

THEORY 1 <sup>st</sup> - IN-SEM EXAMINATION			
SESSION: 2022-23(SUMMER SEMESTER)			
<b>B.Voc/M.Voc</b>	<b>Semester</b>	3RD	
<b>Course name</b>	AUTOMOTIVE ELECTRICAL AND AC		
<b>Course code</b>	AUT1305		
<b>Date</b>			
<b>Name of the Student</b>		<b>Reg. No.</b>	

INSTRUCTIONS
<ul style="list-style-type: none"> <li>• Maximum Marks: <b>20</b></li> <li>• Duration of Examination: <b>01 Hour</b></li> <li>• Attempt all questions.</li> <li>•</li> </ul>

<b>1. Section A</b> (05 objective type questions, each question carries 01 mark)	<b>05×1 = 05</b>
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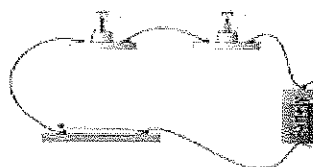
1. A
2. C
3. D
4. A
5. B

<b>2. Section B</b> (03 short answer type questions, each question carries 02 marks)	<b>03×02 = 06</b>
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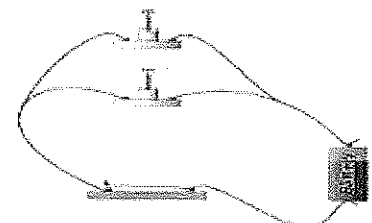
1. **Ohm's law** states that the current through a conductor between two points is directly proportional to the voltage across the two points. Introducing the constant of proportionality, the resistance.

2. Circuits

**Series Circuit**



**Parallel Circuit**



There are two types of circuits:-

1. Series circuit
2. Parallel circuits

3. Voltage

### Voltage

The pressure that is put on free electrons that causes them to flow is known as electromotive force (EMF). The volt is the unit of pressure, i.e., the volt is the amount of electromotive force required to push a current of one ampere through a conductor with a resistance of one ohm.

### Ampere/current

The ampere defines the flow rate of electric current. For instance, when one coulomb (or  $6 \times 10^{18}$  electrons) flows past a given point on a conductor in one second, it is defined as a current of one ampere.

**3. Section C** (03 long type questions, each question carries 03 marks)

**03×03 = 09**

#### 1. Structure of atom

Atoms consist of three main particles: -

##### 1. Electron

Electron is subatomic particle whose charge is negative, they have no known components and substructure.

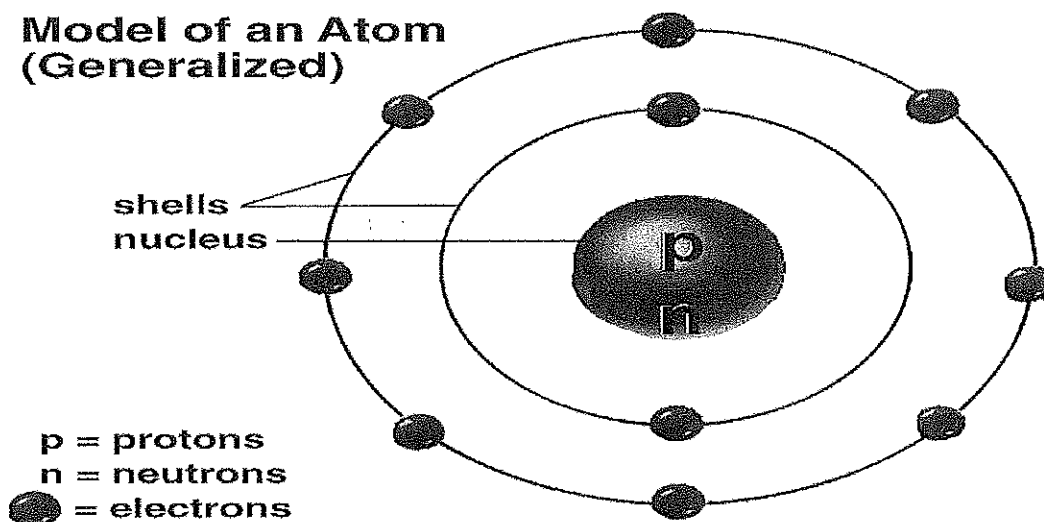
##### 2. Proton

Proton is a sub atomic particle with a positive charge and a mass slightly less than that of neutron.

##### 3. Neutron

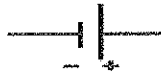
A subatomic particle of about the same mass as a proton but without an electric charge, present in all atomic nuclei except those of ordinary hydrogen.

### **Model of an Atom (Generalized)**

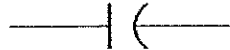


#### 2. Symbols

## Schematic Symbols



Battery



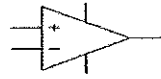
Capacitor



Resistor



Potentiometer



Op Amp



Transistor



FET



Diode



Tube



Ground



Switch



LED

3. Total resistance  $200 + 120 + 350 = 670$

Total current =  $0.06 + 0.1 + 0.03 = 0.19$

Voltage =  $0.06 * 200 + 0.1 * 120 + 0.03 * 350 = 12 + 12 + 10.50 = 34.5$  Volt





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<b>B.Voc/M.Voc</b>	<b>B.Voc</b>	<b>Semester</b>	3rd
<b>Course name / Module</b>	Basics of AutoCAD and Solid works		
<b>Course code</b>	GEN1308		
<b>Date</b>			
<b>Name of the Student</b>		<b>Reg. No.</b>	

**INSTRUCTIONS**

- Maximum Marks: **20**
- Duration of Examination: **01 Hour**
- Attempt all questions.
- Any other instruction may be included, If required.

**Answer sheet**

<b>1. Section A</b> (05 objective type questions, each question carries 01 mark)	<b>05×1 = 05</b>
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Q1. When drawing in 2D, what axis do you not work with?

- a) X
- b) Y
- c) Z**
- d) None of the above

Q2. Which command covert discrete objects in polyline.

- a) Union
- b) Polyline
- c) Join**
- d) None of the above

Q3. Fillet command can be used to obtain

- a) chamfer corners
- b) Round corners
- c) Both of the above**
- d) None of the above

Q4. Scaling objects make them

- a) Smaller
- b) Bigger
- c) Either smaller or bigger**
- d) None of the above

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Q5. Which of the following file extensions cannot be open in Auto CAD.

- a) .dwg
- b) .dot**
- c) .dxf
- d) .dws

**2. Section B** (03 short answer type questions, each question carries 02 marks)

**03×02 = 06**

Q6. What is the use of the MIRROR command?

Ans. The MIRROR command is used to make a copy of a selected object and flip the copy around a specified line to produce a reciprocal image of that selected object.

Q7. What is an object snap mode?

Ans. A set of tools precisely picking strategic points on an object, including endpoint, midpoint, center, and so on, are called object snap mode. It is also called osnap.

Q8. What is the meaning of the array command?

Ans. This command is used to make a copy of several objects that are needed to make a pattern. Of the several ways in which copies are made the array command is easier because it offers regular space mod and path array.

**3. Section C** (03 long type questions, each question carries 03 marks)

**03×03 = 09**

Q9. Write brief introduction about Auto CAD and system requirement to run its latest version.

Ans. AutoCAD is legendary software in the world of Computer Aided Designing (CAD). It has completed 36 years by the 2018. If you are a new user of this software, then the time you spend on learning this software will be a wise investment. If you have used previous versions of AutoCAD, you will be able to learn the new enhancements. I welcome you to learn AutoCAD using this book as it provides step-by-step examples to learn various commands and techniques.

The following are system requirements for running AutoCAD smoothly on your system.

- ❖ Operating System: Microsoft Windows 7 SP1, Windows 8.1, Windows 10 (64 bit only)
- ❖ Processor: > Basic: 2.5 to 2.9 GHz > Recommended: 3+ GHz processor
- ❖ RAM: > 8 GB (16 GB recommended)
- ❖ Display Resolution: > Conventional Displays - 1920 x 1080 with True Color > High Resolution & 4K Displays - Resolutions up to 3840 x 2160 supported on Windows 10, 64-bit systems (with capable display card)
- ❖ Disc Space: 6 GB of free space for installation
- ❖ Browser: Google Chrome
- ❖ .NET Framework Version 4.7

Q10. Write advantages and disadvantages of Auto CAD.

Ans. Advantages of Auto-CAD:

Compatibility –

Standardization is one of beneficial advantage of using AutoCAD. It is used as standard for Computer Aided Design, so that other packages of CAD emulates operations of AutoCAD and ensure about compatibility of files across industrial boundaries.

1. 2D and 3D –

It has ability to make a transition between 2D and 3D. Some versions has ability that they can automatically generate print documentation which is typically based on virtual 3D models. As we know



that 3D modelling is easy difficult, but with help of 3d packages it becomes very easy to create and modify.

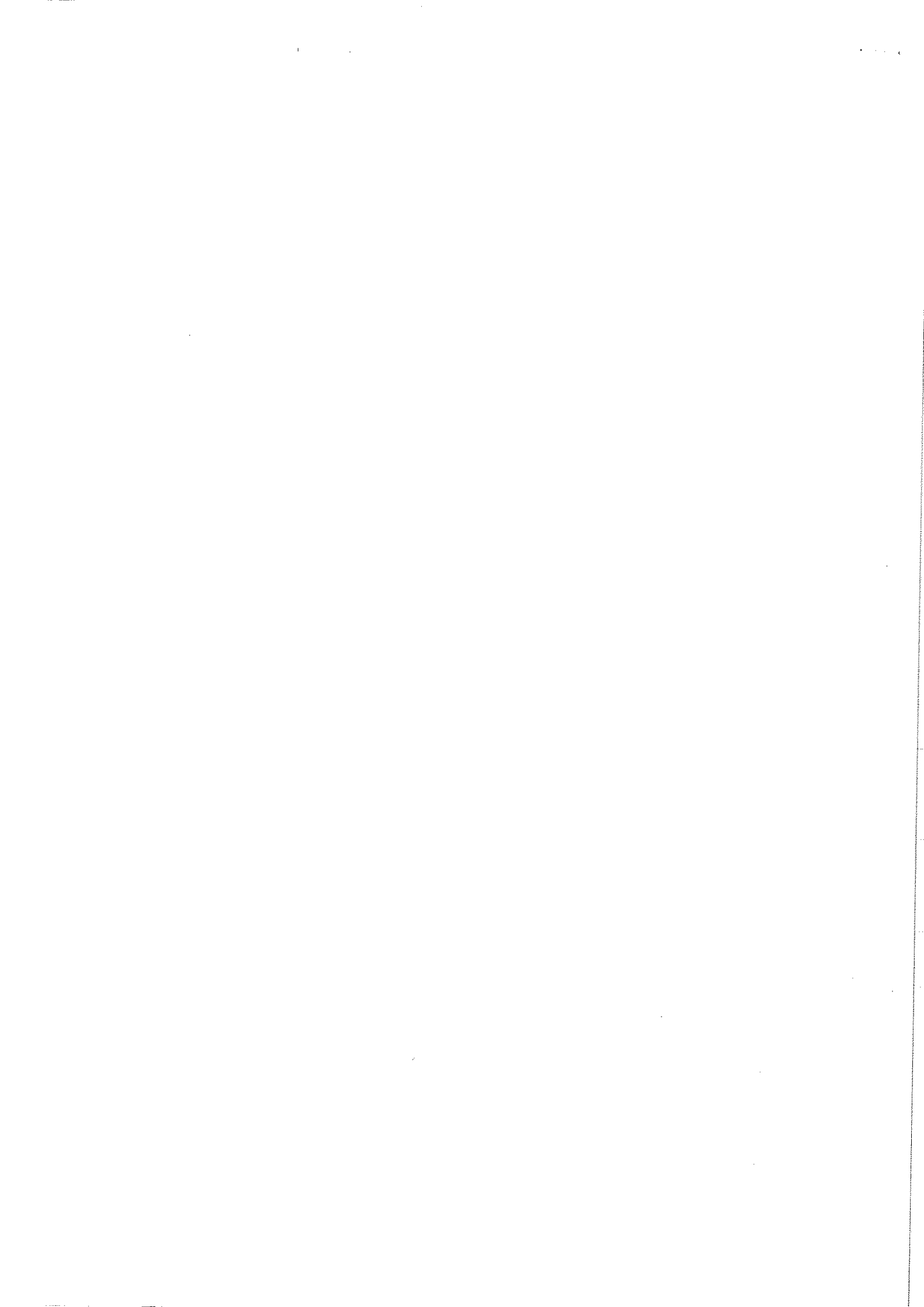
2. Companionable with CAM – CAD goes hand-in-hand with Computer Aided Manufacturing (CAM). AutoCAD automatically interact with matching CAM packages which further create machine tool program for operations like drilling, turning and grinding.
3. Virtualization – On large scale production like bridge or building design etc, virtualization is used. Virtualization is ability to view and walk through project in a 3D view before start manufacturing process.
4. Time Saver – To make any desired drawing it consumes much time but with invent of AutoCAD making drawing is not time consuming task. Also we can generate as much copies of same drawing. The same drawing can be used in other drawing which also helps in saving time.
5. Simulation – It is also used to create simulations and wire-frame models, which help user to check functionality of model without investing in prototype of the model.
6. Databases – It is also help in creation of databases like PDM/PLM, once these database are get created with help of CAD files these can be accessed through WAN.
7. Accuracy – It can produce even large files with same ease and accuracy. Commands like Grid Snap, Zoom and attach are used for accuracy in drawing.

Disadvantages of Auto-CAD:

1. Line – As AutoCAD produces drawings with help of line and shape tools and curves, arcs and straight lines helps in producing shapes. But AutoCAD is useless in editing line and location as freely as in case of illustration programs. It create drawing with only help of lines it does not use volumetric models as we use in Building Information Modelling (BIM). In case of 3D geometry it uses limited effects.
2. Limited File Formats – As it is leading CAD, it limits number of file formats it can import or export. This cause a problem while using more powerful tools and exporting program to an AutoCAD format i.e geometry, color and effects are almost lost.
3. Color, Fill and Texture – For color, fill and texture in AutoCAD user uses line and hatch tools. But in AutoCAD there are limited colors i.e only 256 and hatching provides only texture, we did not obtain photo realistic images as in illustration programs.
4. Non-Parametric – To create 3D models, there are various tools and to edit models time various steps are to be followed which consumes alot of time which is automatically edit in case of Building Information Modelling (BIM)

Q11. Write any six shortcut keys with their use for different 2D commands you used in Auto CAD that saves your time.

- Ans. 1. ARRAY AR Creates Rectangular, Path or Polar 2D arrays.  
2. CHAMFER CHA Used to create chamfers  
3. CIRCLE C Used to create a circle.  
4. FILLET F Used to create a fillet at the corner.  
5. LINE L Used to create a line.  
6. MIRROR MI Used to create a mirror image of an object.  
Etc. (Write any six)



THEORY 1 <sup>st</sup> - IN-SEM EXAMINATION			
SESSION: 2022-23(SUMMER SEMESTER)			
B.Voc/M.Voc	B.Voc	Semester	5 <sup>th</sup>
Course name / Module	Automotive Mechatronics SYSTEM		
Course code	AUT1501		
Date			
Name of the Student			Reg. No.

INSTRUCTIONS
<ul style="list-style-type: none"> <li>• Maximum Marks: <b>20</b></li> <li>• Duration of Examination: <b>01 Hour</b></li> <li>• Attempt all questions.</li> </ul>

<b>1. Section A</b> (05 objective type questions, each question carries 01 mark)	<b>05×1 = 05</b>
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Q1. Which of the below is not a function of the Engine Management System?

- Maximum Engine Power & Performance
- Maximum Braking Performance
- Lowest Exhaust Emissions
- Lowest Fuel Consumption

Q2. The Engine Functions are controlled by \_\_\_\_\_

- TCM
- BCM
- ECU
- ICU

Q3. The Function of a Sensor is \_\_\_\_\_

- To control the component
- To give output signal to ECU
- To give ground signal to Component
- To give input signal to ECU

Q4. Hall effect sensors are employed as :

- CKP sensor
- Camshaft Position sensor
- Oxygen Sensor
- Both a & b

Q5. A change in the electrical resistivity of a semiconductor or metal when a mechanical strain is applied is described as :

- Piezo - electric
- Piezo - resistive
- Inductive
- None of the above

<b>2. Section B</b> (03 short answer type questions, each question carries 02 marks)	<b>03×02 = 06</b>
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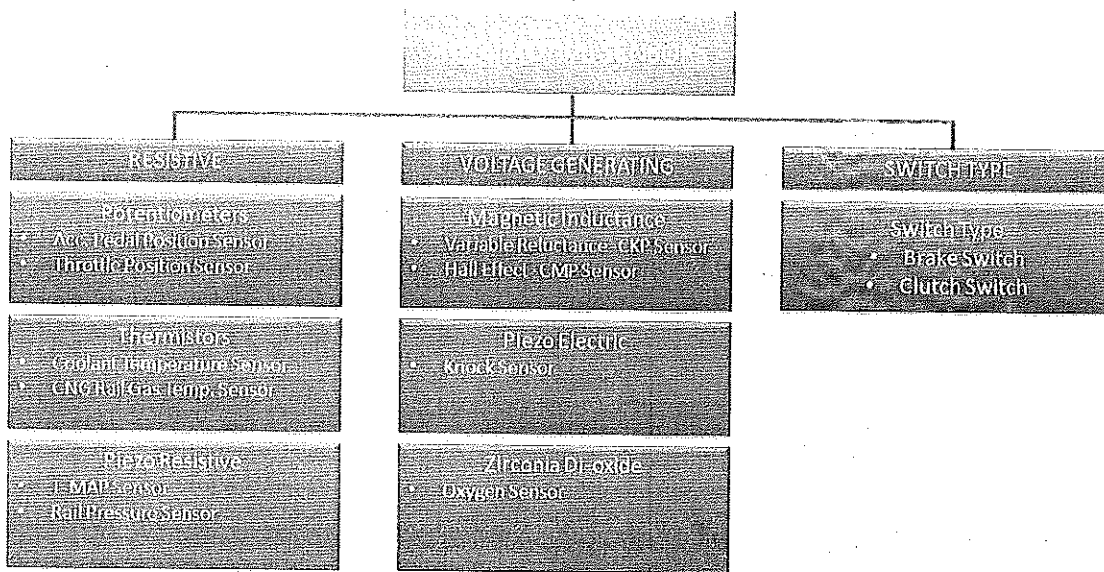
Q6. What is the purpose of the Engine Management System?

Ans: To ensure & meet the emission regulations, it is mandatory to adopt some Engine Control Mechanism where an Electronic Unit can monitor and control the Fuel Delivery & Ignition systems. Hence the Engine Management System along with the OBD (On Board Diagnostic) system came into existence.

OBD is a Diagnostic Mechanism Contained within the ECU that can self-diagnose the system & alert the driver in case of any malfunctions.

Q7. Give the classification of Sensors

Ans: Sensor Classification



Q8. What is the difference between a Mechanical and Mechatronics System?

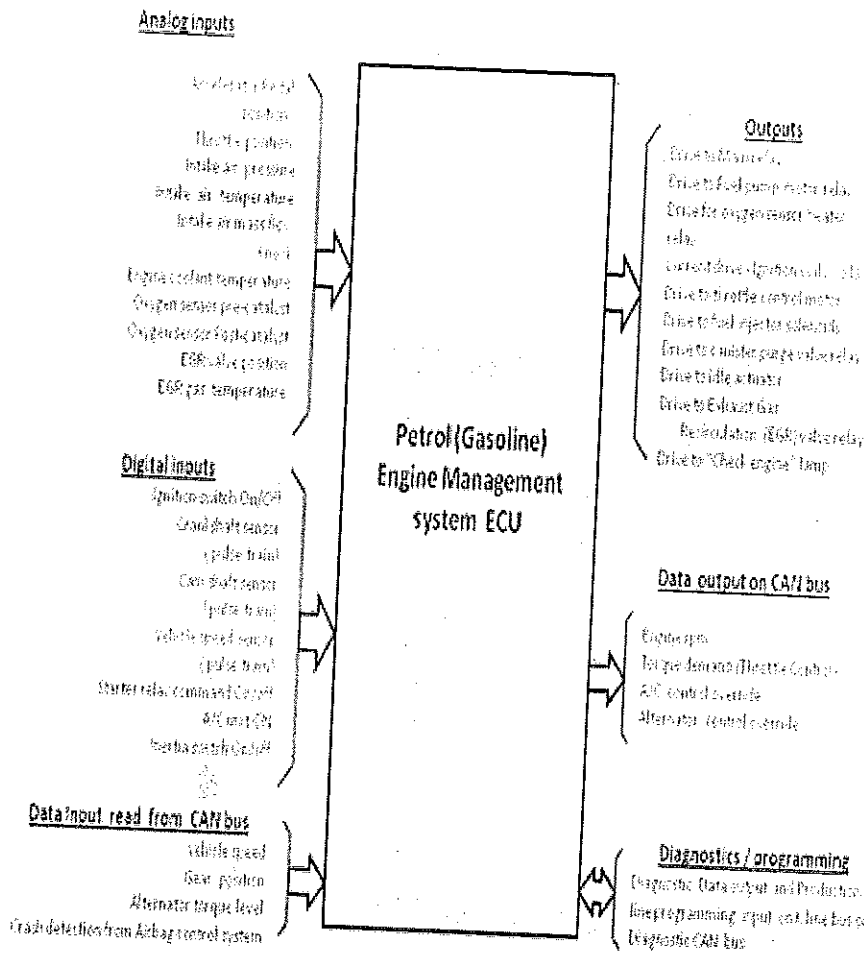
Ans: The basic difference between Mechanical and mechatronics systems is the working capabilities of the system. In Mechanical systems, the action and decision-making both are done by the system only, while in the mechatronics system the decision is taken by a separate entity, and actions are executed by the system as per the decision made by the control unit.

Example: Carburetor is Mechanical system which is replaced by Throttle body in Mechatronics system

<b>3. Section C</b> (03 long type questions, each question carries 03 marks)	<b>03×03 = 09</b>
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Q9. Explain the engine Management system used in IC Engine

Ans: The EMS is essential to ensure a quick response to a driver's input of required thrust as input through the accelerator pedal, and optimum fuel consumption under all driving conditions within the performance parameters while continuously monitoring the system to sense faults or potential faults. The EMS uses a set of sensors that input the signals of different system parameters, and a set of actuators that are driven by the EMS to achieve the control objectives stated above. A quick reference block diagram in Fig gives the inputs and outputs comprising the EMS for a petrol engine is given below. The normal power supply interfaces namely Battery +, Ignition +, the system ground, and the sensor ground are not explicitly shown in the interface diagram.

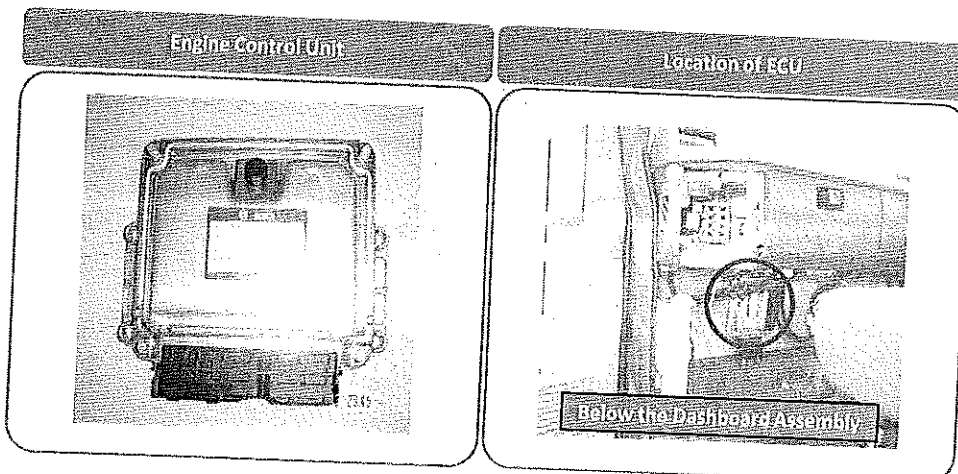


The complete system can be divided in following subsystems

1. Air intake system: Responsible for controlling the intake air, which includes a throttle body fitted with TPS, MAP, and Iat sensors. IAC Valve is also fitted to have a supply of air during a cold start.
2. Fuel Delivery System: Responsible for delivery of fuel to the engine via injectors fitted in the intake manifold.
3. Electronic control system: Include the ECM, which acts as the brain of the system and takes decisions on the basis of inputs received from the various sensors.
4. Emission control system: Responsible for controlling the emissions coming out from the exhaust and includes measures to reduce the pollutants from the exhaust.

Q10. Explain ECU along with its Functions

Ans: **Engine Control Unit (ECU):** ECU is the brain of the engine. ECU collects all the sensor data about the operation parameter of components & controls the actuators to do certain function based on the sensor inputs.



It has some predetermined values or parameters in its software. ECU has inbuilt OBD2 diagnosis option through which the diagnostic fault codes can be retrieved.

**ECU Functions:**

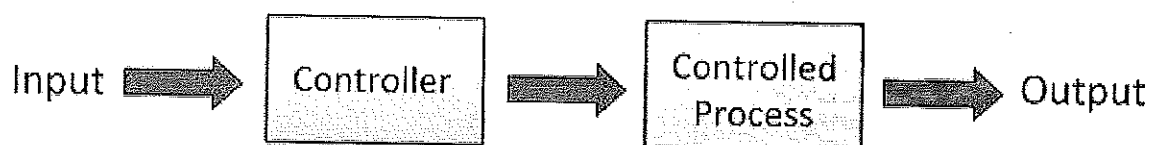
ECU is the brain of the Engine. It decides the amount of fuel, ignition timing, and other parameters of the engine which are required to keep it running in good condition and also at the optimum condition.

The advantages & features of ECU are Internal diagnostics and safety checks, Fuel quantity governing, Fuel Injection timing control, Boost pressure monitoring, Limp home functions in case of System Failure, etc.

Limp Home Function: In case of EMS sensors or any sensor failure or system failure, the ECU defaults to its predetermined default setting so that the vehicle can be driven at a limited speed at the nearest destination like home or workshop.

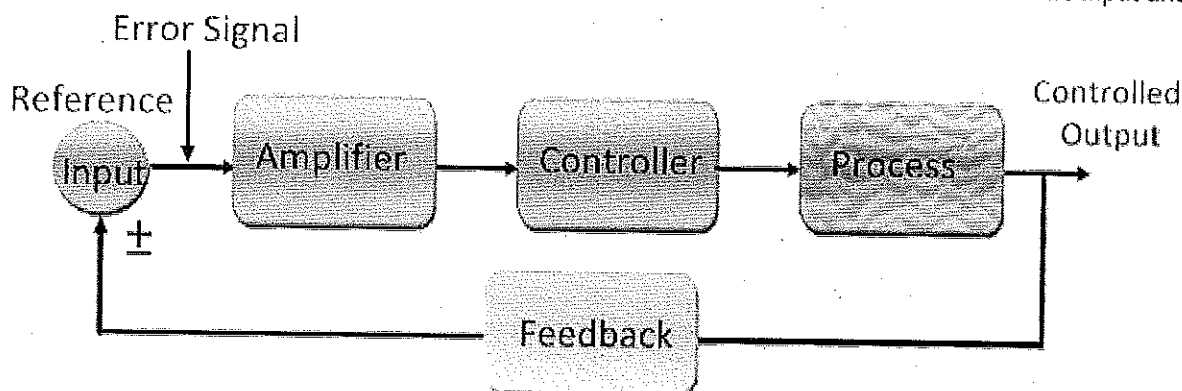
Q11. What do you understand by open loop and closed loop systems? Explain with the help of a Block diagram.

Ans: Open Loop Control System: In an open loop control system, the output does not affect the control action of the system. In other words, the system whose working depends on time is known as the open loop control system. The open loop system is free from feedback. The open loop system is simple and requires less maintenance. Also, it is fast in operation and very economical. But the accuracy of the system is less, and it is less reliable.



Open Loop System

Closed Loop Control System: The closed-loop control system means the output of the system depends on its input. The system has one or more feedback loops between its output and input. The closed-loop system is designed in such a way that they automatically provide the desired output by comparing it with the actual input. The closed-loop system generates the error signal which is the difference between the input and output.



Closed Loop Control System

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SESSION: 2022-23 (SUMMER SEMESTER)			
<b>B. Voc.</b>	<b>Semester</b>	5 <sup>th</sup>	
<b>Course Name</b>	Automotive Electrical System		
<b>Course Code</b>	AUT1502		
<b>Date</b>			
<b>Name of the Student</b>		<b>Reg. No.</b>	

INSTRUCTIONS
<ul style="list-style-type: none"> <li>• Maximum Marks: <b>20</b></li> <li>• Duration of Examination: <b>01 Hour</b></li> <li>• Attempt all questions.</li> </ul>

<b>1. Section A</b> (05 objective type questions, each question carries 01 mark)	<b>05×1 = 05</b>
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- Air consists of.....
  - only Oxygen.
  - Oxygen and CO<sub>2</sub>.
  - mostly NO<sub>x</sub> and Oxygen.
  - 78% Nitrogen, 21% Oxygen.**
- The two most important information for the fuel injection are.....
  - temperature and load.
  - load and rpm.**
  - fuel pressure and rpm.
  - voltage and load.
- A sensor.....
  - receives orders from ECU.
  - sends information to ECU.**
  - needs always 12 volts.
  - sends orders to ECU.
- What belongs to the MOST?
  - Catalytic converter, Audio.
  - Internet, Media, Graphics.**
  - OBD, ABS.
  - The starter motor.
- Current for a starter motor is about.....
  - 350 A.**
  - 240 V.
  - 1.75 A.
  - 60 Ah.

<b>2. Section B</b> (03 short answer type questions, each question carries 02 marks)
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<b>03×02 = 06</b>
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6. What do you understand by an oscilloscope? Describe the use of oscilloscope in basic electrical measurements.

**Answer:** An oscilloscope is an instrument that graphically displays electrical signals and shows how those signals change over time. Engineers use oscilloscopes to measure electrical phenomena and quickly test, verify, and debug their circuit designs. The primary function of an oscilloscope is to measure voltage waves.

7. Name & briefly describe different types of pressure testing in a vehicle.

**Answer:**

a. Coolant Pressure Testing:

Cooling system pressure testers save you the agony of an overheating engine or even its eventual failure.

b. Oil Pressure Testing:

Your car oil pressure can actually be a significant indicator if your engine bearings are worn out or if your engine oil is dirty. However, there are still a lot of other possible causes of unstable oil pressure. That is why you have to be able to know when your car pressure is still normal or not.

c. Fuel Pump Testing:

Diagnosing fuel problems with a car is relatively easy. You hook up a gauge to the fuel rail, attempt to start the car, and then read the number. However, one of the most annoying things that can happen when you work on cars is finding out that you need to do a specific test, but you don't own a tool that can perform that test. A fuel pressure tester is one of the special tools that can make you want to smash things if you find out you need one and don't have one.

8. Give reason for what to check in an electric starter motor if it is not starting and creating a sound of clac...clac...clac.

**Answer:**

- A weak battery.
- Loose, damaged, or corroded battery cables.
- A faulty starter solenoid or relay.
- A bad starter motor.

<b>3. Section C</b> (03 long type questions, each question carries 03 marks)
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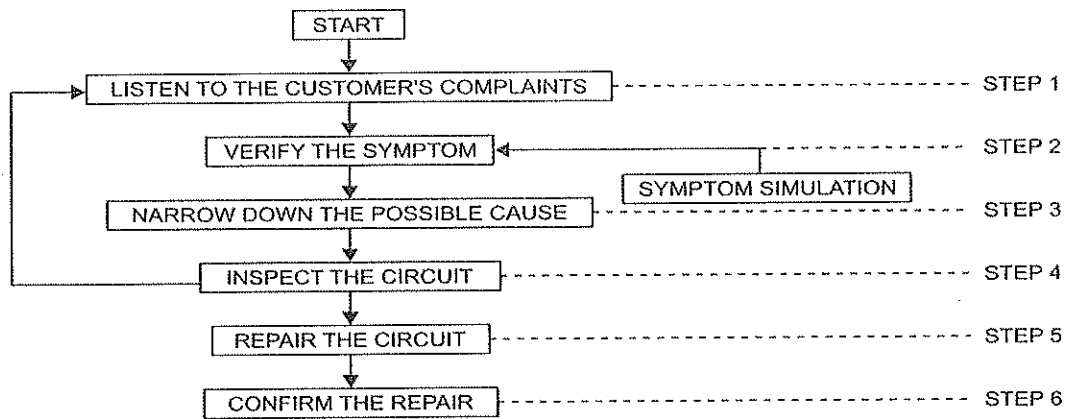
<b>03×03 = 09</b>
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9. Explain MOST (Media Oriented System Transport).

**Answer:** MOST (Media Oriented Systems Transport) is a high-speed multimedia network technology optimized by the automotive industry. It can be used for applications inside or outside the car. The serial MOST bus uses a daisy-chain topology or ring topology and synchronous data communication to transport audio, video, voice and data signals via plastic optical fiber (POF) (MOST25, MOST150) or electrical conductor (MOST50, MOST150) physical layers. MOST technology is used in almost every car brand worldwide, including Audi, BMW, General Motors, Honda, Hyundai, Jaguar, Lancia, Land Rover, Mercedes-Benz, Porsche, Toyota, Volkswagen, SAAB, SKODA, SEAT and Volvo. SMSC and MOST are registered trademarks of Standard Microsystems Corporation ("SMSC"), now owned by Microchip Technology.

10. Describe the optimal system approach to the electrical fault diagnosis in a vehicle.

**Answer:**



11. Explain the followings:

- a. Automotive Ethernet.
- b. Multiplexing.
- c. Emission Testing.

**Answer:**

a. Automotive Ethernet: The Ethernet used in automotive vehicles such as cars is known as automotive Ethernet. It is a physical network which is used to connect various components within a car using wired network.

This Ethernet type has following features:

- Should support High Data Rate without EMI/EMC problems.
- Should meet latency, synchronization and bandwidth requirements.
- Power should be delivered over Ethernet cables.
- Should support distributed network architecture for communication.
- Should work with TCP/IP based protocols.

b. Multiplexing: Multiplexing means transmitting several signals or information streaming on one line at the same time in the form of a single, complex signal and then breaking them down into separate signals on the receiving side.

c. Emission Testing: Emissions testing determines the level of air pollutants emitted from the exhaust of a motor vehicle. The first emissions testing was done in California in 1966.



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SESSION: 2022-23(SUMMER SEMESTER)			
B.Voc/M.Voc	B.Voc	Semester	5 <sup>th</sup>
Course name / Module	Workshop Management		
Course code	AUT1503		
Date			
Name of the Student		Reg. No.	

### INSTRUCTIONS

- Maximum Marks: **20**
- Duration of Examination: **01 Hour**
- Attempt all questions.

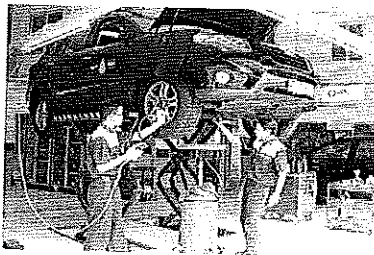
### 1. Section A (05 objective type questions, each question carries 01 mark)

**05×1 = 05**

Q1. Who among below is the face of the Dealership for Customers?

- Technician
- Works Manager
- Warranty In charge
- Service Advisor

Q2. Identify the picture below:



- Accident Repair Bay
- Washing Bay
- Quick Service Bay
- PDI Bay

Q3. Arranging the necessary Items in place for easy access

- SEIRI
- SEITON
- SEISO
- SAIKETSU

Q4. What must you do when tidying up in the workshop?

- Hang up the aprons correctly on the stand
- Put the tools away in their places on the shadow board
- Sweep up the dust on the floor
- All of the above

Q5. Which is the best description of kaizen?

- a) A slow process of continuous improvement
- b) A quick process of continuous improvement
- c) A process to re-engineer all company processes
- d) A process to have outside consultants implement improved methods of production

**2. Section B** (03 short answer type questions, each question carries 02 marks)

**03×02 = 06**

Q6. Write the responsibilities and duties of the technician.

Ans: Technician's primary responsibilities & duties are:

- Maintaining quality in the repairs & maintenance of customer vehicles. Following the fix-it-right first-time policy means always finding out the cause for the fault & fix them. Do not make the customer come for the same fault again.
- Taking proper care of customer vehicles during service. Do not soil or use customer belongings inside the vehicle. Use seat covers, and steering covers while performing repairs on the vehicle. Do not scratch or make any damage to the vehicle.
- Follow the 5S principles in the workshop, which means keep everything in its place after use & discard the waste immediately.
- Always practice safety in the workshop. Wear safety shoes & PPEs (Personal Protective Equipment) and use the correct tools for repairs. Use safety instructions while using the Tools, Equipment & pieces of machinery.
- Follow the instructions carefully. Whether it is from your supervisor or any senior person. Also, follow the instructions of the workshop procedures.

Q7. What is KAIZEN?

Ans: KAI ZEN is the Japanese way of organizing things & staying that way. It is a really cost-effective way. In Japanese KAI means Change & ZEN means Good. It means change for good.

The Kaizen approach consists of 5 founding elements:

- teamwork,
- personal discipline,
- improved morale,
- quality circles,
- suggestions for improvement.

Q8. What are the various safety measures in the Automobile workshop

Ans: Safety Requirements for Auto Repair Shop

There are many requirements every auto repair shop needs to take care of when it comes to the safety of others;

- Clean Up the Spills Immediately
- Sweep the Floors Regularly
- Wear Sturdy Work Boots
- Wearing Proper Work Gloves
- Appropriate Eye Wear
- Wearing Workshop Apparel
- Eating or Consuming Drinks must be confined to the kitchen
- Dispose of the Waste Correctly

- Proper Electrical safety

<b>3. Section C</b> (03 long type questions, each question carries 03 marks)	<b>03×03 = 09</b>
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Q9. Explain ABC Analysis

Ans: ABC analysis is a method that entails categorizing items based on their perceived value and is used in inventory management. It helps companies identify the most valuable products that match their customers' demand, control and allocate resources efficiently, reduce obsolete inventory, and increase sales.

ABC analysis enables businesses to figure out how to manage their inventory based on the key metrics. A brand needs to understand customer demand to determine whether its clients will buy a certain product. Companies that opt for ABC analysis have a chance to analyze their demand and manage their inventory based on this data.

One more reason businesses use ABC analysis is stock optimization. To meet customer needs, obtain a significant sales volume, and a higher profit, a company should categorize its products based on demand, importance, and profit. With the received information in mind, business owners can set prices for their products or services strategically.

To do an effective ABC analysis, you need to follow a particular sequence of actions. We've prepared six steps for you to consider when implementing this method into your business strategy. Stick to these steps to conduct a successful analysis.

1. Define the things you want to analyze. The main goal of ABC analysis is to determine the importance of each product. The method enables you to identify the most and least profitable items. As a result, you'll be able to improve the financial performance of your company. Think of the items you need to analyze to understand their value for consumers and the profit they bring.
2. Gather the necessary information. Once you define the inventory to analyze, collect information about ordering and carrying costs. Leverage one of your accounting tools to obtain this data.
3. Sort your goods. Before diving into the process, sort your products based on their cost. Rank them from the most expensive to the cheapest ones.
4. Figure out the impact of your products on the company. List down the products in a spreadsheet and find out the influence each of them has on your business. Divide the goods and their annual costs.
5. Divide your products into three classes based on demand. Now it's time to split up your goods into categories based on the main principle of ABC analysis. Divide your products into three groups: A — the most valuable products that bring 80% of your profit, category B — less popular and valuable products that bring 15%, and C — items that bring 5% of revenue.
6. Analyze the obtained data. In the end, you'll have a spreadsheet with items that generate the most revenue and those that aren't popular with your buyers. Check out the list to find the money makers at the top. Once you obtain the necessary information about high priority and low priority products, use it to your advantage. Remember that you still need to track your goods' pricing and selling performance to ensure that their positions don't fluctuate.

Q10. Explain 5S Technique

Ans: 5 S Steps are as follows

1. SEIRI: Sorting:

- The first step involved in this procedure is to eliminate unnecessary items from the shop floor. For example, you remove any unused books from your study table. This step is called SEIRI and is the first step towards KAIZEN.

- Advantages - Simplification of Task & Effective use of space.

## 2. SEATON: Systematizing:

Moving on the next step is to plan an order for your materials so that you have easy access to them when needed. Let's go to our previous example of a study desk, I will say the material and you should tell me the proper or appropriate space for them. Waste paper – Dust bin, Pen – Pen holder, loose papers – Files: folders. This step is called SEATON.

Put everything in the assigned place so that it can have easy & quick access as well returns to the place. If everyone's quick access to the items, the work floor becomes efficient.

## 3. SEISO: Cleanliness:

So now we have eliminated the unwanted materials, kept them in order now we have to clean all the materials. Cleaning your workplace will bring a new image to your work place. This step is called SEISO or shine

It is the responsibility of all to keep the workplace clean. Everyone should see workplace through eye of the visitor

## 4. SAIKETSU: Standardizing:

Step number four involves standardizing so that all will follow this procedure to keep the workplace organized and clean. This step will ensure that this will continue to remain neat & clean.

## 5. SHITSUKE: Discipline

Now the final step is the hardest to do the last four steps need to be done continuously to maintain the KAIZEN workplace. This can be only done through self-discipline. This last step is called SHITSUKE

### Q11. Write the functions of the Workshop Manager

Ans: Following are the functions of the Works Manager

- Forecasts goals and objectives for the department and strives to meet them.
- Hires, trains, motivates, counsels, and monitors the performance of all service department staff.
- Prepares and administers an annual operating budget for the service department.
- Maintains reporting systems required by general management and the factory.
- Monitors and controls the performance of the department using appropriate reports, tracking systems, and surveys.
- Strives for harmony and teamwork within the department and with all other departments.
- Develops and implements a marketing plan which promotes new and repeat business.
- Understands, keeps abreast of, and complies with federal, state, and local regulations that affect service operations, such as hazardous waste disposal, OSHA Right-to-Know etc.
- Understands and ensures compliance with manufacturer warranty and policy procedures.
- Directs and schedules the activities of all department employees.
- Facilitates and/or conducts technical training and sends employees to appropriate training schools as needed.
- Monitors technicians' daily productivity reports and corresponding payroll records.
- Monitors and follows up on parts orders with the parts manager to ensure availability.
- Initials all repair orders before submitting them to the warranty department, monitoring for sales and hours relative to expectations.
- Establishes and maintains good working relationships with customers to encourage repeat and referral business.

<b>THEORY 1<sup>st</sup> - IN-SEM EXAMINATION</b>			
<b>SESSION: 2022-23(SUMMER SEMESTER)</b>			
<b>B.Voc/M.Voc</b>	<b>Semester</b> 5 <sup>th</sup>		
<b>Course name / Module</b>	Paint Shop Management		
<b>Course code</b>	AUT1504		
<b>Date</b>	___ Oct - 2022		
<b>Name of the Student</b>		<b>Reg. No.</b>	

<b>INSTRUCTIONS</b>
<ul style="list-style-type: none"> <li>• Maximum Marks: <b>20</b></li> <li>• Duration of Examination: <b>01 Hour</b></li> <li>• Attempt all questions.</li> </ul>

<b>1. Section A</b> (05 objective type questions, each question carries 01 mark)	<b>05×1 = 05</b>
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Q. 1 What are the three things we need during color matching?

- a. **Sunlight, Object, Eye**
- b. Paint, hardener, clear
- c. Plastic primer, Flexible additive, thinner
- d. None of the mention

Q.2 Painter A says, mixing room must have flash proof lights.

Painter B Says, flash proof light is not mandatory for paint mixing room.

Who is correct?

- a. **Painter A**
- b. Painter B
- c. Both (a) & (b)
- d. None of the mentioned

Q. 3 Volatile Organic Compounds are found in:

- a. Paint
- b. Thinner
- c. Catalyst and hardener
- d. **All of the above**

Q.4 What is meaning of VOC?

- a. **Volatile organic compound**
- b. Volatile organic complaint
- c. Volatile organic class
- d. None of the mentione

Q.5 The best light for color matching?

- Natural day light
- Fluorescent light
- Sodium light
- None of the mentioned

**2. Section B** (03 short answer type questions, each question carries 02 marks) **03×02 = 06**

Q.6 What is transfer efficiency? How it can be calculated?

Ans:- It is defined as the ration of weight of solid coating deposited on the metal and the weight of solid coating provided for the application.

Weight of solid coating (gm):-

$$\frac{\text{Weight of liquid} \times \text{Weight of solids}}{100} \%$$

Q.7 Brief about the following:

- Pot life
- Shelf life

Q.8 Describe about different type of spray guns on the basis of paint supply method.

Ans:

Type	Paint Supply Method	Advantage	Disadvantage
Gravity Feed Type	The paint cup is located above the fluid tip of the spray gun. Paint is supplied to the fluid tip by the paint's own gravity, as well as the suction force that is created at the fluid tip.	Fluctuations in the amount of paint discharged due to paint viscosity variations, is kept to a minimum.	Not suitable for continuous paint operation over a wide work area because of the small cup capacity.
Suction Feed Type	The paint cup is located below the fluid tip of the spray gun. Paint is supplied by the suction force created at the fluid tip.	Suitable for spraying over a wide work area because of the large cup capacity.	Heavy because of the large cup capacity.
Compression Type	The paint tank and the spray gun are kept separate. The paint is pressurized in the paint tank by compressed air, or by a pump, and supplied to the spray gun.	Suitable for continuous painting operation over large areas. Can be used with high viscosity paint	Not suitable for small paint jobs.

<b>3. Section C</b> (03 long type questions, each question carries 03 marks)
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<b>03×03 = 09</b>
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Q.9 What is colour matching, also write manual paint mixing procedure.

Ans.

- First of all identify color code of the vehicle.
- Find particular shade card.
- Check availability of all the mentioned tintars.
- While Manual mixing always follow HUE chart.
- Always pour binder first in mixing cup or jar.
- After that pore remaining tinters accordingly.
- Pore thinner and hardener according to

manufacturer recommendation.

Q.10 Explain colour matching techniques.

Ans.

- Accurately select the right color on the correct area of the car, in a correctly illuminated area (if needed different light sources can be used, in order to achieve the right color).
- Use the fan deck with up-to-date color chips, which must be in good condition.
- Use a spray gun with correct settings (opening and inlet pressure).
- Set the gun up with a fully open spray gun and do not modify the pattern
- After setting up the spray gun (the color sample is applied using the gun "fully open").
- Use color samples of 10x15 cm minimum (don't use smaller samples, as these are too sensitive for application variations).
- Apply Century® preferably over a fully cured 2K primer or equivalent, using the right Value Shade®.
- Apply Centari® over the complete panel (from top to bottom, using 50% overlap).
- Let it dry. Respect the recommendations for drying the basecoat, being maximum temperature = 40°C, with the airflow not exceeding 1.5 - 2.0 m/sec.
- Apply the clear coat before evaluating the color.

Q.11 Write the factors which effect the transfer efficiency of a spray gun?

Ans

- Part size
- Part geometry
- Gun-target distance
- Coating viscosity
- Ease with which coating can be atomized
- Spray gun design and method of atomization
- Fluid pressure

- Atomizing air pressure
- Fan size
- Overlapping of successive spray gun strokes
- Orifice diameter of spray gun cap
- Air velocity in the spray booth
- Air balance in the spray booth

THEORY 1 <sup>st</sup> - IN-SEM EXAMINATION			
SESSION: 2022-23(SUMMER SEMESTER)			
B.Voc/M.Voc	M.Voc	Semester	1 <sup>st</sup>
Course name / Module	Elements of Automotive Engineering		
Course code	AUT2101		
Date			
Name of the Student		Reg. No.	

### INSTRUCTIONS

- Maximum Marks: **20**
- Duration of Examination: **01 Hour**
- Attempt all questions.
- Assume suitable data if required

**1. Section A** (05 objective type questions, each question carries 01 mark)

**05×1 = 05**

Q1. In a diesel engine, the fuel is injected by.....

- A. Spark
- B. Injector
- C. Ignitor
- D. Heat resulting from compression air that is supplied from combustion

Q2. The compression ratio of the I.C. engine is.....

- A. The ratio of volumes of air in the cylinder before compression stroke and after compression ratio
- B. Volume displaced by piston per stroke and clearance volume in the cylinder
- C. Ratio of pressure after compression and before compression
- D. None of the above

Q3. A theoretically correct mixture of air and petrol is .....

- A. 10:1
- B. 15:1
- C. 20:1
- D. 25:1

Q4. In a four-stroke engine, the working cycle is completed in.....

- A. One revolution of the crankshaft
- B. Two revolutions of the crankshaft
- C. Three revolutions of the crankshaft
- D. Four revolutions of the crankshaft

Q5. The power developed by the engine cylinder of an I.C. engine is known as.....

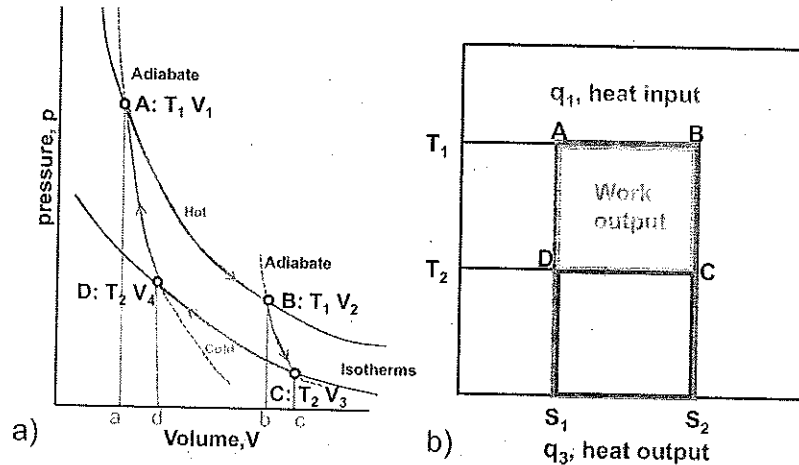
- A. Indicated power
- B. Break power
- C. Actual power
- D. None of the above

**2. Section B** (03 short answer type questions, each question carries 02 marks)

**03×02 = 06**

Q6. Draw PV and T-S Diagram for Carnot cycle

Ans:



Q7. Why MPFI technology is used in current IC Engines

Ans: MPFI technology is used in current IC Engines for the following reasons

- It increases the fuel efficiency of the engine
- With the MPFI system vehicle have fewer emissions
- Better atomization of fuel
- It encourages better utilization and distribution of fuel within an engine
- Smooth operation of the engine
- It reduces the difference in power, produced by each cylinder
- Better acceleration and deacceleration of engine
- In improves durability and functionality of the engine
- It is reliable
- It improves cold start characteristics of the engine
- It reduces vibrations in the engine

Q8. Define any three performance parameters of IC Engine

**Ans: Indicated Horse Power (I.H.P.)**

The power actually developed inside the engine cylinder by the combustion of the fuel is called indicated horsepower.

**Brake Horse Power (B.H.P.)**

The power which the engine actually delivers to do the outside work is called brake horsepower. It is usually 70 to 85% of its indicated horsepower. It can be measured by some measuring instruments like a pony brake or dynamometer.

**Volumetric Efficiency**

The volume of the air-fuel mixture drawn into the cylinder at atmospheric pressure during the intake stroke compared to the volume of the cylinder is known as volumetric efficiency.

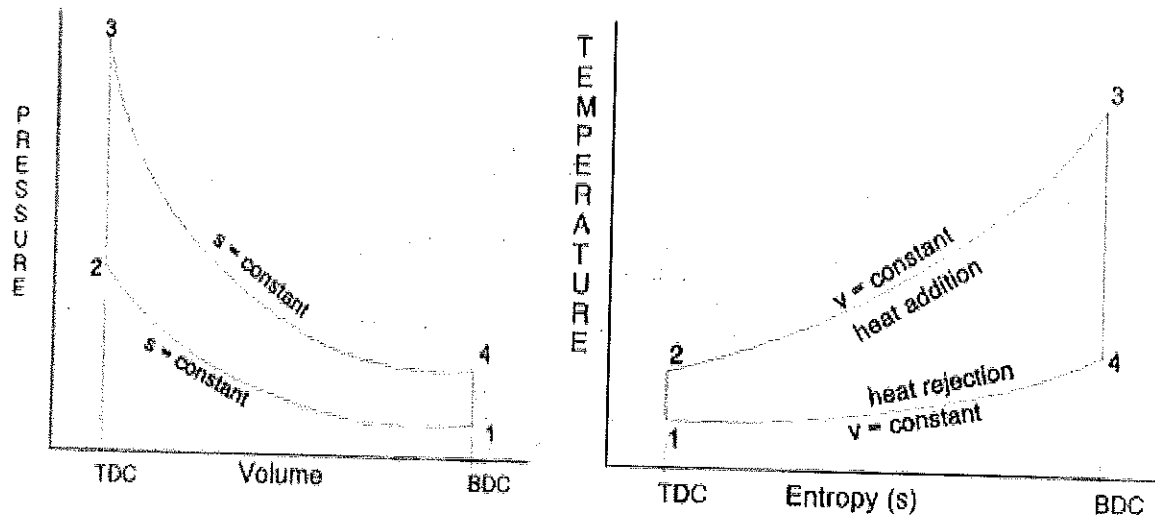
**3. Section C** (03 long type questions, each question carries 03 marks)

**03×03 = 09**

Q9. Derive the relation for efficiency for Otto Cycle

Ans: Otto cycle: Efficiency

Otto cycle is one type of air standard cycle which is designated as the ideal cycle for the operation of internal combustion spark ignition reciprocating engines. Before understanding the method for determination of the efficiency of the Otto cycle, we will have to remind here various processes involved. Therefore first let us see an overview of an Otto cycle with the help of PV diagram and TS diagram as displayed here in following figure. As we can see in below figure, there will be two isentropic or adiabatic processes and two constant volume processes. We will determine the various properties for unit mass of working fluid.



**PV and TS Diagram for Otto cycle**

Process 1-2: Compression stroke

Let us use the concept of first law of thermodynamics

$$Q = \Delta U + W$$

As we have already seen that process 1-2 will follow constant entropy process and therefore  $Q = 0$

Hence we will have from first law of thermodynamics  $\Delta U = -W$

$$\Delta U = C_v (T_2 - T_1)$$

$$W = C_v (T_1 - T_2)$$

Process 2-3: Combustion stroke

As we have already seen that process 2-3 will follow constant volume process and therefore  $W = 0$

$$Q = \Delta U = C_v (T_3 - T_2)$$

Hence, heat energy addition to the system  $Q = Q_1 = C_v (T_3 - T_2)$

Process 3-4: Expansion or power stroke

As we have already seen that process 3-4 will follow constant entropy process and therefore  $Q = 0$

Hence we will have from first law of thermodynamics  $\Delta U = -W$

$$\Delta U = C_v (T_4 - T_3)$$

$$W = C_v (T_3 - T_4)$$

Process 4-1: Blow down

As we have already seen that process 4-1 will follow constant volume process and therefore  $W = 0$

$$Q = \Delta U = C_v (T_1 - T_4)$$

Hence, heat energy rejection from the system  $Q = Q_2 = C_v (T_4 - T_1)$

② → ③ Constant Volume Combustion  
 Heat in during combustion:  $q_{23} = 800 \text{ [kJ/kg]}$   
 $q_{23} - w = \Delta u = C_v \Delta T = C_v (T_3 - T_2)$   
 $\Rightarrow 800 \text{ [kJ/kg]} = 0.834 \left[ \frac{\text{kJ}}{\text{kg K}} \right] (T_3 - 613) \text{ K}$   
 $T_3 = 1572 \text{ K}$   
 $\frac{P_3 v_3}{T_3} = \frac{P_2 v_2}{T_2} \Rightarrow P_3 = P_2 \left( \frac{T_3}{T_2} \right) = 1635 \text{ [kPa]} \left( \frac{1572}{613} \right)$   
 $P_3 = 4193 \text{ kPa}$

③ → ④ - Adiabatic expansion  
 $T v^{k-1} = \text{const} \Rightarrow T_4 = T_3 \left( \frac{v_3}{v_4} \right)^{k-1} = T_3 \left( \frac{1}{r} \right)^{k-1}$   
 $\Rightarrow T_4 = 1572 \left( \frac{1}{8} \right)^{0.344} = 769 \text{ K}$   
 $\frac{P_4 v_4}{T_4} = \frac{P_3 v_3}{T_3} \Rightarrow P_4 = P_3 \left( \frac{v_3}{v_4} \frac{T_4}{T_3} \right) = 4193 \text{ [kPa]} \left( \frac{1}{8} \frac{769}{1572} \right)$   
 $P_4 = 256 \text{ kPa}$   
 adiabatic  
 $w_{34} = \Delta u = C_v \Delta T = C_v (T_4 - T_3)$   
 $\Rightarrow w_{34} = C_v (T_3 - T_4) = 0.834 \left[ \frac{\text{kJ}}{\text{kg K}} \right] (1572 - 769) \text{ K}$   
 $w_{34} = 670 \text{ [kJ/kg]}$

$P v^k = \text{const} \Rightarrow P_4 = P_3 \left( \frac{v_3}{v_4} \right)^k = P_3 \left( \frac{1}{r} \right)^k$   
 $P_4 = 4193 \text{ [kPa]} \left( \frac{1}{8} \right)^{1.344} = 256 \text{ kPa}$

④ → ① - Constant Volume Exhaust  
 Heat rejected during exhaust process:  
 $q_{41} - w = \Delta u = C_v \Delta T = C_v (T_1 - T_4)$   
 $q_{41} = 0.834 \left[ \frac{\text{kJ}}{\text{kg K}} \right] (300 - 769) \text{ K} = -391 \text{ kJ/kg}$

"Network output per cycle" and the thermal efficiency, as follows:

$w_{\text{net}} = w_{12} + w_{34} = (-261 + 670) = 409 \text{ kJ/kg}$   
 As a check, over a complete cycle:  $w_{\text{net}} = q_{\text{net}}$   
 $w_{\text{net}} = q_{\text{net}} = q_{23} + q_{41} = (800 - 391) = 409 \text{ kJ/kg}$   
 Thermal Efficiency:

$\eta_{\text{th}} = \frac{w_{\text{net}}}{q_{\text{in}}} = \frac{w_{\text{net}}}{q_{23}} = \frac{409}{800} \Rightarrow \eta_{\text{th}} = 51\%$  **ANS**

Efficiency of the Otto cycle

Efficiency of the Otto cycle will be determined with the help of following formula

Efficiency of the Otto cycle

Efficiency of the Otto cycle will be determined with the help of following formula

$$\text{Efficiency } \eta = 1 - \frac{Q_2}{Q_1}$$

$$\text{Efficiency } \eta = 1 - \frac{(T_4 - T_1)}{(T_3 - T_2)}$$

Q10. Explain the working of a four-stroke diesel engine with a suitable diagram

Ans: **Working principle of CI engine:**

1. Suction stroke: During this stroke, the inlet valve is open and the exhaust valve is closed. Only air is sucked into the cylinder during this stroke. The piston moves from TDC to BDC and the crankshaft rotates through  $180^\circ$ .
2. Compression Stroke: The air inducted in the cylinder is compressed to the clearance volume. Both valves are closed during this stroke. The piston moves from BDC to TDC and the crankshaft rotates through  $360^\circ$ .
3. Power stroke or Working stroke: At the end of the compression stroke the fuel (diesel) is injected into the hot compressed air. The rate of injection is such that pressure remains constant instead of the change in the piston position. After injection of the fuel is complete the hot gases expand. The piston moves from TDC to BDC position and the crankshaft rotates through  $540^\circ$ .
4. Exhaust Stroke: The inlet valve remains closed and the exhaust valve opens. The piston moves from BDC to TDC position which pushes the burnt gases outside the combustion chamber. The crankshaft rotates by two complete revolutions through  $720^\circ$ .

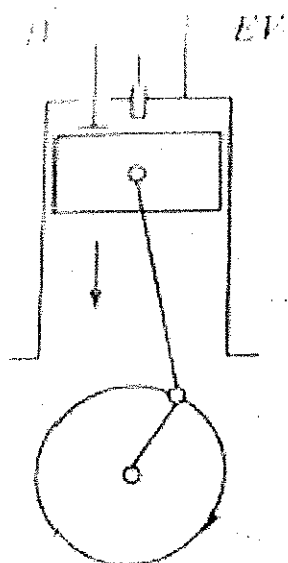


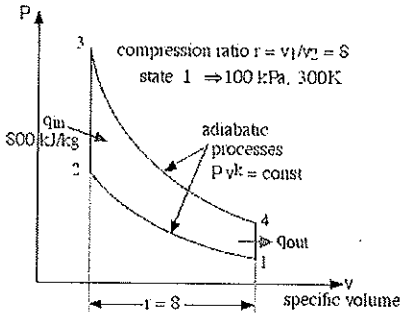
Figure: Working principle of four – stroke C. I. engine



Q11. An ideal air-standard Otto cycle engine has a compression ratio of 8. At the beginning of the compression process, the working fluid is at 100 kPa, 27°C (300 K), and 800 kJ/kg heat is supplied during the constant volume heat addition process. Neatly sketch the pressure-volume [ $P-v$ ] diagram for this cycle, and using the specific heat values for air at a typical average cycle temperature of 900K determine:

- the temperature and pressure of the air at the end of each process
- the network output/cycle [kJ/kg], and
- the thermal efficiency [ $\eta_{th}$ ] of this engine cycle.

Solution: The first step is to draw the  $P-v$  diagram of the complete cycle, including all the relevant information. We notice that neither volume nor mass have been provided, hence the diagram and solution will be in terms of specific quantities.



We assume that the fuel-air mixture is represented by pure air. The relevant equations of state, internal energy and adiabatic process for air follow:

$$Pv = RT, \quad R = 0.287 \text{ [kJ/kg K]}$$

$$\Delta u = C_v \Delta T$$

$$\left. \begin{aligned} \text{adiabatic} &\Rightarrow Pv^k = \text{const} \\ &\Rightarrow T v^{k-1} = \text{const} \end{aligned} \right\} \begin{array}{l} \text{use values of } C_v, k \text{ at} \\ \text{a typical average cycle} \\ \text{temperature} \end{array}$$

nominal specific heat capacity values used for air at 300K are  $C_v = 0.717 \text{ kJ/kg.K}$ , and  $k = 1.4$ .

We now go through all four processes in order to determine the temperature and pressure at the end of each process, as well as the work done and heat transferred during each process.

$$\begin{aligned} &\text{①} \rightarrow \text{②} - \text{Adiabatic compression} \\ &T v^{k-1} = \text{const} \Rightarrow T_2 = T_1 \left( \frac{v_1}{v_2} \right)^{k-1} = T_1 r^{k-1} \\ &\Rightarrow T_2 = 300(\text{K}) \cdot 8^{0.344} = 613 \text{ K} \\ &\frac{P_2 v_2}{T_2} = \frac{P_1 v_1}{T_1} \Rightarrow P_2 = P_1 \left( \frac{v_1}{v_2} \cdot \frac{T_2}{T_1} \right) = 100[\text{kPa}] \left( 8 \cdot \frac{613}{300} \right) \\ &\qquad\qquad\qquad P_2 = 1635 \text{ kPa} \\ &\text{adiabatic} \\ &\int \delta w_{12} = \Delta u = C_v \Delta T = C_v (T_2 - T_1) \\ &\Rightarrow w_{12} = C_v (T_1 - T_2) = 0.717 \text{ [kJ/kg K]} (300 - 613) \text{ K} \\ &\qquad\qquad\qquad w_{12} = -227 \text{ [kJ/kg]} \end{aligned}$$



THEORY 1 <sup>st</sup> - IN-SEM EXAMINATION			
SESSION: 2022-23(SUMMER SEMESTER)			
B.Voc/M.Voc	M.Voc	Semester	1 <sup>st</sup>
Course name / Module	Automotive Vehicle Service		
Course code	AUT2102		
Date			
Name of the Student			Reg. No.

INSTRUCTIONS
<ul style="list-style-type: none"> <li>• Maximum Marks: <b>20</b></li> <li>• Duration of Examination: <b>01 Hour</b></li> <li>• Attempt all questions.</li> </ul>

<b>1. Section A</b> (05 objective type questions, each question carries 01 mark)	<b>05×1 = 05</b>
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Q1. Which among the below is not a component of Steering System?

- Tie-Rod
- Lower Arm
- Steering Gear
- Steering Shaft

Q2. \_\_\_\_\_ component in a steering system is responsible for setting the toe-in angle

- Steering column
- Steering gearbox
- Tie-rods
- Steering pump

Q3. Steering pumps are connected to \_\_\_\_\_

- Crankshaft
- Cam shaft
- Electric motor
- Hydraulic pump

Q4. Which of the following not a benefit of using a power steering?

- More efficient
- Less physical effort
- Low maintenance
- Both b & c

Q5. Which of the following not a benefit of using a power steering?

- More efficient
- Less physical effort
- Low maintenance
- Both b & c

<b>2. Section B</b> (03 short answer type questions, each question carries 02 marks)
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<b>03×02 = 06</b>
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Q6. What do you understand by tire rotation?

Ans: Tyre wear is never uniform on all four wheels whether it is a Front-wheel drive, Rear-wheel drive, Four-wheel drive or All-wheel drive car. The front two tyres always take a greater beating as they are subjected to more pressure due to constant steering and braking and also due to the offset of most of the weight to the front of the car.

Hence in order to have uniform wear of all four tyres, it is advisable to interchange tyres between the front, rear and spare wheel.

There is Four-wheel and Five-wheel rotation method of doing a tyre rotation. Both have different patterns for Front-Wheel, Rear-Wheel, and All-Wheel drive cars.

Q7. Explain Toe-in and camber angle

Ans: **Camber angle** is the inward or outward tilt of the front tires as viewed from the front. The inward tilt is negative, and the outward tilt is positive. Camber is used to distribute the load across the entire tread. Improper camber makes the tire wear on one edge and causes the vehicle to pull to the side that has the most positive camber.

**Toe** is the side-to-side difference in distance between the front and rear of the front tires. If the distance is closer at the front, it's called toe-in. If the difference is closer at the rear, it's called toe-out.

Q8. Why wheel balancing is needed.

Ans: Wheel balancing is something that is strictly concerned with the wheel and the tire correlation. It refers to correcting the imbalance between The weights of the wheel and the tire. Balancing is always done alongside wheel alignment to keep the weight and alignment coordination in sync.

Maintaining a balanced weight in the wheel/tire combination is significant for a smooth and stable drive, less tire wear, and elimination of vibrations. Unbalanced tires increase the risk of wheel and suspension damage massively.

<b>3. Section C</b> (03 long type questions, each question carries 03 marks)
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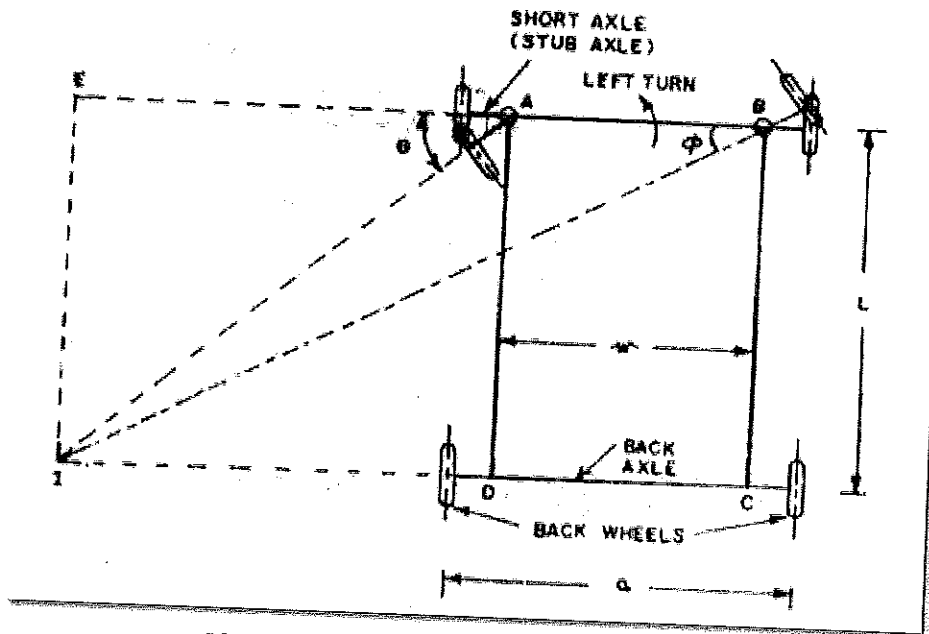
<b>03×03 = 09</b>
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Q9. Derive the relation for the necessary condition of correct steering

Ans: Condition for perfect steering

The condition for perfect steering is that all the four wheels must turn about the same instantaneous centre. While negotiating a curve, the inner wheel makes a larger turning angle  $\theta$  than the angle  $\phi$  subtended by the axis of the outer wheel.

In the fig.1.48,  $a$  = wheel track,  $L$  = wheel base,  $w$  = distance between the pivots of front axles.



**Fig.1.48: Condition for perfect steering**

From  $\triangle AEF$ ,  $\cot\theta = \frac{AE}{EI} = \frac{AE}{L}$  and

from  $\triangle BEI$ ,  $\cot\phi = \frac{EB}{EI} = \frac{(EA + AB)}{EI} = \frac{(EA + w)}{L} = \frac{EA}{L} + \frac{w}{L} = \cot\theta + \frac{w}{L}$

$\therefore \cot\phi - \cot\theta = \frac{w}{L}$

This is the fundamental equation for correct steering. If this condition is satisfied, there will be no skidding of the wheels when the vehicle takes a turn.

Q10. Explain the working of the rack and pinion steering System

Ans: The mostly used steering system is rack and pinion and mostly 80 percent of commercial vehicles are using this type. And this is the simplest one, with fewer parts and easy to design. A rack and pinion is a type of linear actuator that comprises of a pair of gears that convert rotational motion into linear motion. A circular gear called "the pinion" engages teeth on a linear "gear" bar called "the rack"; rotational motion applied to the pinion causes the rack to move relative to the pinion, thereby translating the rotational motion of the pinion into linear motion.

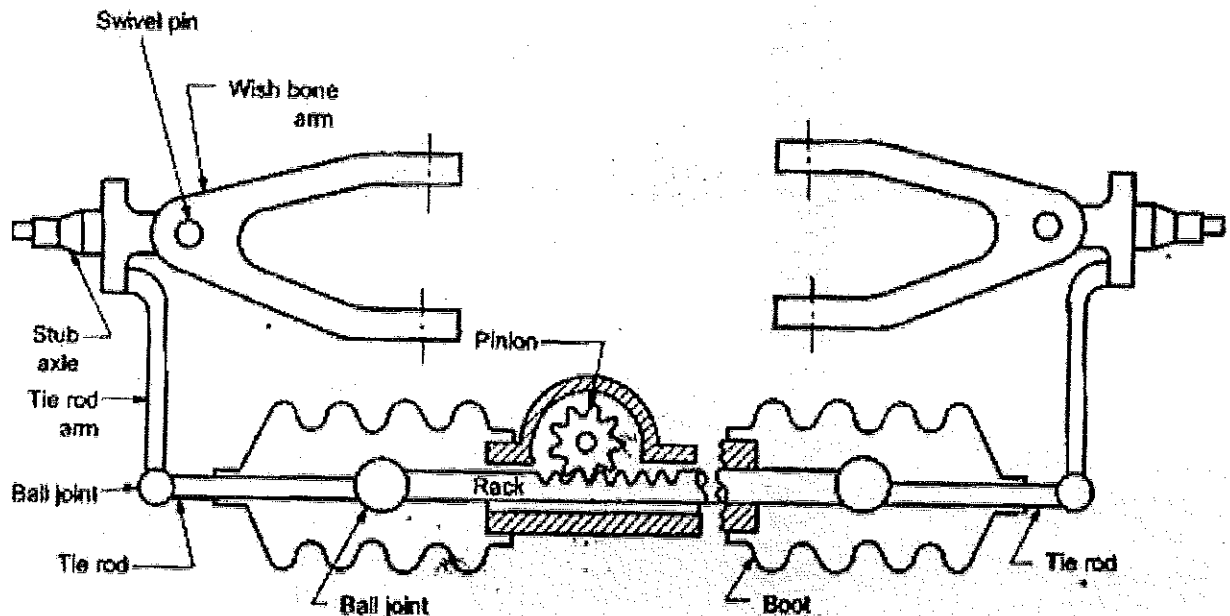
In this type of steering gearbox, a pinion is mounted at the end of the steering shaft. The pinion engages with a rack that is provided with a ball joint at each end in order to allow for the rise and fall of the wheel. The rotary motion of the steering wheel is transmitted to the pinion. The circular motion of the pinion is converted into the linear rack movement, which further transmitted to tie rods to the stub axle through the ball joint.

This type of steering gearbox provides sufficiently low gear reduction for cars and it is quite suitable even for heavier motor vehicles if assisted with power. It occupies very less space and less number of linkages.

Working principle of rack and pinion steering gear:

- The rack-and-pinion steering box has a pinion, connected to the steering column.
- This pinion runs in mesh with a rack that is connected to the steering tie rods. Both the pinion and the rack teeth are helical gears. Helical gearing gives smoother and quieter operation for the driver.
- Turning the steering wheel rotates the pinion, and moves the rack from side to side. Ball joints at the end of the rack locate the tie-rods and allow movement in the steering and suspension.

- Mechanical advantage is gained by the reduction ratio. The value of this ratio depends on the size of the pinion.
- A small pinion gives light steering, but it requires many turns of the steering wheel to travel from the lock, to lock.
- A large pinion means the number of turns of the steering column is reduced, but the steering is heavier to turn.



**Figure: Rack and Pinion Steering Gear Mechanism.**

Q11.Explain the procedure of wheel Alignment

**Ans:** The Alignment Procedure

The first step of an alignment is to test drive the vehicle and assess suspension tuning. The mechanic will then lift the car and inspect it from beneath. If any tire or suspension repairs or replacements are necessary, they will be made before the alignment procedure begins. Additionally, the mechanic will check and adjust tire pressure before connecting the vehicle to the alignment machine. Once the vehicle is connected, the mechanic will make measurements of four primary angles – toe, camber, caster, and thrust – and adjust them to align the suspension.

- Toe is the angle derived from pointing the tires inward or outward from a top-down view. It is critical to maintain even tire wear.
- Camber is the vertical angle of the tires when looking at the vehicle head-on. This configuration impacts the stability of the vehicle, especially at higher speeds.
- Caster measures the steering axis of the vehicle as viewed from the side. It keeps the car on a straight course as intended by the driver.
- Thrust compares the direction of the rear axle relative to the centerline of the vehicle. It also confirms the rear axle is parallel to its front axle, and the wheelbase is equal on both sides of the car. The thrust angle impacts consistencies in handling and turning.

Once the angles have been measured and adjusted, the mechanic will recalibrate the steering wheel to a center position. Finally, another test drive will confirm proper alignment. On average, a vehicle alignment will take 60 to 90 minutes to complete if no suspension components need replacement.

THEORY 1 <sup>st</sup> - IN-SEM EXAMINATION			
SESSION: 2022-23(SUMMER SEMESTER)			
<b>B.Voc/M.Voc</b>	<b>M. VOC</b>	<b>Semester</b>	1 <sup>st</sup>
<b>Course name / Module</b>	AUTOMOTIVE BODY REPAIRS		
<b>Course code</b>	AUT2103		
<b>Date</b>			
<b>Name of the Student</b>		<b>Reg. No.</b>	

### INSTRUCTIONS

- Maximum Marks: **20**
- Duration of Examination: **01 Hour**
- Attempt all questions.
- 

**1. Section A** (05 objective type questions, each question carries 01 mark)

**05×1 = 05**

1. A
2. B
3. B
4. C
5. d

**2. Section B** (03 short answer type questions, each question carries 02 marks)

**03×02 = 06**

1. An automobile repair shop (also known regionally as a garage or a workshop) is an establishment where automobiles are repaired by auto mechanics and technicians.
2. SUV, MPV estete etc
3. Doors fenders, piller are 3

**3. Section C** (03 long type questions, each question carries 03 marks)

**03×03 = 09**

1. Tools are hammer dolly sander etc.
2. Three types of car body sections front section middle sectionand rear sections.
3. Three types
  - a) Ladder chassis
  - b) Backbone chassis
  - c) Monocoque chassis



THEORY 1 <sup>st</sup> - IN-SEM EXAMINATION			
SESSION: 2022-23 (SUMMER SEMESTER)			
<b>B.Voc/M.Voc</b>	<b>M. VOC</b>	<b>Semester</b>	1 <sup>st</sup> .
<b>Course name / Module</b>	AUTOMOTIVE ELECTRICALS		
<b>Course code</b>	AUT2105		
<b>Date</b>			
<b>Name of the Student</b>		<b>Reg. No.</b>	

INSTRUCTIONS
<ul style="list-style-type: none"> <li>• Maximum Marks: <b>20</b></li> <li>• Duration of Examination: <b>01 Hour</b></li> <li>• Attempt all questions.</li> <li>•</li> </ul>

<b>1. Section A</b> (05 objective type questions, each question carries 01 mark)	<b>05×1 = 05</b>
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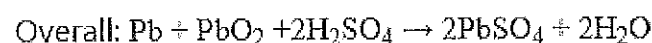
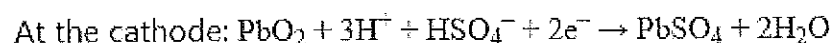
1. A
2. B
3. C
4. D
5. a

<b>2. Section B</b> (03 short answer type questions, each question carries 02 marks)	<b>03×02 = 06</b>
--	-------------------

1. Alternator and startor motor
2. Function is charging of battery working based on electromagnetic induction.
3. When battey is not charging, battery charged more and under voltage charging.

<b>4. Section C</b> (03 long type questions, each question carries 03 marks)	<b>03×03 = 09</b>
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1. Principal and working: When the sulfuric acid dissolves, its molecules break up into positive hydrogen ions (2H<sup>+</sup>) and sulphate negative ions (SO<sub>4</sub><sup>-</sup>) and move freely. ... The SO<sub>4</sub><sup>-</sup> ions being negatively charged moved towards the electrodes connected to the positive terminal of the supply main (i.e., anode).



2. It is a basic law of electromagnetism predicting how a magnetic field will interact with an electric circuit to produce an electromotive force (EMF). This phenomenon is known as electromagnetic induction.
3. Need of charging system is to rum the vehicle



THEORY 1 <sup>st</sup> - IN-SEM EXAMINATION		
SESSION: 2022-23(SUMMER SEMESTER)		
<b>B.Voc/M.Voc</b>	<b>Semester</b>	1 <sup>st</sup>
<b>Course name / Module</b>	AUTOMOTIVE SAFETY AND COMFORT SYSTEM	
<b>Course code</b>	AUT2107	
<b>Date</b>		
<b>Name of the Student</b>		<b>Reg. No.</b>

### INSTRUCTIONS

- Maximum Marks: **20**
- Duration of Examination: **01 Hour**
- Attempt all questions.
- 

**1. Section A** (05 objective type questions, each question carries 01 mark)

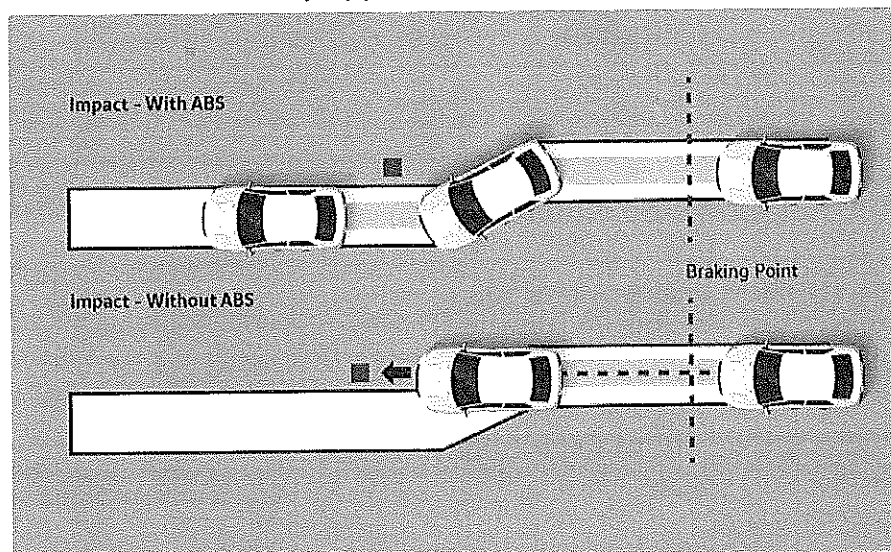
**05×1 = 05**

- a
- b
- c
- d
- a

**6. Section B** (03 short answer type questions, each question carries 02 marks)

**03×02 = 06**

1. ABS prevents wheels from locking when brakes are applied in an emergency. The system ensures that the car comes to a halt with ease and prevents the vehicle from skidding, by keeping it under control. This means that the vehicle is less likely to spin, even when the brakes are fully applied.



2. The chassis of your car comprise of functional elements, including the frame, suspension, steering components, power train, brakes and fuel system. The strength of our body chassis significantly improves control by providing a rigid platform for mounting suspension components.

An indispensable part of the geometry and structure of our cars. They help to maintain the structural integrity of the roof as well as complete the car's safety cell.

Crumple zones are designed to absorb impact energy during a collision so that most of the energy is dissipated across these zones, and not in your passenger compartment. The strong outer shell comes with front and rear crumple zones that help to absorb the impact of a crash, increasing the safety of of occupants

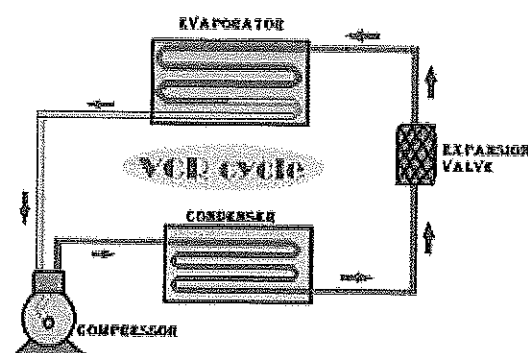
3. The TCS reduces engine output if a wheel spin occurs and adapts the output to suit road surface conditions.

TCS helps the car to start moving, accelerate and climb gradients in unfavorable road conditions.

**7. Section C** (03 long type questions, each question carries 03 marks)

**03×03 = 09**

1. VCRS



2. Active safety

Electronic Stabilisation Control (ESC)

Anti-lock Braking System (ABS)

Traction Control System (TCS)

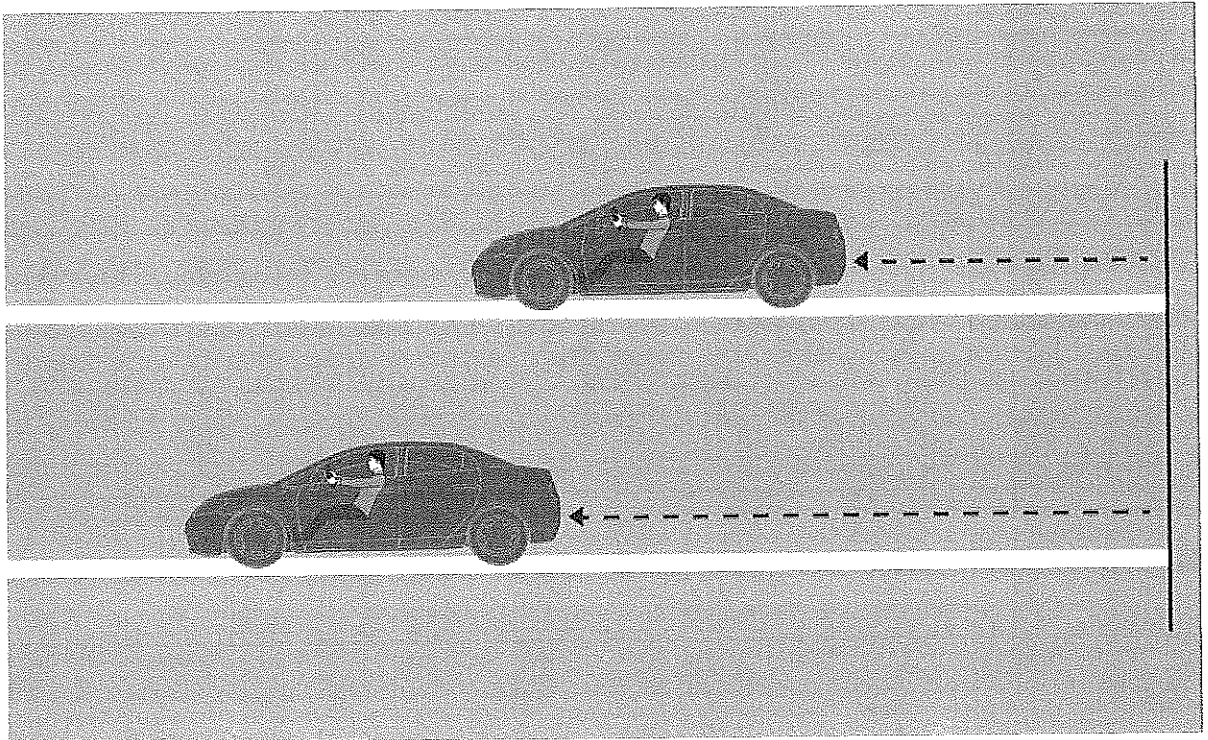
Electronic Brake Force Distribution (EBD)

Parking Sensors

## Passive safety

- Seatbelts
- Supplemental Restraint System - (SRS) Airbags
- Child Seats
- Chassis, Stiff Roof and Crumple Zones
- Battery Cut-off

### 3. Electronic brake force distribution





THEORY 1 <sup>st</sup> - IN-SEM EXAMINATION			
SESSION: 2022-23 (SUMMER SEMESTER)			
<b>B.Voc/M.Voc</b>	<b>B.Voc</b>	<b>Semester</b>	3 <sup>rd</sup> and 5 <sup>th</sup>
<b>Course name / Module</b>	Basics of Automobile		
<b>Course code</b>	AUT1101 (OPEN ELECTIVE)		
<b>Date</b>			
<b>Name of the Student</b>		<b>Reg. No.</b>	

INSTRUCTIONS
<ul style="list-style-type: none"> <li>• Maximum Marks: <b>20</b></li> <li>• Duration of Examination: <b>01 Hour</b></li> <li>• Attempt all questions.</li> </ul>

<b>1. Section A</b> (05 objective type questions, each question carries 01 mark)	<b>05×1 = 05</b>
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- Piston's top most position during the piston movement inside the cylinder block is called \_\_\_\_\_
  - BDC
  - Bore
  - TDC
  - Stroke
- Horse power is \_\_\_\_\_
  - Ability of horse to run
  - Unit of Power
  - Unit of Torque
  - None of above
- Correct sequence for engine four stroke cycle is:
  - Power > Compression > Intake > Exhaust
  - Intake > Power > Compression > Exhaust
  - Compression > Intake > Exhaust > Power
  - Intake > Compression > Power > Exhaust
- Diesel engine and Petrol engine can be classified under which following category:
  - Layout
  - Fuel
  - Fuel injection system
  - Based on stroke
- Petrol engine are mostly found in applications where high engine:
  - Torque is required
  - Power is required
  - Both
  - None of the above

<b>2. Section B</b> (03 short answer type questions, each question carries 02 marks)	<b>03×02 = 06</b>
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Q6 Write application of any four components of IC Engine

Ans:1:Cylinder-block

Cylinder is the main body of IC engine. Cylinder is a part in which the intake of fuel, compression of fuel and burning of fuel take place. The main function of cylinder is to guide the piston. It is in direct contact with the products of combustion so it must be cooled.

2.:Cylinder-head

The top end of the engine cylinder is closed by means of removable cylinder head. There are two holes or ports at the cylinder head, one for intake of fuel and other for exhaust. The main function of cylinder head is to seal the cylinder block and not to permit entry and exit of gases on cover head valve engine.

3:Piston

A piston is fitted to each cylinder as a face to receive gas pressure and transmit the thrust to the connecting rod. It is a prime mover in the engine. The main function of piston is to give tight seal to the cylinder through bore and slide freely inside the cylinder.

4:Piston-rings

A piston must be a fairly loose fit in the cylinder so it can move freely inside the cylinder. If the piston is too tight fit, it would expand as it got hot and might stick tight in the cylinder and if it is too loose it would leak the vapor pressure. To provide a good sealing fit and less friction resistance between the piston and cylinder, pistons are equipped with piston rings. These rings are fitted in grooves which have been cut in the piston.

Q7.What do you understand by FWD and RWD in Vehicle.

Ans: Front-wheel drive sends the power to the front wheels, letting the rear wheels simply roll along. Rear-wheel drive directs powers to the rear wheels, while the front wheels' steer. A vehicle with rear-wheel drive pushes the vehicle forward from the rear wheels while a vehicle with front-wheel drive pulls the vehicle forward.

Q8.Difference Between Petrol and Diesel Engine.

Diesel Engine	Petrol Engine
These engines work on the Diesel cycle	Works on the Otto cycle
The fuel is mixed with air inside the cylinder	Air and the fuel are mixed in a carburettor
Ignition is achieved with the help of the hot, compressed air.	Fuel is ignited with an electric spark
High compression ratio	Relatively low compression ratio
High power production	Relatively low amounts of power are produced in a Petrol engine
These engines work with fuels that have low volatilities	Highly volatile fuels are used in these internal combustion engines
Generally used in heavy vehicles such as trucks and buses	Used in light vehicles such as motorcycles and cars.
Relatively low fuel consumption	High fuel consumption.
High initial and maintenance costs	Comparatively low initial cost and maintenance cost

3. Section C (03 long type questions, each question carries 03 marks)	03×03 = 09
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Q9. Explain the working of four stroke engine used in Automobiles

Ans: **Working principle of IC engine:**

1. Suction stroke: During this stroke, the inlet valve is open and the exhaust valve is closed. Only air is sucked into the cylinder during this stroke. The piston moves from TDC to BDC and the crankshaft rotates through  $180^\circ$ .
2. Compression Stroke: The air inducted in the cylinder is compressed to the clearance volume. Both valves are closed during this stroke. The piston moves from BDC to TDC and the crankshaft rotates through  $360^\circ$ .
3. Power stroke or Working stroke: At the end of the compression stroke the fuel (diesel) is injected into the hot compressed air. The rate of injection is such that pressure remains constant instead of the change in the piston position. After injection of the fuel is complete the hot gases expand. The piston moves from TDC to BDC position and the crankshaft rotates through  $540^\circ$ .
4. Exhaust Stroke: The inlet valve remains closed and the exhaust valve opens. The piston moves from BDC to TDC position which pushes the burnt gases outside the combustion chamber. The crankshaft rotates by two complete revolutions through  $720^\circ$ .

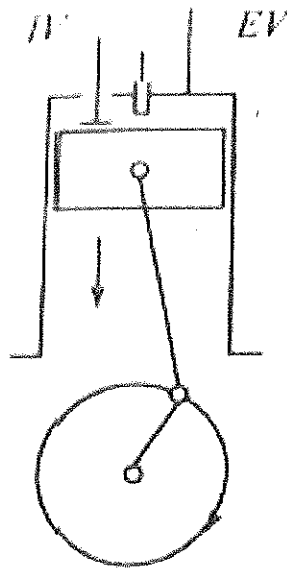


Figure: Working principle of four – stroke C. I. engine

Q10. Write the Classification of Automobile

Ans: Automobiles can be classified in several ways based on their nature, behaviour, load capacity, design, and more. I have mentioned below some the most important categorization of Automobile.

**Based on the purpose of the vehicle.:** Automobiles are categorized based on the purpose of the vehicle as if an automobile is used for good carrier or passenger carrier or used for any special usage.

**For example**, we can say the bus, mini-bus, car, etc. falls under the category of **passenger carrier**. Truck, Pick-up van, trailer, etc. falls under **goods carrier**, and fire brigade, school bus, police vehicle, ambulance, etc. falls under **special usages vehicle**.

**Based on the load capacity of the vehicle.:** Light-duty vehicles, medium-duty vehicles, and heavy-duty vehicle are falls under this category.

**Examples of light-duty vehicles** such as private cars like Nano, Alto, Scorpio etc. or commercial vehicle like pick-up van, taxi, etc even scooter and motorcycle. **Examples of medium-duty vehicles** are mini bus, school bus, etc. And the **examples of heavy-duty vehicles** are Volvo Bus, Truck, Tractor, etc.

**Based on the fuel used by the vehicle:** Automobile vehicles can be categorized as the fuel used for vehicles like **Petrol, Diesel, Electric, CNG, Solar, and Hybrid vehicles**.

**For example**, petrol used as a fuel in general private vehicle like cars, two-wheelers, even light-weight commercial vehicles as well.

**Based on the number of wheels the vehicle has:** Automobiles can be classified as the number of wheels an automobile vehicle has, for example:

Two Wheeler Vehicle (Motor Cycle, Scooty), Three Wheeler Vehicle (Auto, Toto, etc.), Four Wheeler Vehicle (Cars, Bus, Truck, Tractor, etc.), Six Wheeler vehicle (Bus, Trucks, etc.), Eight Wheeler Vehicle (Bus, Trucks, etc.), Even more than Eight Wheeler Vehicle (Trucks, Trailer, etc.).

**Based on the suspension system of the vehicle.:** Based on the suspension system automobile can be classified as follows:

- Independent Suspension System.
- Non-Independent or Rigid Suspension System.
- Air Suspension System.
- Hydro-Electric Suspension System.

**Based on the driving end of the vehicle:** If we consider the driving end then an automobile vehicle will be classified into two types:

- Right Side Drive (Countries like Belgium, Ethiopia, etc. use right-side drive vehicles.)
- Left Side Drive (Countries like India, Bangladesh, Australia, etc. use left-side drive vehicles.)

**Based on the engine location.:** If we consider engine then automobile can be categorized as:

- Front Engine Front Wheel
- Front Engine Rear Wheel
- Rear Engine Front Wheel
- Rear Engine Rear Wheel Drive
  - Front Engine All Wheel Drive

**Based on the transmission system of the vehicle.:** Based on the transmission system automobile classified into three types:

- Manual Transmission System
- Automatic Transmission System

Semi-automatic and dual-clutch Transmissions System

**Based on the body system of the vehicle:** This type of vehicle is categorized as several types such as:

- Two-door sedan (This type of vehicles has two doors, and a sporty look.)
- Hardtop (It has a rigid rooftop, maybe detach or may not).
- Four-door sedan (This type of vehicles has four doors).
- Station wagon (Here the roof of the vehicle is extended rearward).
- Convertible (Can have a roof or no roof).
- Van (It is generally used to transport of goods).

Q11. What do you understand by Chassis? Draw layout of Chassis.

Chassis: the frame, wheels, and machinery of a motor vehicle, on which the body is supported.

