

SIXTH SEMESTER DIPLOMA EXAMINATION IN MECHANICAL ENGINEERING—OCTOBER,2014

ADVANCED PRODUCTION PROCESS

(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. Define the term 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.

2. List the function of a transmission system.**Ans:**

- Enable the engine to be disconnected from the road wheels.
- Enable the leverage between the engine and the driving wheels to be varied.
- Reduce the speed of the engine.
- Turn the drive round through 90°.
- Provide the relative movement between the engine and driving wheels due to flexing of the road spring.

3. List the types of live rear axle.**Ans:**

- 1) Semi floating axle.
- 2) Three quarter floating axle.
- 3) Full floating axle.

4. State any four advantages of hydraulic brakes.**Ans:**

- Simple in construction.
- Equal braking effort to all the wheels.
- Simultaneous operation.
- Increased braking effort.

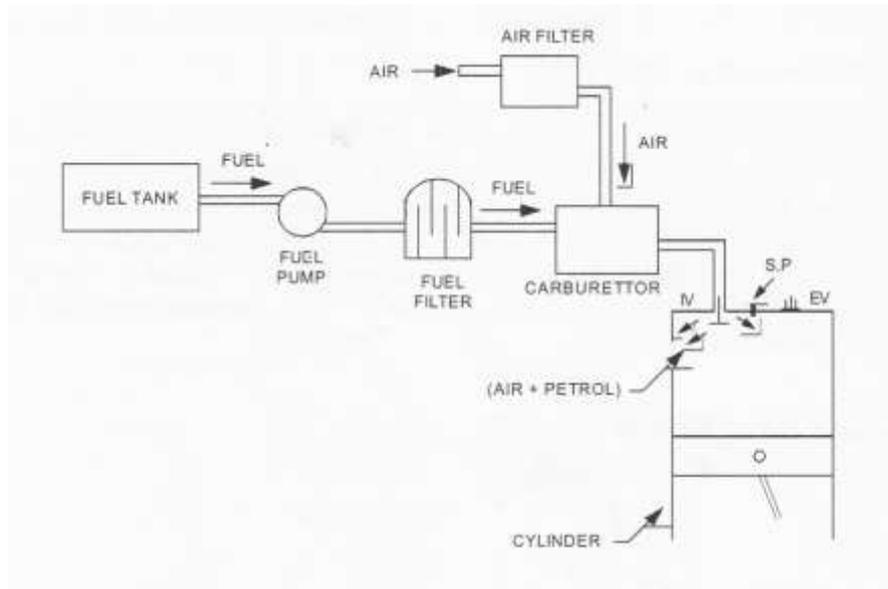
5. List any four advantages of air cooling system.**Ans:**

- Design of engine is simple as no water jackets are required.
- Absence of radiator makes the system simpler and minimises the maintenance problem.
- No danger of leakage and freezing of water in cold climate.
- Weight per given output is less.

PART—B (Maximum marks : 30)

II. Answer Any five questions. Each question carries 6 marks.

1. Sketch and explain the fuel system of diesel engine.**Ans:**



The main components of fuel injection system are, Fuel tank, Fuel feed pump, Filter, Injection pump, and Injector.

During the operation, the fuel from the tank enters the fuel feed pump. In feed pump the pressure of fuel is raised slightly. Then the fuel is drawn into the filter where all the dust particles are removed. From the filter the fuel enters into the injection pump where the pressure of fuel is increased above the pressure of air in the cylinder at the end of compression. At this high pressure fuel is sprayed into the engine cylinder by means of fuel injector. Any spill over fuel in the injector is returned to the filter.

2. Explain the advantages of constant mesh gear box over the sliding mesh gear box.

Ans: Compared to the sliding mesh type, the constant mesh type gear box has the following advantages.

- As the gears have to remain always in mesh, it no longer necessary to use straight spur gears. Instead, helical gears are used which are quieter running.
- Wear of dog teeth on account of engaging and disengaging is reduced because here all the teeth of the dog clutches are involved compared to only two or three teeth in the case of sliding gears.

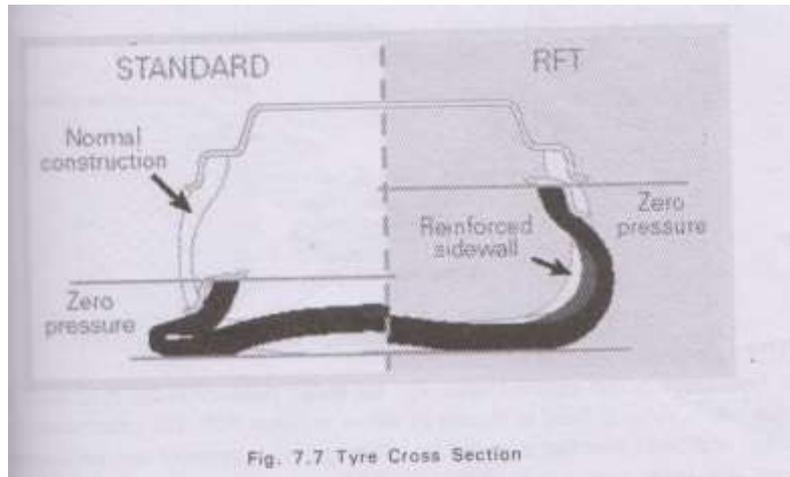
3. Explain briefly air suspension system.

Ans: The automobile chassis is supported on the axles. Springs provided this support. By this means, the vehicle body is isolated from the road shocks. Road shocks may be in the form of bounce, pitch roll or sway.

Suppose the chassis is provided with direct transmission of the loads, the structure of the vehicle body would be subjected to excessive fatigue loading; continued and severe stresses on the engine and in the transmission system would make the working parts experience fracture or breakdown. If the wheel axle is rigidly attached to the frame, uncomfortable ride will result. To avoid these defects, isolation of the body is essential. Therefore, the assembly of parts which perform the function of isolation of the parts from the road shock is called as the suspension system. A suspension system supports an automobile and keeps its wheels always in contact with, uneven road surface.

4. Sketch and explain parts of a tyre.

Ans:



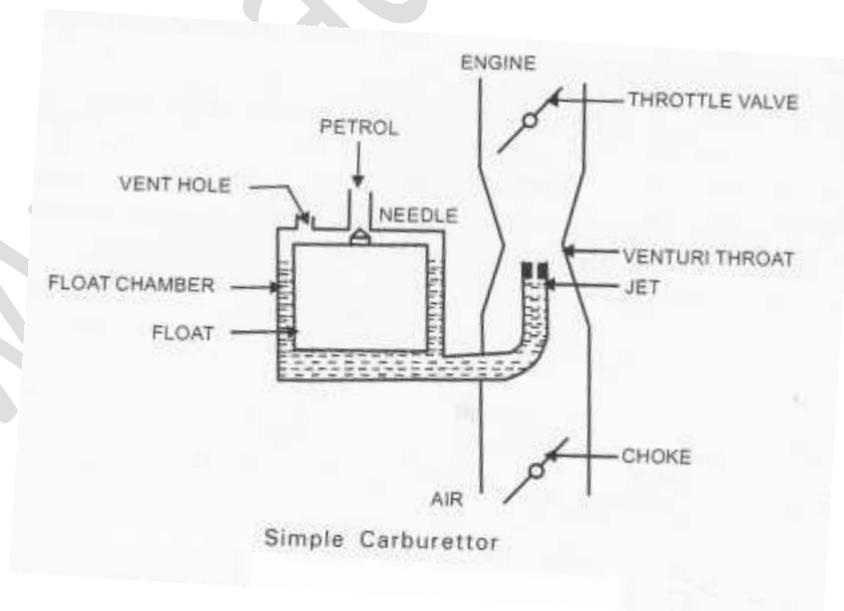
The tyre is a cover for the tube and provides protection. These are placed around the rims of the wheel as a cushion between the wheel and the road.

The tyre cross section can be divided into four regions shown in figure. Are, bed region, side walls, shoulder region, Tread region.

The casing is made up of a number of fabric layers. The casing resists expansion of the tube when road shocks are experienced. Rubbarised cards are used to form sheets of the layers. Each sheet is placed at an inclination to the adjacent layer so that a strong casing is formed. The tyre casing is made of Rayon and Nylon materials to form a strong, flexible and heat resisting tyre. Anomber of hoops of steel wire are used in the bead of the tyre to place the tyre on the rim. The tyres are made of natural or synthetic rubber. These are compounded with chemicals.

5. Sketch and explain the working of simple carburator.

Ans: During suction stroke, a partial vaccum is created in the engine cylinder and carburator. Due to this, air flows into the carburator. At the narrow section of the ventury tube velocity of air increases and air pressure is correspondingly reduced. A pressure difference is thus prodused between float chamber and then venturi, which causes the fuel to flowout of fuel jet in the form of spray. The fuel delivered by the jet into the air stream is finally atomised, mixed with air and vaporised to form homogeneous air fuel mixture which is admitted to the engine cylinder.



6. Specify the advantages and disadvantages of radial ply tyres over the bias-ply tyres.

Ans: Radial play tyres possess the following advantages over the bias-ply tyres.

- ❖ The side walls of radial play tyres can bend radially. Their shock-absorbing deflection is about 25 percent more than the cross-ply tyres.
- ❖ The breaker strips of the radial tyres act independently of the wall plies unlike in cross-ply tyres where there is no breaker strip and the tread is supported only by the higher wall plies.

- ❖ Lower rolling resistance and hysteresis loss, which ultimately means reduced fuel consumption.

The following disadvantages also accompany the above advantages of radial ply tyres.

- ❖ Heavier steering at low speeds.
 - ❖ Uncomfortable harsh ride at low speeds. This is due to stiff belts used.
 - ❖ These cost initially higher (about 20 percent more than the cross ply-tyre).
7. **Explain briefly leaf spring suspension.**

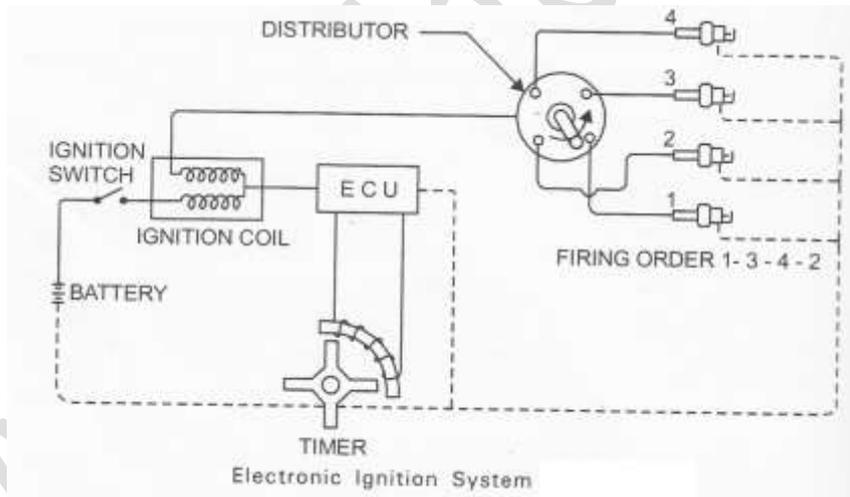
Ans: Leaf springs are formed by bending. They are made up of long flat strips of spring steel. A number of strips are placed one above the other, and held together with the help of centre U bolt and clamps. Each strip is named as a leaf. The longest leaf extends and consists of eyes or loops at both ends. These loops or eyes provide facilities to connect the frame. The other leaves are shorter. The progressive leaf spring is bent in the form of an elliptical shape. Its curvature and camber are pre-determined during manufacturing itself. Normally, the longer leaf is secured to the front hanger by a bolt at one end and by a spring shackle at the other end. Both hangers are bolted to the frame. The spring will get elongated during compression and shortened during expansion. Any change in length of spring is compensated by the shackle. Some rebound clips are located at the intermediate positioning of the spring. These clips are loose enough to permit the leaves together to slide and tight enough to get closer when the spring rebounds. The eyes or loops at the ends are provided with bushings or with some anti-friction material like bronze or rubber. In this leaf spring arrangement the spring weight is made as light as possible. The front eye of the leaf spring is attached to the frame. The rear eye is connected to a spring shackle.

PART—C (Maximum marks : 60)

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

UNIT – I

III. (a) Draw the neat sketch of a coil ignition system.



(b) Explain the various governing system of IC engine.

Ans:

1) Hit and Miss method of governing:

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

It is simple, but the large fluctuation of speed takes place in the idle cycle which needs a heavy flywheel. This method is suitable for small gas or oil engines.

2) Quality governing:

This method is employed for high speed diesel engines (CI engines). 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. Thus the quality of the mixture is varied.

3) Quantity Governing:

This method is employed in spark ignition engines. In this method, the quality of fuel is not altered but the quantity of mixture supplied to the engine varied by regulating the throttle valve.

4) Combined method:

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.

OR

IV. (a) Explain pollution control techniques.

Ans: Engine efficiency has been steadily improved with improved engine design, more precise ignition timing and electronic ignition, more precise fuel metering, and computerized engine management.

Advances in engine and vehicle technology continually reduce the toxicity of exhaust leaving the engine, but these alone have generally been proved insufficient to meet emissions goals. Therefore, technologies to detoxify the exhaust are an essential part of emissions control.

Air injection

One of the first-developed exhaust emission control systems is secondary air injection. Originally, this system was used to inject air into the engine's exhaust ports to provide oxygen so unburned and partially burned hydrocarbons in the exhaust would finish burning. Air injection is now used to support the catalytic converter's oxidation reaction, and to reduce emissions when an engine is started from cold. After a cold start, an engine needs an air-fuel mixture richer than what it needs atoperating temperature, and the catalytic converter does not function efficiently until it has reached its own operating temperature. The air injected upstream of the converter supports combustion in the exhaust headpipe, which speeds catalyst warmup and reduces the amount of unburned hydrocarbon emitted from the tailpipe.

Exhaust gas recirculation

In the United States and Canada, many engines in 1973 and newer vehicles (1972 and newer in California) have a system that routes a metered amount of exhaust into the intake tract under particular operating conditions. Exhaust neither burns nor supports combustion, so it dilutes the air/fuel charge to reduce peak combustion chamber temperatures. This, in turn, reduces the formation of NO_x .

Catalytic converter

The catalytic converter is a device placed in the exhaust pipe, which converts hydrocarbons, carbon monoxide, and NO_x into less harmful gases by using a combination of platinum, palladium and rhodium as catalysts.

There are two types of catalytic converter, a two-way and a three-way converter. Two-way converters were common until the 1980s, when three-way converters replaced them on most automobile engines. See the catalytic converter article for further details.

(b) Discuss the various emissions from automobile engines.

Ans: Types of emissions:

Emissions of many air pollutants have been shown to have variety of negative effects on public health and the natural environment. 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. Prolonged exposure to hydrocarbons contributes to asthma, liver disease, lung disease, and cancer. Regulations governing hydrocarbons vary according to type of engine and jurisdiction; in some cases, "non-methane hydrocarbons" are regulated, while in other cases, "total hydrocarbons" are regulated. Technology for one application (to meet a non-methane hydrocarbon standard) may not be suitable for use in an application that has to meet a total hydrocarbon standard. Methane is not directly toxic, but is more difficult to break down in a catalytic converter, so in effect a "non-methane hydrocarbon" regulation can be considered easier to meet. Since methane is a greenhouse gas, interest is rising in how to eliminate emissions of it.
- 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 (NO_x) - Generated when nitrogen in the air reacts with oxygen at the high temperature and pressure inside the engine. NO_x is a precursor to smog and acid rain. NO_x is a mixture of NO , N_2O , and NO_2 . NO_2 is extremely reactive. It destroys resistance to respiratory infection. NO_x production is increased when an engine runs at its most efficient (i.e. hottest) part of the cycle.
- 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.
- Sulphur oxide (SO_x) - A general term for oxides of sulfur, which are emitted from motor vehicles burning fuel containing sulfur. Reducing the level of fuel sulfur reduces the level of Sulphur oxide emitted from the tailpipe.
- Volatile organic compounds (VOCs) - Organic compounds which typically have a boiling point less than or equal to 250°C ; for example chlorofluorocarbons (CFCs) and formaldehyde. Volatile organic compounds are a subsection of Hydrocarbons that are mentioned separately because of their dangers to public health.

UNIT – II

V. (a) List the different types of clutch.

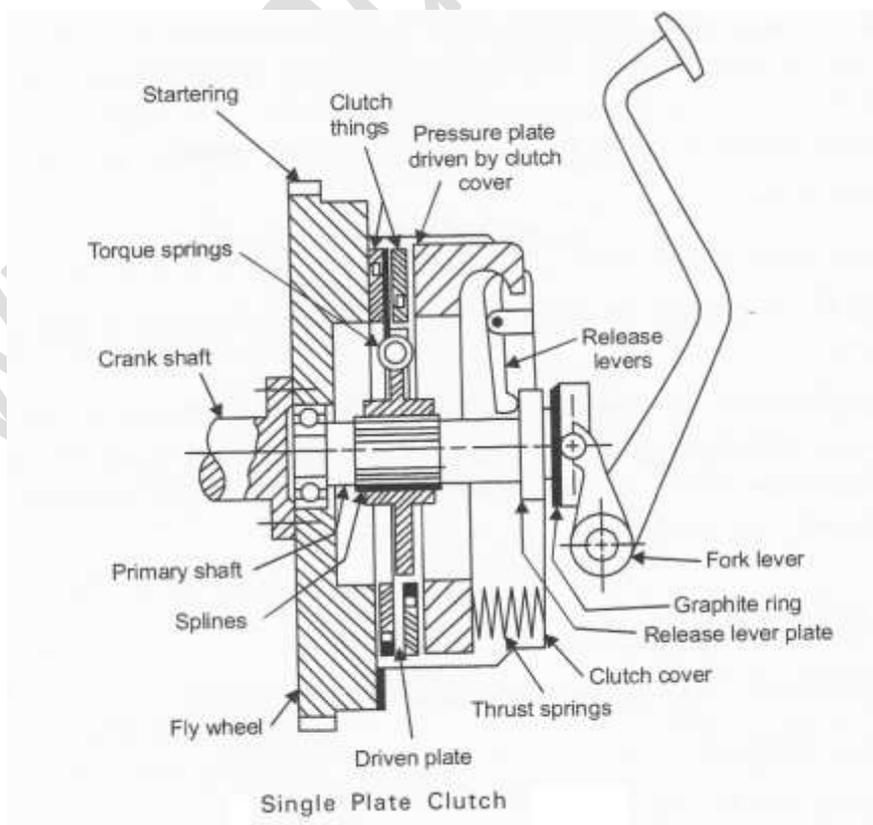
Ans: Clutches are normally classified as positive clutch and gradual engagement clutch.

1. Friction clutch.

i) Wet clutch. ii) Dry clutch. iii) Cone clutch.

2. Centrifugal clutch.
3. Semi centrifugal clutch.
4. Conical spring clutch or diaphragm clutch.
5. Positive clutch.
6. Hydraulic clutch.
7. Electro magnetic clutch.
8. Vacuum clutch.
9. Over running clutch or free wheel clutch.

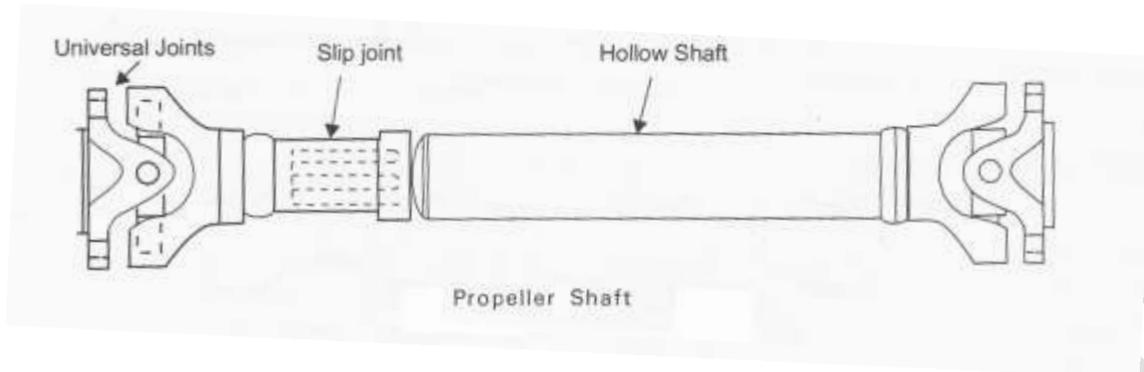
(b) Draw a neat sketch of a single plate clutch.



OR

VI. (a) Explain with simple sketch the function of a propeller shaft.

Ans:



This is an important shaft in the transmission system, by means of which drive is transmitted to the driving axle. The shaft power is to be transmitted to the rear wheels at different lengths and different angles. This shaft connects the transmission with the driving axle by means of universal joints. This shaft also contains a slip joint which enables the shaft to vary its length. Thus the propeller shaft has to transmit the power from the engine end to the driven end in different vertical and horizontal planes. The propeller shaft is to withstand torsional stresses, therefore, it must be well balanced. It should not whip when rotating at high speeds. This is made of a strong steel tube or shaft.

(b) Sketch and explain the working of a differential.

Ans: The figure explain the functioning of differential. When the shaft is moved in a stright ahead position, the bevel gears along with the shaft shall revolve at the same speed in the same direction, irrespective of the speed of the shall. If s-2, is held, stationary, then the right side bevel gear will nut 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, then in the previous case. Because in this case the left side bevel gear recieves two different motions due to,

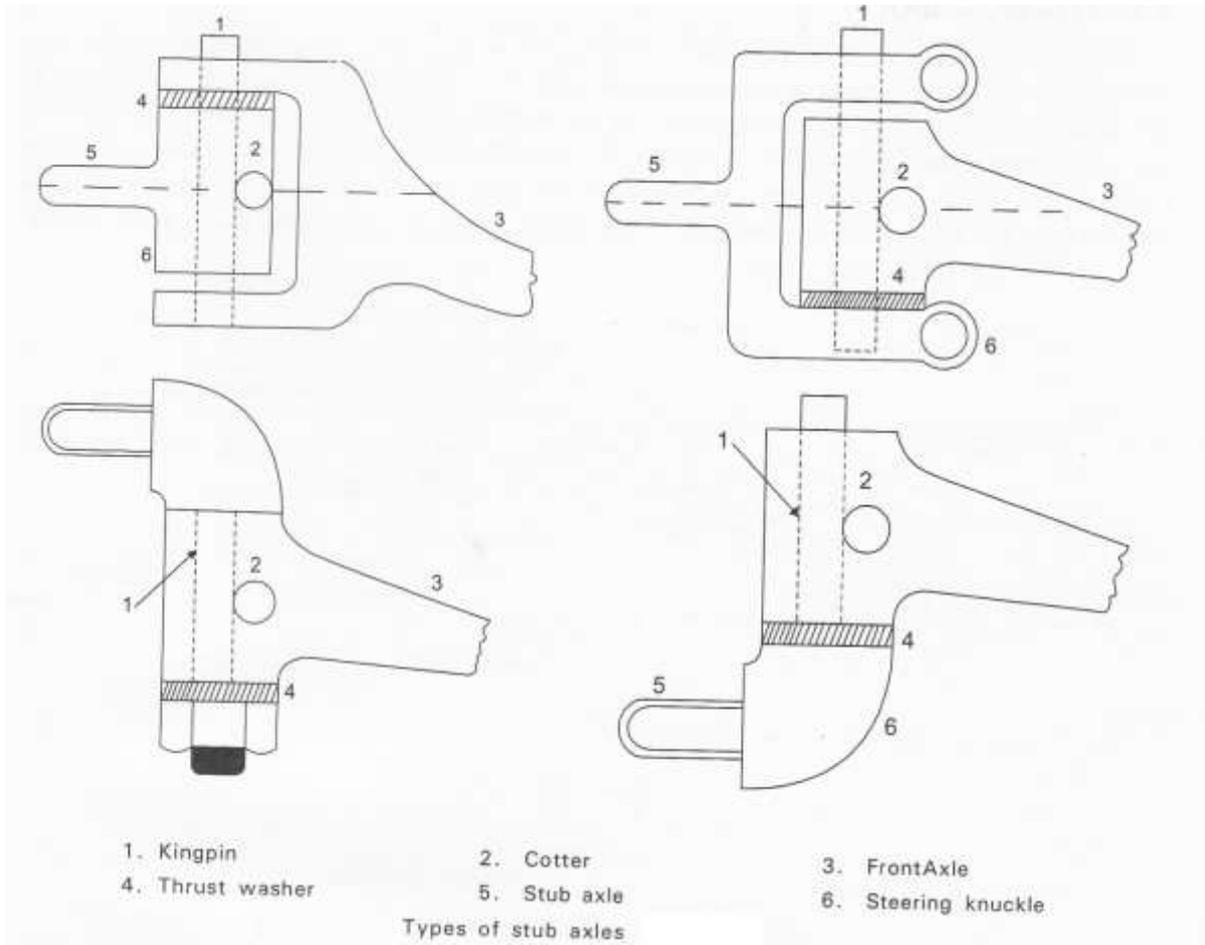
- 1) Forward pulling of the shaft as before.
- 2) Rotation of the pinion about its own axis which is in constant mesh with the bevel gear.

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) Discuss briefly stub axle sketch any two types.

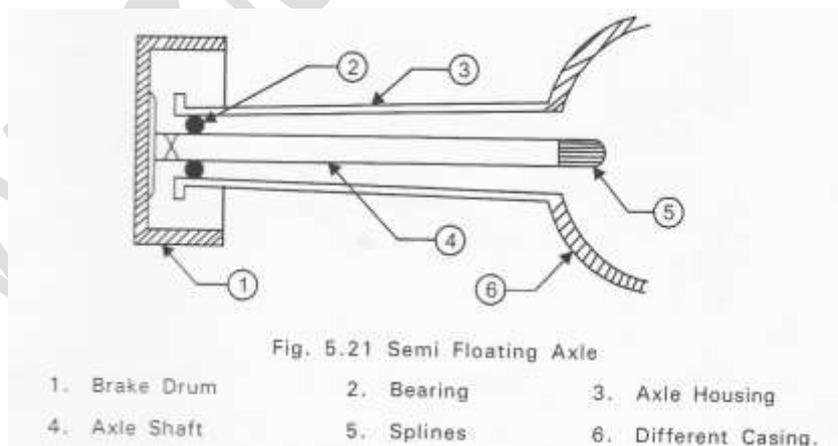
Ans:



Stub axles are connected to the front axles with the help of a king pin. Front wheels are mounted on the stub axles. The stub axles are made of forged steel with 3 percent nickel steel and alloy steels of chromium and molybdenum.

(b) Sketch and explain semi floating rear axle.

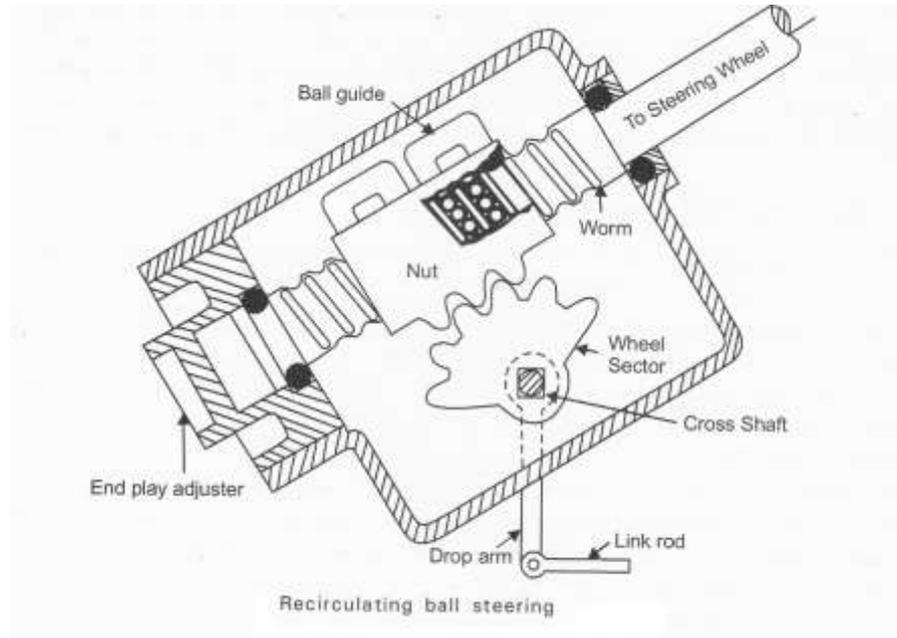
Ans: Semi floating axle



It is splined on the differential end and uses this end for driving purpose only. This end floats and carries no weight. A bearing is placed between the axle shaft and the housing at the outer end to carry the weight of the vehicle. The shaft is held in position by a lock on the differential end or by a bearing on the outer end.

OR

VIII. (a) Draw a neat sketch of a recirculating ball steering gear.



(b) Explain Camber, Caster, and King pin inclination.

Ans: Camber:

This is the outward tilt of the front wheels from the vertical plane at the top. This tilting is called 'positive camber'. In case of negative camber, the load is allowed to act through king pin directly down thereby relieving any bending action of the pivots. The purpose of camber is to bring the road contact of the tyre more nearly at or under the point of the load. And to provide easy steering by allowing the vehicle weight to be carried by the inner wheel bearing and spindle.

Caster: To obtain directional control of the vehicle by making the front wheels to maintain straight-ahead position or return to stright ahead position out of a turn.

The main purpose of the caster angle is to make the driver to have maximum steering, to have directional stability to travel straight ahead. This is achieved by the fact that the projected axis of the king pin strikes the road ahead of the contact point of the tyre. This arrangement has a tendency to drag the wheel behind it providing the vehicle directional stability. The back ward tilt from the vertical is called positive caster and in contrast, the forward tilt in the same plane is called negative caster.

King pin inclination: This is the inward tilt of the king pin as from the vertical plane. This tilting tends to keep the wheels straight ahead, and makes the wheels return to the stright position, after completion of a turn; it also reduces steering effort.

This provide directional stability along with suitable caster. The inclination is normally kept within seven to eight degrees. If there is no inclination as such, the cambered wheels will exeit a steering action on the vertical king pin with the result of hard steering.

UNIT – IV

IX. (a) List advantages and disadvantages of hydraulic brake.

Ans: Advantages of hydraulic brake:

- ❖ Simple in construction.
- ❖ Equal braking effort to all the wheels.
- ❖ Simultaneous operation.
- ❖ Increased braking effort.
- ❖ Self lubrication.
- ❖ Requires less space.
- ❖ High mechanical advantage.
- ❖ Comfortable for the driver's operation.
- ❖ Less rate of wear.

Disadvantages of hydraulic brake:

- ❖ Whenever there is any leakage at any point of the system, the entire system fails.
- ❖ The leakage in the wheel cylinder; may reduce the braking action between the linings and the drum.

(b) Explain with a neat sketch the working of a drum brake.

Ans: In the arrangement of an automobile, the wheel is attached to a drum. There are brake shoes which come in contact with the rotating drums during braking operation. At each wheel, there are two shoes used. The shoes are provided with lining on their surfaces. An anchor is used to lift the brake shoes at one end. The other end is connected by some method so as to make the brake shoes come in contact with the brake drums. After the operation of braking, the brake shoes should return to their original position. For this purpose, retracting springs are fitted. These springs also keep the shoes even when the brakes are not in operation. So, in general the braking system includes brake shoes, drum plates acting as means to fasten cam and the brake shoes with an enclosure to keep the entire mechanism always free from dirt. Only brake linings come in contact for stopping.

OR

X. (a) Discuss the causes of uneven and improper tyre wear.

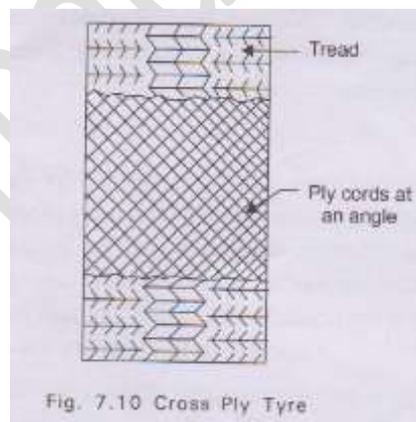
Ans: Irregular tire wear is a frustrating little gremlin that can steal your tires' performance and tread life if you let it. The problem is that irregular wear comes in so many different flavours. The causes of strange tire wear can range from air pressure to improper balance, from misalignment to bent wheels. Here's how to recognize the problem, how to tell where it's coming from and what to do about it.

Causes:

- **Air Pressure:** Improper air pressure will cause tires to wear in specific patterns according to whether the tire is over-pressured or under-pressured.
- **Balance Issues:** Improper balance will cause the tire to spin with a wobble due to unbalanced centrifugal forces. This wobble will cause the tire to wear improperly and probably show up as a vibration as well.
- **Bent Wheels:** A bent wheel, in addition to probably causing a vibration in the car, will also affect the wear on its tire and can even affect the wear on the other tires as well. As the bead of the tire follows the contour of the wheel, the bend in wheel will be mirrored by the tire's shoulder tread as the whole sidewall dips to follow the bend. This can cause all kinds of strange wear.
- **Alignment:** A 4-point alignment (as opposed to a front-end alignment) essentially ensures that the tires are all parallel to each other and flat to the pavement, giving the tires their optimal wear profile. If the alignment is incorrect, any number of wear patterns can develop. Additionally, the kind of impact that will bend a wheel will generally also knock the alignment out, creating a tire wear situation that basically feeds on itself.

(b) Write the constructional details of cross bias ply tyres.

Ans:



Cross bias ply tyres:

In this type, the ply cords are woven at an angle (30° - 40°) to the tyre axis. There are two layers which run in opposite directions as has been shown in the figure. However, the cords are not woven like warp and weft of ordinary cloth, because that would lead to rubbing of the two layers and thus produce heat which would damage the tyre material.