



Winter – 2019 EXAMINATION  
Model Answer

Subject Name: Two Wheeler & Three Wheeler Technology

Subject Code:

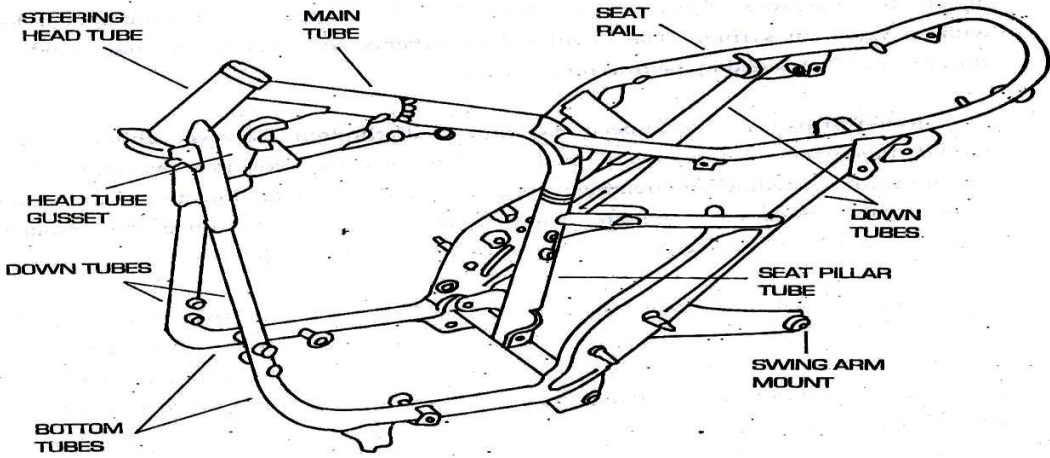
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**Important Instructions to examiners:**

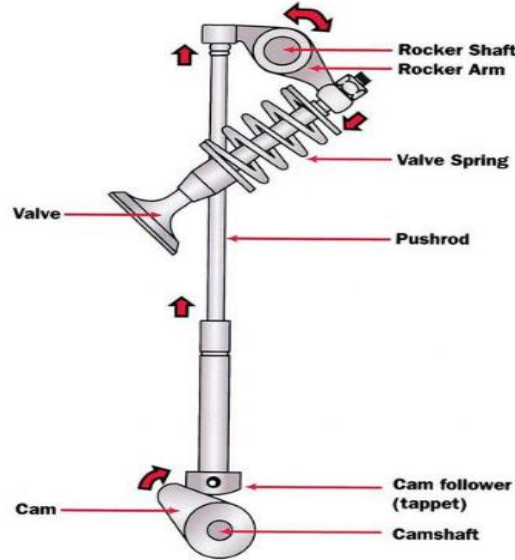
- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling 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		Attempt any <b><u>FIVE</u></b> of the following:	10
	a)	<b>Enlist features of tubular frame.</b>	
		<b>Feature of tubular frame:</b> 1) It acts as a beam supported by the wheels to carry the weight of the propelling machinery and the rider. 2) It provides a non-flexing mount for the engine suspension and wheel. 3) It provides free steering movement of the front wheel	02
	b)	<b>List materials used for two wheeler frame.</b>	
		The use of steel tubing is still common. In modern times other materials, such as titanium, aluminium, magnesium, and carbon-fibre, along with composites of these materials, are now used.	02
	c)	<b>State any two types of muffler with their application.</b>	
		Answer: (1mark for each) <b>Applications of muffler:</b> 1. Baffle type – Used in motor cycle. Straight baffle type muffler is used in those motor cycles who like their bikes to be loud and Quiet baffle type muffler is used in regular motorcycle which sounds quiet. 2. Wave cancellation type –These are of constructive type and destructive type, used mostly in car. 3. Resonance type – These are used in high cc bikes and those	02 (1mark for each)

	<p>vehicles which required special firing sound like racing cars and bike.</p> <p>4. Absorber type: This type is used where high pulsating sound is produced and need to be reduce. e.g. High cc bikes like Royal Enfield etc.</p>	
<b>d)</b>	<b>State functions of carburetor.</b>	
	<p>The main functions of the carburettor are:</p> <ol style="list-style-type: none"> <li>1) To keep a small reserve of fuel at a constant head.</li> <li>2) To vaporize the fuel to prepare a homogeneous air fuel mixture.</li> <li>3) To supply correct amount of the air fuel mixture at the correct strength under all conditions of load and speed.</li> </ol>	<b>02</b> (1 mark for each)
<b>e)</b>	<b>Define: (i) Trail , (ii) Caster angle</b>	
	<p><b>Answer:</b></p> <p><b>i) Trail:</b> Trail refers to distance between imaginary point where the steering axis intersect the ground and the centre of tyre contact point.</p> <p>Measured length between the imaginary point and centre of front tyre contact is known as front trail . Distance between the imaginary point and the centre of rear tyre contact point is known as rear trail.</p> <p><b>ii) Caster Angle –</b> 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 <math>2^{\circ}</math> to <math>8^{\circ}</math>.</p>	<b>02</b> (1 mark for each)
<b>f)</b>	<b>Draw transmission system layout of two wheeler.</b>	
	<p>Due credit shall be give to alternate figure.</p>	
<b>2</b>	<b>Attempt any THREE of the following.</b>	<b>12</b>

	<p>a) <b>Describe constructional details of single cradle frame with neat sketch.</b></p>	<p><b>04</b></p>
	<p><b>Answer</b> <b>Single cradle frame</b> The single cradle is the simplest type of motorcycle frame, and looks similar to the first ever motorcycle frames. It is made from steel tubes that surround the engine with a main tube above and other, smaller diameter tubes beneath. If a single cradle becomes double at the exhaust, as frequently occurs, it is referred to as a split single cradle frame. Single cradle frames are usually found in off-road motorcycles.</p>  <p style="text-align: center;">Figure: Typical motor cycle frame of cradle type</p>	<p>sketch – 2 marks, description-2 marks</p>
	<p>b) <b>Describe procedure to adjust valve clearance of four stroke engine of two wheeler with necessary sketches.</b></p>	<p><b>04</b></p>
	<p><b>Answer:</b> <b>Procedure:</b> 1) Remove the valve cover according to your shop manual's instructions. Don't try to hammer a screwdriver or chisel between the valve cover and the head. You will ruin the gasket surface in a very short order. 2) Before the valves can be set you'll need to find the top dead center (TDC). Manufacturers generally imprint either the flywheel, the alternator rotor, or the ignition rotor with a datum mark indicating top dead center. Depending on the engine design, there may be one mark or a separate mark for each cylinder. Your manual will fill you in on the exact procedure. 3) Remove the spark plugs, pop it into gear, and turn the rear wheel by hand to position the engine. 4) Valve clearances are checked and adjusted when the crankshaft/piston of the cylinder you are adjusting are at top dead center on the compression stroke. Start by rotating the engine in its normal direction of travel. Watch the intake valve as you rotate the engine. The valve will open on the intake stroke and close on the compression stroke. When the valve begins to close, start to look for the TDC indicator. When it lines up with its reference mark, check both rocker arms for free play. 5) To measure the valve clearance select the appropriate feeler gauge, and place the blade of the gauge through the gap between the adjuster and the valve stem. If the manual calls for 0.004 (four-thousandths of an inch) clearance, slide your 0.004 gauge through the gap. If it feels a little loose try a 0.005 blade. If it won't go, you</p>	<p><b>04 Marks</b></p>

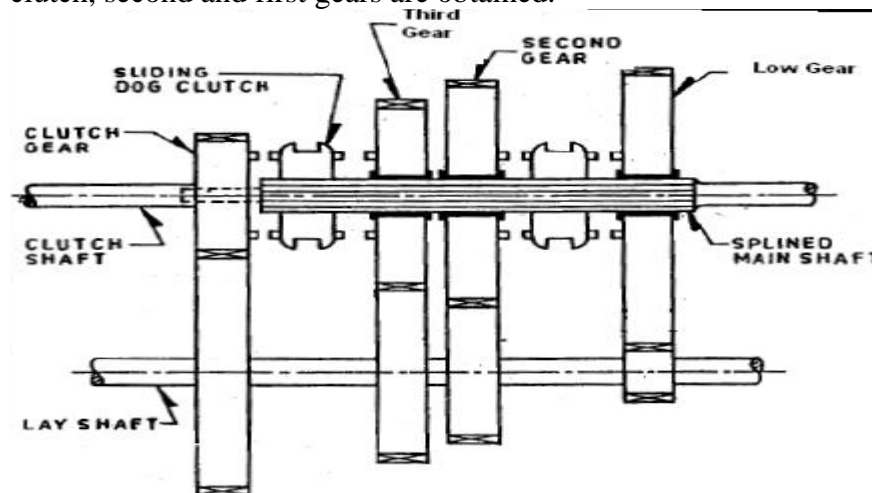
know the adjustment is as good as it's going to get. If the 0.005 slides through the valve, it's still a little loose. Readjust it.  
6) If the valve needs adjustment, loosen the lock nut and, using the appropriate tool, turn the adjuster to decrease or increase the lash. You'll find that leaving the adjuster nut a little snug will keep some tension on the adjusting screw, making it easier to accurately set the clearance. When the clearance feels good, hold the adjusting screw, and tighten up the lock nut.



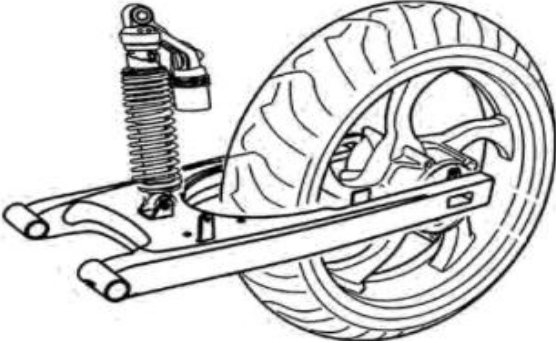
c) Describe working of constant mesh gear box with neat sketch.

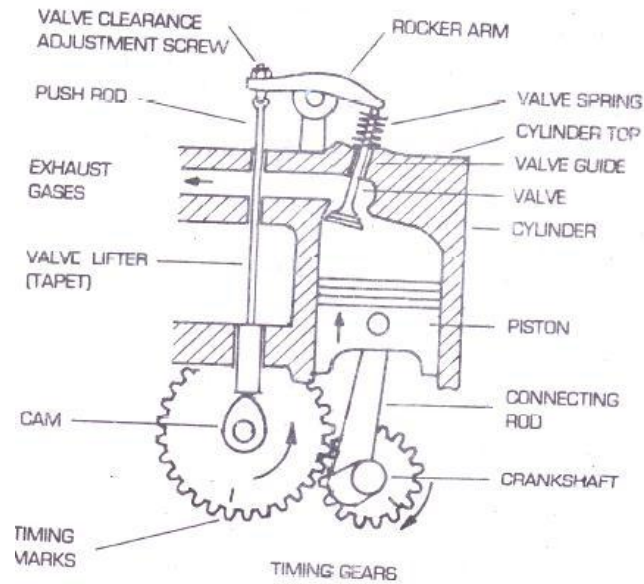
04

**Working of constant mesh gear box:** 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. Top or 4th speed gear is obtained when the left dog clutch is slided 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 clutch (left side) meshes with third gear on main shaft. In this way by sliding the second dog clutch, second and first gears are obtained.



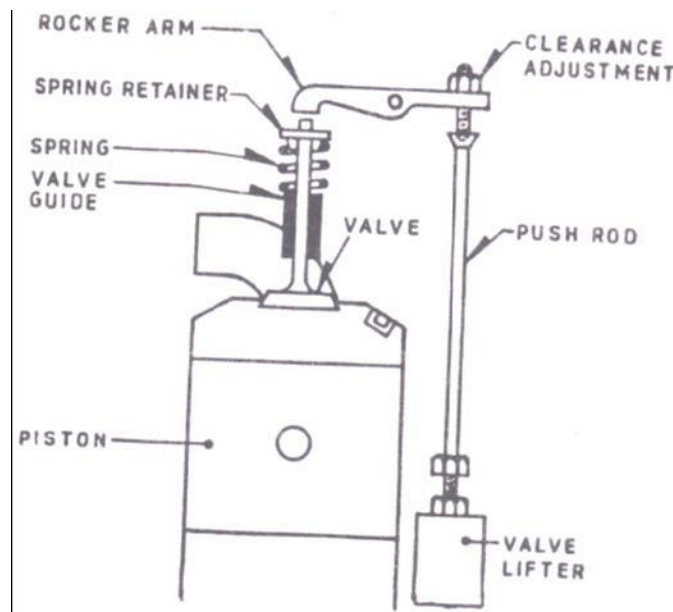
Working-  
02  
Marks,  
  
Sketch –  
2Marks

	<p>d) <b>Describe mono-shock regular swing arm suspension system with neat sketch.</b></p>	<p><b>04</b></p>
	<p>Answer:</p> <p>Mono-shock Regular swing arm : Original technology of mono-shock comes from the racing world where motor cycles compete in most extreme conditions. More advanced version of this technology is employed in these bikes. Many models now a days incorporate this type of shock to give statement of style and comfort.</p> <p>The fundamental idea behind eliminating one of the suspension strut is to reduce overall weight. Furthermore, by placing the rear suspension strut closer to COG of the vehicle, turning characteristics, stability during braking and overall riding performance can dramatically improve. It is easier to adjust the ride height, since there is only one shock to adjust, and there is no worry about matching two shocks.</p>  <p style="text-align: center;"><b>mono-shock regular swing arm suspension</b></p>	<p><b>Descripti on – 2 Marks</b></p>
<p><b>3</b></p>	<p><b>Attempt any THREE of the following.</b></p>	<p><b>12</b></p>
	<p>a) <b>Describe push rod overhead valve operating mechanism with neat sketch.</b></p>	<p><b>04</b></p>
	<p><b>Push rod Overhead valve operating mechanism (OHV 4 -S engine):</b> An overhead valve engine (OHV engine) is an engine in which the valves are placed over the cylinder head. The camshaft drive-chain sprocket has twice as many teeth as the crankshaft sprocket, so that the camshaft rotates at half engine speed. The overhead valve system (OHV) system, operated by pushrods, has the camshaft adjacent and parallel to the crankshaft in the cylinder block.</p> <p>In overhead-valve (OHV) system, as the pushrod rises on the cam it pivots the rocker arm, which pushes the valve down (open) against the pressure of its spring. As the cam lobe rotates further, the valve spring acts to close the valve. As the crankshaft rotates, each valve is opened by means of a tappet, pushrod and rocker arm. The valve is closed by spring pressure.</p> <p>This overhead-valve (OHV) system is less efficient than an overhead camshaft because the number of moving parts limits the speed at which the engine can run safely. Overhead valve arrangement makes the engine slightly shorter than overhead camshaft.</p>	<p><b>Descripti on – 2 marks,  Sketch- 2 Marks</b></p>



Overhead valve arrangement

OR



b) Describe working of capacitive discharge ignition (CDI) system

04

**Working of CDI system:** 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

Working-  
2 marks,  
Sketch -  
2marks

secondary, which while jumping the spark plug gap produces the spark, and the charge of air fuel mixture is ignited.

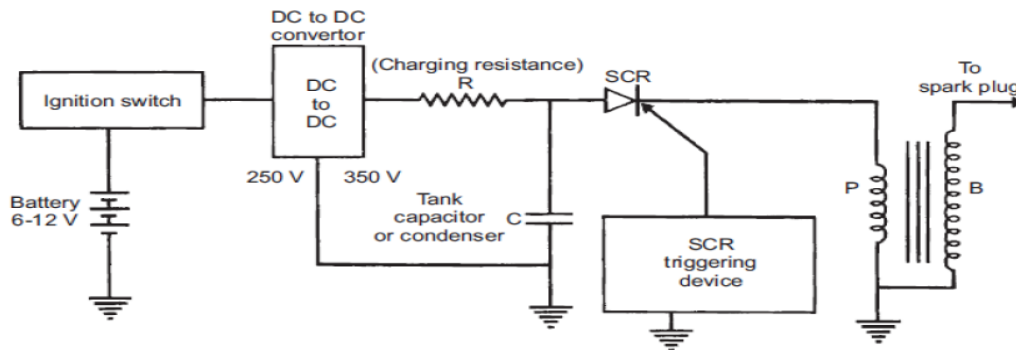


Fig. Capacitance Discharge Ignition System

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.

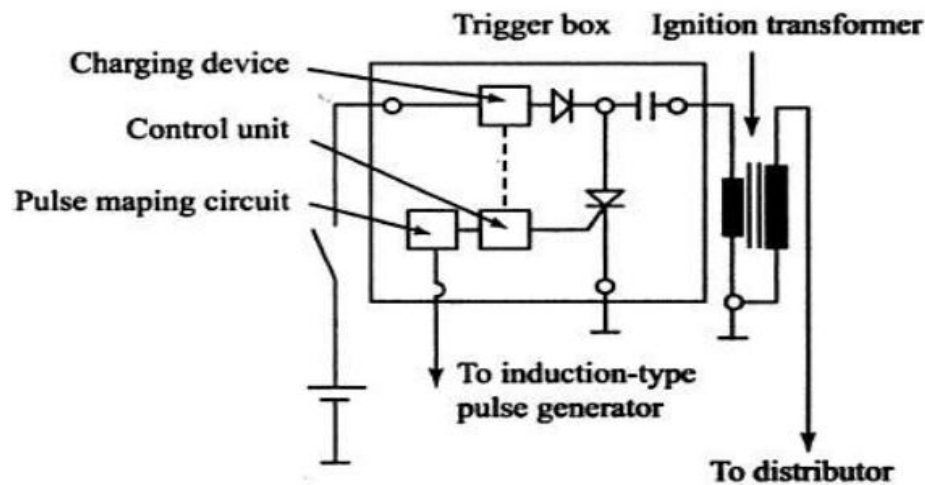


Fig. Schematic of Capacitive Discharge Ignition (CDI) System

Note: Any suitable figure shall be considered.

c)	<p><b>Describe working of two wheeler charging system with labeled sketch</b></p>	04
	<p><b>Working of charging system of two wheeler:</b> 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</p> <ol style="list-style-type: none"> <li>1) Generator produces an A.C. supply of 12 V.</li> <li>2) Blue / white (L/W) wire supplies 12 V A.C. from generator to regulator cum rectifier unit.</li> <li>3) Regulator controlled the supply of current and voltage whereas rectifier converts A.C. supply in to D.C.</li> <li>4) Regulator cum rectifier unit supply 12-14.5 V D.C. to the battery with the help of filament type fuse.</li> <li>5) This fuse is having capacity to deliver 12 V to 16 V and 15 A current.</li> <li>6) In case of failure of fuse it disconnects the supply from regulator cum rectifier to battery.</li> </ol> <p style="text-align: center;"><b>Figure:</b> Schematic diagram of charging system</p>	<p><b>Working</b> - <b>2 Marks ,</b> <b>Sketch-2Marks</b></p>
d)	<p><b>“Indicator lamps play an important role in vehicle safety” justify this statement with suitable illustrations.</b></p>	04
	<p><b>Answer:</b></p> <p>Indicator lamps are used for indicating others the intention of driver for turning the vehicle in particular direction before the actual turning is started. Without the indicator lamps it would not be possible to guess the vehicles movement and the vehicle may collide on each other causing the severe accident.</p> <p>Another method of indicating about turning of vehicle is by showing direction by hand. In two wheeler such indication may cause unbalancing of bike and likely to cause accident.</p> <p>Therefore, Indicators lamp thus plays very important role of indicating the drivers intention of taking turn with safe distance and making the other drivers alert for the same. It thereby avoid the accident.</p>	04 Marks

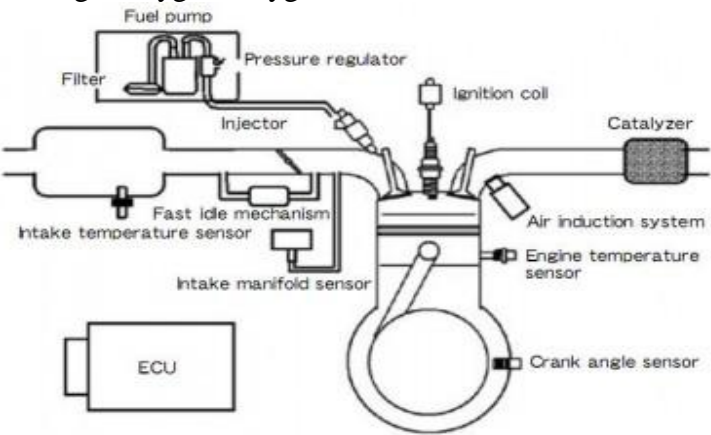




4		<b>Attempt any THREE of the following.</b>	<b>12</b>
	a)	<b>Describe ergonomic aspects of seat arrangement of two wheeler.</b>	<b>04</b>
		<b>ergonomic aspects of seat arrangement of two wheeler:</b> The design of the motorcycle is limited by the physical constraints of making the machine work. Comfort 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 & 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 & 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>04 Marks</b>
	b)	<b>Describe role of crash bar and saree guard in two wheeler safety.</b>	<b>04</b>
		The role of- i) <b>Crash bar:</b> 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.  ii) <b>Saree guards-</b> The 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 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.	<b>04 Marks</b>
	c)	<b>“Ergonomics plays an important role in passenger comfort” justify this statement with illustrations.</b>	<b>04</b>
		<b>Answer:</b>  Ergonomics plays an important role in ensuring complete comfort for the driver and the passenger, ensuring smooth journey, and maximizing experience.  Ergonomics is the process of designing or arranging workplaces, products and	<b>04 Marks</b>

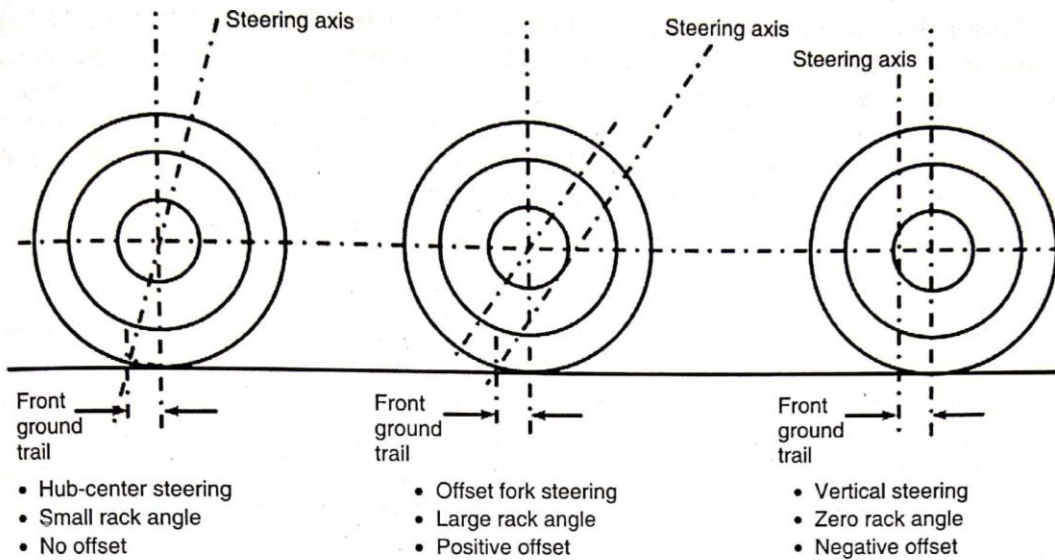


		<p>systems so that they fit the people who use them. It aims to learn about human abilities and limitations, and then apply this learning to improve people's interaction with products, systems and environments.</p> <p>The ergonomics in designing the passenger seat for vehicle involves study of human seating posture, human body dimensions etc. During ride the vehicle</p>	
	d)	<b>“Driving habits are closely associated with drivers safety” justify this statement with illustrations.</b>	<b>04</b>
		<p>Answer: <b>Driving habits are closely associated with drivers safety because drivers do not follow the following good driving habits accidents are likely to occur.</b></p> <p>i) Drivers habit to wear day night goggle will improve the night visibility of driver and hence his safety. ii) Drivers using safety devices like Helmet, jacket, shoes, hand gloves etc. will improve driver's safety. iii) Drivers habit of using various indicators, horns; high and low beam lamps while driving. iv) A Practice of using both brakes avoids skidding of bike and avoids accident. v) Driver's habit of following traffic rules will avoid accidents. vi) Driving vehicle in economy mode not only ensures the fuel economy but also helps to improve safety.</p>	<b>04 Marks</b>
	e)	<b>Describe effects of frontal area exposed in motor cycle on performance of vehicle.</b>	<b>04</b>
		<p>Answer:</p> <p>The amount of drag an object is subjected to comes from two things; the frontal area of the Motorbike and what's called its drag co-efficient.</p> <p>The frontal area of motor cycle involves head lamp, petrol tank, front mud guard, front panel in case of mopeds.</p> <p>The greater the frontal area will increase the resistance to drag and hence the power is lost in overcoming this air resistance.</p> <p>Therefore, the shape of head lamp, shape of petrol tank position and shape of mud guard which reduce the frontal area will improve the performance reducing air resistance called air drag.</p>	<b>04 Marks</b>
<b>5</b>		<b>Attempt any TWO of the following.</b>	<b>12</b>
	a)	<b>Select a material for a frame of 350 CC motorcycle and justify its use.</b>	<b>06</b>
		<p>Answer:</p> <p>The material used for heavy duty motor cycle like 350 cc motor cycle depends upon design, strength and type of frame being used. Generally, Steel is commonly used</p>	

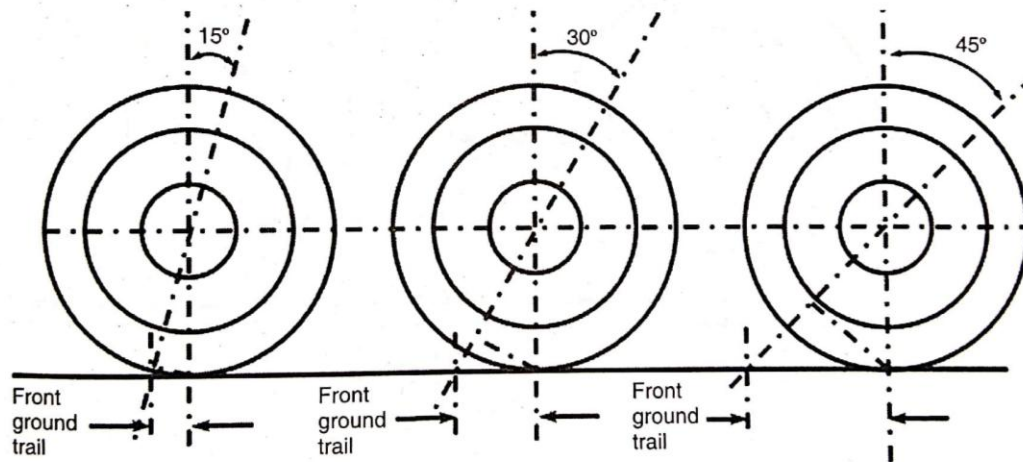
		<p>material due to reasons like joining of parts is easy, raw material cost relatively lesser, young's modulus is high etc.</p> <p>Low alloy nickel plated chromium and molybdenum steel is used for making frame of such heavy duty motorcycle. It has high fatigue strength, abrasion and impact resistance, toughness and torsional strength. It can be heat treated in number of ways to give it a desired combination of properties. The steel is known as AISI-4140 steel.</p> <p>The some parts are made of aluminum alloy to reduce the weight.</p> <p>(Note: credit shall be given to alternate correct answer)</p>	<b>06 marks</b>
	<b>b)</b>	<b>Explain with sketch working of electronic petrol injection system. State its advantages over carbureted fuel system.</b>	<b>06</b>
		<p><b>Working of Electronic Fuel injection system:</b> Because mechanical injection systems have limited adjustments to develop the optimal amount of fuel into an engine that needs to operate under a variety of different conditions (such as when starting, the engine's speed and load, atmospheric and engine temperatures, altitude, ignition timing, etc.) electronic fuel injection (EFI) systems were developed that relied on numerous sensors and controls. When working together, these electronic components can sense variations and the ECU computes the appropriate amount of fuel needed to achieve better engine performance based on a stored "map" of optimal settings for given requirements.</p> <p>EFI gasoline engine components These examples specifically apply to a modern EFI gasoline engine. Parallels to fuels other than gasoline can be made, but only conceptually.</p> <ul style="list-style-type: none"> <li>• Injectors</li> <li>• Fuel pump</li> <li>• Fuel pressure regulator</li> <li>• Engine control unit</li> <li>• Wiring harness</li> <li>• Various sensors (some of the sensors required are listed here)             <ul style="list-style-type: none"> <li>• Crank/cam position: Hall effect sensor</li> <li>• Airflow: MAF sensor, sometimes this is inferred with a MAP sensor</li> <li>• Exhaust gas oxygen: oxygen sensor, EGO sensor, UEGO sensor</li> </ul> </li> </ul>	<b>Working 2 Marks,</b>
		 <p style="text-align: center;">Fig. 1 System diagram</p>	<b>Sketch- 2Marks,</b>



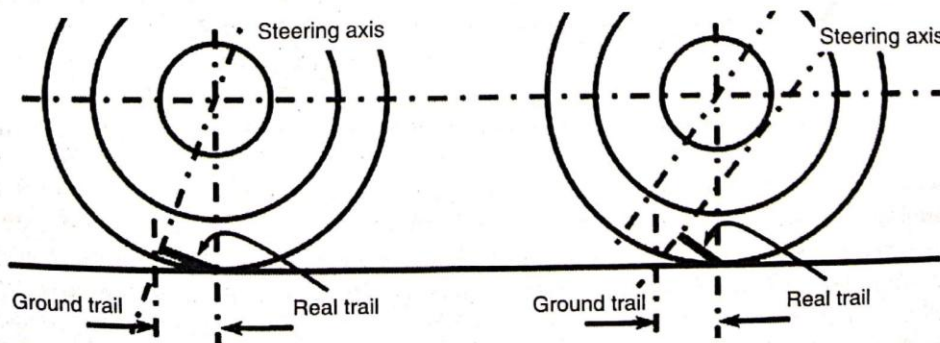
		<b>Advantage of fuel injection system over carburetor</b> 1. Improved power output. 2. Better fuel efficiency over a wide range of engine speed. 3. Quick warm-up of engine. 4. Reduced engine emission that meets strict emission norms. 5. Better throttle response of the engine. 6. Better pick- up (acceleration). 7. Compact design of fuel supply system. 8. Modular design	<b>Advantage - Any 2 - 1 marks for each</b>
	c)	<b>Explain with relevant justification that use of catalytic convertor reduce the tail pipe emissions.</b>	<b>06</b>
		The emissions from exhaust of vehicle are pollutants like Carbon monoxide (CO), Un-burnt Hydro carbon (UBHC), and oxides of nitrogen (NOx) without any after treatment device. Use of catalytic converter affects the exhaust as follows- i) It converts carbon monoxide from exhaust gases into carbon dioxide by oxidation process. ii) It converts unburnt hydrocarbons into carbon dioxide and water by oxidation process. iii) Catalytic convertor in catalyst reduction process reduces nitrogen oxide to pure nitrogen and in oxidation of carbon monoxide to carbon dioxide. In this way catalytic convertor converts more harmful gases into less harmful gases.	<b>06 Marks</b>
<b>6</b>		<b>Attempt any TWO of the following.</b>	<b>12</b>
	a)	<b>Explain with sketches effect of steering geometry on vehicle performance.</b>	<b>06</b>
		<b>Answer:</b> The performance of vehicle is affected by steering geometry as turning ability . maneuverability , stability etc. The effects are due to change in the steering geometry parameters like trail, cater angle or rack angle . <b>Effect of trail:</b> Increasing the trail to increase the restoring force and correcting torque on the wheels results diminishing turning ability. <b>Effects of rack angle or caster angle:</b> Increased rack angle with sufficient amount of trail tends to increase the straight line ability. Increased rack angle with small trail adversely affects the straight line ability. It reduces the caster effect by affecting trail. Tendency of dropping of steering head also increases with larger rack angles	<b>Effects</b> <b>3 marks , sketches</b> <b>3 marks</b>



**Figure 10.5** Equal Amount of Trail Achieved through Various Orientation of Steering Axis.



**Figure 10.6** Increase in Front Trail for Hub-Centre Steering.



**Figure 10.7** Decreased Real Trail.

**b) Select a tyre for sports bike and justify it with illustrations.**

**06**

**Criteria for selecting tyre for Sports bike :**

1. 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.
2. Rolling Resistance: It should provide very good fuel economy by offering lower rolling resistance.
3. Comfort : It should provide a comfortable ride to the rider and pillion rider

**06 Marks**

		<p>4. High speed stability: A tyre should provide better high speed stability.            5. Handling characteristics: A tyre should provide better cornering behaviour.            6. 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.            7. Tyre width: It should have high sectional width for better stability.            8. Type of Tyre: Tubeless tyre</p> <p><b>illustarion:</b></p> <p>Wheel Type: Alloy Wheel            Wheelbase =1440 mm  <b>Tyre :</b>            Front Tyre : 120/70 ZR17 M/C (58W)            Rear Tyre: 190/55 ZR17 M/C (75W)            Tyre type: Tubeless Tyre (TT)            Tyre pressure: front- 32 psi and rear 36 to 38 psi            High sectional width</p>	<b>06 Marks</b>
	<b>c)</b>	<b>Explain with block diagram working of microprocessor controlled ignition system.</b>	<b>06</b>
		<p>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> <p><b>Microprocessor controlled ignition system:</b></p>	<p><b>Explanati on</b></p> <p><b>3Marks,</b></p> <p><b>Block diagram- 3Marks</b></p>

