Summer – 15 EXAMINATION

Subject Code: **17521** **Model Answer** Page No: 1/22

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 three:	**12**
a) State function of frame and list the types of it.	4
Answer: Function of frame: 1) It acts as a beam supported by the wheels to carry the weight of the propelling machinery and the rider. 2) It provides a non-flexing mount for the engine suspension and wheel. 3) It provides free steering movement of the front wheel.	2
Types of frame: motorcycle/ Mopeds use three basic frames 1) Cradle-single cradle and double cradle frame 2) Backbone frame 3) Tubular frame-single down tube using engine as stressed member 4) Stamped frame	2
b) List advantages of multiple valves (4 points)	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) Compare two stroke engine and four stroke engine (4 points) — 4

Answer: Comparison of two stroke engine and four stroke Engine: *(Any four points)* — 4

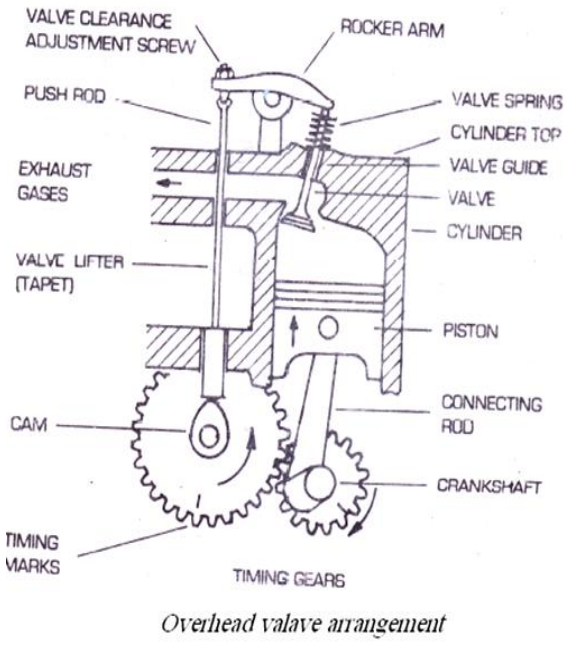
Sr.	Four Stroke Engine	Two Stroke Engine
1	One **working stroke** for **every two revolutions** of the crankshaft.	One **working stroke** for **each revolutions** of the crankshaft.
2	Turning moment on the crankshaft is not even due to one working stroke for every two revolutions of the crankshaft. Hence **heavy flywheel** is required and engine runs unbalanced	Turning moment on the crankshaft is more even due to working stroke for each revolution of the crankshaft, hence **lighter flywheel** is required and engine runs balanced.
3	Engine is heavy.	Engine is light.
4	Thermodynamic cycle is completed in 4 strokes of piston or in two revolutions of crankshaft	Thermodynamic cycle is completed in 2 strokes of piston or in one revolutions of crankshaft
5	Volumetric efficiency is more.	Volumetric efficiency is less.
6	Thermal efficiency is more.	Thermal efficiency is less.
7	Engine design is complicated.	Engine design is simple.
8	Less mechanical efficiency due to more friction on many parts.	More mechanical efficiency due to less friction on few parts.
9	More output due to full fresh charge intake and full burnt gases exhaust.	Less output due to mixing of fresh charge with burnt gases.
10	Engine runs cooler.	Engine runs hotter.
11	Engine requires more space.	Engine requires less space.

d) Draw the labeled sketch of overhead valve arrangements and state its two advantages. — 4

Answer: *(Correct labeled diagram-2 marks, any two advantages-1mark)* — 1

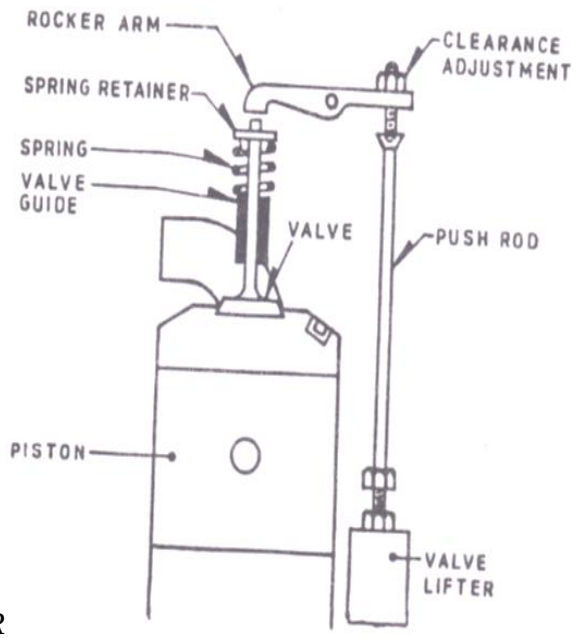
Advantage of overhead Valve arrangement: *(Any two)*

1. The entry of fresh charge into the cylinder and exhausting of products of combustion from the cylinder becomes easier and more efficient.
2. Overhead valve arrangement makes the engine slightly shorter than overhead camshaft.
3. Due to less height, this type of engine is well balanced so that fewer vibrations are created.
4. The distance between center of gravity and ground is less so that vehicle had better handling and stability.
5. Overhead valve arrangement has a less complex drive system.



Overhead valave arrangement

OR



3

B) Attempt any one : 6

a) Draw and describe working of four stroke engine. 6

Answer: Working of Four stroke Engine: ***(Sketch- 2 Marks, Description- 4)***

Working of four stroke petrol engine:

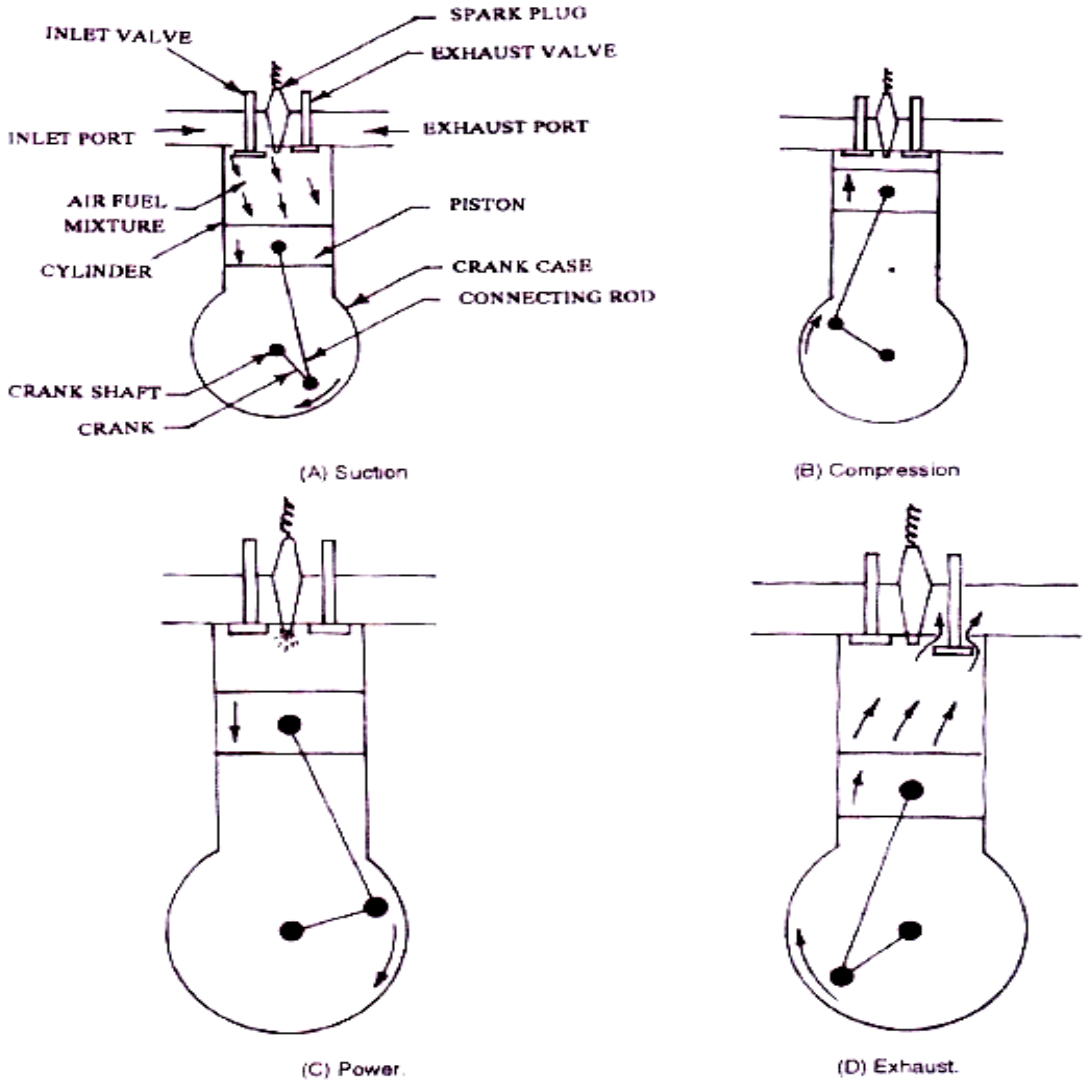
1. Suction stroke: During this stroke, inlet valve is open and exhaust valve is closed. The piston moves from TDC to BDC and crank shaft rotates through 180˚. The downward movement of the piston sucks air-fuel mixture in the cylinder from the carburetor through the open inlet valve.

2. Compression Stroke: During compression stroke, the piston moves upward (from BDC to TDC), thus compressing the charge. Both the inlet and exhaust valves remain closed during the compression stroke.

3. Power stroke or Working stroke: At the end of the compression stroke the charge (air-fuel mixture) is ignited with the help of a spark plug located on the cylinder head. The high pressure of the burnt gases forces the piston towards BDC. Both the valves are in closed position. Of the four strokes only during this stroke power is produced.

4. Exhaust Stroke: At the end of power stroke the exhaust valve opens and the inlet valve remains closed. The piston move from BDC to TDC position which pushes the burnt gases outside the combustion chamber. Crankshaft rotates by two complete revolutions through 720˚.

4



2

Figurer : Four stroke Petrol Engine

OR

Working of 4 stroke CI engine:

1. Suction stroke: During this stroke, inlet valve is open and exhaust valve is closed. Only air is sucked into cylinder during this stroke. The piston moves from TDC to BDC and crank shaft rotates through 180˚.

2. Compression Stroke: The air inducted in the cylinder is compressed to the clearance volume. Both the valves are closed during this stroke. The piston moves from BDC to TDC and crank shaft rotates through 360˚.

3. Power stroke or Working stroke: At the end of the compression stroke the fuel (diesel) is injected into the hot compressed air. The rate of injection is such a that pressure remains constant instead of change in piston position. After injection of the fuel is complete the hot gases expand. The piston moves from TDC to BDC position and crank shaft rotates through 540˚.

4. Exhaust Stroke: The inlet valve remains closed and the exhaust valve opens. The piston move from BDC to TDC position which pushes the burnt gases outside the combustion chamber.

Crankshaft rotates by two complete revolutions through 720˚.

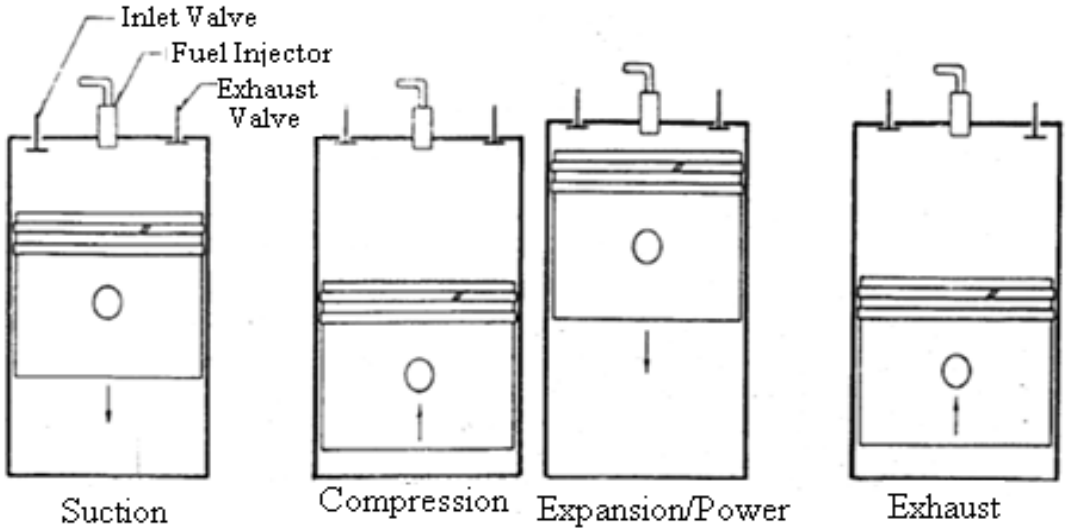


Figure: Working of four – stroke C. I. engine

b)Describe the working of microprocessor controlled ignition system with sketch. 6

Answer- Working of microprocessor controlled ignition system:

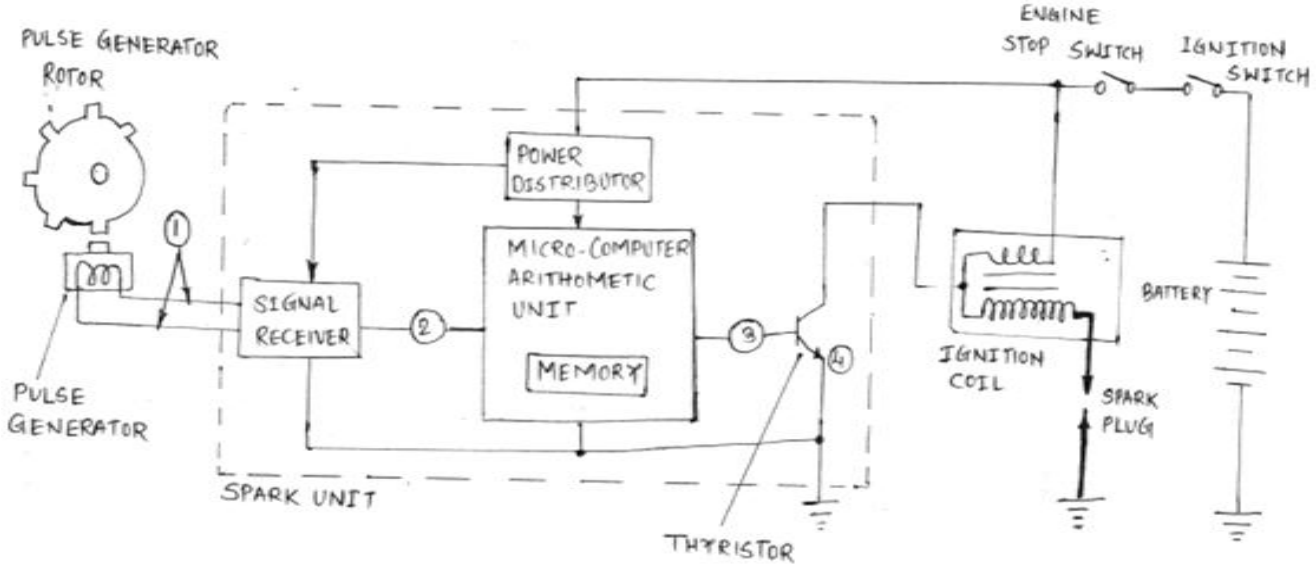
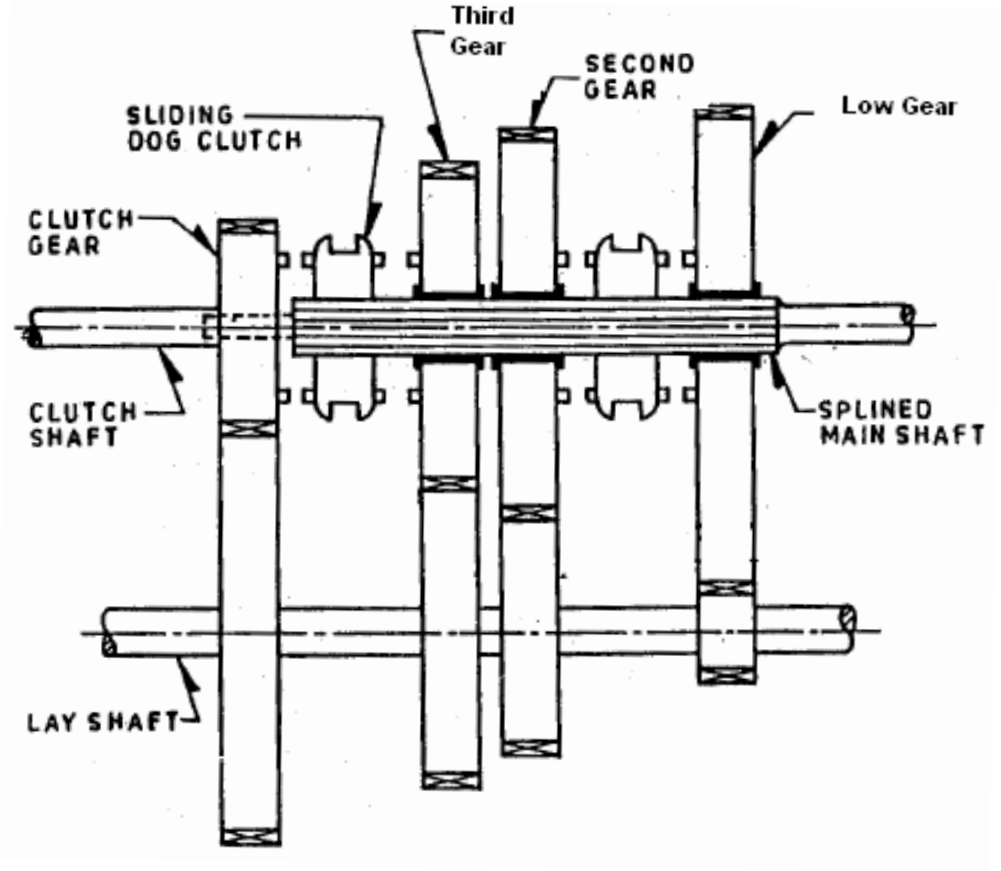


FIG :- Microprocessor Controlled Ignition System.

3

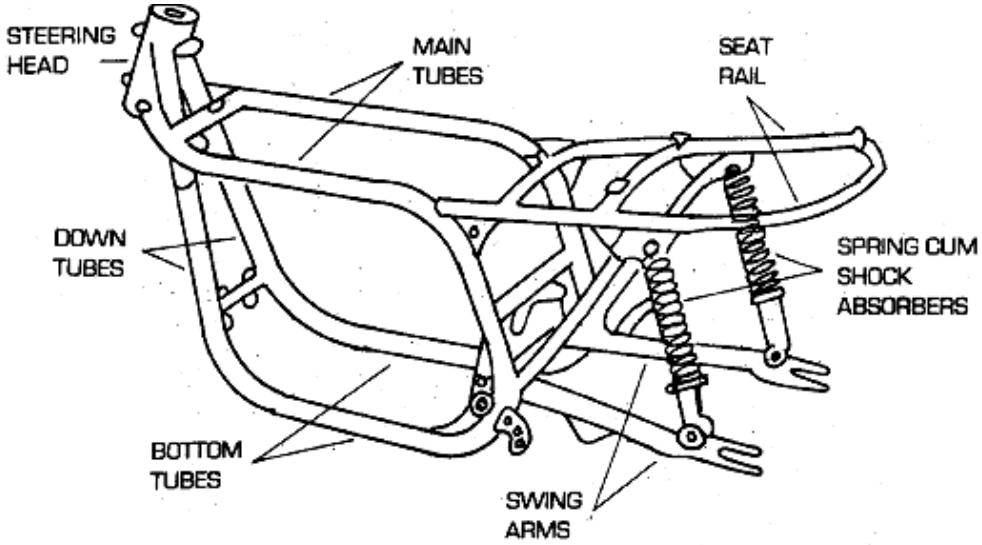
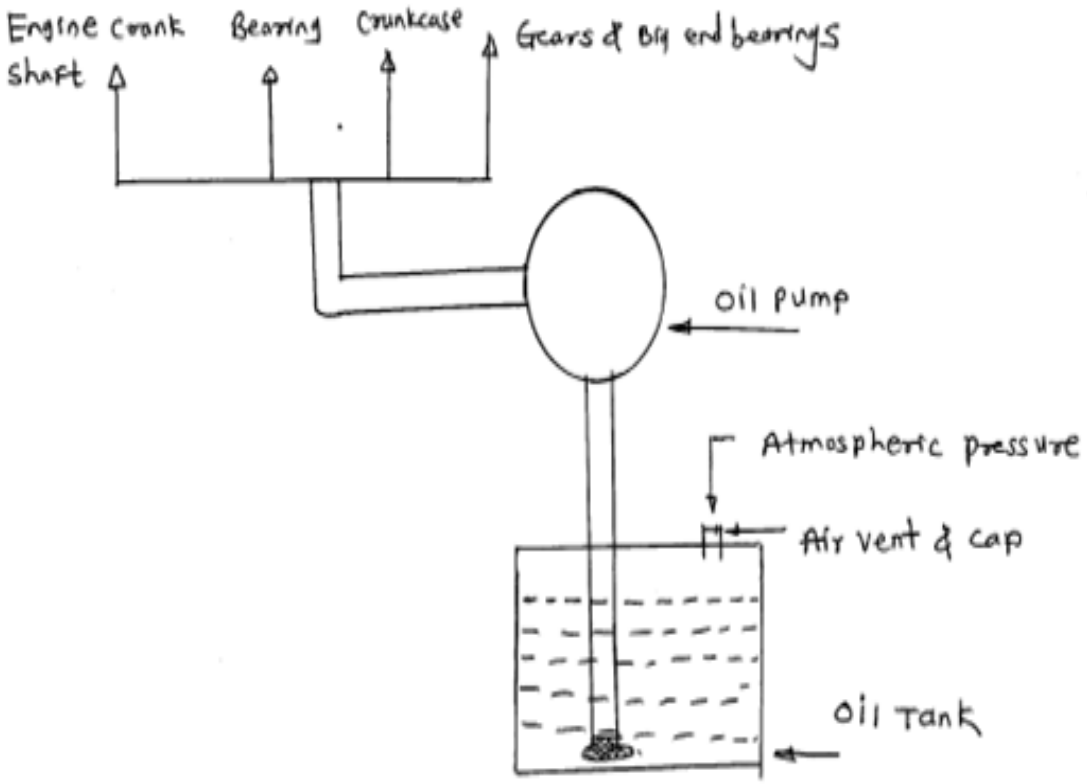
This system digitally controls the ignition timing by a microcomputer inside the spark unit and calculates the ideal ignition timing at all the engine speed. The control unit consists of a distributor, a signal receiver which processes the pulse generator and a microcomputer which has a memory and an arithmetic unit. The circuit below is the ignition system of a 90 $_0$ V – type 2 cylinder engine. 3

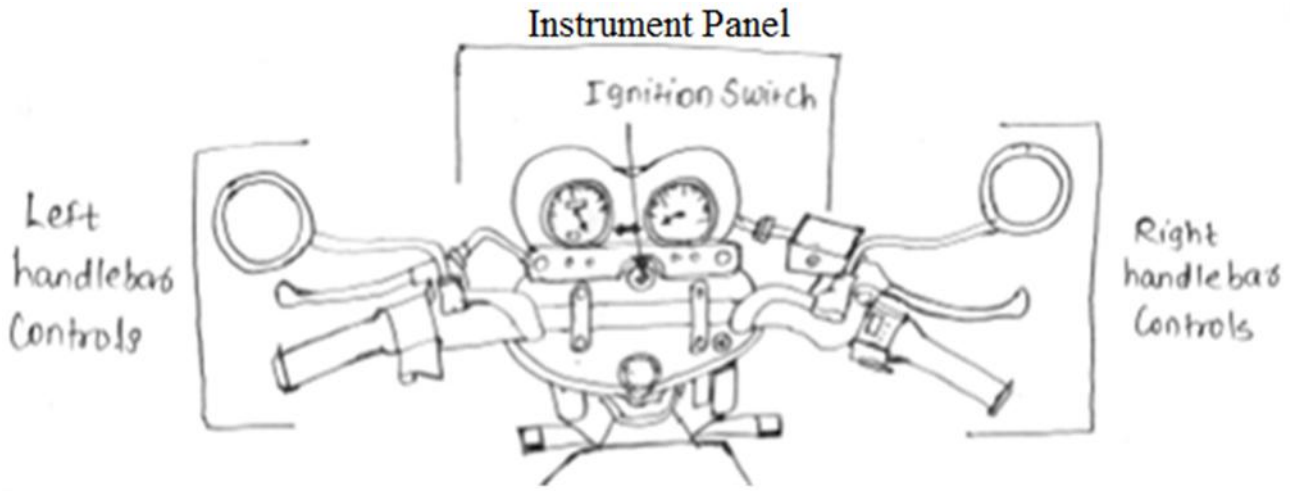
1 As the engine starts, a pulse signal from the pulse generator is sent to the spark unit.
2. The signal receiver converts the pulse signal to a digital signal and it is fed to the microcomputer.
3. As the microcomputer receives the digital signal, it processes signals containing information on the

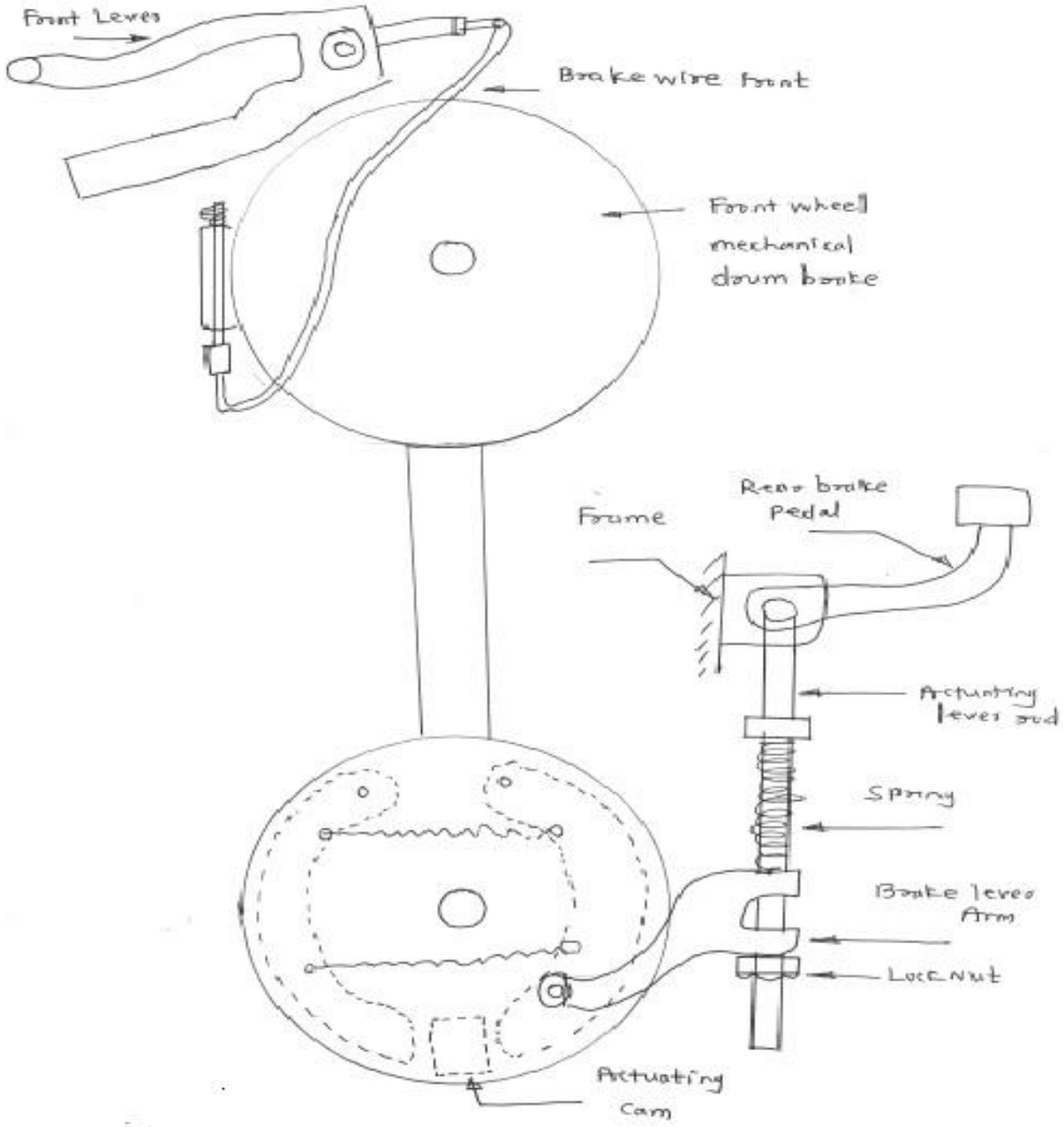
crankshaft angle and engine speed; The microcomputer then reads the information on ignition timing, which is based on the engine speed from its memory and determines the ignition timing. Then the microcomputer sends current to the base. 4. As the current from the microcomputer flows to the base of transistor, the transistor is turned ON, and ignites the spark plug. *Note: Equivalent credit shall be given to any other suitable sketch.*	
2. Attempt any four:	16
a) Describe working of constant mesh gearbox.	4
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 4th speed gear is obtained when the left dog clutch is slided to left to mesh with clutch gear by using the gear shift lever. In this case, main shaft rotates at the same speed as that of clutch gear or engine crankshaft speed which is the maximum speed. Third gear is obtained when dog 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.	2
 Figure: Constant mesh gear box *(Note: Equivalent shall be given to any other suitable sketch and relevant description)*	2

b) State four advantages of electronic fuel injection system.	04
Answer: **Advantage of electronic fuel injection system:** ***(****Any four-1 marks for 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 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.	4
c) State the importance of ergonomic aspects of seat arrangement for rider and pillion rider.	4
Answer: **Importance of ergonomic aspects of seat 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 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.	4

d) 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- 1Mark 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. 6. Provide stability while graduating turns.	4
e) Write the criteria of selection of tyre for : i) Motor cycle ii) Sports bike	4
Answer: **Criteria for selection of a tyre:** **i) For Motorcycle** *(any two-1 marks each)* 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. **ii) For Sports bike** *(any two-1 marks each)* 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 behaviour. 6. Temperature: It should have a characteristic by which the tyre for specific application, will quickly reach optimal operating temperature to provide proper road grip and performance. 7. Tyre width: It should have high sectional width for better stability. 8. Type of Tyre: Tubeless tyre.	2 2
f) State importance of aerodynamic aspect for tail lamp and indicator light arrangement.	4
Answer: **Importance of aerodynamic aspect for tail lamp and indicator light arrangement:** Aerodynamics is important in all riding conditions. By considering aerodynamic aspect body enclosed arrangement of tail lamp & indicator light provides better look as well as reduces cost of vehicle (i.e. reduction of drag force). It provide stylish look. Hence due to aerodynamic considerations in two wheelers, we need less power to operate the same. A compact unit reduces coefficient of aerodynamic drag and reduces component weight. Thus it reduces fuel consumption. Increased life of the assembly as it does not project out of the contour of the vehicle. Oval shape of tail lamp & indicator light reduces air turbulence instead of circular or rectangular shape.	4

3. Attempt any four :	16
a) Draw a schematic diagram of Double Cradle frame and label it.	4
Answer: Schematic diagram of Double Cradle frame: *(diagram with correct labeling- 4marks)*  Figure : Double Cradle	4
b) Describe concept of petroil lubrication with separate oil pump for two stroke engine.	4
Answer: **Concept of Petroil lubrication with separate oil pump:**  Figure: Schematic diagram of petroil lubrication with separate oil pump	1

This is used generally for small two stroke engine e.g. in scooter and motor cycle engines. It is simplest of all types of engine lubrication system. Certain amount of lubricating oil is mixed with petrol itself, the usual ratio being 3 to 5 percent of oil. If it is less there is danger of oil starvation or insufficient lubrication causing damage to engine. If it is more, there will be excessive carbon deposits in cylinder head and engine will give dark smoke. When petrol mixture enters crankcase due to high temperature there, petrol components vaporized leaving a thin film of lubrication oil on the crankcase, cylinder walls and bearings. Petroil lubrication system is insufficient for racing bikes and high cc bikes so that there is a provision of extra arrangement of lubricating oil (a separate oil pump) to lubricate the crankshaft, crankcase, crankshaft bearing and other moving parts.	3
c) Describe the handle bar arrangement in two wheelers.	4
Answer: **Handle bar arrangement in two wheelers:** A motor cycle fork connects a motorcycle's front wheel and axle to its frame, typically via a pair of triple clamps. It typically incorporates the front suspension and front brake, and allows the bike to be steered via handlebars attached to the top clamp. The handle bar arrangement gives rider a proper leverage to make the front wheel as his wish or as he required. It provides convenient mounting place for manually operated controls. The handle bar is made in different shapes and design keeping in mind the rider's comfort and different views. In motorcycles the handle bar is directly mounted on the front fork and it is made out of rigid steel pipe. The handle bar is fitted with controlled sleeves and handgrip on both sides. In scooters the handle bar is made of light alloy sheet by pressing with provision for head lamp and speedometer. All controls cables and electric wires connected to handle bar.  Figure: Handle Bar Arrangements.	2 2
d) i) Why coil-in-coil spring arrangement is used in suspension? ii) How does coil in coil spring affect suspension system?	4
Answer: **i) 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.	2

ii) In Coil in Coil spring arrangement; there is a provision of coil spring to support the shock absorber. In this arrangement a bigger variable coil encloses another smaller variable coil. By providing these two springs fast, smooth absorption of shock takes place and these spring retain the outer casing of shock absorber quickly. Thus it provides - better road contact of wheels and tire, increased rear shock absorber load carrying capacity, reduced response time to operate shock absorber.	2
e) Draw layout of mechanical braking system used in a motor cycle and label it.	4
Answer: *Note: Credit shall be given to any other appropriate layout with correct labeling.*  Layout of mechanical braking system used in a motor cycle	4

4. A)Attempt any three : 12

a) Differentiate between wheels of motor cycle and scooter on the basis of- 4
i) Size
ii) Construction
iii) Tyre rotation
iv) Off road driving suitability

Answer: **Difference between wheels of motor cycle and scooter:**

Sr. No	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
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

4

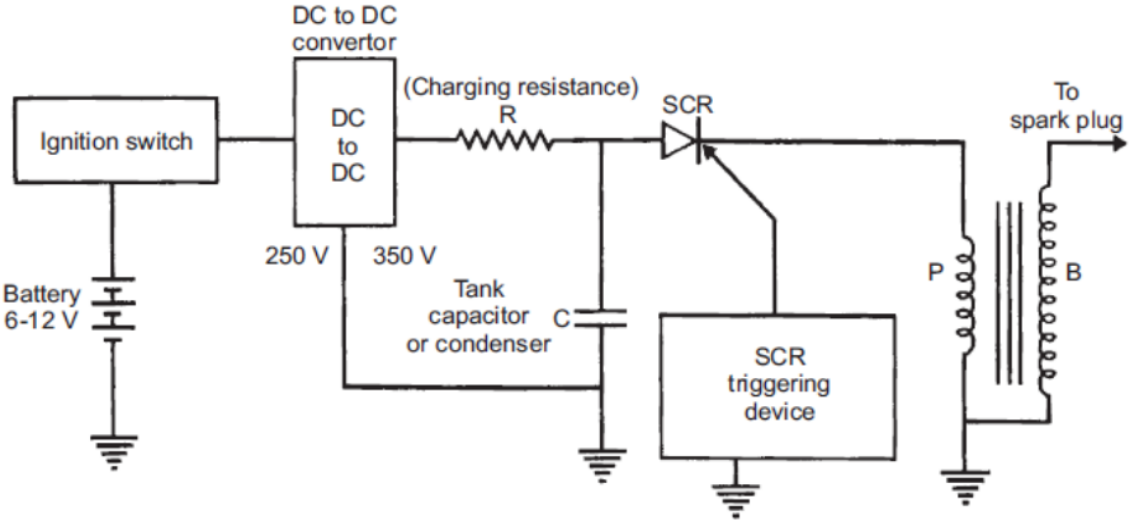
b) State the purpose of following- 4
i) Head lamp
ii) Tail and number plate lamp
iii) Turn signal lamp
iv) Side stand indicator lamp

Answer: **Purpose of-**

1. Head lamps: Head lamps are required to illuminate the high beam sufficiently to permit safe night driving. Head lamps are provided with two beams. One beam is provided for maximum illumination and other gives deflection of light to the ground and side of road. 1

2. Tail and number plate lamp: 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. Number plate lamps are used to illuminate rear registration plate so that follower can read the vehicle registration number. 1

3. Turn signal lamp: It permits the driver to signal his intension to make right or left turn. Pilot light provided on the instrument panel indicates that direction indictor is working. 1

4. Side stand indicating lamp: This lamp is situated at the speedometer housing at central place. When it is ON (red) indicates that side stand is on, so that driver can move side stand by leg to close its position.	1
c) Describe working of charging system of two wheeler.	4
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.	4
d) Describe the working of condenser discharge ignition system with neat sketch.	4
Answer: **Working of condenser discharge ignition system:** It mainly consists of 6-12 V battery, ignition switch, DC to DC convertor, charging resistance, tank capacitor, Silicon Controlled Rectifier (SCR), SCR-triggering device; step up transformer, spark plugs. A 6-12 volt battery is connected to DC to DC converter i.e. power circuit through the ignition switch, which is designed to give or increase the voltage to 250-350 volts. This high voltage is used to charge the tank capacitor (or condenser) to this voltage through the charging resistance. The charging resistance is also so designed that it controls the required current in the SCR. 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.  Figure. Capacitance Discharge Ignition System	2 2

OR

CDI system consists of primary circuit and secondary circuit.
The primary circuit consists of following components:
i) Primary winding of pulse transformer ii) Condenser iii) Resistance iv) SCR v) Pulse generator. vi) Battery vii) DC to AC convertor/charging device

The secondary circuit consists of following components:
i) Secondary winding of pulse transformer ii) Spark plug iii) Spark plug HT coil

Working:

- CDI system uses charge of capacitor for generating spark- using pulse transformer
- Thyrister/ 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.

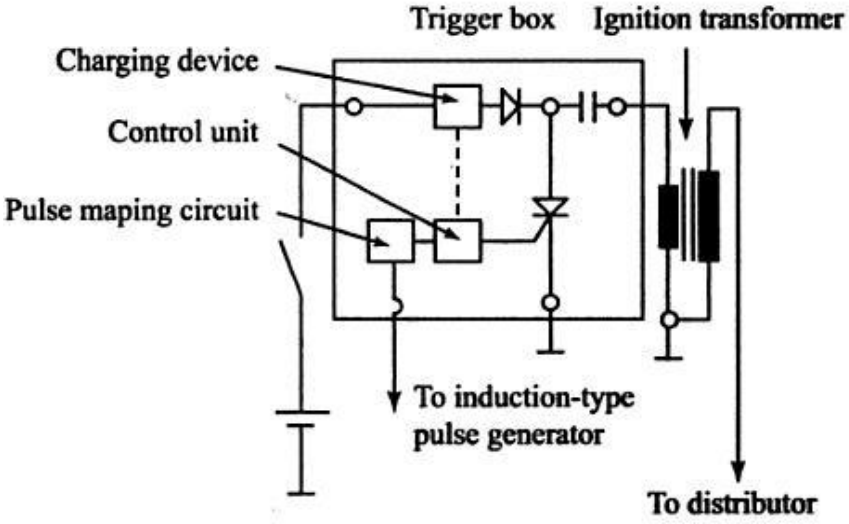
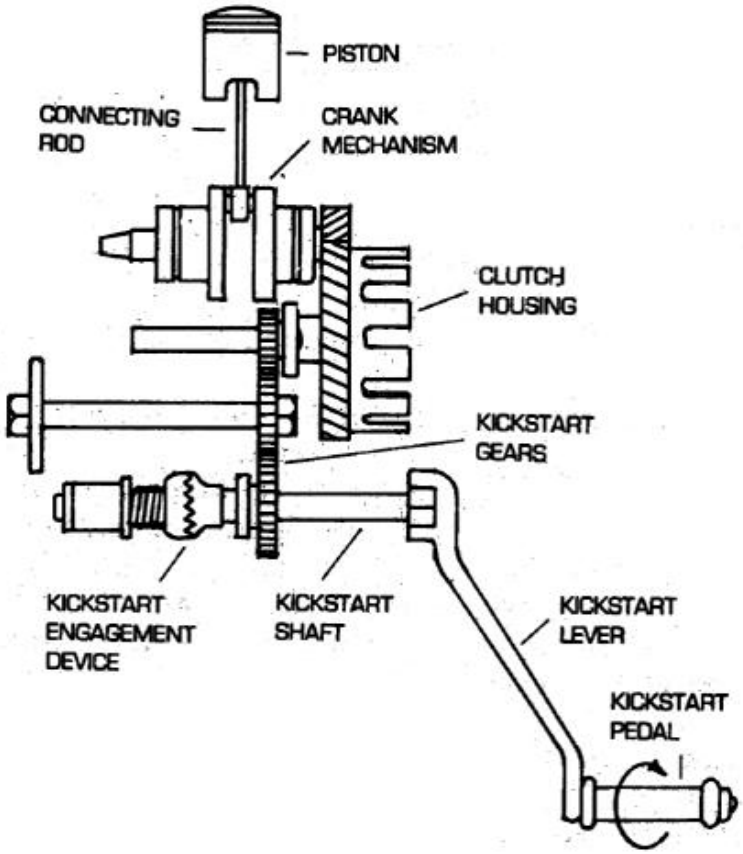


Fig. Schematic of Capacitive Discharge Ignition (CDI) System

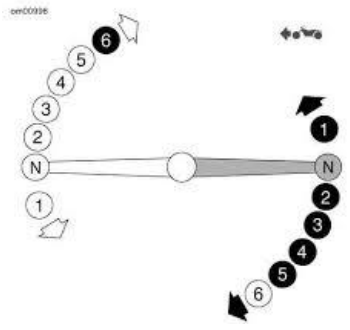
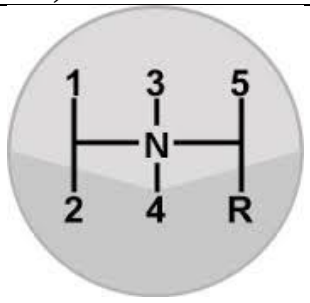
B) Attempt any one :	6
a) List the types of muffler and state their applications.	6
Answer: Types of muffler:*(Any four types-2 marks, applications- 4 marks)* 1. Baffle type 2. Wave cancellation type 3. Resonance type 4. Absorber type 5. combined resonance and absorber type	2

Applications of muffler: 1. Baffle type – Used in motor cycle. Straight baffle type muffler is used in those motor cycles who like their bikes to be loud and Quiet baffle type muffler is used in regular motorcycle which sounds quiet. 2. Wave cancellation type –These are of constructive type and destructive type, used mostly in car. 3. Resonance type – These are used in high cc bikes and those vehicles which required special firing sound like racing cars and bike. 4. Absorber type: This type is used where high pulsating sound is produced and need to be reduce. e.g. High cc bikes like Royal Enfield etc.	4
b) Draw and describe schematic diagram of kick start arrangement.	6
Answer: **Kick start arrangement:** The arrangement of kick start mechanism is shown in the figure. When the kick is applied to start a motorcycle, kick start engagement device actuates the ratchet gear and torsion spring. Ratchet gear transmits power and motion through kick shaft gear to clutch housing with the help of idler or intermediate gear. At the same time, torsion spring stores some energy and uses this energy to return the kick to its initial position. Secondary gear which is mounted on the clutch housing transfer this motion and power to the ring gear which is mounted on the engine crankshaft with the help of clutch housing.	2
 Figure: Kick-start Mechanism	4

5. Attempt any four : 16

a) Compare gear box of two wheeler with four wheeler. 4

Answer : **Comparison of two wheeler gear box with four wheeler gear box** *(Any four points)* 4

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		

b) Why modern scooterate exhaust tail pipe is raised? 4

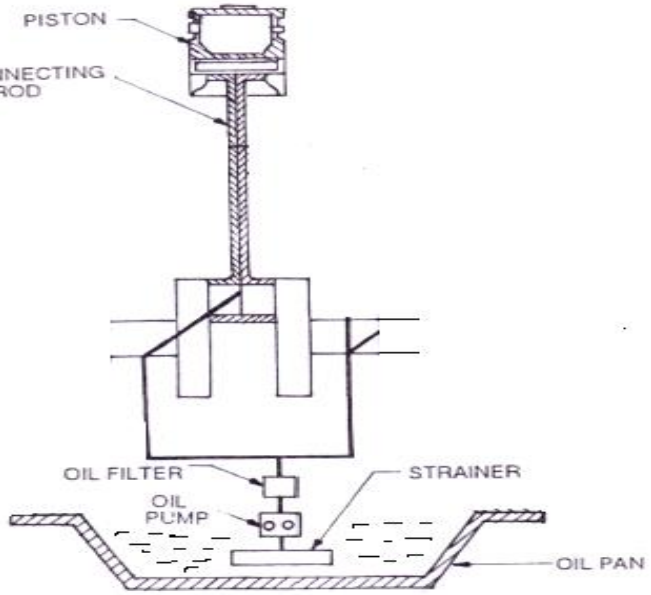
Answer: Modern scooterate exhaust tail pipe is raised, because: 4

Scooterate emissions account for the majority of the airborne pollutants present in metropolitan areas. The high concentration of pollutants within the exhaust wake flow poses serious health hazards; particularly for the rider and passenger of any scooter. Effective methods are required to disperse the exhaust pollutants in an efficient manner so as to minimize their impact on motorcyclist health. Therefore, modern scooterate exhaust tail pipe is raised. However, for both alignment modes

(horizontal tail pipe & raised /inclined tail pipe), the raised tailpipe results in a higher contaminant exposure intensity than the horizontal tailpipe since the exhaust flow is guided directly toward the following scooter. Furthermore, it is shown that the addition of raised exhaust tail pipe to the rear also achieves a moderate improvement in the pollutant dispersion efficiency. Thus, the effects on human health of airborne pollutants such as CO, nitrogen oxide (NO), particulate matter (PM), and volatile organic compounds (VOCs) are reduced due to raised exhaust tail pipe.	
c) State 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
d) Describe the purpose of providing. i) Seat arrangement for rider and pillion rider ii) Head lamp fairing of motor cycles	4
Answer: **i) Seat arrangement for rider and pillion rider** 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. **ii) Head lamp fairing of motor cycles** 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	2 2

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.	
e) Describe the aerodynamic aspects for i) Head lamp shape ii) Shape of fuel tank in motor cycles	4
Answer: **Aerodynamic aspects for** (2 marks each) **i) Head lamp shape** The headlamp is available in different shapes; it is depending on the type of manufacturer or type of vehicle. For example - 1. In motorcycle it is separately placed at the center of handle bar. 2. In case of scooters the head lamp is inbuilt in the handle bar arrangement. 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. **ii) Shape of fuel tank:** The shape of fuel tank in motorcycle provides the following. 1. It holds adequate fuel as per class of motorcycle. 2. Generally the fuel tank shape is a tear drop design. It offers least aerodynamic drag. 3. Its shape allows the rider's knees to be included within the contour of front end of vehicle. i.e. the rear end of fuel tank is narrower. This also reduces air drag. 4. Appropriately positioned handlebar with adequate handlebar width allows rider to lean forward and reduce air drag. If the driver lies on the fuel tank, then he experiences less of parachute effect. i.e. the vehicle is not slowed down due to aerodynamic drag. 5. Its shape accommodates the frame tube and allows fuel to be stored at a lower height to slightly reduce the height of the center of gravity of motorcycle. 6. Space is ensured for handlebar turning through the required angle.	2 2
f) Describe the purpose of providing i) Handle bar position ii) Mudguard shape and position.	4
Answer : **Purpose of providing-** **i) 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 Handle bar position gives proper gesture to the	2

rider. The handle bar should be lighter and transmit less vibration. **ii) Mudguard shape and position**. 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. The mudguard attaches to the seat tube using marine-grade metal snaps, then runs back between the seat stays (over top of the seat stay bridge), where two more sets of snaps hold it in position. Its on-bike shape not only helps it contain the upward spray of water and road gunk, but also gives it some rigidity. To stay as dry and clean as possible when riding your bike on wet roads, you must use a proper shape of mudguards.	2
6. Attempt any four :	16
a) State use of i)Reflector ii) Horn iii) Mobile charge point iv) Tachometer	4
Answer: *(1 mark each)* **i) Use of Reflector:** It act as mirror surface from which head light rays /light are scattered on the road front in downward direction effectively. In tail lamp, reflectors are curves and concave, led light scatter the light rays at rear end such that far from distance it should visualize clearly. **ii) Use of Horn:** Horns is a sound creating device. When the horn is operated, it creates a 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. Horns are included in safety device. Horns are also used as a calling bell to call the person when vehicle is ready to start. **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) Use of 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 power in that gear and ready to shift.	1 1 1 1
b) Describe concept of wet sump pressurized lubrication for two stroke engine.	4
Answer: Concept of wet sump pressurized lubrication for two stroke engine : 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. 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/cm^2. Oil filters and strainers in the systems clear off the oil from dust metal particles and other harmful particles. The oil from the main gallery goes to main bearings from where some of it after lubricating the main bearing falls back to the sump, some is splashed to lubricate the cylinder walls and the remaining goes through a hole to the crankpin. From the crank pin it goes the piston pin through a hole in the connecting rod web where it lubricates the piston rings.	3

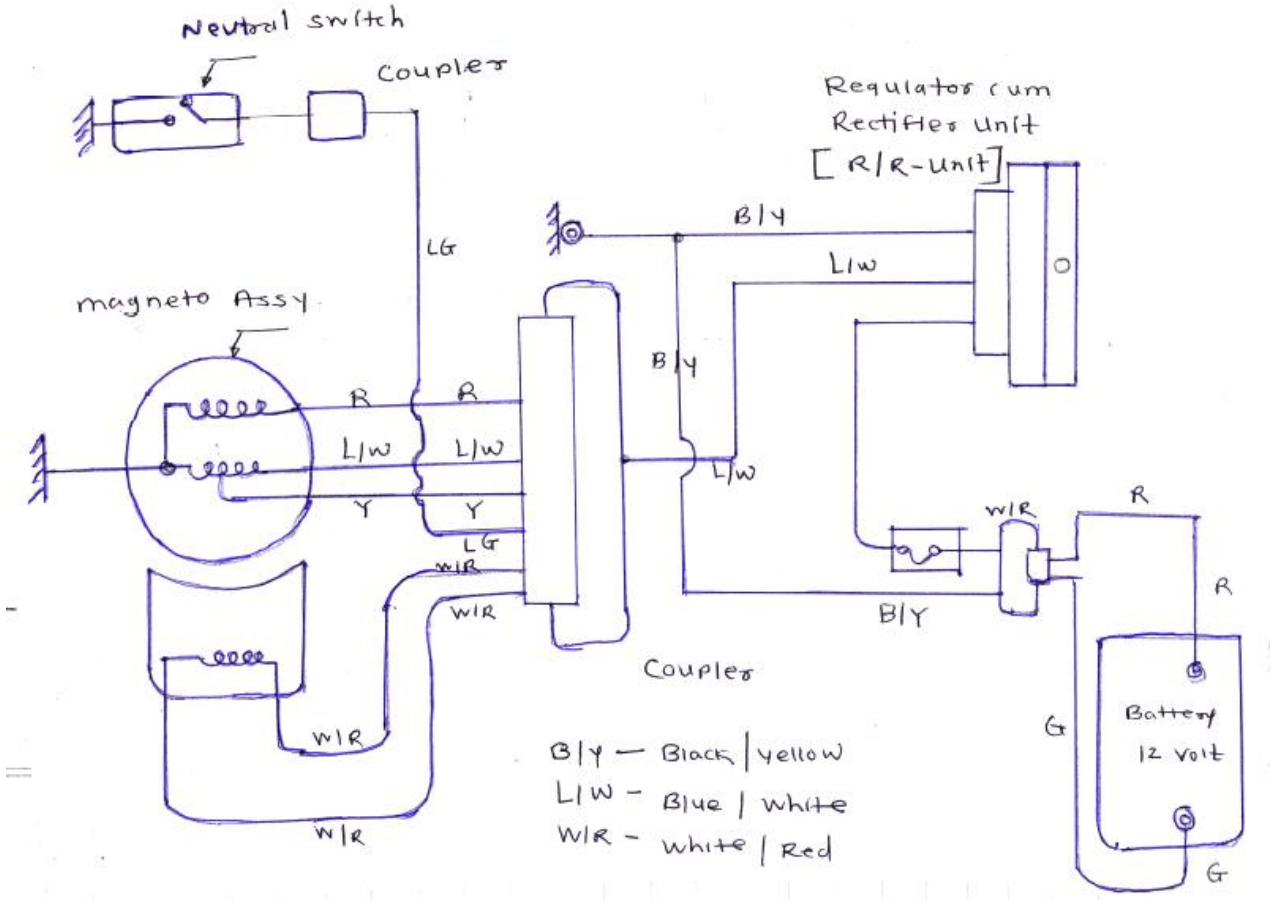


Wet sump presurrised lubrication system

1

c) Draw a schematic diagram showing AC and DC circuits of a two wheeler and label it. 4

Answer: Schematic diagram showing AC and DC circuits of a two wheeler:



4

Figure: AC and DC circuits

d) State the importance of i) Side panels of scooter and motor cycle ii) Ground clearance	4
Answer: **i) Importance of Side panels of scooter and motor cycle:** *(any four points)* The side panels for scooter / scooterate and motorcycle 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/ 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. **ii) Importance of ground clearance: 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.	2 2
e) State importance of following.. i) Driving habits ii) Day-night goggle.	4
Answer: **i) Importance of Driving habits:** A countless number of accidents occur each day on roads. Not a day goes by that we don't hear about some sort of highway pile-up, or of a pedestrian being struck by a distracted driver .There must be a way to prevent the risk of automobile accidents. Being a good driver means more than just obeying speed limits, and traffic lights – it means completely respecting all elements of the road safety code. Whether you're driving through densely populated city streets, where cyclists and pedestrians are ever-present; or navigating winding	2

country roads, where each unpredictable turn can bring disaster, one must always be ready to react swiftly in the event of an unexpected situation. These, and other, obstacles require drivers to display a considerable amount of patience and attentiveness. Unfortunately, most drivers do not adhere to, or are unaware of, all road rules of conduct, and find themselves as the responsible parties in a very high number of accidents. **ii) Importance of 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.	2