



SUMMER- 2018 EXAMINATION

Subject Name: AEE

Model Answer

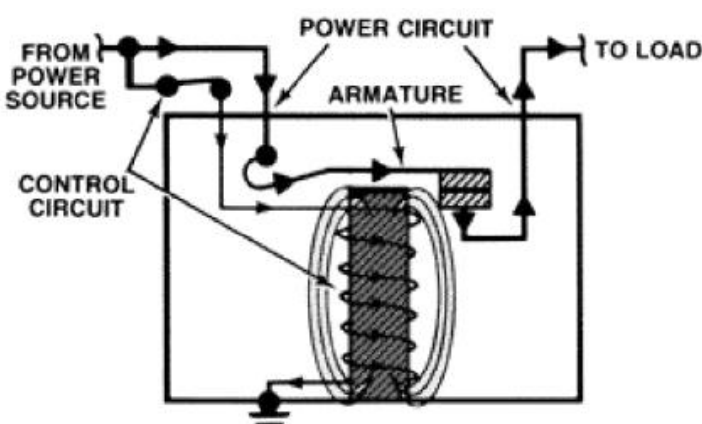
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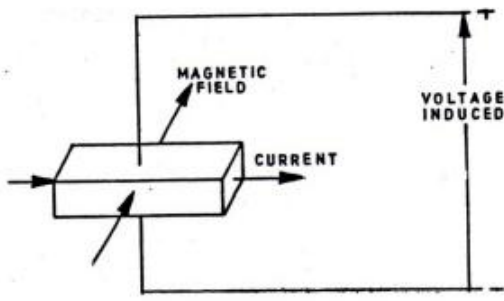
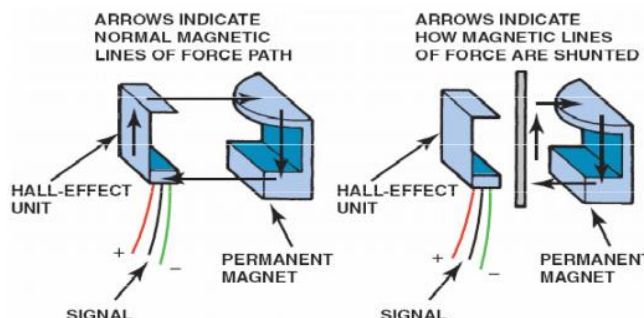
Important Instructions to examiners:

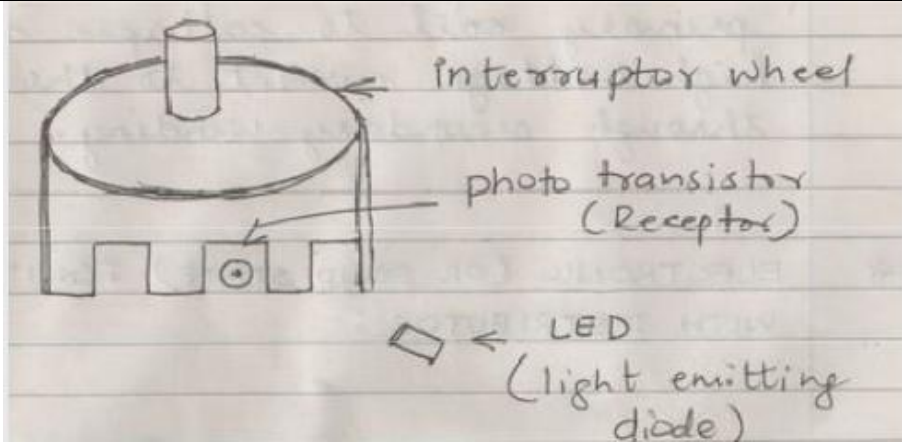
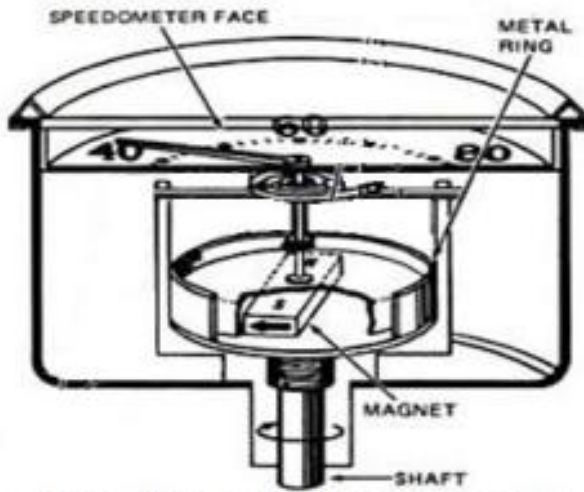
- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling 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.

Q. No.	Sub Q. N.	Answer	Marking Scheme
1	a)	Attempt any <u>THREE</u> of the following:	12
	i)	State the purpose and operation of the following components 1) Fuse 2) Relay	4
		Answer: (Purpose of each 01 Mark, Operation of each 01 Mark) 1) Fuses: Purpose: - A fuse is the most common circuit protection device. A fuse is placed in an electrical circuit so that, when current flow exceeds the rating of the fuse, it blows or blows out i.e. it is designed to turn off the circuit that it protects. Operation:- <ul style="list-style-type: none"> A fuse is the most common circuit protection device. A fuse is placed in an electrical circuit so that, when current flow exceeds the rating of the fuse, it blows or blows out i.e. it is designed to turn off the circuit that it protects. The size of the metal fuse element determines the rating. Excessive current cause's excessive heat and that causes the circuit protector to open as shown in the figure below. Once a fuse blows, it must be replaced with a new one. The element in the fuse melts, opening the circuit and preventing the other components of the circuit from being damaged by the over current. A fuse also separates a number of circuits like starting circuit, ignition circuit, charging circuit etc. thus failure of a fuse doesn't affect the other circuit. 2) Relays: Purpose: <ol style="list-style-type: none"> Purpose of relay is to control a load circuit with the use of small current carrying control circuit. It saves the size of wiring connected to the switches and reduces weight. Operation: <ul style="list-style-type: none"> Current flows through the control coil, which is wrapped around an iron core. The iron core intensifies the magnetic field. The magnetic field attracts the upper contact arm 	2

		<p>and pulls it down, closing the contacts and allowing power from the power source to go to the load.</p> <ul style="list-style-type: none"> When the coil is not energized, the contacts are open, and no power goes to the load. When the control circuit switch is closed, however, current flows to the relay and energizes the coil. The resulting magnetic field pulls the armature down, closing the contacts and allowing power to the load. Many relays are used for controlling high current in one circuit with low current in another circuit.  <p style="text-align: center;">Fig. Operation of Relay</p>	2
	ii)	Describe construction of lead Acid battery.	4
		<p>Answer: (Construction – 2 marks, Equivalent Fig Diagram - 2 marks)</p> <p>Construction of lead acid battery: Batteries are made of five basic components:</p> <ol style="list-style-type: none"> 1. A resilient plastic container. 2. Positive and negative internal plates made of lead. 3. Plate separators made of porous synthetic material. 4. Electrolyte, a dilute solution of sulfuric acid and water, better known as battery acid. 5. Lead terminals, the connection point between the battery and whatever it powers. <p>A battery consists of number of cells, generally six for 12V battery. Each cell consists of positive and negative plates separated by a separator and connected in series with positive and negative terminals of battery respectively. The plates are immersed in a solution of sulfuric acid, which acts as electrolyte. Each plate consists of a grid upon which is attached the active material, lead dioxide on the negative plates, pure lead on the positive plates.</p>	2

		2
iii	Draw a schematic diagram of Bendix drive. Describe its working.	4
	<p>Answer: (Working – 02 marks, Fig-02 mark)</p> <p>Working: Bendix Drive</p> <ol style="list-style-type: none">1. When the motor starts, the armature shaft rotates causing the sleeve to rotate and because the pinion cannot rotate due to unbalance weight, it moves axially towards the motor till it is engaged with flywheel.2. Further movement of the pinion is prevented by the collar attached on the sleeve and because of this pinion has to start rotating.3. As it is also mesh with engine flywheel, the flywheel is rotated and the engine starts.4. When the engine starts, it is flywheel that rotates the pinion and because of its bigger size, the flywheel rotates the pinion much faster than the armature (which by now, has slowed down due to releasing of the self- starter switch) with the result that the pinion backed out of mesh with the flywheel.	2
	<p style="text-align: center;">Fig. Bendix Drive</p>	

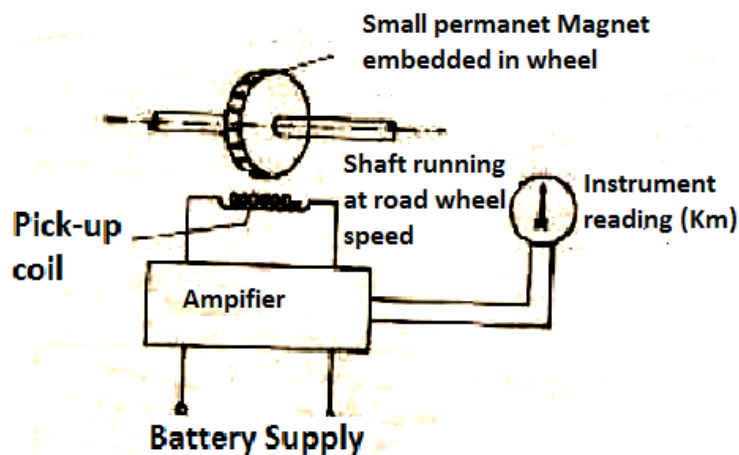
iv)	Enlist four methods of triggering primary circuit. Describe one method.	4
	<p>Answer: (Enlisting – 1 mark, Explanation- 03 marks, credit should be given to sketch)</p> <p>Four methods of triggering of primary circuit:-</p> <p>i) Magnetic pick up ii) Optical switch iii) Hall effect iv) Mutual Induction</p> <p>Hall Effect:</p> <p>The Hall effect was discovered by Edwin H. Hall in 1879. He discovered that, when a thin rectangular gold conductor carrying a current was crossed at right angles by a magnetic field, a difference of potential was produced at the edges of the gold conductor.</p> <p>Modern Hall effect units use semiconductor material e.g. silicon.</p> <p>Principle of Hall Effect:</p> <div style="display: flex; justify-content: space-around; align-items: flex-end;"> <div style="text-align: center;">  <p>Fig No.01</p> </div> <div style="text-align: center;">  <p>Fig No.02</p> </div> </div> <p style="text-align: center;">OR</p> <p>Optical method for triggering primary circuit:</p> <p>An optical triggering mechanism consists of a light emitting diode (LED) and a light sensitive photo transistor (photocell) and also a slotted disc called a light beam interrupter.</p> <ul style="list-style-type: none"> • The slotted disc is attached to the distributor shaft. • The LED and photocell are situated over & under the slotted disc opposite to each other. • As the slotted disc rotates between the LED and the photocell, light from LED shines through the slots. • The intermittent flashes of the LED are translated into voltage pulses by the photocell. • Where the voltage signal occurs, the control unit turns 'ON' the primary circuit. • When the disc interrupts the light and the voltage signal is not given, the control. • The system turns the primary circuit 'OFF' causing the magnetic field in the primary coil to collapse and sending high voltage to the spark plug through secondary winding. 	<p style="text-align: center;">1</p> <p style="text-align: center;">3</p>

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	b)	Attempt any <u>ONE</u> of the following.	6
	i	Draw a schematic diagram of speedometer gauge and describe its working.	6
		<p>Answer: (Equivalent explanation of working 03 and Equivalent Figure 03 Marks)</p> <p>Mechanical Speedometer:</p> <ul style="list-style-type: none"> • 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. <div data-bbox="542 1257 1122 1745" data-label="Image">  </div> <p style="text-align: center;">Fig: A speedometer Assembly</p>	<p style="text-align: center;">04</p> <p style="text-align: center;">02</p>

OR

Electrical type Speedometer.

- The electrical speedometer as shown in fig. operates on the principle that when an electrical generator is driven off the gear box output shaft it generates a voltage which is practically proportional to the speed.
- Fig shows a schematic circuit diagram of an electrical speedometer.
- Small permanent magnets are embedded in a brass wheel which is rotated by a shaft at the gear box output shaft speed.
- A pick-up coil is placed near it. The voltage is induced in the coil when the magnet passes it.
- These small voltage pulses are amplified by transistorized circuits and transformed into a direct current voltage exactly proportional to the number of impulses per second received from the coil.
- Thus the speedometer indicates the vehicle speed.



OR

Transistorized Pulse Generator type Speedometer:

The circuit shown in the figure has a single cable joining the transducer to the speedometer. Pulses are passed through this cable to an IC chip within the speedometer. This chip counts and converts the pulses to an analogue signal. Needle operation of the speedometer is produced by an action similar to that given by a normal voltmeter.

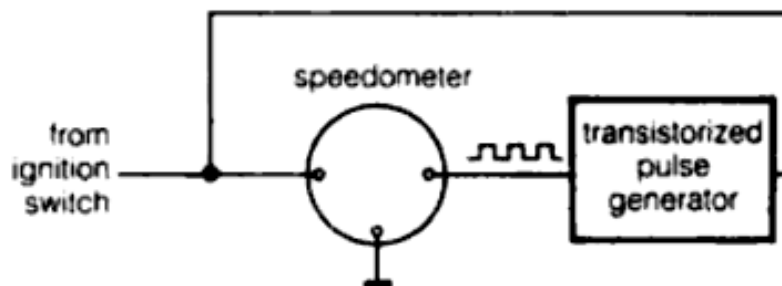
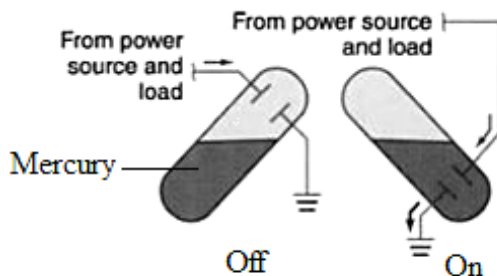
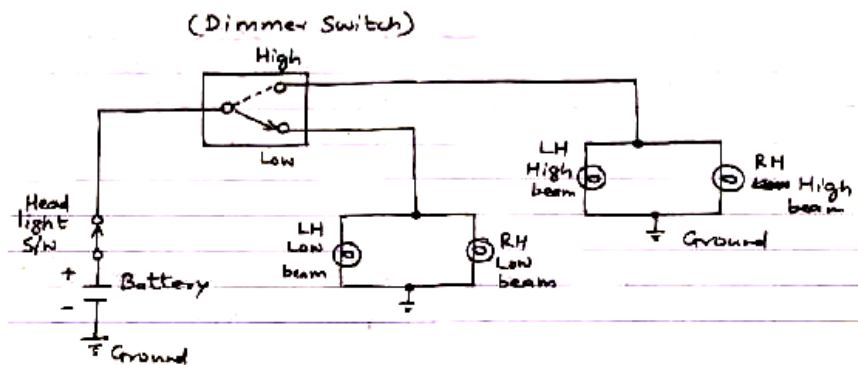
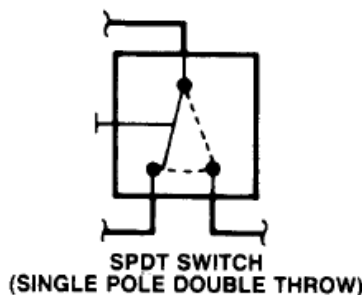


Fig. Transistorized pulse generator-type speedometer

	ii)	State two precautions to be taken while jump starting and describe the procedure with schematic diagram.	6
		<p>Answer: (<i>Precautions 2 mark, Procedure 2 marks & sketch 2 marks</i>)</p> <p>Precautions: (any two – ½ mark each)</p> <ol style="list-style-type: none"> 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. 4. Turn off the ignition switch and all accessories on both vehicles. <p>Jump starting procedure of a battery: Jump starting requires proper battery connecting procedures to prevent sparks. Jump start a vehicle using following procedure:</p> <ol style="list-style-type: none"> 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. 9. Run the host vehicle at 2000 rpm to allow charging system to recharge the battery. <p>Connection Steps: 1-2-3-4 Disconnection Steps: 4-3-2-1</p> <p>Using this method ensures that any possible sparks occur away from the battery.</p> <p>Note: The battery jumper leads should be high quality and have large wire gauge (such as 4 gauge) to safely carry the current necessary to jump start a vehicle.</p> <div data-bbox="375 1415 1268 1688" data-label="Diagram"> </div> <p style="text-align: center;">Note: Reverse sequence after vehicle starts</p> <p style="text-align: center;">Fig. Jump Starting Circuit</p>	<p style="text-align: center;">1</p> <p style="text-align: center;">3</p> <p style="text-align: center;">2</p>

2	Attempt any FOUR of the following:	16
a)	Explain mercury switch and SPDT switch working with help of schematic diagram.	4
	<p>Answer: (Sketch - 1 mark, Operation- 1 mark each)</p> <p>Operation of 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 data-bbox="521 581 1015 854" data-label="Diagram">  </div> <p style="text-align: center;">Figure: A Mercury Switch</p> <p>SPDT Switch (Single Pole Double Throw)</p> <p>A Headlamp dimmer switch is a good example as shown in Fig. of a Single-Pole Double-Throw switch. The switch sends current to either the high-beams or low-beams of the headlight circuit.</p> <div data-bbox="386 1163 1239 1524" data-label="Diagram">  </div> <p style="text-align: center;">OR</p> <div data-bbox="639 1644 998 1936" data-label="Diagram">  </div>	2

b)	Draw neat labeled sketch of relay and explain its working.	4
	<p>Answer: (Sketch 2 Marks & Description 2 marks)</p> <p>Purpose of relay is to control a larger current carrying circuit with the use of small current carrying circuit. A Relay is an electric switch that allows a small amount of current to control a high-current circuit. When the control circuit switch is open, no current flows to the coil of the relay, so the windings are de-energized.</p> <p>The most common type of circuit control is to use a relay. Most circuits have battery voltage present to the lower contact plate of the horn switch. When the switch is depressed, the contacts close and complete the circuit to ground. Only the low current is required to operate the relay coil, so the horn switch does not have to carry the heavy current requirements of the horns.</p> <p>When the horn switch is closed, it energizes the relay core. The core attracts the relay armature, which closes the contacts and completes the horn circuit. Current flow from the battery to the grounded horns.</p> <div data-bbox="522 724 1131 1129" style="text-align: center;"> </div>	02
c)	Draw schematic diagram of blower motor and describe its working.	4
	<p>Answer: (Working 2 marks, Diagram 2 Marks)</p> <ul style="list-style-type: none"> • The blower motor is used to move air inside the vehicle for air conditioning, heating, defrost and ventilation. • The motor is usually a permanent magnet, single speed motor and is located in the heater housing assembly. • A blower motor switch mounted on the dash controls the fan speed. The switch position directs current flow to a resistor block that is wired in series between the switch and the motor. • Fig shows a typical blower motor circuit with four speeds. The three lowest fan speeds (low, medium and medium high) use the blower resistors to drop voltage to the motor and reduce to the motor. • On high speed position, the resistors are bypassed. The 'HI' position on the fan switch energizes a relay. This relay supplies the current for the blower on high speed through a fusible link. 	2

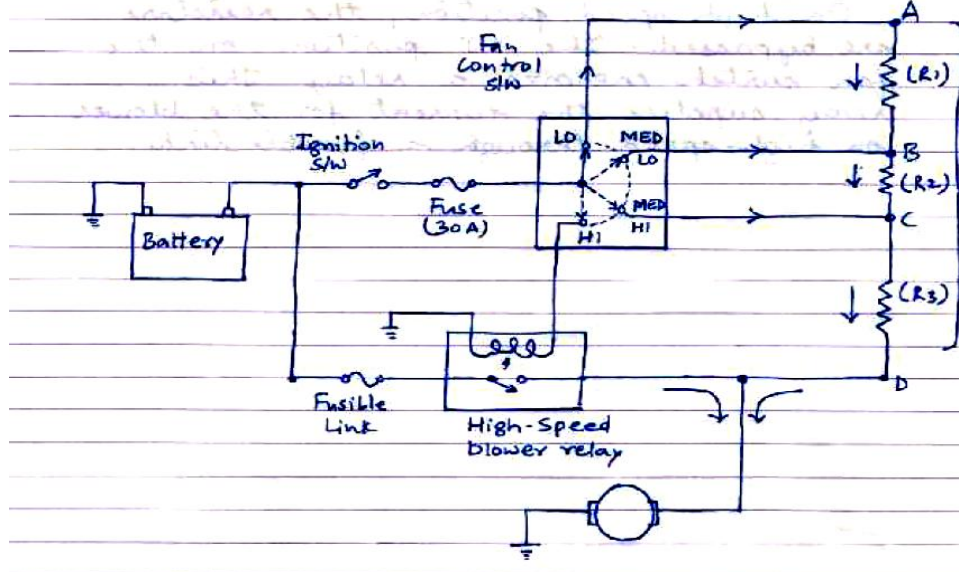


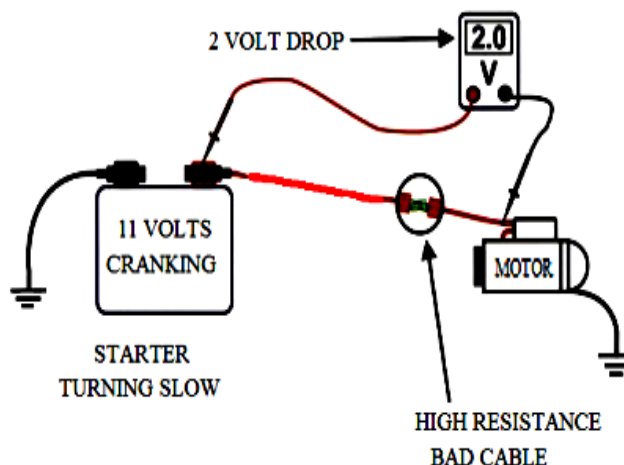
Fig. Circuit Diagram of Blower

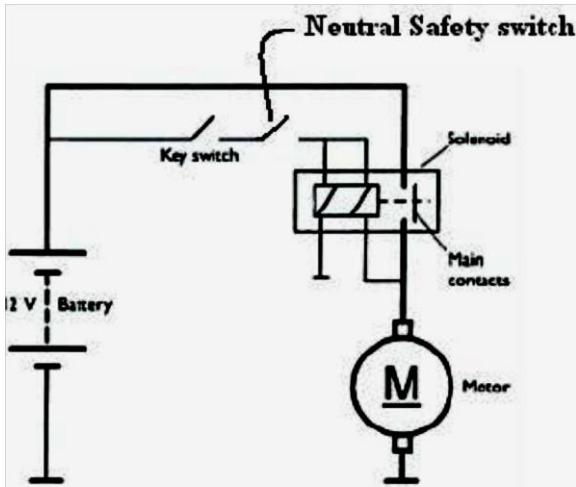
d) Describe a voltage drop test with help of schematic diagram.

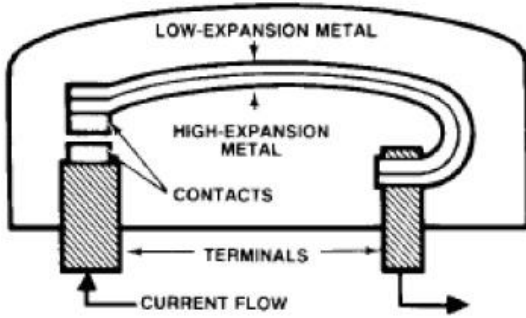
Answer: (Procedure – 4 Marks & give credit to sketch)

- The schematic diagram shows the Insulated side Voltage drop in the Starting system. The test is performed while the circuit is actually operating. Current must be flowing through the circuit to measure the voltage drop.
- When performing a voltage drop test on the positive side of a circuit, connect the positive lead of voltmeter to the source of highest voltage- the battery's positive terminal.
- Connect the voltmeter negative lead to the point across which voltage is to be noted, i.e. the Starter motor solenoid terminal.
- Select lower voltmeter range to get accurate reading. While performing the test, ignition system is disabled.
- Ground side voltage drop test is also equally important.

Schematic diagram showing Voltage Drop Test



e)	Draw a circuit diagram of starting system and describe its working in brief.	4
	<p>Answer: (<i>Working 2 mark, circuit diagram 2 marks.</i>)</p> <p>Working:</p> <p>The Electric Starter Motor converts electrical current into rotary motion. In doing so converts electrical energy into mechanical energy. The interaction of two magnetic fields produces this rotational force. The field coils (either electromagnetic or permanent) located in the housing produce magnetic flux lines. Within the stationary field coils is the armature, a loop of wire (conductor) with one end connected to B+, the other to B-. When current is applied to the armature flux lines circle the loop in one direction on one side and in the opposite direction on the other side. The interaction of the flux lines on the armature and the flux lines from the field coil cause the armature to rotate. The armature will only rotate to the point where the magnetic force is equal on both sides. (Armature 90^0 to magnetic flux lines of field) For the armature to continue to rotate, the polarity or direction of current flow must be reversed. Through the brushes and the commutator, the current flow is reversed as the magnetic forces become equal, causing the armature to continue to rotate. This constant reversal of current flow in the armature provides continual rotation.</p> <div style="text-align: center;">  <p>Fig. Basic starter circuit</p> </div>	<p style="text-align: center;">2</p> <p style="text-align: center;">2</p>
f)	Describe initial excitation and self-excitation of alternator.	4
	<p>Answer: (<i>Description 2 marks each for initial excitation and self-excitation</i>)</p> <p>Answer :</p> <p>i) Initial Excitation:</p> <p>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.</p> <p>ii) Self Excitation:</p> <p>Self Excitation is the process where some of the power outputs from the rotor is used to power the field coil. During running the alternator stator provides all the excitation current. Hence the name 'Self Excitation'.</p>	<p style="text-align: center;">2</p> <p style="text-align: center;">2</p>

3		Attempt any <u>FOUR</u> of the following:	16
	a)	Describe working of automatic resetting type circuit breaker with neat sketch.	4
		<p>Answer: (Sketch – 2 Marks & working -2 Marks)</p> <p>The automatic resetting type circuit breaker is designed to open when circuit current exceeds a given level. It uses a bimetallic strip that opens if current draw is excessive.</p> <p>Automatic Resetting type of Circuit breakers- Automatic resetting type of circuit breaker uses a thermally sensitive element (bimetal strip) that snaps open the contact points when overheated by excessive amperage. But after a short cooling-down period, the circuit breaker resets itself. The bimetal strip has two metals of different coefficient of expansion. There is nothing to replace. Circuit breakers range from 5 to 50 amperes</p> <p style="text-align: center;">Circuit breaker</p>  <p style="text-align: center;">AUTOMATICALLY RESET TYPE</p>	<p style="text-align: center;">2</p> <p style="text-align: center;">2</p>
	b)	State the need of ignition system. Describe working of ballast resistor	4
		<p>Answer: Needs of ignition system:(any two- 1mark each)</p> <ol style="list-style-type: none"> 1. It should provide sufficiently strong spark between the electrodes of the plugs at correct timing. 2. It should function efficiently over the entire range of engine speed. 3. It should be light, effective and reliable in service. 4. It should be compact and easy to maintain. 5. Sufficiently large voltage across the spark plug electrodes to affect the spark discharge even in lean mixtures. 6. Supply energy required to ignite the combustible mixture across air gap. 7. It should be capable to advance or retard ignition timing as per engine load and speed. 8. Effective to trigger the primary circuit at appropriate time with respect to crankshaft position <p>Ballast resistor:</p> <p>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.</p> <p>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 circuit from</p>	<p style="text-align: center;">2</p> <p style="text-align: center;">2</p>

over current faults. Thus, maintaining the stability of the circuit.
These devices are mostly connected in parallel with the load of the circuit.

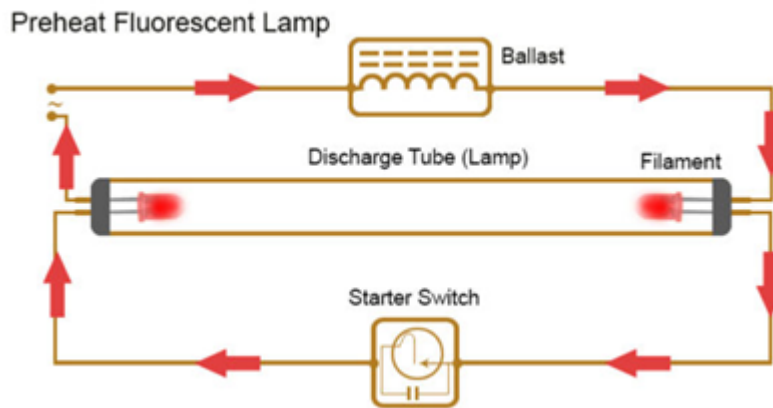


Figure: ballast resistor

- c) **Describe the function of:**
i) detonation sensor.
ii) camshaft position sensor as regards ignition system.

4

Answer: (2 mark for each sensor function)

i) Detonation sensor:

1. 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 voltage signal to the Engine control unit. The ECU uses the detonation sensor signal to control timing.
2. 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.

2

ii) Camshaft position sensor as regards ignition system:

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 cylinder's compression stroke. The cam sensor (in conjunction with the crank sensor) also allows the PCM to determine which cylinder is on its compression stroke.

2

- d) **List common antitheft systems used in vehicle. Describe one in brief.**

4

Answer: Common antitheft systems used in vehicle : (list -2 marks, describe any one -2 marks)

- a) Locks and keys
- b) Passkey Systems
- c) Keyless Entry Systems
- d) Alarm systems

2

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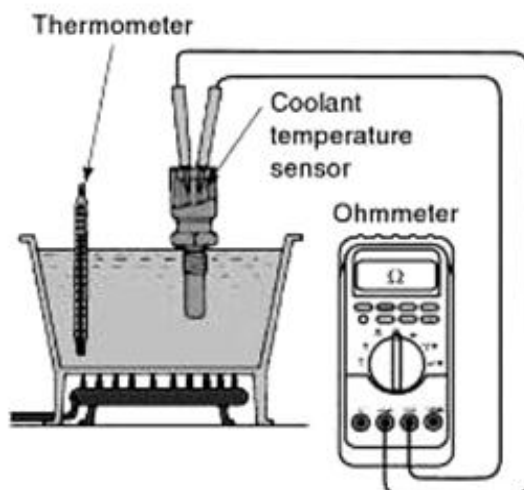


Fig: working of engine coolant sensor

4	a)	Attempt any THREE of the following:	12
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	i)	Describe the operation of automatic door lock system.	4
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Answer: (Operation 2 marks & sketch 2 marks)

Automatic door lock system:-

1. Motors used in power door locks are of permanent magnet type and are operated through a relay by conventional switches. These motors are controlled by a double pole double throw switch that is externally grounded. A clockwise rotation of the motor output shaft extends the shaft to unlock the door.
2. When polarity is reversed, the output shaft rotates anticlockwise retracting the shaft to lock the doors.
3. The purpose of automatic door lock system is to prevent entry to engine, passenger and trunk compartments of the car as well as to prevent a thief from driving the car away. The automatic door lock system is an additional safety and convenience system.
4. The system may use the body computer to control the door lock relays, or a separate controller. The controller (or body computer) takes the place of the door lock switches for automatic operation.

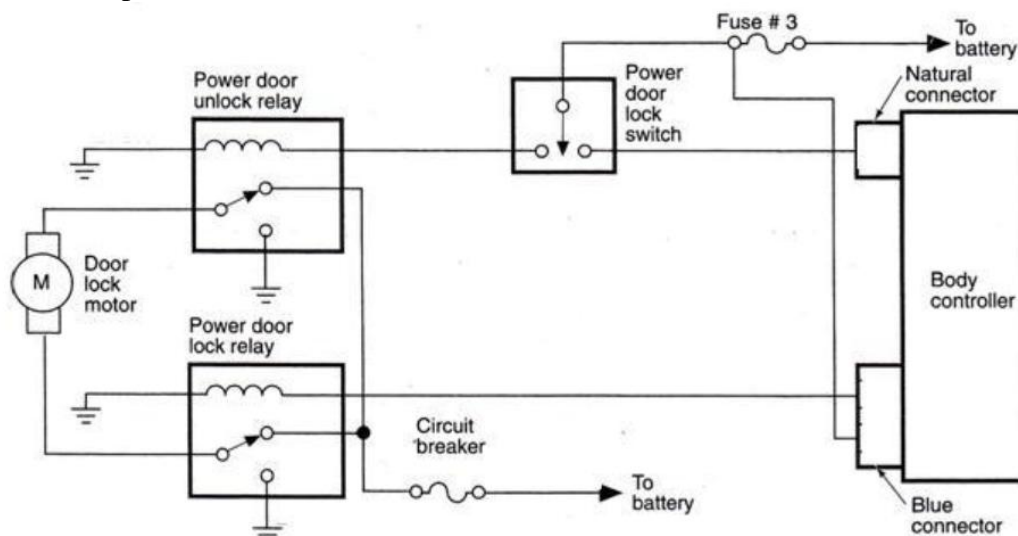


Fig: circuit diagram for automatic door lock system



	ii)	Describe purpose and operation of keyless entry system.	4
		<p>Answer: (Purpose 1 mark & operation 3 marks)</p> <p>Purpose: The keyless entry system allows the driver to unlock the doors or trunk lid from outside the vehicle without using a key.</p> <p>Operation:</p> <ol style="list-style-type: none"> 1. 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 motors 2. 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. 3. 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. 4. The driver's door can be unlocked by entering a five-digit code through the keypad. 5. Remote controlled keyless entry systems are also available. They use a hand held transmitter attached as a key chain. 6. 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
	iii)	<p>State the purpose of OBD II. Define the terms:</p> <ol style="list-style-type: none"> 1) Drive cycle 2) Trip 	4
		<p>Answer: (Purpose –2marks, Define the term -1marks each)</p> <p>Purposes of OBD-II: (any four)</p> <ol style="list-style-type: none"> 1. To enable the computer systems to monitor the ability of systems and components to maintain low emission. 2. The standardized data link connector, that allows for these tools to communicate with the PCM. 3. Identifying faults in the computer-controlled systems and to notify the driver by means of a malfunction indicator light if the emission related fault causes an increase in emission up to 1.5 times the allowable standard. 4. In addition a diagnostic trouble code (DTC) was stored in the computer's memory. 5. For easier diagnosis of a problem by a technician by using added information stored in the PCM. 6. It brings standardization in components and systems used by various automobile manufacturers. e.g. Data link connectors, data circuits, diagnostic tests and diagnostic trouble codes and generic codes. 7. It provides almost complete engine control and also monitors parts of the chassis, body and accessory devices, as well as the diagnostic control network of a vehicle. <p>1) Drive Cycle:</p> <p>A drive cycle may be defined as an engine startup and vehicle operation that allows the PCM to enter closed loop and allows all the monitors to complete their function.</p> <p>OR</p> <p>An OBD- II drive cycle is a method of driving that begins with an engine starts. The engine is then run until the system goes into closed loop. The drive cycle continues to include whatever specific operating conditions are necessary either to initiate and complete a specific monitoring sequence or to verify a symptom or verify a repair.</p> <p>2) Trip:</p>	<p>2</p> <p>1</p>



		<p>A trip is defined as an engine operating drive cycle that contains all of the necessary conditions for a particular test to be performed.</p> <p>OR</p> <p>A trip for a particular diagnostic test is defined as a key on and key off cycle in which all the enabling criteria for a given diagnostic test have been met.</p>	1
	iv)	Describe DTC structure as per SAE J 2012 with an example.	4
		<p>Answer: (Description 2 marks, example 2 marks)</p> <p>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.</p> <div data-bbox="409 772 1230 1247"><p>EXAMPLE: P0137 LOW VOLTAGE BANK 1 SENSOR 2</p><p>The diagram illustrates the structure of the DTC P0137. It shows the code 'P0137' with lines connecting each digit to its meaning: 'P' is Powertrain, '0' is Generic (SAE), '1' is Manufacturer specific, '3' is Specific vehicle system, and '7' is Specific fault designation. A legend on the left lists the first four categories: B - BODY, C - CHASSIS, P - POWERTRAIN, U - NETWORK, and 0 - GENERIC (SAE), 1 - MANUFACTURER SPECIFIC.</p></div>	2
	b)	Attempt any <u>ONE</u> of the following:	6
	i)	Describe the regulator output test with help of a schematic diagram	6
		<p>Answer: Procedure for regulator output test:</p> <p>Measuring the Input Voltage</p> <ol style="list-style-type: none">1. When testing the voltage of a voltage regulator, we first check the voltage from the input pin to ground. This is to make sure that voltage is, in fact, being supplied to the regulator. If the regulator isn't receiving sufficient voltage, of course it will not be able to output its rated regulated voltage. This is why we do this test.2. To test the voltage going into the voltage regulator, we take a multimeter and place it in the DC voltage setting.3. We take the probes of the multimeter and place the positive probe (normally the red probe) on the input pin of the voltage regulator and the negative probe (normally black probe) on the ground pin.4. The voltage that we should read should be higher than the voltage the regulator is rated to output. This is normally 1-2 volts higher. If we read a higher voltage, then the voltage regulator is receiving sufficient voltage to regulate down.	2

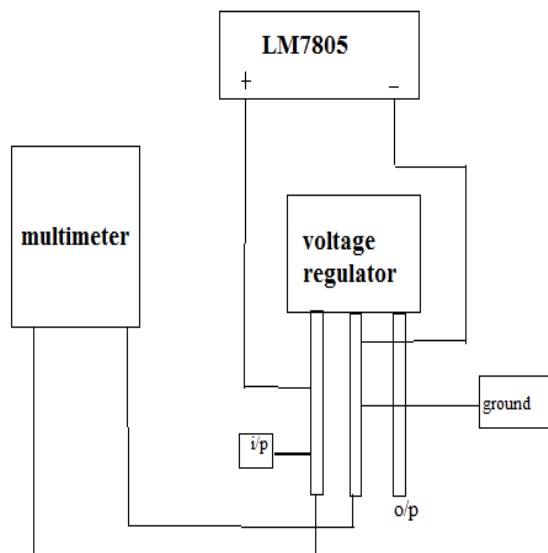


Fig:Input voltage

Measuring the Output Voltage

Now that this step is complete, we now read the output voltage.

1. If the regulator is rated to output 5 volts, then we should read a voltage very near 5 volts coming out from its output. The LM7805 is a voltage regulator is rated to output 5 volts, so we should read this output.
2. To measure the output voltage, we place the same multimeter set in the DC voltage setting and now place the positive probe of the multimeter on the output pin of the regulator and the negative probe on the ground pin of the regulator.
3. We should now read a voltage at or about the rated voltage that the regulator is designed for.
4. If the multimeter does read a voltage near its rated output voltage, the voltage regulator is functional and is good.
5. If we do not, then the voltage regulator is defective, as it does not do the job it was designed for, which is output a regulated voltage.

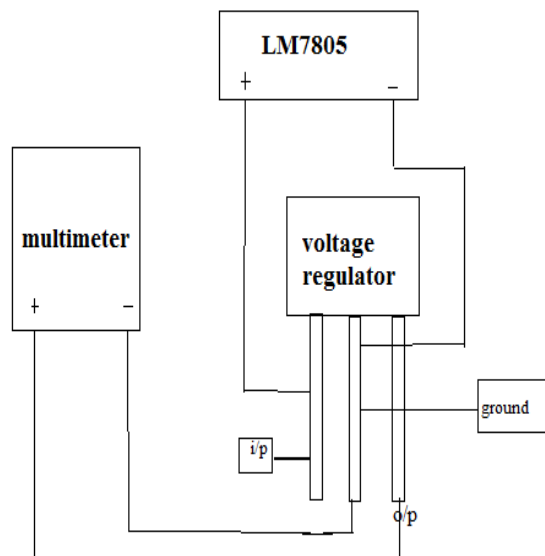
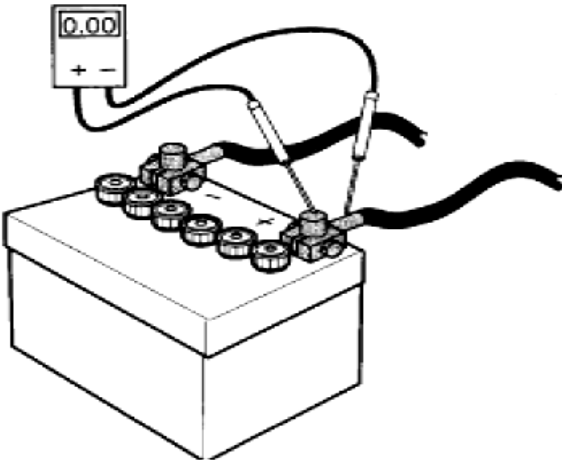


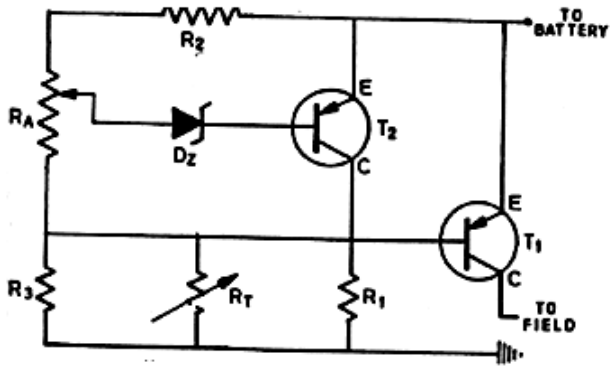
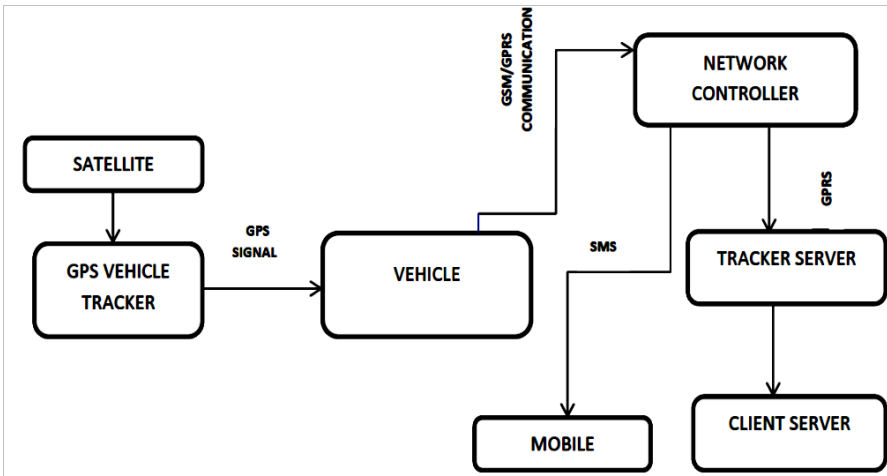
Fig:Output voltage

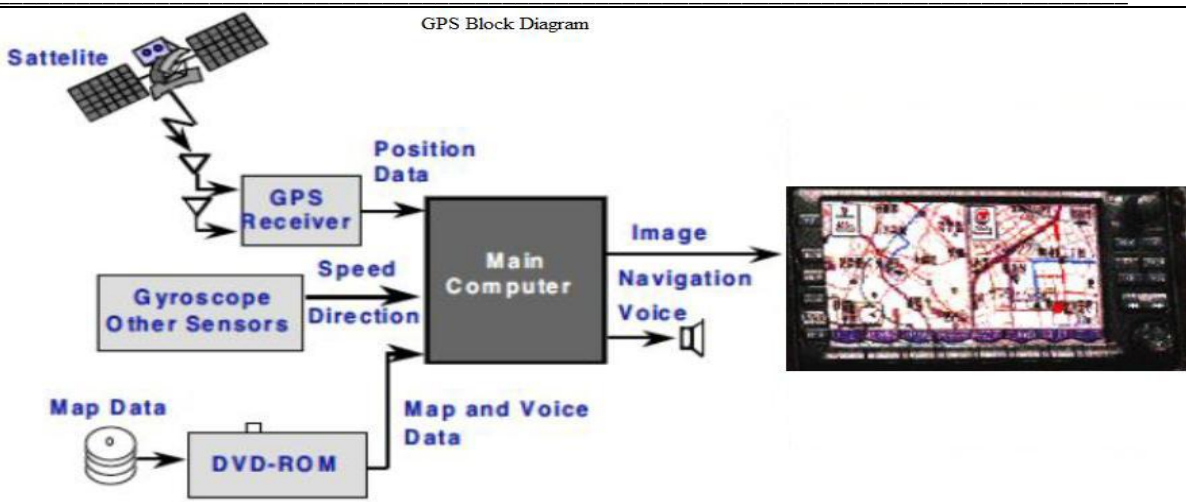
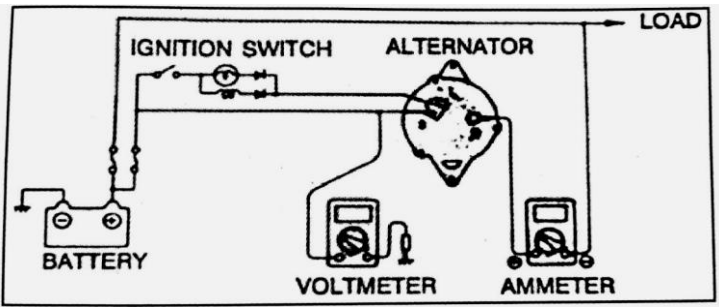


			3
	ii)	Identify and describe operation of ignition system that provides optimum ignition timing while the engine detonates. Draw a schematic diagram for the same.	6
		<p>Answer: (Operation 4 marks & sketch 2 marks)</p> <p>Operation:</p> <p>The computer has a timing map with spark advance values for all combinations of engine speed and engine load. The computer will send a signal to the ignition coil at the indicated time in the timing map in order to fire the spark plug. Overall timing changes are still possible, depending on the engine design. This allows the timing to be advanced or retarded based on various engine applications. Hence a Computer controlled / Distributor less ignition system provides optimum ignition timing while the engine detonates.</p> <p>The Distributor less ignition system consists of three main components:</p> <ol style="list-style-type: none">An ECUCrankshaft speed and crankshaft position sensor.Ignition coils<ol style="list-style-type: none">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.	4

			2
5		Attempt any FOUR of the following :	16
	a)	Describe purpose and operation of automatic headlight dimming.	4
		<p>Answer: (<i>Purpose 2 marks, Operation 2 marks & credit should be given to sketch</i>)</p> <p>Purpose: Automatic Headlight Dimming automatically switches the headlights from high beams to low beams under two different conditions:</p> <ul style="list-style-type: none"> • When light from oncoming vehicles strikes the photocell-amplifier, or • Light from the taillights of a vehicle being passed strikes the photocell-amplifier. <p>Operation: Modern automatic headlight dimming systems use solid-state circuitry and electromagnetic relays to control the beam switching.</p> <p>Most systems consist of the following major components:</p> <ol style="list-style-type: none"> 1. Light sensitive photocell and amplifier unit. 2. High-low beam relay 3. Sensitivity control 4. Dimmer switch 5. Flash-to-pass relay 6. Wiring harness <ul style="list-style-type: none"> • The photocell is a variable resister that uses light to change resistance. The photocell-amplifier is usually mounted behind the front grill. • The sensitivity control is a potentiometer which sets the intensity level at which the photocell amplifier will energize. • The sensitivity can be adjusted to the surrounding ambient light conditions by the driver with the help of a control knob. • An increase in the sensitivity level will make the headlights switch to a low beam sooner (Approaching vehicle is far away). <p>A decrease in the sensitivity level will switch the headlights to low beams when the</p>	2

	b)	Describe the procedure of battery terminal test with help of schematic diagram.	4
		<p>Answer: (Procedure 2 marks & Sketch 2 marks) The Battery terminal test checks for the poor electrical connections between the battery cables and terminals. This simple test will establish whether or not the terminal connection is good. It is good practice to perform this test anytime the battery cable is disconnected and reconnected to the terminals. By performing this test, comebacks, due to loose or faulty connections, can be reduced. Connect the negative voltmeter test lead to the cable clamp and connect the positive meter lead to the battery terminal as shown in figure. Disable the ignition system to prevent the vehicle from starting. This may be done by removing the ignition coil secondary wire from the distributor cap and putting it to groundCrank the engine and observe the voltmeter reading. If the voltmeter shows over 0.3 volts, there is a high resistance at the cable connection. Remove the battery cable using the terminal puller. Clean the cable ends and battery terminals.</p> 	2 2
	c)	Explain the procedure of sound test for electronic fuel Injector.	4
		<p>Answer: (For procedure 4 marks) Procedure for sound test for testing electronic fuel injector: 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> <ol style="list-style-type: none"> 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 	4

		<p>PCM may be defective.</p> <p>9) When the injector clicking noise is erratic, the injector plunger may be sticking.</p> <p>10) If there is no injector clicking noise, proceed with the injector resistance test and light to 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>	
	d)	Draw a circuit diagram of electronic regulation of alternator and label it.	4
		<p>Answer : (Sketch- 4 marks) Electronic voltage regulator-</p>  <p>In Above Figure: T_1 & T_2 = Transistor; D_z = Zener diode & Resistors = R_1, R_2 & R_3, R_A & R_T</p>	4
	e)	Draw block diagram of GPS and label it.	4
		<p>Answer: (Diagram 4 marks) Block diagram of GPS</p>  <p style="text-align: center;">OR</p>	4

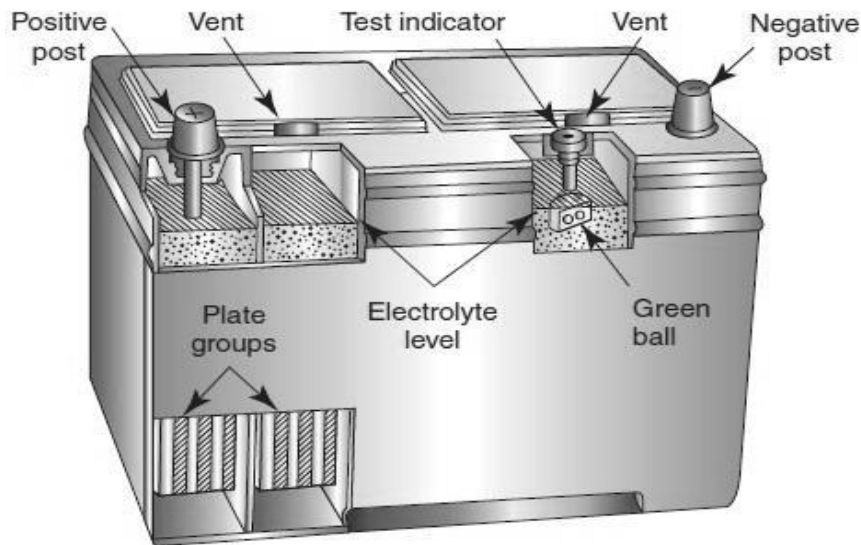
		<p style="text-align: center;">GPS Block Diagram</p> 	
	f)	Describe the procedure for testing of alternator with neat sketch.	4
		<p>Answer : (<i>Procedure 2 Marks , Sketch 2 marks, Credit should be given for other test also</i>)</p> <p>Alternator performance is checked by doing these testing i) Output Test ii) Regulated voltage output Test iii) Charging circuit resistance test iv) Field current draw test</p> <p>i) Testing procedure of Output Test of an Alternator.</p> <ol style="list-style-type: none"> 1. To check the output with load tester, connect tester leads as described by the manufacturer. 2. Use either inductive Amp pickup type or non conductive type tester. 3. With the load tester control set as prescribed by the manufacture's turn ignition switch to the run and note ammeter reading. 4. Start the engine and adjust the idle speed to the specification. (appro. 200 rpm) 5. Adjust the load control on the tester until ammeter reads specified current output. 6. Note down the ammeter reading. 7. Rotate the control knob to the off position. Evaluate the reading. 	2
6		Attempt any <u>FOUR</u> of the following:	16
	a)	State four parameters of battery specification. List four components of a battery.	4
		<p>Answer: (<i>Any four parameter 2 marks , any four components 2 marks</i>)</p> <p>➤ Parameter of battery specification</p> <ol style="list-style-type: none"> 1. Voltage (V) 2. Capacity ratings of the battery. (Ah) 3. Electrode material (Positive plate and negative plate) 4. Electrolyte 	2



		<ol style="list-style-type: none">5. Cycle Lifetime6. Depth Of Discharge7. Temperature Operating Ranges <p>➤ Batteries are made of five basic components:</p> <ol style="list-style-type: none">1. Positive and negative internal plates2. Plate separators3. Electrolyte4. A resilient plastic container5. Lead terminals	2
	b)	Describe the procedure for quick test of starter motor.	4
		<p>Answer: (Equivalent procedure of testing 04 Marks credit should be given to sketch)</p> <p>Quick Test Procedure of Starter motor :</p> <p>If the starter does not turn the engine at all and the engine is in good mechanical condition to locate the problem area.</p> <p>To perform this test:</p> <p>Make sure the transmission is in neutral and set the parking brake. Turn on the headlights. Next turn ignition switch to the start position while observing the headlights.</p> <p>Three things that can happen to the headlight during this test.</p> <ol style="list-style-type: none">i) They will go outii) They will dimiii) They will remain at the same brightness. <ul style="list-style-type: none">• If the lights go out completely, the most likely cause is a poor connection at one of the battery terminals. Check the battery terminals, cables for tightness and clean connections• If the headlights dim, the battery may be discharged. Check the battery condition. If the battery is good then these may be a mechanical damage in the engine. If the engine is good then the starter motor may have internal damage.• If the lights stay bright and the starter does not operate, listen for a deep clicking noise, there is an open in the circuit. The fault is in either the solenoid or the control circuit	4
	c)	Describe construction and working of maintenance free battery.	4
		<p>Answer: (construction 2 marks ,working 2 marks, credit should be given to sketch)</p> <p>Construction & working of maintenance free (dry) batteries:</p> <p>Construction: In a maintenance-free battery there is no provision for the addition of water to the cells. The battery is sealed. It contains cell plates made of a slightly different compound than what is in a conventional battery. The plate grids contain calcium, cadmium, or strontium to reduce gassing and self-discharge. Gassing is the conversion of the battery water into hydrogen and oxygen gas. This process is also called electrolysis. The antimony used in conventional batteries is not used in maintenance-free batteries because it increases the breakdown of water into hydrogen and oxygen and because of its low resistance to overcharging. The use of calcium, cadmium, or strontium reduces the amount of vaporization that takes place during normal operation. The grid may be constructed with additional supports to increase its strength and to provide a shorter path, with less resistance, for the current to flow to the top tab.</p>	2

Working: The battery is sealed except for a small vent so the electrolyte and vapours cannot escape. An expansion or condensation chamber allows the water to condense and drain back into the cells. Because the water cannot escape from the battery, it is not necessary to add water to the battery on a periodic basis. Containing the vapours also reduces the possibility of corrosion and discharge through the surface because of electrolyte on the surface of the battery. Vapours leave the case only when the pressure inside the battery is greater than atmospheric pressure.

Some maintenance-free batteries have a built-in hydrometer to indicate the state of charge. A hydrometer is a test instrument that is used to check the specific gravity of the electrolyte to determine the battery's state of charge. If the dot that is at the bottom of the hydrometer is green, then the battery is fully charged (more than 65% charged). If the dot is black, the battery state of charge is low. If the battery does not have a built-in hydrometer, it cannot be tested with a hydrometer because the battery is sealed.



2

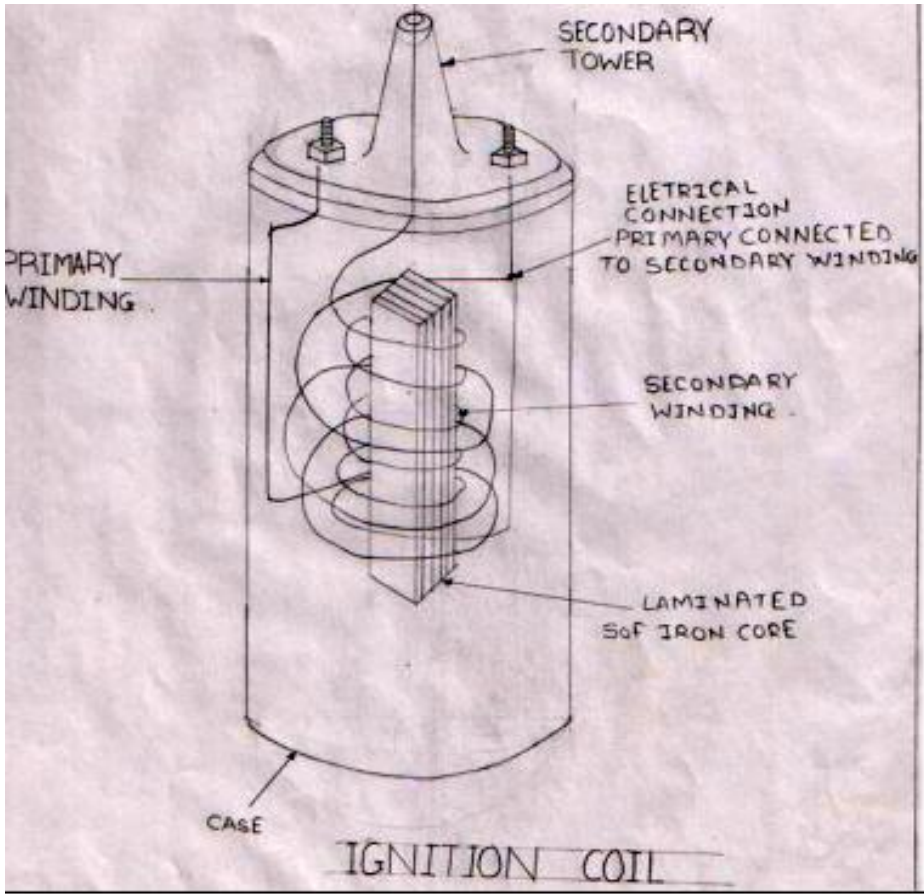
d) Differentiate between conventional and electronic ignition system (four points).

4

Answer: (Any four points 1 mark each)

Sr.no.	Conventional ignition systems	Electronic ignition systems
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.

4

e)	Describe the working of ignition coil with help of a schematic diagram.	4	
	<p>Answer: (<i>Ignition coil operation 2 marks with equivalent sketch 2 marks.</i>)</p> <p>Operation of Can type of Ignition Coil: When the ignition switch is turned on, the current flows from the battery to the primary winding. When the contact breaker points open, the primary circuit breaks and the magnetic field collapses. Rapid collapsing of magnetic field induces high voltage in secondary winding. This high voltage current flowing through the secondary winding goes to the distributor. Distributor sends this current to various spark plugs in firing order.</p>  <p style="text-align: center;">Fig. Ignition Coil</p>	2	2

