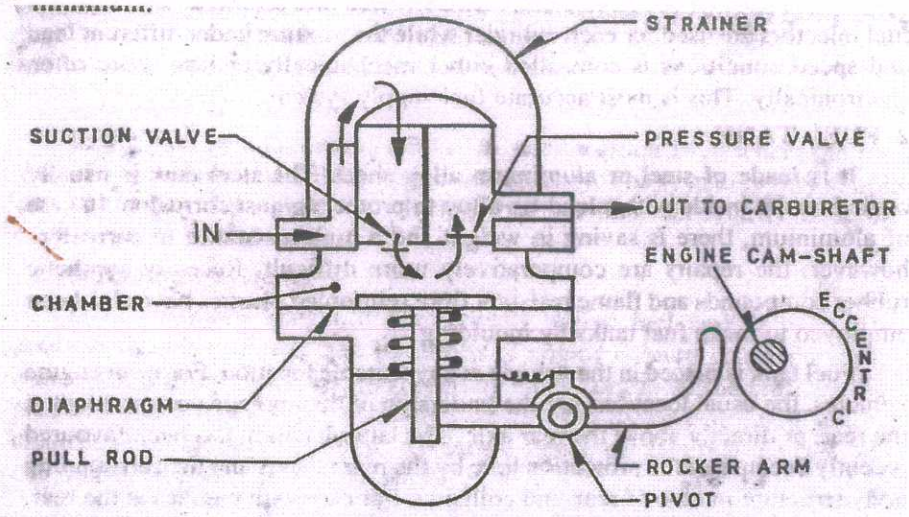
AUTOMOBILE ENGINEERING

Scoring Indicators

Code : TED (15)-4022 **Version : P**

Qn. No.	Scoring Indicators	Split score	Total score
	PART-A		
I	1. Carburetion is the process of mixing the air and fuel in correct ratio for temperature, speed and load on the engine.	2	
	2. Function : to ensure close contact of the hot coolant with outside air – to ensure high rate of heat transfer	2	
	3. To exchange engine power for greater torque and provide mechanical advantage to drive the vehicle under different operating conditions. To provide reverse motion. To provide neutral position and disallow power flow to the rest of the transmission (any two)	2	
	4. Spring Shackles provide the link by means of which the chassis frame is connected to the leaf spring. The shackles provide swinging ability to the leaf springs	2	
	5. Hydro carbons, carbon monoxide, nitric oxide , nitrogen dioxide	2	10
	PART-B		
II	1. 		
	Fig. 8.2. A.C. Mechanical pump. (fig)	3	
	a diaphragm type of pump - diaphragm is made up of high-grade cotton impregnated with synthetic rubber. - valves are made of bakelite, to reduce weight and inertia stresses. - pump is driven by cam shaft by means of an eccentric or cam. - eccentric operates rocker arm which pushes the diaphragm up and down. - downward movement of diaphragm opens the inlet valve and allow the fuel to go in chamber through strainer. - upward movement of diaphragm closes the inlet valve and opens the out let valve allow the fuel goes to carburettor.		
	(description)	3	6

2. Simple carburetor

Main parts – float chamber, fuel jet, venturi, nozzle and a throttle valve.

- Float in the float chamber keeps the fuel level in desired level.
- The level of fuel is slightly below the out let of nozzle to prevents the fuel from spilling out when the engine

is not working.

- A small vent in the float chamber keeps pressure inside atmospheric.

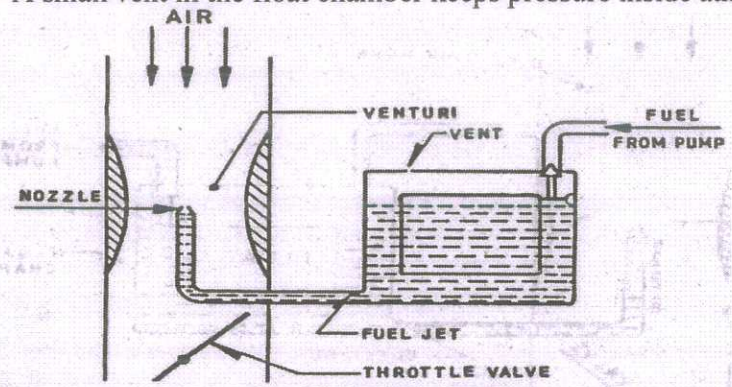


Fig. 8.9. Simple Carburettor.

fig 3

Description 3

Working

- flow of fuel is metered by fuel jet and fuel flows to the venturi through the discharge nozzle.
- venturi is simply a restriction in air passage.
- at less area of venturi the air velocity increases and pressure decreases where the nozzle is located.
- this depression being applied at the nozzle, the fuel comes out and vaporized by the coming air stream.
- The mixture then goes through inlet manifold to the engine cylinder.

6

3. Centrifugal clutch

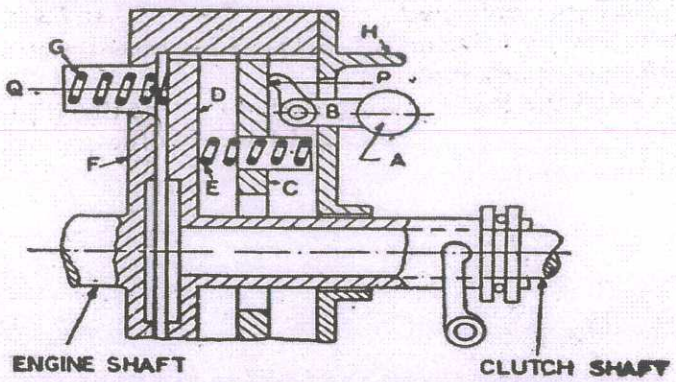


Fig. 3.24. Principle of Centrifugal Clutch.

fig 3

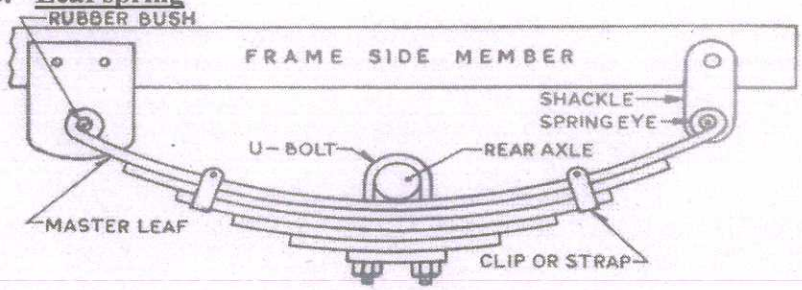
Description 3

Springs are eliminated in this type. The centrifugal force is used to apply pressure on clutch to keep in engaged position. Advantage is that have no separate clutch pedal is required and the clutch is operated automatically depending upon the engine speed.

As the speed increases, the weight A flies.This operating the bell crank lever B which presses the plate C. This force is transmitted to the plate D by means of springs E. The plate D thus pressed against the flywheel F there by engaging the clutch. There is one more set of springs G on the back side of the pressure plate to keep the clutch in disengaged position at low speed. A strip called stop H is also provided to limit the movement of the fly weights and the amount of the centrifugal force.

6

Code : Version :

Qn. No.	Scoring Indicators	Split score	Total score
	4. Requirements of clutch ▪ 1. **Torque transmission-** The clutch should be able to transmit maximum torque of the engine. ▪ 2. **Gradual engagement-** The clutch should engage gradually to avoid sudden jerks. ▪ 3. **Heat dissipation-** The clutch should be able to dissipate large amount of heat which is generated during the clutch operation due to friction. ▪ 4. **Dynamic balancing-** The clutch should be dynamically balanced. This is particularly required in the case of high speed engine clutches. ▪ 5. **Vibration damping-** The clutch should have suitable mechanism to damp vibrations and to eliminate noise produced during the power transmission. ▪ 6. The clutch should be **as small as possible** in size so that it will occupy minimum space. ▪ 7. **Easy of operation-** The clutch should be easy to operate requiring as little exertion as possible on the part of the driver. ▪ 8. **Lightness-** The driven member of the clutch should be made as light as possible so that it will not continue to rotate for any length of time after the clutch has been disengaged. Any six	6	6
	5. Leaf spring  Fig. 7.1. Rear Leaf Spring. Semi-elliptic leaf springs are almost universally used for suspension in light and heavy commercial vehicles.The spring consists of a number of leaves called blades. The blades vary in length as shown. The lengthiest blade has eyes on its ends. This blade is called master leaf. All the blades are bound together by means of steel straps. The spring is supported on the axle, front or rear by means of a U bolt. One end of the spring is mounted on the frame with a simple pin, while on the other end, connection is made with a shackle. When the vehicle comes across a projection on the road surface, the wheels moves up, deflecting the spring. This changes the length between the spring eyes. If both the ends are fixed, the spring will not be able to accommodate this change of length. This is provided for by means of a shackle at one end which gives a flexible connection. fig Description	3 3	6

6. **Disc brake**

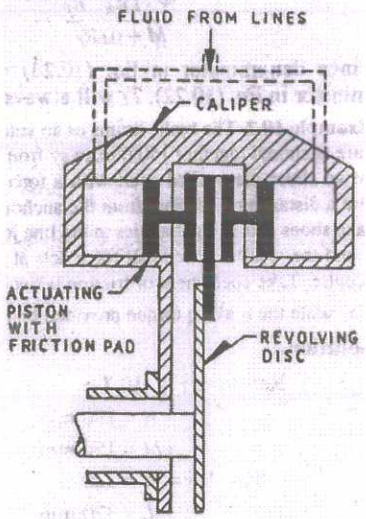


fig 3

Fig. 10.8. Disc brake with fixed caliper.

It consists of a cast iron disc bolted to the wheel hub and a stationary housing called caliper.The caliper is connected to the stationary part of the vehicle. It has two caste parts, each part containing a piston. A revolving disc is provided between these piston and there is friction pad held in position by pins and spring plates.

Passages are drilled in the caliper for the fluid to enter or leave each housing and also connected to another one for bleeding. When the brakes are applied, hydraulically actuated pistons moves the friction pads into contact with the disc, applying equal and opposite forces on the later.

On releasing the brakes rubber sealing rings act as return springs and retract the piston and friction pad released from the disc.

Description 3 6

7.**Electronic ignition system**

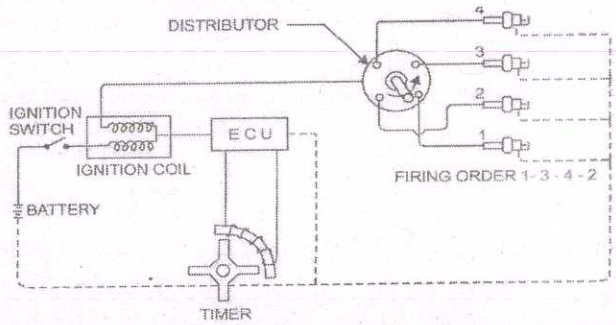


Diagram 3

Fig. 2.34 Electronic Ignition System

In electronic ignition system braker points are replaced by an armature. Armature sends signals to ignition module to make and brake the circuit. When the ignition switch is turned on , current flows from the battery through the ignition switch to the coil primary windings. When the reluctor or armature tooth comes in front of the pick up coil , a voltage signal is generated. The electronic module senses the signal produced by the pick up coil and stop the current to flow from the primary circuit. A timing circuit inside the ignition module turns ON the current flow again when the reluctor tooth rotates away from the pick up coil. Due to continuous make and brake of the current a magnetic field is generated in the ignition coil and an emf is induced in the secondary winding , causing the voltage to increase upto 50000Volts. This high voltage is then transferred to the spark plug through distributor and spark is finally produced.

Description 3 6

Code : Version :

Qn. No.	Scoring Indicators	Split score	Total score
III	a) Fuel system of petrol engine		

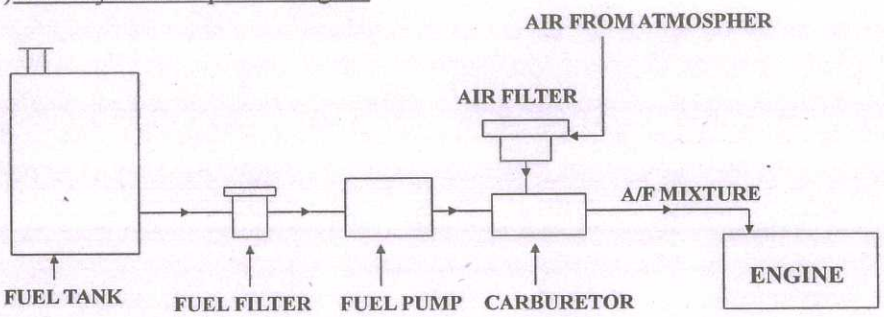


Diagram 4

Main components of this system.

1. Fuel tank,
2. Fuel filter,
3. Fuel pump,
4. Carburetor,
5. Air cleaner,
6. Fuel gauge.

Fuel tank

- made of steel metal
- usually of rectangular or barrel shaped.
- reinforced by means of baffle plates to avoid splashing and surging of fuel
- a neck for pouring fuel, a drain hole to remove fuel, an out let connection for the fuel line.

Fuel filter

- It filters fuel before it goes to the carburetor
- it consist of filtering element which removes dirt and contaminations in fuel

Fuel pump

It is used to draw the fuel from the tank and feed to the carburetor

Carburetor

Its function is to supply combustible mixtureof air and fuel in correct proportions during all conditions of engine working

Air cleaner

- It screens and filters air entering the carburettor to form air fuel mixture.
- It helps in decreases wear rate in the engine
- Act as silencer to decrease noise of air entering the carburetor.
- Oil bath type air cleaner helps in upper cylinder lubrication. ~~b)~~

Descriptions 4 8

b) Comparison Water cooling and Air cooling

1.Direct cooling system	1.Indirect cooling system
2.Not dependent on coolant supply	2.Dependent on water
3.No leakage problem	3.Leakage of water leads to serious defect
4.Minimum maintenance	4.More maintenance
5.Uniform cooling	5.Non uniform cooling
6.Failure of system not affecting much	6.Failure of system leads to damage
7.Easy installation	7.Comparatively difficult installation
8.Used for small capacity engines	8.Used for medium and large capacity engines

any Seven 7 7

OR

IV a)

Magneto ignition system

1. Rotating armature type magneto

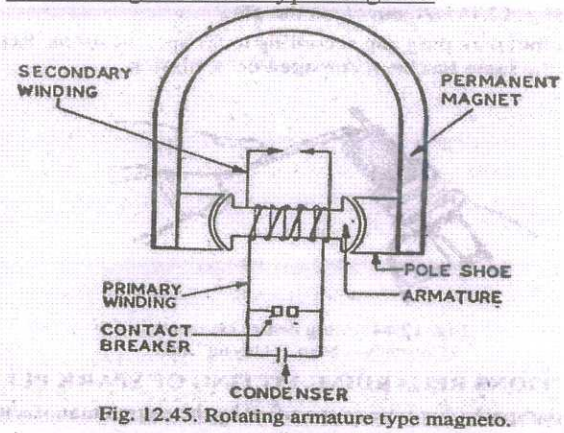


Fig. 12.45. Rotating armature type magneto.

fig 4

A permanent magnet fitted with two pole shoes. An armature rotated between the poles. Armature carries the primary and the secondary windings.- The primary winding consists of a few hundred turns of thick wire and secondary comprises some thousands turns of thin wire. The contact breaker and condenser are also in primary circuit which rotated with the armature. The rotation of armature causes the rate of change of flux in the armature core this produces high voltage in the secondary winding which is sufficient to establish a spark at the spark plug point.

2. Rotating Magnet type

Principle is same as rotating armature type. In this a rotating magnet is placed instead of armature winding. In this windings, contact breaker, and condenser stationary, hence no centrifugal stresses.

Description 4 8

b) Hit and miss governing

- In this method, the supply of fuel is stopped for one or more cycles when the speed of the engine increases. Once the supply is cut off, engine performs idle cycles which will reduce the engine speed

Quality governing

- In this method the quality of fuel supplied is varied by altering the air fuel ratio. For quality governing the amount of air drawn into cylinder is constant, but the supply of fuel varies. This method is employed for high speed diesel engines

Quantity governing

- In this method the quantity of mixture supplied to the engine varied by regulating the throttle valve. It is simple, but combustion of fuel is not effective thereby the thermal efficiency is reduced. This method is employed in spark ignition engines

Combined method of governing

- It is the combination of the quality and quantity governing methods. The disadvantages in each of the governing method can be eliminated in the combined method

7 7

Qn. No.	Scoring Indicators	Split score	Total score
	UNIT-II		
V	a) **Full – floating axle**		

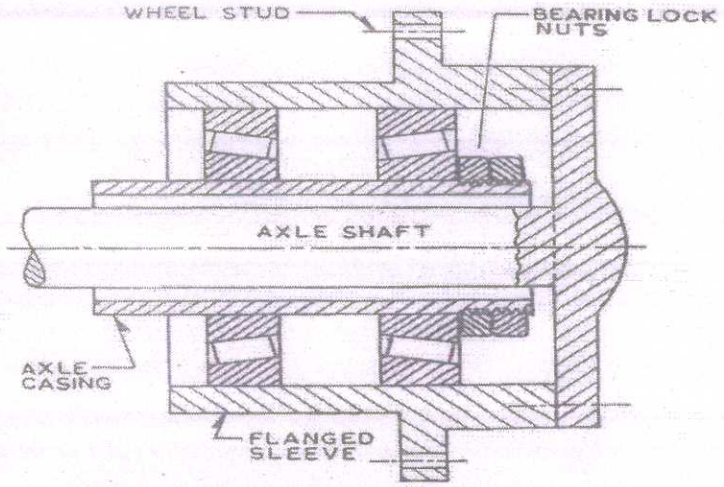


fig 4

- - Used in heavy vehicles.
- The flange of axle shaft connected to the flange sleeve by means of bolts.
- There are two taper roller bearings supporting the axle casing which take any side load.
- The axle shaft carry only the driving torque.
- The weight being completely supported by the wheels and the axle casing.
- Thus the axle shaft can replace easily with out jacking up the vehicle when the shaft is broken.

Description 4 | 8

b)

Elements of transmission system

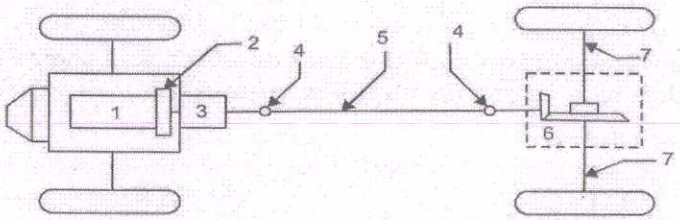


fig 3

Fig. 3.1 Elements of Transmission System

1. Engine 2. Clutch 3. Gear box 4. Universal Joint
5. Propeller Shaft 6. Differential 7. Rear Axles

Description of Parts 4 | 7

OR

VI a) Differential

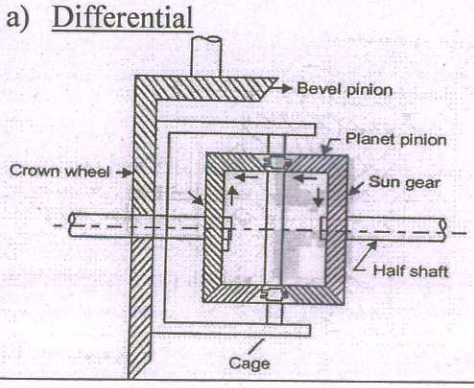


fig 4

When a vehicle taking a turn the outer wheel will have to travel grater distance than the inner wheel In the same time. At the same time keep the speeds of all the wheels same when going straight ahead.This can be obtained by certain mechanism which is used in a device is called differential.

Construction :

Crown wheel is attached a cage which carries a cross-pin (for two planet pinions are employed) or spider (for four planet pinions are employed).Sun gears are meshed with planet pinions. Axle half-shafts are splined to sun gears. Crown wheel is free to rotate on the half-shaft.

Working:

Vehicle is going straight the cage and inner gears rotate as a single unit and the two half- shafts revolve at the same speed.There is no relative motion between the differential gears at this situation. Vehicle is taking a turn, assume the cage is stationary ,Turning of one sun gear causes the other to rotate in the opposite direction.This rotation is super-imposed on normal wheel speed. There will be a resistance to the motion of inner wheel that results the differential action to rotates inner wheel to back and outer wheel rotate forward.

Torque from final drive is divided between the half shafts. The planet pinions are free to rotate on the cross-pin the torque applied is equally on both the planet pinion. That divide the torque equally between the two wheels on the axle, when their speeds are different

Description 4 8

b) Sliding mesh gear box.

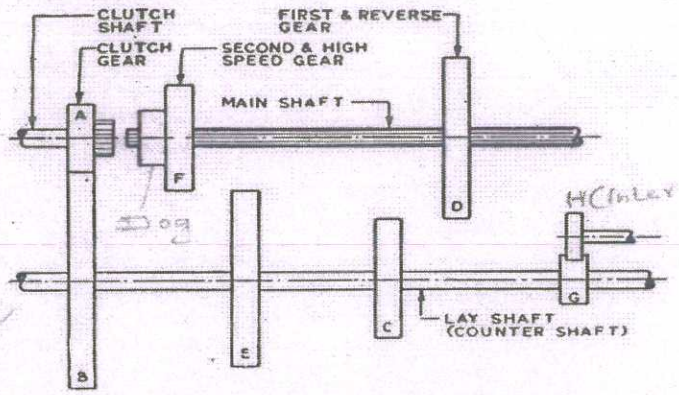


Fig. 4.6. Sliding Mesh Gear Box (gears in neutral).

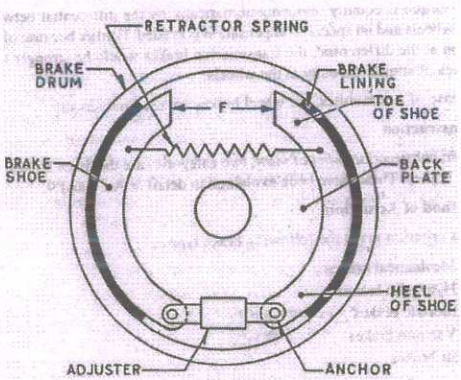
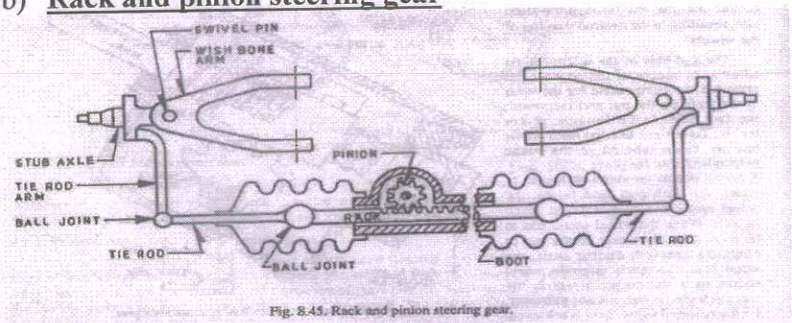
fig 4

Simplest type.The Power flow is from the engine through the clutch to the clutch shaft and then to the clutch gear which is always in mesh with a gear on the layshaft. The gears on layshaft are fixed and they rotate in all time when the engine is running. Three direct and a reverse speeds are attained by moving the gear on the main shaft. Gear movement is by means of selector mechanism.

Description 3 7

Scoring Indicators

Code : **Version :**

Qn. No.	Scoring Indicators	Split score	Total score
VII	a) **Drum brake** In a motor vehicle the wheel is attached to a drum. The brake shoes are made to contact this drum. The brake shoes have brake linings on their outer surfaces. Each brake shoe is hinged at one end by an anchor pin, the other end is operated by some means so that the brake shoe expands outwards- the brake linings come into contact with the drum. Retracting spring keep the brake shoes into position when the brakes are not applied. When the brake pedal is pressed, the cam turns, the shoes expands outwards against the drum. A toggle lever is also used for the same purpose as shown in fig. The brake linings rub against the drum and thus stops its motion Description	4	
	 Fig. 10.3. Drum type brakes. fig	4	8
VII	b) **Rack and pinion steering gear**  Fig. 8.45. Rack and pinion steering gear. fig This type of steering gear is used on light vehicles like cars and in power steering. Maruthi 800 cars employ this steering gear. It is simple, light and responsive. It occupies very small space and uses lesser number of linkage components compared to worm and wheel type of gear. Figure shows the rack and pinion type of steering gear along with its linkage. The rotary motion of the steering wheel is transmitted to the pinion of the steering gear through universal joints. The pinion is in mesh with a rack. The circular motion of the pinion is transferred into the linear rack movement, which is further relayed through the ball joints and tie rods to the sub axles for the wheels to be steered Description	4 3	7

Scoring Indicators

Code : **Version :**

Qn. No.	Scoring Indicators	Split score	Total score
VIII	a) **Bleeding of brakes**		

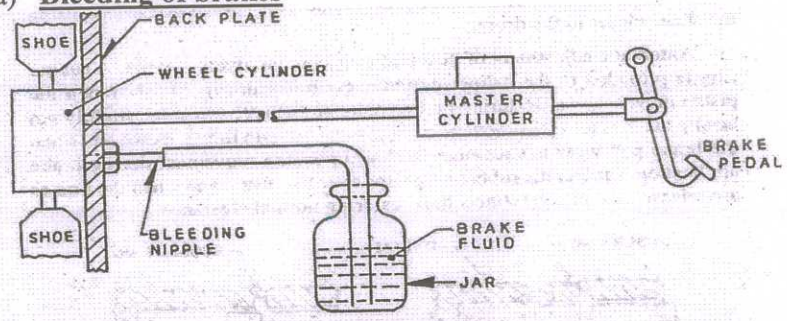


Fig. 10.44. Bleeding of brakes.

fig 4

Sometimes, in the hydraulic brake system, air enters through the joints. Since the air is compressible, high braking pressure is distributed and pedaling action is not effective. So, any air trapped in the system must be removed. The procedure adopted to remove the air out of the hydraulic braking system is called bleeding.

A bleeding valve is provided on the shoe expander or the disc caliper. For bleeding the master cylinder is topped up with the brake fluid and the pipe is connected to the bleeding valve. The other end of this pipe is dipped in the brake fluid contained in some jar. When the brake pedal presses , bleeder valve opens, some air bubbles will come out of the pipe and escape through the brake fluid. The bleeder valve is now closed. This procedure is repeated till the entire air is removed out from the wheel cylinder.

4 8

Description

b) **Steering wheel components**

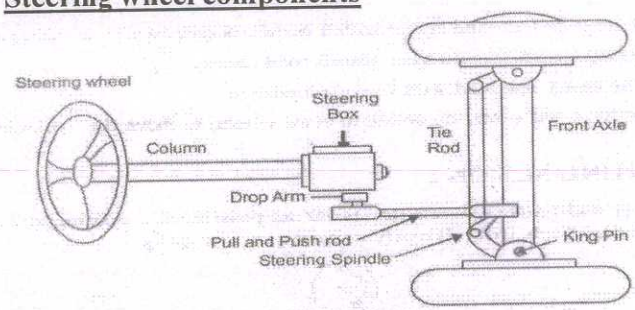


Fig. 6.2 Steering System

fig 3

- The steering system is composed of the following elements.
- Steering,Steering linkage ,Steering knuckle or Steering spindle

Steering

It is the mechanism which changes the direction of rotation of the steering shaft at right angles and provides a leverage or mechanical advantage between the steering wheel and steering linkage.

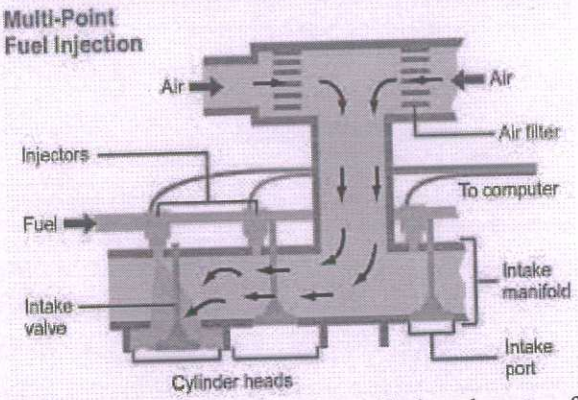
It is composed of the following components.

Steering wheel,Steering column,Steering gear

Steering wheel

It is a circular wheel mounted at the steering shaft and acts as a control to steer the vehicle. A horn push button is fitted at its hub. In modern cars the push button has been replaced by a push ring which is placed inside the steering wheel. The steering hub sometimes contains trafficator switch , lighting switch or selector lever for controlling automatic transmission.

Code : Version :

Qn. No.	Scoring Indicators	Split score	Total score
	Steering column It is a hollow shaft enclosed by a casing. At its upper end steering wheel is attached and at the lower end steering gear is employed. In modern cars , the gear change lever is provided at the steering column for the convenience of the driver. **Steering gears** Steering gear is enclosed in a casing known as steering gear box. The functions of steering gear are as follows. ▪ It provides mechanical advantage and enables the driver to steer the vehicle easily. The rotary movement of the steering shaft at right angle is converted into a straight line motion by a drop arm Description	4	7
	UNIT-IV		
IX	a) **Gasoline injection system or Multi point fuel injection system (MPFI)**  fig Petrol vehicles uses device called carburetor for supplying the air fuel mixture in correct ratio to cylinders in all rpm ranges. Due to construction of the carburetor is relatively simple, it has been used almost exclusively on gasoline engines in the past. However presently we need cleaner exhaust emission system, more economical fuel consumption, improved drivability, etc. So in order to get all these , we need a carburetor that must have various devices to do the above functions, making it more complex system. So In place of the carburetor, therefore, the MPFI (multi point fuel injection) system is used, assuring proper air fuel ratio to the engine by electrically injecting fuel in accordance with various driving condition. Description	4 4	8

IX **b)Air suspension system**

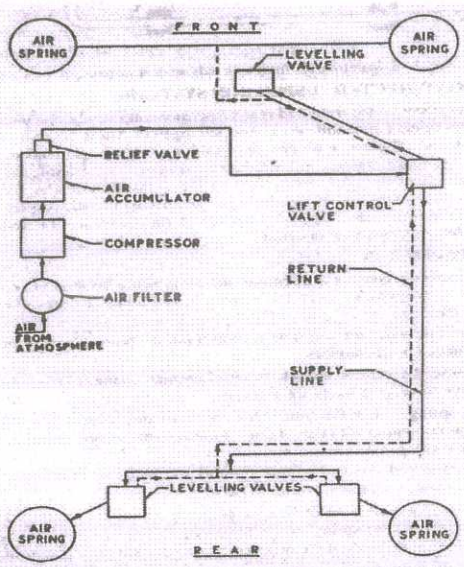


Fig. 7.48. Schematic diagram showing the layout of an air suspension system.

Diagram 4

A layout of air suspension system is shown below.- An air compressor is used to compress the atmospheric air to 240 Mpa An accumulator tank is used to maintain this pressure, which provided with a safety valve.This high pressure air goes through the lift control valve and the leveling valves, to the air springs. The lift control valve is operated manually by means of a handle on the control panel

Description 3 7

OR

X a) **Turbo charger**

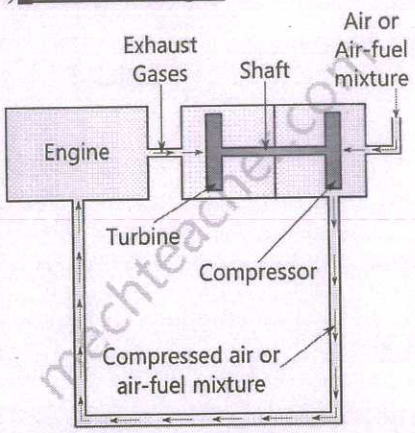


fig 4

Turbochargers are installed on an engine to put more and denser air into the engine combustion chambers. Because of this increased volume and weight of compressed air more fuel can be scheduled to produce more horsepower from a given size engine. A turbocharger very simply is an air pump designed to operate on the normally wasted energy in engine exhaust gas.

Working

The heat energy and pressures in the engine exhaust gas is utilized to drive the turbine wheel. The housing acts as a nozzle to direct the exhaust gas flow to the turbine wheel blades, which drives the shaft wheel assembly. Since the compressor wheel is directly coupled to the shaft, it rotates at the same speed as the turbine wheel. Clean air from the air cleaner is drawn into the compressor housing and wheel where it is compressed and delivered through a crossover pipe to the engine air intake manifold.

Description 4

In this technique, a measured amount of the raw powder-form material is initially dispensed from a container by a moving piston. A roller then distributes and compresses the powder at the top of the fabrication chamber. A liquid adhesive is then deposited from the multi-channel jetting head in a 2D pattern onto the powder, make it bond and form a layer of the object. When a layer is completed, the piston helps spread and join the next powder layer. This incremental (layer-by- layer) method is gradually continued to achieve a complete built up of prototype. Unbound powder is swept up subsequent to a heating process, leaving the fabricated part sound and intact.

8

b)

Parking aid with ultra sonic sensors

Ultrasonic Sensors in a vehicle detects the distance between the vehicle and the obstacle. This vehicle is equipped with two ultrasonic sensors. Each ultrasonic sensor transmits ultrasonic waves, receives the reflected waves from an obstacle behind the vehicle, and transmits a signal to the clearance sonar. Clearance Sonar Judges the approximate distance between the vehicle and obstacle based on the signals from the ultrasonic sensors and sends the buzzer signal to the clearance warning buzzer. Clearance Warning Buzzer emits an intermittent sound to inform the driver that the Clearance Sonar has detected an obstacle within the prescribed range.

7 7