



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 judgment 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.

Marks

1. A) Attempt any <u>THREE</u> of the following-	12
a) List four major frame components and write function of each.	4
Answer: Major frame components: (Any four) 1. Bottom tube 2. Steering head tube 3. Swing arm mount 4. Seat rail 5. Down tube 6. Seat pillar tubes 7. Main tube.	2
Function of major frame components: (any four) 1. Bottom tube: It acts as a beam supported by the wheels to carry the weight of the propelling machinery and the rider. 2. Steering head tube: It provides free steering movement of the front wheel. 3. Swing arm mount: It provides a non-flexing mount for the engine suspension and wheel. 4. Seat rail: It carry & support load of rider & pillion rider 5. Down tube: It provides structural strength to the steering head tube & bottom tubes. 6. Seat pillar tubes: It provides structural strength to the seat rail & main tube. 7. Main tube: It supports fuel tank assembly.	2
b) State four advantages of electronic fuel injection system.	4
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).	4



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<ol style="list-style-type: none">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 carbureted 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 the functions of carburetor under following engine operating conditions. i) Idling ii) Accelerating	2
Answer: Functions of carburetor under: i) Idling: During idling condition, engine requires rich air fuel mixture (about 12 :1). The throttle slide is almost closes the passage of air. The amount of air passing across the venturi is small amount. The engine vacuum is applied to the idle discharge port. Idle mixture screw controls the quantity of fuel reaching the mixing chamber. Thus throttle stop screw and idle mixture screw adjustments provide required charge to the engine. It provides the required idling speed of the engine. ii) Accelerating: When acceleration is desired the accelerator twist grip is twisted suddenly, which actuate the main jet giving an extra supply of fuel for acceleration. With opening of throttle valve, the diaphragm of acceleration pump is pushed for additional delivery of fuel in the mixing chamber of carburetor. Such an acceleration pump is used in a performance scooter / motorcycle. With the displacement of pump diaphragm additional fuel is discharged through a separate nozzle in the mixing chamber. It results in rich charge supplied to the engine. Thus acceleration circuit provides improved driveability or increased response to throttle operation.	2 2
d) Describe construction and working of washable dual foam wet type air cleaner.	4
Answer: Washable dual foam wet type air cleaner: 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 untrapped dust.This type of air cleaner should be cleaned periodically, about every 8000 km.	1 2



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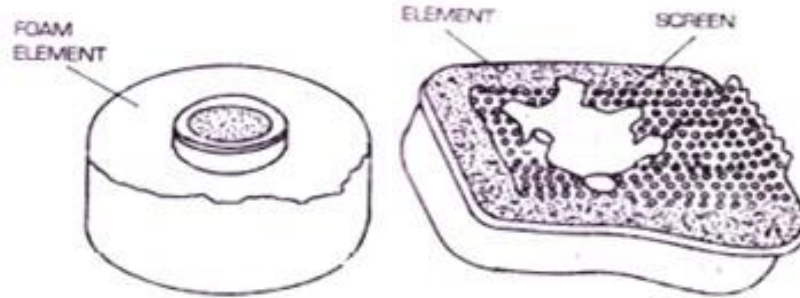


Fig: Foam wet Type air cleaner

1

B) Attempt any ONE :

6

a) Draw a labeled diagram of down draught carburetor and describe its working.

6

Answer: Down draught carburetor:

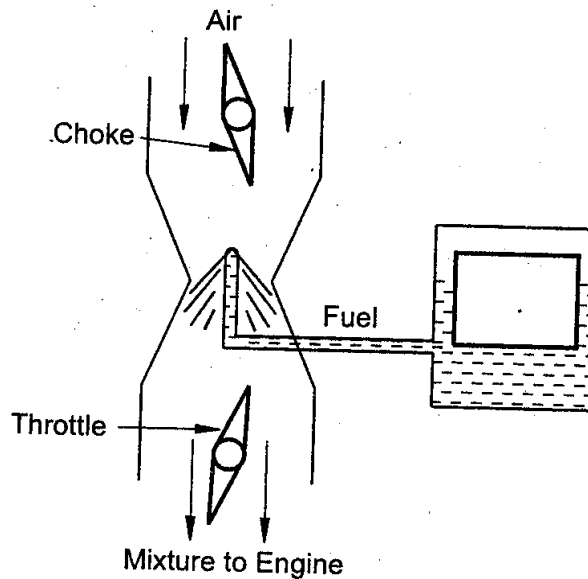


Figure: Down draught carburetor

2

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 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.

4

b) Describe the function of following components of starting system:

- i) DC motor
- ii) Battery
- iii) Solenoid

6



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. 2
- 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. 2
- 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. 2

2. Attempt any FOUR :

a) Describe construction and working of constant mesh gear box.

Answer: Constant mesh gear box:

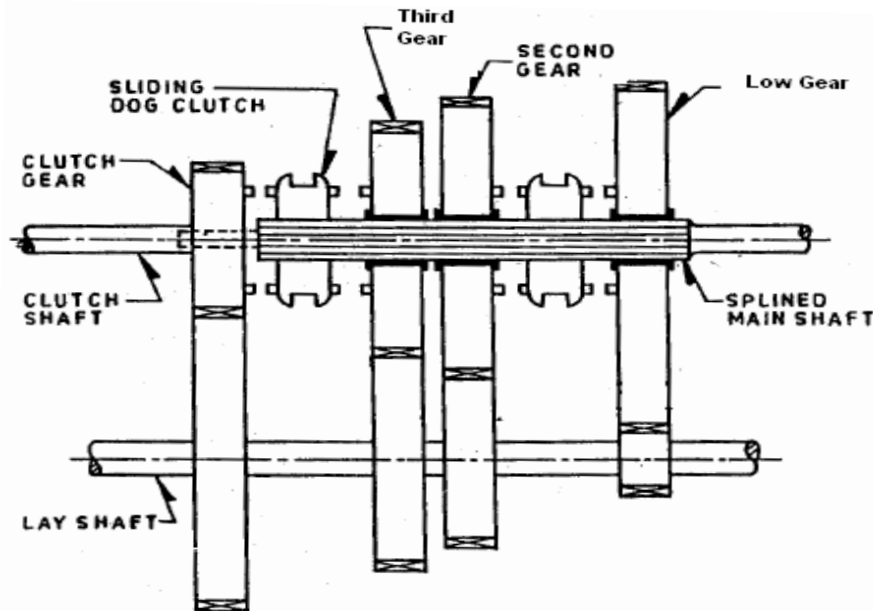


Figure: Constant mesh gear box

(Note: Equivalent shall be given to any other suitable sketch and relevant description)

Construction: A simplified diagram of constant mesh box has been shown in Figure. In this gear box, all gears on the main transmission shaft are constantly connected to corresponding gears on countershaft or lay shaft. In addition, two dog clutches are provided on the main shaft. One dog clutch is between the third gear and clutch gear and another is between the first (Low) gear and second gear. 1

Working: Top or 4th speed gear is obtained when the left dog clutch is slides to left to mesh with clutch gear by using the gear shift lever. In this case, main shaft rotates at the same speed as that of clutch gear or engine crankshaft speed which is the maximum speed. Third gear is obtained when dog 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. 1



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b) State four advantages of multiple valves used in four stroke engine.	4
Answer :Advantages of multiple valve: (Any four- 1 mark each) 1. Increased power output. 2. Better breathing causes lower pumping losses and efficient scavenging. 3. Better fuel efficiency over a wide range of engine speed. 4. Light weight engine. Better Power to weight ratio of engine. 5. Reduced engine emission. 6. Better throttle response due to lighter weight components of the engine (acceleration and deceleration as well as change in engine performance with respect to throttle position change). 7. Better pick- up (acceleration). 8. Compact design of engine. i.e. higher power to weight ratio. 9. Maximum RPM of the engine is increased. i.e. the engine can be revved at higher rpm and therefore, power output and maximum speed of vehicle is increased. 10. Less frequency of engine decarbonizing and spark plug cleaning. 11. Faster combustion due to central location of the spark plug in combustion chamber. 12. Stable and smooth engine idle operation.	4
c) State four advantages of Gas filled shock-absorber for rear end suspension.	4
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.	4
d) Draw a labeled sketch of hydraulic disc break and describe its construction and working.	4
Answer: Hydraulic Disc Brake: Construction: A disc brake consists of a rotating disc and two friction pads which are actuated by hydraulic braking system. The friction pads remain free on each side of disc when brakes are no applied. They rub against disc when brakes are applied to stop the vehicle. Working: In a disc brake, the fluid from the master cylinder is forced into a caliper where it presses against a piston. The piston in turn crushes two brake pads against the disc that is being attached to wheel, making it to stop or slow down. Main advantage of disc brakes is their resistance to wear as the discs remain cool even after repeated brake applications.	1 1

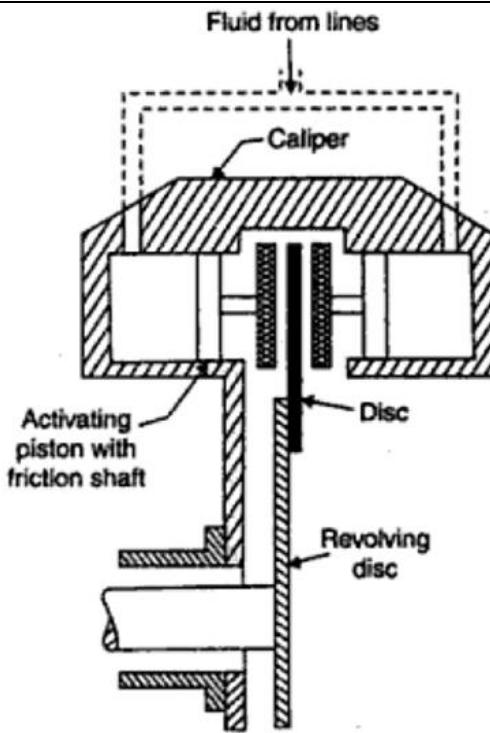


Figure: hydraulic disc brake

(Note: Equivalent shall be given to any other suitable sketch and relevant description)

- e) Describe the purpose of following -
- i) Ground clearance
 - ii) Shape of pillion rider seat.

Answer: Purpose of -

i) Ground clearance:

It overcomes potholes and bumps on road with ease and at certain speeds without worrying about any part of vehicle being hit by the road irregularity. It provides adequate cornering clearance during turns. It gives adequate height to the seating position of rider as well as accommodate for change in position of suspension height and during brake dip. It enable driver to ride vehicle through low lying water logged areas without the trouble of water entering engine systems.

ii) Shape of pillion rider seat:

The design of the motorcycle is limited by the physical constraints of making the machine work. Comfort and ease of use, and ultimately safety, will be determined by the type of bike. The seat and footrests provide the right height for rider and pillion.

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.

For pillion riders the design of seat at rear end is important. At the time of braking due to inertia effect the pillion rider should moves on front side pushing the rider at downward direction not in forward direction. It improves the comfort driving as well as seating. Now a day instead of using separate seat for rider & pillion rider, combined seat is used for better comfort. It provides large space as compared to earlier (old) designed seat.



<p>f) Write the purpose of providing :</p> <ul style="list-style-type: none">i) Head lamp fairing of motorcycle.ii) Side panels of motorcycle.	4
<p>Answer: Purpose of providing-</p> <p>i) Head lamp fairing of motor cycles:</p> <p>A motorcycle fairing is a shell placed over the frame of some motorcycles, especially racing motorcycles and sport bikes, with the primary purpose to reduce air drag. The secondary functions are the protection of the rider from airborne hazards and wind-induced hypothermia and of the engine components in the case of an accident. The major benefit of a fairing on sport touring and touring motorcycles is a reduction in fuel consumption. The reduction in aerodynamic drag allows for taller gearing, which in turn increases engine life. 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. The angle of various beams must be suitably adjusted so that the visibility is cleared.</p> <p>ii) Side panels of motorcycle: The side panels for motorcycle provides the following purposes:</p> <ul style="list-style-type: none">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/ scooterate Side panels also protect the rider/ pillion rider from the engine heat and hot exhaust muffler. Some designs include a spare wheel within a side panel.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.	2
3. Attempt any FOUR :	16
a) What is gear ratio? Write the gear ratios for motorcycle.	4



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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 are 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.

Gear ratio for motorcycle (YamahaYZF-R15):

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(1.364:1)
4 th	24/21(1.143:1)
5 th	22/23(0.957:1)
6 th	21/25(0.840:1)

(Note: Equivalent credit should be given to gear ratios of any other motorcycle)

b) List three intake systems for two stroke engines and describe anyone with neat sketch.

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.

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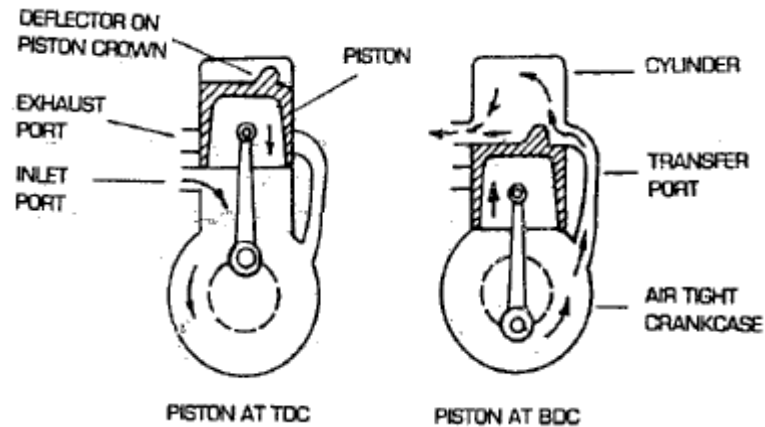


Fig: Operation of Piston controlled port two stroke engine

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 breakage 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 enter 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.

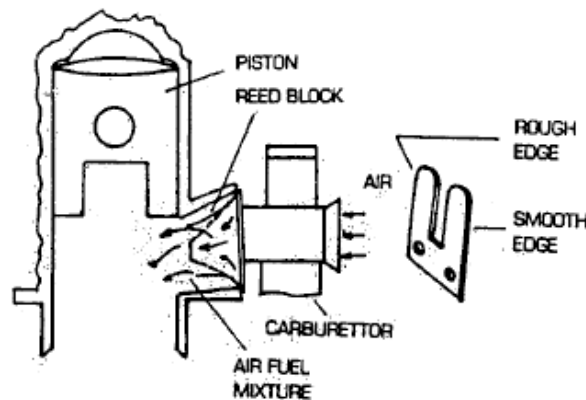


Fig: Reed assembly in the intake port

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 carburetor outlet.

As the rotary disc valve rotates at some instant the cut away section exposes the inlet port to the carburetor 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.

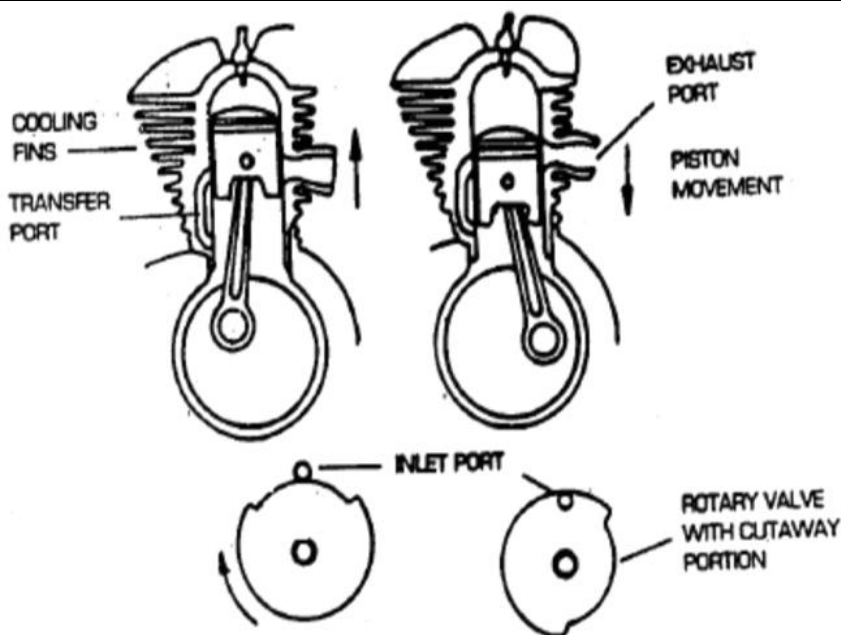


Fig: Disc valve operation

c) State the factors that affect the steering most. Give reasons.

4

Answer: The factors that affect the steering most are- (Any four)

1. **Steering handle & Fork:** They must provide free movement of the linkage to transmit driver's effort at the handle bar to the front wheel. If there is more play in the steering column steering noise and vibrations are created, most of the steering efforts shall be going waste and if there is less play, hard steering would result in.
2. **Tyre pressure:** It should be as per specifications. Less or uneven pressure of air in the wheels shall result in hard steering and more tyre pressure shall lead to wobbling.
3. **Condition of wheel, wheel bearings and bushes:** hard steering shall result in if there is less play, Run out wheels, wheel alignment shall be affected, which has great influence on the steering operation.
4. **Caster:** caster angle restores the deflected steering to the straight ahead position. It gives a certain degree of straight line stability.
5. **Steering - Rake and Trail:** Rake and Trail will effect while motorcycle takes a turn. The smaller the Rake Angle, the easier to allow sharp turning and cornering, The greater the Trail, the better stability while travelling straight
6. **Brake adjustments:** If brakes are not properly adjusted, a certain drag on wheel affects the steerability.
7. **Road and operating conditions:** Rough roads, pot holes, rainy season, fog, etc. affect the steering and stability of vehicle.
8. **Overloads :** Excessive load on vehicle will affect the riding because of difficult steering

4

d) i) How does variable rate coil spring affect suspension system?

ii) State the purpose of providing coil-in-coil spring arrangement in suspension system.

4



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Answer:		
Variable rate coil spring affect suspension system:		
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.		2
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 auxillary spring. There is a space between these two springs because conventional springs take all the loads and travel on smooth roads.		
Purpose of providing coil-in-coil spring arrangement in suspension system:-		
Coil-in-coil spring arrangement is used due to following reasons:		2
<ol style="list-style-type: none"> 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 		
e)State and explain criterion for selection of tyre.		4
Answer: Criteria for selection of a tyre:		
<ol style="list-style-type: none"> 1. Performance and efficiency: A tyre should give good performance in rain, cold/ hot weather, on different road surfaces. 2. Cost: A tyre should have low cost. 3. Comfort : It should provide a comfortable ride to the rider and pillion rider 4. Durability: It should have long life. 5. Cushion: It should provide adequate cushion against road shocks. 6. Tread Depth: It should provide adequate tread depth as per application. 7. 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. 8. Rolling Resistance: It should provide very good fuel economy by offering lower rolling resistance. 9. High speed stability: A tyre should provide better high speed stability. 10. Handling characteristics: A tyre should provide better cornering behaviour. 11. 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. 12. Tyre width: It should have high sectional width for better stability. 13. Type of Tyre: Tubeless tyre or tube tyre. 		
4. A) Attempt any <u>THREE</u> of the following:		12
a) Differentiate between wheels of motorcycle and scooter on the basis of -		4
<ol style="list-style-type: none"> i) Size ii) Type of wheels. iii) Construction iv) Off road driving suitability 		



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Answer: Difference between wheels of motorcycle and scooter:

Sr.	Parameter	Motor cycle Wheel	Scooter Wheel	
1.	Size	Mostly prefer size for front-2.75 x 17 for rear -3.00 x 17 Ground clearance-170 mm	Mostly prefer size 3.50-10 Ground clearance-135 mm	4
2.	Construction	Solid wheel and spoke wheel are used, Made from cast aluminum and some wheels are carved from a block of solid aluminum Using computer controlled carving.	Wheel consists of steel rim and pressed steel disc. The rim is rolled section. Sometimes riveted but usually welded to the flange of the disc	
3.	Tyre rotation	Motorcycle don't need rotations, in fact front and rear tire size are different hence it can't be rotated.	Scooter tires need to be rotated every 3000km. scooters are equipped with additional Stephaney and the front and rear tire size are same so it need to be rotated.	
4.	Off road driving suitability	Motorcycle is suitable and reliable than scooter on off road condition. On small bumps and ditches motorcycle tires could not caught or trapped.	Scooters are less reliable than motorcycle because of tire size are small. These are caught or trapped on small bumps and small ditches	

b) State four benefits of twin spark ignition system.

4

Answer:

Benefits of twin spark ignition system- (Any four)

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.

4

c) Draw schematic diagram of charging system of a two wheeler.

4

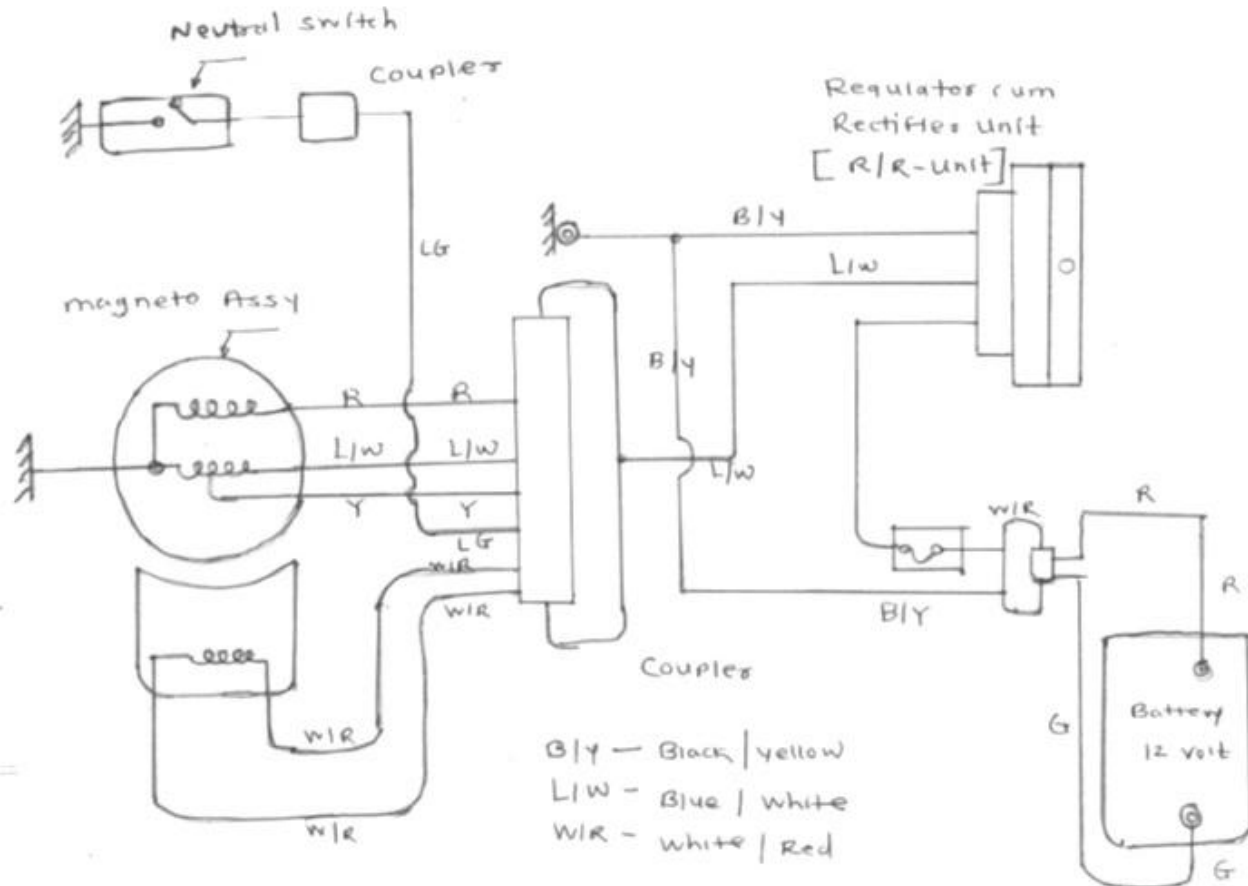
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Answer: Schematic diagram of charging system of a two wheeler:



4

d) State the purpose of following:

- i) LED lights in tail lamp
- ii) Tachometer at dash board

4

Answer: Purpose of -

i) LED lights in tail lamp: LED stands for light emitting diode.

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.

2

ii) Tachometer at the dashboard:

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.

2

B) Attempt any ONE:

6

- a) How catalytic converter performs under oxidation and reduction of exhaust gas? Give chemical reaction for the same.

6



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<p>Answer: Performance of catalytic converter under oxidation: 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:</p> $2\text{CO} + \text{O}_2 \Rightarrow 2\text{CO}_2$	2 1
<p>Performance of catalytic converter under reduction of exhaust gas: 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 NO₂ 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 O₂. The nitrogen atoms bond with other nitrogen atoms that are also stuck to the catalyst, forming N₂. Chemical reaction for catalytic converter under reduction of exhaust gas:</p> $2\text{NO} \Rightarrow \text{N}_2 + \text{O}_2 \text{ or } 2\text{NO}_2 \Rightarrow \text{N}_2 + 2\text{O}_2$	2 1
<p>b) State the use of following: i) Head lamp reflector ii) Neutral indicator lamp iii) Turn signal lamp iv) Tail lamp v) Trip meter vi) Speedometer</p>	6
<p>Answer: Use of- i) Head lamp reflector: The head lamp reflector directs the random light rays of the light bulb in to concentrated beam of light. ii) 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. iii) Turn signal lamp: 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. iv) Tail lamp: 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 reverse light is also a part of tail lamp assembly to indicate if the vehicle is backing up. v) Trip meter- It is used to record distance covered in a trip or tour. Also helps in calculating mileage. vi) Speedometer: Speedometer indicates the driving speed of vehicle that is kilometer per hours. It also indicates the total running kilometer by vehicle(odometer).</p>	1 1 1 1 1 1
<p>5. Attempt any <u>FOUR</u>:</p>	16
<p>a) Compare gear box of two wheeler with gear box of four wheeler.</p>	4



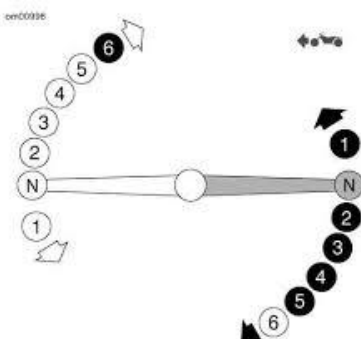
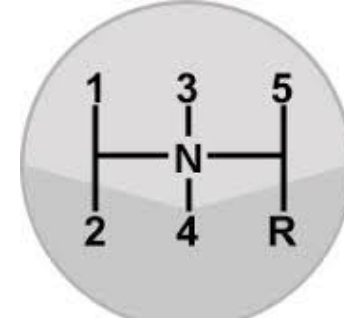
Winter – 15 EXAMINATION

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Answer: Comparison of two wheeler and four wheeler gear box:(any four)

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 un-synchronized 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		

4

b) Differentiate between kick start and self-start arrangement of starting system.

4



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Answer: Difference between kick start and self-start arrangement of starting system:(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.

c) Enlist four safe riding habits.

Answer: Safe driving habits to avoid accidents: (Any 4 points)

1. To avoid low visibility the driver should wear clearly visible clothing.
2. At night driving the driver should not wear day night goggle.
3. Use safety devices for e.g. Helmet, jacket, shoes, hand gloves etc.
4. Use various indicators, horns; high and low beam lamps while driving.
5. When applying the brakes, use both front and rear brakes.
6. The driver should maintain steady speed avoiding quick acceleration and sudden braking.
7. Always obey lane discipline
8. Drive vehicle in economy mode.

d) Describe the aerodynamic aspects for

- i) Head lamp shape
- ii) Shape of fuel tank in motorcycle

Answer: Aerodynamic aspects for:

i) Shape of headlamp: The headlamp is available in different shapes; it is depending on the 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.



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<p>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.</p> <p>ii) 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.</p>	2
<p>e) State the use of following:</p> <ul style="list-style-type: none">i) Saree guardii) Day night goggleiii) Foot rest for pillion rideriv) Mud guard	4
<p>Answer: Use of-</p> <p>i) Saree guard: The Saree guard is 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 like saree or Dupatta from getting tangled in the rear wheel. The Saree guards will not only protect the rider, but also the cargo from being pulled into the rear wheel.</p> <p>ii) Day-night goggle: 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.</p> <p>iii) Foot rest for pillion rider: Foot rest helps to maintain riding comfort and control of vehicle as driver and pillion rider lean to change position of center of gravity of vehicle. Obtain support and helps rider to get into proper position during suspension movements. Rider tends to stand on the foot rest while riding on a bumpy road to reduce effect of road shock.</p> <p>iv) Mud guard: It is used in combination with the vehicle fender to protect the vehicle, passengers, other vehicles, and pedestrians from mud and other flying debris thrown into the air by the rotating tire. Mud guard can be aerodynamically engineered, utilizing shaping, louvers or vents to improve airflow and lower drag.</p>	1 1 1 1
<p>6 Attempt any <u>TWO</u>:</p>	16
<p>a) Draw and describe the working of wet sump pressurized lubrication system in four stroke engines. Also state its two advantages.</p>	8
<p>Answer: Wet sump pressurized lubrication system:(3 marks)</p> <p>The system in which lubricating oil is stored in the oil sump is called wet sump system, like pressure lubricating system. In this system, the engine parts are lubricated under pressure feed.</p> <p>The lubricating oils is stored in a separate tank or the sump from where an oil pump takes the oil through a strainer and delivers it through a filter to the main oil gallery at a pressure to 2-4 kg/cm². The</p>	3



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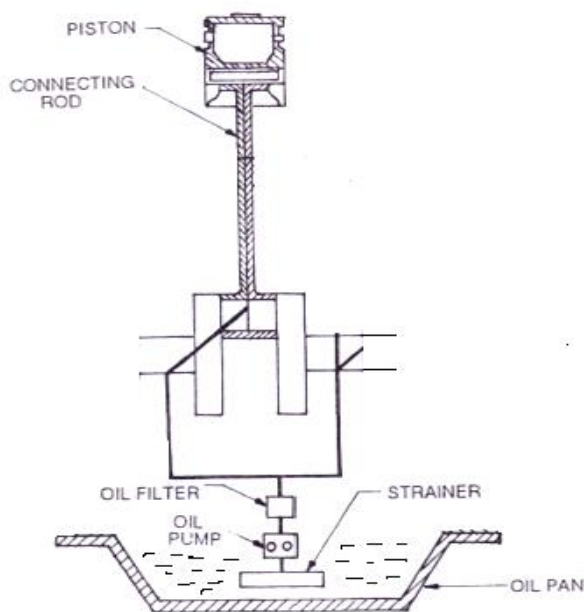
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oil from the main gallery goes to main bearings from where some of it after lubricating the main bearing falls back to the sump, some is splashed to lubricate the cylinder walls and the remaining goes through a hole to the crankpin. From the crank pin it goes the piston pin through a hole in the connecting rod web where it lubricates the piston rings.

For lubricating camshafts and timing gears the oils is led through a separate oil line from the oil gallery. The valve tappets are lubricated by connecting the main oil gallery to the tappet surfaces through drilled holes. An oil pressure gauge at the instruments panel indicates the oil pressure in the system. Oil filters and strainers in the systems clear off the oil from dust metal particles and other harmful particles.



Wet sump pressurised lubrication system

Advantages :- (any two- 2marks)

1. No need to mix lubricating oil with petrol as compared to two stroke engine.
2. Number of parts involved in this lubrication system is higher, at higher speed this system is working effectively.
3. Oil is supplied in the engine's internal components in the correct amount required to provide the best protection at different engine speeds.
4. This helps reduce oil consumption, spark plug fouling, and excessive smoke and can help to increase the engine's life (i.e. less emission compared to two stroke engine).

b) Describe construction and working of capacitor discharge ignition system with suitable sketch. Also state its four advantages over conventional ignition system.

Answer: Construction & Working of capacitor discharge ignition(CDI) system:(3 marks)

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.

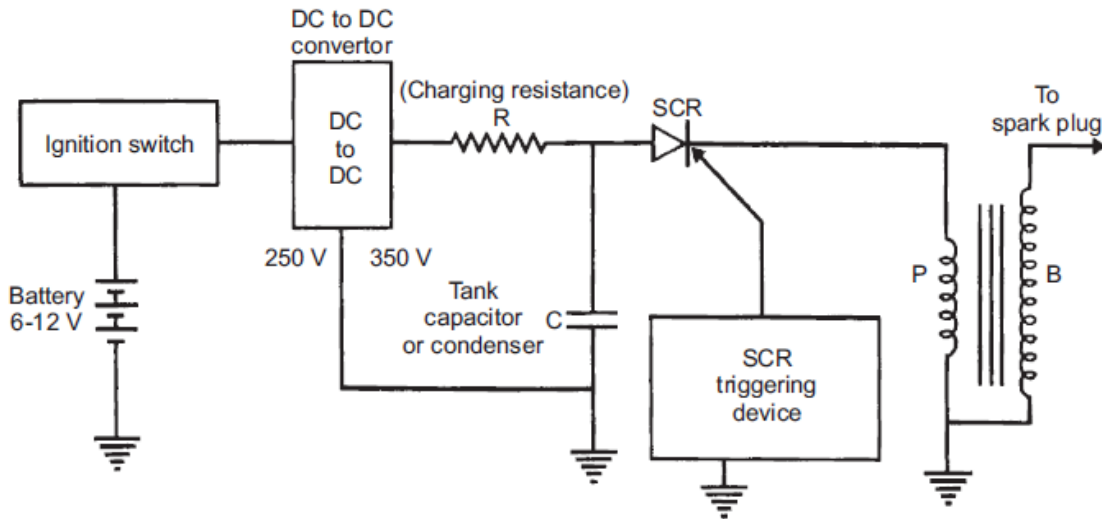


Fig. Capacitance Discharge Ignition System(3 marks)

OR

Construction and working:

CDI system consists of primary circuit and secondary circuit.

The primary circuit consists of: 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: i) Secondary winding of pulse transformer ii) Spark plug iii) Spark plug HT coil.

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.

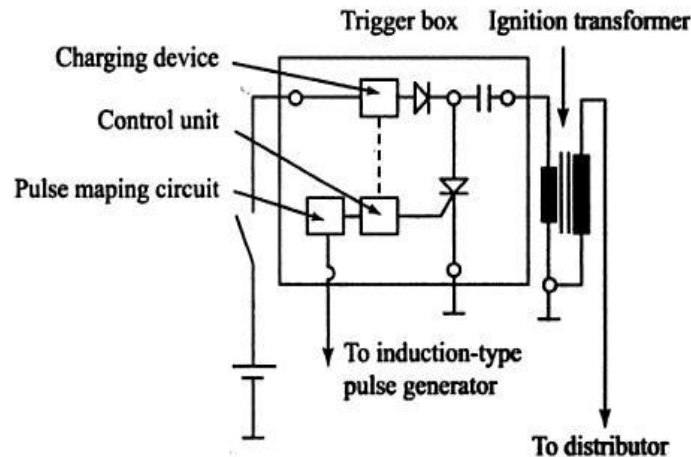


Fig. Schematic of Capacitive Discharge Ignition (CDI) System



<p>Advantages over conventional ignition system: <i>(any four- 2marks)</i></p> <ol style="list-style-type: none">1. High voltage at secondary circuit throughout engine speed range.2. Spark plug fouling is greatly reduced.3. Maintenance is easier.4. Precise control of ignition timing is obtained.5. Input current and output available voltage are constant over a wide speed range.6. To offset the problem of the short spark duration, Advantage is sometimes taken of the high secondary output by increasing the sparking plug gap to give a larger spark.7. Fast buildup of output voltage.	2
<p>c) Describe the ergonomic aspects for</p> <ol style="list-style-type: none">i) Seat arrangement for riderii) Motorcycle handle bar position.	8
<p>Answer:</p> <p>i) Seat arrangement for rider :</p> <p>Seat height is the measurement (usually in millimeters or inches) from the lowest point of a motorcycle's saddle to the ground, with the bike positioned upright (i.e., not on its side stand or center stand.) But the figure can vary depending on suspension settings; for instance, if the bike is setup with more preload, it can sit taller and settle less when a rider rests his or her weight on the saddle. Off-road and dual purpose bikes have increased suspension travel, which can do a great job of smoothing out surface irregularities. But greater suspension travel also raises the overall elevation of the bike, and naturally, the saddle. 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. For pillion riders the design of seat at rear end is important. At the time of braking due to inertia effect the pillion rider should moves on front side pushing the rider at downward direction not in forward direction. It improves the comfort driving as well as seating.</p> <p>ii) Motorcycle Handle bar position:</p> <p>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.</p>	4