

SIXTH SEMESTER DIPLOMA EXAMINATION IN MECHANICAL ENGINEERING—MARCH,2014

AUTOMOBILE ENGINEERING

(Maximum marks : 100)

[Time : 3 hours]

PART—A (Maximum marks : 10)**I. Answer all questions in one or two sentences. Each question carries two marks.****1. State the function of a thermostat in cooling system.**

Ans: Thermostat helps the engine to reach the operating temperature as soon as possible after starting as the engine is designed to operate most efficiently over a small temperature range of 80 to 100°C. In many engines the thermostat is in the coolant passage between the cylinder head and the radiators.

2. What is carburation.

Ans: The homogeneous mixture of air and fuel is prepared outside the engine cylinder. The air-fuel mixture is supplied into the engine cylinder during suction stroke. The process of preparation of the charge for SI engines is called Carburation.

3. Identify the function of a clutch.**Ans:**

- To engage or disengage the rest of the transmission as required.
- To transmit the engine power to the rear wheels without shock.
- To enable the gear to get engaged when the vehicle is in motion.

4. List any two types of rear axles.

Ans: Semi floating axle, Three-Quarter Floating axle.

5. What is brake bleeding.

Ans: Some times in the hydraulic brake system air enters through the joints. Since the air is compressible, high braking pressure is disturbed 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 braking system is called Bleeding.

PART—B (Maximum marks : 30)**II. Answer Any five questions. Each question carries 6 marks.****1. State the purpose of lubrication in IC engines.**

Ans: During the operation, the rubbing surfaces of engine parts wear, and there will be power loss due to friction. It is necessary to lubricate the engine parts. The functions of the lubrication system are given below,

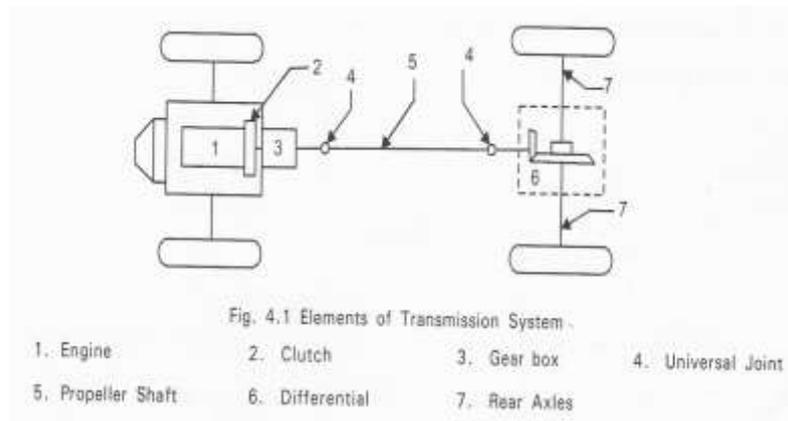
- To decrease the power required to overcome the friction, thereby increasing the power output.
- To reduce the wear between rubbing and bearing surfaces so that the engine service life is increased.
- To clean the surface by washing away carbon and metal particles caused by wear.
- To prevent the flow of gases through a space between piston rings and cylinder walls.
- To reduce the noise.

2. Explain any three noise reduction control techniques in an automobile.**Ans:**

- Reduction at the source of combustion forces and mechanical forces.
- Reduction of the vibration transmission between the sources and the outer surfaces.
- Reduction of the sound radiation of the outer surface.

3. Draw the elements of transmission system of an automobile.

Ans:



4. Compare fluid flywheel with torque converter.

Ans:

<u>Fluid coupling</u>	<u>Torque converter</u>
➤ Contains only two members impeller and turbine.	➤ Three members impeller, turbine and a stator.
➤ Simply a torque transmission unit.	➤ Torque multiplication unit 3:1 to 4:1
➤ Serves as an automatic clutch.	➤ Serves as an automatic clutch as well as a torque multiplier.
➤ Efficient at high speed.	➤ Inefficient at high speeds but more efficient under load.
➤ Impeller and runner are locked up and oil movement stops when centrifugal force is the same on both the member.	➤ No such locking and oil flows continuously.

5. State any six objectives of suspension system.

Ans:

1. To safe guard the passengers and goods against road shocks.
2. To preserve the road shock from getting transmitted to the vehicle body.
3. To preserve the stability of the vehicle while in motion.
4. To provide proper road hold when driving cornering and breaking.
5. To maintain proper steering geometry.
6. To bear the torque and braking reaction.

6. Write short note on MPFI (Gasoline injection system).

Ans: The term MPFI is used to specify a technology used in Gasoline/Petrol engine. There is no fuel injector installed near each cylinder that is why they call it multi point fuel injection.

In burn petrol is an engine to produce power, petrol has to be mixed with some air, ignited in a cylinder, which produces energy and runs the engine. In MPFI system, each cylinder has one injector. Each of these injectors are controlled by one central car computer. This computer is 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.

7. Explain the working of disc type brake.

Ans: The disc type used in automobile is normally of a caliper type, consisting of a rotating disc and two friction pads on either side. The road wheel is connected to the outer surface of the disc with a splash shield providing protection for the inner surface. While fitting the disc brake in the front wheel, the caliper assembly is secured to the steering knuckle. In the case of the rear wheel brake, it is connected to the axle housing.

The disc is made of high grade gray cast iron with better wear resistance property. And superfinishing. The friction pads made up of asbestos, fibre are fixed to a steel backing plate. This backing plate provided to take torque reaction during braking. The friction pads are held in radial position on the backplate by two retaining pins passing through the holes in calipers. The friction pads ride freely on either side of the disc and are positioned by the hydraulic pistons. The two wheel cylinders in the caliper half is connected by the drilled passages to the hydraulic brake line. The hydraulic fluid fed in the line completely. The size

of the piston is made equal to that of the pads to reduce noise during braking. Rubber seals are provided for dust and moisture protection.

PART—C (Maximum marks : 60)

Answer one full question from each unit . Each question carries 15marks.

UNIT – I

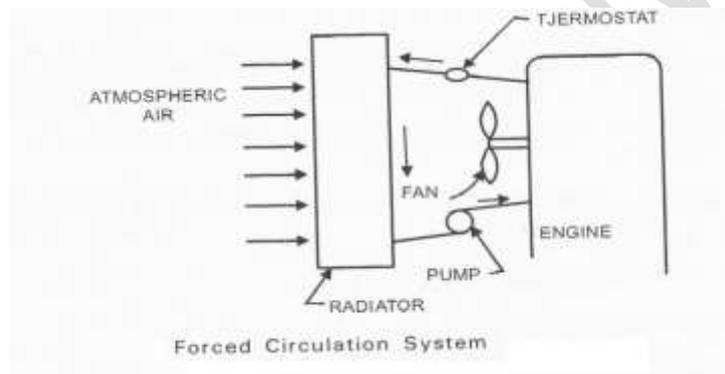
III. (a) Compare battery ignition system and magneto ignition system.

Ans:

Criterion	Battery ignition system	Magneto ignition system
Source of energy	Battery (6 to 12 v)	Magneto
Maintanance	Costly, due to discharge of battery.	Cheap, since there is no battery.
Quality of spark	Good, even at low speed	Poor at starting, due to low speed
Efficiency	Decreases as the speed increases	Increases as the speed increases.
Uses	Used in cars and light trucks	Used in high speed cars and two wheelers.

(b) With neat sketch explain the working of forced circulation system of water cooling.

Ans:



In this system water circulation is maintained by a pump operated by the engine itself. Cooling water enters at lower position of the engine and absorb heat while it is passing through jacket. The hot water come out from the top and passes in to the radiator where it is cooled and then return to the jacket. Cooling of water in radiator is effected by atmosferic air drawn through the radiator by fan.

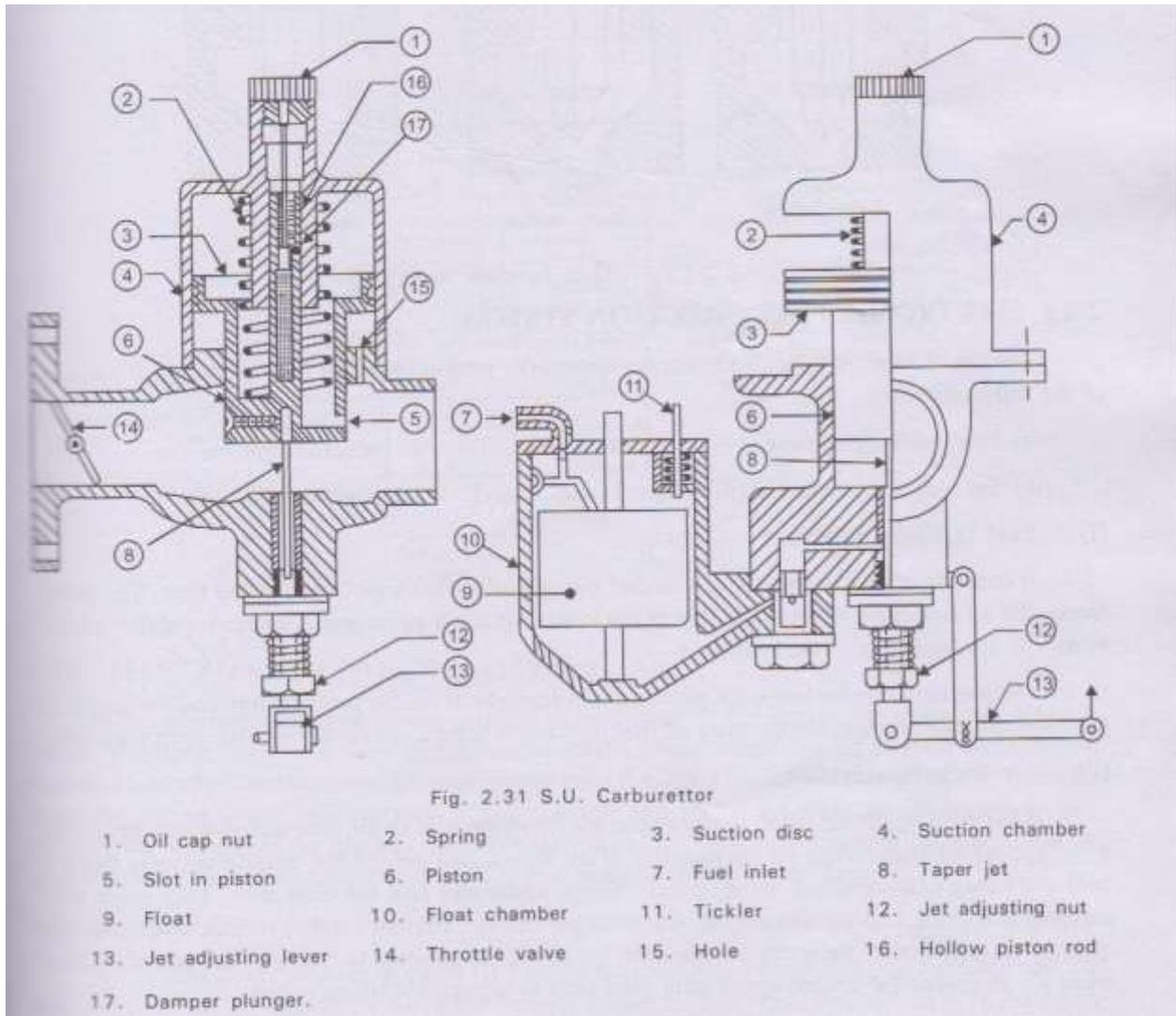
In modern cooling system a thermostat is used. It controls the jacket water temperature. When the water temperature is low, thermostt closes the valve and water circulation is cutoff. When the temperature of water in jacket reached to a suitable valve for efficient operation, thermostat opens the valve and circulation of water is maintained by the pump.

In this system the cooling is effective under all conditions of operation. But cooling is stopped as soon as the engine is stopped. This system is used for cooling large and medium size engines.

OR

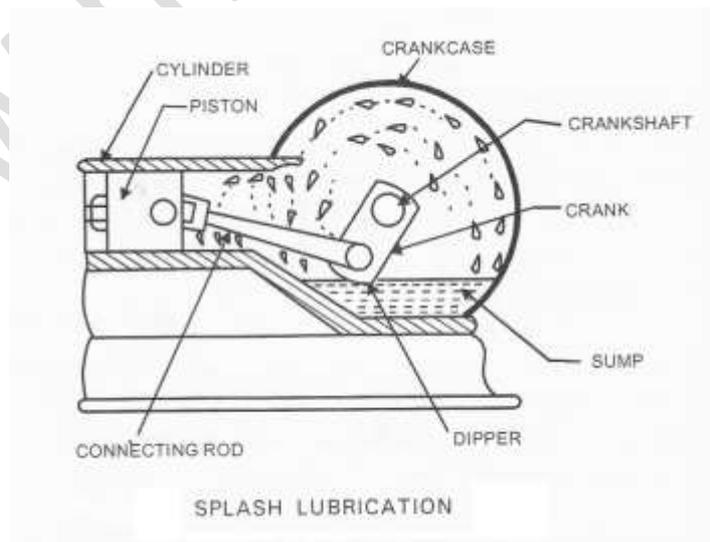
IV. (a) Draw a SU carburettor and label the parts.

Ans:



(b) Explain the splash system of lubrication with a sketch.

Ans:



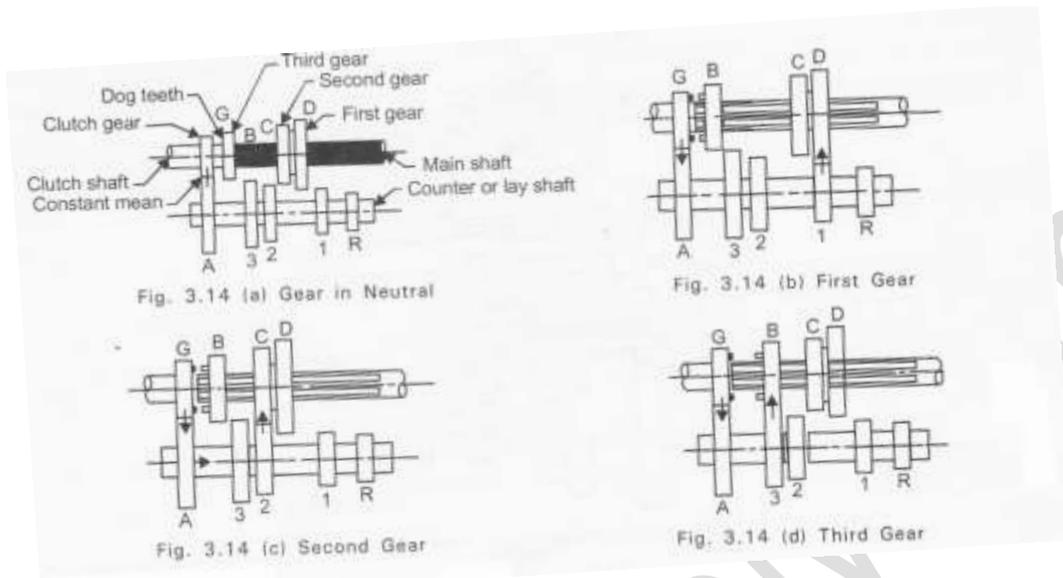
Splash lubrication is employed for small engines. In this case parts are lubricated by oil thrown by a small projection at the big end of connecting rod.

The oil is kept in the crank case and a certain level is maintained. The dipper provided at the end of the connecting rod drops in the oil, and oil is splashed into the piston and the other parts of engine which need lubrication. Oil pockets are provided to catch the splashing oil, and from the pockets the oil will flow to the bearing surfaces through a drilled hole.

UNIT – II

V. (a) Explain with sketch the working of a sliding mesh gear box.

Ans:



Sliding mesh gear box

This is the simple type of gear box. The arrangement of the gearbox is shown in figure. The power flow is from engine through the clutch to the clutch shaft and then to the clutch gear. Apart from the clutch shaft, there are two other parallel shafts called counter shaft and main shaft. The counter shaft carries the fixed gears reduced diameters.

The main shaft is a spindle one. The combination of the gears can be adjusted by sliding the gears over the splines. A fork is provided in selector mechanism to make any one of the main shaft gears to get engaged with the counter shaft or layshaft. The counter shaft gear will be rotating all the while along with the clutch gear. So the power out put shaft is the main shaft. With the help of a selector mechanism and lever, the gears can be obtained in series. There is also an idling gear provided, which is mounted on the casing and which could get engaged with the counter shaft for reverse gear. The entire arrangement is immersed in an oil bath and enclosed in a housing with firm packaging for prevention of leakage of oil. As per the arrangement three direct and one reverse drives are possible.

(b) Explain the working of a torque converter.

Ans: Torque converter

This is a mechanism designed to get a mechanical advantage or gear ratio by hydraulic transmission. Torque converter is a automotive transmission gives a maximum gear ratio during starting from rest. As the speed increases, the transmission gradually decreases the gear ratio.

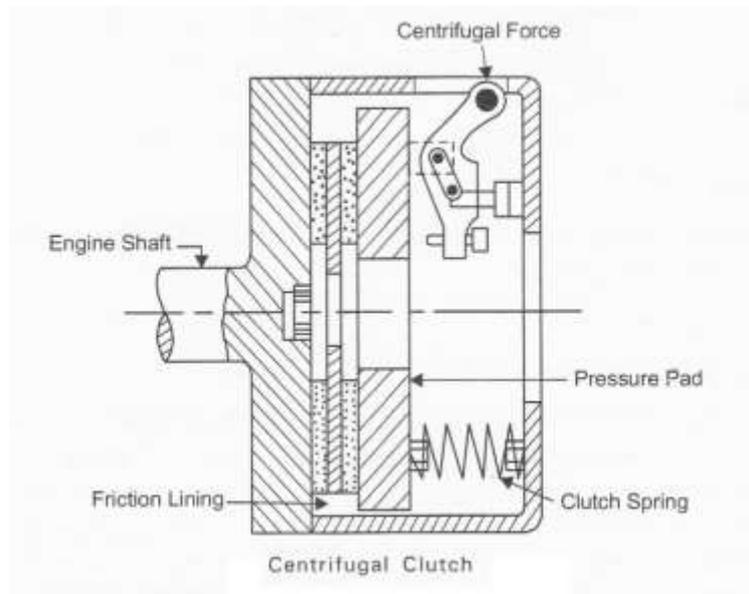
The principle of the single stage torque converter shown in figure. This consists of an impeller which is the driving member connected to the engine. The turbine which is the driven member connected to the propeller shaft. The stator is fixed to the frame.

To start with the presence of the centrifugal force at the impeller, force the fluid from the impeller into the turbine, it is to be noted that the impeller is driven by the engine shaft and the turbine attached to the out put shaft is assumed to be initially stationary. Suppose, there was no stator, the fluid from the turbine would entire into die impeller directly. This throwing of fluid will push the turbine blade in the opposite direction, causing a power loss. This dragging action on the turbine can be avoided if the fluid from the turbine is made to strike at a stator. This operation the presence of the stator changes the direction of the fluid suitably to strike the impeller in the most favourable direction. Later, the impeller pushes the fluid back into the turbine. This process is repeated continuously causing the torque on the turbine to increases. Of course, this favourable action of the stator in deflecting the fluid and subsequent increase of torque continues till the wheel speed remains lesser than the engine speed, like in any conventional gearbox.

OR

VI. (a) With neat sketch explain the working of a centrifugal clutch.

Ans: Centrifugal clutch

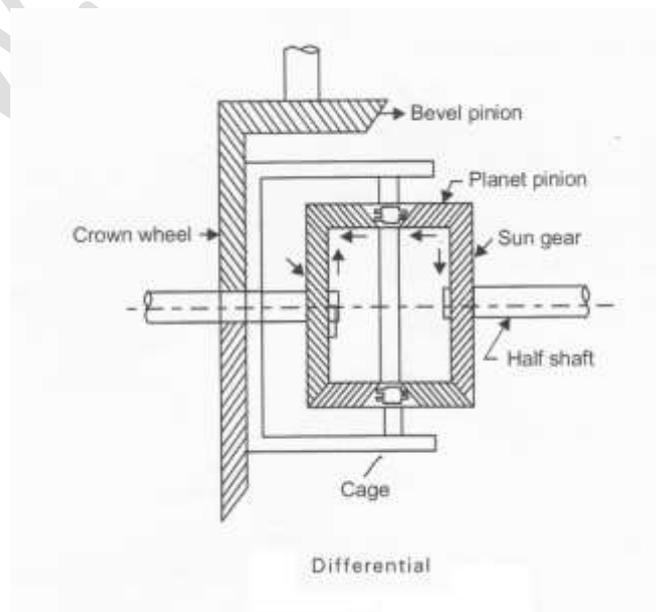


In this arrangement the centrifugal action of flyweights is made use of for engaging and disengaging the pressure plate. The functioning of the clutch is automatic and depends upon the engine speed. In this arrangement, there is no need for specific operation to disengage the clutch. The vehicle can also be stopped with gear load, without stalling the engine. The vehicle is controlled by the accelerator pressure and gear transmission at the starting only. The arrangement makes the driving operation very easy and convenient.

As the speed increases, the fly weights move outwards due to centrifugal force. This movement operates a bell crank lever and presses the floating plate. There are helical springs between the floating plate and pressure plate. Through the springs, the pressure plate containing the friction lining presses the clutch. There is one more set of springs on the back side of the pressure plate shown in figure to keep the clutch in disengaged position at low speed. A projection or a strip called stop is also provided to limit the movement of the fly-weights and the amount of the centrifugal force. Even if the speed is beyond this limit, the pressure on the plates will remain constant.

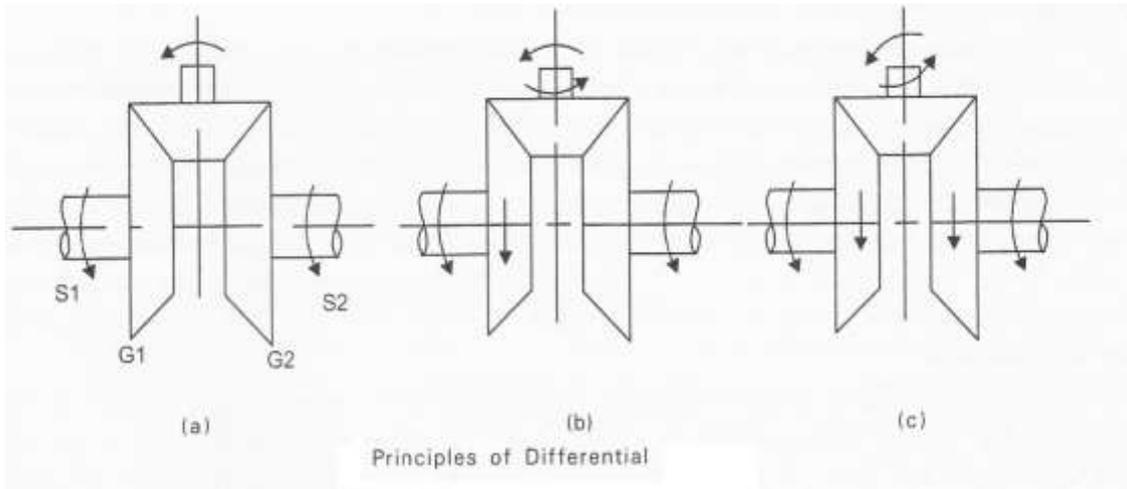
(b) Illustrate the working of a differential unit.

Ans: The figure explains the functioning of differential. In figure when the shaft is moved in a straight ahead position, the bevel gears along with the shaft shall revolve at the same speed in the same direction. If as shown in the figure S-2 is held stationary, then the right side bevel gear will not rotate. In this case, if the main shaft is assumed to move forward, the pinion rotates about its own axis and the left side bevel gear rotates faster, than in the previous case. Because in this case the left side bevel gear receives two different motions due to,



1. Forward pulling of the shaft as before.

2. Rotation of the pinion about its own axis which is in constant mesh with the bevel gear.

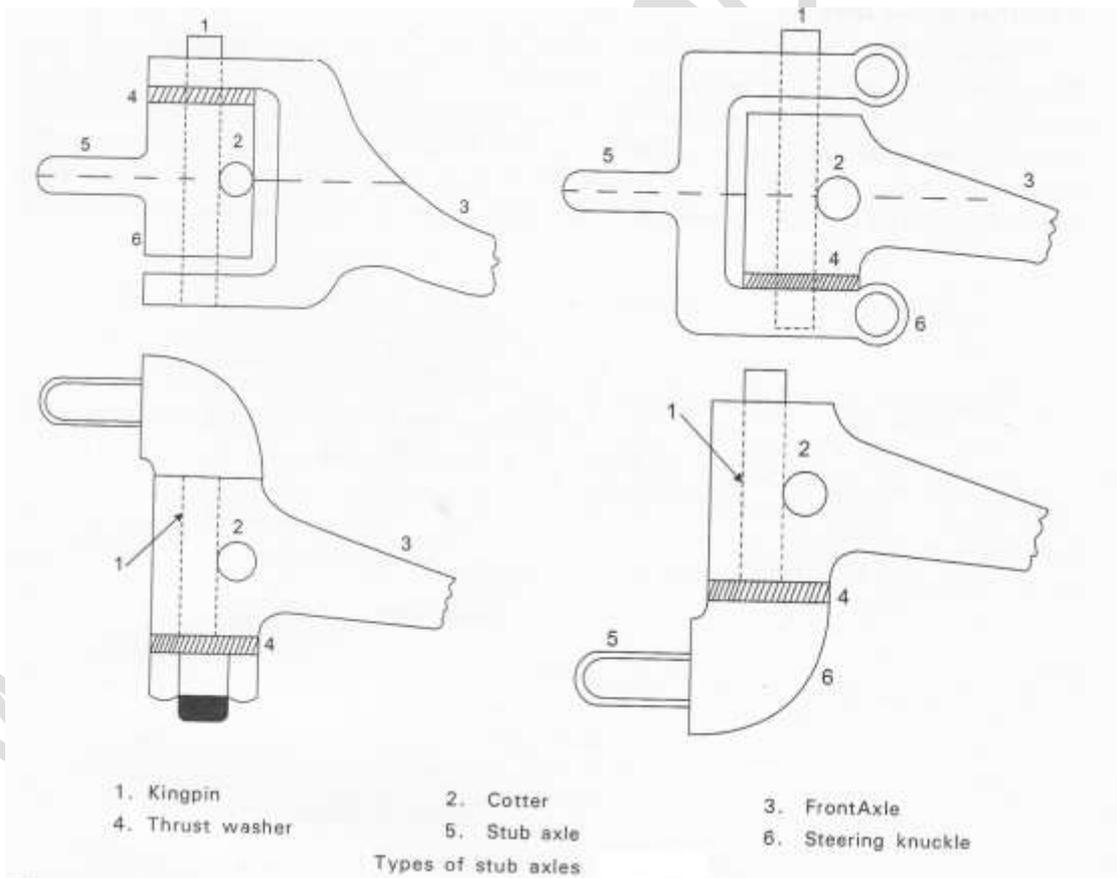


Suppose the right side bevel is allowed to slip on pinion wheel, then the left side bevel gear shall rotate at a lower speed than in the previous case.

UNIT – III

VII. (a) Sketch any four type of stub axle and show their parts.

Ans:



(b) What is the purpose of camber ? Explain the effect of incorrect camber.

Ans: Purpose:

- To bring the road contact of the tyre more nearly at or under the point of the load.
- To provide easy steering by allowing the vehicle weight to be carried by the inner wheel bearing and spindle.

Effect of incorrect camber:

- Excessive wear on wheel bearing.
- Excessive wear on ball joint.
- Excessive wear on one side of the tyre tread.
- Excessive uneven camber cause vehicle to pull on one side.
- Negative camber leads to inside wear and positive camber leads to outside wear.

Camber angle should not exceed more than two degrees. It is understood that tyre life will be maximum when the camber angle, in running condition, is zero with medium load.

OR

VIII. (a) With neat sketch explain the steering system of an automobile.

Ans: Steering system

Steering wheel:- This is the control wheel to steer a vehicle by the driver. This contains traffic indicating switch, light switch, etc. Shown in figure.

Steering column:- It is hollow tube. The steering wheel is attached at its upper end and the steering gear is fitted at the lower end.

Steering gear:- The function of steering gear as follows.

- This gives the mechanical advantage and gets drivers effort reduced.
- The rotary movement of the steering shaft at right angle is converted into a straight line motion by a drop arm.

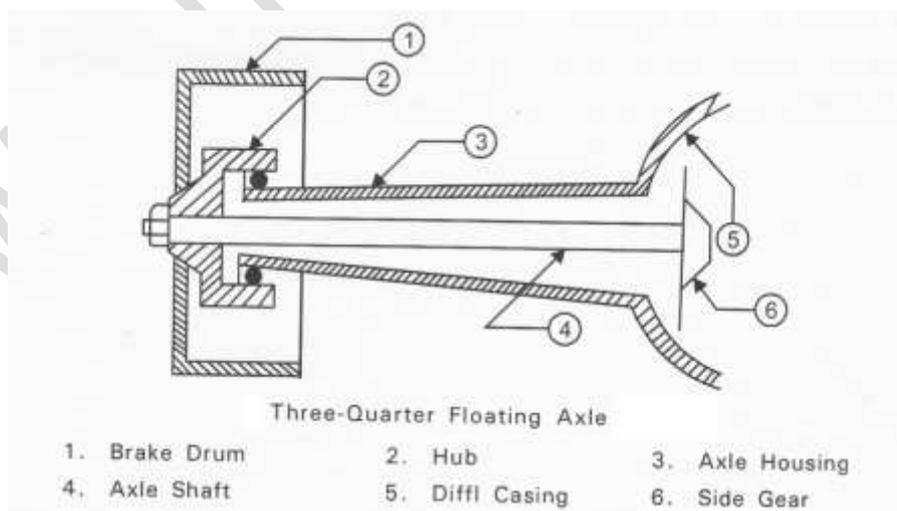
Gear components are enclosed in a steering gear box. The steering gear box is classified as,

1. Worm and worm wheel.
2. Worm and sector arm wheel.
3. Screw and nut.
4. Cam and lever and
5. Rack and pinion.

By turning the steering wheel, motion is transmitted through steering shaft to the steering gear box. A drop arm which is splined to the steering gear box, rocking at one end, is connected to the drag link by a ball joint at the other end. This drag link transmits the motion to the steering arm and steering knuckle. The track rod which is attached to the steering arm by ball joint turns the other wheel.

(b) Draw and explain three-quarter floating axle.

Three-quarter floating axle



This axle shaft is rarely used on the modern vehicle. It carries very little load as the outer bearing is placed between the wheel hub and the axle housing shown in figure.

The hub fits on to a taper on the axle and a small amount of load is taken up here as the vehicle turns or sways. The differential side gear is fastened solidly to the axle and keeps the axle shaft.

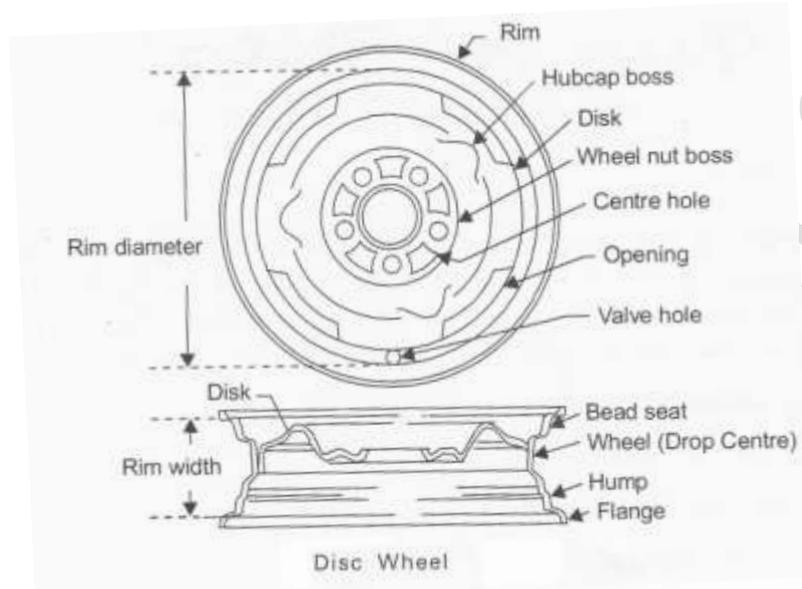
IX. (a) Explain the construction of Disc wheel with figure.

Ans: Disc wheel

The disc type of wheel consists mainly of two parts:

- The wheel rim.
- The pressed steel disc.

The disc is welded to the inner periphery of the wheel rim. Normally the rim is of rolled section. The disc function like a spoke. The wheel assembly is bolted to the brake drum. Some slots are provided for air cooling and a hole is there in the rim to provide the seating for the tube valve. This type of wheels for air cooling and a hole is there in the rim to provide the seating for the tube valve. This type of wheels is simple, cheap and robust in construction.



The disc type wheel is also called “safety rim”. The figure shows the how a disc wheel is constructed. The outer part is termed as rim. This is in one piece and welded to the disc. The centre of the rim is smaller in diameter than the rest. So the rim is called a drop center. This portion makes it possible to remove the tyre from the rim. When one side of the tyre is placed in the dropped area, it is then possible to lift the outer side of the tyre over the rim flange.

(b) Explain the working of power window in an automobile.

Ans: Power windows

With power windows, when one pushes the button up or down, and the windows move. It all begins with the car battery that sends the power to the power distribution box, from there the power is directed to the ignition; so that when the vehicle is turned ON, the windows will be in operation. From the ignition a wire runs to the fuse box before leading on to the window switch, this is essential in the case of a fault. The fuse will burn out therefore preventing any major costly repairs to larger components.

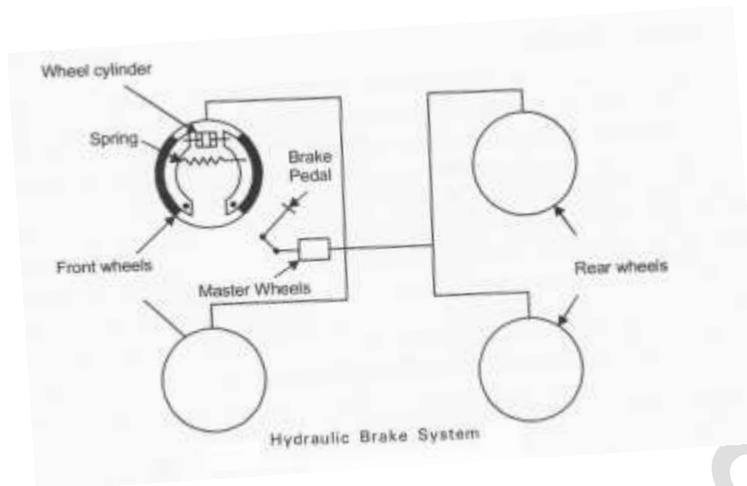
The majority of power windows work in the same way by having an automatic down feature on the driver side window.

The power window motor is a small motor that has an attached worm gear. This worm gear is a length of metal with a spiral on one end, similar to that of a screw. The worm is attached to a gear; this circular gear has teeth around the outside. As the worm turns it moves the gear by linking the teeth inside the spiral; the gear is then linked to several spur gears. Spur gears are used to create gear reductions in machine with motors. The worm is fixed at a specific angle to the gear, which allows the worm to run the gear, but prevents the gear from turning the worm. The motion of the worm and gears create a gear reduction which gives enough force to turn or rotate things, this is called torque. There are supporting bars below each electric window and attached to each bar is an arm. This arm slides along the bars as the window rises and falls. The other end of the arm has a plate with teeth that slot into the teeth of the gears; as the gears turn so does the arm and in turn rises or lowers the window glass. On the opposite side of the bars is a counter arm that counteracts the weight of the window, so if the main arm is raised on the right side of the window the counter arm will be raised on the left, ensuring that the glass rises and falls evenly and level.

OR

X. (a) With the help of a block diagram explain the working of a hydraulic brake system.

Ans:



Hydraulic brake system

Brake system in which hydraulic pressure is applied is called; 'Hydraulic system'. The hydraulic pressure is applied instead of a cam as in the mechanical brake, to turn loose end of the brake shoes. The main components on the system are:

1. Master cylinder.
2. Wheel cylinder. The principle of hydraulic brake system shown in figure.

First, let us assume four cylinders of the same cross sections. Let a certain force be applied at the main cylinder as shown. If the same force is applied to all the other four cylinders, the weights are exactly supported by the liquid in all the cylinders. This fundamental explains that the pressure at the central cylinder is equal to that of all cylinders.

Hydraulic brake system consists of a master cylinder and four wheel cylinders. The brake fluid flows from the master cylinder and flows to all the cylinders through pipe lines.

Brake shoes held by springs are provided on all the four wheels. When the brake pedal is pressed, the piston on the master cylinder forces out the fluid from the cylinder, and passes through the cylinder and the pipe lines. When this fluid enters the wheel cylinders, it pushes the two pistons in the wheel cylinder and the shoes outwards which in turn press against the brake drum.

(b) Compare radial and bias-ply tyre.

Ans:

Radial ply tyre:

Here ply cords run in radial direction or in the direction of the tyre axis. There are some breaker strips in the circumferential direction. The material used for breaker strips is flexible, so that there is no change in circumference due to variation of inflation. These breaker strips which are in-extensible, function like girders and provides directional stability.

Bias ply tyre:

In this skeleton work the ply cords are woven at an angle as shown in figure. In the opposite direction. This type tyre has bad wear and heating characteristics.