

Sumeer-2019 EXAMINATION

Subject Name: AEE

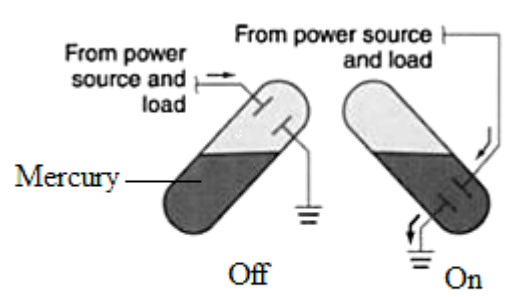
Model Answer

Subject Code:

17617

Important instructions for examiner:

- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills).
- 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
- 5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
- 6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
- 7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q. No.	Sub Q. N.	Answer	Marking Scheme
1	a)	Attempt any THREE of the following.	12
	i	Explain mercury switch with neat sketch	04
		<p>Answer:- (<i>Sketch:- 2 marks, Explanation:- 2 marks</i>)</p> <p>Mercury switch: In one end of the capsule are two electrical contacts. The switch is attached to the hood or luggage compartment lid. Normally, the mercury is in the end opposite to the contacts. When the lid is opened, the mercury flows to the contact end and provides a circuit between the electrical contacts. Mercury switches are designed so that when the hood or trunk reaches a certain opening angle, the mercury in the switch makes electrical contact, and activates the lamp.</p> <div style="text-align: center;">  </div> <p style="text-align: center;">Figure: A Mercury Switch</p>	

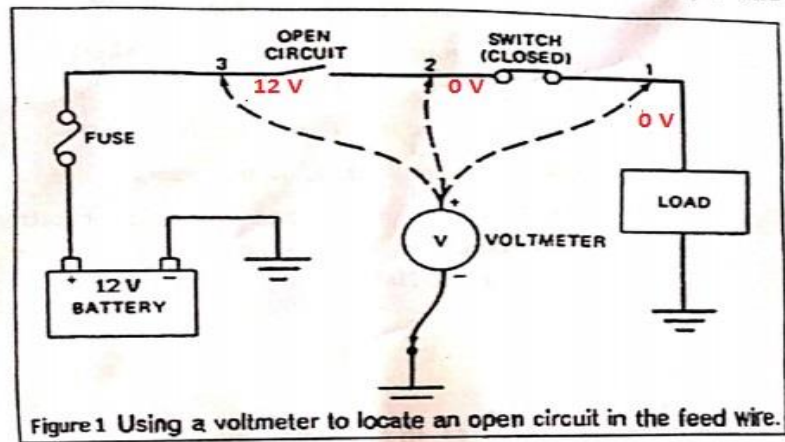


	ii.	Write chemical reaction while discharging. State material used in lead acid battery for: 1) Positive Plate 2) Negative Plate 3) Plate Grid 4) Electrolyte	04
		Answer:- The chemical reaction during discharging is as below: $\text{Pb} + \text{PbO}_2 + 2\text{H}_2\text{SO}_4 \rightarrow 2\text{PbSO}_4 + 2\text{H}_2\text{O}$ Materials Used For: 1. Positive Plate :- Lead oxide 2. Negative Plate :- Pure Lead 3. Plate Grid :- Lead calcium alloy 4. Electrolyte:- Dilute mixture of Water and Sulfuric acid (H ₂ SO ₄)	02 02
	iii	What is cranking? State the purpose of neutral safety switch in starting system.	04
		Answer: Cranking:- Cranking means rotate crankshaft of the engine by means of some external power source (Usually an electric motor). Cranking is required for starting of engine and after engine starts Four strokes or two stroke engines keep running on its own inertia. Purpose of Neutral safety switch in starting motor: The switch provides continuity in starter circuit if the transmission is in neutral or clutch is disengaged.	02 02
	iv.	Explain function of ballast resistor and condenser in ignition system.	04
		Answer: <ul style="list-style-type: none">• Ballast resistor: A resistor limits the current in a circuit by increasing the resistance as the current increases above a certain value. A ballast resistor is used in a circuit to limit the current and hence prevent it from over current faults. Here, as the current in the circuit varies and increases above a particular threshold value, the resistance also starts to increase. This in turn decreases the current and protects the	02



	<p>circuit from over current faults. Thus, maintaining the stability of the circuit. These devices are mostly connected in parallel with the load of the circuit</p> <ul style="list-style-type: none">• Condenser <p>Basically the function of a condenser in a coil ignition circuit is to reduce the spark at the contact points as they open in the distributor and thus minimize burning and pitting of the points. Arcing is caused by the effect of self-induction in the coil as the points interrupt the flow of current. Condenser discharges back through the primary winding producing an oscillation of the current flow in the primary circuit for the brief interval that is required for the primary circuit to return to a state of equilibrium.</p>	02
b)	Attempt any ONE of the following	06
(i)	1) List four circuit defects, Explain effect of unnecessary resistance in circuit. 2) Fig No 1 shows a testing of feed wire with open circuit defect. Redraw the figure and write voltage that will be indicated by voltmeter at positions 1, 2, and 3.	06
	<p>Answer:-</p> <p>Types of circuit defects.</p> <ol style="list-style-type: none">Open CircuitShort CircuitShort to groundResistance in connection (Voltage Drop) <p>Effect of unnecessary resistance in circuit.</p> <p>The most common effect of a high resistance connection will be localized heating around the connection. On a high current circuit even a small unwanted resistance (of the order of an ohm) can result in the dissipation of hundreds of watts of power at the joint. This will quickly damage the insulation of cable. The follow-on risks are that of fire, or circuit failure, or unexpected operation of the circuit protective device due to short circuit resulting from insulation failure.</p> <p>A secondary effect can be that of excessive voltage drop experienced in other parts of the circuit. This can result in equipment damage, failure of protective devices to operate correctly, and flickering or variation in brightness of lamps etc.</p>	03

ii.



03

ii What is jump starting? Explain its precautions and procedure with sketch

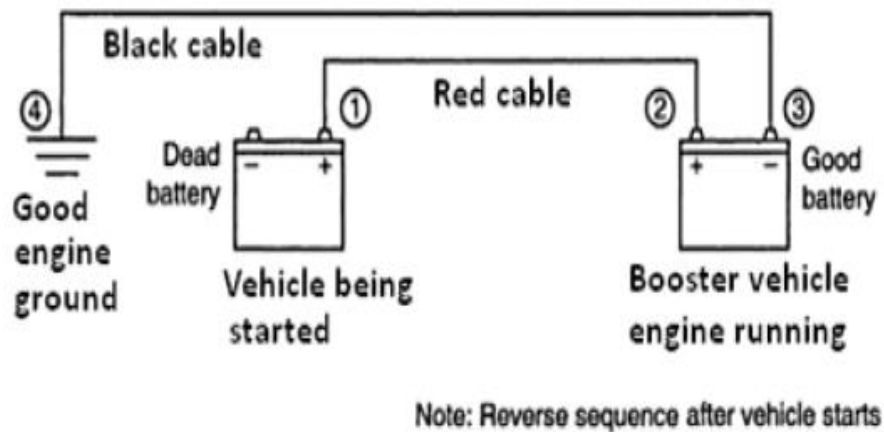
06

Answer:-

Jump starting

A jump start, also called a boost, is a method of starting a vehicle with a discharged or dead battery. A temporary connection is made to the battery of another vehicle, or to some other external power source. The external supply of electricity recharges the disabled vehicle's battery and provides some of the power needed to crank the engine. Once the vehicle has been started, its normal charging system will recharge, so the auxiliary source can be removed. If the vehicle charging system is functional, normal operation of the vehicle will restore the charge of the battery.

01



02

Fig. Jump Starting Circuit



Jump starting procedure of a battery:

Jump starting requires proper battery connecting procedures to prevent sparks. Jump start a vehicle using following procedure:

1. Engage the parking brake and put the transmission in park or neutral.
2. Make sure the two vehicles are not touching.
3. Turn on the heater blower motor in the vehicle with the dead battery. This will allow the battery to help absorb any damaging voltage spikes. Turn off all other switches and lights.
4. Connect the two positive cables using the positive jumper leads.
5. Connect one end of the negative jumper lead to the booster battery.
6. Lastly connect the other lead of the negative jumper lead to a good ground on the vehicle with the dead battery. This location could be the vehicle frame or the engine block.
7. Start the jumper vehicle and run at fast idle and try to start the disabled one.
8. Crank the engine. As soon as the dead vehicle starts, disconnect the jumper cables in reverse order of connection.

Run the host Precautions: (1 Mark for each)

1. DO NOT lean directly over the battery while making jumper connections.
2. Make sure the two vehicles are not touching each other.
3. For each vehicle engage the parking brake and put the transmission in neutral or park.
4. Turn off the ignition switch and all accessories on both vehicles vehicle at 2000 rpm to allow charging system to recharge the battery

02

01

Q2.

Attempt any **FOUR** of the following.

16

a) **Explain working of electro chromic mirror.**

04

Answer:- (Explanation: 02marks)

Electro chromic mirror:-

An electrochromic mirror controls optical properties such as optical transmission,

absorption, reflectance and/or emittance in a continual but reversible manner on application of voltage (electrochromism).

Electrochromic mirror work on reflectance mode.. In this mode, one of the transparent conducting electrodes (TCE) is replaced with a reflective surface like aluminum, gold or silver, which controls the reflective light intensity; this mode is useful in rear-view mirrors of cars and EC display devices.

Electrochromic reflecting surfaces are employed as self-darkening mirrors that regulate reflections of flashing light from following vehicles at night so that a driver can see them without discomfort.



Fig 1. Electro chromic mirror (Not compulsory)

04

b) Describe working of balancing coil type fuel gauge with neat sketch

04

Answer:- (Working: 02 marks, Sketch:- 02 marks)

Balancing coil type fuel gauge:-

The tank unit of the balancing coil type fuel gauge has a float and arm assembly connected to a sliding contact. As the fuel level in the tank changes, the position of the contact changes on a rheostat winding, thus varying circuit resistance and resulting current flow. The unit on the instrument panel contains two magnetic coils (limiting coil and operating coil) and a permanent magnet, which is attached to the gauge needle. When the fuel tank is empty, the limiting coil stronger than the operating coil, thus the magnet is drawn toward it and the needle reads EMPTY on the gauge. As the tank is filled, the operating coils become stronger, attracting the magnet and moving needles toward the F or FULL position.

02

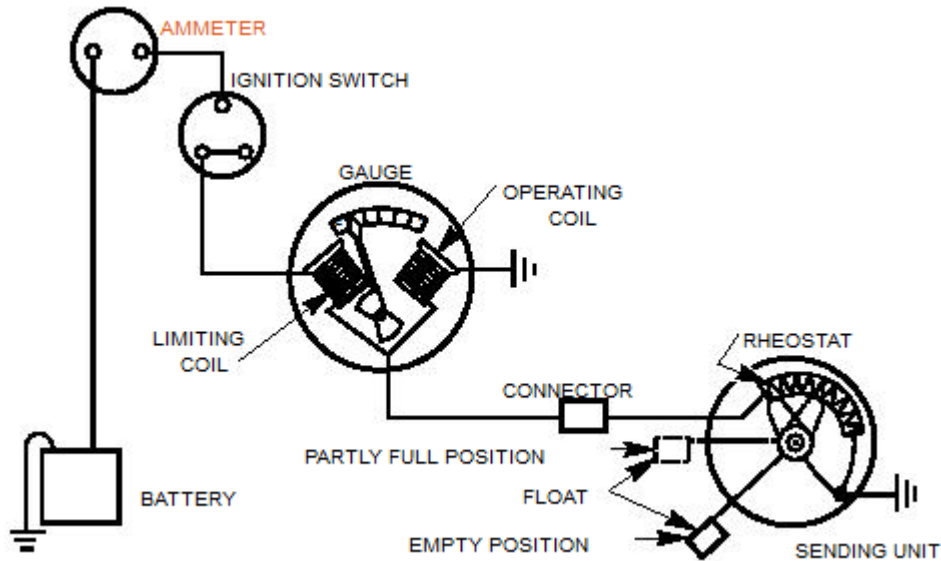


Fig Balancing coil type fuel gauge

02

c) Explain concept of initial excitation and self-excitation of alternator.

04

Answer:

Initial Excitation of alternator:-

Initial Excitation is the process in which battery current is directly used with the help of rotor relay of voltage regulator to excite the rotor. Initial excitation means to provide magnetic field to the rotor. The vehicle battery supplies the required current to the rotor.

02

Self-excitation of alternator:-

The iron core of the rotor will possess some residual magnetism, but it is not enough to guarantee that the alternator will start to generate current when it is rotated. In order to excite the rotor a 2.2W charge warning lamp is connected from the battery to the rotor through the ignition switch, which gives sufficient rotor current to set up a magnetic field strong enough to give the generation.

02

d) Compare relay with solenoid.

04

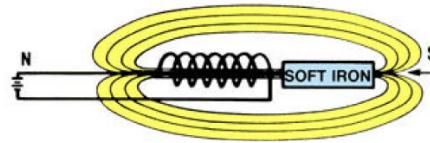
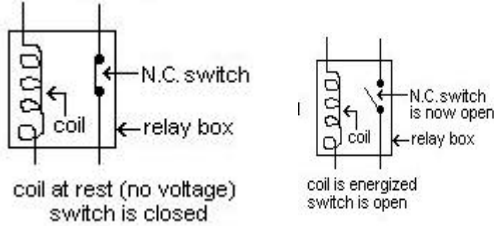
Answer:

Relay	Solenoid.
i. Purpose of relay is to control a load circuit with the use of small current carrying control circuit	ii. Purpose of a solenoid is to control a larger current carrying circuit with use of small current carrying circuit

02

ii. It controls one electrical circuit by opening & closing contacts in other circuits.

iii. It converts electrical energy into mechanical movement of core



02

e) **Compare fuse with circuit breaker**

04

Answer:- (Any four points:- 1 marks for each)

Fuse	Circuit breaker
1. Automotive fuses are used to protect the wiring and electrical equipment for vehicles	1.Circuit breakers are generally used to open the circuit if an overload occurs.
2. A fuse is a type of resistor that acts as a sacrificial device to provide over current protection, of either the load or source circuit.	2.A circuit breakers protect devices which are more sensitive and costly
3. Its essential component is a metal wire or strip that melts when too much current flows, which interrupts the circuit in which it is connected.	3. They are automatically reset. Thermally expandable
4. Ex Cartridge fuse, MAXI Fuses	4. Ex. Automatic Resetting type of Circuit breakers thermal circuit breaker

f) **Describe construction and working of overrunning clutch with simple sketch**

04

Answer: (Description :- 02 marks, Sketch: 02 marks)

A device used to connect two coaxial shafts or a shaft to a freely moving part that is seated on the shaft. An over running clutch transmits rotary motion and torque from a driving member to a driven member in one direction only.

There are over running versions of positive clutches, including adaptations of the ratchet and jaw types, there are also overrunning friction clutches, with circular cylindrical and eccentric rollers and with self-tensioning helical springs.

Overrunning clutches are used to prevent a reverse transmission of motion in a kinematic loop, such as motion from the driving wheel of a bicycle to the pedals

They are used to convert a rocking motion to a rotary motion, for instance, in the pulse type of continuously variable transmissions, or to impart to a slowly rotating shaft a faster rotation in the same direction, as, for example, in mechanisms for high-speed shifting in metal cutting machines.

Other applications include winding mechanisms and arresting devices, where reverse shaft rotation must be prevented.

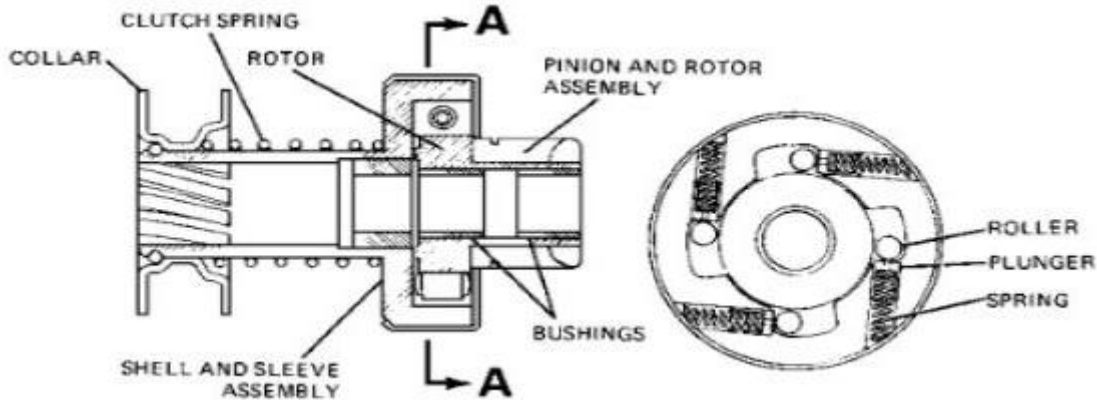


Fig. Overrunning of Clutch

3 Attempt any FOUR of the following.

16

a) Describe working of automatic ON-OFF head lamp system. Why time delay circuitry is provided in it?

04

Answer:

Automatic On/Off head light with time delay:-

The automatic on/off with time delay feature has two functions:-

- To turn on the headlights automatically when the ambient light decreases to a predetermined level.
- To allow the headlights to remain on for a certain amount of time after the vehicle has been turned off. This system is used in combination with the automatic dimming system.

02

The common components of the automatic on/off with time delay include:-

1. Photocell and amplifier.
2. Power relay.



3. Timer control.

In this system the photocell is located inside the vehicles dash to sense the outside light. As the ambient light level decreases, the internal resistance of the photocell increases. When the resistance value reaches a predetermined value, the photocell and amplifier trigger the sensor amplifier module. The sensor-amplifier module energizes the relay, turning on the headlights and exterior parking lights. Some systems provide a time delay feature that allows driver to set a timer circuit to control how long the headlights remain on after they leave the vehicle. The timer control is a potentiometer that is the part of the head light switch. The timer control unit controls the automatic operation of the system and the length of time the headlights stay on after the ignition switch is turned off. The timer control signals the sensor amplifier module to energize the relay for the requested amount of time.

02

b) Describe DTC structure as detected by SAEJ 2012.

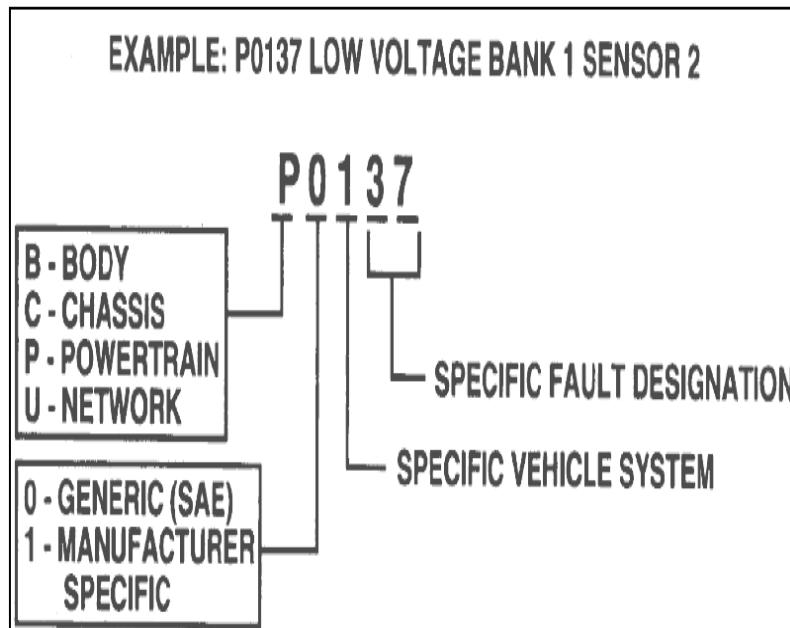
04

Answer:

Answer: (Description-2 marks, sketch-2marks)

SAE J-2012 (Diagnostic Trouble Codes) defines a set of diagnostic trouble codes (DTCs) where industry uniformity has been achieved. DTCs (five digits) consist of an alpha character followed by four characters. The first digit of the code indicates if the DTC is generic or manufacturer specific. A “0” indicates the code is generic while a “1” indicates it is manufacturer specific. The second digit indicates the vehicle the vehicle system that generated the fault code.

02



02

c)	<p>Explain working principle of mechanical speedometer gauge with simple sketch</p>	04
	<p>Answer:</p> <p>Mechanical Speedometer:</p> <p>The speedometer is driven from the transmission output shaft by a set of gears. The driven gear fastens to a flexible shaft or speedometer cable. It runs from the transmission output shaft to the back of the speedometer head. Inside the speedometer, the cable turns a shaft with a small magnet on it. The rotating magnetic field produces a varying pull on the metal ring surrounding the magnet. A pointer is attached to the metal ring. As the magnetic field spins, it causes the ring to overcome a light spring and swing with the magnetic field. This moves the pointer which then indicates car speed. The faster the vehicle speed, the faster the magnet spins, and the farther the pointer moves.</p> <div data-bbox="581 898 1101 1367" data-label="Diagram"> </div> <p>Fig: A speedometer Assembly</p>	02
d)	<p>Write function of –</p> <ol style="list-style-type: none"> i) Crank shaft position sensor ii) Camshaft position sensor iii) Detonation sensor iv) Cylinder identification sensor 	04
	<p>Answer: (One mark for each sensor)</p> <p>a) Detonation Sensor:</p> <p>A large spark-advance is needed to obtain maximum power and economy from an engine. But when the spark is over-advanced, combustion knock will occur. To overcome this problem a detonation sensor is used. The detonation sensor detects the engine detonation and sends the</p>	01



voltage signal to the Engine control unit. The ECU uses the detonation sensor signal to control timing. The detonation sensor signal is an input to the ECM which then retards the computed ignition timing signal already advanced by the igniter circuit. i.e. the ignition timing is retarded to make the engine work without detonation.

b) Cylinder Identification sensor / camshaft position sensor:

The function of cylinder identification sensor used in ignition system is to detect the position of the engine camshaft. Camshaft position is used to identify when first piston is 26° before top dead center (BTDC) of its compression stroke. The DIS module uses the CID signal to select the proper coil to fire. It uses a Hall-effect pickup.

01

c) Crankshaft position sensor:

The ECU uses the crankshaft position signal to determine engine RPM, crankshaft position and engine misfire. The ECU can determine from its programming the engine firing order. This signal is sent to the ignition control module or engine control module which then energizes the appropriate coil.

01

d) Camshaft position sensor:

1. The camshaft sensor informs the PCM of the camshaft position relative to the crankshaft. By monitoring the camshaft position, the PCM remains informed as to the timing of the opening and closing of the intake valves. By monitoring the camshaft sensor and comparing it with the crankshaft sensor, the PCM knows when each cylinder is approaching top dead center and where the valves are positioned.
2. Ignition and fuel injector timing relies on this information. This is especially helpful with sequential fuel injection. Sequential fuel injection fires individual injectors at a specific point in the cylinders compression stroke. The cam sensor (in conjunction with the crank sensor) also allows the PCM to determine which cylinder is on its compression stroke.

01

e)

Describe operation of distributor less ignition system with block diagram

04

Answer:

i. The Distributor less ignition system consists of three main components:

- a. An ECU
- b. Crankshaft speed and crankshaft position sensor.
- c. Ignition coils

• The system is generally used for four cylinder or six cylinder engines. The basic principle is that of the 'Lost Spark'.

• The distribution of the spark is achieved by using two double ended coils, which are fired

alternately by using ECU.

- The timing is determined by using information from a crank shaft speed and crankshaft position sensors as well as some other sensors such as engine load, coolant temperature and detonation sensor etc.
- The coil pack (2 ignition coils for four cylinder engine) gets triggered twice in each cycle of operation by using ECU, so that flow of current through one of the two primary windings is stopped.
- When the flow of current is stopped, the magnetic field in the primary winding collapses suddenly and a high voltage is produced in the secondary winding.
- When one of the coils is fired, a spark is delivered to two companion cylinders, either 1 and 4 or 2 and 3 for four cylinder engine, at the end of compression and exhaust respectively.

The spark delivered to the cylinder on the compression stroke will ignite the mixture.

□ The spark produced in the other cylinder will have no effect, as this cylinder will be completing its exhaust stroke.

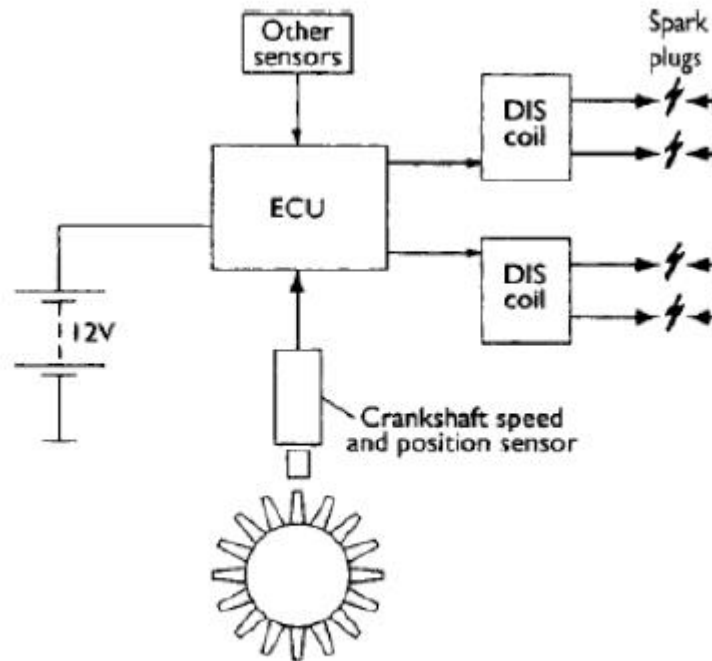


Figure: Block diagram of distributor less ignition system

4 a) Attempt any Three of the following.

12

i) State silent features of keyless entry system.

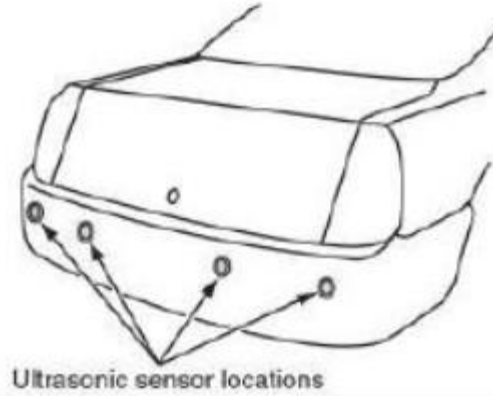
04

Answer: (Any four feature:- 1 mark for each)

1. The keyless entry system allows the driver to unlock the doors or trunk lid from outside the vehicle without using a key.



	<ol style="list-style-type: none">2. The main components of the keyless entry system include: 1) A control module 2) A coded button keypad located on the driver's door 3) Door lock motors3. The keypad consists of five normally open, single-poles, and single-throw switches. Each switch represents two numbers 1-2, 3-4, 5-6, 7-8, 9-0.4. The keypad is wired into the circuit to provide input to the control module. The control module is programmed to lock the doors with door lock motors when the 7-8, and 9-0 switches are closed at the same time.5. The driver's door can be unlocked by entering a five-digit code through the keypad.6. Remote controlled keyless entry systems are also available. They use a hand held transmitter attached as a key chain.7. It can be operated within a range of 25 to 50 feet and from any direction. The operating is done by a button press, then driver door is unlocked, theft security is disarmed. During exit, lock button locks all doors.	04
ii	Describe working of park assist system	04
	<p>Answer: (Explanations - 4marks. Credit should be given to an equivalent sketch.)</p> <p>Working of park assists system:</p> <p>Parking sensors make reversing into tricky/ tight spaces easier and help prevent minor damage to a vehicle. The park assist system sensors make it easier by warning when you're getting too close to something, preventing small knocks and scratches.</p> <p>The system has up to six ultrasonic sensors located in the rear - and sometimes the front - bumpers. Each of the sensors receives battery voltage and ground from the park assist module. Each sensor has a dedicated serial bus communication circuit to the module. The sensors monitor a range of up to 150 centimeters behind and, depending on the model, in front of the vehicle. The system comes into action when reverse gear is engaged, or at very low speed. It uses the principle of the echo sounder to detect obstacles and their distance from your car.</p> <p>The park assist system is a parking aid that alerts the driver to obstacles located in the path immediately behind the vehicle / in the path of vehicle. Ultrasonic sensors evaluate attributes of a target by interpreting the echoes from sound waves. When an object is detected, the system uses an LED display and warning chimes to provide the driver with visual and audible warning of the objects presence. It starts to sound an intermittent warning tone which gets faster the nearer you are. The warning signal becomes continuous when the vehicle gets so close that will result in a collision.</p>	04



(iii) Explain construction and working of exhaust gas oxygen sensor

04

Answer:-

- Inside the vented cover on the end of the sensor that screws into the exhaust manifold is a zirconium ceramic bulb. The bulb is coated on the outside with a porous layer of platinum. Inside the bulb are two strips of platinum that serve as electrodes or contacts.
- The main active component of most types of oxygen sensors is zirconium dioxide (ZrO_2). This ceramic is housed in gas permeable electrodes of platinum. A further ceramic coating is applied to the side of the sensor exposed to the exhaust gas as a protection against residue from the combustion process. The principle of operation is that, at temperatures in excess of $300^\circ C$, the zirconium dioxide will conduct the oxygen ions

02

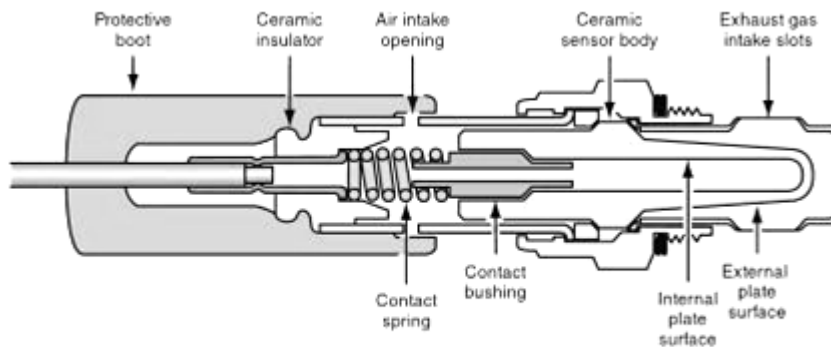
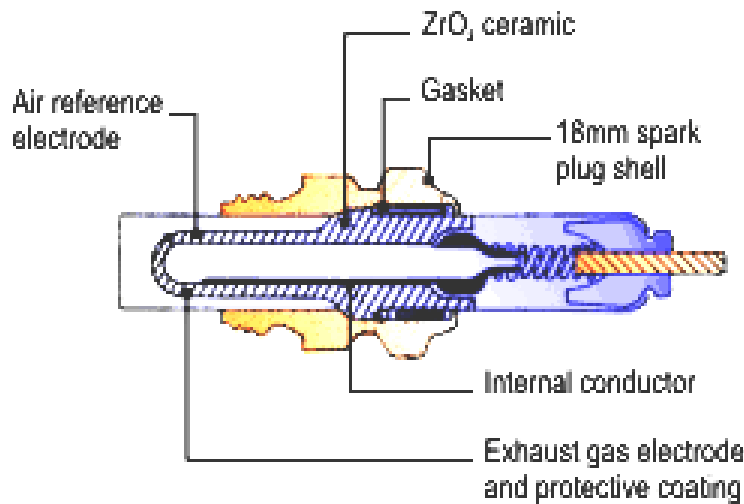


FIGURE Typical oxygen sensor

02

OR



iv Explain the sound test of electronic fuel injector. Write its significance 04

Answer:

Procedure for sound test for testing electronic fuel injector:

- 1) The electronic fuel injection system relies on electronic signals that control how these items operate
- 2) Along with checking a fuel injector electronically, you can listen for certain kinds of sounds that will tell you when a fuel injector might not be working correctly.
- 3) A clunking sound or similar warning sound may show that the fuel injector is not functioning the way it should.
- 4) If the injector electrical leads are difficult to access, an injector power balance test is hard to perform. As an alternative, start the engine and use a technician stethoscope to listen for correct injector operation.
- 5) A good injector makes a rhythmic clicking sound as the solenoid is energized and de-energized several times each second.
- 6) If clunk- clunk instead of steady click-click is heard, chances are the problem injector has been found.
- 7) Cleaning or replacement is in order.
- 8) If an injector does not produce any clicking noise, the injector, connecting wires or PCM may be defective.
- 9) When the injector clicking noise is erratic, the injector plunger may be sticking.
- 10) If there is no injector clicking noise, proceed with the injector resistance test and light to

03



	<p>locate the cause of problem.</p> <p>11) If a stethoscope is not handy, use a thin steel rod, wooden dowel, or fingers to feel for a steady on/off pulsing of the injector solenoid.</p> <p>Significance of sound test :</p> <p>The use of auto fuel injectors is a sophisticated way to provide the right fuel and air mix to an engine for a vehicle. The small cylindrical fuel injectors play a specific role in a larger fuel intake system, along with other elements like the fuel pump and the fuel tank. Over time, fuel injectors may need to be maintained or checked for proper functioning</p>	01												
b)	Attempt any One of the following.	06												
i.	<p>The following defects were observed in starting system. List two possible causes and remedies for each. –</p> <p>1) Starter spins but does not crank the engine. 2) Starter cranks the engine slowly 3) Starter does not spin.</p>	06												
	<p>Answer: (two marks for each defects)</p> <table border="1"> <thead> <tr> <th>Defects</th> <th>Causes</th> <th>Remedies</th> </tr> </thead> <tbody> <tr> <td>Starter spins but does not crank the engine.</td> <td>1) Solenoid is broken 2) Wire may be short 3) Flywheel ring gear worn</td> <td>Replace solenoid Repair wires Repair flywheel</td> </tr> <tr> <td>Starter cranks the engine slowly</td> <td>1) Loose electrical connections 2) Less input voltage</td> <td>Check/Repair connections Check/charge the battery</td> </tr> <tr> <td>Starter does not spin</td> <td>1. Low current/voltage 2. Worn brushes</td> <td>Check battery voltage and charge Replace brushes</td> </tr> </tbody> </table>	Defects	Causes	Remedies	Starter spins but does not crank the engine.	1) Solenoid is broken 2) Wire may be short 3) Flywheel ring gear worn	Replace solenoid Repair wires Repair flywheel	Starter cranks the engine slowly	1) Loose electrical connections 2) Less input voltage	Check/Repair connections Check/charge the battery	Starter does not spin	1. Low current/voltage 2. Worn brushes	Check battery voltage and charge Replace brushes	06
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ii	State the need of ignition timing advance. Explain working of centrifugal advance and vacuum advance mechanism in distributor with simple sketch	06												
	<p>Answer:</p> <p>Need of ignition timing advance</p> <p>1. To completely burn the fuel instantly 2. To improve performance of engine</p>	02												

3. To avoid knocking/detonation of engine.
4. To improve power output of engine

Centrifugal advance Mechanism

When the engine speed increases weight moves outward due to centrifugal force rotating the plate and cam in the anti-clockwise direction

- This movement affects the desired advance.
- This timing of spark varies from no advance at low speed to full advance at high speed

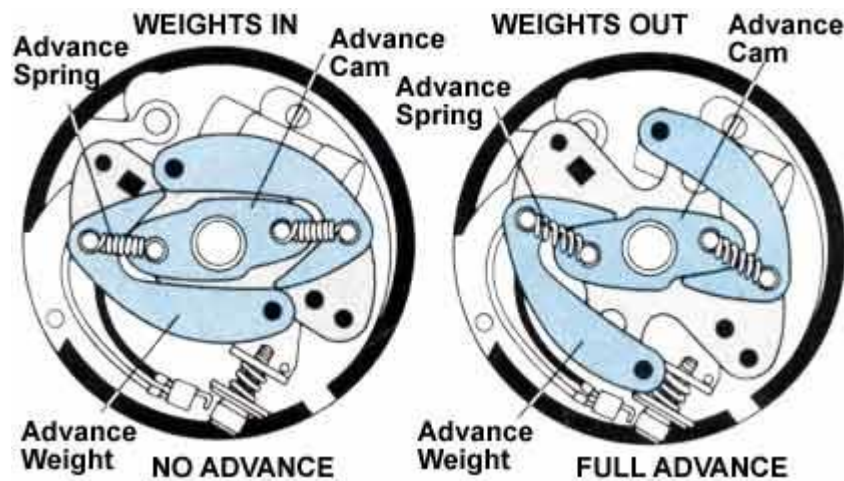


Fig Centrifugal advance Mechanism

Vacuum advance system

The vacuum advance system consists of a vacuum diaphragm mounted on the distributor body. The diaphragm is spring-loaded in the zero-advance position, and has a rod that connects to a hole in the breaker plate, which is the movable plate the

Points are mounted on. When vacuum is applied to the diaphragm, it pulls on the rod, which in turn pulls on the breaker plate, rotating it with respect to the eight sided

Cam on the distributor shaft which opens and closes the points. When viewed from the top, the distributor shaft (and the eight-sided cam for the points) turns clockwise. When the vacuum advance rod pulls on the breaker plate, it rotates the breaker plate (and the points) counter-clockwise, which “advances” the opening of the points (triggering the

Coil to fire the spark plugs). A typical vacuum advance unit, when fully deployed, will add about 15 (crankshaft) degrees of spark advance over and above what the distributor’s centrifugal advance system is providing at the moment, which depends on engine rpm. They

02

02

are two independent systems, but they work together to provide the correct amount of spark advance.

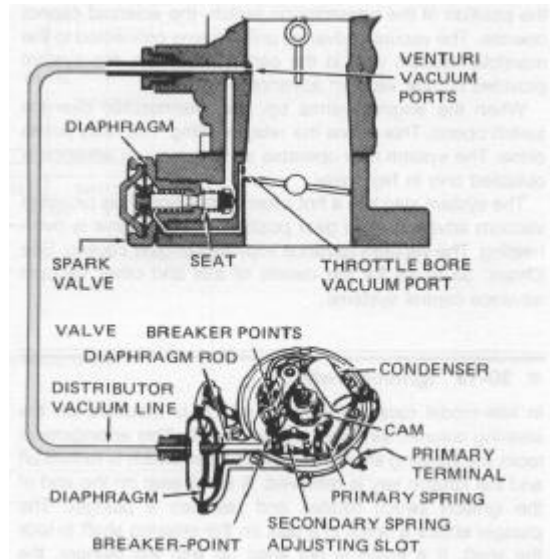


Fig Vacuum advance mechanism

(credit should be given to equivalent answer)

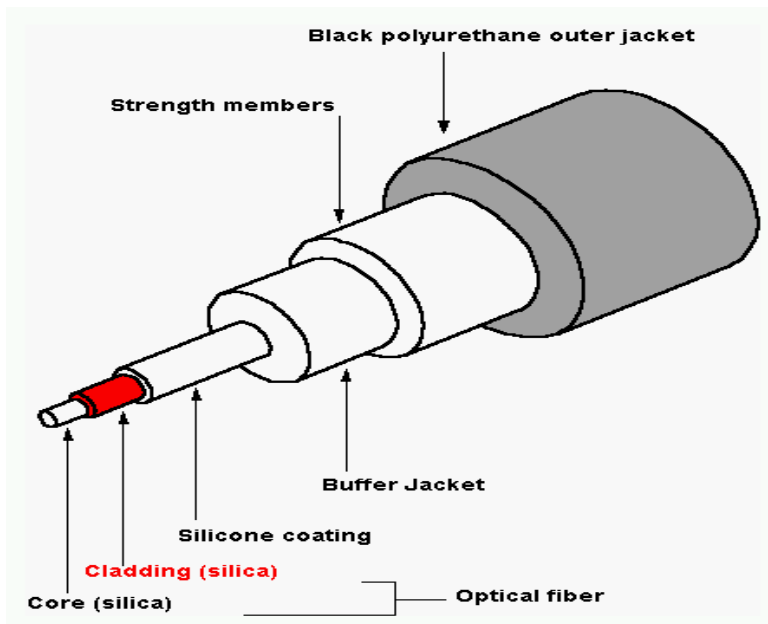
5 Attempt any FOUR of the following.

16

a) Draw a labelled sketch of optical fiber cable. List its three advantages.

04

Answer : *(sketch :-02 marks, any four advantages: ½ for each)*



02

(credit should be given to equivalent sketch)

Advantages:

1. Greater Bandwidth & Faster Speed
2. Cheap: Several miles of optical fiber cable can be made cheaper than equivalent lengths of copper wire
3. Optical fiber is thinner, and can be drawn to smaller diameters than copper wire
4. Higher carrying data capacity
5. Less signal degradation—The loss of signal in optical fiber is less than that in copper wire.
6. Light signals—Unlike electrical signals transmitted in copper wires, light signals from one fiber do not interfere with those of other fibers in the same fiber cable
7. Long Lifespan—Optical fibers usually have a longer life cycle for over 100 years.

02

b) Draw a block diagram of GPS and label it

04

Answer:

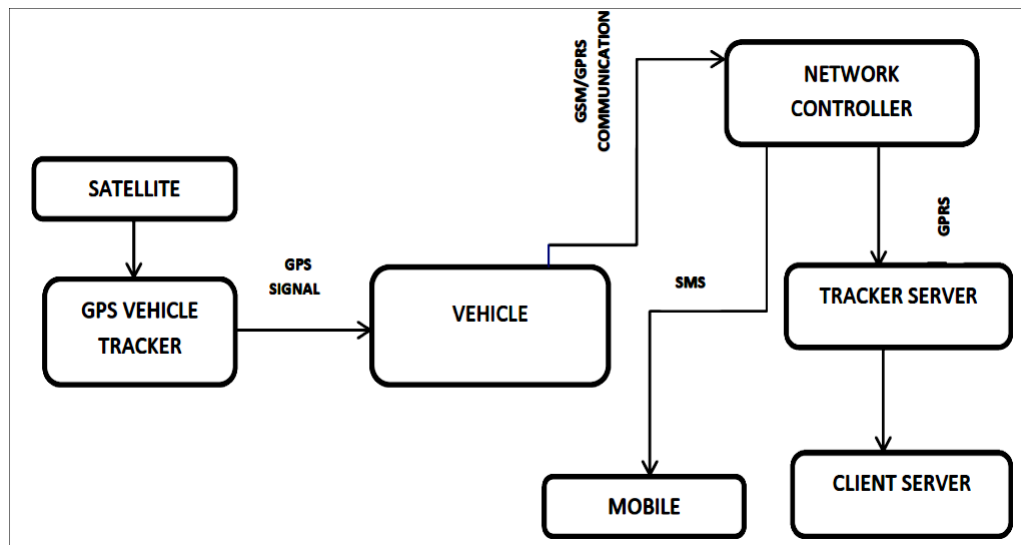


Fig. Block diagram of GPS

04

c) Explain sulphation. Write its causes.

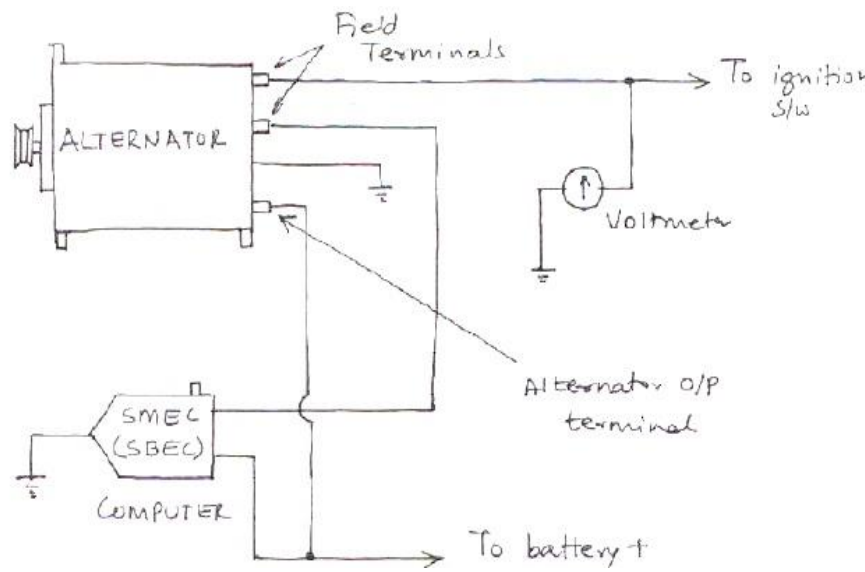
04

Answer: (Explain:- 02 marks cause:-02 marks)

Undercharging occurs if the battery is not receiving enough charge to return it to a full state of charge, this will slowly cause sulphation. This fault can occur if the car is being used only occasionally for short journeys.

02

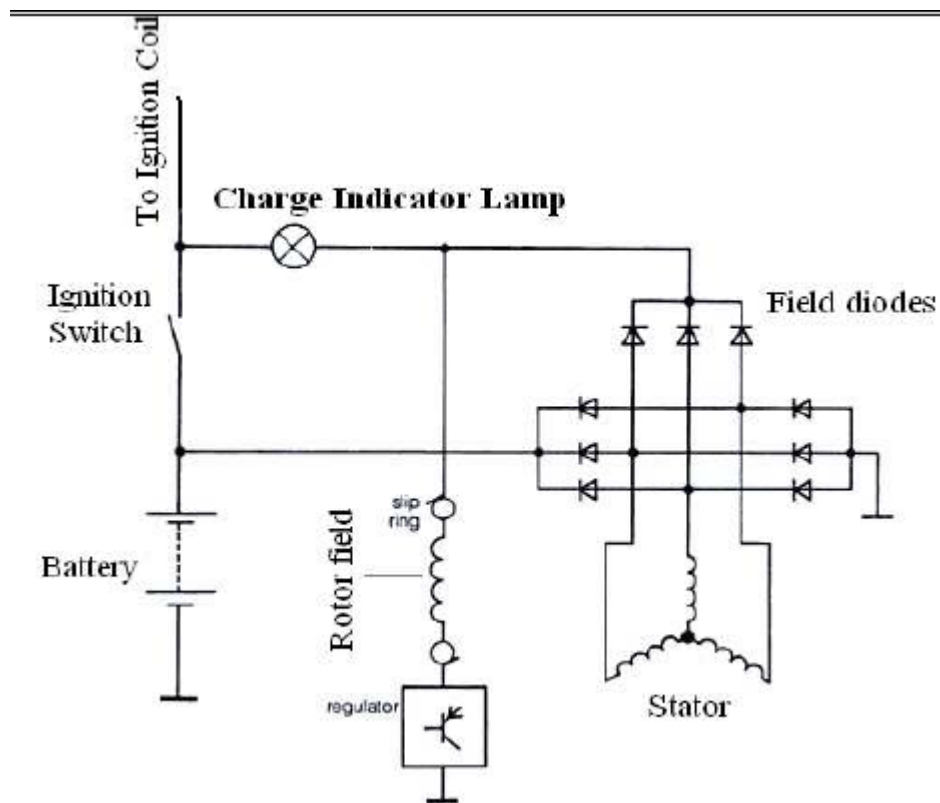
	<p>i. During battery discharge, the active material in negative & positive plates gets converted into lead sulphate.</p> <p>ii. If battery is recharged without allowing it to stand in this condition, the lead sulphate will get reconverted into active material without any difficulty.</p> <p>iii. On the other hand, if the battery is allowed to stand in discharged condition for a longer period, the lead sulphate will become hard, which shall resist reversion. Plates tend to expand and break the grid.</p> <p>iv. During this process, the negative plate becomes grayish white whereas positive plate tends to become milky white.</p>	02
d)	<p>Write procedure for testing a coolant temperature sensor.</p>	04
	<p>Answer: (procedure – 4 marks & credit should be given to equivalent sketch)</p> <p>The following procedure is followed to diagnose engine coolant temperature sensor.</p> <ul style="list-style-type: none"> • Remove the ECT sensor from the engine • Place it in a container of water with thermometer. • Make sure that more than half of the sensor is submerged in the water. • Connect a pair of ohmmeter leads to the sensor terminals. • Heat the water in the container and measure the resistance at different temperatures. • The sensor should have the specified resistance of 0.98 to 1.34 KΩ at 400 C and 0.22 to 0.35 KΩ at 800 $^{\circ}$C <div data-bbox="623 1304 1143 1835" data-label="Diagram"> <p>The diagram illustrates the testing process. On the left, a thermometer is shown in a beaker of water. To its right, a coolant temperature sensor is also submerged in the water. On the far right, an ohmmeter is connected to the two electrical terminals of the coolant temperature sensor. Labels with leader lines identify the 'Thermometer', 'Coolant temperature sensor', and 'Ohmmeter'.</p> </div> <p>Figure Testing a coolant temperature sensor in hot water using a thermometer and an ohmmeter.</p>	04

e)	<p>What is voltage regulation? Explain working of computer regulation.</p>	04
	<p>Answer:</p> <p>Voltage regulation:</p> <p>Voltage regulation is a measure of change in the voltage magnitude between the sending and receiving end of a component, such as a transmission or distribution line. Voltage regulation describes the ability of a system to provide near constant voltage over a wide range of load conditions. The term may refer to a passive property that results in more or less voltage drop under various load conditions, or to the active intervention with devices for the specific purpose of adjusting voltage.</p> <p>Working of computer regulation</p>  <p>SMEC: Single modules engines controlled</p> <p>In this type, the voltage is controlled by the body computer.</p> <ul style="list-style-type: none"> • Voltage regulator switches the field voltage 'ON' and 'OFF' at a fixed frequency of about 400 times per second. • The voltage is controlled by varying the ON and OFF time of the field current. The regulation of the field current is through the ground. • The logic modules, decision of voltage regulation is based on: <ol style="list-style-type: none"> a. Output voltage of an alternator b. Battery temperature c. Battery voltage 	01 02 01



	f)	How is continuity test and ground test conducted on stator? What results are shown by a good stator during tests?	04
		Answer: Connect the test lamp or ohmmeter to the stator frame & one of the stator leads. 2. Record reading of ohmmeter / lamp illumination 3. Connect the test lamp or ohmmeter between each pair of stator leads 4. Record reading of the ohmmeter / lamp illumination. If the ohmmeter reads infinity between any two of the three stator windings, the stator is open and, therefore, defective. The ohmmeter should read infinity between any stator lead and the steel laminations. If the reading is less than infinity, the stator is grounded. Stator windings can be tested if shorted because the normal resistance is very low.	04
6		Attempt any FOUR of the following.	16
	a)	List four battery rating methods and explain CCA.	04
		Answer : (<i>List:02, explain: 02</i>) Battery ratings: It is a measure of the energy stored in the battery. It is expressed in terms of the period during which the battery will give the rated current before it reaches the specified final voltage. Types of Battery ratings (any four) 1) Ampere-hours (A-h) 2) Cranking amperes (CA) 3) Cold cranking amperes (CCA). 4) Hot cranking amperes (HCA) 5) Reserve capacity minutes (RCM). Cold cranking amperes (CCA):- is the amount of current a battery can provide at 0 °F (-18°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). It is a more demanding test than those at higher temperatures.	04
	b)	Explain operation of charge indicator light with sample wiring block diagram	04
		Answer :- (<i>Diagram - 2 marks, working- 2 marks ,credit given to equivalent diagram</i>) Operation of Charge Indicator Light Circuit: • When the engine is to be started, the ignition is switched on.	

- This connects the Charge Indicator Lamp to the battery and makes a circuit through rotor field and regulator to earth.
- At this stage the charge indicator lamp is illuminated and the field is excited to the extent controlled by the wattage of the lamp; a typical lamp size is 12V, 2W.
- As alternator speed is raised, the potential difference on the output side of the field diodes is increased.
- This gradually reduces the voltage applied to the lamp so the light slowly fades and goes out when the output voltage of the alternator equals the battery voltage; i.e. when the alternator “cuts –in” and starts to charge.
- When this happens the field diodes will be providing the entire field current.



c)

List four battery tests and explain how and when battery drain test is conducted

04

Answer : (Listing - 2 marks each & Description -2 marks & sketch 2 marks)

Types of battery tests: (any Four)

- Battery terminal test,
- Leakage test,
- Specific Gravity Test,
- Open circuit test,
- Battery drain test.



Battery drain test.

A parasitic battery drain is when an abnormal and continuous discharge of power occurs after having shut off the engine. Usually, this is caused by a short circuit or an electrical device that remains in the "on" position or energized, such as:

A trunk

An under-hood or a glove-compartment light

A switch

A computer module

The amperage battery drain test

The voltage drop battery drain test

The bad alternator diode test

The car battery hydrometer test

The first three tests require the use of a digital multimeter.

Table of Contents

Preparing for the Test

The Amperage Battery Drain Test

The Voltage Drop Battery Drain Test (alternative to the Amperage test)

Before you start your tests:

Turn off all accessories and remove the key from the ignition switch.

Unplug any device from the lighter socket, even if your device is turned off.

Unscrew the light bulb from under the hood just enough to turn it off.

The amperage battery drain test requires disconnecting one of the battery cables.

To begin the amperage method test, disconnect the negative battery cable from the battery terminal. This is the black cable connected to the battery post with the negative (-) sign next to it. Then, connect your digital meter's ground (black) probe to the negative battery post.

Connect the meter's positive (red) probe to the battery cable terminal you just disconnected.

Set your multimeter to the highest setting on the DC (direct current) amperage scale and turn it on.

Now, check your meter's display. It should read zero amps.



Move the meter's dial to the next lower setting on the amperage scale.

Keep moving to a lower setting until you detect the presence of current. On a vehicle without a parasitic drain problem, this current is within a range of about 50 milliamps (mA). On a vehicle with a parasitic drain problem, this current will be higher than the normal range.

d) Compare conventional and electronic ignition system.

04

Answer: (any 4 point: 1 mark for each)

Sr. no.	Conventional ignition system	Electronic ignition system
1	Spark timing is not depends upon speed	Proper spark timing is achieved throughout the speed range
2	Moderate energy output from the ignition coil is obtained.	High energy output from the ignition coil is obtained.
3	Noise occurs during high speed	It gives noiseless operation at high speed;
4	Some carbon deposition occurs on Spark plug electrode .	Spark plug electrode remains clean off carbon deposits & ash deposits.
5	More Emissions occurs	Reduction in emission.
6	Less output power	Increased output power

04

e) Describe with neat sketch working a hall effect switch

04

Answer: (Hall Effect- 1 mark. Explanation with sketch 3 marks. Equivalent sketch is acceptable.)

Hall Effect:

When a thin rectangular gold conductor carrying a current is crossed at right angles by a magnetic field, a difference of potential is produced at the edges of the gold conductor.

Modern Hall effect units use semiconductor material e.g. silicon.

Working of Hall Effect:

- The Hall Effect switch consists of a Hall unit (Silicon), a permanent magnet, and a rotating shutter wheel.
- Whenever the opening of the rotating shutter wheel comes in between the Hall unit and the permanent magnet, it allows the magnetic field to strike the sensor and a small voltage is produced and is sent to the electronic control unit.
- As the distributor rotates; a blocking shutter diverts the magnetic field and the current stops flowing from the sensor.

- The electronic control units can be designed to either turn on or turn off the ignition coil primary current when the shutter blades are blocking.

