

## SCHEME OF VALUATION (Scoring Indicators)

Revision: 15 Course Code: TED(15)4022  
Course Title: AUTOMOBILE ENGINEERING

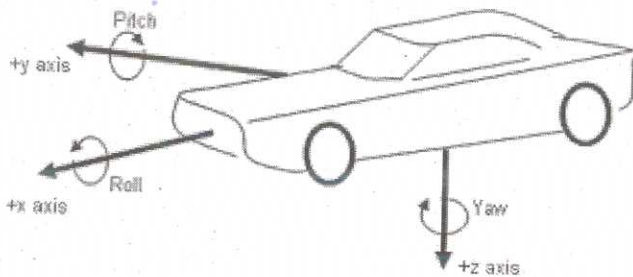
### Scoring Indicator

QNs	Sub	Scoring Indicator	Splitup score	Sub Total	Total
<b>PART - A</b>					
<b>I</b>	1	Carburetion is the process of fuel becoming vapour and mixing with a stream of air in a carburettor. The purpose of carburetion is to provide a combustible mixture of fuel and air in the required quantity and quality for efficient operation of the engine under all conditions.	2	2	2
	2	Quantity governing Quality governing Hit and Miss governing	2	2	2
	3	It consists of two gears mounted so that the centre of one gear revolves around the centre of the other. A carrier connects the centres of the two gears and rotates to carry one gear, called the planet gear, around the other, called the sun gear. The planet and sun-gears mesh so that their pitch circles roll without slip. A point on the pitch circle of the planet gear traces an epi-cycloid curve.	2	2	2
	4	It represents the rim diameter of the wheel of an automobile	2	2	2
	5	They are widely known as an air-to-air cooler for forced induction (turbocharged or supercharged) internal combustion engines to improve their volumetric efficiency, which they do by increasing intake air density through nearly constant pressure cooling.	2	2	2
<b>PART - B</b>					
<b>II</b>	1	The carburettor has several functions: 1) it combines gasoline and air creating a highly combustible mixture, 2) it regulates the ratio of air and fuel, and 3) it controls the engine's speed.	3x2	6	6
	2	two main functions of a clutch are: 1. To engage and disengage the transmission from engine to the remaining parts of transmission. (To allow the engine to be separated from rest of the transmission system) This is required when: (a) Starting and running the engine at a sufficiently high speed to generate sufficient power necessary for moving the vehicle from rest. (b) Shifting the gears so that damage to gear teeth can be avoided. (c) Stopping the vehicle after applying brakes.  2. The second function of the clutch is to allow the engine to take up the driving load of the vehicle gradually and without shock.	Any 3 points x2	6	6
	3	CV joints allow a drive shaft to transmit power through a variable angle, at constant rotational speed, without an appreciable increase in friction or play. A universal joint is a joint or coupling connecting rigid rods whose axes are inclined to each other, and is commonly used in shafts that transmit rotary motion. It consists of a pair of hinges located close together, oriented at 90° to each other, connected by a cross shaft. The universal joint is not a constant-velocity joint.	2x3	6	6

Pitch, yaw and roll are the three dimensions of movement when an object moves through a medium. There are in fact six degrees of freedom of a rigid body moving in three-dimensional space.

As the movement along each of the three axes is independent of each other and independent of the rotation about any of these axes, the motion has six degrees of freedom .

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3x2

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A fluid coupling or hydraulic coupling is a hydrodynamic or 'hydrokinetic' device used to transmit rotating mechanical power. It has been used in automobile transmissions as an alternative to a mechanical clutch. It also has widespread application in marine and industrial machine drives, where variable speed operation and controlled start-up without shock loading of the power transmission system is essential.

There is no mechanical interconnection between the impeller and the rotor (i.e. the driving and driven units) and the power is transmitted by virtue of the fluid filled in the coupling. The impeller when rotated by the prime mover imparts velocity and energy to the fluid, which is converted into mechanical energy in the rotor thus rotating it

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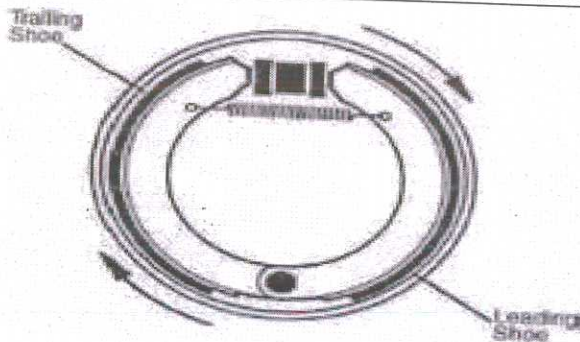


Fig 3+3

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The term "leading/trailing" means that only one shoe is "leading", moving into the rotation of the drum and thus exhibiting a self-servo (or self-applying) effect. The leading shoe is "dragged" into the friction surface of the drum and thus achieving greater braking force. The other shoe is "trailing", moving against the direction of rotation, is thrown away from the friction surface of the drum and is far less effective.

Antilock Braking System (ABS) is a type of an active safety system of a vehicle. It is also known as the anti-skid braking system. This system comes into action when the driver suddenly applies the brakes during an emergency.

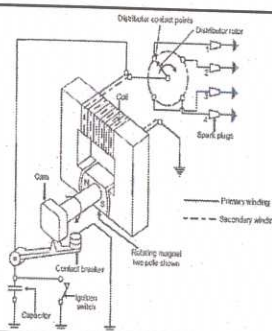
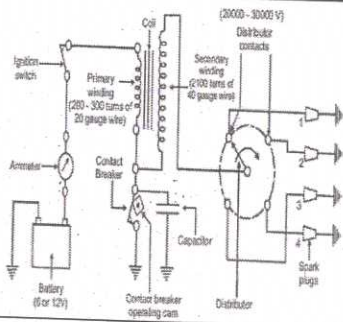
Whenever the driver suddenly applies the brakes to a high-speed vehicle, there is always a chance of the 'wheel-lock'. The wheel-lock means that the respective wheel stops suddenly instead of coming to a halt slowly. Due to the wheel-lock, the driver loses control over the vehicle and the vehicle skids off the road. Thus, a fatal accident takes place. In order to avoid such situations, the manufacturers employ the ABS system. ABS module orders the brake control unit to reduce the braking force of that wheel. Reducing the braking force means reducing the hydraulic pressure in the brake line acting on that wheel. The Brake Control Unit reduces the line pressure with the help of valves in the system. When the braking force reduces, the wheel starts rotating at a higher speed; thereby avoiding the wheel-lock. As the wheel doesn't lock, steer ability of the vehicle remains intact which means that the vehicle moves according to the driver's input without skidding.

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PART - C



S.No.	Battery Ignition System	Magneto Ignition System			
1.	As the name implies, battery is necessary in this type of ignition system.	No battery is needed in this type of ignition system. It has its own electric generator.	Any 5 comparison 5+Fig 2+2		
2.	It is difficult to start when the battery is discharge.	There is no such problem because no battery is used.		9	9
3.	It required high maintenance due to battery.	It required less maintenance.			
4.	In battery ignition system current for primary circuit is obtain by battery.	In magneto ignition system, required Electriccurrent is generated by the magneto, which is an electric generator.			
5.	Spark strength does not depend on speed of engine due to current is supplied by battery.	Spark strength depends on speed of engine due to magneto.			
6.	Good spark is available at low speed.	During starting or at low speed, quality of spark is poor.			
7.	Efficiency of system decreases with the reduction in spark intensity as engine speed rises.	Efficiency of the system improves as the engine speed rises due to high intensity spark.			

III a

Air-fuel ratio (AFR) is the mass ratio of air to a solid, liquid, or gaseous fuel present in a combustion process. The combustion may take place in a controlled manner such as in an internal combustion engine. If exactly enough air is provided to completely burn all of the fuel, the ratio is known as the stoichiometric mixture, often abbreviated to stoich. Ratios lower than stoichiometric are considered "rich". Rich mixtures are less efficient, but may produce more power and burn cooler. Ratios higher than stoichiometric are considered "lean." Lean mixtures are more efficient but may cause higher temperatures, which can lead to the formation of nitrogen oxides.

The stoichiometric mixture for a gasoline engine is the ideal ratio of air to fuel that burns all fuel with no excess air. For gasoline fuel, the stoichiometric air-fuel mixture is about 14.7:1<sup>[1]</sup> i.e. for every one gram of fuel, 14.7 grams of air are required.

Any mixture greater than 14.7:1 is considered a lean mixture; any less than 14.7:1 is a rich mixture

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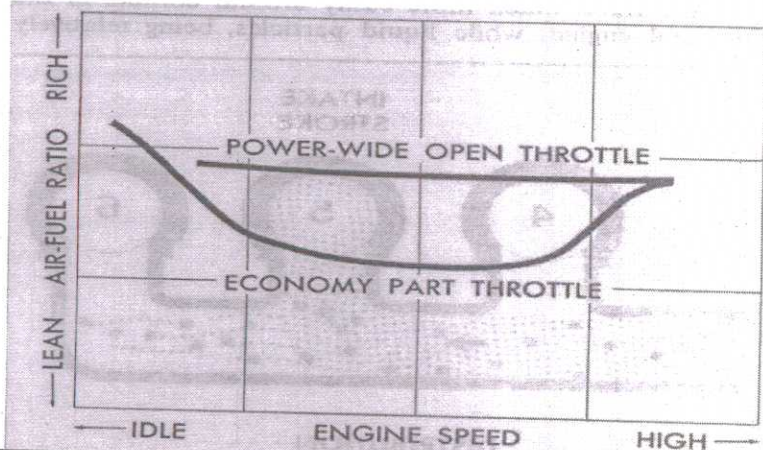


Fig 3+3

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IV

a

The thermostat is located between the engine and the radiator. This little temperature-sensitive spring valve stays closed during engine warm-up. When the thermostat is closed, it prevents coolant from leaving the engine and circulating through the radiator until the correct running temperature is reached. The correct running temperature for most engines is between 180 degrees F and 200 degrees F. When the right temperature is reached, the spring valve opens, allowing coolant to circulate through the radiator to be cooled.

Temperature indicators are used to indicate the driver regarding overheating or an abnormal condition of the cooling system. For this purpose, a temperature indicating light and/or gauge is installed in the instrument panel of the car. Both balancing-coil and bimetal thermostat type gauges are in use for temperature indication. The indicator light warns the driver about the abnormal situation.

The purpose of a car water pump is to push coolant through the car's engine block, radiator and hoses to get the engine heat away from the system. Most frequently, the water pump drives off the crankshaft pulley or the crankshaft itself. The coolant that gathers between the impeller blades travels outward using centrifugal force, and suction draws the coolant into the water pump from the radiator.

After the coolant enters the water pump, it goes through the whole engine, where it absorbs the heat that the combustion process produces, and then it goes to the radiator, so the heat can exit to the outside air.

3+3+3

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A good lubricant generally possesses the following characteristics:

- A high boiling point and low freezing point (in order to stay liquid within a wide range of temperature)
- A high viscosity index.
- Thermal stability.
- Hydraulic stability.
- Demulsibility.
- Corrosion prevention.
- A high resistance to oxidation.

The important functions of lubricant oils are as follows:

(i) Lubrication: The oil lubricates the two rubbing surfaces and in the process minimizes friction and the heat generated. Thus the main and big end bearing, piston rings and cylinder walls tappet and guides, rocker shaft and bushes, valve stems and guides and other rubbing surfaces are lubricated by the lubrication system.

(ii) Heat Dissipation and cooling: The presence of oil film reduces friction but does not fully eliminate it. The heat generated between moving parts is carried by the oil film.

(iii) Load Carrying: The impulsive thrust is carried by the thin film of oil between piston and cylinder, crankshaft journals and bearings. The load carrying capacity of this thin film of oil depends upon the viscosity rating of oil. Low viscosity oil shall be squeezed out resulting in wear, overheating and seizure.

(iv) Internal Cleaning: while lubricating the various parts, the oil cleans the parts internally of debris, dirt, metal particles and bye products of combustion.

(v) Sealing: The oil must seal the combustion products in the combustion chamber piston blow by are greatly reduced and the piston floats over the thin film of oil between it and cylinder.

Any 3 points 3+3

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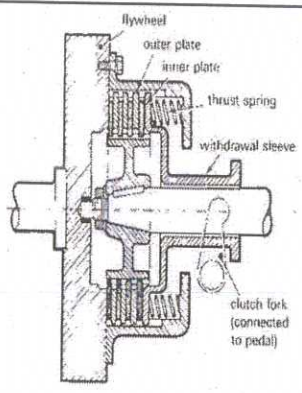
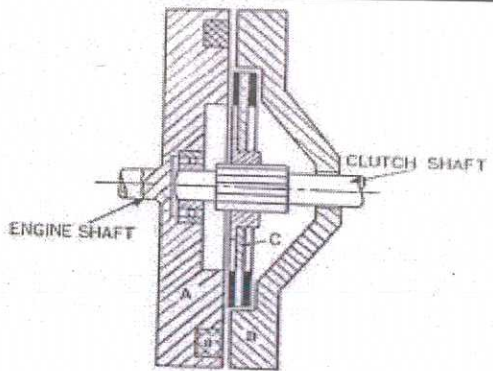


Fig. Multi plate clutch

- single disc has some big benefits:
- Increased durability for higher torque engines
- Decreased slippage for stronger, faster engagement (great for hauling/towing heavier loads)
- Smoother operation than double-disc clutch kits (more on that below)
- Relatively affordable replacement costs
- Low heat generation
- Required large radial space

- Double disc clutch kits have a few advantages:
- More torque and horsepower capacity
- Maximum durability
- Firm engagement for excellent performance in extreme applications
- High heat generation, cooling required
- Less radial space

Fig 2+fig 3+Any 2 points each 2+2

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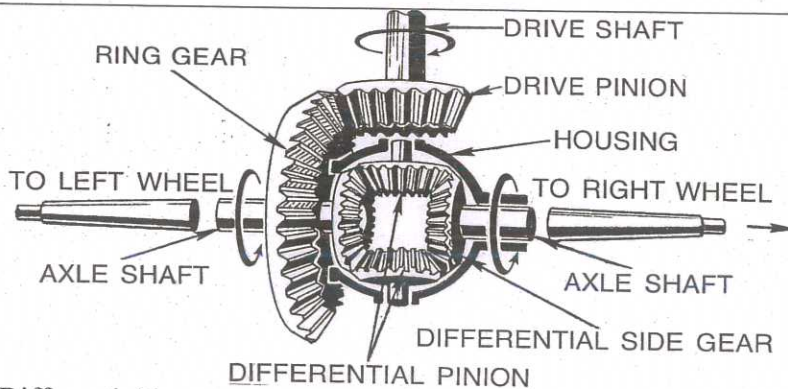
**Functions of the Gearbox:**

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- To provide different gear ratios so that engine power can be delivered to the transmission system in various combinations of speed and torque. For example, to move a vehicle from rest requires low speed and high torque (first gear), whereas to keep a vehicle moving at 50kph requires high speed and low torque (top gear).
- To provide reversal of automobiles
- To provide neutral, so that a plant vehicle can be operated with the vehicle at rest, but with the engine running at high revolutions in order to provide power for units such as hydraulic pumps.
- To provide a means to take power away from the gearbox to power auxilliary components.

Any 3 points 3x2

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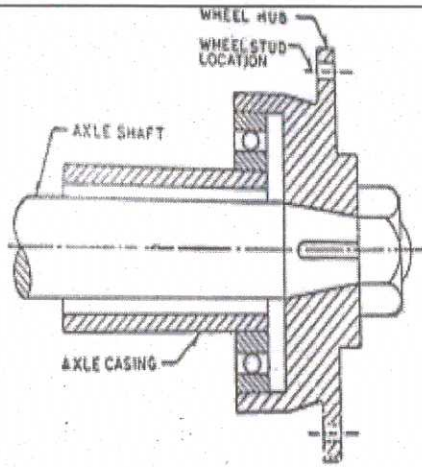
VI

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Differential is an arrangement of gears which work together and allow the vehicle to take a turn smoothly. In the differential, bevel pinion gear is fixed to the propeller shaft which rotates the crown wheel. The crown wheel has another unit called the differential unit. It consists of two bevel gears (sun gear) and two bevel gears (planet gear). The bevel gears are in contact with the half shaft of the rear axle. When the crown wheel is rotating, it rotates the differential unit. The bevel (sun) gears of the differential rotate the two shafts. When the car is on a straight road, the ring gear, differential case, differential pinion gears, and two differential side gears all turn as a unit. The two differential pinion gears do not rotate on the pinion shaft. This is because they exert equal force on the two differential side gears. As a result the side gears turn at the same speed as the ring gear, which causes both drive wheels to turn at the same speed also. However, when the car begins to round a curve, the differential pinion gears rotate on the pinion shaft. This permits the outer wheel to turn faster than the inner wheel.

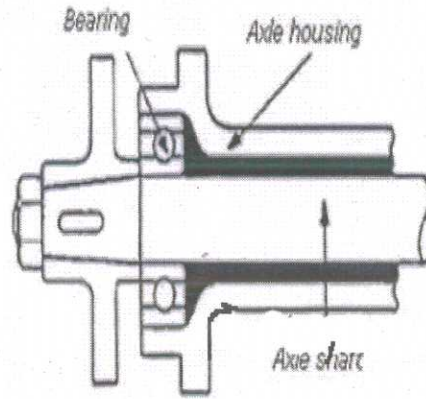
Fig 5 +4

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**Three Quarter Floating Axle**

The wheel hub is supported by the single bearing located in the center of the wheel hub. The wheel hub runs on the axle housing. The axle shaft is keyed rigidly to the wheel hub. This arrangement provides the driving connection and maintains the alignment of the wheel.



The hub of the wheel is keyed to the outer end of the axle shaft. The axle housing supports the wheel bearing, which is placed inside the outer end of the axle housing. The bearing is held on the axle by a retainer. This arrangement results in the axle shaft helping to support the weight of the vehicle in addition to transmitting rotation to the wheels.

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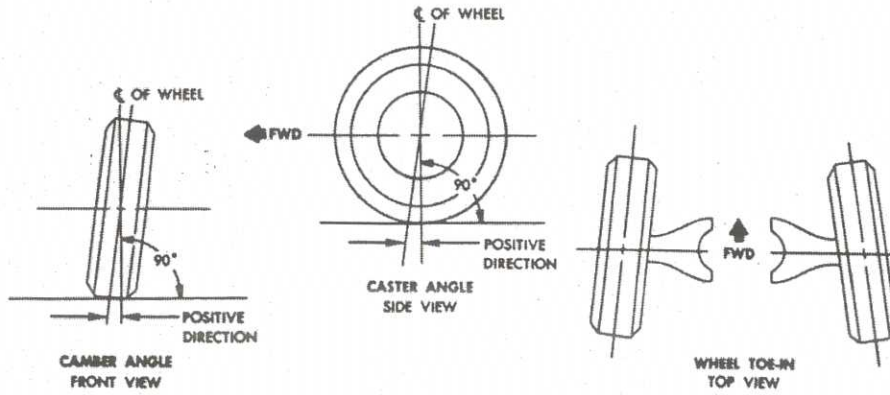
Fig 2+fig 2+2

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VII

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Camber is the angle of the wheel relative to vertical, as viewed from the front or the rear of the car. If the wheel leans in towards the chassis, it has negative camber; if it leans away from the car, it has positive camber (see next page). The cornering force that a tire can develop is highly dependent on its angle relative to the road surface, and so wheel camber has a major effect on the road holding of a car.

Caster is the angle to which the steering pivot axis is tilted forward or rearward from vertical, as viewed from the side. If the pivot axis is tilted backward (that is, the top pivot is positioned farther rearward than the bottom pivot), then the caster is positive; if it's tilted forward, then the caster is negative.

Positive caster tends to straighten the wheel when the vehicle is traveling forward, and thus is used to enhance straight-line stability.

When a pair of wheels is set so that their leading edges are pointed slightly towards each other, the wheel pair is said to have toe-in. If the leading edges point away from each other, the pair is said to have toe-out. The amount of toe can be expressed in degrees as the angle to which the wheels are out of parallel, or more commonly, as the difference between the track widths as measured at the leading and trailing edges of the tires or wheels.

3+3+3

	<p><b>Natural rubber</b> -is made from a white liquid called latex that oozes from certain plants when you cut them. There are over 200 plants in the world that produce latex. The most plentiful amount of latex can be found in the rubber tree.</p> <p><b>synthetic rubber</b> -is any artificial elastomer. The elastomers that go into tires are a petroleum byproduct. produced through the petroleum refining process and containing unique ingredients that are added to make the tire last longer, grip better or to improve rolling resistance for better fuel economy.</p> <p><b>carbon black</b> -Most tires are black. This is because a key ingredient that is added to the mix of natural and synthetic rubber is carbon black. Carbon black are tiny dust-like particles that act like a bonding agent for the other ingredients in the tire. Carbon black has the added feature of catching ultraviolet rays and absorbing the heat of the sun. This helps protect the tire against ozone and UV damage.</p> <p><b>steel cords</b> -An estimated 15% of the material in a tire is steel, mainly in the form of cord. Rubber is vulcanized to steel cords that are spirally wrapped to form bead wire. The bead is the part of the tire that attaches to the rim. It takes a lot of pressure to mount a tire on the wheel.</p> <p><b>fabric belt</b> -An important element in tires is the fabric belt that forms the casing of the tire and helps the tire maintain its shape even at high speeds. The casing forms the main body of the tire, and it is made of strips of cloth-like fabric that are covered with rubber. Each strip of rubberized fabric is used to form a layer called a ply</p> <p><b>Nylon &amp; Steel</b> – steel meshes and the nylon meshes are also used as a liner between plies in the form of belts.</p>	Any 3 points3x2	6	6
VIII	<p><b>master cylinder:</b></p> <ol style="list-style-type: none"> <li>1. The required hydraulic pressure is built up to operate the system.</li> <li>2. It maintains a constant volume of fluid in the system.</li> <li>3. To bleed or force air out of the brake line and wheel cylinder, a pump is used.</li> </ol> <p><b>wheel cylinder.</b></p> <p><b>a</b></p> <ol style="list-style-type: none"> <li>1. It actuates the shoes outward to contact the brake drum.</li> <li>2. It converts the hydraulic pressure of very low value into a significant value of mechanical force of higher value.</li> </ol> <p><b>Brake shoe adjustor</b></p> <p>The purpose of adjustor is to compensate the wear of brake leather due to regular use of vehicle.</p>	Anypoints3x3	9	9
VIII	<p><b>b</b></p> <ol style="list-style-type: none"> <li>1. To eliminate road shocks from transmission to vehicle components.</li> <li>2. To obtain good road holding while driving, cornering and braking.</li> <li>3. To keep the proper steering geometry.</li> <li>4. To obtain a particular height to body structure.</li> <li>5. To resist the torque and braking reactions.</li> <li>8. To maintain the stability of the vehicle while traveling over rough round or when turning in order to minimize the rolling, pitching or vertical movement tendency.</li> <li>9. To safeguard the occupants against road shocks and provide a riding comfort.</li> <li>10. To minimize the effects of stresses due to road shocks on the mechanism of the motor vehicle and provide a cushioning effect.</li> <li>11. To keep the body perfectly in level while travelling over rough uneven ground. <i>I.e.</i> the up and down movements of wheels should be relative to the body.</li> <li>12. To prevent the structure of the vehicle from shock loading and vibration due to irregularities of the road surface without impairing its stability.</li> <li>13. To obtain the requisite height to body structure.</li> <li>14. To support the body on the axles and keep the proper geometrical relationship between the body and wheels.</li> </ol>	Any 6 points6x1	6	6

Automatic transmission, arrangement of gears, brakes, clutches, a fluid drive, and governing devices that automatically changes the speed ratio between the engine and the wheels of an automobile.

The lay shaft, main shaft and clutch shaft with parallel gear train arrangement is replaced with an epicyclic or sun and planetary gear train arrangement and also the manual clutch from manual power train is replaced with hydro-coupled clutch or torque converter which in turn removes the clutch pedal from the vehicle.

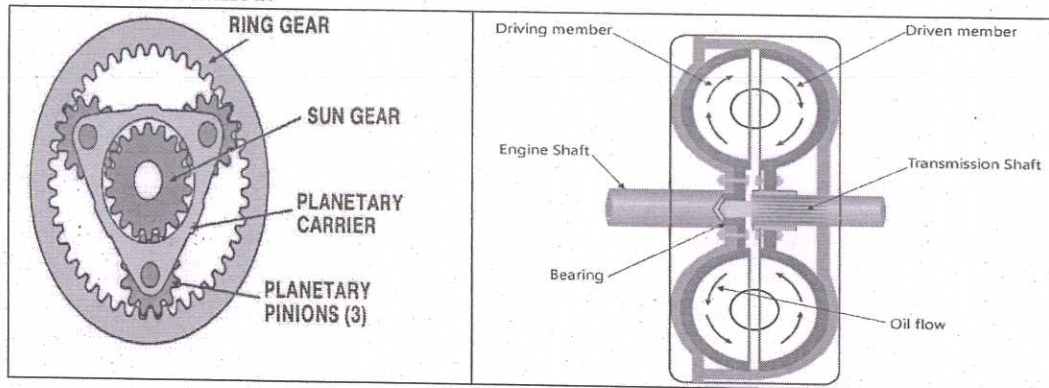
The automatic transmission usually comes with p-parking, n-neutral, r-reverse, d-drive, s-speed, mode. Each mode is having infinite torque and speed ratios required by vehicle.

1. Epicyclic gear train- It is also known as the sun and planetary gear arrangement, The parallel shaft gear train from manual transmission is replaced with more compact epicyclic gear train in automatic transmission
2. Hydraulic system- It is the system of automatic transmission that contains oil pumps, governor and hydraulic valves that controls the brake or clutch band by sending pressurised fluid through the valve body in order to control the epicyclic gearbox, The bands are connected to the hydraulic system through the shift valve and the output shaft is connected to the hydraulic system through the governor used.
3. Torque convertor- The clutch from the manual transmission is replaced with the torque convertor that uses pressurised fluid for the engagement and disengagement of the engine output, The torque convertor is operated by the accelerator pedal.

Working

It is the forward drive mode which consists the different gear ratios from high torque to medium speed, When this mode is selected and if the vehicle is in its steady state then by sensing the accelerator pedal by hydraulic system or electronic control unit the input is sent to epicyclic gearbox which in turn locks the annular gear with the help of bands and high torque or first gear ratios are obtained.

When the vehicle starts moving and attaining the accelerator pedal input from the hydraulic system or electronic control device is again sent to the epicyclic gearbox which in turn activates the bands which in turn locks the sun gear and medium speed or second gear ratios are obtained.



(i)epicyclic gearbox

(ii)Torque convertor

IX a

Fig 3+fig 3+3

9 9

<p><b>b</b></p>	<p>MPFi emerged as an excellent way to replace the carburetor. In MPFi system, each cylinder has one injector (which makes it multi-point). Each of these Injectors are controlled by a small micro-processor, which keeps telling each Injector about how much petrol and at what time it needs to inject near the cylinder so that only the required amount of petrol goes into the cylinder at the right moment. The micro-processor has a number of sensors to keep track of the temperature of the Engine, the Speed of the Engine, the load on the Engine, the current state of the engine, the amount of oxygen coming out of exhaust pipes or the amount of air pressure near the cylinders. Based on these observations the MPFi system decides how much fuel should be injected i.e the amount of petrol that should go in to make the vehicle fuel efficient. This technology consists of the following parts: 1. Injectors 2. Fuel Rail 3. Fuel pump 4. Fuel Pressure Sensor 5. ECU 6. Sensors 7. Fuel pressure regulator.</p> <p>In CRDi, the fuel system components are more intelligent which are controlled electrically. The traditional injectors are replaced with advanced electrically operated solenoid injectors. Injectors are opened with an ECU (Engine control unit) signal depending upon the variables such as engine speed, load, engine temperature etc. Combustion in CRDi commences directly in the main combustion chamber located at the top of the piston crown. A fuel distribution pipe is used to maintain optimum residual fuel and acts as a fuel reservoir for all the injectors. The fuel is constantly supplied at the required pressure for injection. High pressure fuel is stored usually in this tube which then supplies it to the solenoid valve injectors as opposed to fuel injection pump supplying diesel through independent fuel lines to injectors.</p>	<p>3+3</p>	<p>6</p>	<p>6</p>
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The three types of auto emissions are evaporative emissions, refuelling losses, and exhaust emissions. It is interesting to note that the car does not always need to be running to be giving off emissions.

#### Evaporative Emissions

Gasoline, antifreeze, and other auto liquids are made up of hydrocarbons that can be released into the air in many different ways. Diurnal evaporation is a process where gasoline evaporates from the engine thanks to the rise in the temperature outside. The hotter the day gets, the more emissions vehicles give off. Running losses are fumes given off by the gasoline when the car is running, while hot soak emissions occur after the engine has been turned off but is still warm.

#### Refuelling Losses

Whenever you put fuel in your vehicle, there are emissions that are given off into the atmosphere. If you watch closely as you fuel your vehicle, especially on hot days, you can see the emissions as they leave.

#### Exhaust Emissions

These are the fumes given off after the engine has burned the gasoline in the course of operating the vehicle. These are the emissions that are most evident and the ones that have been the subject of a variety of changes in laws over the years.

Emissions that are principal pollutants of concern include: Hydrocarbons -- A class of burned or partially burned fuel, hydrocarbons are toxins.

Hydrocarbons are a major contributor to smog, which can be a major problem in urban areas.

Carbon monoxide (CO) -- A product of incomplete combustion, carbon monoxide reduces the blood's ability to carry oxygen; overexposure (carbon monoxide poisoning) may be fatal.

Carbon Monoxide poisoning is a killer in high concentrations.

Nitrogen oxides (NOx) -- Generated when nitrogen in the air reacts with oxygen at the high temperature and pressure inside the engine.

It destroys resistance to respiratory infection.

Particulate matter -- Soot or smoke made up of particles in the micrometre size range: Particulate matter causes negative health effects, including but not limited to respiratory disease and cancer.

Sulfur oxide (SOx) -- A general term for oxides of sulfur, which are emitted from motor vehicles burning fuel containing sulfur.

X a

Roll over protection system is a system and a method for mitigating vehicle rollovers; the method comprises monitoring a vehicular tilt and sensing a vehicular rollover in a particular direction, through a tilt sensor. Further, the system determines an occurrence of a rollover according to a calculated tilt threshold, through a central processing unit. Steering the vehicle in the sensed direction of the rollover, accelerating the vehicle in the same direction, and braking the vehicle upon sensing a decrease in the rollover, all being controlled through a controller, enables the vehicle to eventually stabilize and return to track.

**b** The system uses a gyroscopic sensor that registers the amount of change in the lateral angle at which the vehicle is leaning. Using this information, the controller unit calculates the likelihood of a rollover. If there is an imminent risk of a rollover, the stability system is activated, power to the engine is cut and the brakes are applied to one or more of the wheels until the vehicle regains stability.

Electronic stability control is a computerized system that works by transmitting signals to the ESC control unit from individual sensors that are attached to each wheel. If a car begins to rotate in a direction different from the angle of the steering wheel, the sensors alert the system, which is then able to brake individual wheels as necessary to correct oversteering or understeering. It also slows the engine until control is regained. This allows the ESC to monitor and recover from skids that a human driver can't. Imagine driving on a snowy road. You are pointing your steering wheel straight ahead, but suddenly you start to skid to the left. Stability control will then kick in to cut power to the engine and brake the proper wheels to move the car where you are pointing the steering wheel. Traction control would only stop the skid.

3+3

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