
| | **(a)** | **State function of clutch. Draw a neat sketch of centrifugal clutch.** | | **04** |
| | | **Answer: function of Clutch:**<br>i) Clutch disengages and engages the engine to the transmission whenever required.<br>ii) It transmits engine power to the gear box.<br>iii) By using clutch we are able to shift the gears smoothly without damaging gear teeth. | | **02** |
| | |  <br>Figure: Centrifugal Clutch<br>*(Note: Equivalent shall be given to any other suitable sketch)* | | **02** |
| | **(b)** | **Draw a neat sketch of catalytic convertor and state any four advantages of catalytic convertor.** | | **04** |
| | | **Answer:**<br>  | | 02 |

**OR**

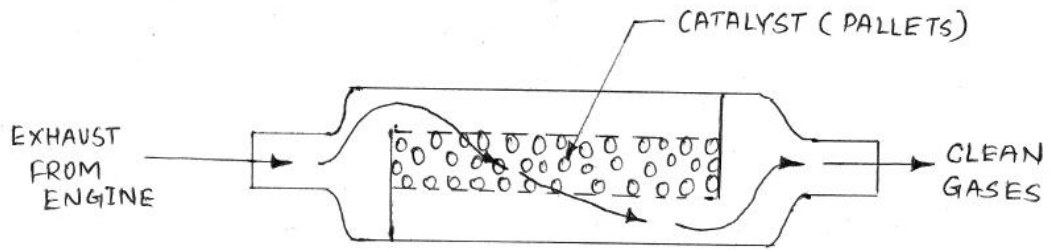



FIG: Catalytic Converter

*(Note: Equivalent shall be given to any other suitable sketch)*

**Advantages of Catalytic convertor:**

i) In Two way Catalytic convertor it converts carbon monoxide from exhaust gases into carbon dioxide by oxidation process.

ii) In Two way catalytic convertor it converts unburnt hydrocarbons into carbon dioxide and water by oxidation process.

iii) In Three way Catalytic convertor in catalyst reduction process reduction of nitrogen oxide to pure nitrogen and oxidation of carbon monoxide to carbon dioxide take place

iv) In Three way Catalytic convertor in catalyst oxidation process oxidation of hydrogen and carbon to water vapors and carbon dioxide take place

In this way catalytic convertor converts more harmful gases into less harmful gases.

02

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| | **(c)** | **Explain working of double acting types of shock absorbers with neat sketch.** | **04** |
| | | **Answer: Double acting type of shock absorber:**<br>The telescopic shock absorber is shown in fig its upper eye is connected to the axle and the lower eye to the chassis frame. A two way valve A is attached to a rod another two way valve B is attached to the lower end of cylinder the fluid is in the space above and below the valve A and also in the annular space between the cylinder and tube which is connected to the space below the valve B the heat has a gland. Any fluid scraped off by the rod is brought down into the annular space through the inclined passage. When the vehicle comes across a bump the lower eye moves up. Therefore the fluid passes from the lower side of the valve A to its upper side but since the volume of the space above valve A is less than the volume of the rod the fluid exerts pressure on the valve B. This pressure of the fluid through the valve opening provides the damping force. Similarly when the lower eye moves down the fluid passes from the upper side of the valve A to the lower side and also from the lower side of the valve B to its upper side. | **02** |

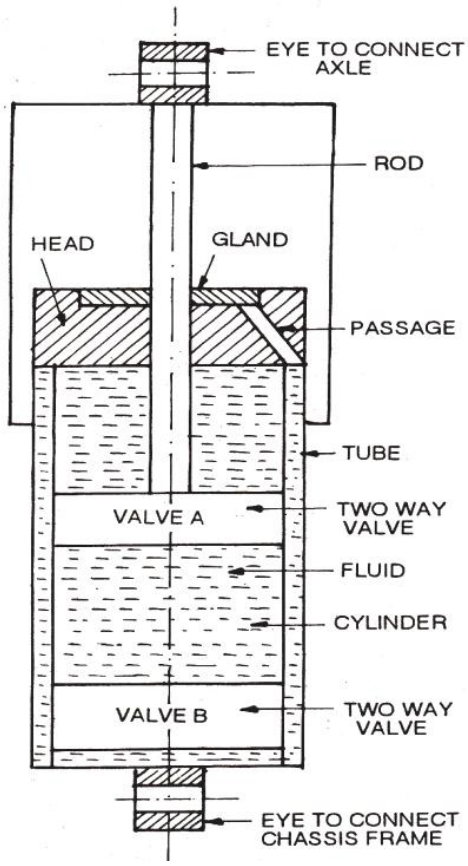


Figure: Double acting shock absorber

**02**

**(d) Differentiate between hydraulic and Mechanical brakes.** **04**

Answer: Any four points)

| Sr. | Mechanical brake | Hydraulics brake |
|---|---|---|
| 1. | In mechanical breaks no need of brake fluid so brake shoes will not affect by any leakages. | Brake shoes will be affected if leakage of brake fluid occurs |
| 2. | More effort is required for applying brakes | Less effort is required for applying brakes |
| 3. | Braking is less powerful than Hydraulics brakes | Braking is powerful |
| 4. | More frictional losses | Less frictional losses as it is self-lubricating |
| 5. | Simple in construction | Complicated in construction than mechanical brakes |
| 6. | Less efficient than Hydraulics brake | More efficient than mechanical brake |
| 7. | Maintenance/repair cost is less | Maintenance/repair cost is more |
| 8. | Comparatively easy to remove and replace friction pads | Removal and replacement of brake linings is difficult and consumes more time. |
| 9 | Air bleeding kit is not required | Air bleeding kit is required |
| 10 | Pressure intensity is less | Pressure intensity is more |

**04**

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| | **(e)** | **State use of (i) Speedometer (ii) Trip meter** | **04** |
| | | Answer: **Use of** -<br>**i) Speedometer**: Speedometer indicates the driving speed of vehicle that is kilometer per hours. It also indicates the total running kilometer by vehicle.<br>**ii) Trip meter-** It is used to record distance covered in a trip or tour. Also helps in calculating mileage. | **02**<br>**02** |
| | **(f)** | **Illustrate the use of helmet for safety concern.** | **04** |
| | | **Answer:**<br>**Helmet:**<br>The primary goal of motorcycle helmet is motorcycle safety to protect the riders head during impact, thus preventing or reducing head injury and saving the riders life. Some helmets provide additional convenience such as ventilation, face shield and ear protection. The helmet is used to protect the head injury at front, rear and head restraint. The helmet protects against cervical spine injury. It provides protection against noise, wind and improves visibility. | **04** |
| **3** | | **Attempt any FOUR of the following** | **16** |
| | **a)** | **List out any four types of frame.** | **04** |
| | | **Answer**<br>**Types of frame: motorcycle/ Mopeds use three basic frames**<br>1) Cradle-single cradle and double cradle frame<br>2) Backbone frame<br>3) Tubular frame-single down tube using engine as stressed member<br>4) Stamped frame | **04** |
| | **b)** | **Draw a block diagram and working of positive crank case ventilation.** | **04** |
| | | **Answer**<br>Positive Crankcase Ventilation System Since water vapour in exhaust and blow by gases enter crankcase due to various reasons there is every chance that these contaminants will cause sludge and corrode metal parts. Therefore a mean of removing these contaminants before they can act on the oil is essential. In Positive Crankcase Ventilation system the un-burnt gases are re-circulated into the combustion chamber and burnt with the fresh charge. Another reason of using crankcase ventilation is to relieve any pressure build-up in the crankcase which may cause crankshaft seal leakage The figure shows the intake manifold return PCV system. It has a tube leading from the crankcase or else the rocker arm cover through a flow control valve into the intake manifold usually just below the carburettor. To provide proper ventilation of the interior of the engine, fresh air is usually drawn through a rocker arm cover opposite that containing the PCV system | **02** |

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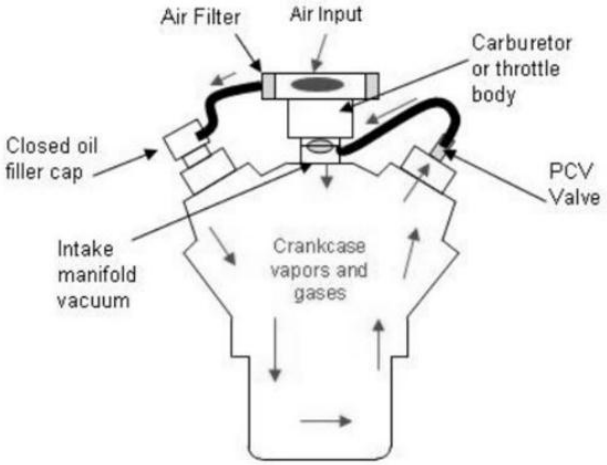
| | |  Figure: PCV system. | **02** |
| | **c)** | **Write down any four advantages of mono shock suspension system.** | **04** |
| | | **Answer Advantages of gas filled shock absorber** used at rear end-*(Any four points-1Mark each)*<br>1. The full diameter of the tube can be used as a working chamber and thereby a larger volume of oil becomes available for damping.<br>2. The larger volume of oil made available in any one stroke because of the adjustments between gas and oil volumes provides a better facility for the damping force.<br>3. The tolerance to heat in gas filled shock absorber is greater.<br>4. Gas filled shock absorber give longer life to tyres and other related components in the suspension such as springs, brushes etc.<br>5. A gas filled shock absorber is designed to reduce foaming of the oil.<br>6. Provide stability while graduating turns. | **04** |
| | **d)** | **Explain criteria for selection of wheels and tyres.** | **04** |
| | | **Answer**<br>**Criteria for selection of a tyre:** ***(****Any four points****)***<br>**1. Performance and efficiency:** A tyre should give good performance in rain, cold/ hot weather, on different road surfaces. It should provide very good fuel economy by offering lower rolling resistance.<br>2. **Cost**: A tyre should have low cost.<br>3. **Road Grip**: It should have a very good grip of road surface on hot/ cold/ wet/ dry/ gravel road surface while travelling straight or cornering.<br>4. **Comfort**: It should provide a comfortable ride to the rider and pillion rider<br>5. **High speed stability**: A tyre should provide better high speed stability.<br>6. **Handling characteristics**: A tyre should provide better cornering behavior.<br>7. **Durability**: it should have long life.<br>8. **Cushion**: It should provide adequate cushion against road shocks.<br>9. **Temperature**: it should have a characteristic by which the tyre for specific application, will quickly reach optimal operating temperature to provide proper road grip and performance.<br>10. **Tread Depth**: It should provide adequate tread depth as per application. | **04** |

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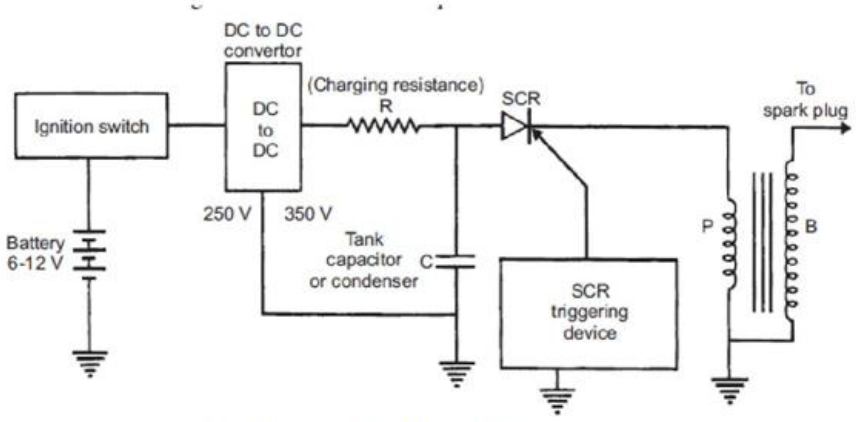
| | **e)** | **Describe the working of Condenser Discharge Ignition (CDI) System.** | **04** |
| | | **Answer: Working of CDI system:**<br>It mainly consists of 6-12 V battery, ignition switch, DC to DC convertor, charging resistance, tank capacitor, Silicon Controlled Rectifier (SCR), SCR-triggering device; step up transformer, spark plugs. A 6-12 volt battery is connected to DC to DC converter i.e. power circuit through the ignition switch, which is designed to give or increase the voltage to 250-350 volts. This high voltage is used to charge the tank capacitor (or condenser) to this voltage through the charging resistance. The charging resistance is also so designed that it controls the required current in the SCR.<br><br>Depending upon the engine firing order, whenever the SCR triggering device, sends a pulse, then the current flowing through the primary winding is stopped. And the magnetic field begins to collapse. This collapsing magnetic field will induce or step up high voltage current in the secondary, which while jumping the spark plug gap produces the spark, and the charge of air fuel mixture is ignited.<br>CDI system consists of primary circuit and secondary circuit.<br>**The primary circuit consists of following components:**<br>i) Primary winding of pulse transformer ii) Condenser iii) Resistance iv) SCR v) Pulse generator. vi) Battery vii) DC to AC convertor/charging device<br><br>**The secondary circuit consists of following components:**<br>i) Secondary winding of pulse transformer ii) Spark plug iii) Spark plug HT coil<br><br>  <br><br>Figure 4.4 : Capacitance Discharge Ignition System<br><br>OR<br><br>**Working:**<br>• CDI system uses charge of capacitor for generating spark- using pulse transformer<br>• Thyrister/ silicon controlled rectifier is used as switch- for primary circuit current through capacitor.<br>• It also uses a pulse generator to trigger SCR through Gate circuit.<br>• Pulse transformer has low inductance, so the change in flux across primary and secondary windings is very rapid.<br>• This provides high voltage spark (about 30,000V) during the entire speed range of the | **02**<br><br>**02**<br><br>**02** |

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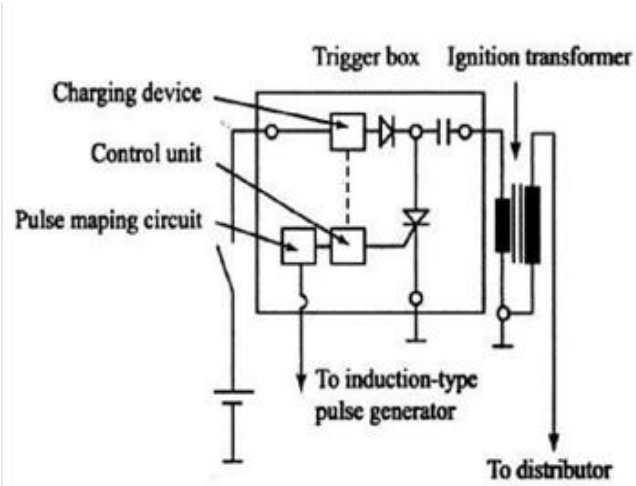
| | | engine.<br>• The electronic circuitry uses conversion of AC to DC charging device, signal conditioning and amplifying unit and control circuit.<br>  <br><br>*Fig. Schematic of Capacitive Discharge Ignition (CDI) System* | **02** |
| | **f)** | **How shape of fuel tank affects on two wheeler performance?** | **04** |
| | | The shape of fuel tank in motorcycle provides the following. *(Any four)*<br>1. It holds adequate fuel as per class of motorcycle.<br>2. Generally the fuel tank shape is a tear drop design. It offers least aerodynamic drag.<br>3. Its shape allows the rider's knees to be included within the contour of front end of vehicle. i.e. the rear end of fuel tank is narrower. This also reduces air drag.<br>4. Appropriately positioned handlebar with adequate handlebar width allows rider to lean forward and reduce air drag. If the driver lies on the fuel tank, then he experiences less of parachute effect. i.e. the vehicle is not slowed down due to aerodynamic drag.<br>5. Its shape accommodates the frame tube and allows fuel to be stored at a lower height to slightly reduce the height of the center of gravity of motorcycle.<br>6. Space is ensured for handlebar turning through the required angle. | **04** |
| **4** | **A)** | **Attempt any THREE of the following.** | **12** |
| | **a)** | **State the benefits of Twin Spark Ignition System.** | **04** |
| | | **Answer Benefits of twin spark ignition system**- *(Any four)*<br>1. The twin spark plugs introduce spark simultaneously in the combustion chamber and improve combustion process, which leads to low emissions, better fuel efficiency and minimizes knocking drastically.<br>2. Because of twin sparks the diameter of the flame increases rapidly that would result in instantaneous burning of fuels. Thus force exerted on the piston would increase leading to better work output.<br>3. Less vibration and noise.<br>4.Long life of the engine parts such as piston ring and valve stem<br>5. Decreases in the specific fuel consumption.<br>6. No overheating. | **04** |

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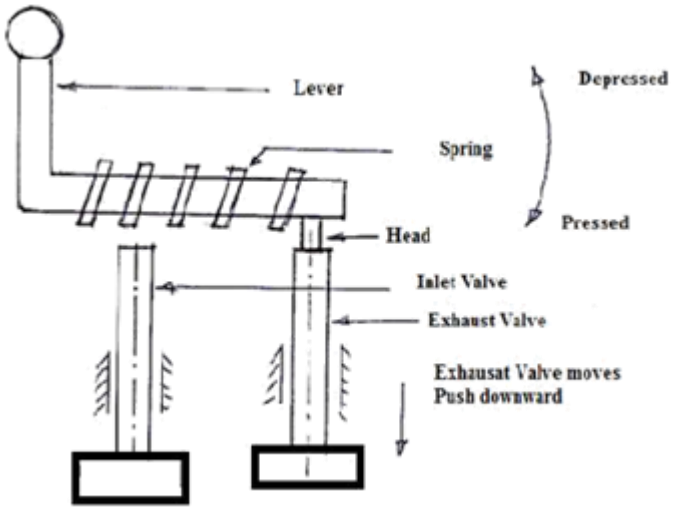
| | | 7. Increase the thermal efficiency of engine and even bear high load on it.<br>8. Increase the thermal efficiency of the engine & even bear high loads on it. | |
| | **b)** | **Why a decompression valve is used in some engine? Draw a schematic diagram for the same.** | **04** |
| | | **Answer**<br>**Purpose of decompression valve:**<br>In two wheelers, some engines are having higher compression ratio, more than 12:1. These vehicles are difficult to start by kick start or self-start mechanism. To overcome the starting problem of such vehicles there is need to use decompression valve mechanism.<br><br>Decompression valve is a mechanism by which exhaust valve is open by plunger with head. It presses the exhaust valve at the end of compression stroke, so that excess amount of compression pressure is reduced, then the vehicle is easily started. (Note: After vehicle is started again depress the decompression valve)<br><br>  <br> | **02**<br><br>**02** |
| | **c)** | **Explain the terms of the belt drive with Variator mechanism.** | **04** |
| | | **Answer:**<br>Belt drive with Variator mechanism consists three basic components- A high power metal or rubber belt, A variable input driving pulley which is connected to the crankshaft of the engine, output driven pulley which transfers energy to the drive shaft. Each pulley is made of two 20 degree cones facing each other. A belt rides in the groove between the two cones. This assembly has rollers which move in and out depending on the load condition and engine rpm giving the differential pulley diameter thus providing the optimum wheel rpm and traction force V belts are preferred if the belt is made of rubber.<br>When the two cones of the pulley are far apart (When the diameter increases) the belt rides lower in the groove and the radius of the belt loop going around the pulley gets smaller. When the cones are close together (when the diameter decreases), the belt rides higher in the groove and the radius of the belt loop going around the pulley gets larger. CVTs may use hydraulic pressure, centrifugal force or spring tension to create the force necessary to adjust the pulley halves. | **02** |

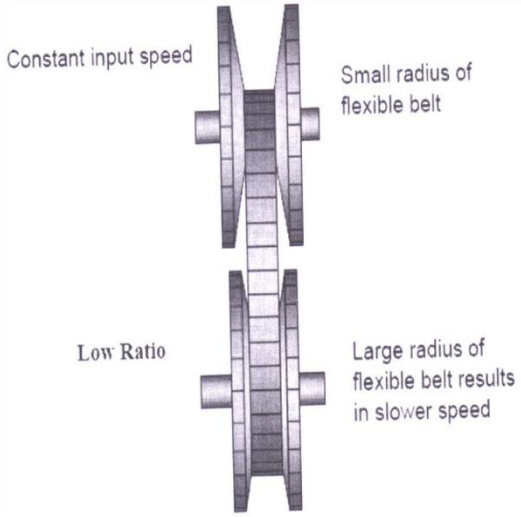
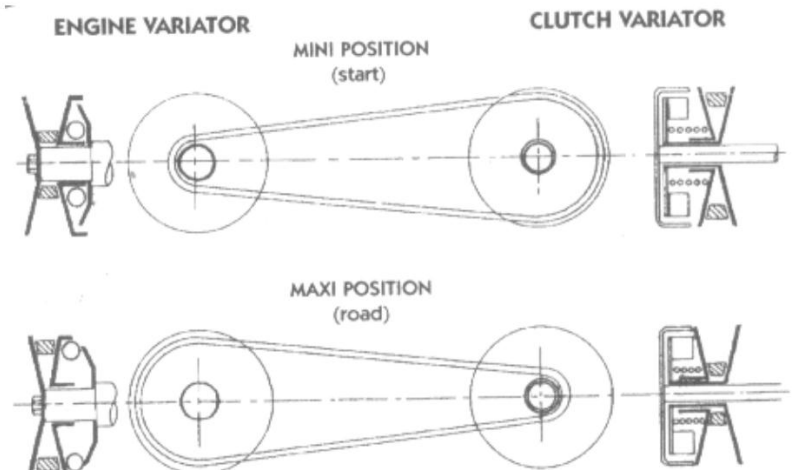



Figure: Pulley based vario drive arrangement

OR




**02**

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| | **d)** | **State the purpose of providing**<br>**i)Crash bar**<br>**ii) Saree guard**<br>**iii)Mud guard**<br>**iv)Sealed beam head lamp** | **04** |
| | | **Answer** The purpose of-(each for 01 mark)<br>**i) Crash bar:** Crash bars aim to protect motorcycle engines and body panels as well as it is used to protect the rider. It is also used as a mount point for accessories like highway pegs, lights and, on police motorcycles, sirens, cameras and radar guns.<br>**ii) Saree guards- T**he Saree guards are very practical accessories that can prevent a lot of unwanted accidents. The Saree guard is an important though local piece of initiative to help loose & flowing clothes from getting tangled in the rear wheel. There have been numerous events where female pillion riders have ended up with injuries because the Saree or Dupatta they were wearing got pulled into the rear wheel resulting in them getting | |

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| | | either thrown off the bike or in extreme events, facing the risk of getting choked So for safety purposes the Saree guard is most essential. The Saree guards will not only protect the rider, but also the cargo from being pulled into the rear wheel.<br>**iii) Mud guard-** It is used in combination with the vehicle fender to protect the vehicle, passengers, other vehicles, and pedestrians from mud and other flying debris thrown into the air by the rotating tire. Mud guard can be aerodynamically engineered, utilizing shaping, louvers or vents to improve airflow and lower drag.<br>**iv)Sealed beam – head lamp:** Sealed beam head lamp means these are complete one assembly which covers head lamp, head lamp reflector and head lamp housing. These are closed with seals (i.e. (Rubber packing/seals). It prevents air to be entered inside the head lamp housing which create air resistance. Air is prevented which contains dust particles affects on the life of head lamp reflector and head light glass. | **04** |
| | **B)** | **Attempt any ONE of the following.** | **06** |
| | **a)** | **State the function of carburetor. Explain working of any one in details with neat sketch.** | **06** |
| | | **Answer**<br>**Functions of carburetor under four engine operating conditions:**<br>**i) Idling:** A separate idling and low speed passage is provided with low speed port and idle port. For idling rich mixture is required in small quantity the throttle valve is almost closed. The whole of engine suction is now applied at the idle port through which air and fuel are drawn, giving rich mixture.<br>**ii) Starting:** Choke is used for starting. it is mounted eccentrically which facilities it's automatic opening after the engine has started as the choke valve is closed, whole of engine suction is applied at the main nozzle, which then deliver fuel. As the air flow is quite small, the mixture supplied is very rich.<br>**iii) Acceleration:** When acceleration is desired the accelerator twist grip is twisted, which actuate the main jet giving an extra supply of fuel for acceleration it must be clear that the purpose of accelerating circuit is not to provide a continuous fuel supply for acceleration, but only to provide extra supply of fuel to avoid flat spot.<br>**iv) Normal running:** The throttle is held partly opened so that engine suction is now applied at the main jet, which now supplies the fuel. The air enters directly through the venturi; the quantity of mixture is controlled by throttle valve.<br>**Down draught carburetor:**<br>**Working:**<br>In down draught carburetor, the fuel flows with air under gravity & fuel need not be lifted by the air& it enters into the cylinder even at low air velocity or low engine speed. In this type of arrangement, some unvapourised fuel is likely to separate out when engine is cold at starting. Therefore provision is to be made to take care of this. The heavy fuel particles are collected at the bottom of the mixing tube which is surrounded by exhaust gases so it is vaporized & carried with the air in the engine. This arrangement is very commonly used in all presently used carburetors. This type of carburetor is mostly used in this type air and fuel mixture flow from top to bottom it is fitted on top or inlet manifold gravitation for help to flow mixture costly. | **02**<br>**02** |

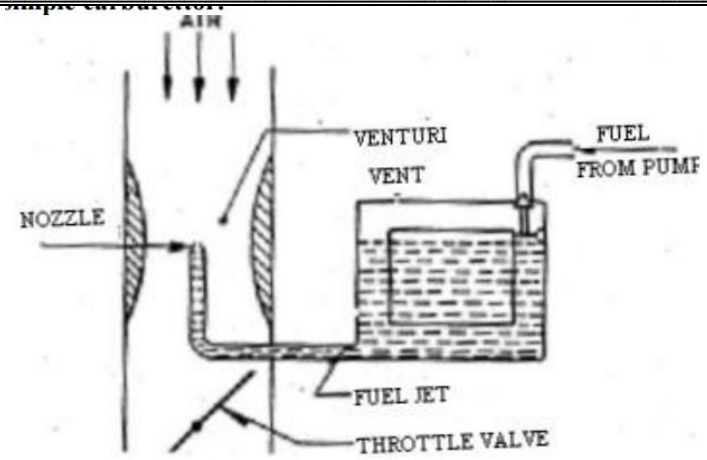
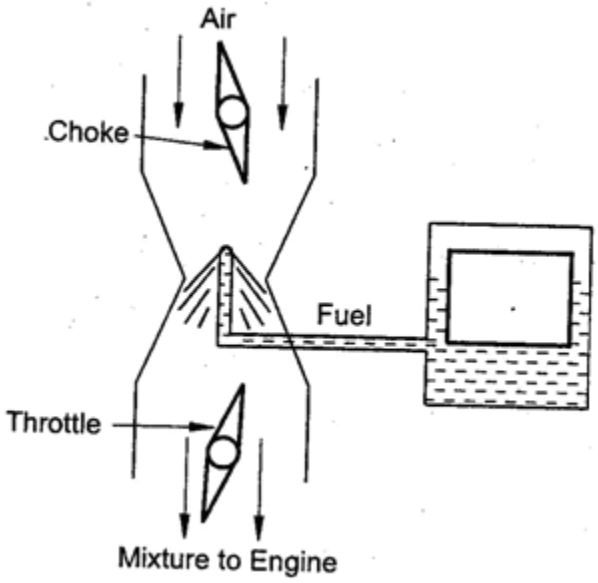



Figure: **Down draught carburetor**

**OR**




(Any suitable type of carburetor description with figure should be given full credit)

**02**

**b) Explain working of charging system with its schematic diagram.** **06**

**Answer***(Working: 3 marks, diagram: 3 marks)*

**Working of charging system of two wheeler:**

The main components of two wheeler charging system are-

1. Battery, 2.Regulator cum rectifier unit (Regulator and rectifier are assemble in one unit), 3. Generator (Magneto) assembly, 4. Fuse

- Generator produces an A.C. supply of 12 V.
- Blue / white (L/W) wire supplies 12 V A.C. from generator to regulator cum rectifier unit.
- Regulator controlled the supply of current and voltage whereas rectifier converts A.C. supply in to D.C.
- Regulator cum rectifier unit supply 12-14.5 V D.C. to the battery with the

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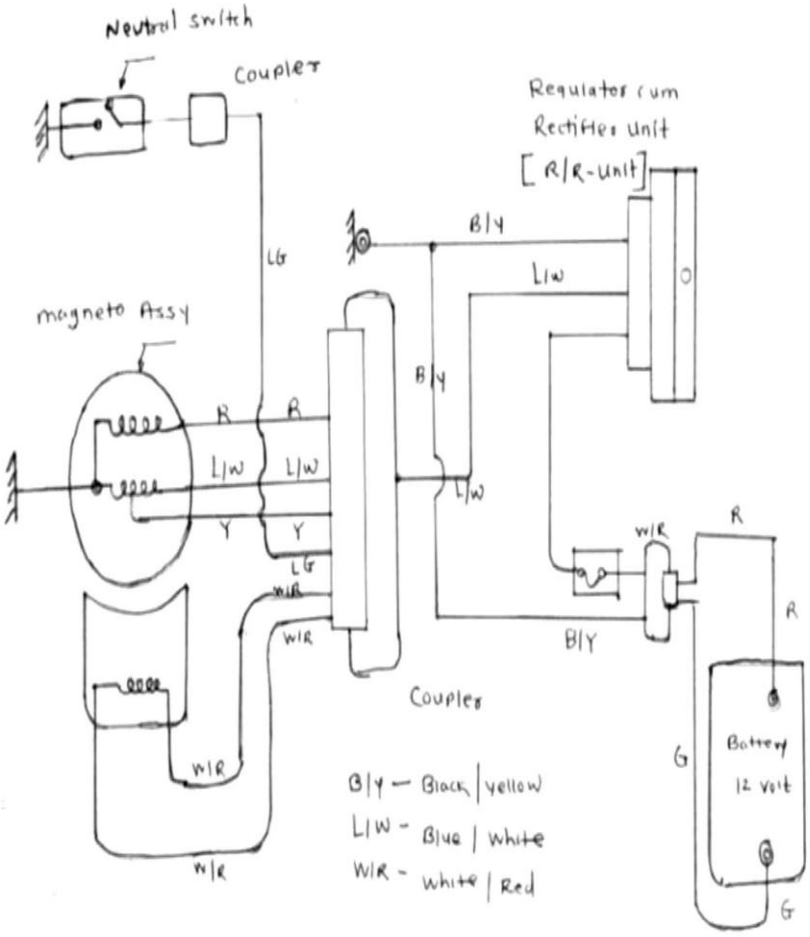
| | | help of filament type fuse.<br>• This fuse is having capacity to deliver 12 V to 16 V and 15 A current.<br>• In case of failure of fuse it disconnects the supply from regulator cum rectifier to battery.<br>  | |
| **5** | | **Attempt any <u>FOUR</u> of the following.** | **16** |
| | **a)** | **State advantages of electronic fuel injection system. (any four)**<br>**Answer:**<br>**Advantage of electronic fuel injection system (Any four-1 marks for each)**<br>1. Improved power output.<br>2. Better fuel efficiency over a wide range of engine speed.<br>3. Quick warm-up of engine.<br>4. Reduced engine emission that meets strict emission norms.<br>5. Better throttle response of the engine.<br>6. Better pick- up (acceleration).<br>7. Compact design of fuel supply system.<br>8. Modular design. | **04** |

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| | | 9. Engine performance is maintained under various loads and atmospheric pressures (altitude).<br>10. Engine need not be tuned from time to time as in case of carbureted engine fuel supply system.<br>11. Engine idle speed is controlled by microprocessor and so precisely controlled.<br>12. Vapour lock problem does not occur, as EFI system uses an electric fuel feed pump. The pump maintains sufficient pressure in the fuel line to avoid vapour lock in hot weather.<br>13.Improved atomization. Fuel is forced into the intake manifold under pressure that helps break fuel droplets into a fine mist.<br>14. Better fuel distribution. Equal flow of fuel vapors into each cylinder.<br>15. Smoother idle. Lean fuel mixture can be used without rough idle because of better fuel distribution and low-speed atomization.<br>16.Lower emissions. Lean efficient air-fuel mixture reduces exhaust pollution.<br>17.Better cold weather drivability. Injection provides better control of mixture enrichment than a carburetor.<br>18. Increased engine power. Precise metering of fuel to each cylinder and increased air flow can result in more horsepower output.<br>19. Fewer parts. Simpler, late model, electronic fuel injection system have fewer parts than modern computer-controlled carburetors. | |
| | **b)** | **Describe the function of :**<br>**i) Horn**<br>**ii) Reflection in head lamp & tail lamp** | **04** |
| | | **Answer:**<br>**i) Function of Horns -** Horns is a sound creating device electrical horns are used in all the automobile vehicles<br>1. When the horns is operated is create loud vibrating sound indicating that vehicle is coming so that the passengers or the other slow moving vehicles may clear off the path to pass.<br>2. Lights breaks & horns are the devices that prevent accident. Horns are included in safety device.<br>3. Horns are also used as a calling bell to call the person when vehicle is ready to start.<br><br>**ii) Function of Reflectors in head lamp and tail lamp**- Reflectors are used in head light assembly and tail lamp, concave in shape or parabolic. Reflector is portion which coated by aluminum / mercury powder coating on a concave fiber or metallic part. It act as mirror surface from which head light rays /light are scattered on the road front in downward direction effectively. In tail lamp reflectors are curves and concave, led light scatter the light rays at rear end such that far from distance it should visualize clearly. | **02**<br><br>**02** |

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| | **c)** | **Describe the ergonomic aspects for floor/foot rest for driver and pillion rider.** | **04** |
| | | **Answer:**<br><br>**Ergonomic aspects for floor/foot rest for driver and pillion rider:**<br>Foot rest/ foot rest helps to maintain riding comfort and control of vehicle as driver and pillion rider lean to change position of center of gravity of vehicle. Obtain support and helps rider to get into proper position during suspension movements. Rider tends to stand on the foot rest while riding on a bumpy road to reduce effect of road shock. This reduces stress at the joints. The location of foot rest & shape of seat as well the handle bar position differs as per manufacturers. It is related to rider's driving comfort.<br>A footrest is recommended at the leg-brake side. This is because, unintentionally the rider while resting his foot, applies the brake gently. In the long run, this damages the bike and also reduces mileages. Driver and pillion rider is supposed to rest his or her foot on when driving | **04** |
| | **d)** | **Explain wet sump pressurized lubrication in four stroke engine.** | **04** |
| | | **Answer:** *(working-2 marks and diagram-2 marks)*<br>**Wet sump pressurized lubrication system:**<br>The system in which lubricating oil is stored in the oil sump is called wet sump system, like pressure lubricating system. In this system, the engine parts are lubricated under pressure feed.<br>The lubricating oils is stored in a separate tank or the sump from where an oil pump takes the oil through a strainer and delivers it through a filter to the main oil gallery at a pressure to 2-4 kg/cm2. The oil from the main gallery goes to main bearings from where some of it after lubricating the main bearing falls back to the sump, some is splashed to lubricate the cylinder walls and the remaining goes through a hole to the crankpin. From the crank pin it goes the piston pin through a hole in the connecting rod web where it lubricates the piston rings. For lubricating camshafts and timing gears the oils is led thought a separate oil line from the oil gallery. The valve tappets are lubricated by connecting the main oil gallery to the tappet surfaces through drilled holes. An oil pressure gauge at the instruments panel indicates the oil pressure in the system. Oil filters and strainers in the systems clear off the oil from dust metal particles and other harmful particles. | **02** |

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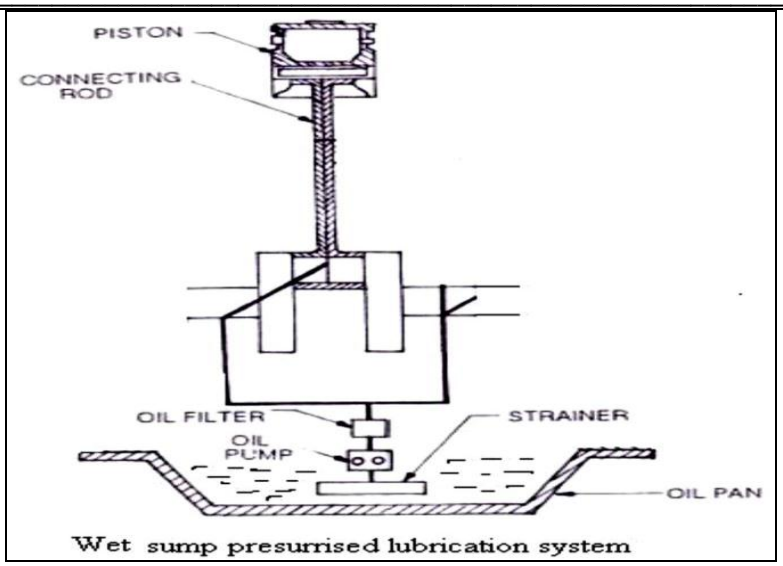
| | |  Wet sump presurrised lubrication system | **02** |
| | **e)** | **State the importance of**<br>**i) Side panels for scooter and motorcycle. ii) Mud-guard shape for motorcycle.** | **04** |
| | | **Answer: Importance of-**<br>**i) Side panels for scooter/Scooterate*:*** *(any four points)*<br>The side panels for scooter / Scooterate provide the following:<br>1. They cover internal components like wiring harness, engine and other systems from dirt, dust and protect them.<br>2. Components like battery, air filter and electrical/ electronic components are protected from dirt, dust and from thieves. Locking arrangement is provided in some designs.<br>3. Removal of side panels expose wiring harness and other systems for repair/ maintenance.<br>4. It proves a good look with graphics and panel colours matching the colour of vehicle fuel tank.<br>5. Appropriately shaped side panels proved aerodynamic shape to the vehicle and reduce air drag. The entire body of the motorcycle is covered to provide the lowest attainable drag coefficient ratio. It reduces fuel consumption.<br>6. In event of a crash, the side panels slide against the road surface and the engine and chassis are protected. It also saves injury to the rider and pillion rider from getting injured.<br>7. A reduction in air drag allows for taller gearing which in turn increases engine life.<br>8. Scooter/ Scooterate Side panels also protect the rider/ pillion rider from the engine heat and hot exhaust muffler. Some designs include a spare wheel within a side panel.<br>9. The rider‘s clothes do not get stuck at protruding components/ system assemblies or torn on account of rider‘s body movement.<br>10. Side panels protect the rider and pillion rider from the splashed water, dust, dirt and debris on the road.<br>**ii) Mud guard shape and position:** It is used for styling and eye catching looks. It also gives the sporty styling. It improves the personality of rider. The combination of black and chrome styling gives better aesthetics look. Mud guard can be large rectangular sheets suspended behind the tires. It protects the vehicle, passengers, other vehicles from mud and other flying debris thrown into the air by the rotating tyres. A design for an effective mud-guard for the front wheels, as users have a bad experience under wet conditions as their feet and trousers get soily. | **02**<br><br>**02** |

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| | **f)** | **List out components of starting system and their function.** | **04** |
| | | **Answer: (any four- 1 marks for each)**<br><br>Function of starting system components:<br>i) **DC motor:** Upon receiving current, motor initially provides adequately high torque needed for engine cranking. A DC motor is any of a class of electrical machines that converts direct current electrical power into mechanical power.<br><br>ii) **Battery:** A starter battery supplies the current to starter motor, needed for engine cranking.<br>An automotive battery is a type of rechargeable battery that supplies electric energy to an automobile. Battery powers the starter motor, the lights, and the ignition system of a vehicle's engine, mainly in combustion vehicles.<br>iii) **Solenoid:** Solenoid controls a larger cranking current with use of small current carrying circuit that uses a movable core. The core is mechanically linked to the electrical contacts through some form of mechanical linkage. Solenoids are electromagnetic switches with a movable core that converts current flow into mechanical movement.<br>iv) **Relay:** Relay uses small amount of current to control large amount.<br><br>v) **Battery:** A starter battery supplies the current to starter motor, needed for engine cranking.<br>An automotive battery is a type of rechargeable battery that supplies electric energy to an automobile. Battery powers the starter motor, the lights, and the ignition system of a vehicle's engine, mainly in combustion vehicles.<br>vi) **Ignition switch**: Ignition switch closes or opens the circuit . | **04** |
| **6)** | | **Attempt any <u>FOUR</u> of the following.** | **16** |
| | **a)** | **Describe layout of gravity feed type of fuel supply system.** | **04** |
| | | **Answer: (Description – 2 marks and layout - 2 marks, Credit should be given to equivalent Sketch**.<br><br>**Gravity feed type of fuel supply system-**<br>In this system the petrol is supply to the engine by gravitational force.<br>In this system the level of fuel is high than engine, due to the level tank the petrol will automatically supply by gravitational force. This system is having fuel tank, cock, filter, and carburetor. This system of fuel feed is cheaper because it does not require a fuel pump. The cock is very important in this system because there is a possibility of leakage the cock is having three position that is on, of and reserve. The fuel filter is provided at the entrance to the carburetor. Further precaution is taken by designing a large sized float chamber so that dust particles in petrol settle down or precipitate in the float chamber and do not enter the fuel nozzle of the carburetor. This system used in two wheeler and three wheeler. | **02** |

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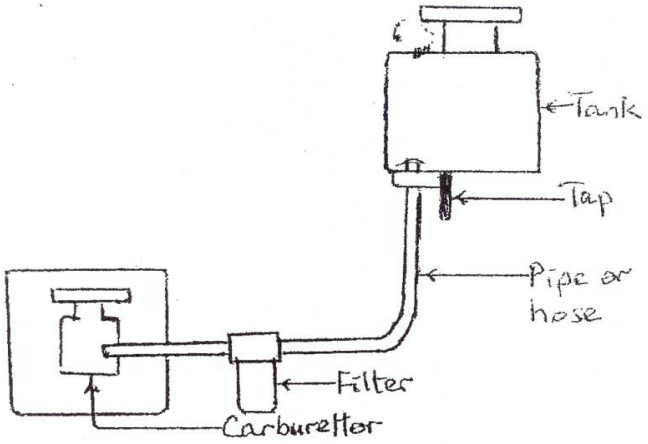
| | |  | **02** |
| | **b)** | **State the purpose of using following:**<br>**i) LED light in tail lamp**<br>**ii) Neutral indicator lamp**<br>**iii) High Beam indicator lamp**<br>**iv) Speed meter lamp** | **04** |
| | | **Answer:**<br>**i. LED light in tail lamp:**<br>LED stands for light emitting diode.<br>The LED tail lamps are used to illuminate the rear end of vehicle and it is signal for other vehicles that a vehicle is running on the road. Tail lamps are also uses to indicate the other vehicles that a vehicle is park outside the road at night. LED looks cool and give your bike a unique custom look. Number plate lamps are used to illuminate rear registration plate so that follower can read the vehicle registration number.<br><br>**ii. Neutral indicator lamp:**<br>Neutral indicator lamp light glow when the gear in a neutral position. It indicates the driver that vehicle is in neutral or in gear position.<br><br>**iii. High Beam indicator lamp:**<br>It illuminates the road far enough ahead for safe night driving. It should be adjusted vertically as per the requirement of visibility of the rider. Use your high beam whenever you are not following or meeting a car.<br><br>**iv. Speed meter lamp:**<br>It indicates the kilometer per hour of forward speed. | **01**<br><br>**01**<br><br>**01**<br><br>**01** |

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| | **c)** | **Explain the effect of following aesthetics aspects of motorcycle:**<br>**i) Ground clearance**<br>**ii) Head lamp fairing of motorcycle** | **04** |
| | | **Answer:** ***(Equivalent points should be given credit)***<br>**i) Ground Clearance:**<br>Ground clearance is the distance between any lowest part of vehicle and the ground, when both the tyres are in contact with the ground and inflated to correct tyre pressure. The aesthetics look & ground clearance of motor cycle depends upon the requirement of customer as well as manufacturer. As per type of two wheeler, (sports/off road bike) the ground clearance may differ. The high or low ground clearance affects the aesthetics of motorcycle. The ground clearance should be such that the aesthetics and aerodynamic requirement of motorcycle does not affect. From aesthetics point of view ground clearance should be minimum, to achieve the maximum vehicle stability. The ground clearance is providing adequate height to the seating position of rider.<br><br>**ii) Head lamp fairing of motorcycle**:<br>A motorcycle fairing is a shell placed over the frame of some motorcycles, especially racing motorcycles and sport bikes, with the primary purpose to reduce air drag. The secondary fu are the protection of the rider from airborne hazards and wind-induced hypothermia and of engine components in the case of an accident. The major benefit of a fairing on sport tourin touring motorcycles is a reduction in fuel consumption. The reduction in aerodynamic drag for taller gearing, which in turn increases engine life. The head lamp is open to atmosphere. front upcoming air strikes directly on it. So that the head lamp body must be robust and it sl suitably installed. If any sharp edge is on the outer body of the head lamp creates air resista which affects the efficiency of vehicle. So that the shape must be streamline with no sharp e The rounded portion of outer body minimized the air resistance. In this way the head lamp r streamlined aerodynamically shaped and easy to install. The angle of various beams must b adjusted so that the visibility is cleared. | **02**<br><br>**02** |
| | **d)** | **Describe the uses of jacket & day night goggles as safety concern.** | **04** |
| | | **Answer:**<br>**Use of Jacket:**<br>While driving a motorcycle, use proper jacket to cover the body. Jacket closes the body completely; due to wind our cloths are continuously blows, making tedious sound which was very enormous i.e. undesirable. Jackets never stick to the body. These are made from impregnated/laminated cloths; these are light weight, high resistance to sunlight, wear and tear résistance in case of accidents. Water droplets are not sticking. Jacket adds the effective driving values. These are available in dark glowing colors with radium spectrum so that at night driving it shows your presence on the road.<br>**Use of Day-night goggle:**<br>Eye protection is of utmost importance - an insect or a kicked-up pebble in the eye at speed has enough momentum to cause significant damage. Such an event could easily cause the rider to lose control and crash. Besides this danger, squinting into the wind is unpleasant at best and watering eyes are quite distracting. Goggles or Day night goggles are forms of protective eyewear that usually enclose or protect the area surrounding the eye in order to prevent particulates, water or chemicals from striking the eyes. It prevents insects, dust, and so on from hitting the eyes. | **02**<br><br>**02** |

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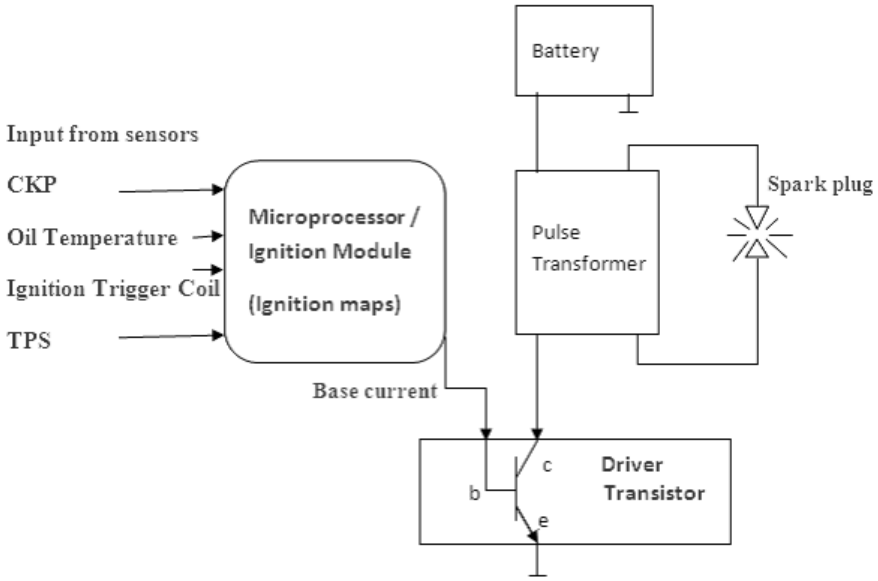
| | **e)** | **Describe operation of microprocessor controlled ignition system with block diagram.** | **04** |
| | | **Answer: (Description- 2 marks , sketch – 2 marks**<br><br>**Microprocessor controlled ignition system;**<br><br>The microprocessor controlled ignition system uses input from sensors like crankshaft posit temperature sensor, ignition trigger coil and throttle position sensor. The ignition module/ n uses ignition maps to trigger the driver transistor for optimum spark timing. It uses a pulse t type of ignition coil) having low inductance. As the trigger coil generates a signal/ pulse – i microprocessor. Microprocessor switches on the driver transistor by supplying base current collector emitter circuit of the driver transistor carries the primary circuit current to ground.<br>Primary current flow causes magnetism to be induced in secondary winding as well (pri secondary windings are wound around the same iron core of ignition coil). A high voltage i secondary winding of pulse transformer. This voltage is sufficient to ignite the leanest charg chamber. The ignition maps stored in the ignition module / microprocessor enables the spar accurately.<br><br>**Microprocessor controlled ignition system:**<br><br>  <br><br><br>**OR**<br>This system digitally controls the ignition timing by a microcomputer inside the spark unit a ideal ignition timing at all the engine speed. The control unit consists of a distributor, which processes the pulse generator and a microcomputer which has a memory and an ari circuit below is the ignition system of a 90 0 V – type 2 cylinder engine.<br><br>1. As the engine starts, a pulse signal from the pulse generator is sent to the spark unit.<br>2. The signal receiver converts the pulse signal to a digital signal and it is fed to the micro<br>3. As the microcomputer receives the digital signal, it processes signals containing in crankshaft angle and engine speed; the microcomputer then reads the information or which is based on the engine speed from its memory and determines the ignition | **02**<br><br>**02**<br><br>**02** |

microcomputer sends current to the base.

4. As the current from the microcomputer flows to the base of transistor, the transistor is turned ON, a ignites the spark plug.

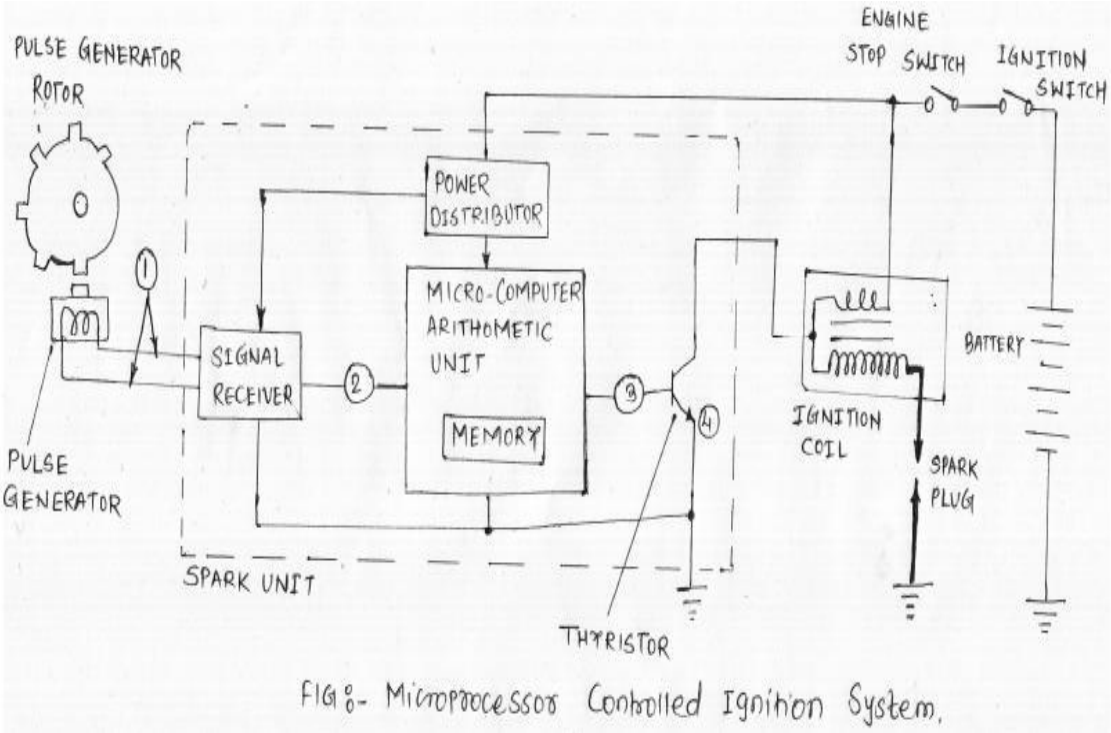



FIG:- Microprocessor Controlled Ignition System.

**02**