



The Shirpur Education Society's

**R. C. Patel College of Engineering and
Polytechnic, Shirpur**

Department of Mechanical Engineering

NAME OF COURSE: - Automobile Engineering

CODE OF COURSE: - 315372

SEMESTER: - TYME-5K

SUBJECT TEACHER: - Mr. J. N. Chaudhari

CHAPTER No. 5 :- Introduction to Auto Electrical

Systems – 08 M



QUESTION BANK OF CHAPTER – 5

INTRODUCTION TO AUTO ELECTRICAL SYSTEMS

Program Name: Diploma in Mechanical Engineering

Program Code: ME

Name of Subject & Code : Automobile Engineering (315372)

Semester : FIFTH

Instructions: (1) Illustrate your answers with neat sketches wherever necessary.

Q.1.	Two marks questions.	Previous Exam	CO PO Mapping
1.	Enlist different sensors used in Automobile.	W25-1.g	C05-TL05.5-R
2.	Define battery capacity.		C05-TL05.2-R
3.	State the need of charging system.		C05-TL05.3-R
Q.2.	Four marks questions.	Previous Exam	CO PO Mapping
1.	Explain construction and working of lead acid battery with neat sketch.	W25-5.a S25-4.b	C05-TL05.1-U
2.	Explain battery ignition system for four cylinder engine.	S26-4.e	C05-TL05.4-U
3.	Enlist various colour code used in wiring system. State its necessity.	S26-5.c S25-4.d	C05-TL05.5-R
4.	Explain working of alternator with neat sketch	S25-3.d	C05-TL05.3-U
5.	Explain construction and working of Bendix Drive used in starting system with neat sketch.	S25-6.b W24-4.b	C05-TL05.3-U
6.	Explain working of starting system of a vehicle with neat sketch.	W24-3.d	C05-TL05.3-U
7.	Enlist any four gauges and sensors with their functions	W24-4.d W24-1.e	C05-TL05.5-R
8.	Explain battery rating.	W25-1.f S25-1.e	C05-TL05.2-U
9.	Explain with neat sketch electronic ignition system.		C05-TL05.4-U
10.	Explain with neat sketch magneto ignition system.		C05-TL05.4-U
11.	Differentiate between battery ignition system and magneto ignition system.		C05-TL05.4-A



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12.	Differentiate between battery ignition system and electronic ignition system.		C05-TL05.4-A
	* **Best of Luck** *		

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14/8/26

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Subject Teacher

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* Automobile Engineering *

Chapter 5: Introduction to Auto Electrical System

5.1 Introduction to Battery & its components: Function & requirements of battery, Types of battery, Battery components & working, Battery rating & battery capacity.

* Battery :-

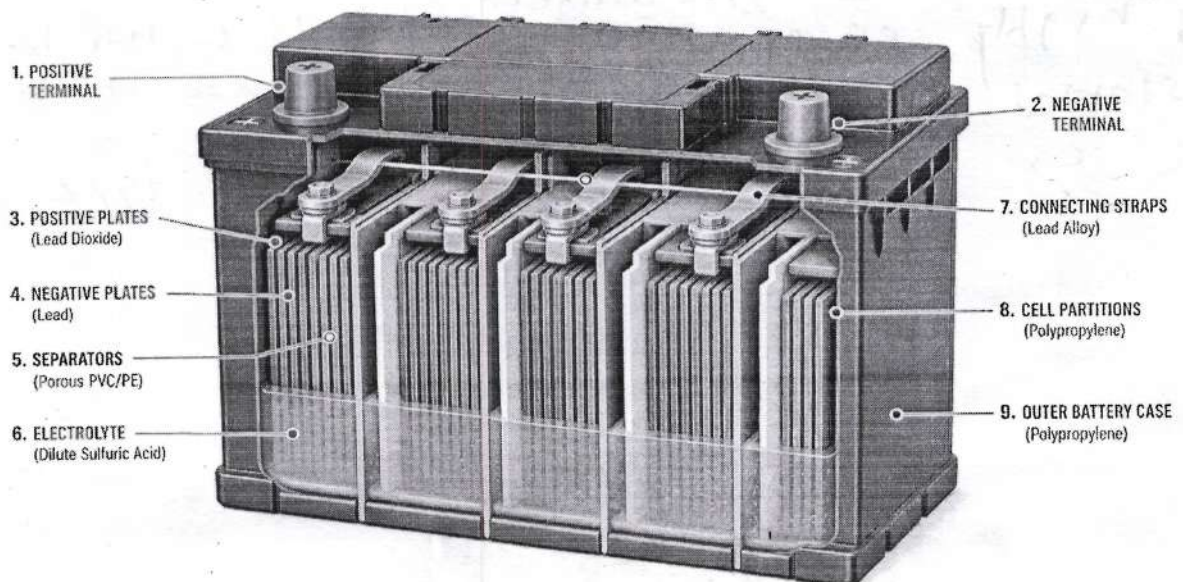
It is an electrochemical device that stores energy in chemical form & converts it into electrical energy to operate vehicle systems.

* Functions of Battery:

1. Starting the engine (supplies power to starter motor)
2. Ignition system supply (spark generation)
3. Power to electrical accessories (lights, horn, dashboard).
4. Acts as voltage stabilizer in the electrical system.

* Requirements of Good battery:

- High starting power (high current capacity).
- Quick charging & discharging capability.
- Low internal resistance.
- Long life & durability.
- Low maintenance.
- Ability to work under temp. variations.
- Leak-proof & safe operation.



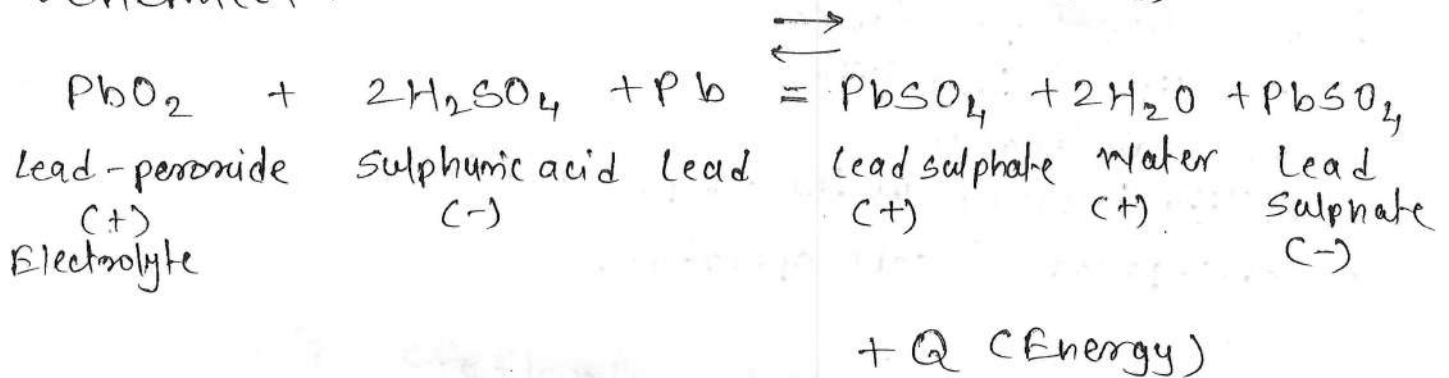
Construction -

- Positive plate - Lead dioxide (PbO_2)
- Negative plate - Sponge lead (Pb)
- Electrolyte - Dilute sulfuric acid (H_2SO_4)
- Separator - Prevents short circuit betⁿ plates
- Container (Case) - Holds all components,
- Terminals - Provide connection to circuit.
- Vent Caps - Release gases & allow maintenance,

Working -

- During Discharging (Supplying Power):
 - Chemical energy $\rightarrow$ Electrical energy
 - Lead dioxide + Lead + Acid $\rightarrow$ Lead sulphate + Water.
 - Battery gives current to starter & electrical system.
- During Charging:
 - Electrical energy $\rightarrow$ Chemical energy.
 - Lead sulphate converts back to lead dioxide & lead.
 - Battery stores energy again.

Chemical Reaction (Charging & Discharging): -



* Types of Batteries :-

1. Lead Acid Battery
2. Alkaline battery $\rightarrow$ i) Nickel iron type
 $\rightarrow$ ii) Nickel cadmium type
3. Zinc-air battery
4. ZEBRA Battery (Molten Salt Battery)
5. Sodium - Sulphur battery.
6. Lithium ion battery
7. Swing Cell

* Types of Battery Rating :-

1. 20 - Hour Rating (C20 Rating) :

Defⁿ - It is the capacity of a battery when it's discharged slowly over 20 hours.

Explanation -

- Standard method for rating lead-acid batteries.
- Battery is discharged at constant current for 20 hrs.
- Final voltage reaches about 10.5 V (for 12 V battery)

Example - 100 Ah battery (C20) $\rightarrow$ Supplies 5A for 20 hr.

2. Cold Rating (Cold Cranking Amps - CCA) :

Defⁿ - It is a maximum current a battery can supply at -18°C for 30 sec. without dropping voltage below a limit.

Explanation -

- Measures starting ability in cold weather.
- Voltage should not fall below 7.2 V (for 12 V battery)

Importance $\rightarrow$ Higher CCA = Better engine starting in cold conditions.

3. 25 Ampere Rating (Reserve Capacity - RC) :

Defⁿ - It is the time (in minute) a fully charged battery can supply 25A current before voltage drops to 10.5 V.

Explanation -

- Indicates backup power capacity.
- Useful when alternator fails.

Example - RC = 120 minute $\rightarrow$ battery can supply 25 A for 120 minutes.

4. Twenty - Minute Rate :

Defⁿ - It is the capacity of battery when discharged over a short period (20 minutes) at high current.

Explanation -

- Used for high load conditions.
- Shows battery performance during heavy current demand.

Importance -

- Capacity is lower than 20-hour rating due to high discharge rate.

* Battery Capacity :-

Defn - It is the total amount of electrical energy (charge) a battery can store & deliver under specified condⁿ.

$$\text{Capacity (Ah)} = \text{Current (A)} \times \text{Time (hour)}$$

e.g → 100 Ah battery can supply → 10 A for 10 hrs,
5 A for 20 hrs
2 A for 50 hrs.

* Factors Affecting Battery Capacity :-

1. Discharge rate -
 - Higher current → lower capacity
2. Temperature -
 - Low temp ↓ Capacity.
 - High temp ↑ capacity (but reduces life)
3. Electrolyte Condition -
 - Proper level & concentration needed
4. Battery Age -
 - Capacity decreases with time.
5. Maintenance -
 - Poor maintenance reduces efficiency.

5.2 starting system & charging system : Functions & Requirement of starting & charging system, starting system components & their functions, Alternator components & their functions, Working Principle of alternator.

* Starting System :

It is used to start the engine by cranking it until it begins to run on its own.

• Main functions of Starting System :

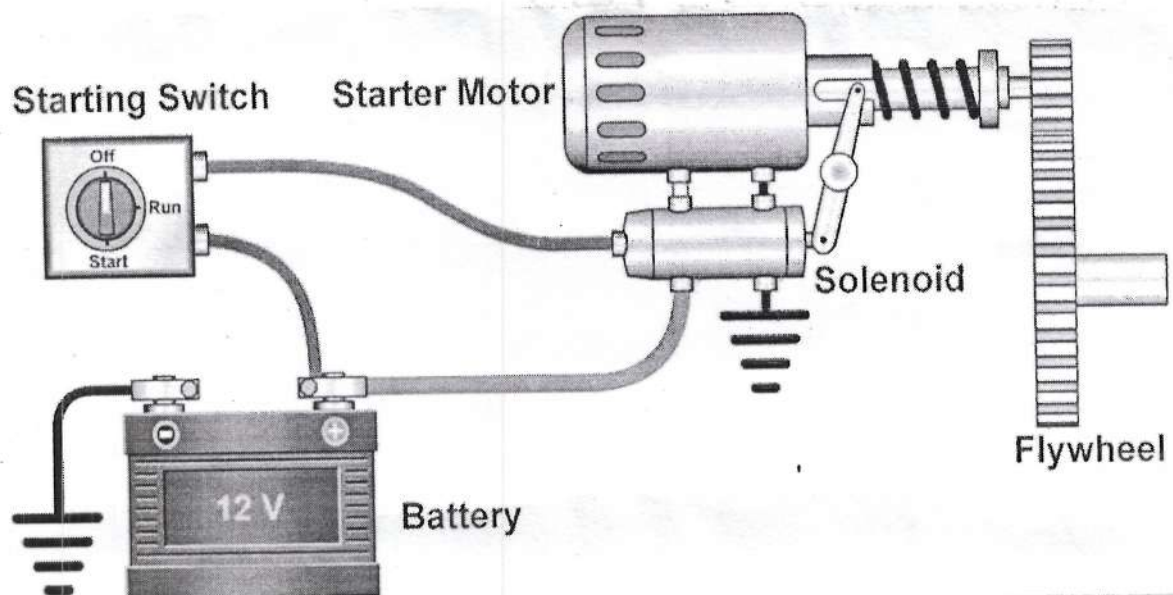
- Converts electrical energy → mechanical energy.
- Rotates engine crankshaft using starter motor.

- initiates combustion process.
- Helps engine reaches self-running speed.

• Requirements of Starting System:

- should provide high torque to crank engine
- Must operate quickly & reliably.
- should work under low temp. conditions.
- Must consume minimum power
- should be compact & durable.
- Must ensure smooth engagement & disengagement.

* Starting System:-



Construction -

1. Battery -
 - supplies electrical energy to the starter motor.
2. Ignition switch
 - controls the starting switch
 - connects battery to starter when key is turned.
3. Starter Motor -
 - converts electrical energy → mechanical energy.
 - Rotates engine crankshaft.
4. Starter solenoid
 - Act as electromagnetic switch
 - Engages starter motor with flywheel.

5. Drive Mechanism (Bendix Drive) Pinion Gear):
 - Connects starter motor to engine flywheel
 - Disengages after engine starts.
6. Flywheel
 - Receives rotation from starter
 - Helps in engine cranking.

Working Principle :-

1. Key is turned to START position.
2. Battery supplies current to starter solenoid.
3. Solenoid pushes pinion gear to engage ~~crankshaft~~ with flywheel.
4. Starter motor rotates $\rightarrow$ turns engine crankshaft.
5. Engine starts (combustion begins)
6. Pinion gear automatically disengages.

* Charging System:

The charging system is used to generate electricity & recharge the battery while the engine is running.

* Functions of Charging System -

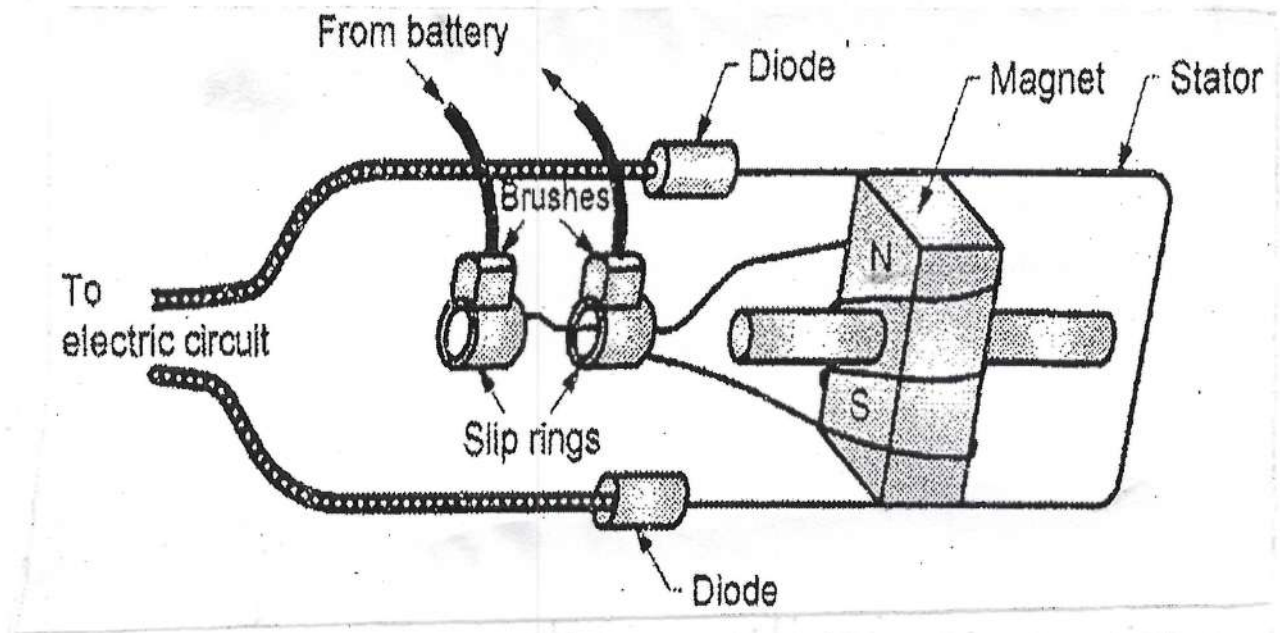
- Supplies power to electrical loads (lights, horn, ECU)
- Charges the battery continuously.
- Maintains constant voltage level.
- Converts mechanical energy $\rightarrow$ electrical energy (via alternator)

* Requirements of Charging system -

- Should maintain proper battery charge
- Must supply sufficient current to all loads.
- Should provide constant voltage output.
- Must be efficient & reliable.
- Should work at different engine speeds.
- Must prevent overcharging & undercharging.

* Alternator :-

* Alternator -



Construction -

1. Rotor (Field Winding) -
 - Produces rotating magnetic field.
2. Stator -
 - Stationary winding, Generates AC current
3. Slip Rings
 - Supply current to rotor
4. Brushes
 - Provide electrical contact with slip rings
5. Diode Rectifier
 - Converts AC $\rightarrow$ DC
6. Voltage Regulator
 - Maintains constant o/p voltage.
7. Pulley & Fan
 - Pulley rotates alternator using engine belt.
 - Fan cools the alternator.

Working -

1. Engine rotates alternator pulley via belt.
2. Rotor spins $\rightarrow$ creates rotating magnetic field.
3. Magnetic field cuts stator conductors.
4. AC current is generated (electromagnetic induction)
5. Diodes convert AC $\rightarrow$ DC current.
6. DC o/p charges battery & supplies loads.

7. voltage regulator controls output voltage.

5.3 Ignition System: Introduction to various types of Ignition System. (Battery Ignition, Magneto Ignition & Electronic Ignition System).

* Ignition System :-

Defⁿ -

An ignition system is used to generate & supply a high voltage ~~peak~~ spark to the spark plug at the correct time to ignite the air-fuel mixture in petrol engines.

* Functions of Ignition System -

- Produces high voltage spark.
- Ignite air-fuel mixture in cylinders.
- Supply spark at correct timing.
- Ensure smooth engine operation.

* Requirements of Ignition System -

- Should generate sufficient high voltage (20-30 kV)
- Must provide proper spark timing.
- Should work at all engine speeds.
- Must be reliable & efficient.
- Should require low maintenance.
- Must produce strong & consistent spark.

* Types of Ignition System -

1. Battery Ignition system
2. Magneto Ignition system
3. Electronic Ignition system.

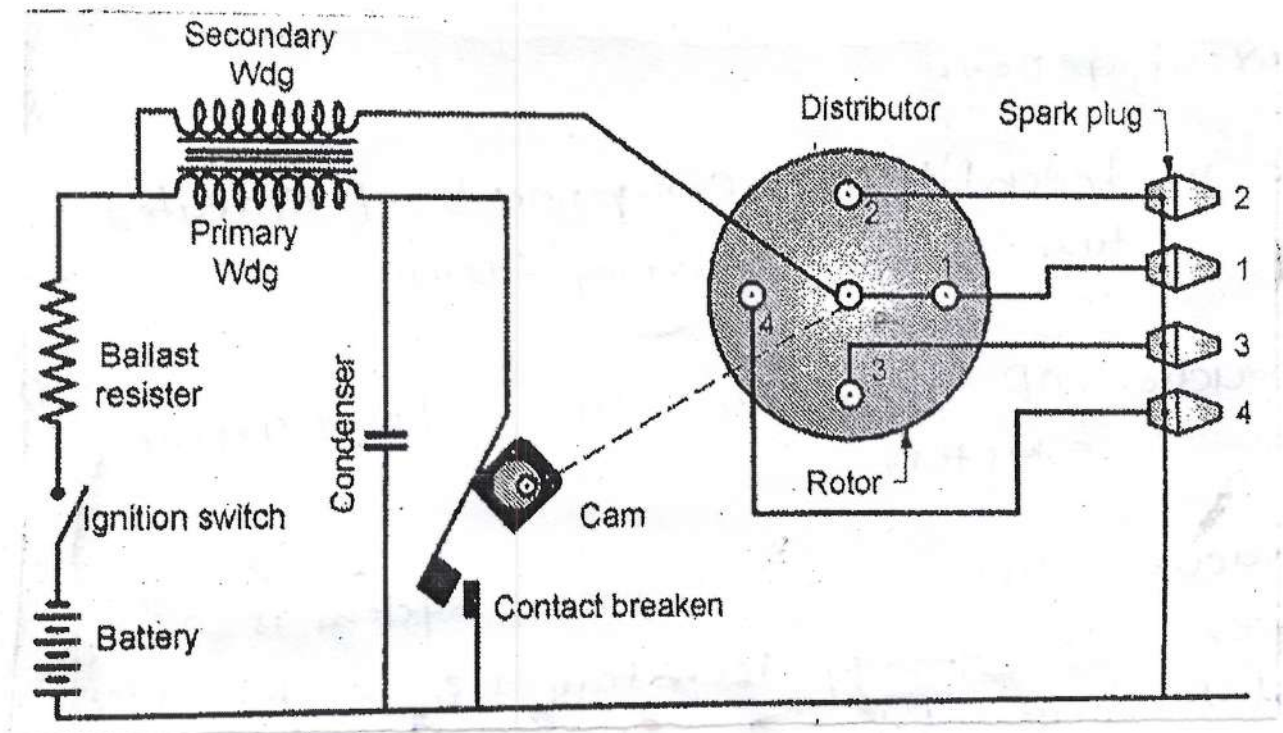
* Battery Ignition System -

Construction -

- Battery - supplies low voltage (6V/12V)
- Ignition coil - Steps up voltage (to ~ 20-30 kV)
- Breaker Points (Contact Points) - open/close circuit.

- Condenser (Capacitor) - prevents arcing
- Distributor - distributes high voltage to spark plugs.
- Spark plug - produces spark.

Diagram -



Working -

1. Ignition switch is turned ON.
2. Battery supplies current to primary winding of ignition coil.
3. Breaker points open $\rightarrow$ magnetic field collapses.
4. High voltage is induced in secondary windings.
5. Distributor sends high voltage to correct spark plug.
6. Spark plug produces spark $\rightarrow$ combustion starts.

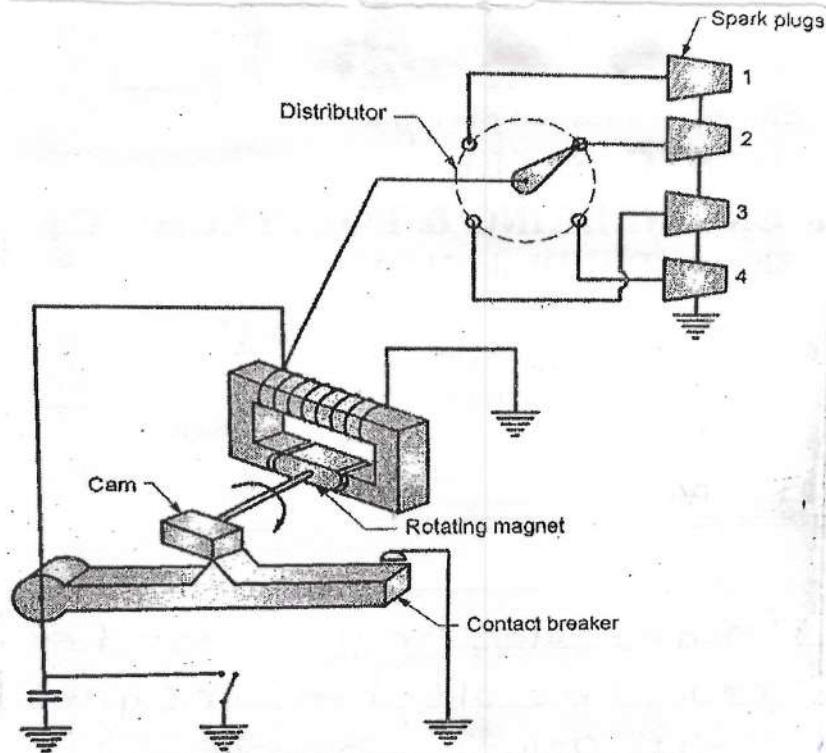
* Magneto Ignition System -

Construction -

1. Permanent magnet - Produces magnetic field.
2. Armature (coil) - contains primary & secondary windings.
3. Contact Breaker (points) - Opens & closes circuit.
4. Condenser (Capacitor) - Prevents sparking at breaker points.
5. Distributor (if multi-cylinder) - Distributes high voltage

G. Spark plug - Produces spark.

Diagram -



Working -

1. Magnet rotates $\rightarrow$ creates changing magnetic field
 2. EMF is induced in primary winding.
 3. When breaker points open $\rightarrow$ current stops suddenly
 4. Magnetic field collapses $\rightarrow$ induces high voltage in secondary winding.
 5. High voltage is sent to spark plug.
 6. Spark plug produces spark $\rightarrow$ ignition occurs.
- Principle used $\rightarrow$ Electromagnetic induction,

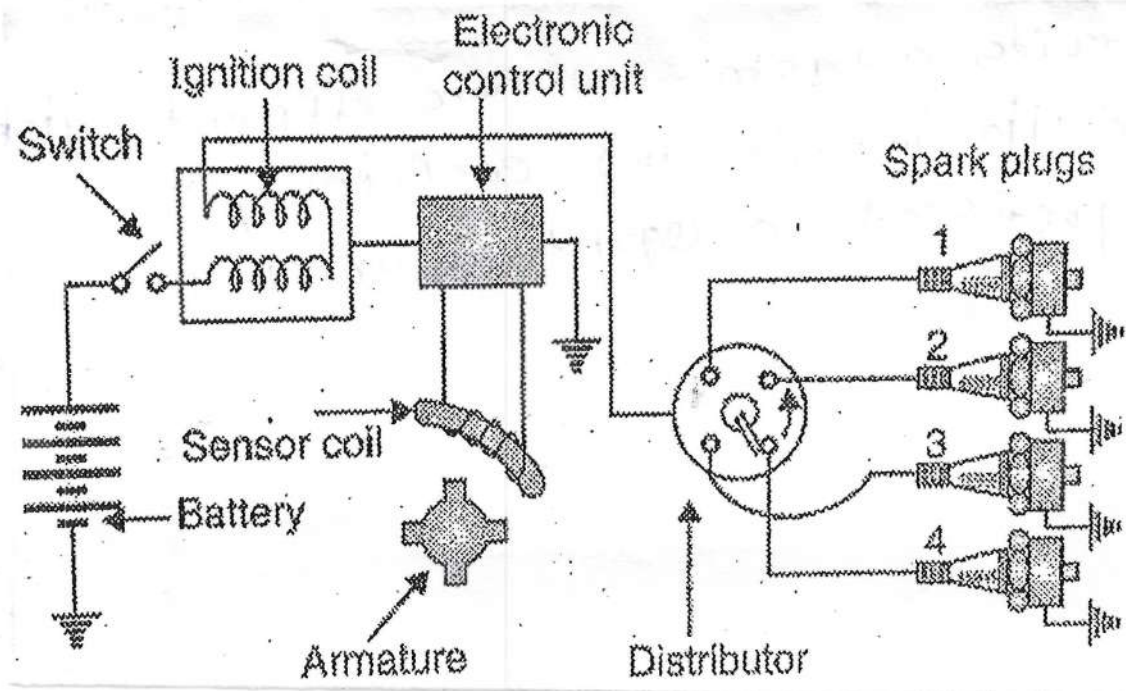
* Electronic Ignition System:

Construction -

- Battery - Supplies electrical energy
- Ignition coil - Converts low voltage to high voltage
- Electronic Control Unit (ECU) - Controls ignition timing.
- Sensors (Crankshaft/Comshaft) - Detect engine position.
- Ignition Module/Transistor - Switches current electronically.

- Spark plug - produces spark.

Diagram -



Working -

1. Sensors detect crankshaft position
2. Signal sent to ECU.
3. ECU calculates exact ignition timing.
4. ECU sends signal to ignition module (transistor)
5. Transistor switches current in ignition coil.
6. Coil produces high voltage.
7. Spark plug ignites air fuel mixture.

* Differentiate between Battery Ignition & Magneto Ignition system,

Features	Battery Ignition System	Magneto Ignition System
• Source of Energy	Battery	Magneto (self-generated)
• Need of battery	Required	Not required
• Working principle	Uses battery current + ignition coil	Uses electromagnetic induction

Features	Battery Ignition System	Magneto Ignition System
• Starting	Good Starting at low speed	Difficult starting at low speed.
• Maintenance	More (battery maintenance needed)	Less maintenance
• Cost	Lower initial cost	Higher initial cost.
• Efficiency	Moderate	High at high speed
• Spark intensity	Depends on battery condition.	Strong at high speed.
• Application	Cars, trucks (older systems)	Motorcycles, small engines, aircraft.

* Differentiate between Battery Ignition system & ~~Magneto~~ Ignition system
Electronic

Features	Battery Ignition System	Electronic Ignition System.
• Power Source	Battery	Battery + ECU
• Working method	Uses mechanical contact breaker, point.	Uses electronic sensors & transistors switching
• Ignition Timing	Less accurate	Highly accurate
• Maintenance	High (due to wear of parts)	Very low (no mechanical wear)
• Efficiency	Moderate	High
• Spark strength	Comparatively weak	Strong & consistent
• Starting performance	Affected by battery condition	Better & reliable.
• Life of components	Shorter	Longer

Features	Battery Ignition System	Electronic Ignition System
• Cost	Low	Higher
• Application	Older vehicles	Modern vehicles.

5.4 Miscellaneous : Types of sensors used in Automobiles.

* Types of Sensors :

1. Inductive Sensor
2. Hall Effect Sensor
3. Voltage Generating sensor
4. Light sensor
5. Resistive sensor
6. Temperature sensor
7. Switch sensor
8. Pressure sensor (MAP)
9. Oxygen sensor
10. Crankshaft position sensor
11. Throttle position sensor.

* Functions of Sensor:

1. Inductive Sensor

function -

- Detects metal objects or rotating parts
- Measures speed of rotating parts / components.
- Used in wheel speed sensing (ABS).
- works without physical contact

2. Hall Effect sensor

function -

- Detects position of rotating parts.
- Measures speed & dirⁿ, provides digital o/p signal
- Works on magnetic field principle.
- Used in crankshaft / camshaft position sensing.

3. Light sensor (Photo sensor)

function -

- Detects light intensity.

- Used in automatic headlight control
- Helps in day/night detection
- Improves driver comfort & safety.

4. Resistive Sensor

Function -

- Changes resistance with i/p (position/level)
- Used in throttle position sensing
- Measures fuel level in tank.
- Converts physical change $\rightarrow$ electrical signal.

5. Voltage Generating Sensor

Function -

- Generates voltage without external power.
- Works on piezoelectric or thermoelectric effect.
- Used in knock sensing, Detects pressure & vibration,
- Converts energy $\rightarrow$ electrical o/p directly.

6. Temperature Sensor

Function -

- Measures engine temp., sends signal to ECU
- Controls fuel injection & ignition timing.
- Prevents engine overheating
- Helps in cooling system control.

7. Pressure Sensor (MAP sensor)

Function -

- Measures intake manifold pressure
- Helps calculate engine load
- Sends data to ECU, controls fuel injection,
- Improves engine efficiency.

8. Oxygen Sensor (O_2 sensor)

Function -

- Measures oxygen level in exhaust gases.
- Maintains air-fuel ratio
- Sends feedback to ECU
- Reduces emissions
- Improves fuel efficiency.

9. Crankshaft Position Sensor

function -

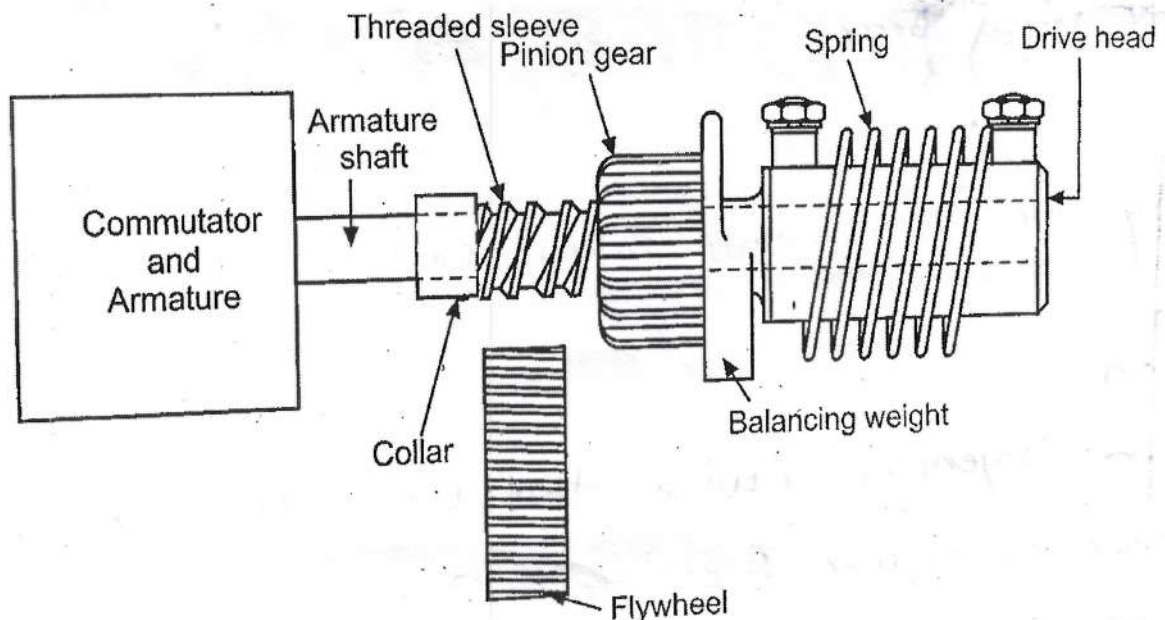
1. Detects crankshaft position
2. Measures engine speed (RPM)
3. Helps in ignition timing control
4. Sends signal to ECU
5. Essential for engine starting.

10. Throttle Position Sensor (TPS)

function -

1. Detects throttle valve position
2. Sends signal to ECU
3. Controls fuel injection
4. Helps in acceleration control
5. Improves engine performance.

* Bendix Drive :



Construction -

It is the mechanism used in starting system to engage the starter motor with the engine flywheel during starting & automatically disengage it after the engine starts.

1. Pinion Gear - Engages with the teeth of the flywheel
2. Helical Screw / splined sleeve - Allows the pinion to move axially.
3. Drive sleeve - Mounted on the starter motor shaft.
4. Spring - Helps in engagement & absorbs shock.
5. Starter motor shaft - Rotates the bendix drive.
6. Flywheel Ring Gear - Receives rotation from the starter motor.

Working -

• During starting:

1. When starter switch is operated, the starter motor starts rotating.
2. Due to inertia of pinion gear, it moves along the helical screw.
3. The pinion moves forward & engages with the flywheel ring gear.
4. The rotating starter motor then turns the flywheel & crankshaft.
5. The engine starts running.

• After Engine Starts:

6. When the engine starts, the flywheel rotates faster than the starter motor.
7. The pinion is forced back along the helical screw due to its relative motion.
8. It disengages from the flywheel.
9. Thus, the starter motor is protected from being driven at excessive speed by the running engine.

* Gauges Used in Automobile:

It is an instrument used to measure & indicate the cond'n or operating parameters of diff. automobile systems to the driver.

1. Fuel Gauge -

Functions -

1. Indicates the fuel level in tank
2. Warns driver when fuel is low.
3. Helps estimate remaining fuel
4. Assists in planning fuel refilling

2. Temperature Gauge -

Functions -

1. Indicates engine coolant temp.
2. Show whether engine is operating at normal temp.
3. Warns about engine overheating
4. Helps detect cooling-system problems.

3. Oil Pressure Gauge -

Functions -

1. Indicates engine oil pressure
2. Shows proper functioning of the lubrication system.
3. Helps detect oil leakage or pump failure
4. Warns about low oil pressure.

4. Speedometer -

Functions -

1. Indicates vehicle speed.
2. Helps the driver maintain the speed limit.
3. Helps the driver monitor changes in speed.
4. Helps control vehicle speed according to road condⁿ.

5. Tachometer -

Functions -

1. Indicates engine speed in rpm.
2. Helps prevent over-speeding of the engine.
3. Helps select the proper gear.
4. Indicates the engine's operating condition.

6. Ammeter / Battery Charge Gauge -

Functions -

1. Indicates the dirⁿ of current flow to or from the battery.
2. Shows whether the battery is charging or discharging.
3. Helps identify charging-system faults.
4. Helps monitor the condⁿ of the

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R. C. Patel College of Engineering and Polytechnic, Shirpur

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Date: 30-07-2026

Institute Name – R. C. Patel College of Engineering & Polytechnic, Shirpur

Institute Code - 1808

Name of the Industry – Thermal Power Plant (Large Scale Industry)

Title of the Industrial Training Program – Best Operations and Maintenance Practices in Large Scale Industry

Duration of the Training Program – 13/10/2026 to 17/10/2026

Training Venue - Adani Power Dahanu Thermal Power Station, Dahanu, District Plaghar

Sr. No.	Full Name of Participant with Prefix such as Shri/Smt.	Branch	Designation	Staff approved by MSBTE (Y/N)	Email-Id & Mobile No.	Aadhaar No.
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2	Shri. Bhushan Shivdas Patil	ME	Lecturer	No	bhushan0144@gmail.com Mob No: 8956840310	992826342141

I hereby recommend the above-mentioned faculty member/s for the said training program and declare that the information provided above is true and correct to the best of my knowledge.

(Seal of the Institute)



(Name & Signature of Principal)

Dr. N. G. Haswani

Principal

R C Patel College of Engineering and Polytechnic, Shirpur

Principal
R C Patel College of Engineering
and Polytectinic, Shirpur

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