

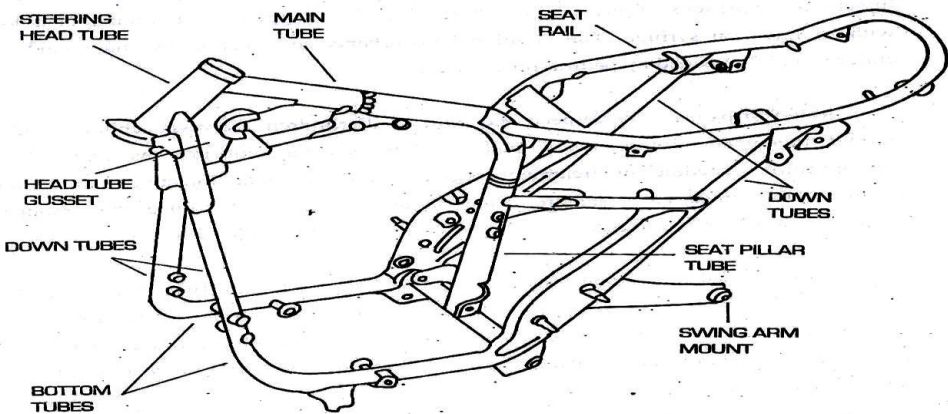
SUMMER- 19 EXAMINATION  
Model Answer

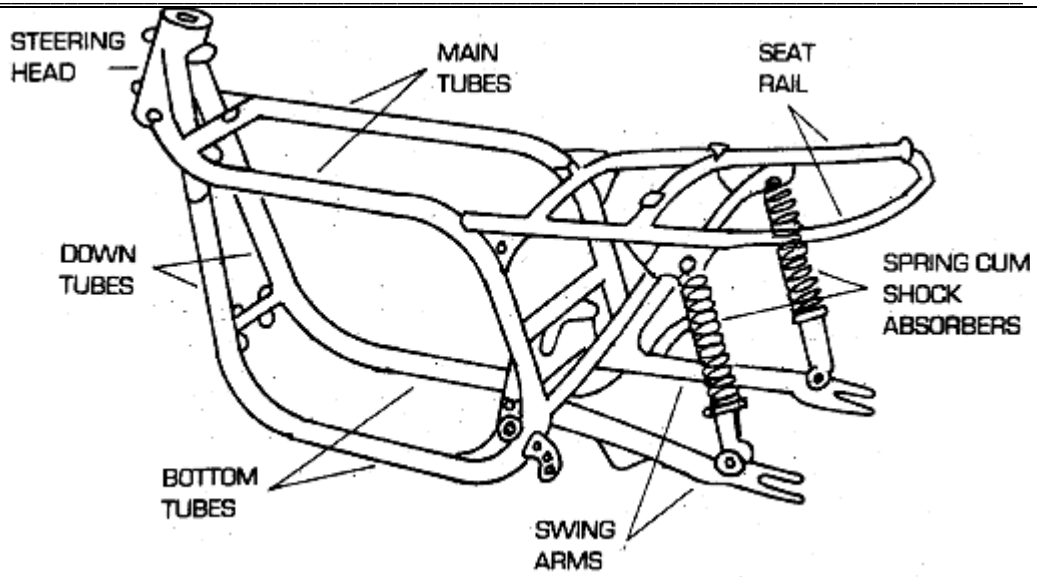
Subject Name: Two Wheeler Technology

Subject Code: 17521

**Important Instructions to examiners:**

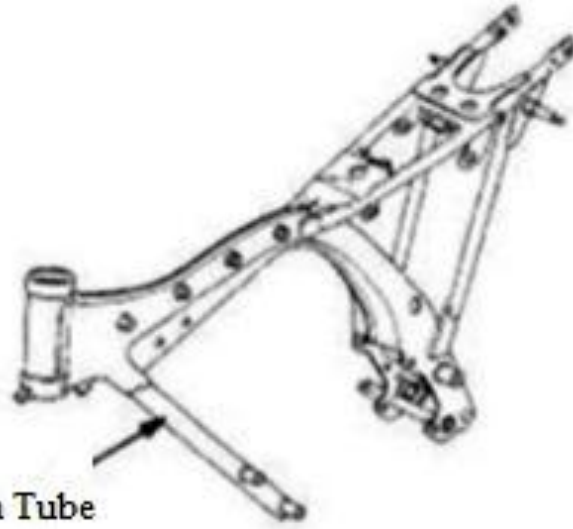
- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling 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
	(i)	Enlist any three types of frames and sketch any one and label it.	04
		<p><b>Answer :</b> ( List – 1 mark, any one sketch – 2 marks, labelling – 1 mark)</p> <p><b>Types of frame: Motorcycle/ Mopeds use three basic frames</b></p> <ol style="list-style-type: none"> <li>1) Cradle-single cradle and double cradle frame</li> <li>2) Back Bone frame</li> <li>3) Stamped frame</li> </ol>  <p>Figure: Typical motor cycle frame of cradle type</p>	<p>List – 1 mark, any one sketch – 2 marks, labelling – 1 mark</p>



Double cradle frame

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



Backbone Frame

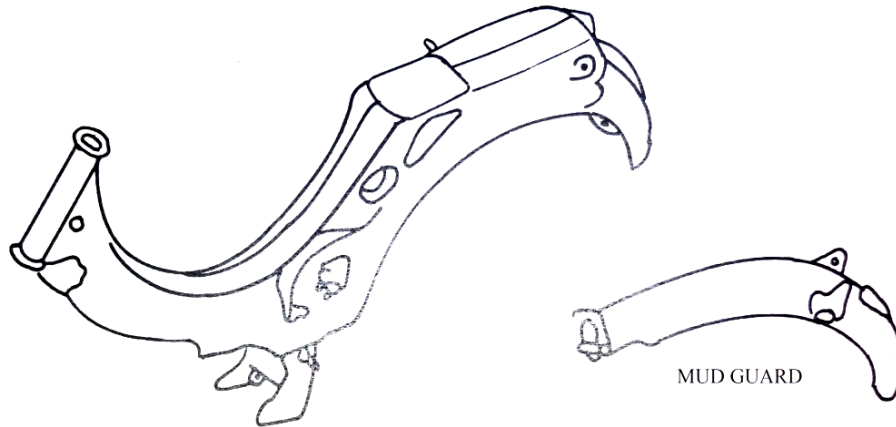
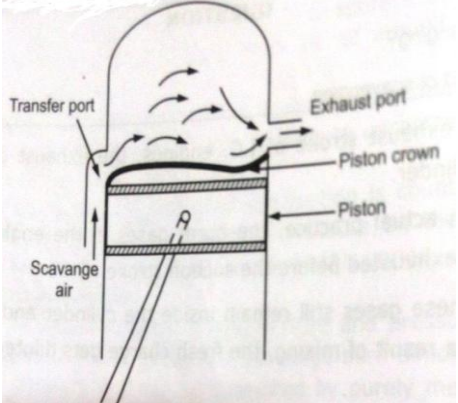


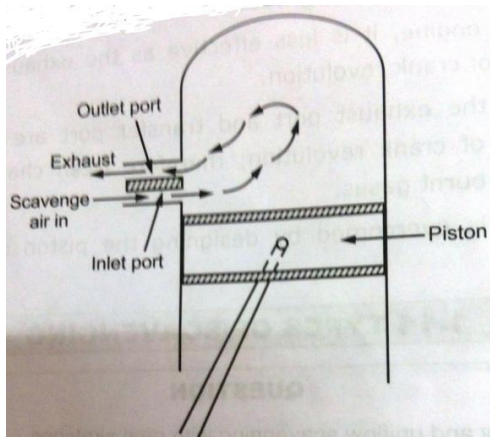
Figure: Stamped frame



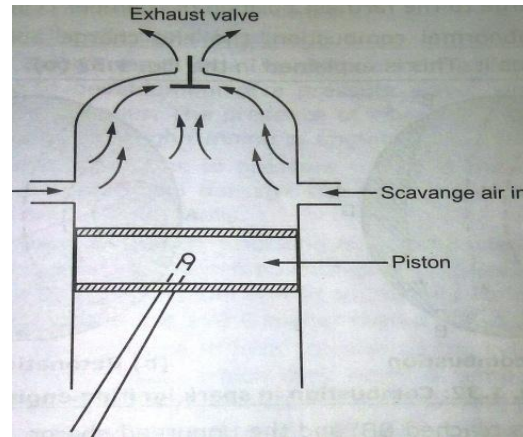
	<b>(ii) Enlist any four advantages of electronic fuel injection system.</b>	<b>04</b>																		
	<p>Answer: <b>Advantage of electronic fuel injection system:</b> (Any four-1 marks for each)</p> <ol style="list-style-type: none"> <li>1. Improved power output.</li> <li>2. Better fuel efficiency over a wide range of engine speed.</li> <li>3. Quick warm-up of engine.</li> <li>4. Reduced engine emission that meets strict emission norms.</li> <li>5. Better throttle response of the engine.</li> <li>6. Better pick- up (acceleration).</li> <li>7. Compact design of fuel supply system.</li> <li>8. Modular design.</li> <li>9. Engine performance is maintained under various loads and atmospheric pressures (altitude).</li> <li>10. Engine need not be tuned from time to time as in case of carbureted engine fuel supply system.</li> <li>11. Engine idle speed is controlled by microprocessor and so precisely controlled.</li> <li>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.</li> <li>13. Improved atomization. Fuel is forced into the intake manifold under pressure that helps break fuel droplets into a fine mist.</li> <li>14. Better fuel distribution. Equal flow of fuel vapors into each cylinder.</li> <li>15. Smoother idle. Lean fuel mixture can be used without rough idle because of better fuel distribution and low-speed atomization.</li> <li>16. Better cold weather drivability. Injection provides better control of mixture enrichment than a carburetor.</li> </ol>	<b>04</b>																		
	<b>(iii) Differentiate between gravity feed and vacuum operated fuel supply system.(any four points)</b>	<b>04</b>																		
	<p>Answer: Difference <b>between gravity feed and vacuum operated fuel supply system.(any four points = 04 marks)</b></p> <table border="1" data-bbox="300 1323 1372 1984"> <thead> <tr> <th data-bbox="300 1323 397 1407">Sr. No.</th> <th data-bbox="397 1323 836 1407">Gravity feed System</th> <th data-bbox="836 1323 1372 1407">Vacuum operated fuel feed system</th> </tr> </thead> <tbody> <tr> <td data-bbox="300 1407 397 1533">1</td> <td data-bbox="397 1407 836 1533">In this type, the fuel tank is mounted at a place higher than that of carburettor.</td> <td data-bbox="836 1407 1372 1533">In this type, the fuel tank need not be mounted at a place higher than that of carburettor.</td> </tr> <tr> <td data-bbox="300 1533 397 1701">2</td> <td data-bbox="397 1533 836 1701">The fuel flows from the tank to the carburettor due to gravitational force.</td> <td data-bbox="836 1533 1372 1701">During suction stroke, vacuum is created in the engine cylinder and this vacuum is applied for supply of fuel from fuel tank to carburetor.</td> </tr> <tr> <td data-bbox="300 1701 397 1827">3</td> <td data-bbox="397 1701 836 1827">The fuel tank is directly connected to carburetor through fuel cock/knob and filter.</td> <td data-bbox="836 1701 1372 1827">The fuel tank is connected to carburettor through vacuum controlled valve.</td> </tr> <tr> <td data-bbox="300 1827 397 1911">4</td> <td data-bbox="397 1827 836 1911">It is simple method of fuel feed system.</td> <td data-bbox="836 1827 1372 1911">It is complex method of fuel feed system as compared with gravity feed system.</td> </tr> <tr> <td data-bbox="300 1911 397 1984">5</td> <td data-bbox="397 1911 836 1984">Fuel is supplied once fuel knob is on.</td> <td data-bbox="836 1911 1372 1984">Fuel is supplied to carburetor only when engine creates vacuum.</td> </tr> </tbody> </table>	Sr. No.	Gravity feed System	Vacuum operated fuel feed system	1	In this type, the fuel tank is mounted at a place higher than that of carburettor.	In this type, the fuel tank need not be mounted at a place higher than that of carburettor.	2	The fuel flows from the tank to the carburettor due to gravitational force.	During suction stroke, vacuum is created in the engine cylinder and this vacuum is applied for supply of fuel from fuel tank to carburetor.	3	The fuel tank is directly connected to carburetor through fuel cock/knob and filter.	The fuel tank is connected to carburettor through vacuum controlled valve.	4	It is simple method of fuel feed system.	It is complex method of fuel feed system as compared with gravity feed system.	5	Fuel is supplied once fuel knob is on.	Fuel is supplied to carburetor only when engine creates vacuum.	<b>04</b>
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	(iv)	<b>Explain the significance of exhaust gas recirculation system in vehicle.</b>	<b>04</b>
		<p>Answer: Significance of EGR system.</p> <p>EGR- exhaust gas recirculation, works by recirculating a portion of an engine's exhaust gas back to the engine cylinders. This dilutes the Oxygen in the incoming air stream and provides gases inert to combustion to act as absorbents of combustion heat to reduce peak in-cylinder temperatures.</p> <p>In internal combustion engines, <b>exhaust gas recirculation (EGR)</b> is a nitrogen oxide emissions reduction technique used in petrol and diesel engines.</p> <p>Because nitrogen oxide forms primarily when a mixture of nitrogen and oxygen is subjected to high temperature, the lower combustion chamber temperatures caused by EGR reduces the amount of nitrogen oxide the combustion generates (though at some loss of engine efficiency). Gases re-introduced from EGR systems will also contain near equilibrium concentrations of nitrogen oxide and carbon monoxide; the small fraction initially within the combustion chamber inhibits the total net production of these and other pollutants when sampled on a time average. Most modern engines now require exhaust gas recirculation to meet emissions standards. Chemical properties of different fuels limit how much EGR may be used. For example methanol is more tolerant to EGR than gasoline.</p>	<b>04</b>
<b>1</b>	<b>b)</b>	<b>Attempt any ONE of the following:</b>	<b>06</b>
	(i)	<b>With the help of neat sketch, explain arrangement of ports in two stroke engine cylinder.</b>	<b>06</b>
		<p><b>Answer:</b> (Any one arrangement - <i>Description= 2 Marks and fig 2 Marks</i>)</p> <p>The different arrangements of inlet, transfer port and exhaust port depend upon the method of scavenging used. There are three method of scavenging in two stroke engine:</p> <ul style="list-style-type: none"> <li>• <b>(1) Transfer and exhaust port positioned opposite in cylinder wall: (Cross Flow Scavenging):-</b> <ul style="list-style-type: none"> <li>– In this method, the inlet port and exhaust port are situated on the opposite sides of engine cylinder used for cross flow scavenging.</li> </ul> </li> </ul> <div style="text-align: center;">  <p><b>Cross Flow Scavenging</b></p> </div> <ul style="list-style-type: none"> <li>• <b>(2) Inlet and outlet ports are positioned on same side in cylinder wall: (Back Flow or Loop Scavenging) :-</b> <ul style="list-style-type: none"> <li>– In this method, the inlet and outlet ports are situated on the same side of the engine cylinder used for loop scavenging.</li> </ul> </li> <li>• <b>(3) Inlet in cylinder wall and exhaust ports in head (Uni- flow Scavenging) :-</b></li> </ul>	

- In this method, the fresh charge, while entering from one side (or sometimes two sides) of the engine cylinder pushes out the gases through exhaust valve situated on the top of the cylinder



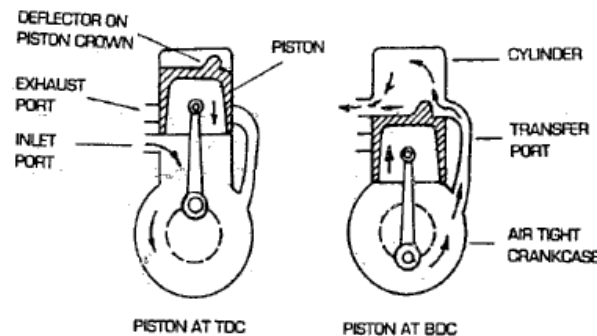
**Back Flow or Loop Scavenging**



**Uni-flow Scavenging**

**OR**

**Piston controlled port:** Piston controlled port two stroke engine has three main moving parts namely piston, connecting rod and crankshaft. Ports of different sizes are located in the cylinders wall at different levels and locations. When the piston descends from TDC. At some point of its travels, piston crown opens the exhaust port. Expanding combustion products rush out through exhaust port. The downward movement of piston compresses the air fuel mixture that has been previously sucked into the crankcase. Further downward movement of piston causes the piston crown to open the transfer port. The mixture compressed to some extent and confined in the crankcase, now rushes through transfer ports and fills the cylinders.



**Fig: Operation of Piston controlled port two stroke engine**

- (ii) **Explain with neat block diagram, working of microprocessor controlled ignition system.**

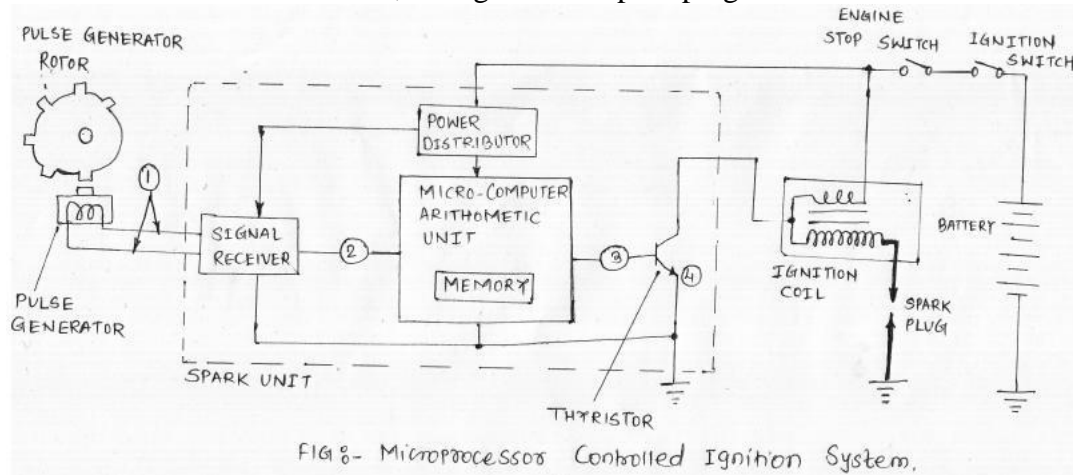
**06**

Answer: (Working 03 marks , block diagram 03 marks)

**Working of microprocessor controlled ignition system:** This system digitally controls the ignition timing by a microcomputer inside the spark unit and calculates the ideal ignition timing at all the engine speed. The control unit consists of a distributor, a signal receiver which processes the pulse generator and a microcomputer which has a memory and an arithmetic unit. The circuit below is the ignition system of a 90<sup>0</sup> V – type 2 cylinder engine.

**03**

1. As the engine starts, a pulse signal from the pulse generator is sent to the spark unit.
2. The signal receiver converts the pulse signal to a digital signal and it is fed to the microcomputer.
3. As the microcomputer receives the digital signal, it processes signals containing information on the crankshaft angle and engine speed; the microcomputer then reads the information on ignition timing, which is based on the engine speed from its memory and determines the ignition timing. Then the microcomputer sends current to the base.
4. As the current from the microcomputer flows to the base of transistor, the transistor is turned ON, and ignites the spark plug.



OR

The microprocessor controlled ignition system uses input from sensors like crankshaft position sensor, oil temperature sensor, ignition trigger coil and throttle position sensor. The ignition module/ microprocessor uses ignition maps to trigger the driver transistor for optimum spark timing. It uses a pulse transformer (a type of ignition coil) having low inductance. As the trigger coil generates a signal/ pulse – it is sent to the microprocessor. Microprocessor switches on the driver transistor by supplying base current. Now the collector emitter circuit of the driver transistor carries the primary circuit current to ground. Primary current flow causes magnetism to be induced in secondary winding as well (primary and secondary windings are wound around the same iron core of ignition coil). A high voltage is induced in the secondary winding of pulse transformer. This voltage is sufficient to ignite the leanest charge in combustion chamber. The ignition maps stored in the ignition module / microprocessor enables the spark to be timed accurately.

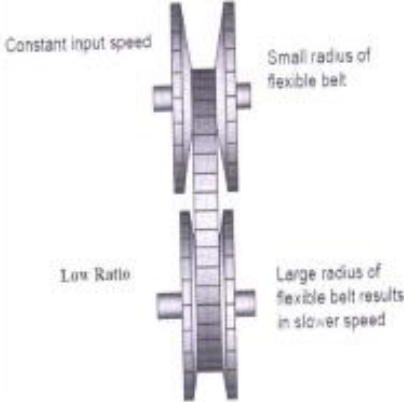
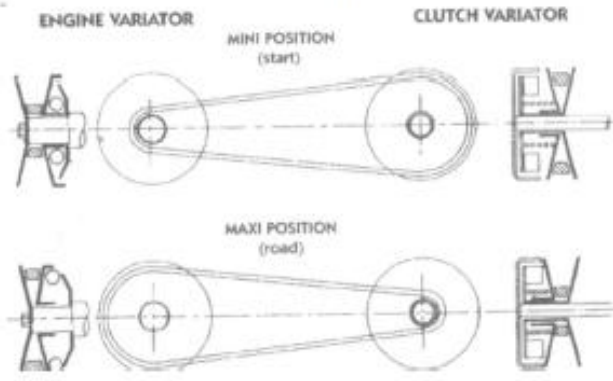
	<p style="text-align: center;"><b>Microprocessor controlled ignition system:</b></p>	
2	<p><b>Attempt any FOUR of the following:</b></p>	16
(a)	<p><b>Draw neat sketch of constant mesh gear box and label it.</b></p>	04
	<p>Answer: (neat sketch 02 marks, label 02 marks)</p> <p style="text-align: center;">Fig. Constant Mesh Gear Box</p>	04
(b)	<p><b>Enlist any four functions of carburetor.</b></p>	04
	<p><b>Functions of carburetor under four engine operating conditions: (01 mark for each fuction)</b></p> <p><b>i) Idling:</b> A separate idling and low speed passage is provided with low speed port and idle port.</p> <p><b>ii) Starting:</b> 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.</p>	04

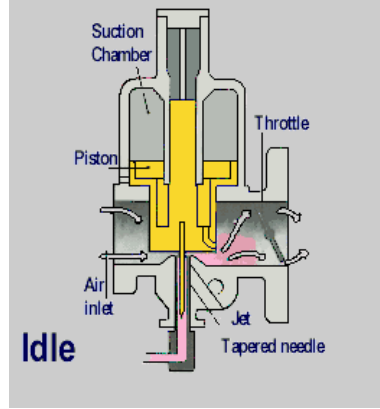


	<p><b>iii) Acceleration:</b> When acceleration is desired the accelerator twist grip is twisted, which actuate the main jet giving an extra supply of fuel for acceleration it must be clear that the purpose of accelerating circuit is not to provide a continuous fuel supply for acceleration, but only to provide extra supply of fuel to avoid flat spot.</p> <p><b>iv) Normal running:</b> 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.</p> <p style="text-align: center;">OR</p> <ol style="list-style-type: none"><li>1) It combines gasoline and air creating a highly combustible mixture,</li><li>2) It regulates the ratio of air and fuel, and</li><li>3) It controls the engine's speed.</li><li>4) it provides the rich mixture for when choke is applied.</li></ol>	
	<p><b>(c) Explain the ergonomic factors considered in seat arrangement of rider.</b></p>	<b>04</b>
	<p><b>Answer: Importance of ergonomic aspects of seat arrangement for rider:</b> 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 one person may not work for someone else. It is more convince to both rider &amp; pillion rider to seat for long trip or tour. The taper portion of raised seat supports the seating arrangement for rider. The taper portion of seat supports the back bone of rider. 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 &amp; 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 &amp; leather) to protect both rider &amp; pillion rider from shocks &amp; vibrations on road.</p>	<b>04</b>
	<p><b>(d) Enlist any four advantages of mono-shock suspension system.</b></p>	<b>04</b>
	<p><b>Answer Advantages of gas filled shock absorber used at rear end-(Any four points- 1Mark each)</b></p> <ol style="list-style-type: none"><li>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.</li><li>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.</li><li>3. The tolerance to heat in gas filled shock absorber is greater.</li><li>4. Gas filled shock absorber give longer life to tyres and other related components in the suspension such as springs, brushes etc.</li><li>5. A gas filled shock absorber is designed to reduce foaming of the oil.</li><li>6. Provide stability while graduating turns.</li></ol>	<b>04</b>

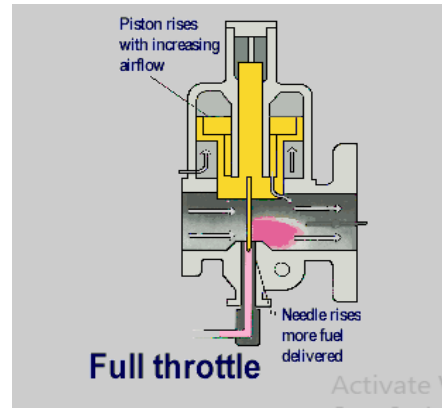


	<p>(e) Explain with suitable example tyre specification.</p>	04
	<p><b>Answer:</b> ( Example 01 mark, Description of terms 3 marks)</p> <p>Tyres are specified by nominal section width, aspect ratio, its construction (types of carcass) and diameter of the tyre's inner rim. For example: Tyre specification: 185/55-15 81H Where 185 – Nominal Section width of tyre (in mm) 55- Aspect ratio (in % ) 15 - Diameter of tyre's inner rim (in inches) 81- Load Index H- Speed Index</p> <div style="text-align: center;"> <p>OR</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <div style="border: 1px solid red; padding: 5px; font-size: 2em; font-weight: bold;">195</div> <div style="margin-top: 10px;">↔</div> <p><b>=195 Millimeters.</b> This is the nominal section width of the tyre</p> </div> <div style="text-align: center;"> <div style="border: 1px solid red; padding: 5px; font-size: 2em; font-weight: bold;">/ 55</div> <div style="margin-top: 10px;">↕</div> <p><b>=55%.</b> Described as the aspect ratio. This mark represents the height of the tyre sidewall as the percentage of the nominal section width.</p> </div> <div style="text-align: center;"> <div style="border: 1px solid red; padding: 5px; font-size: 2em; font-weight: bold;">R</div> <div style="margin-top: 10px;"> </div> <p><b>Radial construction</b></p> </div> <div style="text-align: center;"> <div style="border: 1px solid red; padding: 5px; font-size: 2em; font-weight: bold;">16</div> <div style="margin-top: 10px;">↔</div> <p><b>=16 inches.</b> This is the diameter of the tyre's inner rim in inches.</p> </div> </div> </div>	04
3	Attempt any four of the following	16

	<p>a) <b>Explain belt drive with variator mechanism</b></p>	<p><b>04</b></p>
	<p><b>Answer:</b></p> <div style="text-align: center;">  <p>Figure: Pulley based vario drive arrangement</p> <p>OR</p>  </div> <p>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.</p> <p>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.</p>	<p><b>02</b></p> <p><b>02</b></p>
	<p>b) <b>Explain the working of carburetor under following engine operating conditions: (i) Idling (ii) Accelerating</b></p>	<p><b>04</b></p>
	<p><b>Answer:</b></p> <p><b>i) Idling :</b> 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.</p>	<p><b>02</b></p>



**Fig. Idling**



**Acceleration**

02

**ii) 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.

c) **State the purpose of providing caster angle**

04

**Answer:**

Caster is the backward tilt of the king pin and axle when viewed from the side.

- 1) The purpose of caster is to give the vehicle directional stability or ability to travel straight ahead with minimum of actual steering by the driver.
- 2) This is accomplished by the fact that the projected centre line of king pin strikes the road ahead of the contact point of the tyre. This has a tendency to lead or drag the wheel behind it, giving the vehicle directional stability.
- 3) If the axle is set horizontally and the king pin vertically, the weight of the vehicle would be directly above the point of contact. As a result, the wheels would be wandering and the car would lack steering stability.
- 4) The caster or backward tilt of the axle prevents wheel wander and makes the vertical load precede the point of contact which causes the wheels to run straight normally and to straighten up after turn.

04

d) **State the significance of variable rate coil spring**

04

**Answer: (Any suitable answer shall be given due credit )**

04

Most leaf spring have the spring rate that is more or less constant throughout their travel i.e. deflection. When a motorcycle goes over a sever bump or is heavily loaded, a spring having higher rate deflection is required, than that is required for ordinary service on smooth roads, in order to cushion the road shock properly. For such service variable rate springs are used. The variable rate coil spring provides a low rate for ordinary service and higher rate for heavy obstruction or roads. These consists of several conventional springs and below which is placed a small auxiliary spring. There is a space between these two springs because conventional springs take all the loads and travel on smooth roads.

**OR**



		<ol style="list-style-type: none"> <li>1. It provides effect of a dual rate spring.</li> <li>2. It is a low cost substitute for variable rate spring.</li> <li>3. It provides better contact with road surface while on bump.</li> <li>4. Suspension is soft for light shock loads while it is stiff for heavier shock loads.</li> <li>5. They offer a softening and gradual flexibility to the vehicle's ride</li> </ol>																																		
	<b>e)</b>	<b>Differentiate between mechanical and hydraulic brakes (any 04 points)</b>	<b>04</b>																																	
		<p><b>Answer: (Any 4 points – 1 mark each)</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 5%;">Sr.</th> <th style="width: 45%;">Mechanical brake</th> <th style="width: 45%;">Hydraulics brake</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>In mechanical breaks no need of brake fluid so brake shoes will not affect by any leakages.</td> <td>Brake shoes will be affected if leakage of brake fluid occurs</td> </tr> <tr> <td>2.</td> <td>More effort is required for applying brakes</td> <td>Less effort is required for applying brakes</td> </tr> <tr> <td>3.</td> <td>Braking is less powerful than Hydraulics brakes</td> <td>Braking is powerful</td> </tr> <tr> <td>4.</td> <td>More frictional losses</td> <td>Less frictional losses as it is self-lubricating</td> </tr> <tr> <td>5.</td> <td>Simple in construction</td> <td>Complicated in construction than mechanical brakes</td> </tr> <tr> <td>6.</td> <td>Less efficient than Hydraulics brake</td> <td>More efficient than mechanical brake</td> </tr> <tr> <td>7.</td> <td>Maintenance/repair cost is less</td> <td>Maintenance/repair cost is more</td> </tr> <tr> <td>8.</td> <td>Comparatively easy to remove and replace friction pads</td> <td>Removal and replacement of brake linings is difficult and consumes more time.</td> </tr> <tr> <td>9.</td> <td>Air bleeding kit is not required</td> <td>Air bleeding kit is required</td> </tr> <tr> <td>10.</td> <td>Pressure intensity is less</td> <td>Pressure intensity is more</td> </tr> </tbody> </table>	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	<b>04</b>
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	<b>(ii)</b>	<b>Explain working of CDI system with neat sketch</b>	<b>04</b>																																	

**Answer :**

It mainly consists of 6-12 V battery, ignition switch, DC to DC converter, 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. 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.

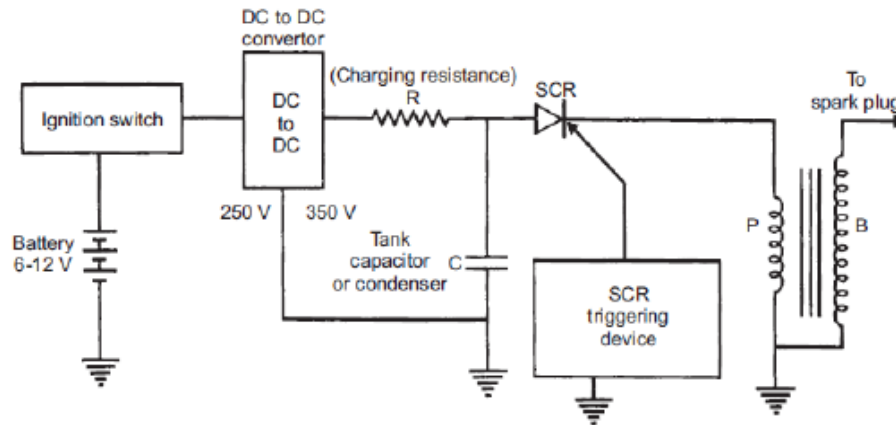


Fig. Capacitance Discharge Ignition System

**OR**

CDI system consists of primary circuit and secondary circuit The primary circuit consists of following components: i) Primary winding of pulse transformer ii) Condenser iii) Resistance iv) SCR v) Pulse generator.

vi) Battery vii) DC to AC convertor/charging device

The secondary circuit consists of following components: i) Secondary winding of pulse transformer ii) Spark plug iii) Spark plug HT coil Working: • CDI system uses charge of capacitor for generating spark- using pulse transformer • Thyristor/silicon controlled rectifier is used as switch- for primary circuit current through capacitor. • It also uses a pulse generator to trigger SCR through Gate circuit. • Pulse transformer has low inductance, so the change in flux across primary and secondary windings is very rapid. • This provides high voltage spark (about 30,000V) during the entire speed range of the engine. • The electronic circuitry uses conversion of AC to DC charging device, signal conditioning and amplifying unit and control circuit.

02

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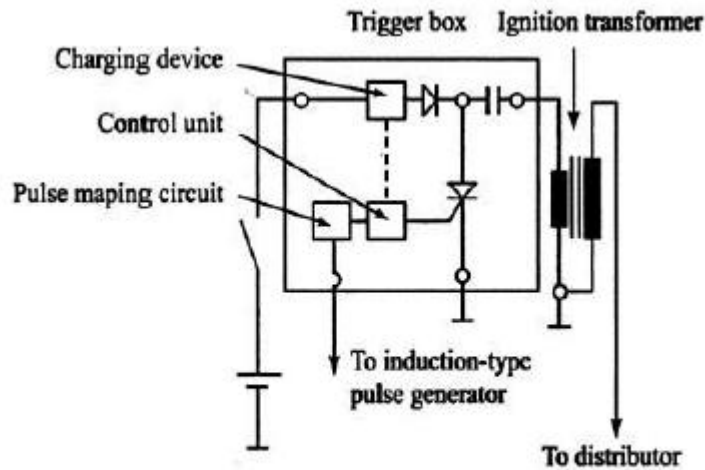


Fig. Schematic of Capacitive Discharge Ignition (CDI) System

(iii) State the functions of starting system components (any 04)

04

**Answer : (Any 4 components – 1 mark each)**

**The components of starting system and their functions are as follows**

**Kick Start System**

**1) Kick Start Pedal**

Kick start pedal is used to start system. When we apply the force on the pedal, kick start pedal rotates which further gives motion and power to kick start shaft.

**2) Kick start Shaft**

As we apply the force on the pedal the kick start shaft rotates and at the same time it rotates with the kick start gear

**3) Kick start Gears**

Ratchet gear transmits power and motion through kick shaft gear to clutch housing with the help of idler or intermediate gear.

**4) Kick Start Engagement Device**

When the kick is applied to start a motorcycle, kick start engagement device actuates the ratchet gear and torsion spring.

**5) Battery:** A starter battery supplies the current to starter motor, needed for engine cranking.

**6) Ignition switch:** It controls the current supplied to the solenoid and to the starter motor for cranking. In starter mode, the switch provides current to solenoid and the starter motor get supply.

**7) Neutral safety switch:** The switch provides continuity in starter circuit if the transmission is in neutral or clutch is disengaged.

**8) 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

04

(iv) State the specification of following components:

**1) Head lamp 2) speedometer lamp**

04

**Answer (suitable reply shall be considered for due credit)**

**1) Head lamp :**

voltage- 12 v, Wattage-35 Watt, Technology- Halogen, Life Span-400 Hours, Lumens- 825 + 15% , Gross weight -463 gm, Hight-13 cm , Length- 25.5 cm , Width- 19 cm

02

02

	<b>2) Speedometer lamp : Voltage- 12 v, Wattage-1.7 to 3.4 Watt</b>	
<b>b)</b>	<b>Attempt any three of the following</b>	<b>12</b>
<b>(i)</b>	<b>Draw neat sketch of tail pipe arrangement and explain its purpose. Also state its location.</b>	<b>04</b>
	<p><b>Answer:</b> Tail pipe is final length of exhaust pipe which ends with just a straight or angled cut where it vents open to air. Some tail pipes also have a small resonator inside for additional noise reduction. The exhaust gases leave the muffler or silencer, not in a steady stream but as a pulsating one. Each wave as it reaches the outlet is reflected back into the pipe. It is desirable that on its way back it reaches the muffler not at the moment of a fresh discharge from it but between two discharges. This can be realized by adjusting length of the tail pipe, either shortening or lengthening. In some installation, the tail pipe goes up vertically. Then it is called stack, if stack goes up through a roof, it should allowed to expand freely.</p> <p>Location: Tail pipe is located at the end of muffler or silencer .</p> <p style="text-align: center;">Fig- Tail Pipe</p> <p style="text-align: center;"><i>(Note: Equivalent credit shall be given to any other suitable sketch and relevant description)</i></p>	<p><b>01</b></p> <p><b>01</b></p> <p><b>02</b></p>
<b>(ii)</b>	<b>Explain with schematic circuit, working of charging system</b>	
	<p><b>Answer:</b> <b>Working of charging system of two wheeler:</b> The main components of two wheeler charging system are-</p> <ol style="list-style-type: none"> <li>1. Battery</li> <li>2. Regulator cum rectifier unit (Regulator and rectifier are assemble in one unit)</li> <li>3. Generator (Magneto) assembly</li> <li>4. Fuse</li> </ol> <ul style="list-style-type: none"> <li>- Generator produces an A.C. supply of 12 V.</li> <li>- Blue / white (b/W) wire supplies 12 V A.C. from generator to regulator cum rectifier unit.</li> <li>- Regulator control the supply of current and voltage whereas rectifier converts A.C. supply in to D.C.</li> <li>- Regulator cum rectifier unit supply 12-14.5 V D.C. to the battery with the help of filament type fuse.</li> <li>- This fuse is having capacity to deliver 12 V to 16 V and 15 A current.</li> </ul>	



		In case of failure of fuse it disconnects the supply from regulator cum rectifier to battery.	
5		<b>Attempt any four of the following</b>	<b>16</b>
	a)	<b>Explain importance of different gear ratios in scooter</b>	<b>4</b>
		<b>Answer:</b> The engine delivers its full power at high speed. When a vehicle starts from rest, hill climbing, accelerating and meeting other road resistances, high torque (tractive effort) is required at driving wheels. Hence a gear box having different gear ratios is used to permit the engine crankshaft to revolve a relatively high speed, while the wheels turn at slower speeds. The vehicle speed is also changed with the help of gear box keeping the engine speed same with certain limit. This is the main purpose of gearbox to provide speed and torque variations in road wheels by keeping engine speed or torque constant. The gear ratios in first gear provides higher torque and less speed which gets reversed in top gear where the torque requirement gets reduced and speed requirement increases. To meet this varying requirement different gear ratios are required.	
	b)	<b>State the purpose of lubrication and enlist different locations where lubrication is required.</b>	<b>4</b>
		<b>Answer :</b> <b>Purpose of Lubrication:</b> i) Reduce frictional resistance of the engine to a minimum to ensure maximum mechanical efficiency. ii) Protect engine against wear. iii) Serves as cooling agent by picking up heat. iv) Remove all impurities from the lubricated region v) Form a seal between piston ring and cylinder wall to prevent blow by. vi) To prevent overheating of engine.  <b>Locations:</b> i) Engine parts- Piston and cylinder, Small & big end bearing, valve guide and valve operating mechanism etc. ii) Gear box iii) Wheel bearings iv) Sprocket and Chain v) Various Joints in linkages of clutch, brakes, steering system.	<b>02</b>       <b>02</b>
	c)	<b>State the functions in starting system:</b> <b>(I) D. C. Motor      (ii) Battery</b>	<b>4</b>
		<b>Answer :</b> Function of starting system components: i) <b>DC motor:</b> 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.  <b>ii) Battery:</b> A starter battery supplies the current to starter motor, needed for engine cranking.	<b>02</b>       <b>02</b>





		<p>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.</p>	
	<b>d)</b>	<b>Explain aesthetic aspect in relation with ground clearance and mud guard shape.</b>	<b>4</b>
		<p><b>Answer:</b> <b>Aesthetic aspect in relation with</b> <b>i) Ground Clearance:</b></p> <p>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 &amp; 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.</p> <p><b>ii) Mud guard shape:</b></p> <p>It is used for styling and eye catching looks. It also gives the sporty styling. It improves the personality of rider. It makes people attractive. 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. Best coverage, protects bike as well as rider, and protects the rider behind you. Without mudguards a bike looks like any regular road racing bike.</p>	<b>02</b>  <b>02</b>
	<b>e)</b>	<b>State any four aerodynamic aspect in motor cycle fuel tank shape.</b>	<b>4</b>
		<p><b>Answer: (Any Four- 1 mark each)</b> <b>Shape of fuel tank:</b> <b>The shape of fuel tank in motorcycle provides the following.</b></p> <ol style="list-style-type: none"><li>1. It holds adequate fuel as per class of motorcycle.</li><li>2. Generally the fuel tank shape is a tear drop design. It offers least aerodynamic drag.</li><li>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.</li><li>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.</li><li>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.</li><li>6. Space is ensured for handlebar turning through the required angle.</li></ol>	



4		<b>Attempt any FOUR of the following</b>	<b>16</b>
	a)	<b>Enlist benefits of Twin spark ignition system</b>	<b>4</b>
		<b>Answer : (Any four – 1mark each)</b> <b>Benefits of twin spark ignition system-</b> 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. 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. 3. Less vibration and noise. 4. Long life of the engine parts such as piston ring and valve stem 5. Decreases in the specific fuel consumption. 6. No overheating. 7. Increase the thermal efficiency of engine and even bear high load on it. 8. Increase the thermal efficiency of the engine & even bear high loads on it.	
	b)	<b>How catalytic converter controls the emission?</b>	<b>4</b>
		<b>Answer:</b> <b>Working of catalytic converter under oxidation:</b> The oxidation catalyst is the second stage of the catalytic converter. It reduces the unburned hydrocarbons and carbon monoxide by burning (oxidizing) them over a platinum and palladium catalyst. This catalyst aids the reaction of the CO and hydrocarbons with the remaining oxygen in the exhaust gas Chemical reaction for catalytic converter under oxidation: $2\text{CO} + \text{O}_2 \Rightarrow 2\text{CO}_2$ <b>Working of catalytic converter under reduction of exhaust gas:</b> The reduction catalyst is the first stage of the catalytic converter. It uses platinum and rhodium to help reduce the NOx emissions. When an NO or NO <sub>2</sub> molecule contacts the catalyst, the catalyst rips the nitrogen atom out of the molecule and holds on to it, freeing the oxygen in the form of O <sub>2</sub> . The nitrogen atoms bond with other nitrogen atoms that are also stuck to the catalyst, forming N <sub>2</sub> . Chemical reaction for catalytic converter under reduction of exhaust gas: $2\text{NO} \Rightarrow \text{N}_2 + \text{O}_2 \text{ or } 2\text{NO}_2 \Rightarrow \text{N}_2 + 2\text{O}_2$	
	c)	<b>State the purpose of using LED lights in tail lamp.</b>	<b>4</b>
		<b>Answer:</b> <b>Purpose of LED lights in tail lamp: LED stands for light emitting diode.</b> 1. LEDs are bright but use very little power, typically 26 mA of current per LED 2. LED produce extremely low amount of heat, high impact resistant and come in waterproof encloses. 3. Average life of LED is approximately 1,00,000 hours or 10 years of continuous use much longer than convention light bulb. 4. LED looks cool and give your bike a unique custom look.	<b>4</b>



	<b>d)</b>	<b>Enlist any two functions of each of the following: (i) Crash Bar , (ii) Saree guard.</b>	<b>4</b>
		<b>Answer:(1 mark for each) Functions of -</b>  <b>i) Crash bar: (any two)</b> i) Crash bars used to protect motorcycle engines ii) it is also used to protect body panels. iii) It is used to protect the rider. iv) It is also used as a mount point for accessories like highway pegs, lights and, on police motorcycles, sirens, cameras and radar guns.  <b>ii) Saree guards- (any two)</b> i) The Saree guards are very practical accessories that can prevent a lot of unwanted accidents. ii) The Saree guard is an important though local piece of initiative to help loose & flowing clothes from getting tangled in the rear wheel. iii) The Saree guards will not only protect the rider, but also the cargo from being pulled into the rear wheel.	<b>02</b>  <b>02</b>
	<b>e)</b>	<b>State any two good driving habits and bad driving habits.</b>	<b>4</b>
		<b>Answer:</b> <b>Following are the good driving habits: (Any 2 points)</b>  i) To avoid low visibility the driver should wear clearly visible clothing. ii) At night driving the driver should not wear day night goggle. iii) Use safety devices for e.g. Helmet, jacket, shoes, hand gloves etc. iv) Use various indicators, horns; high and low beam lamps while driving. v) When applying the brakes, use both front and rear brakes. vi) The driver should maintain steady speed avoiding quick acceleration and sudden braking. vii) Always obey lane discipline viii) Drive vehicle in economy mode.  <b>Following are the Bad driving habits: (Any 2 points)</b> i) Driving vehicle without wearing safety devices Helmet, shoes,jacket, hand gloves etc ii) Not using various indicators, horns; High and low beam lamps while driving. iii) Applying rear brake only. iv) Driving without following traffic rules- Rash driving, over speeding etc. v) Use of mobile phone while driving. vi) Not obeying lane discipline. vii) Frequent gear shifting.	<b>02</b>  <b>02</b>