SNS College of Technology, Coimbatore-35.
(Autonomous)
Internal Assessment –I
ANSWER KEY

A

19MCE402 – AUTOTRONICS
PART – A

1		List various emission of diesel engine • Unburned hydrocarbons (HC) • Carbon monoxide (CO) • Nitrogen oxides (NOx) • Particulate matter (PM)
2		Define the principle of alternator. • An alternator or synchronous generator works on the principle of electromagnetic induction. When the flux linking a conductor changes an EMF is induced in the conductor. When the armature winding of alternator subjected to the rotating magnetic field the voltage will be generated in the armature winding.
3		Explain the principle of charging system in automobiles. • Charging systems deliver electrical energy to power the vehicle while it is running and sustains the battery charge. The vehicle's charging system consists of three parts: the battery, the alternator, and the voltage regulator. The battery supplies the necessary electrical power to start the engine.
4		Infer the advantages of petrol injection. • Accurate air-fuel mixture and atomization. • Cleaner and more efficient combustion. • Sharper and quicker throttle response. • Better fuel efficiency or mileage. • Compared to carburetors, FI systems are maintenance-free and less prone to damages. • Can easily be tuned through ECU mapping.
5		Recall the function of carburetor • The primary function of a carburetor is to mix air and fuel to make a combustion mixture. A carburetor is responsible for engine speed. A carburetor controls the proportion of air and fuel in different engine situations. It keeps a certain amount of fluid always floating in chambers.
		PART – B
6	(a)	Explain briefly about the adaptive lighting system and charging system. **Adaptive front lighting systems (AFS)** • **Adaptive front lighting systems (AFS)** attempt to dynamically adjust the headlights of the vehicle so that the driver has optimum nighttime vision without compromising the safety of other road users. The AFS uses stepper motors to control the headlight angle when the vehicle steers or the road is not even. Besides, the adaptive system tries to avoid a direct glare to oncoming vehicles. It uses headlights that consist of an array of LEDs.

- Depending on the position of the oncoming car, some of these LEDs are automatically dimmed. In this way, while around the oncoming car is illuminated, the driver side is dimmed. The AFS uses image sensors to detect the position of the oncoming vehicle. Figure 1 shows how the AFS adjusts the headlights to dim the driver side of the oncoming car.

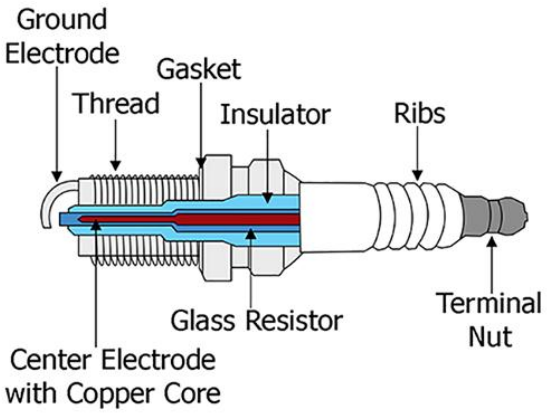
- The AFS consists of several different building blocks, such as LED drivers, LED matrix managers, stepper motors, imaging sensors, MCUs, etc. To efficiently control the light intensity and direction, these blocks should be fast, efficient and accurate.
- The functionality of the AFS depends on producing complex light patterns at a fast rate. LEDs exhibit an illumination rise time about two times faster than that of incandescent sources. Besides, LEDs are more power-efficient and offer a superior clarity of white light. Due to these advantages, they are widely utilized in the automotive industry. To produce the light patterns required by the AFS, we can incorporate an array of LEDs in the headlight and selectively turn some of them on.

Charging System

- The charging system provides the electricity that powers the starter motor and runs electrical accessories, such as lights, audio system, air conditioner, window defroster and other components. Its main parts are the battery, alternator and voltage regulator. If any parts of the charging system are worn, a vehicle will be hard to start or may not start at all.
- The battery stores the power that initially starts the engine, and the alternator generates the electricity that's stored in the battery. The voltage regulator controls the amount of electricity generated to prevent overcharging and damaging the battery. Because the alternator on most engines is driven by an accessory belt, a loose or worn belt can result in too little battery charging.

	(b)	Extend in detail about the principle and operation of starter motor. • A starter motor is an essential component in an internal combustion engine-powered vehicle. Its primary function is to crank the engine and initiate the combustion process to get the engine running. Here's a basic explanation of the principle and operation of a starter motor: **Principle** • The starter motor operates on the principle of electromagnetic induction. When electric current flows through a coil of wire in the presence of a magnetic field, it generates a mechanical force, which causes the motor to turn. This turning motion is used to engage with the engine's flywheel or flexplate, which in turn rotates the engine's crankshaft, leading to the engine's compression and ignition cycle. **Operation:** 1. **Ignition Key:** When you turn the ignition key to start your vehicle, it sends an electrical signal to the starter motor solenoid, which is essentially an electromagnetic switch. 2. **Solenoid Activation:** The solenoid receives the electrical signal and becomes magnetized. This causes the solenoid plunger to move, closing a set of heavy-duty contacts within the solenoid. 3. **Current Flow:** Once the contacts are closed, a high amount of electrical current flows from the vehicle's battery through the solenoid and into the starter motor itself. 4. **Motor Rotation:** The current flows through a heavy-duty coil of wire (the armature) inside the starter motor. This generates a magnetic field, and due to the interaction between the magnetic field and the current, a strong rotational force (torque) is produced, causing the starter motor to turn. 5. **Engagement:** As the starter motor turns, it has a small gear called a pinion gear attached to its shaft. This pinion gear meshes with the engine's flywheel or flexplate, which is attached to the engine's crankshaft. 6. **Engine Cranking:** The engagement of the pinion gear with the flywheel/flexplate causes the engine's crankshaft to start turning. This initiates the engine's compression and ignition cycle, ultimately starting the engine. 7. **Solenoid Disengagement:** Once the engine has started, the ignition key is released from the start position. This deactivates the solenoid, which in turn opens the heavy-duty contacts, cutting off the electrical current to the starter motor. 8. **Return to Rest:** The starter motor, no longer receiving electrical current and with the disengagement of the pinion gear from the flywheel/flexplate, comes to a stop. It returns to its rest position, ready for the next start cycle. The starter motor plays a critical role in the initial startup of an internal combustion engine. Once the engine is running, it relies on the power generated by the running engine (through the alternator) to recharge the battery and supply electrical power to other vehicle systems.
7	(a)	Examine the details of spark plugs with suitable diagram. Spark Plug is a device that is used to ignite the air-fuel mixture in the engine cylinder of an

internal combustion engine. They are generally used in petrol engines or engine that runs on Natural gas. For the combustion of the fuel, we need a spark to initiate the combustion process in a gasoline engine (Petrol engine). A good spark plug produces sparks at the correct timing making the combustion of air-fuel mixture efficient and this improves the working of our vehicle.



1. Insulator:

- The insulator is typically made of ceramic material that can withstand extreme heat and electrical insulation.
- It acts as a barrier between the high-voltage center electrode and the grounded metal body of the spark plug.

2. Center Electrode:

- The center electrode extends into the combustion chamber and carries the electrical current from the ignition system.
- It is usually made of high-conductivity materials like copper, platinum, or iridium.
- The center electrode's tip forms a small gap with the ground electrode, where the spark occurs.

3. Ground Electrode:

- The ground electrode is connected to the metal body of the spark plug.
- It is positioned opposite to the center electrode and forms a spark gap with it.
- Like the center electrode, it can be made from various materials, including copper, platinum, or iridium.

4. Metal Shell:

- The metal shell of the spark plug provides structural integrity and a pathway for heat dissipation.
- It is threaded at the base to allow installation into the engine's cylinder head.

5. Gasket:

- The gasket, typically made of a compressible material like rubber or metal, ensures a tight seal between the spark plug and the engine's cylinder head.

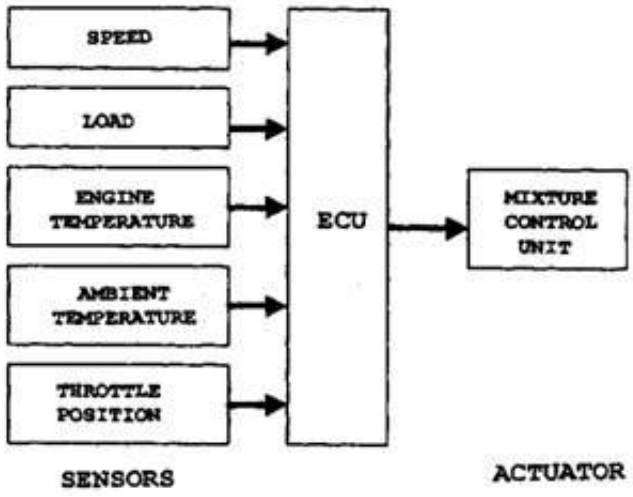
- This prevents combustion gases from escaping and maintains engine compression.

6. Insulator Nose:

- The insulator nose is the part of the ceramic insulator that extends into the combustion chamber.
- It helps maintain the proper spark plug temperature by being exposed to the hot gases inside the cylinder.

(b) With a neat sketch, illustrate the basic electronic control of carburetion and areas of control.

- Basic electronic control of carburetion, also known as electronic carburetor control, is a system that uses electronic sensors and controllers to manage the air-fuel mixture delivered to an internal combustion engine. This system has largely been replaced by electronic fuel injection (EFI) systems in modern vehicles, but it's still relevant in some older or simpler engines.
- Every year more and more stringent anti-pollution regulations are being introduced. Also there is a constant need for improvements to obtain better fuel economy from an engine. To meet these two requirements, it is necessary for a fuel system to sense the engines operating conditions accurately and then to use these information to provide a near-ideal mixture. Such a system must be very sensitive and quick in operation, and so electronic control systems have come into prominence.
- Constant-depression carburetor, however, many aspects considered also apply to other types of carburetor. This system uses four sensing devices to measure engine parameters and surrounding conditions that affect the operation of the carburetor. Electrical signals from these sensors are passed to a computer called an electronic control unit (ECU). The ECU is programmed during manufacture to execute in response to a given set of conditions, which enables the carburetor to operate efficiently over a wide speed and load range.



8.	(a)	Apply the different emission standards and equivalent Bharat standards followed in Audi and renowned automobile industry. • September 2021, Bharat Stage (BS) standards are emissions standards and regulations set by the Indian government to regulate the pollutants emitted by vehicles, primarily focusing on the reduction of harmful gases such as carbon monoxide (CO), nitrogen oxides (NOx), particulate matter (PM), and hydrocarbons (HC) from internal combustion engines. Audi, like other automotive manufacturers operating in India, has to adhere to these emission standards when producing and selling vehicles in the country. The specific standards and their application can vary based on the type of vehicle and its engine technology. How Bharat Stage standards apply to Audi and other automakers are follows, 1. **Compliance:** Audi must manufacture vehicles that comply with the current Bharat Stage emissions standards. The Indian government periodically updates these standards to reduce emissions and improve air quality. Audi, like other automakers, needs to ensure that its vehicles meet or exceed these standards. 2. **Emission Control Technologies:** To meet Bharat Stage standards, Audi uses advanced emission control technologies in its vehicles. This can include technologies like selective catalytic reduction (SCR), diesel particulate filters (DPF), exhaust gas recirculation (EGR), and more, depending on the engine type (diesel or gasoline) and the specific BS stage requirements. 3. **Testing and Certification:** Before a vehicle can be sold in India, it must undergo emissions testing to verify compliance with the applicable BS standards. Audi, like other manufacturers, is responsible for ensuring that its vehicles pass these tests and receive the necessary certifications. 4. **Timeline for Adoption:** Audi, along with other automakers, must adhere to the timeline set by the Indian government for the adoption of new BS standards. The timeline specifies when each BS stage will be implemented, gradually reducing permissible emissions limits. 5. **Product Lineup:** Audi adjusts its product lineup to ensure that it offers vehicles compliant with the current BS standards. This may involve updating or discontinuing models that do not meet the new emission requirements. 6. **Technological Advancements:** To stay compliant with evolving BS standards, Audi invests in research and development to develop cleaner and more fuel-efficient technologies. This can include improving engine efficiency, implementing hybrid or electric powertrains, and using lightweight materials to reduce emissions. 7. **Environmental Responsibility:** Audi, like many automakers, often promotes its commitment to environmental responsibility and sustainability. This includes showcasing their efforts to meet or exceed emissions standards and reduce the environmental impact of their vehicles. The specifics of Audi's compliance with Bharat Stage standards may vary depending on the model, engine type, and the specific BS stage that was in effect when the vehicle was manufactured.
	(b)	Construct an ignition system incorporated in E-vehicle with proper diagram.

- In an electric vehicle (EV), the traditional ignition system found in internal combustion engine (ICE) vehicles is replaced by an entirely different system because EVs do not have internal combustion engines. Instead of spark plugs and fuel, electric vehicles use batteries and electric motors to generate power and drive the vehicle. The key components and operation of the ignition system in an electric vehicle:

1. Electric Motor:

- The electric motor is the primary component responsible for generating power and driving the vehicle's wheels.
- When the driver applies the throttle or accelerator pedal, the electric motor receives electrical power from the vehicle's traction battery.

2. Traction Battery:

- The traction battery is a high-capacity rechargeable battery pack that stores electrical energy for the electric motor's operation.
- It supplies DC (direct current) voltage to power the electric motor.

3. Power Inverter:

- The power inverter, often referred to as an inverter drive or motor controller, converts the DC voltage from the traction battery into AC (alternating current) voltage that is needed to drive the electric motor.
- The inverter also regulates the motor's speed and torque based on driver inputs.

4. Throttle or Accelerator Pedal:

- The driver controls the vehicle's speed and acceleration by pressing the throttle or accelerator pedal.
- The pedal position is transmitted as an electronic signal to the motor controller, which adjusts the motor's output accordingly.

5. Regenerative Braking System:

- Electric vehicles often incorporate regenerative braking systems, which allow the electric motor to act as a generator during deceleration.
- When the driver lifts off the accelerator or applies the brakes, the motor generates electricity, which is then sent back to the traction battery for storage.

6. Keyless Start or Push-Button Start:

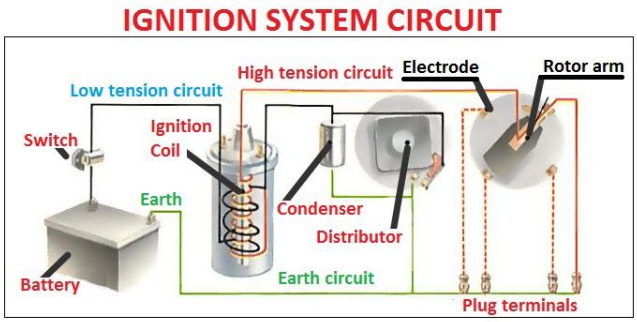
- Instead of a traditional ignition key, many electric vehicles use keyless start or push-button start systems.
- These systems allow the driver to start and stop the electric motor by pressing a button or using proximity sensors.

7. Battery Management System (BMS):

- The BMS is responsible for monitoring the health and performance of the traction battery.
- It ensures that the battery operates within safe temperature and voltage ranges and manages the charging and discharging processes.

8. Safety Systems:

- Electric vehicles include safety systems to disconnect the battery and power electronics in case of an accident or other emergencies.
- High-voltage components are often isolated to protect passengers and first responders.



Segment on the distributor cap ⇨ plug leads ⇨ plug caps ⇨ central electrode ⇨ nose of the plug