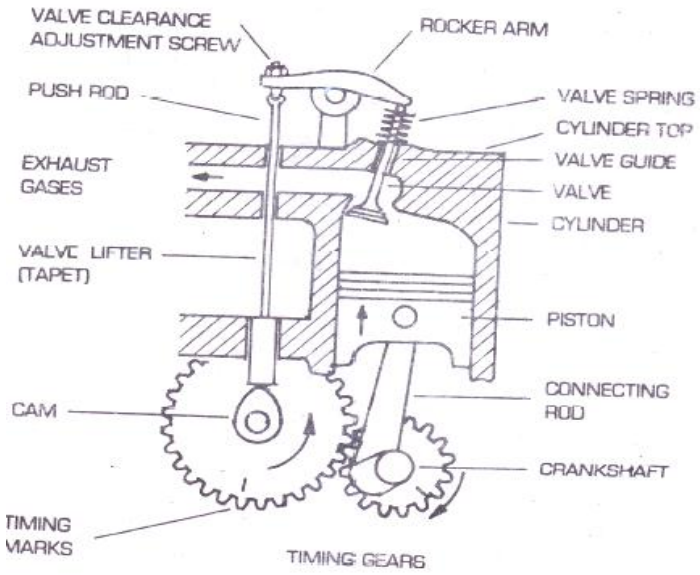
Important Instructions to examiners:
1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language 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** of the following :	**12**
a) State any two types of drives used in two wheeler transmission system and give one example of each.	04
Answer : Types of drives used in two wheeler transmission system: (any two: 02 marks each) **1. Gear-Driven Primary Drive:** Most motorcycles use a gear-driven primary drive. This drive system may utilize spur, offset spur or helical gears to transfer power from the crankshaft to the clutch system. With a gear-driven primary drive system, the two gears turn in opposite directions because each gear is on a separate shaft. This makes the clutch turn in the opposite direction of the crankshaft. Gear- driven primary drive systems must be lubricated to prevent excessive heat caused by the friction of the gears as the engine operates. E.g. Splendor plus Motorcycles. **2. Chain-Driven Primary Drive:** The chain-driven primary drive uses a chain and two sprockets to transfer power from the crankshaft to the clutch system. Sprockets are the teeth outside of a wheel that engage the links of a chain. With a chain-driven primary drive, both sprockets turn in the same direction and use either a roller chain or a Hy-Vo chain design. The Hy-Vo chain design is the most commonly used; it is a much stronger design and quieter than the roller chain. Just like with a gear-driven primary drive, you must keep chain-driven primary drive systems well lubricated. E.g. Kawasaki Ninja Motorcycles. **3. Belt-Driven Primary Drive:** The belt-driven primary drives system uses a toothed belt and two pulleys with teeth attached to them. Just like the chain-driven primary drive system, the belt driven type has both pulleys turning in the same direction. This type of primary drive is very quiet because it uses a belt instead of gears or a chain. Unlike the other primary drive systems, you must keep a belt-driven primary drive dry. E.g. Honda-Activa, Scooterate, mopeds.	4

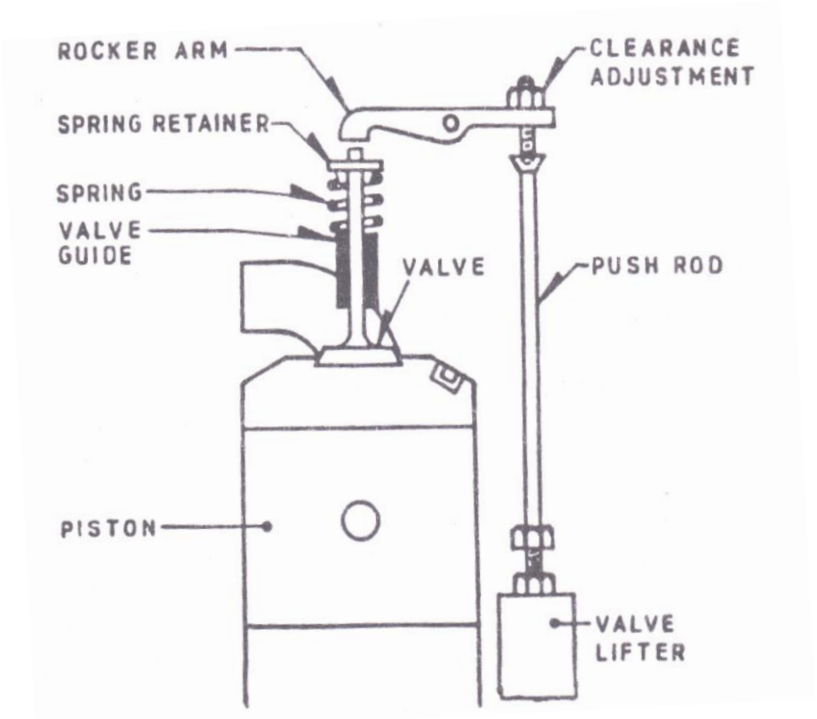
b) State advantages of electronic fuel injection system.	04
Answer: **Advantage of electronic fuel injection system**: (Any four-1 marks for each) 1. Improved power output. 2. Better fuel efficiency over a wide range of engine speed. 3. Quick warm-up of engine. 4. Reduced engine emission that meets strict 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. Lower emissions. Lean efficient air-fuel mixture reduces exhaust pollution. 17. Better cold weather drivability. Injection provides better control of mixture enrichment than a carburetor. 18. Increased engine power. Precise metering of fuel to each cylinder and increased air flow can result in more horsepower output. 19. Fewer parts. Simpler, late model, electronic fuel injection system have fewer parts than modern computer-controlled carburetors	04
c) Sketch and describe overhead valve arrangement used in 4 –S engine.	04
Answer: Description- 2 marks, sketch -2 marks. **Overhead valve arrangement used in 4 –S engine (OHV 4 -S engine):** An overhead valve engine (OHV engine) is an engine in which the valves are placed over the cylinder head. The camshaft drive-chain sprocket has twice as many teeth as the crankshaft sprocket, so that the camshaft rotates at half engine speed. The overhead valve system (OHV) system, operated by pushrods, has the camshaft adjacent and parallel to the crankshaft in the cylinder block. In overhead-valve (OHV) system, as the pushrod rises on the cam it pivots the rocker arm, which pushes the valve down (open) against the pressure of its spring. As the cam lobe rotates further, the valve spring acts to close the valve. As the crankshaft rotates, each valve is opened by means of a tappet, pushrod and rocker arm. The valve is closed by spring pressure. This overhead-valve (OHV) system is less efficient than an overhead camshaft because the number of moving parts limits the speed at which the engine can run safely. Overhead valve arrangement makes the engine slightly shorter than overhead camshaft.	02



Overhead valave arrangement

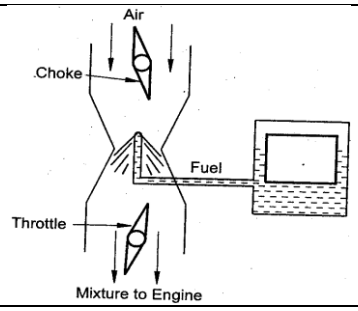
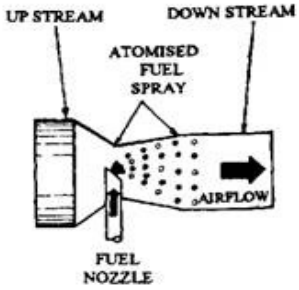
02

OR



iv)With schematic sketch differentiate down draught and side draught carburetor — 04

Answer: **Difference between down draught and side draught carburetor:** (any four)

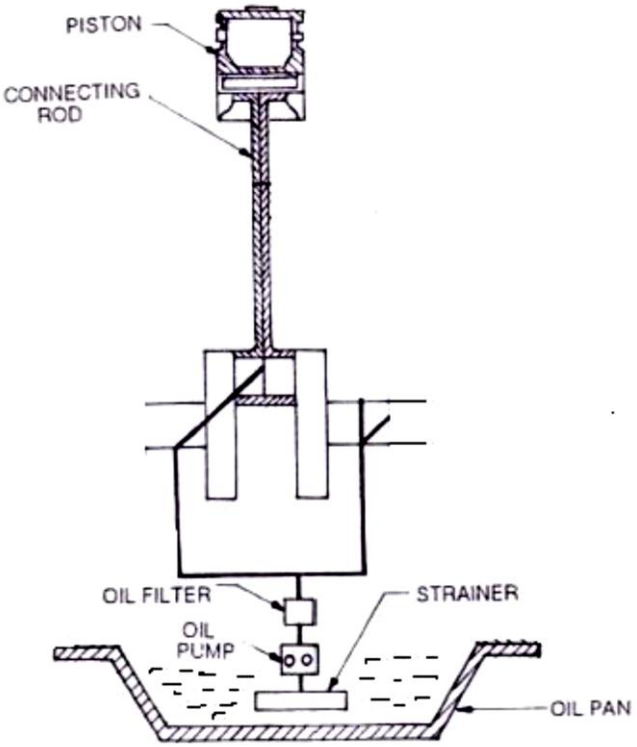
Sr	Parameter	Down Draught System	Side Draught System
01	Direction of air flow	Top to downward side	Horizontal /side to side
02	Location	Located at top of an engine	Located on side of an engine
03	Volumetric Efficiency	High	Low
04	Possibility of Leakage	Yes, Due to defective float	No.
05	Installation of an air filter	Attached easily.	Not easy to install.
06	Required space	More	Small
07	Sketch		
08	Application	Passenger cars, Motorcycles	Racing cars ,Scooters and motorcycles

04

B) Attempt any **ONE** of the following : — 06

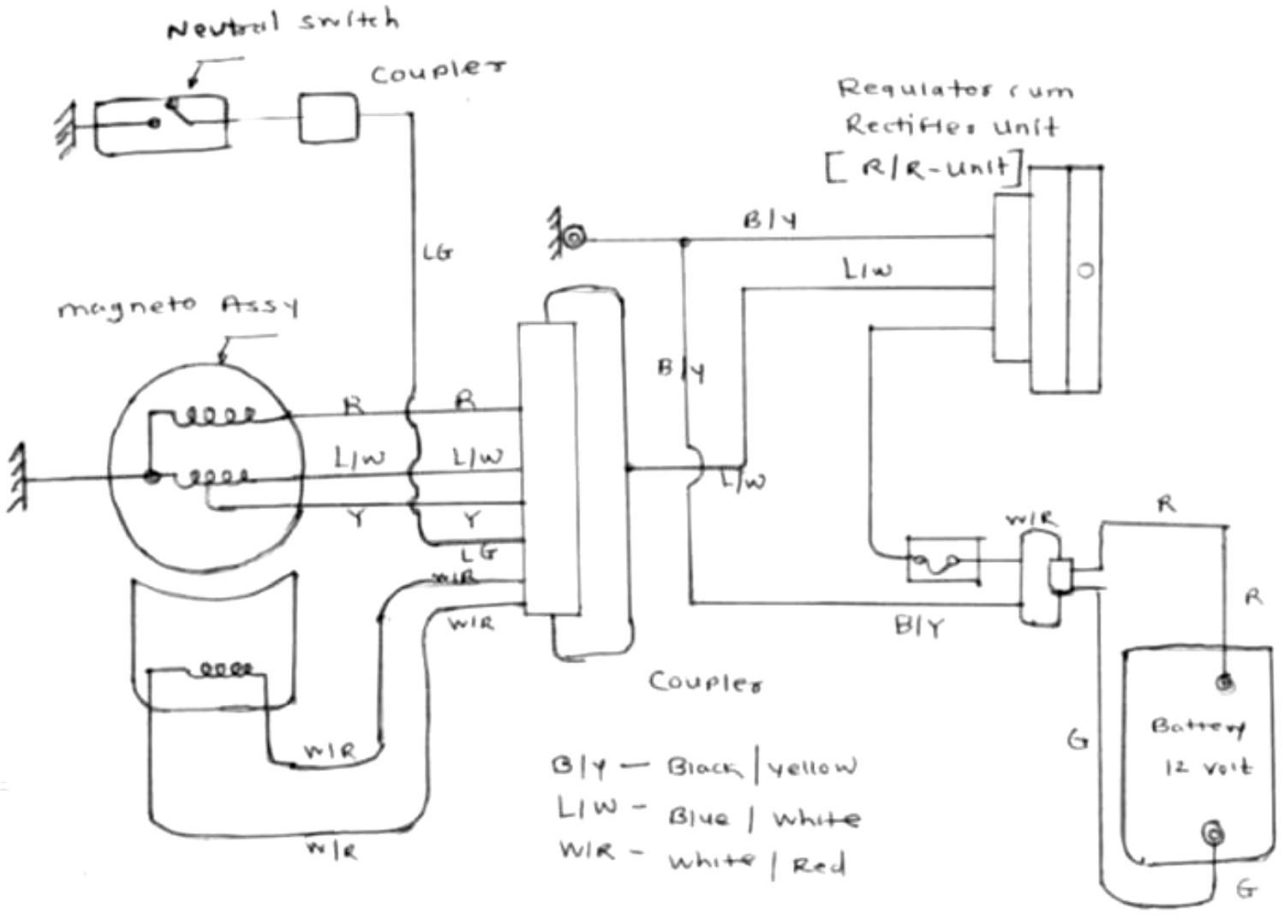
a) Draw a block diagram of wet sump pressurized lubrication system and describe its working.

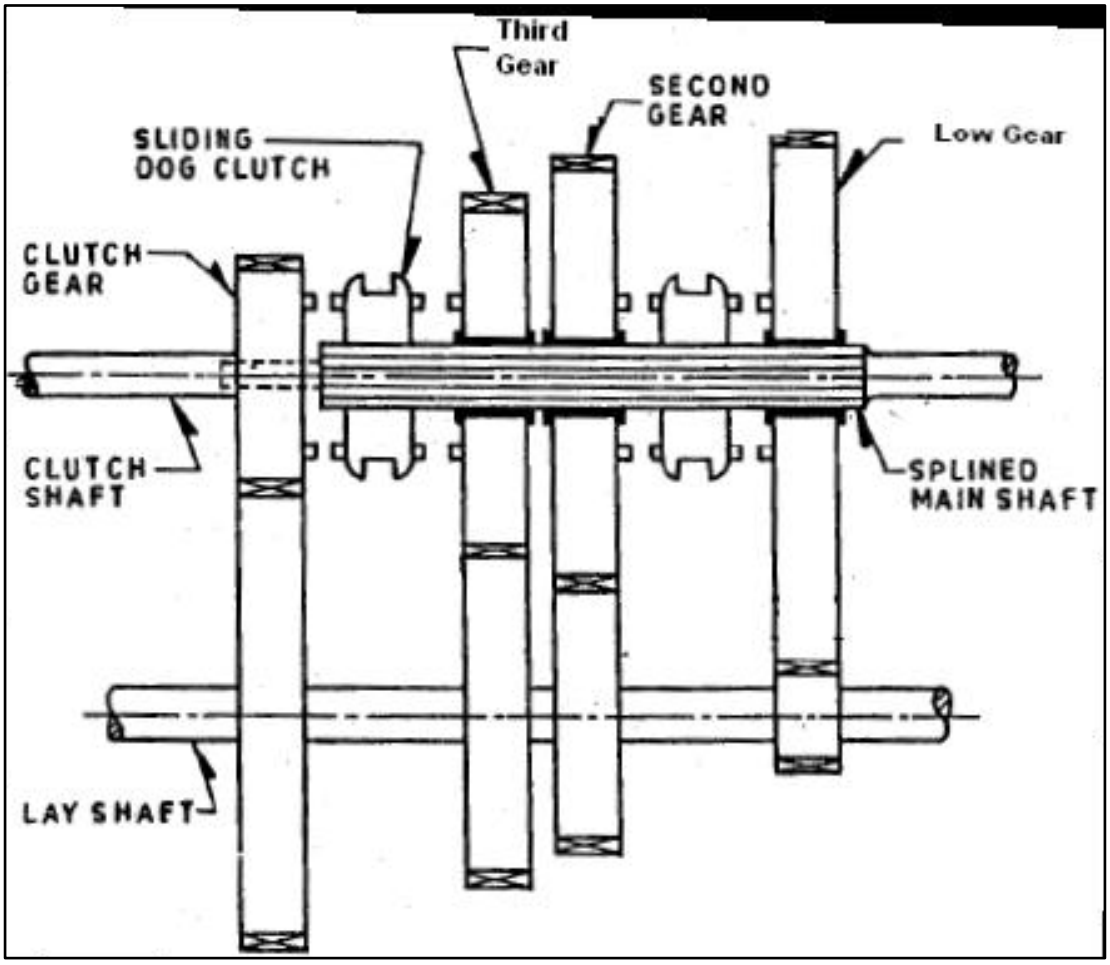
Answer: Wet sump pressurized lubrication system: *(Working: 3 marks, diagram: 3 marks)*



Wet sump presurrised lubrication system

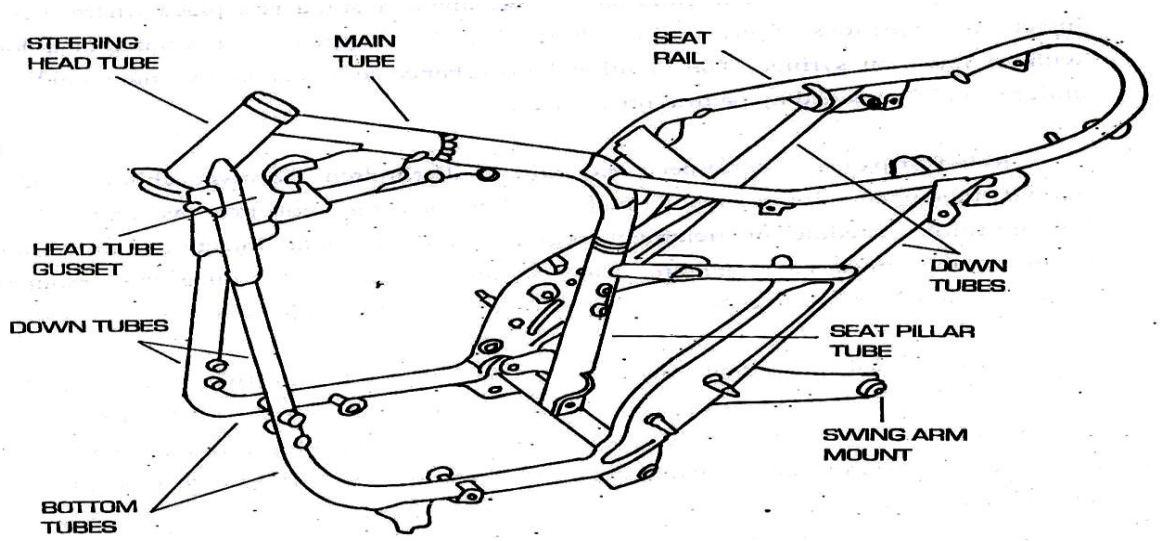
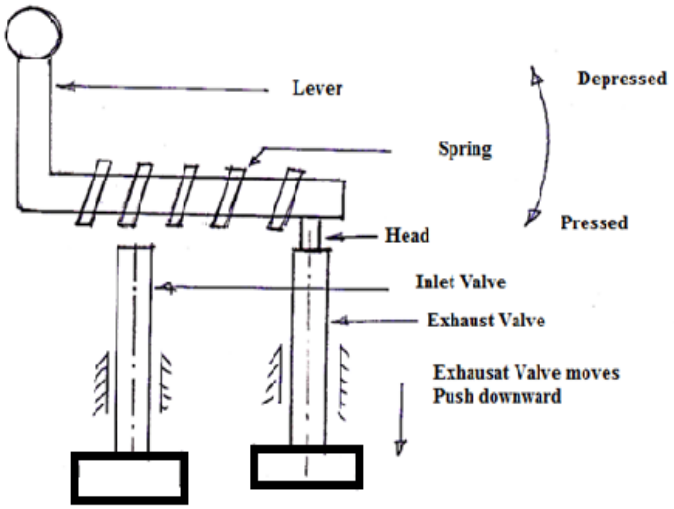
3

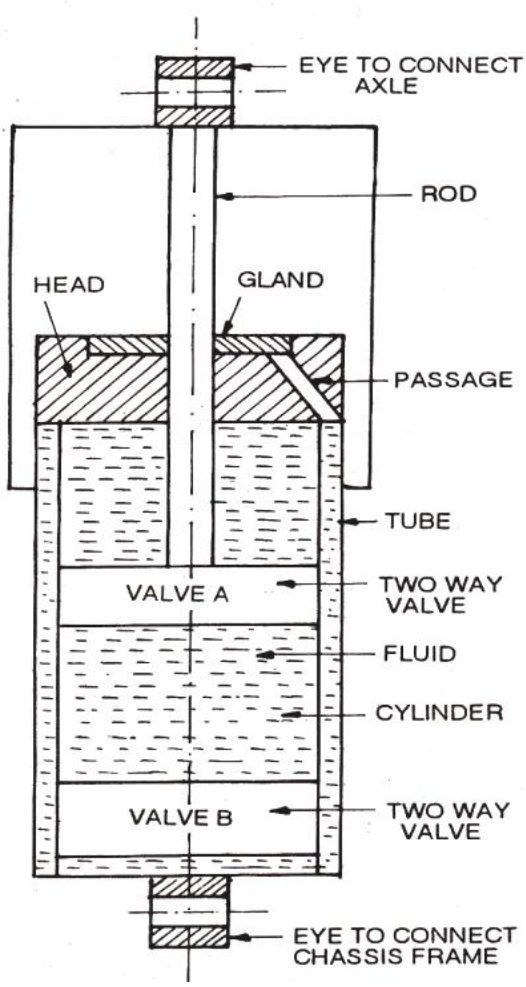
The system in which lubricating oil is stored in the oil sump is called wet sump system, like pressure lubricating system. In this system, the engine parts are lubricated under pressure feed. The lubricating oils is stored in a separate tank or the sump from where an oil pump takes the oil through a strainer and delivers it through a filter to the main oil gallery at a pressure to 2-4 kg/cm^2. 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. For lubricating camshafts and timing gears the oils is led thought 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.	3
b) Draw a schematic circuit diagram of charging system and describe its working.	06
Answer: *(Working: 3 marks, diagram: 3 marks)*  **Figure:** Schematic diagram of charging system **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.	3 3

• 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.	
2. Attempt any **FOUR** of the following	16
a) Describe the working of gear box used in motorcycle with schematic layout.	04
Answer : (Working: 2marks, diagram: 2 marks) **Working of Gear box used in motorcycle:** Constant mesh gear box: 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 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	2
(Note: Equivalent marks shall be given to any other suitable sketch and relevant description)	

b) Give functions of carburetor under four engine operating conditions.	04
Answer: **Functions of carburetor under four engine operating conditions:** **i) Idling** : A separate idling and low speed passage is provided with low speed port and idle port. For idling rich mixture is required in small quantity the throttle valve is almost closed. The whole of engine suction is now applied at the idle port through which air and fuel are drawn, giving rich mixture. **ii) Starting :** Choke is used for starting. it is mounted eccentrically which facilities it's automatic opening after the engine has started as the choke valve is closed, whole of engine suction is applied at the main nozzle, which then deliver fuel. As the air flow is quite small, the mixture supplied is very rich. **iii) Acceleration:** When acceleration is desired the accelerator twist grip is twisted, which actuate the main jet giving an extra supply of fuel for acceleration it must be clear that the purpose of accelerating circuit is not to provide a continuous fuel supply for acceleration, but only to provide extra supply of fuel to avoid flat spot. **iv) Normal running:** The throttle is held partly opened so that engine suction is now applied at the main jet, which now supplies the fuel. The air enters directly through the venturi; the quantity of mixture is controlled by throttle valve.	1 1 1 1
c) Describe the effect of following factors on aerodynamic performance of vehicle: i) Shape of head lamp ii) Shape of fuel tank	04
Answer : **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. 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. **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.	2 2

d) What are the advantages of gas filled shock absorber used in rear end suspension?	04
Answer: **Advantages of gas filled shock absorber** used at rear end- *(Any four points -1 Mark each)* 1. The full diameter of the tube can be used as a working chamber and thereby a larger volume of oil becomes available for damping. 2. The larger volume of oil made available in any one stroke because of the adjustments between gas and oil volumes provides a better facility for the damping force. 3. The tolerance to heat in gas filled shock absorber is greater. 4. Gas filled shock absorber give longer life to tyres and other related components in the suspension such as springs, brushes etc. 5. A gas filled shock absorber is designed to reduce foaming of the oil.	4
e) Give specifications of wheels and tyres for i) Motorcycle ii) Sports Bike.	04
Answer : Specifications of wheels and tyres for: **i) Motorcycle :** Wheel Type: Spoke ,Alloy Wheelbase =1320 mm **Tyre :** Front Tyre : 2.75× 17 Rear Tyre : 3.00× 17 Tyre type: Tube type Tyre (TT), Tubeless Tyre (TT) Tyre pressure: Front - 25 psi and Rear 28 to 32 psi Low sectional width **ii) Sports Bike:** Wheel Type: Alloy Wheel Wheelbase =1440 mm **Tyre :** Front Tyre : 120/70 ZR17 M/C (58W) Rear Tyre: 190/55 ZR17 M/C (75W) Tyre type: Tubeless Tyre (TT) Tyre pressure: front- 32 psi and rear 36 to 38 psi High sectional width	02 02
3. Attempt any **FOUR** of the following:	16
a) Describe with sketch single down- tube type frame using the engine as stress member.	04
Answer: **Single down- tube type frame using the engine as stress member: Single Cradle Frame-** The single cradle is the simplest type of motorcycle frame, and looks similar to the first ever motorcycle frames. It is made from steel tubes that surround the engine with a main tube above and other, smaller diameter tubes beneath. If a single cradle becomes double at the exhaust, as frequently occurs, it is referred to as a split single cradle frame. Single cradle frames are usually found in off-road motorcycles.	02

Engines as a Stressed member: Using the engine (and gearbox in some cases) as a stressed member of the frame (or chassis) has been used extensively on motorcycles. Manufacturers of motorcycles with this design of frame typically attached the headstock to the upper part of their engines; a separate frame carrying the rider and rear suspension is bolted to the rear.  Figure: single down- tube type frame using the engine as stress member.	02
b) Why decompression valve is used in some engines? Describe the arrangement with sketch.	04
Answer: Purpose of decompression valve: In two wheelers, some engines are having higher compression ratio, more than 12:1. These vehicles are difficult to start by kick start or self-start mechanism. To overcome the starting problem of such vehicles there is need to use decompression valve mechanism. Decompression valve is a mechanism by which exhaust valve is open by plunger with head. It presses the exhaust valve at the end of compression stroke, so that excess amount of compression pressure is reduced, then the vehicle is easily started. (Note: After vehicle is started again depress the decompression valve)  Figure: Decompression valve mechanism	02 02

c) Describe with sketch double acting type of shock absorber.	04
Answer: **Double acting type of shock absorber:**  Figure: Double acting shock absorber The telescopic shock absorber is shown in fig its upper eye is connected to the axle and the lower eye to the chassis frame. A two way valve A is attached to a rod another two way valve B is attached to the lower end of cylinder the fluid is in the space above and below the valve A and also in the annular space between the cylinder and tube which is connected to the space below the valve B the heat has a gland. Any fluid scraped off by the rod is brought down into the annular space through the inclined passage. When the vehicle comes across a bump the lower eye moves up. Therefore the fluid passes from the lower side of the valve A to its upper side but since the volume of the space above valve A is less than the volume of the rod the fluid exerts pressure on the valve B. This pressure of the fluid through the valve opening provides the damping force. Similarly when the lower eye moves down the fluid passes from the upper side of the valve A to the lower side and also from the lower side of the valve B to its upper side.	02 02
d) Compare variable rate coil spring and coil-in-coil spring suspension arrangement.	04
Answer: **Comparison between variable rate coil spring and coil-in-coil spring suspension arrangement:** *(*any four)	

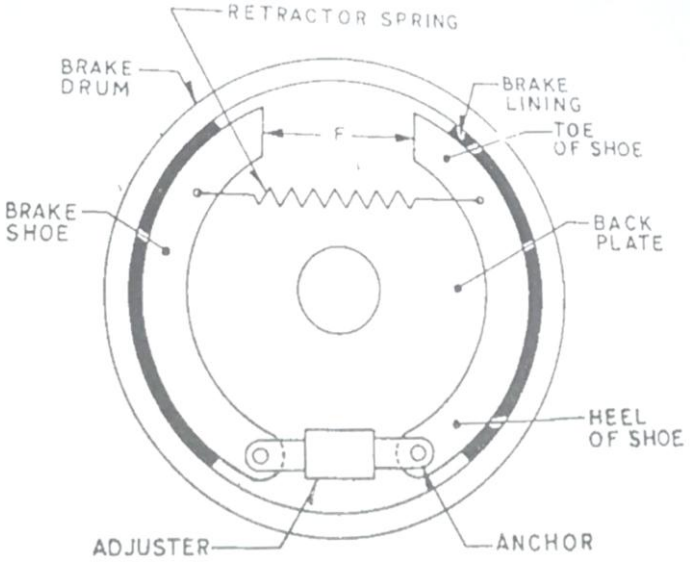
Sr.	Variable rate coil spring arrangement	Coil-in-coil spring suspension arrangement
1.	In this type a single coil spring which has 3 to 4 variable dia. of section are provided	Two separate coil springs are provided. One is larger diameter spring which encloses second smaller diameter spring.
2.	Material & manufacturing cost are less compared to coil in coil	Material & manufacturing cost are more compared to variable rate coil spring
3.	Space requirement is less	Space requirement is more
4.	Free travel length of spring is more.	Free travel length of spring is less.
5.	Moderate riding comfort is obtained for higher load	Maximum riding comfort is obtained for higher load
6.	Simple in construction	Robust in construction.
7.	Chances of failure (shock absorber) are more	Chances of failure (shock absorber) are less
8.	Suitable for urban road conditions	Suitable for urban as well as rural areas.

04

e) Describe working of internal expanding shoe type of mechanical brake. 04

Answer: Working of Internal expanding shoe type of mechanical brake:

In a motor vehicle the wheel is attached to an auxiliary wheel called drum. The brake shoes are made to contact this drum. In most designs, two shoes are used with each drum to form a complete brake mechanism at each wheel. The brake shoes have brake lining on their outer surfaces. Each brake shoes is hinged at one end by an anchor pin, the other end is created by some means so that brake shoes expand outwards. The brake linings come into contact with the drum. Retracting springs keeps the brake shoes into position when the brakes are not applied. The drum encloses the entire mechanism to keep out dust and moisture. When the pedal is pressed the cam moves the shoes outwards through linkages, thereby coming in frictional contact with the rotating drum. As soon as the brake pedal is released the retaining springs help the brake shoes to brought back and releases brakes. 02



02

Figure: Internal expanding shoe type of mechanical brake

4. A) Attempt any **THREE** of the following: 12

a) Compare mechanical brake with hydraulics brakes. 04

Answer: **Comparison between mechanical brake with hydraulics brakes: (**Any four points) 04

Sr.	Mechanical brake	Hydraulics brake
1.	In mechanical breaks no need of brake fluid so brake shoes will not affect by any leakages.	Brake shoes will be affected if leakage of brake fluid occurs
2.	More effort is required for applying brakes	Less effort is required for applying brakes
3.	Braking is less powerful than Hydraulics brakes	Braking is powerful
4.	More frictional losses	Less frictional losses as it is self-lubricating
5.	Simple in construction	Complicated in construction than mechanical brakes
6.	Less efficient than Hydraulics brake	More efficient than mechanical brake
7.	Maintenance/repair cost is less	Maintenance/repair cost is more
8.	Comparatively easy to remove and replace friction pads	Removal and replacement of brake linings is difficult and consumes more time.
9	Air bleeding kit is not required	Air bleeding kit is required
10	Pressure intensity is less	Pressure intensity is more

b) State two benefits of (i) twin spark ignition system (ii) LED lights in tail lamp 04

Answer :

(i) Benefits of twin spark ignition system- *(Any four)* 2

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.

(ii) LED lights in tail lamp: LED stands for light emitting diode. 2

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 gives your bike a unique custom look.

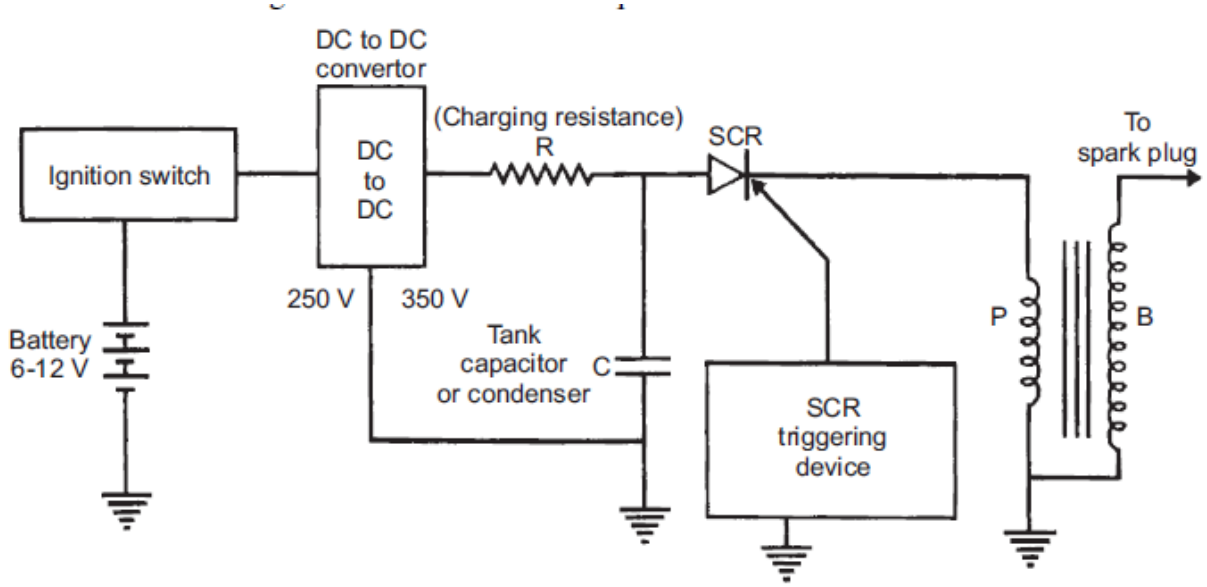
c) Describe the working of CDI system	04

Answer: Working of CDI system: (any suitable figure should carry full marks)

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. 02

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.



02

Fig. Capacitance Discharge Ignition System

OR

CDI system consists of primary circuit and secondary circuit

The primary circuit consists of following components:

i) Primary winding of pulse transformer
ii) Condenser
iii) Resistance
iv) SCR
v) Pulse generator.
vi) Battery
vii) DC to AC convertor/charging device

The secondary circuit consists of following components:

i) Secondary winding of pulse transformer
ii) Spark plug
iii) Spark plug HT coil

Working:

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

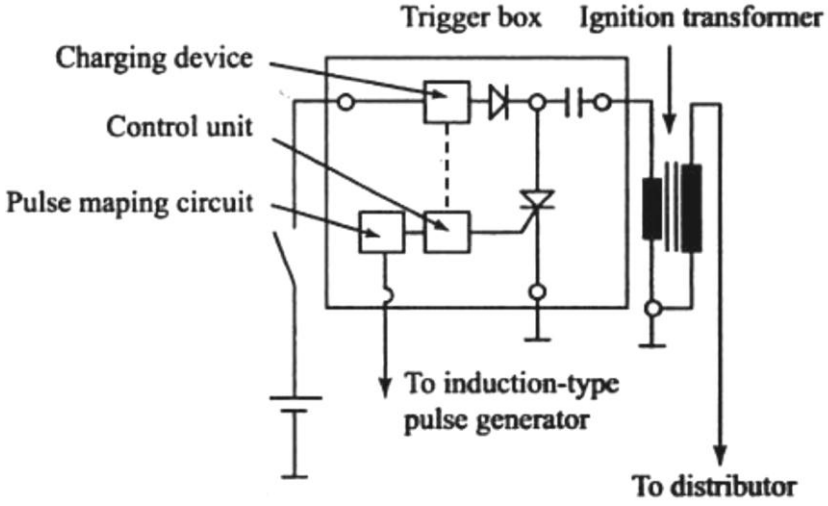


Fig. Schematic of Capacitive Discharge Ignition (CDI) System

d) State any four lighting accessories and write their functions — 04

Answer: Note: (Any 04 - 1 mark for each) — 4

Functions of Lighting accessories of two wheeler are -

Head Lamp, Tail and number plate Lamp, Turn Signal Lamp, Side Stand Indicator Lamp, High Beam Indicator Lamp, Neutral Indicator Lamp, Speedometer Lamp)

i) High beam indicator lamp- It illuminates the road far enough ahead for safe night driving. It should be adjusted vertically as per the requirement of visibility of the rider. Use your high beam whenever you are not following or meeting a car.

ii) 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

iii) Speedometer lamp- It indicates the kilometer per hour of forward speed.

iv) 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.

v) 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.

B) Attempt any **ONE** of the following:	06
a) What is EGR? Describe the working of EGR system with block diagram	06

Answer: **EGR is Exhaust Gas recirculation:**

The EGR system is used to reduce the amount of NOx in the exhaust. NOx production increases as the temperature inside the combustion chamber rises due to acceleration or heavy engine loads, because high temperature encourages the nitrogen and oxygen in air to combine. Therefore, the best way to decrease the production of NOx is to hold down the temperature in the combustion chamber. — 02

Working of EGR System: — 02

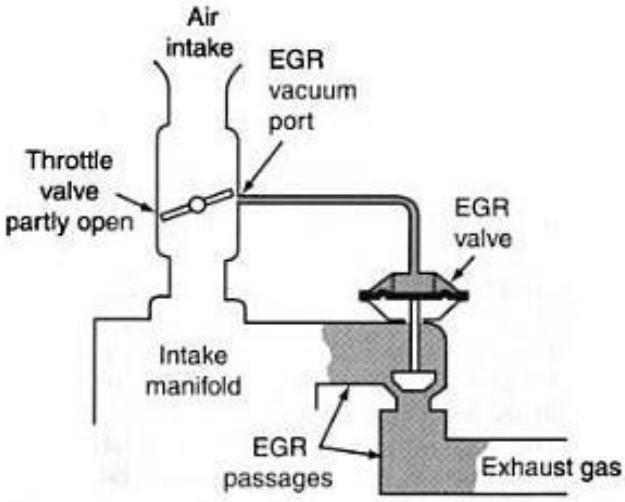


Figure: The EGR valve controls the amount of exhaust flowing back into intake manifold

OR

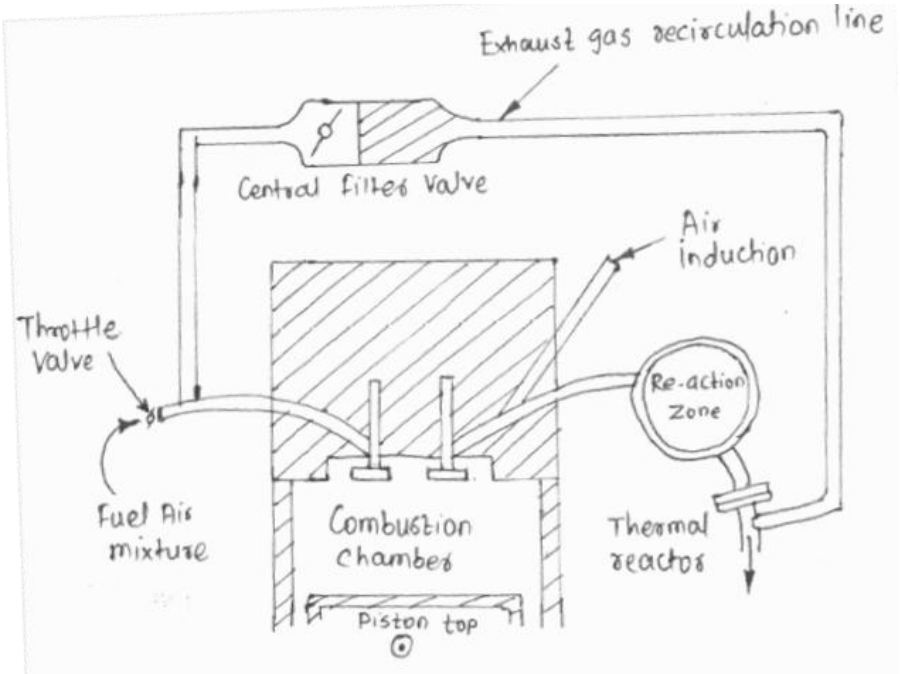
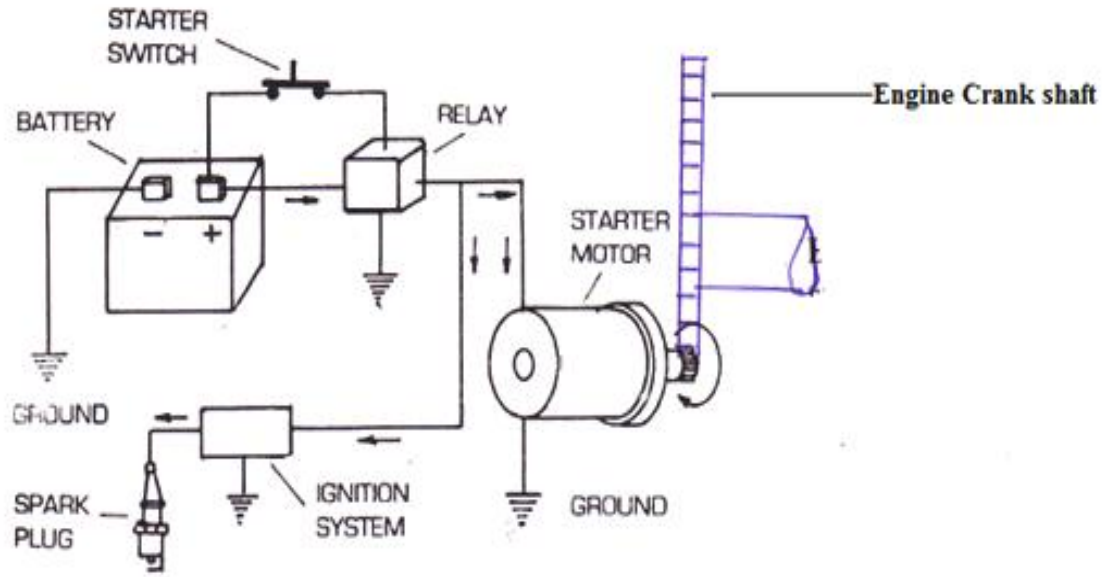


Figure: Exhaust Gas Recirculation System

The EGR system recirculates CO2 & H2O gases through the intake manifold in order to reduce the temperature at which combustion takes place. When the air:fuel mixture & exhaust gases are mixed together, the proportion of fuel in the air:fuel mixture naturally falls (mixture becomes leaner), and in addition, some of the heat produced by combustion of this mixture is carried away by the exhaust gas. The maximum temperature attained in the combustion chamber therefore falls, reducing the amount of NOx produced. The EGR system allows a small amount of exhaust gas (less than 10% of total) to be supplied into the incoming air:fuel mixture. The main aim is to reduce the NOx.	02
b) Describe with sketch button start system of two wheeler. Give battery rating for button start vehicles.	06
Answer**: Button start system of two wheeler:** The self starting system or the electric starting system operates like the primary starting system but uses a small electric motor. The motor uses a gear or chain to trun either the camshaft, mainshaft or crankshaft so as to the engine. This startign system consists of a starter motor (also called cranking motor) drive mechanism soleniod a handle bas mounted starter swirch and interconnecting wiring. When the button of the starter switch is pressed the electrical circuit to the solenoid is completed or closed. The relatively small current that flows through the circuit energieses the solenoid and closes its heavy duty starter switch (Starter realy magnetic switch) contacts. The solenoid thus activated sends the battery current directly to the stater motor. The cranking motor is mostly of a direct current motor. This converts electrical energy supplied by the battery to mechaniscal energy by rotating the armature shaft. The drive mechanism couples the shaft through a pinion and flywheel ring gear to the engine.	02
 Figure: Button start system of two wheeler	02
Types of Battery ratings: (Any Two – 1 mark each) 1. Ampere-hours (A-h) is the product of the time that a battery can deliver a certain amount of current (in hours) times that current (in amperes), for a particular discharge period. This is one indication of the total amount of charge a battery is able to store and deliver at its rated voltage. This rating is rarely stated for automotive batteries, except in Europe where it is required by law	02

2. Cranking amperes (CA) also sometimes referred to as marine cranking amperes (MCA), is the amount of current a battery can provide at 32°F (0°C). The rating is defined as the number of amperes a lead-acid battery at that temperature can deliver for 30 seconds and maintain at least 1.2 volts per cell (7.2 volts for a 12 volt battery).
3. Cold cranking amperes (CCA) is the amount of current a battery can provide at 0°F (−18°C). The battery rating is defined as the current a lead-acid battery at that temperature can deliver for 30 seconds and maintain at least 1.2 volts per cell (7.2 volts for a 12-volt battery). It is a more demanding test than those at higher temperatures.
4. Hot cranking amperes (HCA) is the amount of current a battery can provide at 80°F (26.7°C). The rating is defined as the current a lead-acid battery at that temperature can deliver for 30 seconds and maintain at least 1.2 volts per cell (7.2 volts for a 12-volt battery).
5.Reserve capacity minutes(RCM) ,also referred to as reserve capacity(RC), is a battery's ability to sustain a minimum stated electrical load; it is defined as the time (in minutes) that a lead-acid battery at 80°F (27°C) will continuously deliver 25 amperes before its voltage drops below 10.5 volts.

5. Attempt any **FOUR** of the following: 16

a) Compare chain drive with belt drive 04

Answer: **Comparison of chain drive with belt drive: (**Any 04 - 1 mark for each point) 04

Sr.	Chain drive	Belt drive
1.	They have reduced noise emission	They are quieter in operation. Noisy operation during initial acceleration.
2.	Most efficient system	Comparable with chain drive
3.	Smallest width	Wider than chain drive.
4.	Proper and periodic lubrication is necessary.	No lubrication for belt. Belts do not rust
5.	You can split a chain and replace it easily.	Belt replacement requires removal of swing arm.
6.	Cost lowest	Cost moderate
7.	Max Velocity Ratio is maintained	Less Velocity Ratio is maintained
8.	Application-Motorcycle	Application- Scooterate, mopeds

b) Differentiate between induction system used in two stroke engine and four stroke engines 04

Answer: **Difference between induction system used in two stroke engine and four stroke engines** : (Any 04 points - 1 mark for each point) 04

Sr.	Induction system –Two stroke	Induction system –Four stroke
1	Two stroke induction system Uses Reed valve , Rotary disc, Port type systems	Four stroke induction system uses inlet valve type system
2	Reverse flow of air-fuel through the intake port are prevented due to closing of reed valve	Reverse flow of air-fuel through the intake valve are prevented due to closing of valve and valve seat.
3	Two stroke induction system uses a piston which has a cut away	Four stroke induction systems don't use a piston which has a cut away.
4	Maximum Volumetric efficiency of the engine is achieved hence more power.	Moderate Volumetric efficiency of the engine is achieved hence less power, compared to two stroke induction system
5	Carburetor is exactly placed above the	Carburetor is placed in line to engine ex. Bajaj

		two stroke engine- M-80, scooter etc. hence advantage of gravity fuel feed is better	motor cycles –discover, gets moderate advantage of gravity fuel feed.
	6	Less space is required for two stoke induction system	More space required for two stroke induction system.
	7	Air filter and intake manifold are smaller	Air filter and intake manifold are bigger.
	8	Scavenging is poor, incomplete combustion	Scavenging is good, complete combustion.

c) Describe the use of speedometer, odometer, tachometer and trip meter — 04

Answer: **Use of** -

i) Speedometer: Speedometer indicates the driving speed of vehicle that is kilometer per hours. It also indicates the total running kilometer by vehicle. — 1

ii) Odometer: Odometer indicates cumulative distance travelled by vehicle, km — 1

iii)Tachometer: The tachometer is used to measure/register the engine speed in revolution per minute (RPM).The use is to let you know that you have reached maximum engine speed in that gear and ready to shift. Driver can easily see the tachometer and act accordingly since it is located at dashboard — 1

iv) Trip meter- It is used to record distance covered in a trip or tour. Also helps in calculating mileage. — 1

d) Describe the use of drive gears as safety concerns — 04

Answer**: Use of drive gears** (Jacket and Helmet) as a safety concern: (Any 02 - 02 mark for each)

1. Jacket-

While driving a motorcycle, use proper jacket to cover the body. Jacket closes the body completely; due to wind our cloths are continuously blows, making tedious sound which was very enormous i.e. undesirable. Jackets never stick to the body. These are made from impregnated/laminated cloths; these are light weight, high resistance to sunlight, wear and tear résistance in case of accidents. Water droplets are not sticking. Jacket adds the effective driving values. These are available in dark glowing colors with radium spectrum so that at night driving it shows your presence on the road. — 2

2. Helmet:

The primary goal of motorcycle helmet is motorcycle safety to protect the riders head during impact, thus preventing or reducing head injury and saving the riders life. Some helmets provide additional convenience such as ventilation, face shield and ear protection. The helmet is used to protect the head injury at front, rear and head restraint. The helmet protects against cervical spine injury. It provides protection against noise, wind and improves visibility. — 2

3. 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.

e) State any four good driving habits	04
Answer : Following are the **good driving habits to avoid accidents**: (Any 4 points) i) To avoid low visibility the driver should wear clearly visible clothing. ii) At night driving the driver should not wear day night goggle. iii) Use safety devices for e.g. Helmet, jacket, shoes, hand gloves etc. iv) Use various indicators, horns; high and low beam lamps while driving. v) When applying the brakes, use both front and rear brakes. vi) The driver should maintain steady speed avoiding quick acceleration and sudden braking. vii) Always obey lane discipline viii) Drive vehicle in economy mode.	04
6. Attempt any **FOUR** of the following.	16
a) Write merits and demerits of microprocessor controlled ignition system over CDI system	04
Answer: Merits and demerits of microprocessor controlled ignition system over CDI system: **Merits:** *(Any 2 merits -2 marks)* 1. Engine idle speed is controlled by microprocessor and so precisely controlled. 2. One advantage of a microprocessor-controlled ignition system is that ignition timing advance is not fixed as in a discrete component, electronic inductive system; the ignition timing may be advanced by any desired amount as a function of the engine's speed 3. The best features of a microprocessor-controlled ignition circuit to improve the startability and the efficiency of an internal combustion engine. 4. This ignition system achieves a greater amount of timing advance than achievable with an inductive ignition system alone, thereby increasing engine efficiency. 5. It provides an ignition system with increased startability and increased operating characteristics at engine running speed. 6. It provide long, high-intensity spark. **Demerits:** *(Any 2 demerits - 2 marks)* 1. A major disadvantage of microprocessor-controlled systems, however, is that they typically require a direct current power source to operate the microprocessor. 2. If the battery is not fully charged, a microprocessor-based system may be unable to start the engine since the battery may not provide sufficient power to drive the microprocessor. 3. It has a long charging time, a low voltage rise (low voltage build up).	2 2
b) Compare wet sump pressurized lubrication system with petroil lubrication system	04

Answer: **Comparison of lubrication systems:** *(Any 4 points – 1 mark each)* — 4

Sr	Petroil lubrication system	Pressurized lubrication system
1	This system is generally adopted in two stroke engine	This system is generally adopted in four stroke engine
2.	No need of oil pump	Need of oil pump
3.	Lubricating oil is mixed with petrol	No need to mix lubricating oil with petrol
4.	Less space required for oil sump	More space required for oil sump
5.	If the engine is allow to remain unused for considerable time, lubricating oil separate off from petrol and leads to clogging of passages in corroborator, resulting engine straining trouble.	If engine is allow to remain unused for considerable time, no need to separate petrol in engine oil because they are already separated from each other. Drain engine oil and petrol separately.

6.	Number of parts involved in this lubrication system is very less, at higher speed this system is not working effectively.	Number of parts involved in this lubrication system is higher, at higher speed this system is working effectively.	
7	Examples : Scooter , M-80, Rickshaw	Eg: Pulsar, Caliber 115, Bajaj Discover 115.	

c)Describe the purpose of providing - i) Horn ii) Reflectors in head lamp & tail lamp — 04

Answer : Purpose of Providing -

i) Horns -Horns is a sound creating device electrical horns are used in all the automobile vehicles

1. When the horns is operated is create loud vibrating sound indicating that vehicle is coming so that the passengers or the other slow moving vehicles may clear off the path to pass.
2. Lights breaks & horns are the devices that prevent accident. Horns are included in safety device.
3. Horns are also used as a calling bell to call the person when vehicle is ready to start.

— 02

ii) Reflectors in head lamp and tail lamp - Reflectors are used in head light assembly and tail lamp, concave in shape or parabolic. Reflector is portion which coated by aluminum / mercury powder coating on a concave fiber or metallic part. 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. — 02

d) Describe aesthetic aspects of i) side panels for scooter/Scooterate ii) Mud guard shape and position — 04

Answer**: Aesthetic aspects of –**

i) Side panels for scooter/Scooterate*: (any four points)*

The side panels for scooter / Scooterate 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.

— 02

ii) Mud guard shape and position: It is used for styling and eye catching looks. It also gives the sporty styling. It improves the personality of rider. The combination of black and chrome styling gives better aesthetics look. Mud guard can be large rectangular sheets suspended behind the tires. It protects the vehicle, passengers, other vehicles from mud and other flying debris thrown into the air by the rotating tyres. — 02

e) Describe the ergonomic effect of following i) seating arrangement for rider and pillion ii) Handle bar position	04
Answer: **Ergonomic aspects of –** **i) Seating arrangement for rider and pillion rider:** The design of the motorcycle is limited by the physical constraints of making the machine work. Comfort and ease of use, and ultimately your safety, will be determined by the type of bike you choose and this should depend on how you plan to use it. The seat and footrests are the right height for you. The fit of the bike to the user can be critical in long term comfort. Riders, of course, are different shapes and sizes so a bike that works well for one person may not work for someone else. It is more convince to both rider & pillion rider to seat for long trip or tour. The tapper portion of raised seat supports the seating arrangement for rider. The taper portion of seat supports the back bone of rider. For pillion riders the design of seat at rear end is important. At the time of 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. **ii) Handle bar position:** It gives rider a proper leverage to make the front wheel as his wish or as he required. The position of handle bar should be ergonomically correct. It is related to rider's driving comfort. The handle bar is fitted with controlled sleeves and handgrip on both sides. The handle bar it is made in different shapes and design keeping in mind the rider comfort and different views. The handle bar position is concerns with the shape of seat and foot rest. The location of foot rest & shape of seat as well the handle bar position differs as per manufacturers. It also depends upon the type of bike. Different type of bike has a body position, feet position and hands position The Handle bar position gives proper gesture to the rider. Improper selection of bike may create the back pain or other problems to the rider while long drive. The handle bar should be lighter and transmit less vibration.	02 02
f) State the importance of following i) Helmet ii) day night goggle	04
Answer: Importance of - **i) Helmet:** The primary goal of motorcycle helmet is motorcycle safety to protect the riders head during impact, thus preventing or reducing head injury and saving the riders life. Some helmets provide additional convenience such as ventilation, face shield and ear protection. The helmet is used to protect the head injury at front, rear and head restraint. The helmet protects against cervical spine injury. It provides protection against noise, wind and improves visibility. **ii) Day-night goggle:** Eye protection is of utmost importance - an insect or a kicked-up pebble in the eye at speed has enough momentum to cause significant damage. Such an event could easily cause the rider to lose control and crash. Besides this danger, squinting into the wind is unpleasant at best and watering eyes are quite distracting. Goggles or Day night goggles are forms of protective eyewear that usually enclose or protect the area surrounding the eye in order to prevent particulates, water or chemicals from striking the eyes. It prevents insects, dust, and so on from hitting the eyes.	02 02