SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

AN AUTONOMOUS INSTITUTION

Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai

INTERNAL ASSESSMENT EXAMINATION – II

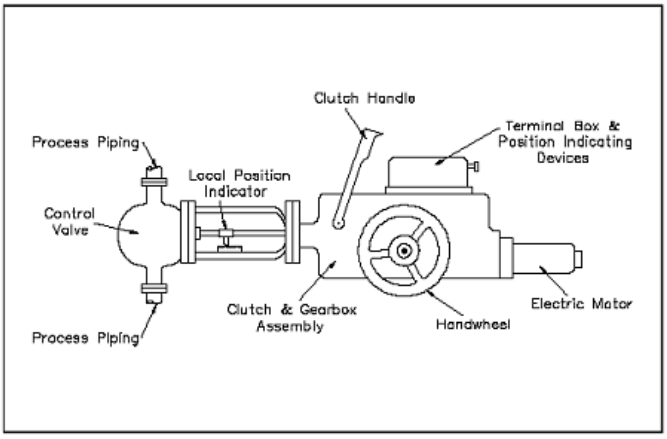
Answer Key

VI Semester
B.E- Mechanical & Mechatronics Engineering (Additive Manufacturing)
19OE120 – Automotive Electronics
Regulations 2019

1.Define throttle actuator?

The throttle actuator is usually a DC motor that acts as a servo motor. A servo motor is a self-contained electrical device that rotates machine parts precisely and efficiently. The DC motor operates a set of gears that gives the motor tremendous torque.

2.Draw electric motor actuator block diagram?



3.**What is the purpose of the starting system?**

The starter system is responsible for turning the engine over during ignition and allowing everything else to happen. When you turn the ignition on, the starter motor engages and turns the engine over allowing it to suck in air.

4.List the factors that affect the minimum speed of the starter motor

- Type of Power Supply.
- Winding Specifications.
- Environmental Temperature.
- Type of Magnet.
- Flux Yoke.
- Phase.

5.Name any three components in the starting system.

- Starting Motor
- Drive Mechanism

- The ignition switch

PART B

6 (A) **Compare and contrast different types of actuators.?**

	Pneumatic Actuator	Electric Actuator
Design	Simple	Complex
Force	Depends on air pressure	Depends on screw pitch/lead
Speed	High	Low
Accuracy	Low	High
Repeatability	Low	High
Motion Control Capability	Low	High
Efficiency	Low	High
Cost	Lower initial cost	Lower total cost of ownership
Data Collection	Still developing	Highly developed
Environment	Harsh, hazardous	Refer to IP rating
Temperature	Higher ambient temperature	Lower ambient temperature
Noise	High	Low
Maintenance	High	Minimal
Life	Estimated	Calculated
Ideal Application	End-to-end postioning	Multi-point positioning

(b)**Explain the construction and working of vacuum type actuators in**?

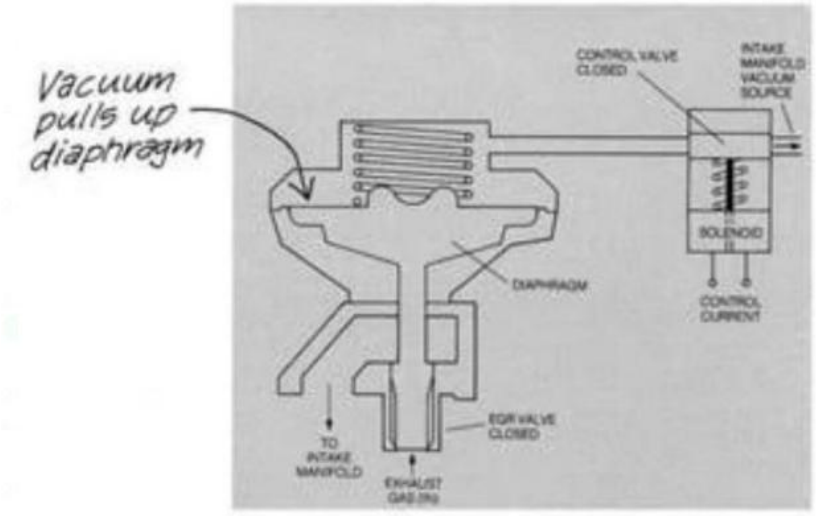
- The exhaust gas recirculation (EGR) is utilized to reduce NOx emissions. The amount of EGR is regulated by the engine controller.
- When the correct amount of EGR has been determined by the controller based on measurements from the various engine control sensors, the controller sends an electrical signal to the EGR actuator.
- Typically, this actuator is a variable-position valve that regulates the EGR as a function of intake manifold pressure and exhaust gas pressure.
- Although there are many EGR configurations, only one representative example will be discussed to explain the basic operation of this type of actuator.

- The example EGR actuator is shown schematically in Figure. This actuator is a vacuum-operated diaphragm valve with a spring that holds the valve closed if no vacuum is applied.

- This actuator is a vacuum-operated diaphragm valve with a spring holds the valve closed if no vacuum is applied.

- The vacuum that operates the diaphragm is supplied by the intake manifold and is controlled by a solenoid-operated valve.

- This solenoid valve is controlled by the output of the control system. This solenoid operates essentially the same as that explained in the discussion on fuel injectors. Whenever the solenoid is energized (i.e., by current supplied by the control system flowing through the coil), the EGR valve is opened by the applied vacuum.



- The amount of valve opening is determined by the average pressure on the vacuum side of the diaphragm. This pressure is regulated by pulsing the solenoid with a variable-duty-cycle electrical control current.

- The duty cycle of this pulsing current controls the average pressure in the chamber that affects the diaphragm deflection, thereby regulating the amount of EGR.

7(a**) Describe the advanced starting system technology in modern vehi a neat block diagram**

Advanced starting system technology in modern vehicles

- Biometric Start
- Voice recognition start
- Gesture recognition start
- Artificial intelligence start
- Wireless charging start

- **Biometric Start**: In the future, cars may have biometric sensors that can detect the driver's fingerprint or iris to start the engine. This can help to improve security and prevent theft.

(i) Hands

Fingerprints –

- Fingerprint recognition is one of the most well-known applications of biometrics.
- It is also an integrated authentication feature in most cellphones on the market today.
- Fingerprint recognition involves recognizing the unique differences in patterns of certain characteristics of fingerprints, such as whorls, ridge patterns, and minutiae points (the points plotted to ridge endings and ridge discontinuities) which differentiate the fingerprints of different individuals.

Palm & hand –

- Palm recognition also utilizes physiological measurements similar to those used in fingerprint recognition (e.g. matching minutiae points and ridge patterns)

Veins & face/hand temperature – Vein patterns in the hands or fingers are another biometric characteristic that can be used to authenticate identity

(ii) Head

Face & ear – Biometric facial recognition is another technology widely used for authentication and identification purposes.

Eye – The eye is also the source of multiple traits used in biometric systems

- **Voice Recognition Start**: Similar to biometric start, voice recognition start would allow the driver to start the engine by simply speaking a command.
- **Gesture Recognition Start**: With gesture recognition, the driver could start the engine by making a specific hand gesture, such as waving their hand in front of a sensor.
- **Artificial Intelligence Start**: As cars become more autonomous, they may be able to use artificial intelligence to start the engine automatically based on the driver's habits and preferences.
- **Wireless Charging Start**: Instead of traditional starting methods that rely on a battery, wireless charging technology may be used to start the engine, eliminating the need for a traditional starter motor.

(b) Elaborate the diagnosing starting system faults in detail?

Diagnosing starting system faults

- The starting system may have troubles such as the engine does not crank or the engine cranks but does not start.
- Apart from these troubles, the solenoid may have some noise; the pinion may not disengage properly.
- To diagnose the trouble, the headlights be switched on and observed.
- If lights do not dim, and there is no cranking and check whether there is the voltage at the ignition switch and starting motor terminals with ignition key on ‘start.’
- If lights dim heavily and there is no cranking the possibility of battery is discharged.
- If lights dim slightly and no cranking occurs, the pinion may not be engaging properly with the crankshaft.
- Also, there may be an open circuit in the starting motor.

- If lights go out completely and cranking does not occur, there may be an improper connection in the battery.
- If there are no lights and cranking also does not occur, the battery is open or dead. If the engine cranks slowly and does not start, it may be due to the defective starting motor.
- Solenoid noise may be due to low battery or defective solenoid winding.
- Artificial Intelligence Start: As cars become more autonomous, they may be able to use artificial intelligence to start the engine automatically based on the driver's habits and preferences.
- Wireless Charging Start: Instead of traditional starting methods that rely on a battery, wireless charging technology may be used to start the engine, eliminating the need for a traditional starter motor.

PART C

8(a)**Compare and contrast different types of starter motors.**

Engine starters are used in many applications including:

- Gasoline, marine, and diesel engines
- Portable generators
- Mining equipment
- Construction equipment
- Irrigation pumps
- Turbines
- Jet engines
- Aircraft

Types

Engine starter types include pneumatic, hydraulic, electric, spring, manual, and recoil.

Pneumatic

- Pneumatic engine starters or air starters are used to start diesel engines, gas turbines, and some reciprocating engines.
- They provide rapid acceleration and high turning speeds for immediate ignition. Compared to electric starters, air starters and air start systems have a higher power-to-weight ratio.
- Typically, they admit compressed air or gas to cylinders whose pistons are just over top dead forcing them downward.

Specifications for pneumatic air starters include:

- Maximum working pressure
- Maximum power
- Speed at maximum power
- Maximum torque
- Net weight
- Maximum diameter of the air feed piping

Hydraulic

- Hydraulic engine starters are used in field generators, marine propulsion engines, water pumping equipment for fire suppression, and hydraulic fracturing (fracking) equipment for oil and gas exploration.
- They are also used in diesel engines, typically those with 6 to 16 cylinders that require emergency starts over a range of temperatures.
- Like pneumatic engine starters and other air starting systems, hydraulic engines starters are designed for spark-less operation.
- Related components include valves, pumps, filters, reservoirs, and piston accumulators.

Product specifications for hydraulic engine starters include pressure range and crank size.

Electric

- Electric engine starters use either a permanent magnet or a direct current (DC) electric motor with a starter solenoid.
- They are often used in cars, trucks, boats, and construction equipment. When a key-operated switch is activated, current from a battery is applied to the solenoid.
- The solenoid then engages a lever that activates the driveshaft, pushing a drive pinion until it meshes with the starter ring gear on the engine's flywheel.
- Once the engine starts, a spring separates the pinion gear from the ring gear, causing the starter motor to stop.

Specifications for electric engine starters include parameters for connecting and switching.

Spring

- Spring starters are mechanical devices that do not require electricity, hydraulic pressure, or compressed air.
- Energy is store in a manually-rechargeable power spring or spring pack that eliminates the need for a battery, alternator, or wiring. In some systems, a conversion kit can be installed to provide electrical power.
- Typically, spring starters are used in industrial, marine and agricultural applications; often in remote or hazardous locations.

Manual and Recoil

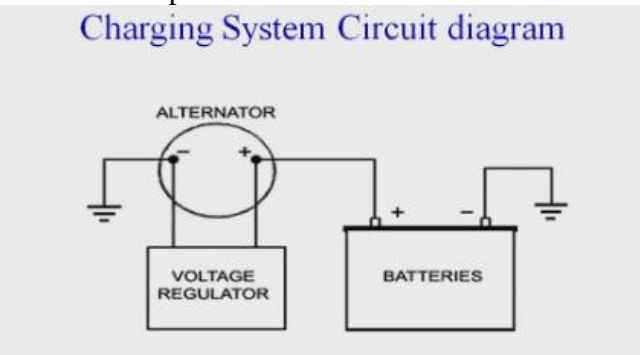
- Manual engine starters and recoil engine starters are used in lawnmowers, snow blowers, motorcycles, and other small engines.

8(b) **Draw a circuit diagram of a charging system in recent automot technology and explain how the charging system works.?**

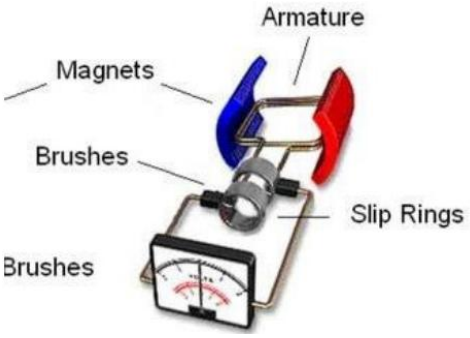
Requirements of the charging system

- Supply the current demands made by all loads.
- Supply whatever charge current the batterydemands.
- Operate at idle speed.

- Supply constant voltage under all conditions.
- Have an efficient power-to-weight ratio.
- Be reliable, quiet, and have resistance tocontamination.
- Require low maintenance.
- Provide an indication of correct operation

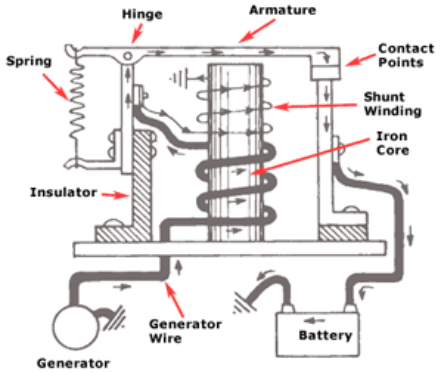


AC Generator (Alternator)



- An alternator, as an integral part of every combustion engine vehicle, its main responsibility is to convert chemical energy to electrical energy so that you can charge and replenish the battery in your engine and other electrical components in a car.

Voltage Regulator



A voltage regulator is an electromagnetic device. It operates in the same way as cutout relay. The voltage regulator prevents generation of excessive voltage, thus avoiding the damage to the electronic devices and overcharging of the battery. The current regulator limits the current and thus output of the generator is prevented from increasing beyond the rated output. The voltage produced depends on

- The physical thing,

- The speed of rotation
- The strength of magnetic field

Charging System(Working)

- The charging system consists of an alternator (generator), drive belt, battery, voltage regulator and the associated wiring.
- The charging system, like the starting system is a series circuit with the battery wired in parallel.
- After the engine is started and running, the alternator takes over as the source of power and the battery then becomes part of the load on the charging system.
- The alternator, which is driven by the belt, consists of a rotating coil of laminated wire called the rotor. Surrounding the rotor are more coils of laminated wire that remain stationary (called stator) just inside the alternator case.
- When current is passed through the rotor via the slip rings and brushes, the rotor becomes a rotating magnet having a magnetic field.
- When a magnetic field passes through a conductor (the stator), alternating current (A/C) is generated. This A/C current is rectified, turned into direct current (D/C), by the diodes located within the alternator