

Q.1(a) Attempt any THREE of the following: [12]

Q.1(a)(i) What is clutch? State functions and classification of friction clutches. [4]

(A) Clutch is a device used in transmission system of a vehicle to engage and disengage the engine to the transmission. Thus the clutch is located in between engine and transmission (gear box).

Function of Clutch:

- (1) To permit engagement or disengagement of a gear when the vehicle is stationary and the engine is running.
- (2) To transmit the engine power to the road wheels smoothly without shock to the transmission system while setting the vehicle in motion.
- (3) To permit the engaging of the gears when the vehicle is in motion without damaging the gear wheels.
- (4) To allow the engine to take up load gradually without shock or jerk.

Classification of Friction Clutches:

Disc (Plate) Type Clutch

(1) Single Plate Clutch

1.1.1 Coil Spring Type Single Plate Clutch

1.1.2 Diaphragm Spring Type Single Plate Clutch

(2) Multiplate Clutch

2.1.1 Dry Type Multiplate Clutch

2.1.2 Wet Type Multiplate Clutch

(3) Cone Clutch

Q.1(a)(ii) Justify aerodynamic shape of body. [4]

(A) **Necessity of Aerodynamic Shape of Body:**

- (1) Due to the increasing demand of efficient and comfortable cars, Automobile Aerodynamics is an important element in improving the overall performance of Vehicle.
- (2) Air resistance opposes the forward motion of the car. It influences fuel consumption and attainable maximum speed of vehicle.
- (3) Hence it is the design engineer's task to make the drag coefficient of vehicle as small as possible by shaping the body aerodynamically.

Advantages of Aerodynamic Shape of Body:

- (1) Reduce Air resistance or air drag.
- (2) Reduce driver effort to drive vehicle.
- (3) Improve speed of vehicle.
- (4) Provide better fuel economy through reducing fuel consumption.
- (5) Provide attractive shapes and better aesthetic appearance to the vehicle.
- (6) Reduce noise pollution.
- (7) Reduce running cost of vehicle.

Q.1(a)(iii) State advantages and disadvantages of LPG/CNG engine over petrol engine [4]

(A) **Advantages of LPG & CNG operated engines:**

- (1) The fuel cost is less.
- (2) Less pollution and more efficiency.

- (3) It is safer for vehicle. The LPG/CNG fuel tank is made of thick wall so they can withstand dynamic explosion, crash test, and direct gunfire.
- (4) Increased life of lubricating oils, as LPG/CNG does not contaminate and dilute the crankcase oil. No need of oil change frequently which reduce vehicle maintenance.
- (5) Due to its antilock property, CNG can be used safely in engine with compression ratio as high as 12:1 compare to gasoline engine. Because CNG has a higher octane number than petrol, CNG engines operate at higher compression ratio without knocking.
- (6) CNG/LPG fuel systems are sealed, preventing fuel losses from spills or evaporation.

Disadvantages of LPG & CNG operated engines :

- (1) Space Required for LPG/CNG Cylinder is more.
- (2) LPG/CNG tank is bulky.
- (3) More current rated battery is required.
- (4) Eats entire boots space of vehicle.
- (5) Easily not available in rural areas.

Q.1(a)(iv) Define following terms:

[4]

- (1) **Camber** (2) **Caster** (3) **Toe in** (4) **King pin inclination**

- (A) (1) **Camber:** It is the tilt of car wheels from the vertical. Camber is **positive**, if the tilt is outward at the top. Camber is **negative**, if the tilt is inward at the top.
- (2) **Castor:** It is the angle between king pin centre line and the vertical, in plane of wheel. If king pin center line meets the ground at a point in front of wheel centre line it is called **Positive Castor**. If it is behind the wheel centre line, it is called **Negative Castor**.
- (3) **Toe in:** When the front wheels of the vehicle are pointing inward, they are said to toe in.
- (4) **King Pin Inclination:** Inclination of king pin from vertical is called the king pin inclination.

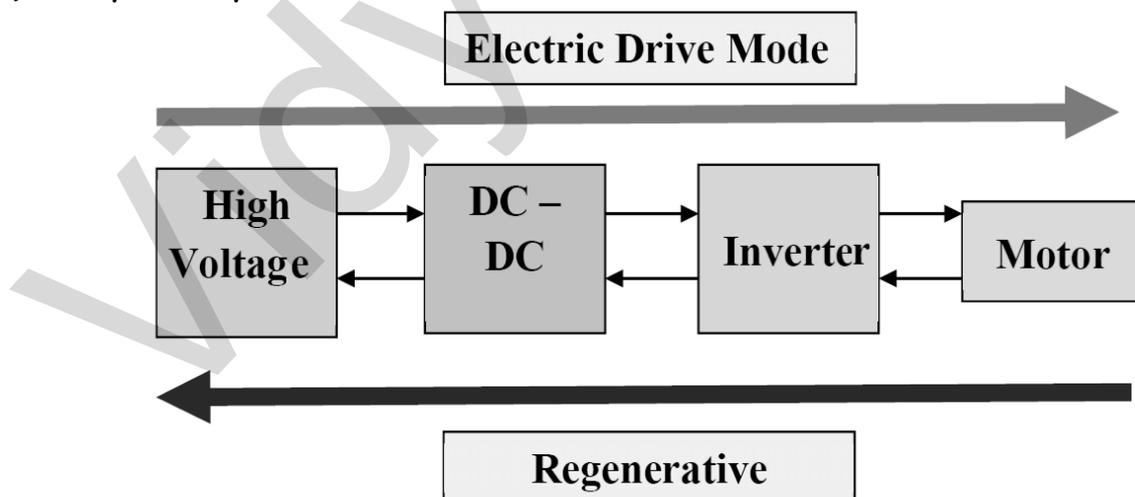
Q.1(b) Attempt any ONE of the following:

[6]

Q.1(b) (i) Draw a layout of hybrid vehicle and explain its working. State its advantages

[6]

(A) **Layout of hybrid vehicle**



Generally, a vehicle which can utilize more than one energy sources for propulsion, it is called as Hybrid Vehicle. So the combination of petrol Engine & LPG, Diesel Engine & CNG, or Petrol and Battery operated vehicle are the examples of Hybrid vehicles.

Working of Hybrid Vehicle:

When the driven steps on the pedal the generator convert energy from the engine into electricity and store it in the battery. The battery then provides power to the electric

motor. The internal combustion engine and electric motor works simultaneously and each provides power to the power split device.

The power split device combines both powers and uses it to the transmission. The transmission then turns the wheel and propels the vehicle.

Advantages of Hybrid Vehicle:

- (1) It converts 40 % of the energy stored in petrol to power the vehicle.
- (2) It provides moderate speed range (110 mph).
- (3) Energy Efficient.
- (4) Environment Friendly.
- (5) Zero Emission.
- (6) Reduce Noise.

Q.1(b) (ii) Explain the working of transfer case with neat sketch and give its application. [6]

(A) Working of Transfer Case:

Transfer Case is the device used in all wheel drive vehicle, that splits the power between the front and rear axles on a four-wheel-drive car. While the differentials handle the speed difference between the inside and outside wheels, the transfer case in an all-wheel-drive system contains a device that allows for a speed difference between the front and rear wheels

When the shifter mechanism *A* is at the centre so that no gear is connected to the input shaft, the drive is in neutral as shown Fig. (a). Fig (b) shows a position when the shifter mechanism *A* connects the input shaft with the big input gear, but the shifter mechanism *B* disconnects the front output shaft from the rear output shaft. In this position, two-wheel drive with the high gear is obtained.

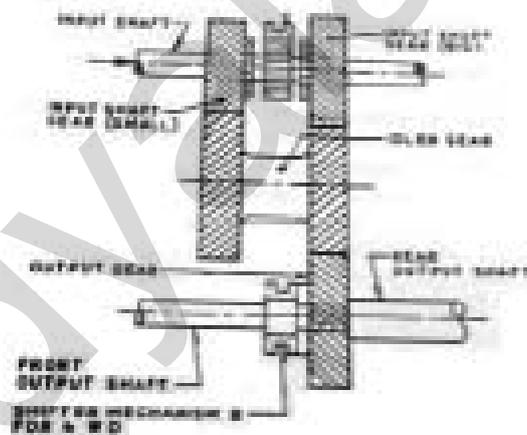


Fig. (a): Neutral Position of Transfer Case

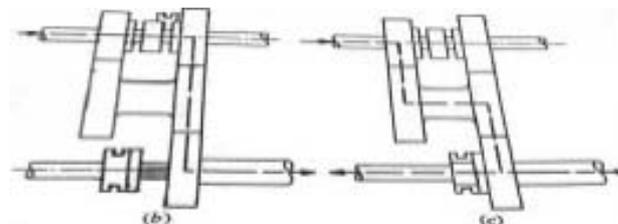


Fig. (b) : 2 WD in High Gear Fig. (c) : 4 WD in Low Gear

In the same way Fig. (c) depicts the situation with four wheel drive in low gear. Obviously, four-wheel drive with low gear should be used invariably with the low gears on the main transmission. Also, the transfer box gears should be engaged with the vehicle stationary since these are not provided with synchromesh devices.

Application of Transfer Case:

Transfer Case (Gear Box) is an essential element of Four (All) Wheel drive vehicle.

- (1) Mahindra Jeep
- (2) Maruti Gypsy
- (3) Shaktiman Truck (Military Vehicle)

Q.2 Attempt any FOUR of the following :

[16]

Q.2(a) Differentiate between conventional and unitary body.

[4]

(A)

	Conventional body	Unitary Body
(i)	There are two heavy side members and cross members welded, bolted or riveted to the superstructure.	In this, heavy cross and side members are eliminated. Thick metal sheet is directly welded to the floor pan of vehicle.
(ii)	Heavier in construction	Light in weight
(iii)	Ground clearance is more	Ground clearance is less
(iv)	Higher centre of gravity	Lower centre of gravity
(v)	Due to use of nut & bolts, it's having noisy operation.	There are no bolts or nuts to loosen
(vi)	Maintenance is easier	In case of accident, difficult to maintain
(vii)	Less wear and corrosion	More wear and corrosion
(viii)	Production cost is more	Production cost is less, if manufacturing in mass quantity
(ix)	Used in heavy vehicles like trucks & buses	Used in light vehicles like passenger cars

Q.2(b) Enumerate the various resistances that have to be overcome by an automobile moving on the road. [4]

(A) **Resistance offered by moving Vehicle:**

(1) **Air or Wind Resistance (R_a):** It is the resistance offered by air to the movement of a vehicle. It depends upon the size and shape of vehicle as well as upon its speed and wind velocity.

$$R_a = K_a \cdot A \cdot V^2$$

Where,

K_a = Coefficient of Air Resistance

A = Projected Frontal Area of Vehicle

V = Speed of Vehicle

(2) **Gradient Resistance (R_g):** It is the force opposing forward motion of a vehicle up a gradient. In case of a motor vehicle moving up a gradient, the component of the weight parallel to the surface affects the movement of the vehicle upward on the gradient. It is depend on the steepness of the grade.

$$R_g = W \cdot \sin\theta$$

Where,

W = Weight of Vehicle

θ = Gradient

(3) **Rolling Resistance (R_r):** It is the force necessary to maintain constant speed on a level road. This resistance is based upon the deformation or nature of the road surface and nature of the tyre as well as dissipation of energy through impact and the total weight of the vehicle along with load in it.

$$R_r = K_r \cdot W$$

Where,

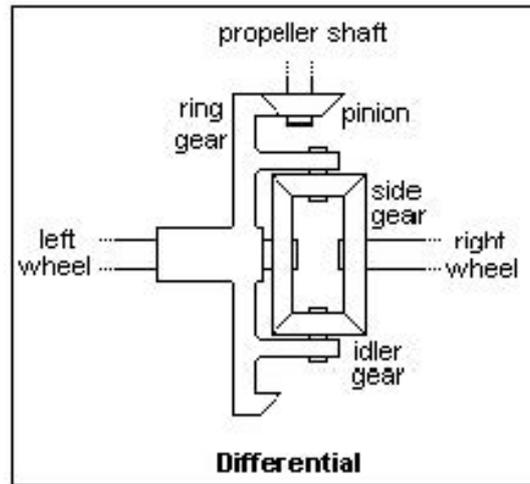
K_r = Coefficient of Rolling Resistance

W = Weight of the Vehicle

Q.2(c) State the need of differential with neat sketch.

[4]

(A)



Need of differential :

- (1) When vehicle is taking turn outer wheel will have to travel greater distance as compared to inner wheel.
- (2) The vehicle has a solid rear axle only and no other device, there will be tendency to skid.
- (3) Hence wheel skidding is avoided by incorporating so mechanism i.e. differential.
- (4) Differential reduces the speed of inner wheel and increases the speed of outer wheel when vehicle is taking turn, at the same time keep the speed of rear wheel same when going straight ahead.

Q.2(d) Explain working of Bendix drive used in starting system, with neat sketch.

[4]

(A)

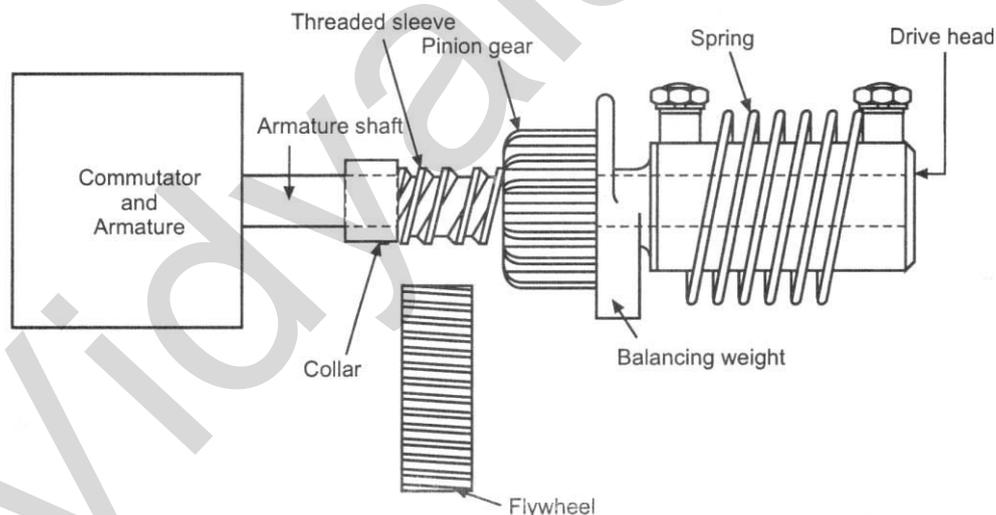


Fig. : Bendix drive

Bendix drive is an inertia based drive in which the pinion on the starter motor armature engages and disengages with the flywheel depending on the inertia of motor and flywheel. When the ignition switch is turned 'ON', the starter motor armature starts spinning. This causes the sleeve to rotate while the pinion is stationary due to the unbalanced weight. The pinion hence moves axially towards the collar until it engages with the flywheel ring gear. Since the pinion cannot move further axially, it starts to rotate along with the sleeve thereby also rotating the flywheel. When the flywheel starts rotating at above 100 rpm the engine gets started. After the engine has started the pinion gear is turned by the engine much faster than rotated by starting motor. This causes, the pinion gear to turn back on the threaded sleeve, making it disengaged with the flywheel.

Q.2(e) Why air conditioning is necessary in an automobile? [4]

(A) Necessity of Air Conditioning in an Automobile:

- (1) During cold weather, a vehicle without a heater could become unfortunately, even dangerously, cold.
- (2) The vehicle could get unfortunately hot for a variety of reasons.
- (3) A vehicle may collect heat from any of the following sources:
 - Heat from sun which radiates through the roof and windows
 - Engine heat transmitted through the dash panel
 - Heat from exhaust system
 - Heat from hot pavement conducted through floor panels
 - Heat radiated by passengers
- (4) These heat sources combine to increase temperature of passenger compartment and cause mild to extreme discomfort.
- (5) Thus the main purpose of the automobile climate control (Air Conditioning) systems is to provide passenger comfort.
- (6) Climate control (Air Conditioning) systems perform this function by circulating and cooling or warming the air in the vehicle passenger compartment to control the temperature and lower the humidity.

Q.3 Attempt any TWO of the following : [16]

Q.3(a) Compare between hydraulic braking system with pneumatic braking system.

(A)

	Hydraulic braking	Pneumatic braking
(i)	Braking Fluid used as a working medium	Compressed air is used as a working medium
(ii)	Simple in construction	Robust (Heavy) in construction
(iii)	Occupied less space as compared to Air brake	Occupied more space as compared to Hydraulic brake
(iv)	System is self lubricating	Need to lubricate mechanical parts
(v)	Bleeding is necessary	No need of bleeding
(vi)	Increased braking effort, but less powerful than air brakes.	Most powerful than Hydraulic brake
(vii)	Low maintenance cost.	Maintenance cost is more
(viii)	Mostly used in passenger cars, LCVs.	Exclusively used in heavy vehicles like bus & truck

Q.3(b) Draw neat labelled sketch of constant mesh gear box and explain working. [8]

(A) Working of constant mesh gear box : In this type of gear box, all the gears are in constant mesh with corresponding on the shaft. The gears on the main shaft which is splined are free. The dog clutches are provided which are free to slide on the main shaft. the gears on the lay shaft are fixed.

When the left dog clutch is slide to left by means of the selector mechanism, its teeth are engaged with those on the clutch gear and we get the direct gear. The same do clutch when slide to right makes contact with the second gear and second gear is obtained. Similarly movement of the right dog cloth to the left results in low gear and towards right in reverse gear.

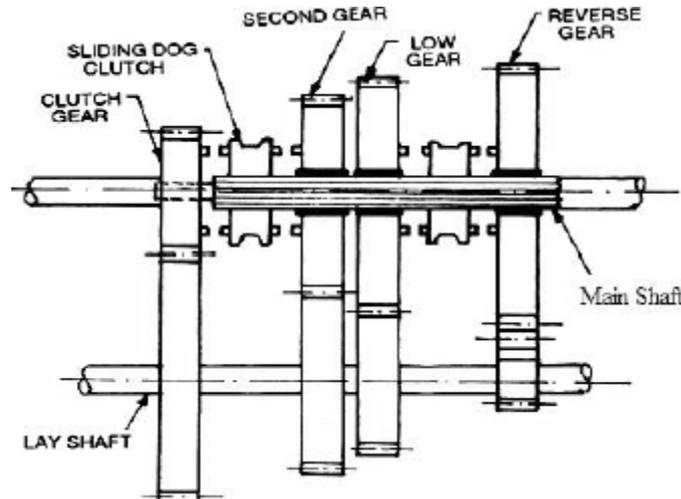


Fig. : Constant mesh gear box (Neutral Position)

Q.3(c) Describe the working of multi-plate dry clutch with diagram. State its applications. [8]

(A) **Multi Plate (Dry) Clutch** : It is the extension of single plate clutch. It consist of a number of clutch (friction) as well as pressure plates. As the number of plates increased, the friction surfaces also increase. The increase in number of friction surfaces obviously increases the capacity of the clutch to transmit torque. The plates are alternately fitted to the engine shaft and gear box shaft. They are firmly pressed by strong coil springs and assembled in a cover assembly. Each alternate plate has inner and outer splines, this each of the alternate plate slides on the splines on pressure plate.

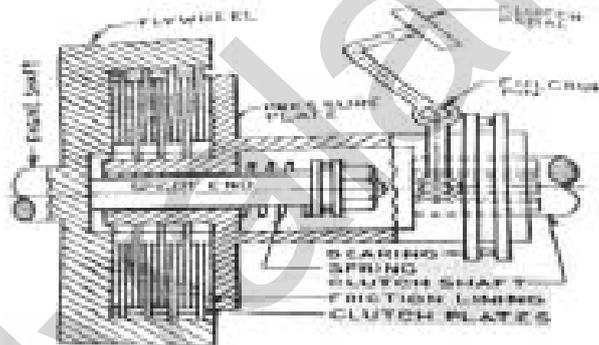


Fig. : Multi Plate (Dry) Clutch

Working of Multi Plate Clutch : The pressure plates are used to apply the pressure on friction plates and the inside diameter of the pressure plate is splined while making the inside diameter splined, the rotating motion of pressure plate is restricted. The pressure plate moves on the driven shaft axially. when we apply the pedal the pressure plates and the friction plates come in contact with each other and the speed or power is transmitted from the engine shaft to the transmission shaft.

Applications : This type of clutch is used in Scooters and Motor Cycles where space availability is limited. Besides, this finds the application in Heavy Transport Vehicles and Racing Cars where high torque is to be transmitted.

Q.4(a) Attempt any THREE of the following: [12]

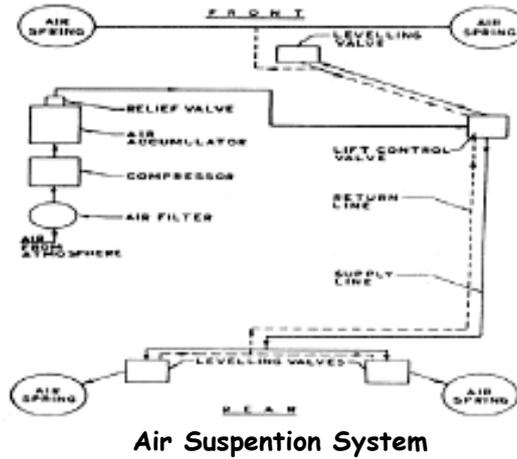
Q.4(a) (i) Enlist any four requirements of suspension system in automobile. [4]

(A) **Requirements of suspension system** :

- Minimum deflection constant with required stability.
- Comparability with other vehicle components, i.e. tyre, frame etc
- Minimum wheel hop.
- Low maintenance and operating cost.
- Low initial cost.
- Minimum weight and tyre wear.

Q.4(a) (ii) Explain construction of air suspension with neat sketch. [4]

(A) Construction of air suspension :



Construction :

- It consists of four air bags replaced by four springs.
- Air bags are filled with compressed air and mounted on beneath the chassis.
- Air gets further compressed and absorbs the shock when wheel encounter a bump on the road.
- Controls through valve control system
- Type : 1) Air bag type 2) Piston type

Q.4(a) (iii) Write different colour codes of wires used in automobile wiring system. [4]

(A)

Sr. No.	Colour	Circuit	Example with tracer
(i)	Brown	Battery and generator circuit.	
(ii)	Yellow	Overdrive Circuit	Overdrive switch or column to overdrive relay – yellow with green tracer.
(iii)	White	Ignition circuit and all other requirements when ignition circuit is switched or without fuse protection.	Starter switch to solenoid switch – white with red tracer.
(iv)	Green and light green	Auxiliary circuits fed through Ignition switch as well as protected by Ignition auxiliary fuse.	Stop lamp switch to stop lamp green with purple tracer.
(v)	Purple	Circuits protected by fuse and normally not controlled by the Ignition switch.	Horn push to horn – purple with black tracer.
(vi)	Blue	Head lamp circuit.	Lighting switch to head lamp-blue with white tracer.
(vii)	Red	Side and tail lamp circuit Including fog lamp, panel lights etc.	Panel lamp switch to panel lamp-red with white tracer.
(viii)	Black	Earth (ground) circuits.	

Q.4(a) (iv) Compare two-wheel and four-wheel drive of vehicle.

[4]

(A)

Sr. No.	Point	Two-wheel	Four-wheel
(i)	Torque and power transmission	Torque and power is transmitted to only front or rear wheels, hence spinning of drive wheels on loose roads is possible.	Torque and power is transmitted to both the front and rear wheels, hence spinning of drive wheels and loose roads are not possible and vehicle can be taken out from ditch safely.
(ii)	Engine location and drive	Engine is located either at the front or rear and drive is given to either to front wheels or rear wheels.	Engine is located at the front or at center and the drive is given to all the four wheels.
(iii)	Performance and efficiency	On road performance of 2WD is better where moderate torque and higher speeds are desired. Fuel efficiency is more.	Off road performance of 4WD is better where higher torque and slow speeds are desired. Fuel efficiency is less.
(vi)	Merits, demerits, (Any one)	<ul style="list-style-type: none"> • Initial cost is less as compare to 4WD. Running cost is less due to lower fuel consumption. • Weight is concentrated only on driving wheels. • Aerodynamic design is possible. • Floor height can be reduced hence lower ground clearance can be kept. • It is applicable in high speed, light motor vehicles and cars. 	<ul style="list-style-type: none"> • Higher initial cost as well as running cost because of extra fuel consumption. • Weight is uniformly distributed on all the wheels. • Aerodynamic design isn't possible. • Floor height cannot be reduced hence ground clearance is more. • It is used in heavy duty motor vehicles as well as in off road/ cross country vehicles.

Q.4(b) Attempt any ONE of the following:

[6]

Q.4(b) (i) State need of power steering and explain general layout of power steering.

[6]

(A) Need of Power Steering :

- To reduce the effort needed to turn the steering wheel.
- To achieve higher degree of steering response.
- To achieve driving comfort by absorbing road shocks.
- To reduce driver's fatigue.
- Higher control over the vehicle is possible which leads to greater safety of vehicle.

General Layout of power Steering : Power steering provides hydraulic or electric assistance to the turning effort applied to the manual steering. When the manual effort at the steering wheel exceeds, a predetermined value, the power steering become operative.

1. Hydraulic Power Steering (Linkage Type) : The hydraulic power assisted steering system as shown in figure consists of hydraulic pump, hydraulic ram, hydraulic control valve, fluid reservoir, rack and pinion gear box, steering shaft, and steering wheel. The hydraulic fluid is stored into a reservoir to which a pump is connected. This pump lifts the fluid from reservoir and sends it to hydraulic control valve through the feed line. The steering wheel is connected to hydraulic control valve through the steering shaft.

When the steering wheel is at rest and the vehicle is going in straight ahead, at that time the both high pressure lines are open in position. So fluid exerts the same pressure on both sides of piston. So the rack does not operate the front wheels to turn in either side. As soon as the driver turn the steering wheel, the contact control valve operates hydraulic control valve which closes one of the port or pressure line, while the other remains open. So high pressure fluid from the pump goes to one side of the piston and operates the rack which in turn to operate the front wheels to turn in desired direction.

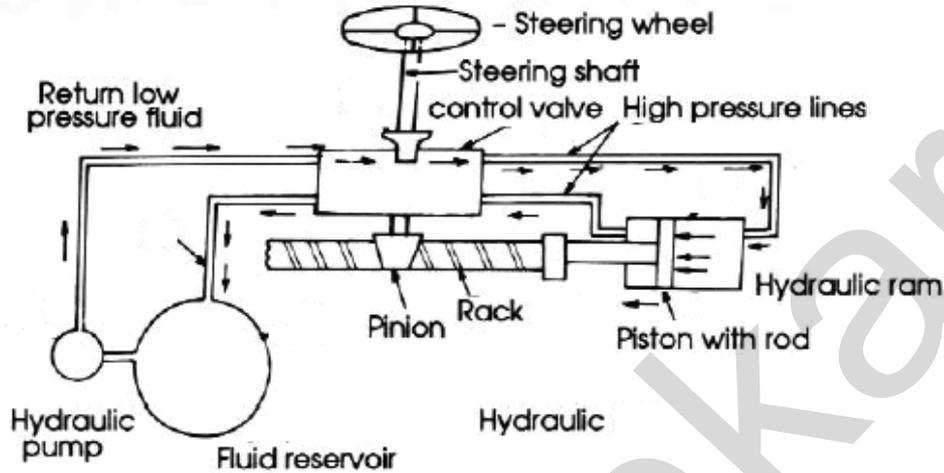


Fig. : Hydraulic power steering

OR
Electric Power Steering

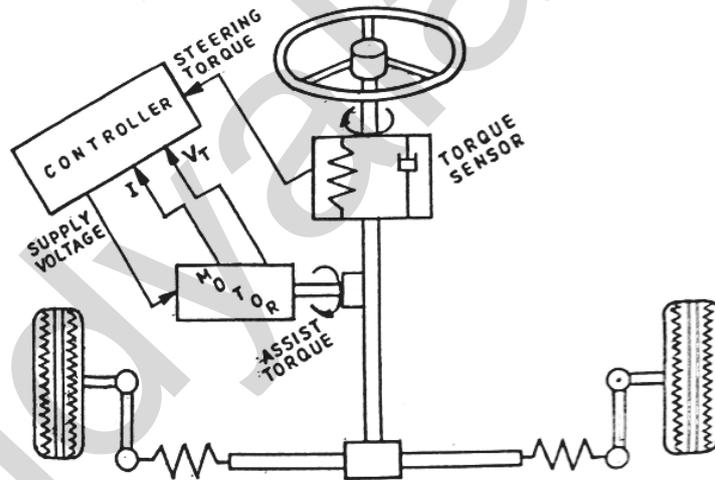


Fig. : Electric Power Steering

In an electronic power steering system, steering sensor consisting of in fact two sensors, viz, a torque sensor that converts the steering torque input and its direction into voltage signals and rotational sensor that converts the rotational speed and direction into voltage signals is located on the input shaft of the steering gear box.

Input from the steering sensor and the vehicle speed sensor are fed to a microprocessor control unit where these are compared with a programmed force assist map. The control unit then sense out the appropriate command signals to the current controller with supplies the appropriate current to the electric motor. The motor pushes the rack to the right or left depending on which direction the current flows. Increase the current to the motor, increase the amount of power assist and thus turning of wheels takes place.

Q.4(b) (ii) State and explain air conditioning parameters for human comfort. [6]

(A) Human comfort parameters

Following are the parameters to be considered along with proper elaborations:

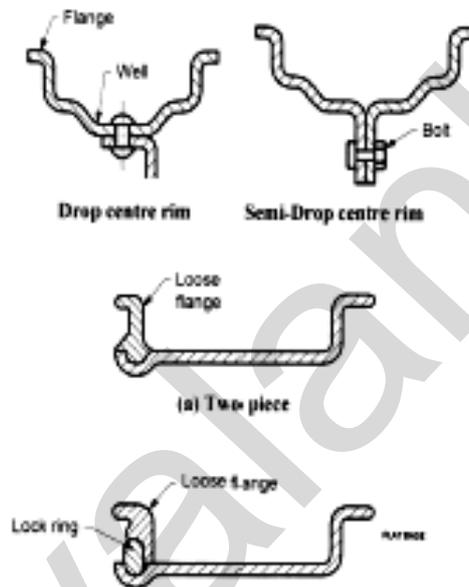
- (1) Air Temperature
- (2) Relative Humidity
- (3) Air velocity
- (4) Mean radiant temp
- (5) Human activity level and clothing insulation

Q.5 Attempt any FOUR of the following: [16]

Q.5(a) List the various types of rims used in automobiles and draw neat sketch of any one. [4]

(A) There are two types RIMS

- (i) Drop centre rim
- (ii) Flat base rim



Q.5(b) (i) State functions of propeller shaft. (ii) State requirements of good steering system. [4]

(A) (i) Functions of Propeller shaft : (Any two)

- It transmits rotary motion and power from gear box to the differential at varied angle.
- It accommodates change in length when the rear axle moves up and down.
- It absorbs the shocks coming on the transmission system when the vehicle starts from rest.

(ii) Requirement of good steering system :

- (1) The steering mechanism should be very accurate and easy to handle.
- (2) It should multiply the turning effort applied on the steering wheel by the driver.
- (3) It should be to a certain degree irreversible, so that the road shocks encountered by the wheel are not transmitted to the driver's hand.
- (4) The Steering mechanism should have self rightening effect, so that when the driver released the steering wheel after taking a turn, the wheel should try to achieve straight ahead position.

Q.5(c) Draw labelled neat sketch of telescopic type shock absorber and explain working. [4]

(A) Working of Telescopic Shock Absorber :

Below figure shows a simple Telescopic Shock absorber. There is a fluid in space above valve assembly (A), below (A) and also in annular space between cylinder (C) and tube (D), which is connected to the space below valve assembly (B). (H) is gland in head (J) and any fluid scrapped off by rod (G) is brought down into annular space through inclined passage shown in head Eye (E) is connected to axle, while eye (F) is attached to chassis frame. Fluid generally used in shock absorbers is a mixture of 60 per cent Transformer oil and 40 per cent Turbine oil.

When car has come across a bump, Eye (E) would move up and thereby the fluid will pass from lower side of valve assembly (A) to its upper side. Due to pressure of fluid through rod (G) fluid will go to underside of valve (B). This passing of fluid through valve openings provides damping. Similarly for downward motion of eye €, fluid will pass upper side of valve assembly (A) to lower side and also from lower side of valve assembly (B) to its upper side.

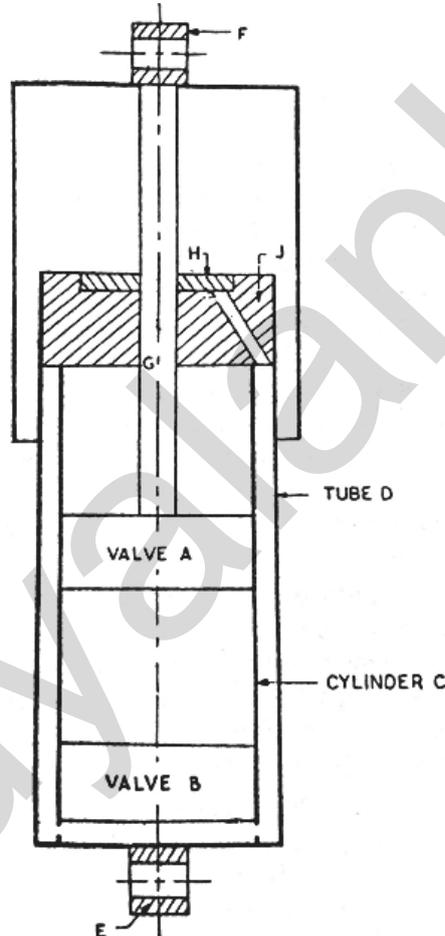


Fig : Telescopic type shock absorber

Q.5(d) Explain battery capacity and rating. [4]

(A) **Battery Capacity** : It can be defined as the maximum amount of current the battery can deliver. Maximum amount of current that a cell can furnish depends up on the following factors.

- (1) Numbers of plates
- (2) Area of plates
- (3) Temperature of electrolyte
- (4) Quantity of electrolyte

About $1/10 \text{ m}^2$ of the surface plate must be in contact with an electrolyte to produce 40 to 60 ampere of current.

Battery Rating : Battery rating is recommended by (SAE) and is defining as lighting ability of a full charge battery.

- (1) **20 Hours rating (in ampere- hours)** : It is also known as ampere-hour capacity and represents a lasting power of a battery on small load. It is also known as ampere-hour capacity and represents a lasting power of a battery on small load. It is obtain by discharging of battery at a current rate equal to 1/20 of the manufacture's ampere hours rating. The current rate that battery delivers continuously for 20 hours after which cell voltage should not drop below 1.75 and battery temperature is 80° F.
- (2) **Cold rating** : It gives an indication of cold weather of starting ability of battery. Numbers of minutes of a 6 volt battery can deliver 300 Ampere at 0° F before cell voltage drops below 1 volt.
- (3) **25 ampere rating** : Measures battery performance at a moderate constant current output at 80° F to final limiting voltage 1.75 Volt/Cell.
- (4) **Twenty minutes rate** : Amount of current a battery can deliver continuously during 20 minutes without dropping the cell voltage below 1.5. a temp of 27°C is maintained at the start of the test.

Q.5(e) State various factors affecting tyre life.

[4]

(A) **Factors affecting tyre life** : The following are the main factors which affect tyre performance and consequently their life;

- (1) **Inflation** : The tyre must be inflated according to the specification of the original vehicle manufacturer. Both the under inflation and over inflation are detrimental to tyre life.
- (2) **Vehicle Maintenance** : The state of vehicle maintenance can also affect the tyre life. Following are the main mechanical irregularities which are revealed by the typical wear of the tyre.
 - Wheel Alignment
 - Brake Adjustment
 - Matching and spacing of dual tyre
- (3) **Manner of Driving** : apart from inflation and vehicle maintenance, the manner in which a vehicle is driven, affect the tyre life. Excessive speeding, quick starts and sudden stops all cause faster tread wear.
- (4) **Overloading** : In case of overloading the tyre has insufficient amount of air to support the deal weight carried. This results in decrease of tyre mileage.
- (5) **Miscellaneous Factors**: It includes;
 - Heat
 - Road conditions
 - Season (Weather condition)
 - Position of tier

Q.6 Attempt any TWO of the following:

[16]

Q.6(a) Why it is necessary to charge automobile battery? When trickle battery charging method is used? [8]

(A) **Necessity of Batter Charging** : The function of charging system is an automobile is to generate, regulate and supply the electrical energy for charging the battery.

- (1) To supply the current demands made by all loads.
- (2) To supply whatever charge current the battery demands.
- (3) To operate at idle speed.
- (4) To supply constant voltage under all conditions.
- (5) Have an efficient power-to-weight ratio.
- (6) Be reliable, quiet, and have resistance to contamination.
- (7) Require low maintenance.
- (8) Provide an indication of correct operation.

Use of Trickle Charging Method

- (1) Trickle charging is designed to compensate for the for the self discharge of the battery.
- (2) In this continuous charge, i.e. long term constant current charging for standby use is possible.
- (3) The charge rate varies according to the frequency of discharge.
- (4) This method is not suitable for some battery chemistry, e.g. NiMH and Lithium, which are susceptible to damage from overcharging.
- (5) In some applications the charger is designed to switch to trickle charging when the battery is fully charged.

Q.6(b) Draw neat sketch of radial ply tyres and cross ply tyre and describe their [8] construction.

(A) Construction of Radial Ply Tyre

- (1) In this ply cords run in the radial direction, i.e. in the direction of the tyre axis.
- (2) Over this structure run a number of breaker strips in the circumferential direction.
- (3) The material for the breaker strips must be flexible but inextensible, so that no change of circumference takes place with change in the amount of inflation.
- (4) The inextensible breaker strips behaves like a girder in its own plane and provides the directional stability.

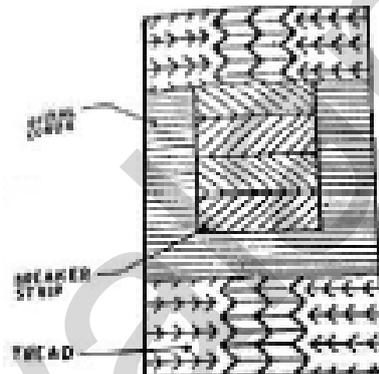


Fig. : Radial Ply Tyre

Construction of Cross Ply Tyre

- (1) In this, the ply cords are woven at an angle (30°– 40°) to the tyre axis.
- (2) There are two layers, which run in opposite directions as shown in figure.
- (3) This tyre has better wear and road holding characteristics.
- (4) But they must not be fitted on front wheels only.

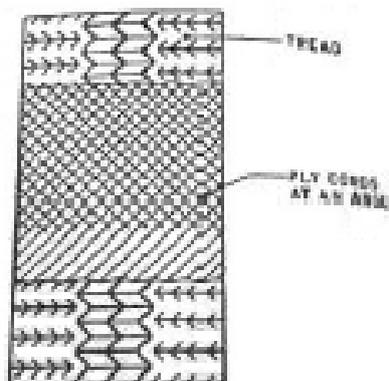


Fig. : Cross (Bias) Ply Tyre

Q.6(c) Explain construction and working of alternator, state its advantages.

[8]

(A) Construction and working of alternator

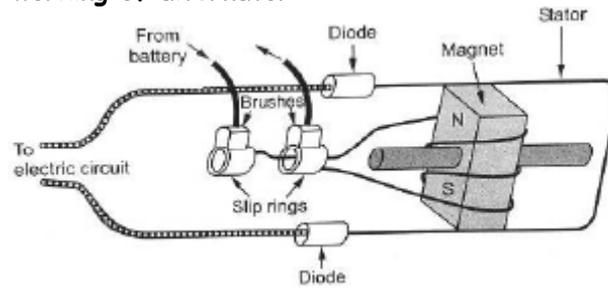


Fig. : Alternator

Construction : It consists of fan, rectifier, diode, spacer, stator, drive and housing, slip rings, rotors, drive and bearing, regulator, pulley etc. The operation of alternator is improved by placing the stator and rotor assembly inside the iron frame of housing which provide a conducting path for the magnetic line of force. Voltage increase by increasing stator winding in to number of coil. Alternators consist of rotor assembly, stator assembly and rectifier mounted in housing. housing near of two piece of die cast aluminium which is light and weight. Stator is clamp in housing.

Working : it consists of an electromagnetic rotor which is energized form the current of the battery through brush and slip ring assembly. Rotor is rotated by belt and pulley arrangement get power form engine stator winding is wound around the rotor. The rectifier circuit consisting of diodes is connected to the stator winding. Diodes are electronic device that allows current to flow only in one direction.

When the electromagnetic rotor is turned its magnetic lines of force cut the stationary stator loop. This induces a current in the stator winding. Through the electromagnetic rotor reverses its polarity the alternating current produces in the stator winding is converted to direct current by the diodes.

Advantages

- Alternator is generator that produces the alternating current.
- Use on vehicle to charge the battery and operate the electrical circuits.
- Much smaller, light in weight.

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