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
01		**Attempt any FIVE of the following:**	20
	a)	**What is Gear ratio? State the Gear ratio of motor cycle.**	04
		Answer: Gear ratio: Gear ratio is ratio of number of teeth on the driven gear to number of teeth on the driving gear. In a motorcycle there is more than one gear at work so there also are more gear ratio. All these are working together and form the overall ratio. Most gearing consists of: 1. Primary drive, this is the gear ratio between engine RPM and the clutch shaft RPM, also called 'Primary reduction ratio' 2. Gearbox ratio, this is the ratio between the clutch shaft RPM and the countershaft RPM. Because there are more gears in a gearbox, different ratio are possible 3. Final drive ratio, this is the ratio between countershaft RPM and rear sprocket RPM. In the low gear the driven gear almost has more teeth and in the higher gear, the driven gear has less number of teeth compare to the driving gear.	02

Primary reduction ratio	73/24(3.042)
Secondary reduction ratio	42/14(3.000)
Gear Ratio	
1 st	34/12(2.833:1)
2 nd	30/16(1.875:1)
3 rd	30/22(1.1364:1)
4 th	24/21(1.143:1)
5 th	22/23(0.957:1)
6 th	21/25(0.840:1)

Gear ratio for motorcycle (YamahaYZF-R15)
(Note: Equivalent credit should be given to gear ratios of any other motorcycle)

02

	b)	**State any four advantages of electronic Injection System.**	04
		Answer: **Advantage of electronic fuel injection system:** ***(****Any four-1 mark each****)*** 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. 9. Engine performance is maintained under various loads and atmospheric pressures (altitude). 10. Engine need not be tuned from time to time as in case of carburetted engine fuel supply system. 11. Engine idle speed is controlled by microprocessor and so precisely controlled. 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. 13. Improved atomization. Fuel is forced into the intake manifold under pressure that helps break fuel droplets into a fine mist. 14. Better fuel distribution. Equal flow of fuel vapors into each cylinder. 15. Smoother idle. Lean fuel mixture can be used without rough idle because of better fuel distribution and low-speed atomization. 16. Better cold weather drivability. Injection provides better control of mixture enrichment than a carburetor.	
	c)	**State four advantages of gas filled shock absorber used in rear end suspension system**.	04
		Answer**: Advantages of gas filled shock absorber used at rear end- *(Any four points -1 Mark each)*** 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. 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. 3. The tolerance to heat in gas filled shock absorber is greater. 4. Gas filled shock absorber give longer life to tyres and other related components in the suspension such as springs, brushes etc. 5. A gas filled shock absorber is designed to reduce foaming of the oil.	

d) Differentiate between Disc Brake and Drum Brake system with examples. 04

Answer: Comparison of drum brake with disc brake: *(Any four points -1 mark each)*

Sr. No.	Drum brake	Disc brake
1.	Friction occurs on the internal surfaces therefore heat dissipated only by conduction through the drum	Frication surfaces are directly exposed to the cooling air.
2.	Curved frication pads are used	Flat frication pads are used
3.	Non uniform wear of frication linings.	There uniform wear of friction pads
4.	There is loss of efficiency due to expansion	There is no loss of efficiency due to expansion
5.	Comparatively higher weight	Weight is less so saving up to 20 % is possible
6.	Comparatively higher anti-fade characteristics	Disk brakes have comparatively better anti fade characteristics.
7.	Complicated design	Simple in design
8.	Removal and replacement of brake linings is difficult and consumes more time.	Comparatively easy to remove and replace friction pads
9	More friction area	Less friction area
10	Pressure intensity is less	Pressure intensity is more

e) Describe the working of microprocessor controlled Ignition system 04

Answer: 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 0 V – type 2 cylinder engine. 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. 02

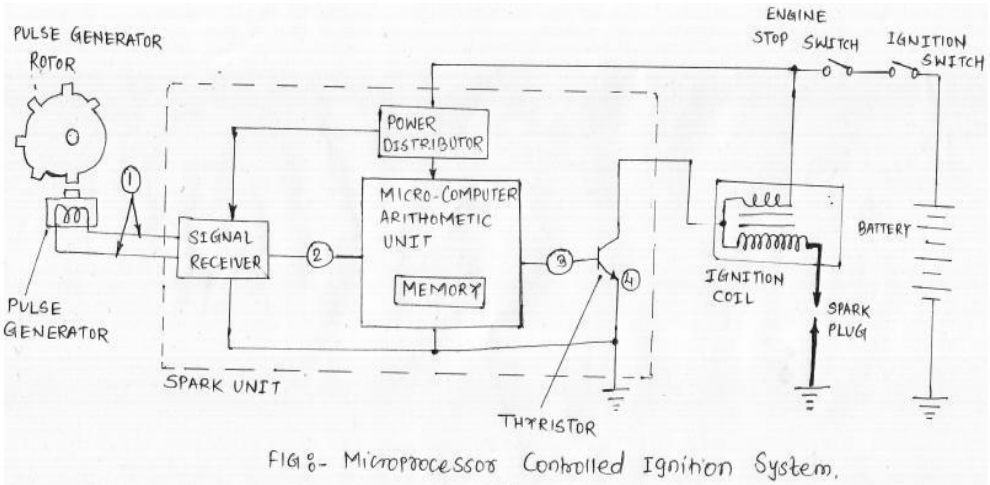
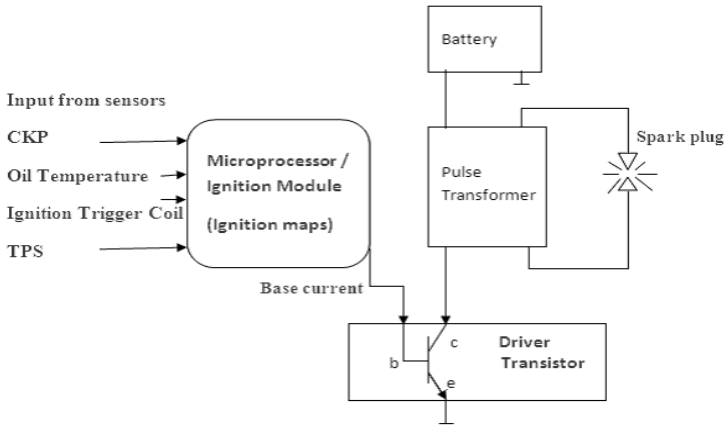


FIG 8- Microprocessor Controlled Ignition System. 02

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. — 02

Microprocessor controlled ignition system:



— 02

f) State the importance of Helmet and Day-night Goggle while driving 2-wheeler. — 04

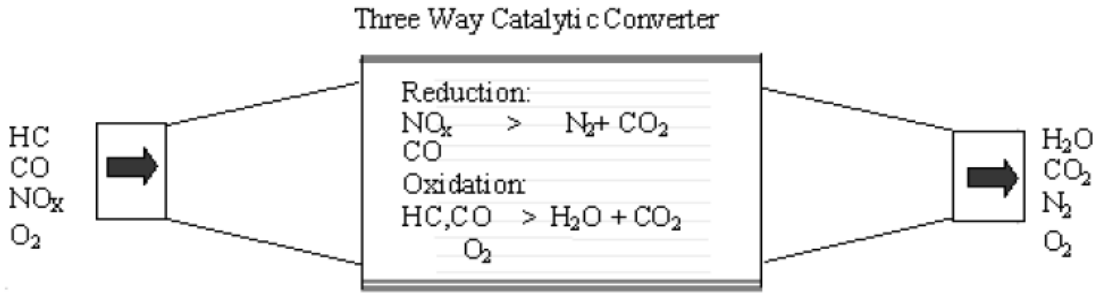
Answer: **i) Helmet:** The primary goal of motorcycle helmet is motorcycle safety to protect the riders head during impact, thus preventing or reducing head injury and saving the riders life. Some helmets provide additional convenience such as ventilation, face shield and ear protection. The helmet is 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. — 02

i) **Day-night Goggle:** 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

<table>
<tr><td></td><td>g)</td><td>Describe the construction and working of washable oiled sponge element type of air filter.</td><td>04</td></tr>
<tr><td></td><td></td><td>Answer: Construction: It consists of filtering element which is made from a polyster or polyurethane low density sponge which has been impregnated with lubricating oil. The foam filter usually fits over a metal or plastic apparatus to help hold its shape. One side of air filter is open to atmosphere and other is connected to the induction side of the engine.
Working: A side of air filter which is open to atmosphere sucks the atmospheric air through duct .The air passes through the tiny holes of air filter. The oil which is present over the foam air filter reduces the size of air passages & it provides a sticky retaining medium for the entrapped dust. This type of air cleaner should be cleaned periodically, about every 8000 km.</td><td>02

02</td></tr>
<tr><td>02</td><td></td><td>Attempt any <u>FOUR</u> of the following:</td><td>16</td></tr>
<tr><td></td><td>a)</td><td>Compare chain drive with Belt drive with their applications.</td><td>04</td></tr>
<tr><td></td><td></td><td>Answer: Comparison of chain drive with belt drive: (Any 04 - 1 mark for each point)
<table>
<tr><th>Sr. Chain drive</th><th>Belt drive</th></tr>
<tr><td>1. They have reduced noise emission</td><td>They are quieter in operation. Noisy operation durin initial acceleration.</td></tr>
<tr><td>2. Most efficient system</td><td>Comparable with chain drive</td></tr>
<tr><td>3. Smallest width</td><td>Wider than chain drive.</td></tr>
<tr><td>4. Proper and periodic lubrication is necessary.</td><td>No lubrication for belt. Belts do not rust</td></tr>
<tr><td>5. You can split a chain and replace it easily.</td><td>Belt replacement requires removal of swing arm.</td></tr>
<tr><td>6. Cost lowest</td><td>Cost moderate</td></tr>
<tr><td>7. Max Velocity Ratio is maintained</td><td>Less Velocity Ratio is maintained</td></tr>
<tr><td>8. Application-Motorcycle</td><td>Application- Scooterette, mopeds</td></tr>
</table></td><td></td></tr>
<tr><td></td><td>b)</td><td>Describe the working of catalytic Converter with a neat sketch.</td><td>04</td></tr>
<tr><td></td><td></td><td>Answer: Answer:
Three Way Catalytic Converter:
Working: The catalytic converters conversion rate is largely a function of operating temperature; no meaningful treatment of pollutants takes place until the converter has reached an operating temperature of approximately 400…8000C provide ideal conditions for maximum efficiency and extended service life.
Catalyst Reduction First, nitrogen oxide gives up its oxygen. This only occurs when a sufficient amount of carbon monoxide is available for the oxygen to bond with. This chemical reaction results in reduction of nitrogen oxide to pure nitrogen and oxidation of carbon monoxide to form carbon dioxide.
Catalyst Oxidation. Second, hydrocarbon and carbon monoxide continue to burn. This occurs only if there is a sufficient amount of oxygen available for the hydrogen and carbon to bond with. This chemical reaction results in oxidation of hydrogen and carbon to form water</td><td>02</td></tr>
</table>

vapour (H2O) and carbon dioxide (CO2).



02

Fig: Catalytic convertor

OR

Two Way Catalytic Convertor:

Working: A two way catalytic converter has two simultaneous task:

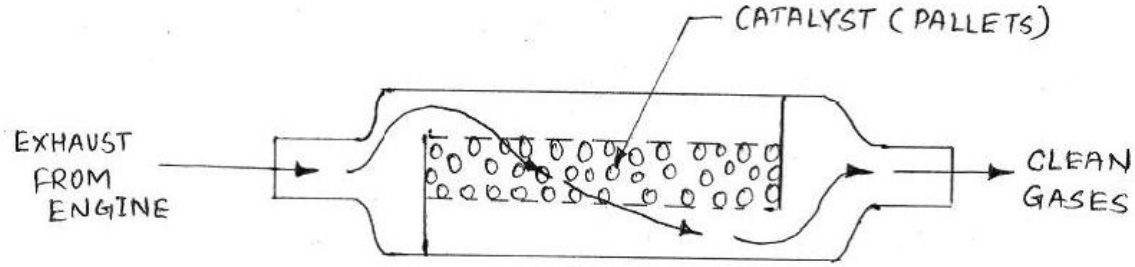
1) Oxidation of carbon monoxide to carbon dioxide:2CO+O2→2CO2

2) Oxidation of unburnt hydrocarbons (unburnt & partially burnt fuel) to carbon dioxide & water:

$2CxHy+(2x+y/2)O2 \rightarrow 2x\ CO2+yH2O$

02

This type of catalytic converter is widely used on diesel engines to reduce hydrocarbon & carbon monoxide.

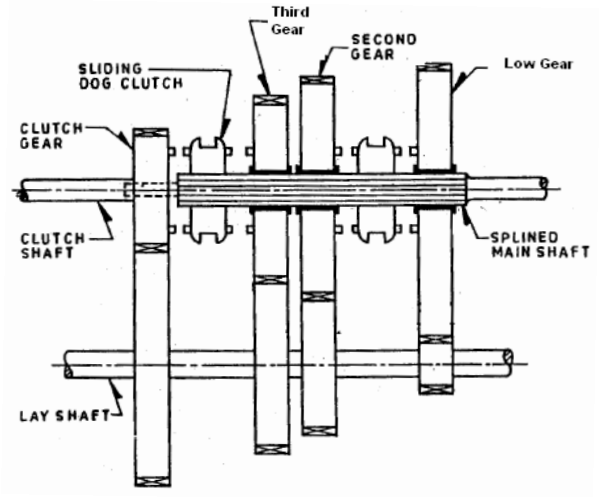


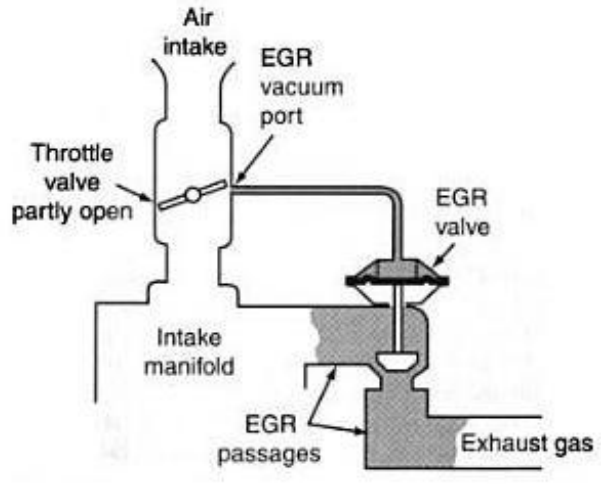
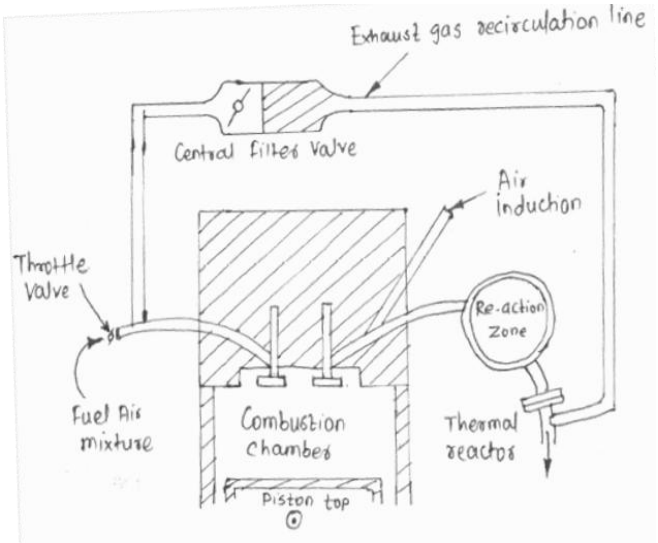
02

Fig: Catalytic convertor

	c)	**State the purpose of providing Coil-in-Coil spring arrangement in suspension system.**	04
		Answer: Purpose of providing coil-in-coil spring arrangement in suspension system:- Coil-in-coil spring arrangement is used due to following reasons: 1. It provides effect of a dual rate spring. 2. It is a low cost substitute for variable rate spring. 3. It provides better contact with road surface while on bump. 4. Suspension is soft for light shock loads while it is stiff for heavier shock loads. 5. They offer a softening and gradual flexibility to the vehicle's ride	**(**Any 04 - 1 mark for each point)

	d)	**What is the criteria for selection of a tyre for a Sport bikes.**	04
		Answer: Criteria for selection of a tyre: ***(Any four points)*** 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 4. High speed stability: A tyre should provide better high speed stability. 5. Handling characteristics: A tyre should provide better cornering behavior. 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.	
	e)	**What is mean by DTSi system? State its purpose.**	04
		Answer: DTSi system stands for Digital Twin Spark Ignition system. In digital Twin Spark Ignition system, engine has twin or two spark plugs and the ignition timing is digitally mapped on the microprocessor chip provided in the CDI unit. The spark plugs located at opposite ends of the combustion chamber and hence fast & efficient combustion is obtained. **Purpose**- 1) The microprocessor memory chip manages accurate ignition timing at all level of engine load and speed with respect to engine rpm. This optimizes power and lead to better derivability. 2. The twin spark plugs introduce spark simultaneously in the combustion chamber and improvises combustion process, which leads to low emissions, better fuel efficiency and minimizes knocking drastically. 3. This system can adjust idling speed & even cuts off fuel feed when acceleration grip is released and meters the enrichment of the air – fuel mixture for cold starting and accelerating purposes. 4. Less vibration and noise 5. Long life of the engine parts such as piston ring and valve stem 6. Decreases in the specific fuel consumption 7. No overheating. 8. Increase the thermal efficiency of engine and even bear high load on it.	*02* *(Any two- 02 Marks)*
	f)	**Why ground clearance is most necessary for 2-wheelers. Explain.**	04
		Answer: Ground clearance is provided for following reasons: *(any four points)* 1. To overcome potholes and bumps on road with ease and at certain speeds without worrying about any part of vehicle being hit by the road irregularity. 2. To provide adequate cornering clearance during turns. 3. To provide adequate height to the seating position of rider 4. To accommodate for change in position of suspension height and during brake dip. 5. To enable driver to ride vehicle through low lying water logged areas without the trouble of water entering engine systems.	

03		**Attempt any FOUR of the following:**	16
	a)	**Describe the working of Constant Mesh Gear box used in motor Cycle with schematic layout.**	04
		Answer: 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 4^{th} 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 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.  **Figure: Constant mesh gear box** ***(Note: Equivalent shall be given to any other suitable sketch and relevant description)***	02 02
	b)	**What is mean by EGR? Describe it with neat sketch.**	04
		Answer: EGR is Exhaust Gas recirculation: The EGR system is used to reduce the amount of NOx in the exhaust. NOx production increases as the temperature inside the combustion chamber rises due to acceleration or heavy engine loads, because high temperature encourages the nitrogen and oxygen in air to combine. Therefore, the best way to decrease the production of NOx is to hold down the temperature in the combustion chamber. The EGR system recirculates CO2 & H2O gases through the intake manifold in order to reduce the temperature at which combustion takes place. When the air: fuel mixture & exhaust gases are mixed together, the proportion of fuel in the air: fuel mixture naturally falls (mixture becomes leaner), and in addition, some of the heat produced by combustion of this mixture is carried away by the exhaust gas. The maximum temperature attained in the combustion chamber therefore falls, reducing the amount of NOx produced. The EGR system allows a small amount of exhaust gas (less than 10% of total) to be supplied into the incoming air: fuel mixture. The main aim is to reduce the	02

		NOx.  **Figure: The EGR valve controls the amount of exhaust flowing back into intake manifold** **OR**  **Figure: Exhaust Gas Recirculation System**	02
	c)	**State the purpose of following: i) Horn ii) Reflector iii) Mobile charge point iv) tachometer**	04
		Answer: **i) Horn:** Horns is a sound creating device electrical horns are used in all the automobile vehicles. 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. Lights breaks & horns are the devices that prevent accident. Horns are included in safety device. Horns are also used as a calling bell to call the person when vehicle is ready to start. **ii) Use of Reflector:** It act as mirror surface from which head light rays /light are scattered on	01

		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. It is a piece of glass or metal for reflecting light in a required direction. **iii) Use of Mobile charge point:** A phone charger is a must whenever you are out of the house, whether you are in a car or a bike. The Bike Charger is a device that uses your Bike battery to charge the Mobile phone. Mobile charge point is a great asset during travel and emergency situations. **iv)Tachometer:** The tachometer is used to measure/register the engine speed in revolution per minute (RPM).The use is to let you know that you have reached maximum engine speed in that gear and ready to shift. Driver can easily see the tachometer and act accordingly since it is located at dashboard	01 01 01
	d)	**State any four and safe driving habits to avoid accidents.**	04
		Answer: Following are the good driving habits to avoid accidents: (Any 4 points) 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.	
	e)	**State the functions of fuel supply system of 2- wheeler.**	04
		Answer: Functions of fuel supply system: (Any 4 points) 1) To ensure the smooth and uninterrupted supply of fuel. 2) To supply metered quantity of fuel at specific time. 3) To supply the fuel in the form of finely atomized particles. 4) To store the fuel and minimize the vapour loss to atmosphere. 5) To prevent the contamination of fuel. 6) To filter out the foreign particles and contaminant from fuel. 7) To supply the fuel under gravity or under pressure as per the design. 8) To control the ratio of Fuel: Air as per the requirement of load and speed.	
	f)	**State the importance of: i) Side panels of scooter and motor Cycle. ii) Tail lamp and Indicator Light**	04
		Answer: i) Side panels of scooter and motor Cycle: The side panels for scooter / Scooterette provide the following: 1. They cover internal components like wiring harness, engine and other systems from dirt, dust and protect them. 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. 3. Removal of side panels expose wiring harness and other systems for repair/ maintenance. 4. It proves a good look with graphics and panel colours matching the colour of vehicle fuel tank.	

		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. 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. 7. A reduction in air drag allows for taller gearing which in turn increases engine life. 8. Scooter/ Scooterette 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. 9. The rider's clothes do not get stuck at protruding components/ system assemblies or torn on account of rider's body movement. 10. Side panels protect the rider and pillion rider from the splashed water, dust, dirt and debris on the road. **ii) Tail lamp and Indicator Light:** A red light on the back of road vehicle that makes it possible for the vehicle to be seen in the dark. These are also use during time of emergency. The 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. The reverse light is also a part of tail lamp assembly to indicate if the vehicle is backing up. Reflectors are used in head light assembly and tail lamp, concave in shape or parabolic. It is a safety device. It is used to indicate the direction of the vehicle like left & right side. While driving on road, It gives informative signal (illumination light or flash) to the other vehicles. Turning your signal light on before each turn reduces confusion and frustration for the traffic around you.	02 02
04		**Attempt any <u>FOUR</u> of the following:**	16
	a)	**Describe Centrifugal Clutch used in LMV with neat sketch**	04
		Answer: The centrifugal clutches are usually incorporated into the motor pulleys. It consists of a number of shoes on the inside of a rim of the pulley, as shown in fig. The outer surface of the shoes are covered with a friction material. These shoes, which can move radially in guides, are held against the boss (or spider) on the driving shaft by means of springs. The springs exert a radially inward force which is assumed constant. The mass of the shoe, when revolving, causes it to exert a radially outward force (i.e. centrifugal force). The magnitude of this centrifugal force depends upon the speed at which the shoe is revolving. A little consideration will show that when the centrifugal force is less than the spring force, the shoe remain in the same position as when the driving shaft was stationary, but when the centrifugal force is equal to the spring force, the shoe is just floating. When the centrifugal force exceeds the spring force, the shoe moves outward and cones into contact with the driven member and presses against it. The force with which the shoe presses against the driven member is the difference of the centrifugal force and the spring force. The increase of speed causes the shoe to press harder and enables more torque to be transmitted.	02 02

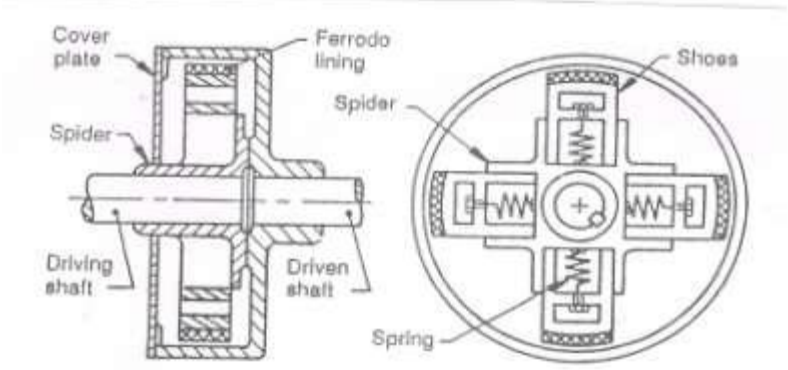


Fig. Centrifugal clutch.

b) List Intake Systems of 2- stroke Petrol engine. Describe any one with sketch. 04

Answer: Intake systems for two stroke engines: (*List-1 mark, Description of any one system with sketch -3 marks*) Three intake systems for two strokes engine are: 1) Piston controlled port 2) Reed valve 3) Rotary disc valve

1. 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.

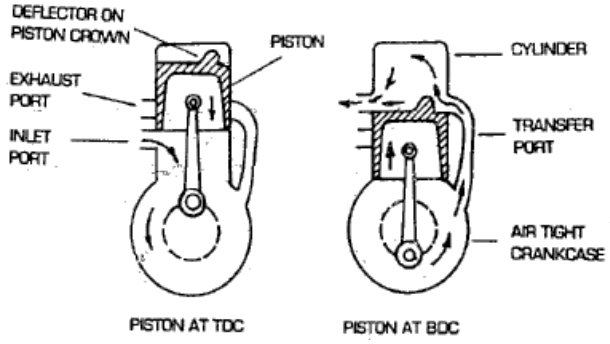


Fig: Operation of Piston controlled port two stroke engine

2. Reed valve: The reed valve system uses a set of thin flapper petals. Reed petals are made of either fiber or flexible metal plate. The reed valve fitted to a two stroke engine controls the entry of air fuel mixture in to the crankcase. The operation of reed valve is dependent on the crankcase pressure and vacuum. The reed stops prevents over flex and possible brakeage of reed petals. When the piston travels up in cylinder bore, vacuum is created below it. As the crankcase vacuum develops and as the piston bottom edge uncovers the inlet ports, the reed petals are bent and lifted from the cage. This allows the air fuel mixture to inter into the crankcase. The mixture flow into the crankcase continuous as long as there is enough vacuum to hold reed petals open. As the crankcase begins to pressurize due to the downward

movement of piston, reed petals are forced to close.

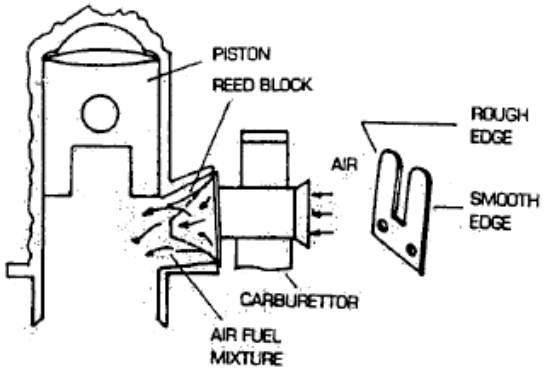


Fig: Reed assembly in the intake port

3. Rotary disc valve The rotary disc valve two stroke engine operates on the same principle as the piston controlled port type engine except for the mode of admission of fresh charge into the crankcase. The rotary disc valve is resin hardened fiber disc. This disc has a cut way section along its circumference. The disc mounted the end of the crankshaft. The disc is enclosed within a narrow sealed chamber. This chamber is located between the crankcase inlet port and the carburettor outlet. As the rotary disc valve rotates at some instant the cut away section exposes the inlet port to the carburettor outlet. This allows air fuel mixture to be sucked into the crankcase. Vacuum is created in to the crankcase by the upward movement of piston. Then, on further rotation cut away section ends. Then inlet port is sealed by the disc. Now the mixture entry into the crankcase is terminated. The cut away section in the disc acts as inlet valve.

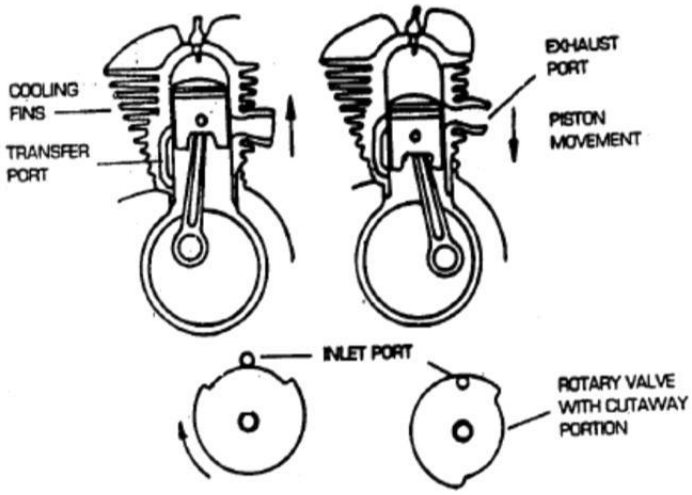
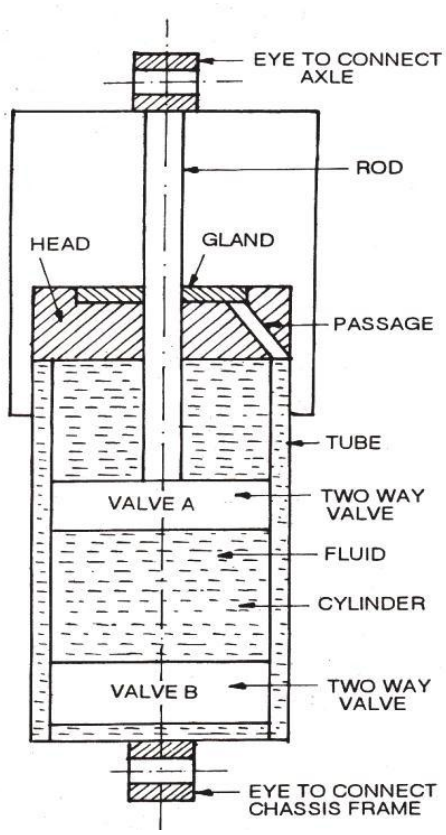


Fig: Disc valve operation

	c)	**Describe the working of Double acting type shock absorber with neat sketch.**	04
		Answer: Double acting type of shock absorber: 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.  **Figure: Double acting shock absorber**	02 02
	d)	**Describe the working of charging system of two wheeler with block diagram**	04
		Answer: 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 help of filament type fuse.
- This fuse is having capacity to deliver 12 V to 16 V and 15 A current.

In case of failure of fuse it disconnects the supply from regulator cum rectifier to battery.

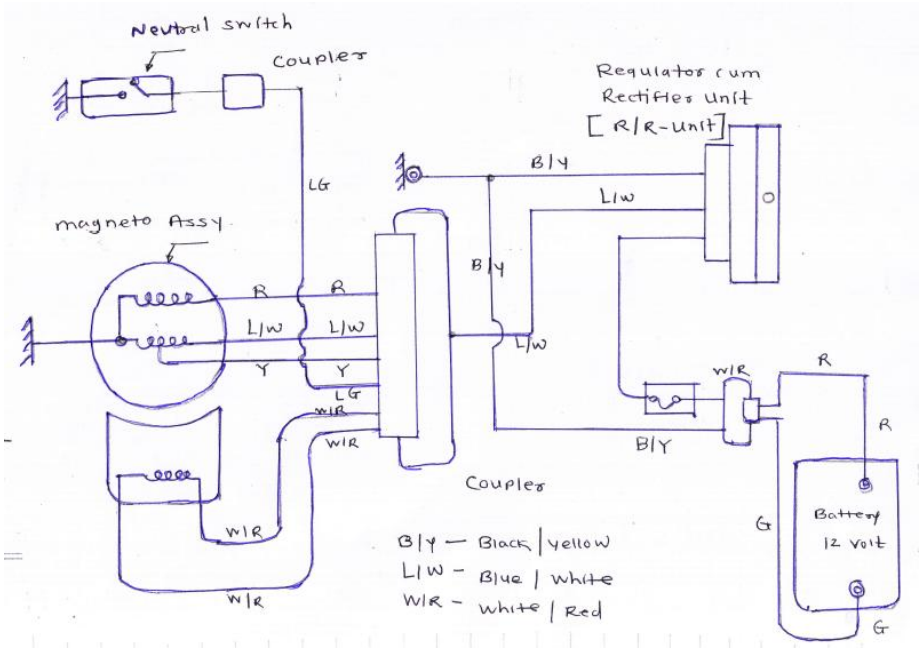
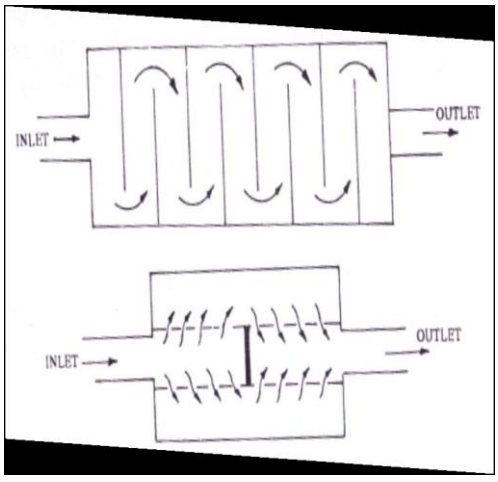


Figure: Circuit diagram of two wheeler charging system showing AC and DC circuits

e) Explain the ergonomic effects of (i)Motor Cycle Handle Bar Position (ii) Seating arrangement for rider and pillion rider — 04

Answer: (i) Motor Cycle Handle Bar Position: 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. — 02

(ii) Seating arrangement for rider and pillion rider: 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 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 — 02

		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.	
	f)	**What is Muffler? State its types. Explain any one with sketch.**	04
		Answer: Muffler: It is a device for decreasing the amount of noise emitted by the exhaust of an IC engine**.**	01
		OR	
		The exhaust gases leave the exhaust manifold with high pressure and also produce a loud noise. In order to reduce the noise as much as possible, a muffler or silencer is used in exhaust system. The muffler is fitted between pipe and the tail.	
		Types of muffler: 1. Baffle type 2. Wave cancellation type 3. Resonance type 4. Absorber type 5. combined resonance and absorber type	01
		1. Baffle type muffler: It consists of number of baffles spot welded inside the cylindrical body. The purpose of these baffles is to close direct passage of exhaust gases, thus the gases travels a longer path in the muffler. There are many designs of baffles used in the muffler. Figure shows two types of such muffler. The measure drawback of this type muffler is its low efficiency. Due to the restricted flow of exhaust gases, back pressure increases causing the loss of engine HP.	01
			01
		Figure: Baffle type muffler	01

2. Wave cancellation type muffler: In this type of muffler the exhaust gases entering the mufflers are divided into two parts to flow in the muffler. The lengths of these paths are so adjusted that after they came out of muffler, crests of one wave coincide with the trough of the second wave, thus the cancelling each other & reducing the noise to zero theoretically. This is achieved if the length of two paths differs by half the wavelength. But this is not practically achieved because the noise created by exhaust gases is combination of different frequencies at the different engine speeds. However appreciable noise is reduced.

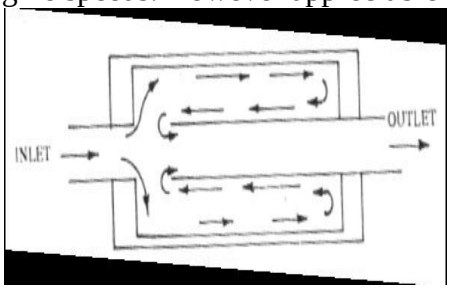


Fig : Wave cancellation type muffler

3. Resonance type muffler: It consists of a number of Helmholtz resonators in series through which a pipe having access port passes. Helmholtz is the name of a person who originated the idea of this type of muffler. The exhaust gases flow through this pipe. The resonators eliminate the fundamental and higher harmonics of the engine noise. 01

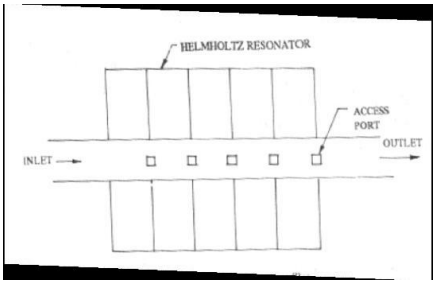


Fig: Resonance type muffler

4. Absorber type muffler: It consists of a perforated tube, around which a sound absorbing material, like fiber glass or steel wool, is placed. The exhaust gases pass through the perforated tube. The sound absorbing material reduces the high pressure fluctuation of the exhaust gases thus reducing the noise intensity. These mufflers may be either straight through type or reverse flow type as shown in figure. 01

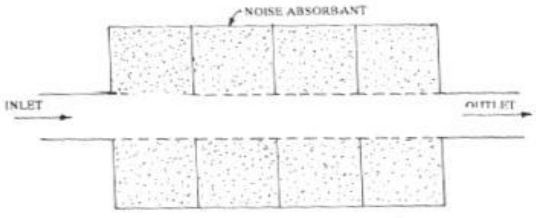


Figure: Straight through Absorber type muffler

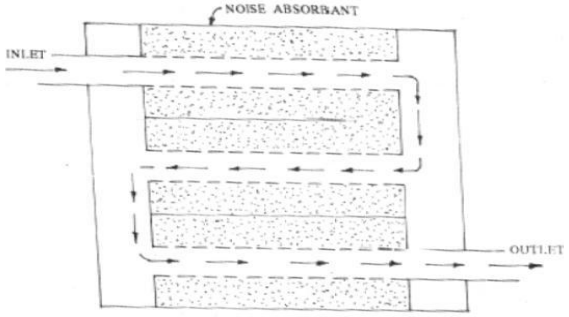


Fig : Reverse flow Absorber type muffler

5. Combined resonance and absorber type muffler: Sometimes a resonance chamber is provided at one end or in the middle of the straight through absorber type muffler to reduce the pressure and noise still further. In some designs, the resonance chamber is a separate unit called a resonator, which connected in series to the muffler.

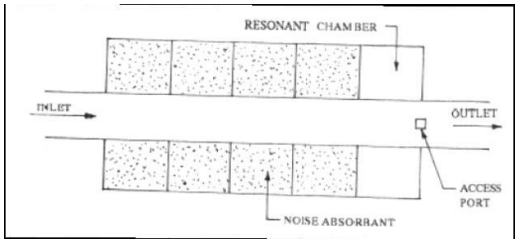
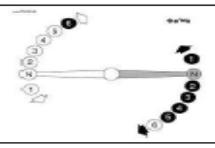
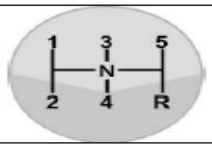


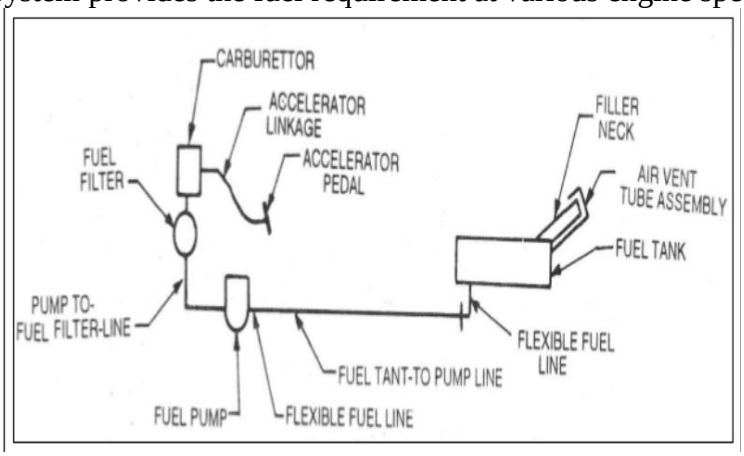
Figure: Combined resonance and absorber type muffler

05 **Attempt any FOUR of the following:** 16

a) **Compare Two wheeler Gear box with Four wheeler Gear Box** 04

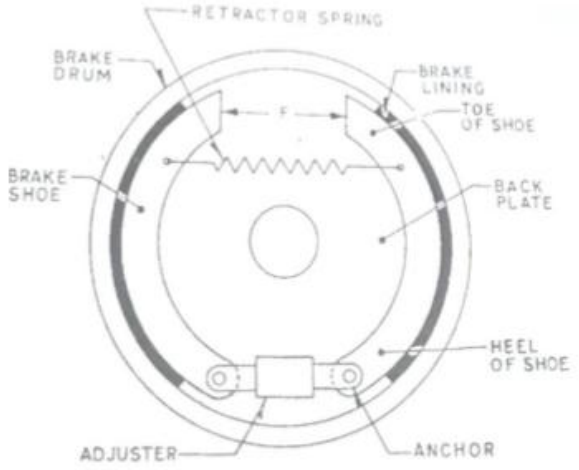
Sr. no.	Parameter	Two wheeler gear box	Four wheeler gear box
1	Type of gear box	Only Constant mesh gearbox is used. Motorcycle gearboxes are unsynchronized in principle.	Constant mesh / sliding mesh or synchromesh gearbox may be used.
2	Dog system	Motorcycle dog system is simple, lighter and takes up less space.	Car dog system is heavier and takes up more space.
3	Skill required in changing gear	More skill is required to change gears.	Less skill is required to change gears.
4	Gear selection	Motorcycle transmissions are sequential. i.e. whether up shifting or downshifting, you must select each ratio in order, with neutral available only between first and second gears.	Driver can access neutral from any gear or speed. Car transmissions are not sequential. But sequential shifting is preferred.
5	Size	Small.	Large.
6	Cost	Low cost due to absence of synchronizer.	High cost due to use of synchronizer.
7	Weight	Lighter	Heavier
8	Maintenance	Less maintenance	More maintenance: Due to complicated dog shift arrangement. : Synchronizer cones may need replacement.
9	Lubrication	Uses engine oil as lubricant for gearbox. (SAE 30W40)	Uses separate oil as lubricant. (SAE 90)
10	Symbolic presentation of gear shifting		

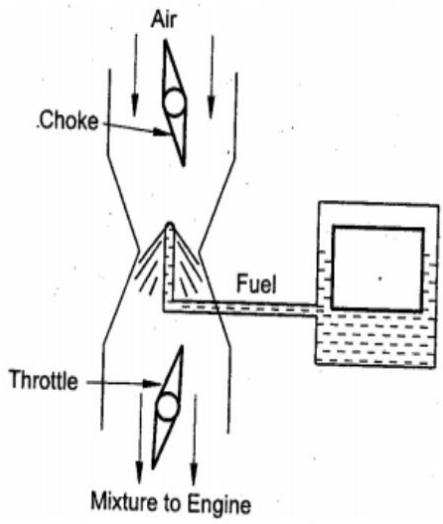
(Any four points)

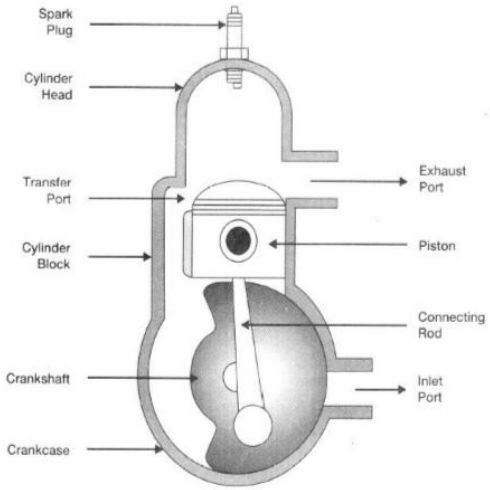
	b)	**Describe the Gravity feed fuel supply system.**	04
		Answer: This system is based upon the simple fact that the engine suction can be based for sucking fuel from the main tank to the auxiliary fuel tank from where it flows by gravity to the carburetor float chamber. In this system the fuel tank is placed below the level of the carburetor. The fuel from the tank is sucked by a separate unit (auto-vac) with the assistance of the inlet manifold vacuum. Then the fuel is fed to the carburetor by gravity. The pump feed system is shown in the figure above. In this system, a steel pipe carries the fuel to the fuel pump which pumps it into the float chamber of the carburetor through a flexible pipe. If the fuel pump is mechanical, it has to be driven from the engine camshaft and hence placed on the engine itself. However electrically operated pump can be placed anywhere. It is mostly located at the rear in the fuel tank reducing the tendency of forming vapour lock. The system provides the fuel requirement at various engine speeds efficiently.  	02 02
	c)	**Compare Kick start and Button start of 2 wheeler vehicles with proper example.**	04
			(any four)

Sr.	Kick start arrangement	Self-start arrangement
01	Kick start mechanism is tiresome operation-requires physical or manual force to start the engine	It doesn't require any type of physical or manual force.
02	It is cheaper or less expensive	It is expensive.
03	It is maintenance free due to absence of battery, starter motor and electrical switches.	Regular maintenance is required i.e. High maintenance.
04	It is difficult to start the vehicle in cold conditions	To start a vehicle, it is very easy. We can start motor cycle in any gear.
05	Require less space and simple construction.	Require more space and complicated construction
06	Kick start involve only mechanical components, no need of battery for starting.	It involves number of components, like battery, self-starter, so the cost of motor cycle increases
07	In case of high compression vehicle, back kick problem arises so it could damage the leg.	Self-starting, hence no back kick problem arises, so it could not damage the leg.
08	No need of battery charging.	It is necessary to use the vehicle regularly to charge the battery.
09	e.g. In old vehicles like-Hero Hondasplendor,Bajaj-Platina etc.	e.g.In all new vehicles like- Bajaj Discover,Pulsar etc.

	d)	**State the use of : i)Neutral indicator lamp ii)Speedometer lamp**	04
		Answer: i) Neutral indicator lamp: 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. **ii) Speedometer:** Speedometer indicates the driving speed of vehicle that is kilometer per hours. It also indicates the total running kilometer by vehicle (odometer). Speedometer indicates the driving speed of vehicle that is kilometer per hours. It also indicates the total running kilometer by vehicle (odometer). A speedometer or a speed meter is a gauge that measures and displays the instantaneous speed of a vehicle. Speedometer is a free GPS based digital head up display (HUD) that shows useful speed and distance information for your journey.	02 02
	e)	**Write the working of carburetor under four engine operating conditions.** **i)Idling ii)Starting iii)Accelerating iv)Normal running**	04
		Answer: 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. **ii) Starting:** Choke is used for starting. It is mounted eccentrically which facilitates its 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 delivers fuel. As the air flow is quite small, the mixture supplied is very rich. **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. **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.	01 01 01 01
	f)	**Describe the working of internal expanding shoe type mechanical brake with sketch.**	04
		Answer: Working of Internal expanding shoe type of mechanical brake: 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

		 Figure: Internal expanding shoe type of mechanical brake	02
Q6		**Attempt any FOUR of the following:**	16
	a)	**What are the major components of transmission system of motor cycle? Explain any two.**	04
		Answer: The major components of transmission system of motorcycle are: (Any two- 2 mark each) **1. Clutch: i)** Clutch disengages and engages the engine to the transmission whenever required. **ii)** It transmits engine power to the gear box. **iii)** By using clutch we are able to shift the gears smoothly without damaging gear teeth. **2. Gear box: i)** It is used to transmit power and motion from engine to rear wheels by using clutch. **ii**) Gear box provides high torque at starting and hill climbing by using lower gear. iii) It provides various speed and torque combination by using set of gears **iv**) The transmission also provides a neutral position so that the engine and the road wheels are disconnected even with the clutch in the engaged position. **3. Drive chain and sprocket: i)** These are used to transmit a power and speed from gear box to rear wheel. **ii)** By using Drive chain and sprocket we will get maximum velocity ratio. **4. Clutch lever: i)** The clutch lever is used to disengage and engage the clutch by clutch cable. **ii)** It acts as a leverage which further connects clutch cable to the clutch lever mechanism which is fitted on the crank case. **5. Gear change lever or pedal: i)** It is used to shift the gear as per the driver's requirement. **ii)** It transmits the necessary power to gear drum.	
	b)	**Describe the working of Down Draught Carburetor system with neat sketch.**	04
		Answer: Down draught carburetor: Working: 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	02

		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.  Figure: Down draught carburetor	02
	c)	**Mention the functions of following. i)D.C. Motor ii)Battery iii)Solenoid**	04
		Answer: Function of starting system components: **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. **ii) Battery:** A starter battery supplies the current to starter motor, needed for engine cranking. 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. **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.	04
	d)	**Describe the effects of following on aerodynamic shape of Motor cycle. i)Shape of fuel tank ii)Shape of head lamp**	04
		Answer: i) Shape of fuel tank: Generally the fuel tank shape is a tear drop design. It offers least aerodynamic drag. 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. 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. 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. Space is ensured for handlebar turning through the required angle. **ii) Shape of headlamp:** The headlamp is available in different shapes; it is depending on the	02

		type of manufacturer or type of vehicle. In motorcycle it is separately placed at the centre of handle bar, while in scooters the head lamp is inbuilt in the handle bar arrangement. Modern head lamps are now parabolic curve reflector, sealed beam enclosed in head lamp fairing. The head lamp is open to atmosphere. The front upcoming air strikes directly on it. So that the head lamp body must be robust and it should be suitably installed. If any sharp edge is on the outer body of the head lamp creates air resistance which affects the efficiency of vehicle. So that the shape must be streamline with no sharp edges. The rounded portion of outer body minimized the air resistance. In this way the head lamp must be streamlined aerodynamically shaped and easy to install.	02
	e)	**Draw Schematic diagram of 2 Stroke Petrol Engine and label the parts of it.**	04
		Answer: Schematic diagram of two-stroke petrol engine: (Sketch - 2 marks, Correct labeling - 2 marks)  *TWo stroke Engine*	
	f)	**State the function of i) crash bar ii)saree guard**	04
		Answer: 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. **ii) Saree guards-** 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.	02 02