Winter - 2022 EXAMINATION

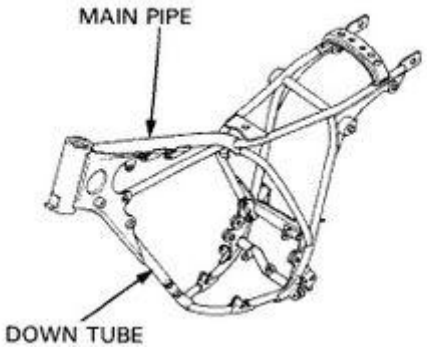
Subject Name: TTW **Model Answer** **Subject Code: 22559**

Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills.\
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.
8) As per the policy decision of Maharashtra State Government, teaching in English/Marathi and Bilingual (English + Marathi) medium is introduced at first year of AICTE diploma Programme from academic year 2021-2022. Hence if the students in first year (first and second semesters) write answers in Marathi or bilingual language (English +Marathi), the Examiner shall consider the same and assess the answer based on matching of concepts with model answer.

Q. No.	Sub Q. No	Answer	Marking Scheme
1.		**Attempt any FIVE of the following:**	**10**
	a)	**State any two functions of frame**	
		Answer: *(any two=1 mark for each)* 1. It supports all the system and components of two-wheeler. 2. It acts as a beam supported by the wheels to carry the weight of the propelling machinery and the rider. 3. It provides a non-flexing mount for the engine suspension and wheel. 4. It provides free steering movement of the front wheel.	2
	b)	**Define need of positive crank case ventilation.**	**02**
		Answer: The positive crank case ventilation system allows for cleaner exhaust, prevents blowby at seals and gaskets, removes crankcase gasses produced by the combustion process that will sludge up and destroy the engine if left unchecked.	02
	c)	**Define caster angle**	**02**
		Answer: The castor is the angle provided between an imaginary center line passing through the steering head and imaginary vertical line passing through the front wheel center Angle is 15^{o} to 30^{o}.	02

	d)	**State any two disadvantages of petrol lubrication**	**02**
		Answer: 1. It causes exhaust smoke due to the burning of lubricating oil. 2. exhaust smoke forms carbon deposits on the piston crown and exhaust ports which reduces efficiency of the engine. 3. Incorrect oil-fuel ratio leads to incomplete combustions and more exhaust emissions 4. Incorrect oil-fuel ratio leads to harmful effects on spark plugs, piston rings etc.	02
	e)	**State the different selection criteria for wheel**	**02**
		Answer: (any four=1/2 marks for each) 1. **Weight of wheel and its strength**: Cast wheel is strong yet light in weight. 2. **Wheel type**: Spoked wheel is used with tubed tyres, while cast wheel is used with tubeless tyre. 3. **Ease of manufacturing**: Cast wheels are strong and simple to mass produce. Spoked wheels are labour intensive to build. 4. **Maintenance of wheel**: If a cast wheel is involved in an impact, it should be replaced even if there is no visible damage. Spoked wheel suffers crash damage.	02
	f)	**List different components of starting system.**	**02**
		Answer: 1. Battery 2. Ignition switch 3. Starter safety switch 4. Solenoid 5. Control circuit 6. Starter motor	02
	g)	**State use of jacket and helmet**	**02**
		Answer: *(any four=1/2 marks for each)* 1. Drivers using safety devices like Helmet and jacket will improve rider's/ pillion rider's safety. 2. The jacket helps prevent serious injury to the body in the event of an accident 3. The jacket keeps it stylish as well as protect ourselves from the cold. 4. Helmet protect your eyes, ears, and head from the weather. 5. Helmet reduces your risk of a serious brain injury and death	02
2.		**Attempt any <u>THREE</u> of the following:**	**12**
	a)	**Describe single cradle frame**	**04**
		Answer: *(description = 04 marks; Credit should be given to sketch, if drawn)* **Single cradle frame:** The single cradle is the simplest type of motorcycle frame. It comprises steel tubes of various diameters and strength ratings welded together to form a structure that holds together the various components of a motorcycle. 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. In some cases, the engine acts as a member of a chassis and bears the stress. These frames are	04



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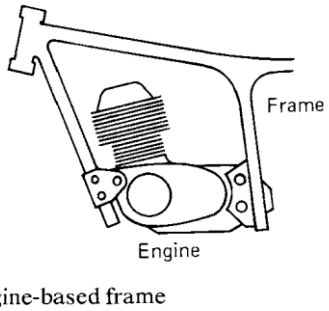


Engine-based frame

Figure: Typical motor cycle Single cradle frame

b) Compare between four strokes S.I. and C.I. engines — **04**

Answer: *(Any four =1 mark for each)*

Sr No.	S.I. Engines	C.I. Engines
1	SI engine is known as the Spark Ignition engine.	CI engine is known as the Compression Ignition engine.
2	The fuel used here is Gasoline or Petrol.	In CI engine the fuel used is Diesel.
3	Engine compression ratio is between 8:1 and 10:1	Engine compression ratio is between 16:1 and 22:1
4	Engine has less vibration.	It has more vibrations.
5	Engine is lighter in weight	Engine is heavier in weight
6	It has more fuel consumption. Thermal efficiency is low.	It has less fuel consumption. Thermal efficiency is high.
7	Engine has lower initial cost.	It has higher initial cost.
8	Torque does not remain constant over engine speed range.	Torque remains constant over wide range of engine speed.
9	This is also called a constant volume cycle.	This is called a constant pressure cycle
10	Engine does not produce much sound while running.	Engine produces more sound while running.
11	A homogenous mixture of fuel.	A heterogeneous mixture of fuel
12	Detonation takes place at the end of the combustion	Knocking takes place at the beginning of the combustion

4

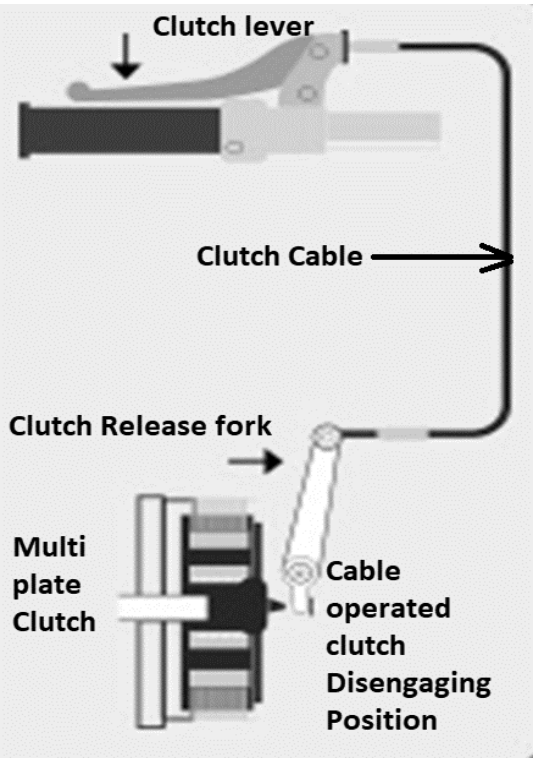
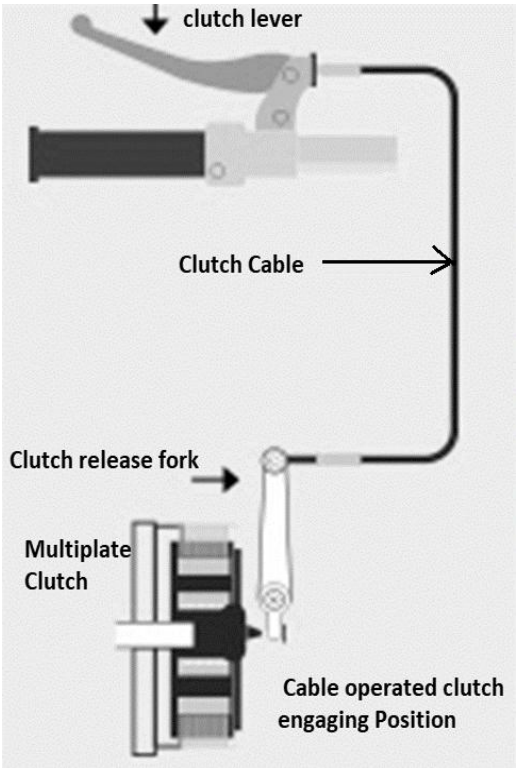
c) Explain with neat sketch cable actuated clutch mechanism — **04**

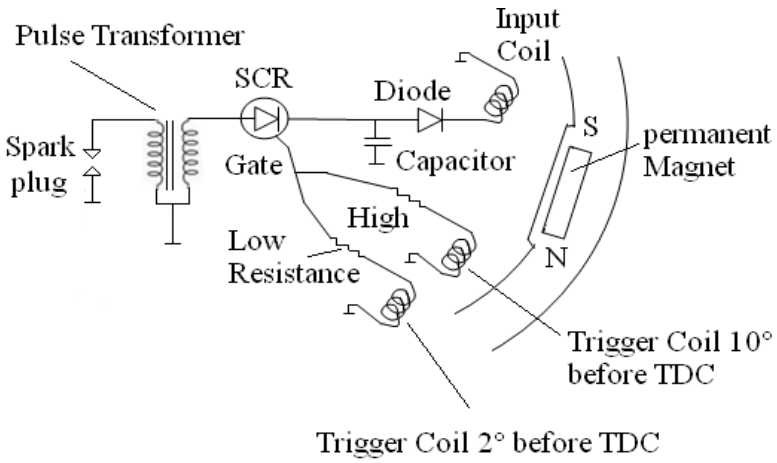
Answer: *(Explanation: 02 marks, sketch =02 marks)*

Explanation:

The cable operated clutch in two-wheeler performs same controlling action as four-wheeler foot operated mechanical clutch linkage mechanism. It has the advantages of flexible operation so that rider can engage and disengage the clutch with the help of lever

The clutch cable is made of the braided wire. The upper end is connected to the clutch lever and lower end is fastened to the clutch release fork. It is designed with a flexible outer PVC

		When the clutch lever is pressed to the disengage position. It pivots on the clutch lever fork and pull the inner cable through the outer housing. This action moves the clutch fork forward to disengage the clutch. The pressure plate springs and springs on the clutch pedal provide the force to move the cable back when the clutch lever is released.  OR  Note: *Credit shall be given to other relevant figure*.	04
	d)	**Explain working of capacitive discharge ignition system**	**04**
		Answer: (*Working= 02 marks, sketch =02 marks)* This is a Capacitor Discharge Ignition System. It is widely used in two wheelers. It consists of following components 1. Spark Plug 2. Silicon Controlled Rectifier (SCR) 3. Input Coil 4. Trigger Coils at 2° before TDC and 10° before TDC. 5. Capacitor 6. Resistances to protect SCR, 7. Magneto Rotor. As the flywheel passes past the input coil, an alternating current charges the capacitor. Diode allows the current to flow to the capacitor and charge the same as SCR is turned off. The trigger coil provides gate voltage to turn on the SCR. The magnet after passing past the input coil passes past a small trigger coil. Then the trigger coil produces enough voltage to trigger the SCR. The capacitor then discharges through the primary of the pulse transformer. The pulse transformer gets primary gets triggered at right time (2° btdc for low speed and 10°btdc at high speed).	



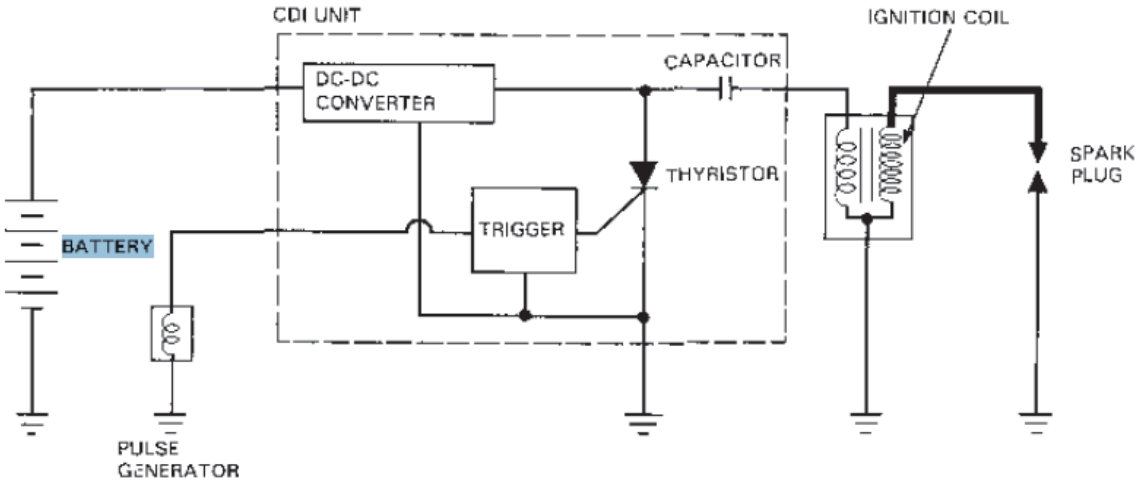
Capacitive Discharge Ignition System

OR

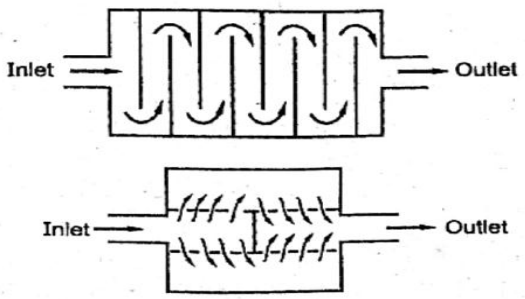
A CDI system with induction type pulse generator contains a trigger box, a charging device, and a pulse shaping circuit and ignition transformer. The main components are listed below. Magneto, Pulse generator, spark plug, signal shaping and amplifier, ignition coil, trigger-ignition timing control circuit, power supply.

The DC- CDI control unit includes a DC-DC converter which amplifies the battery voltage to about 220 V, which is then stored in the capacitor. The pulse generator coil provides gate voltage to turn on the Silicon Controlled Rectifier (SCR)/ THYRISTOR. The magneto rotor is provided with pulse generator at its periphery. The capacitor then discharges through the primary of the pulse transformer through SCR.

Pulse transformer type ignition coil provides greater spark energy even at low rpm since the power source is stable battery energy.



Note: *Any suitable figure shall be credited.*

3		**Attempt any THREE of the Following**	**12**
	a.	**List Different types of muffler. Explain any one.**	**04**
		Answer: (*Type= 02 marks, Explanation =01 marks sketch =01 marks)* **Types of muffler:** 1. Baffle type 2. Wave cancellation type 3. Resonance type 4. Absorber type 5. combined resonance and absorber type **1. Baffle type muffler:** It consists of number of baffles spot welded inside the cylindrical body. The purpose of these baffles is to close direct passage of exhaust gases, thus the gases travels a longer path in the muffler. There are many designs of baffles used in the muffler. Figure shows two types of such muffler. The measure drawback of this type muffler is its low efficiency. Due to the restricted flow of exhaust gases, back pressure increases causing the loss of engine HP.  Fig: Baffle type muffler **2. Wave cancellation type muffler:** In this type of muffler the exhaust gases entering the mufflers are divided into two parts to flow in the muffler. The lengths of these paths are so adjusted that after they came out of muffler, crests of one wave coincide with the trough of the second wave, thus the cancelling each other & reducing the noise to zero theoretically. This is achieved if the length of two paths differs by half the wavelength. But this is not practically achieved because the noise created by exhaust gases is combination of different frequencies at the different engine speeds. However appreciable noise is reduced.	04

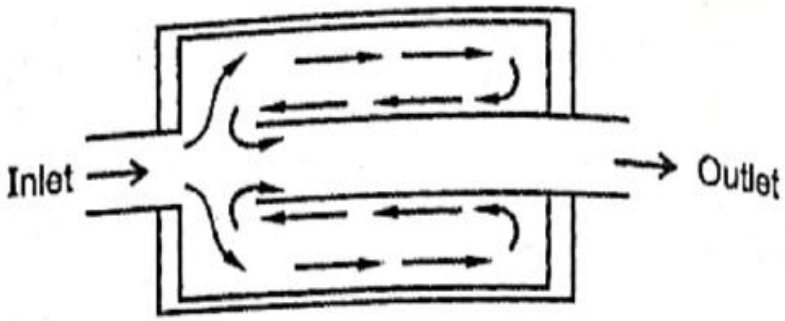


Fig : Wave cancellation type muffler

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

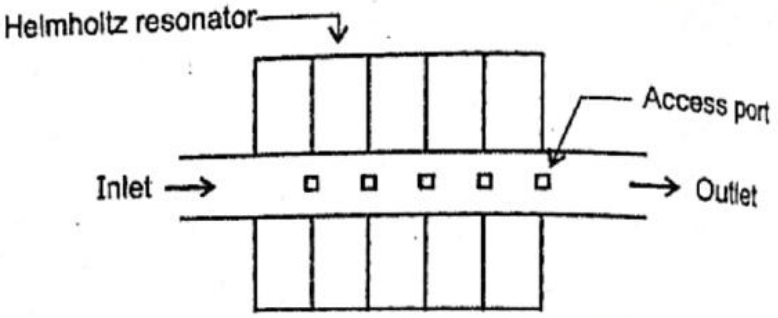


Fig: Resonance type muffler

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

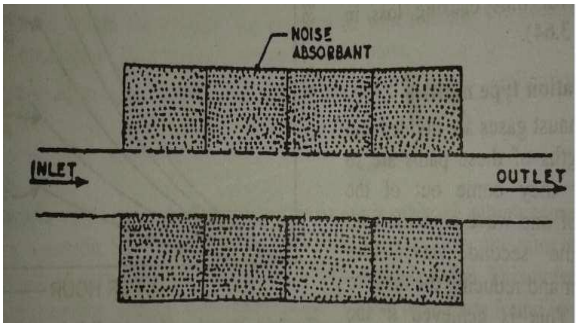
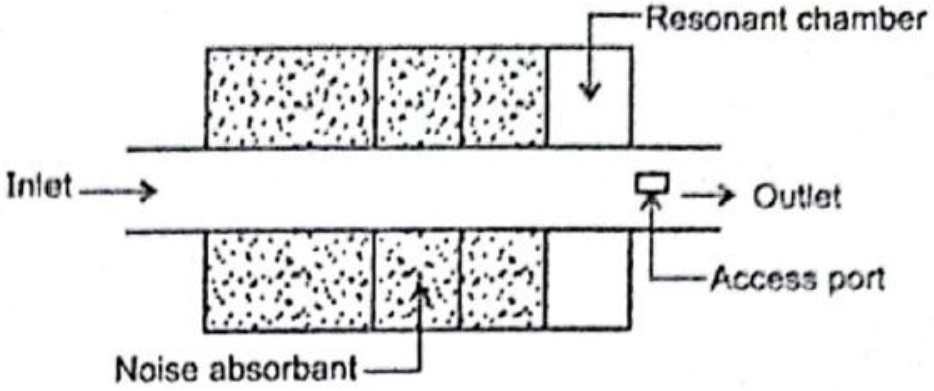


Fig: Straight through Absorber type muffler

		5. Combined resonance and absorber type muffler: Sometimes a resonance chamber is provided at one end or in the middle of the straight through absorber type muffler to reduce the pressure and noise still further. In some designs, the resonance chamber is a separate unit called a resonator, which connected in series to the muffler.  **Fig: Combined resonance and absorber type muffler**	
	b.	**Explain constructional details of monocoque frame.**	**04**
		Answer: Monocoque frame act as a single piece unit that function as seat mounting, tank and tail section. Monocoque frames are built in highly robotized, capital-intensive plants, and are generally more expensive to make unless you have an enormous economy of scale. However, for certain extreme motorcycles, the entire skeletal structure is finished as a single, super-stiff piece of metal, and is termed as a monocoque frame. Such frames are used only for machines which have extreme power, and demand an uncompromising torsional rigidity along with lightweight construction. Apart from their complex construction and a high degree of precision, such frames also very often make use of exotic materials such as carbon-fibre and magnesium and thus, are very expensive as compared to other popular frame types. Examples: Vespa scooter Features of Monocoque construction: 1. It is a unitized construction where body and chassis both carry/support structural load. 2. It is comparatively light in weight and still it is strong.(high strength to weight ratio) 3. Designers choose different materials for construction that are useful to serve purpose. Limitations of Monocoque construction: 1. In event of an accident, repair work is difficult and costs more. 2. Rust/ corrosion drastically reduce strength of construction. Monocoque frame of Motorcycle 1. They are very heavy and rigid, combining seat mounting, tank, and tail into a single sturdy piece of metal. 2. They are used almost exclusively on specialized competition bikes and are not a good choice for street bikes.	**04**

	c.	**Differentiate between chain drive and belt drive.**	**04**
		Answer: *(Any 4 points, 01 marks each).* **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. Max Velocity Ratio is maintained / Less Velocity Ratio is maintained 7. Application-Motorcycle / Application- Scooterate, mopeds, electric motorcycle	04
	d.	**State the function of - i) Crash Bar ii) Saree Guard**	**04**
		Answer: **i) Crash Bar: -** Crash bars aim to protect motorcycle engines and body panels as well as it is used to protect the rider. It is also used as a mount point for accessories like highway pegs, lights and, on police motorcycles, sirens, cameras and radar guns. **ii) Saree Guard: -** The Saree guard can prevent a lot of unwanted accidents. There is a unique sari guard feature that deflects loose and flowing clothing (e.g. Sari of ladies) from getting trapped in the rear wheel. The Saree guards will not only protect the pillion rider, but also the cargo from being pulled into the rear wheel. It also acts as a foot rest for pillion rider.	02 02
4		**Attempt any THREE of the following.**	**12**
	a.	**Explain layout of passenger auto rickshaw.**	
		Answer: *(Explanation=2 marks, Layout=2 marks)* Figure shows a layout of a passenger auto rickshaw. It consists of frameless structure. The vehicle body provides a strong, rigid structure on which to attach the components necessary to make up the vehicle. 80% of body is made up of pressed steel sheets and rest of the body is made up of canvas, i.e. rooftop is made from flexible canvas. On older vehicles, the engine	

		was located at middle under the seat of driver while all newer vehicles are equipped with rear mounted engine configuration. This vehicle uses low speed high torque producing engine. Transmission is provided to the rear wheels through multi plate clutch, and 3–4 or 5 speed constant-mesh gearbox, and by using differential gear box in the rear axle. The engine is started by means of a hand lever (kick) start or electric start arrangement. The front steel body partly gives protection to the driver, passengers and the vehicle. It also consists of a glass windshield in the front of vehicle. A wiper assembly is attached for the front windshield. The steering mechanism, handlebar controls and brake controls are similar like scooters. The rear brake lever is mounted on the floor. Rear wheel is mounted on swinging arm which is connected with frame through rear suspension. Generally the front suspensions are leading link or trailing link type. These vehicles use hydraulically operated drum brakes on all three wheels. Handbrake is also provided to park the vehicle on ascent.  1. Front glass shield 2. Wiper 3. Driver compartment 4. Side lights 5. Front body 6. Head light 7. Front suspension 8. Front wheel 9. Canvas roof 10. Passenger compartment 11. Engine compartment 12. Tail light 13. Rear body 14. Rear wheels 15. Swing arms Fig: Layout of Passenger Auto-rickshaw	04
	b.	**Explain the effect of shape of fuel tank in motorcycle aerodynamics.**	04
		Answer: The shape of fuel tank in motorcycle provides the following. (Any four) 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.	04

		5. Its shape accommodates the frame tube and allows fuel to be stored at a lower height to slightly reduce the height of the centre of gravity of motorcycle. 6. Space is ensured for handlebar turning through the required angle.	
	c.	**State the use of – i) Day night goggle ii) Mud guard**	04
		Answer: **i) Day night goggle: -** Eye protection is of utmost importance - an insect or a kicked-up pebble in the eye at speed has enough momentum to cause significant damage. Such an event could easily cause the rider to lose control and crash. Besides this danger, squinting into the wind is unpleasant at best and watering eyes are quite distracting. Goggles or Day night goggles are forms of protective eyewear that usually enclose or protect the area surrounding the eye in order to prevent particulates, water or chemicals from striking the eyes. It prevents insects, dust, and so on from hitting the eyes. **ii) Mud Guard: -** It is used in combination with the vehicle fender to protect the vehicle, passengers, other vehicles, and pedestrians from mud and other flying debris thrown into the air by the rotating tire. Mud guard can be aerodynamically engineered, utilizing shaping, louvers or vents to improve airflow and lower drag.	02 02
	d.	**Explain with neat sketch EGR.**	**04**
		Answer: *(Explanation=2 marks, Layout=2 marks)* **EGR is Exhaust Gas recirculation:** The EGR system is used to reduce the amount of NO_x in the exhaust. NO_x production increases as the temperature inside the combustion chamber rises due to acceleration or heavy engine loads, because high temperature encourages the nitrogen and oxygen in air to combine. Therefore, the best way to decrease the production of NOx is to hold down the temperature in the combustion chamber. The EGR system recirculates exhaust gases through the intake manifold in order to reduce the combustion chamber temperature. When fresh charge and exhaust gases are mixed together, the proportion of fuel in the charge 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 NO_x 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.	04

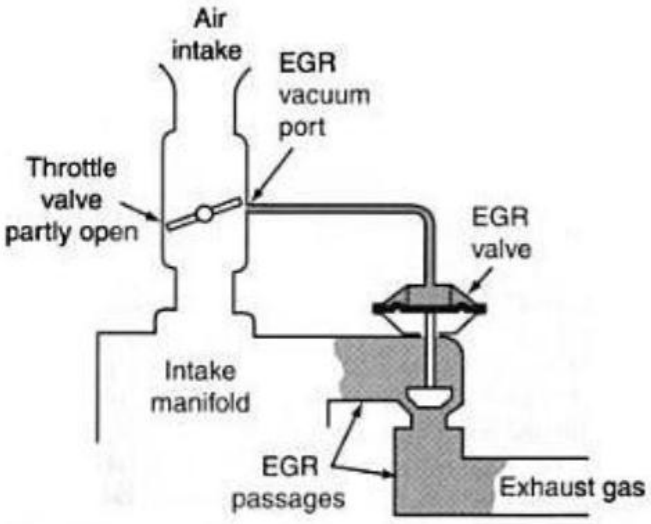
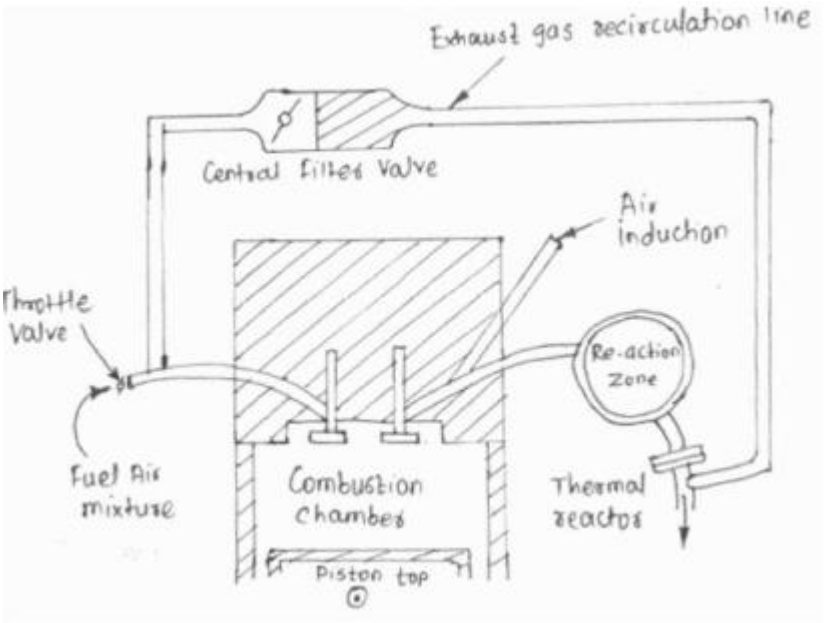


Figure: The EGR valve controls the amount of exhaust flowing back into intake manifold

OR



	e.	**State the effect of driving habits**	
		Answer: **Effect of driving habits:- (Any four points, 01 marks for each)** 1. Before starting your scooter or bike first time every day check whether tyre pressure, brakes, indicator lights, headlights, horns, rear-view mirrors are all okay. Effect: Avoids inconvenience. 2. Wearing helmet during riding: Effect: In event of an accident, severe injury is avoided 3. Beware of bikers overtaking you suddenly from your left side. Always keep an eye on	

both left and right rear-view mirrors. Effect: Avoids accident.

4. In a road with lots of traffic movement do not try to overtake big vehicles like bus or Lorries, especially when these vehicles are moving at a reasonably high speed. Effect: Safe riding.
5. When a bus is stopping at a bus stop ahead of you, never overtake it from the left side as passengers would be alighting out the bus and there is every chance you might hit any of them. While overtaking a stationary bus, lorry, van or car be sure that you have enough driving space even if a vehicle comes from the opposite side. Effect: Safety of road users.
6. Take care not to stop your bike suddenly especially when the red lights come on traffic signals but always raise your hand, signalling to the vehicle coming behind that you are going to stop. Effect: Safety of road users and avoids collision.
7. Switching on indicator light is very important as turning abruptly to your right or left without indicating may cause serious accidents. If indicators are not working, use your hand signals before turning. Effect: avoids accident and smooth ride
8. During rainy seasons when roads become very slippery or waterlogged, take extreme precautions as your vehicle might skid especially while turning. Drive very slowly in waterlogged roads as there could be potholes or road cuts anywhere which can make you lose your balance and fall down. Effect: Safe ride
9. Never jump signals and follow traffic rules strictly. When stopping at signals, give space on your left for vehicles which might turn left. Effect: Safety of road users. Avoids fine.

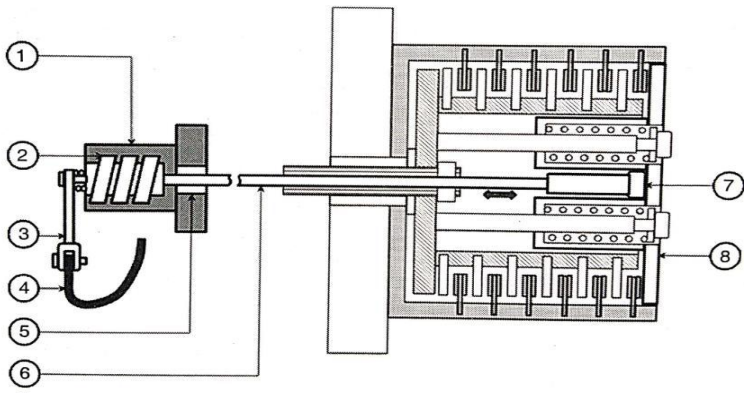
5. Attempt any TWO of the following. **12**

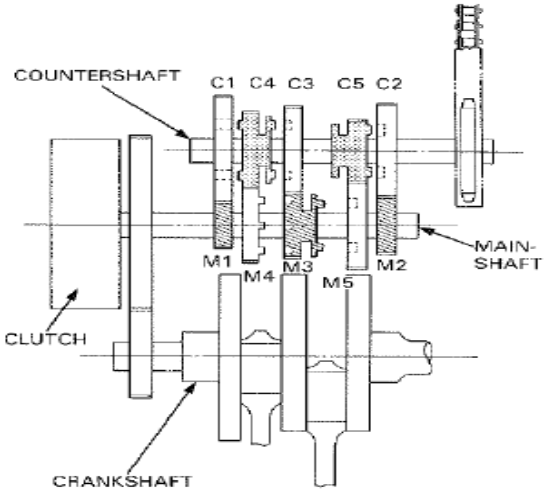
a) Compare kick start and button start arrangement on the basis of effort, battery, convenience and maintenance. **06**

Answer: *(1½ mark for each comparison point)*

Comparison on basis of	Kick Start Arrangement	Button Start Arrangement
1. Effort	In kick start arrangement cranking effort is generated by forcing kick downward using foot.	In button-start arrangement starter motor and starter drive mechanism provide the cranking effort and start the engine on one push of a button.

		2. Battery	Battery need not be in charged position for cranking. We can start two-wheeler by kick start arrangement. But horn won't sound or the headlights will glow dimly.	In button start two wheeler large amount of current is supplied by battery quickly during engine cranking. So, battery should be in charged condition.	
		3. Convenience	Kick start bikes are less user friendly for novice bikers as it can take a few kicks for battery ignition.	Button-start bikes are very user-friendly. Just a simple push of a button and bike will start instantly. This is a lot better than the discomfort and pain while kicking a bike's lever	
		4. Maintenance	Kick start arrangement requires low maintenance unlike button start two wheeler they don't have electric starter.	Button start arrangement requires high maintenance because of constant use of electric starter they get worn out, which needs repairs or replacement.	
	b)	**State the purpose of-** **i) Speedometer** **ii) Trip meter** **iii) Head lamp**			**06**
		Answer: *(02 marks for each point)* 1. **Speedometer**: Purpose of using speedometer is to…. a To see the current vehicle speed b To estimate the time required for journey if distance is known. c To enable rider to drive vehicle in economy mode/speed. d To follow speed relevant traffic rule applicable in certain patches of road travel. 2. **Trip meter:** Trip meter is used for ….. a To see the distance travelled during the trip. b To estimate the fuel consumption and obtain fuel economy/ efficiency of vehicle, expressed in terms of kmpl. c To help keep log book records. d To follow Google map instructions while taking turns. 3. **Head Lamp** is one of the most important safety features on a motorcycle. As well as illuminating the road ahead, we are making our self-visible to other drivers on the road, especially at night. The best way to help others see your motorcycle is to keep the headlight on — *at all times*. Headlamp provides illumination in desired pattern of light intensity. Motorcycles must have a headlight sufficient to reveal a person or vehicle not less than 30 m ahead when traveling 40 km/hour or less; not less than 60 m when traveling 40-55 km/hour; and not less than 90 m when traveling more than 55 km/hour.		
	c)	**Explain working of Multi-plate clutch with neat sketch.**			**06**
		Answer: *(Working=3marks, Sketch=3marks)* Multi-plate clutch always remains in engaged position due to clutch spring force. The spring force must be released to disengage the clutch, i.e. the plate must be separated to disengage the transmission from the engine. A release mechanism is used to achieve this engagement. The release mechanism pushes the pressure plate away from the clutch boss. The clutch springs are compressed and axial force is removed for the moment. The friction plates and clutch plates become free to rotate and spin freely with respect to each other.		

		As shown in figure a lever is connected to the inner release component which is directly pulled by the clutch cable. A pushrod -1 is extended from inner release to the other side in the clutch boss. The pushrod -1 can freely reciprocate inside the output shaft of the clutch. At the end of pushrod-1, another small pushrod -2 is used to push the pressure plate away from the clutch boss. A retaining spring used between inner releases to hold the position of lever. The screw type motion of inner release is transmitted to the pushrods. The pull of the clutch cable is then converted into the direct pushing motion needed to disengage the clutch. The compressed clutch springs again force the pressure plate to engage the clutch as soon as the drivers release the hand lever.  1. Release outer 5. Bush 2. Release inner 6. Pushrod–1 3. Lever 7. Pushrod–2 4. Clutch cable 8. Pressure plate **Figure**: Working of Multiplate Clutch	
6		**Attempt any TWO of the following.**	**12**
	a)	**Explain Carburettor working under various engine operating conditions.** **i) Idling** **ii) Starting** **iii) Accelerating** **iv) Normal running**	
		Answer: *(1.1/2 marks for each)* **Functions of carburetor under four engine operating conditions:** (1½ mark for each operating condition) **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 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 its automatic opening after the engine has started as the choke valve is closed. Whole of engine suction is applied at the main nozzle, which then 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 actuates a plunger to push fuel to the acceleration jet. It provides 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 and chemically correct air: fuel mixture is supplied to the engine; the quantity of mixture is controlled by throttle valve.	
	b)	**Explain construction and working of constant mesh gear box with neat sketch.**	**06**
		Answer: *(Construction=2, Working=2, Sketch=2)* **Construction and working of constant mesh gear box:** A simplified diagram of constant mesh box has been shown in Figure. In this type of gearbox, all the gears are in constant mesh with the corresponding gears on the layshaft. This gearbox uses a one-piece cluster gear with four or five gears formed with different diameters. This cluster of gears is known as main shaft. The main shaft is rotated though the primary-drive. The layshaft gears are free to rotate. The layshaft itself works as output shaft for the transmission and directly connected through final drive to the driving wheel. In certain designs, the output shaft (countershaft) is made hollow in which the gear shifting mechanism works. This shaft is also provided with seats to accommodate steel balls. The gear shifter rod reciprocates inside the hollow output shaft. The gears on the output shaft are free to rotate but do not slide. Therefore, all the gears remain in mesh with corresponding gears on the cluster (main shaft). The locking of gear and output shaft is accomplished with the help of steel balls. Various gear ratios are obtained. For example, M1 and C1 provide first gear ratio, while M5 and C5 provide fifth gear ratio.  M1, M2, M3, M4 and M5 are main shaft gears- Input Shaft; C1, C2, C3, C4 and C5 are countershaft gears- output Shaft connected to chain drive type of final drive as shown in the diagram.	
	c)	**Explain working of micro processor controlled ignition system with neat sketch.**	**06**
		Answer: *(Working 03 marks , block diagram 03 marks)* Working of microprocessor controlled ignition system: This system digitally controls the ignition timing by a microcomputer inside the spark unit and calculates the optimum ignition timing at all engine speeds. The control unit consists of a distributor, a signal receiver which processes the pulse generator (1) and a microcomputer (2) which has a memory and an arithmetic unit. **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 (Ignition Map from EEPROM) and determines the ignition timing. Then the microcomputer sends current to the base of transistor (3).	

4. As the current from the microcomputer flows to the base of transistor, the transistor (4) is turned ON. This makes ignition coil primary circuit to carry the current and step-up the voltage at secondary circuit by mutual induction. This high voltage is used to ignite spark across electrodes of spark plug.

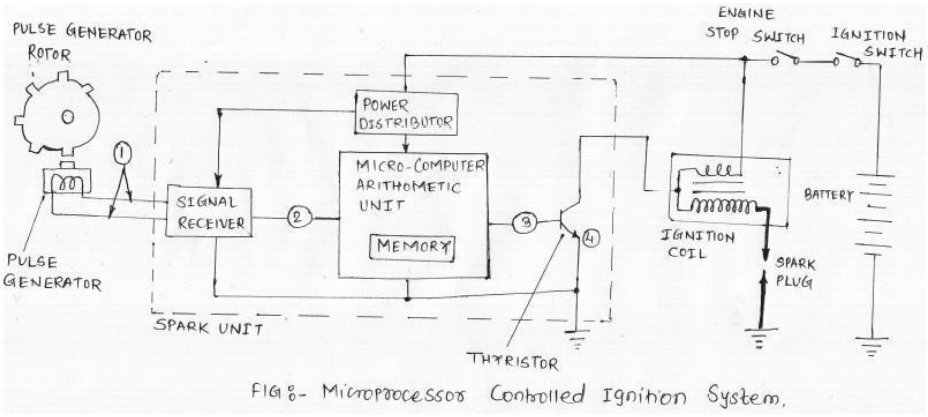


FIG :- Microprocessor Controlled Ignition System.

OR

The microprocessor controlled ignition system uses input from sensors like crankshaft position sensor, oil temperature sensor, ignition trigger coil and throttle position sensor. The ignition module/ microprocessor uses ignition maps to trigger the driver transistor for optimum spark timing. It uses a pulse transformer (a type of ignition coil) having low inductance.

As the trigger coil generates a signal/ pulse –it is sent to the microprocessor. Microprocessor switches on the driver transistor by supplying base current. Now the collector emitter circuit of the driver transistor carries the primary circuit current to ground. Primary current flow causes magnetism to be induced in secondary winding as well (primary and secondary windings are wound around the same iron core of ignition coil). A high voltage (of about 30 KV) is induced in the secondary winding of pulse transformer. This voltage is sufficient to ignite the leanest charge in combustion chamber. The ignition maps stored in the ignition module / microprocessor enables the spark to be timed accurately.

Microprocessor controlled ignition system: