



The Shirpur Education Society's

**R. C. Patel College of Engineering and
Polytechnic, Shirpur**

Department of Mechanical Engineering

NAME OF COURSE: - Automobile Engineering

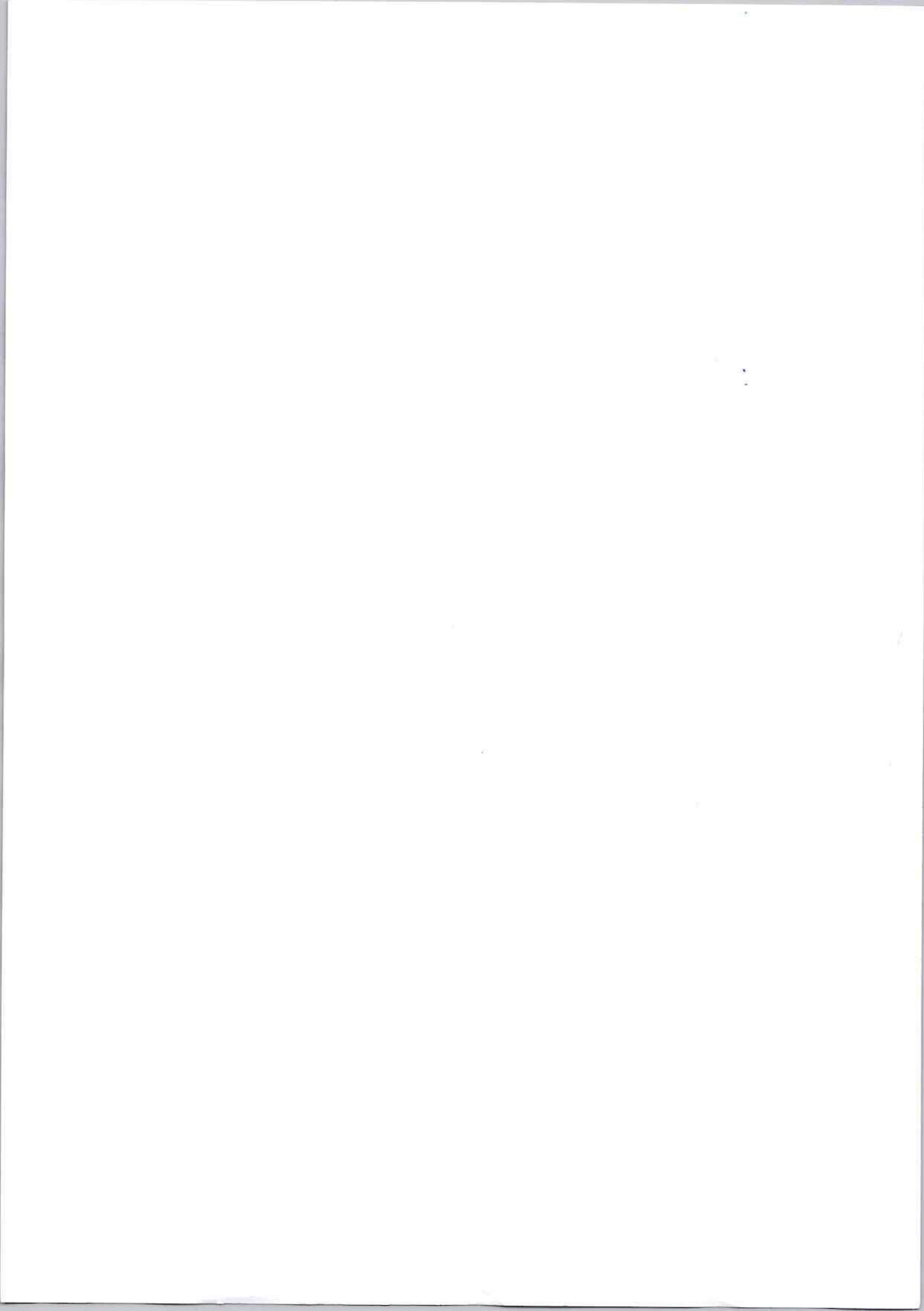
CODE OF COURSE: - 315372

SEMESTER: - TYME-5K

SUBJECT TEACHER: - Mr. J. N. Chaudhari

CHAPTER No. 2 :- Automobile Transmission system –

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QUESTION BANK OF CHAPTER – 2

AUTOMOBILE TRANSMISSION SYSTEM

Program Name: Diploma in Mechanical Engineering

Program Code: ME

Name of Subject & Code : Automobile Engineering (315372)

Semester : FIFTH

Instructions: (1) Illustrate your answers with neat sketches wherever necessary.

Q.1.	Two marks questions.	Previous Exam	CO PO Mapping
1.	State working principle of clutch, function and necessity of clutch.	W25,S25-1.b W24-1.g S26-1.a	C02-TL02.4-R
2.	State function of universal and slip joint in propeller shaft.	S26-1.c S26-1.g	C02-TL02.6-R
Q.2.	Four marks questions.	Previous Exam	CO PO Mapping
1.	b) Compare single plate clutch and multi plate clutch on basis of i) Power transmission capacity ii) Heat dissipation iii) Size iv) Application	W25-2.b	C02-TL02.3-A
2.	With neat sketch explain torque convertor.	W25-3.a	C02-TL02.9-U
3.	Describe construction and working of propeller shaft with sketch.	W25-4.b	C02-TL02.6-U
4.	Write the difference between live and dead axle. With neat sketch explain semi floating type rear axle with application.	W25-6.c W24-6.a	C02-TL02.8-U
5.	Explain with neat sketch construction, working of differential.	W25-5.a S26-5.a	C02-TL02.7-U
6.	Describe with neat sketch single plate clutch.	S26-2.c	C02-TL02.4-U
7.	State different types of rear axle. Explain working of any one.	S26-3.c	C02-TL02.8-U
8.	Explain with neat sketch working of constant mesh gear box.	S26-4.c S25-5.a	C02-TL02.5-U
9.	Draw neat sketch of overdrive and explain its working.	S26-6.c	C02-TL02.5-U
10.	Explain construction and working of diaphragm clutch with neat sketch	S25-2.b	C02-TL02.4-U
11.	List various parts of synchromesh gear box with role of each component.	W24-2.b	C02-TL02.5-U



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12.	State any two functions of Gear Box in automobile. Explain with neat sketch working of epicyclic gear box	S26-1.e W24-1.b	C02- TL02.5-U
13.	Describe with neat sketch multi plate clutch.		C02- TL02.4-U
* **Best of Luck** *			


14/07/26

Mr. J. N. Chaudhari
Subject Teacher


14/07/26

Mr. A. D. Patil
HOD(ME)

* Automobile Engineering *

Chapter 2: Automobile Transmission System

2.1 Transmission system layout, components & its application: layout of two wheel drive transmission system (2WD) & four wheel drive transmission system (4WD) & application,

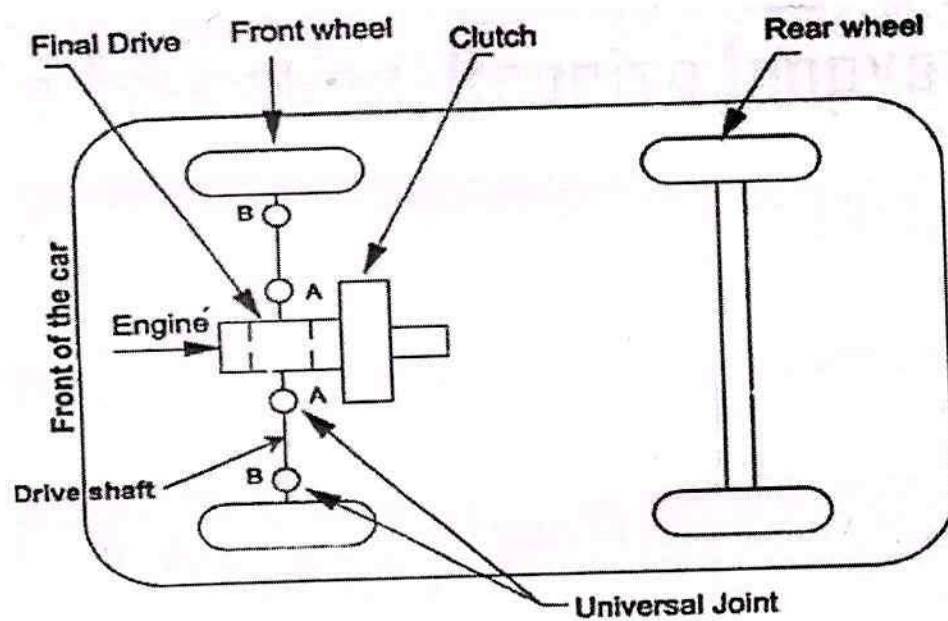
* Transmission System:

It is a set of components that transmit power from engine to wheels & controls speed & torque.

1. Layout of Two Wheel Drive (2WD):

Types of 2WD → front wheel drive (FWD)
→ Rear wheel drive (RWD)

A) front wheel Drive (FWD) -



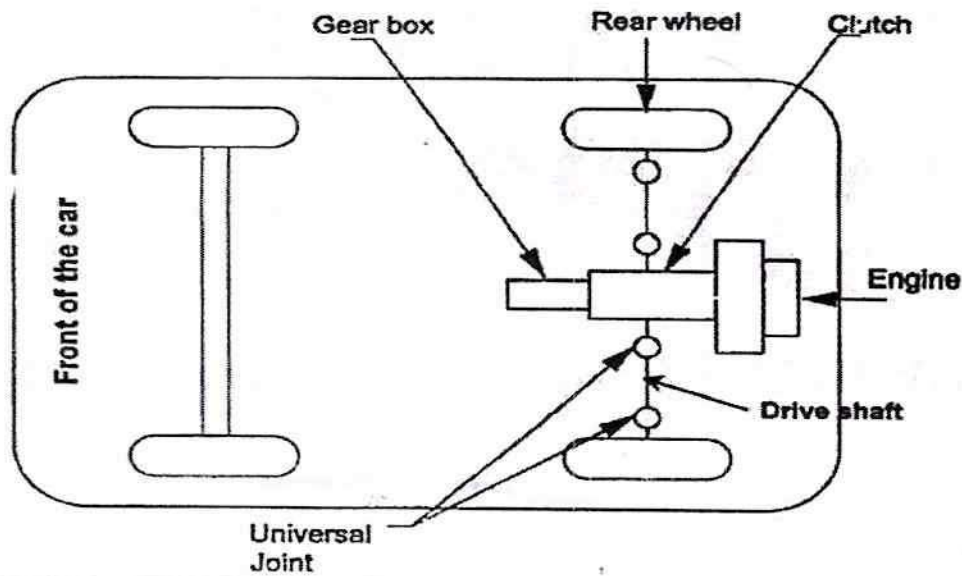
Working →

- Engine → clutch → Gearbox → Differential → front wheels.
- No propeller shaft, compact & lightweight.

Applications →

- Hatchback, small cars.

B) Rear Wheel Drive (RWD) -



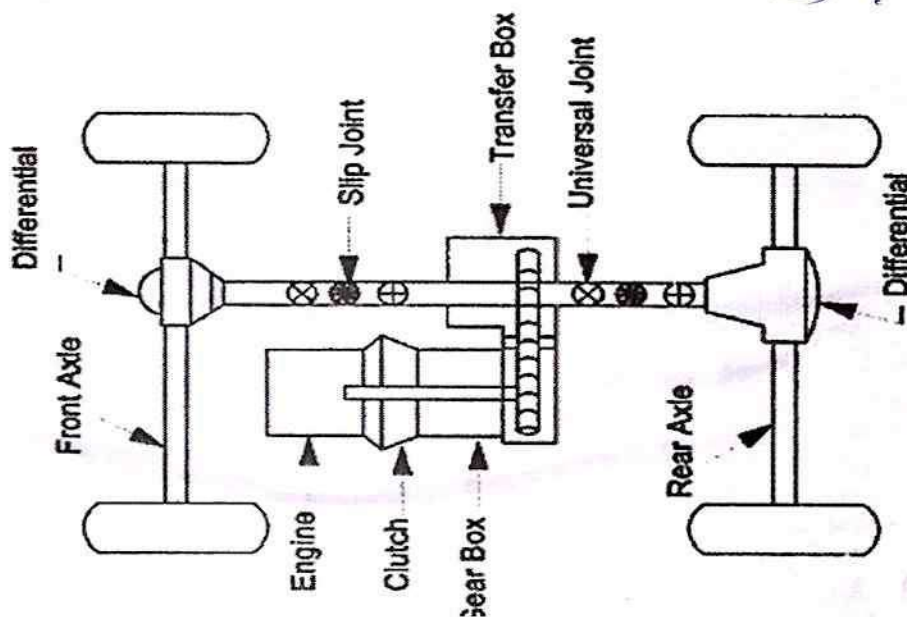
Working -

- Engine → clutch → Gearbox → Propeller shaft → Differential → Rear wheels.
- Power & driving function at rear
- Front wheels only for steering.

Applications -

- Trucks, Buses, performance cars.

2. Layout of four wheel Drive (4WD) :



Working -

- Engine → clutch → Gearbox → Transfer case →
 - front
 - Rear
 → front propeller shaft → front Differential → front wheels.
 - Rear propeller shaft → Rear Differential → Rear wheels.

- Power supplied to all four wheels,
- May include low-range gear for off-road use,

Applications -

- SUVs, off-road vehicles,
- Military vehicles, construction vehicles,

2.2 Clutch: function & necessity, Requirement, Classification, working principle, construction & working of single plate (Coil spring & Diaphragm) clutch, Multiplate clutch,

* Clutch :

A clutch is a mechanical device used to engage & disengage power transmission from engine to gear box.

* Function of clutch :

- Connects engine to transmission system,
- Disconnects engine during gear shifting
- Allows smooth starting of vehicle,
- Prevents shock & vibration,

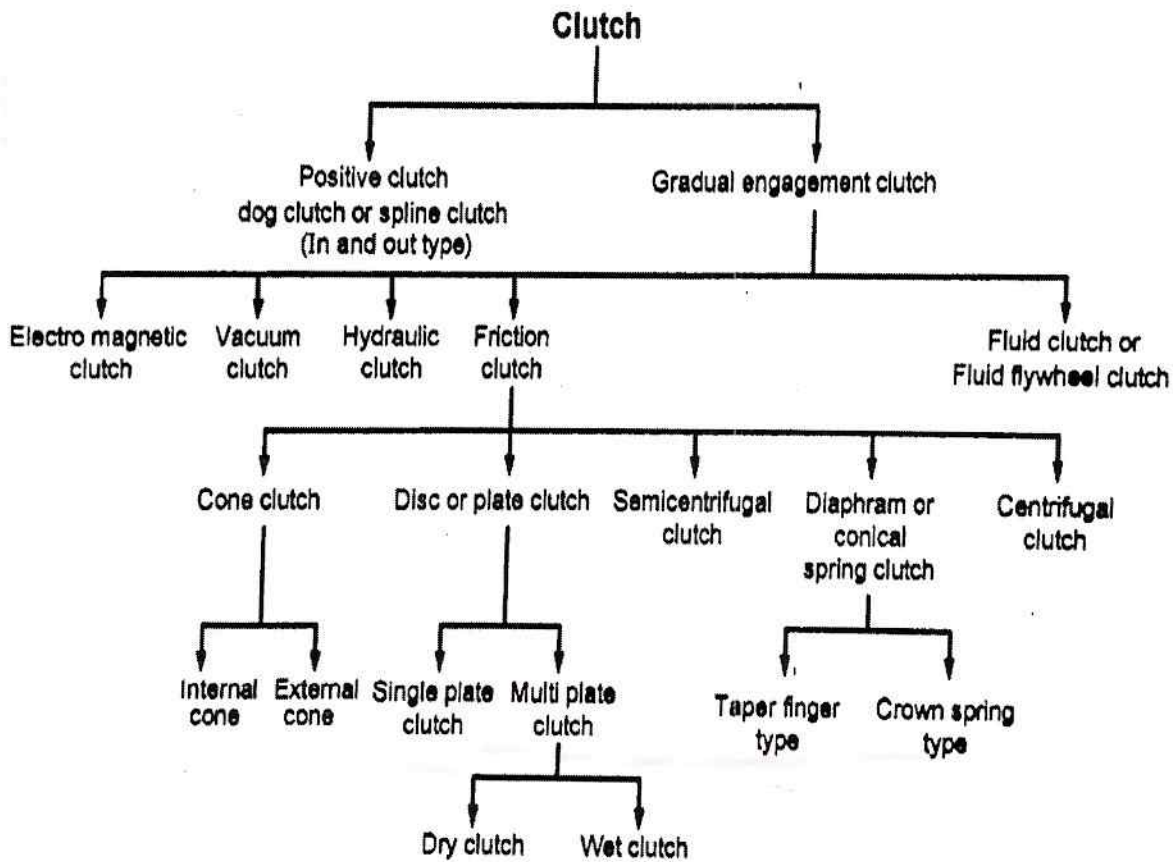
* Necessity of clutch :

- Engine runs continuously but wheel needs variable motion.
- Required during - starting
- Gear changing
- stopping without stopping engine,

* Requirements of Good clutch :

- High frictional grip
- Smooth engagement
- Good heat dissipation
- Low wear & tear
- Simple & reliable design,

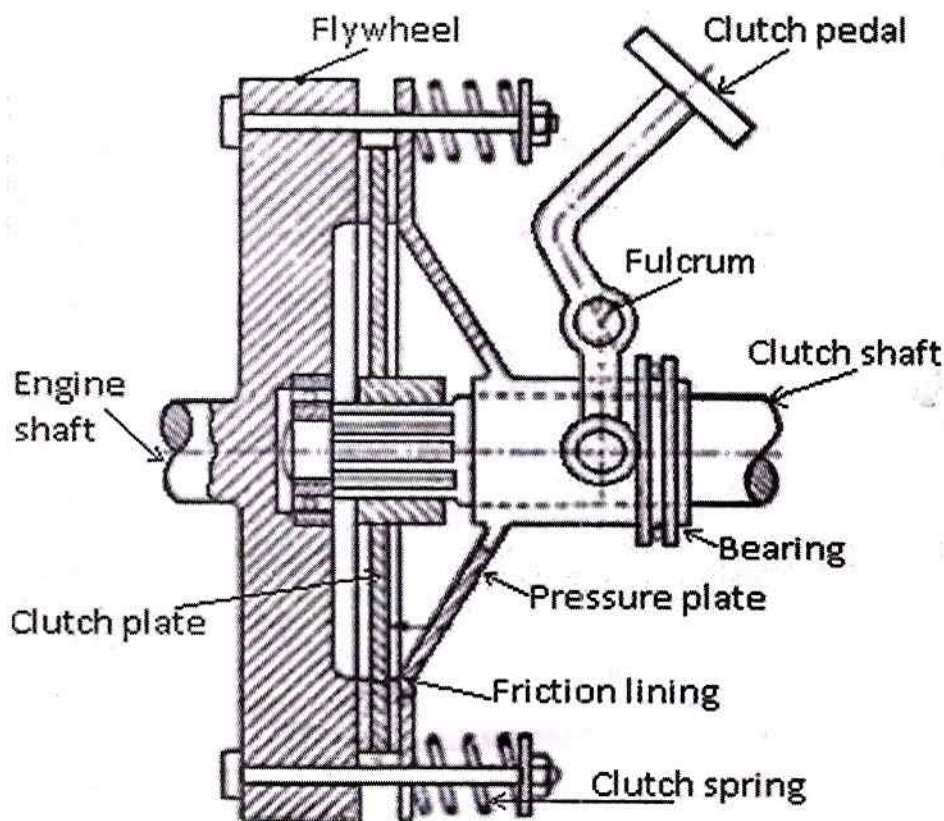
* Classification of clutch:



* Single Plate Clutch :

There are two types → coil spring clutch
Diaphragm clutch,

1. Coil Spring Clutch :



Construction -

- The clutch consists of flywheel mounted on engine shaft.
- A clutch plate is placed betⁿ flywheel & pressure plate.
- A pressure plate is attached to clutch cover.
- Several coil springs are arranged circumferentially to apply pressure on the press. plate.
- A release bearing & clutch fork are used to operate the clutch.

Working -

- Engaged Position - coil spring exerts force on the pressure plate, which presses the clutch plate against the flywheel. Due to friction, power is transmitted from engine to gearbox.
- Disengaged Position - When clutch pedal is pressed the release bearing pushes the pressure plate away by compressing the springs. The clutch plate gets separated & power transmission stops.

Advantages -

- Simple design, easy to manufacture & repair

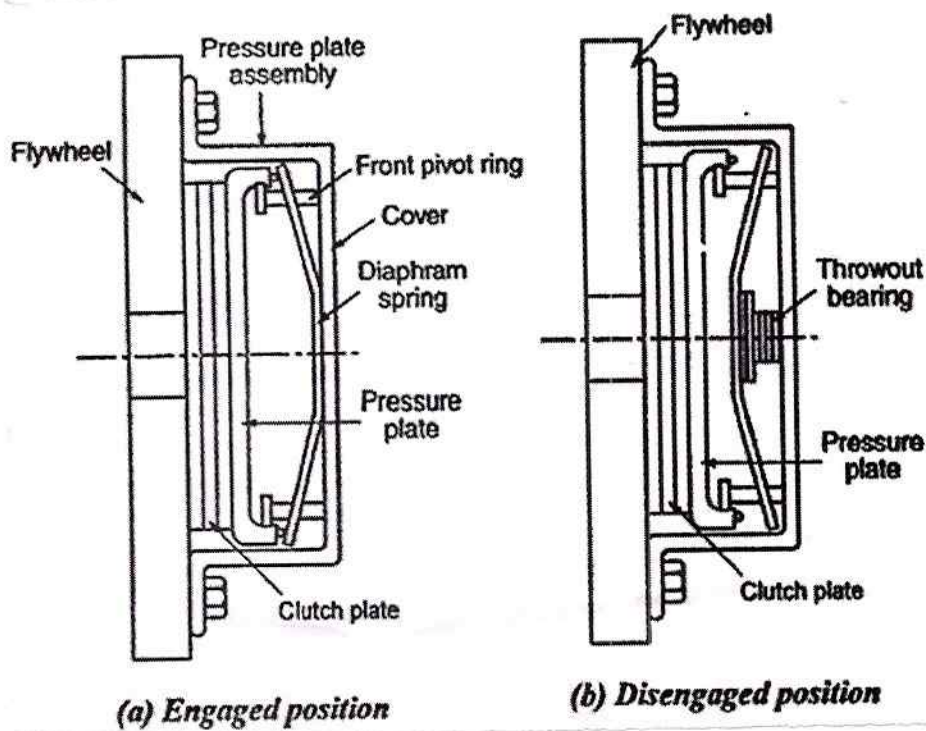
Disadvantages -

- Requires more pedal effort
- Uneven pressure distribution.

2. Diaphragm Clutch :

Construction -

- It consists of flywheel, clutch plate & press. plate similar to single plate clutch.
- Instead of coil springs, a diaphragm (conical disc) is used.
- The diaphragm spring is fixed to pressure plate & acts as a lever & spring simultaneously.
- A release bearing is provided at the center.



Working -

- Engaged Position - The diaphragm spring pushes the pressure plate against the clutch plate, holding it tightly betⁿ pressure plate & flywheel, thus transmitting power.
- Disengaged position - When clutch plate is pressed, released bearing pushes the center of the diaphragm spring inward. This reduces the clamping force, allowing the clutch plate to disengage & stop power transmission.

Advantages -

- Smooth & uniform pressure, less pedal effort

Disadvantages -

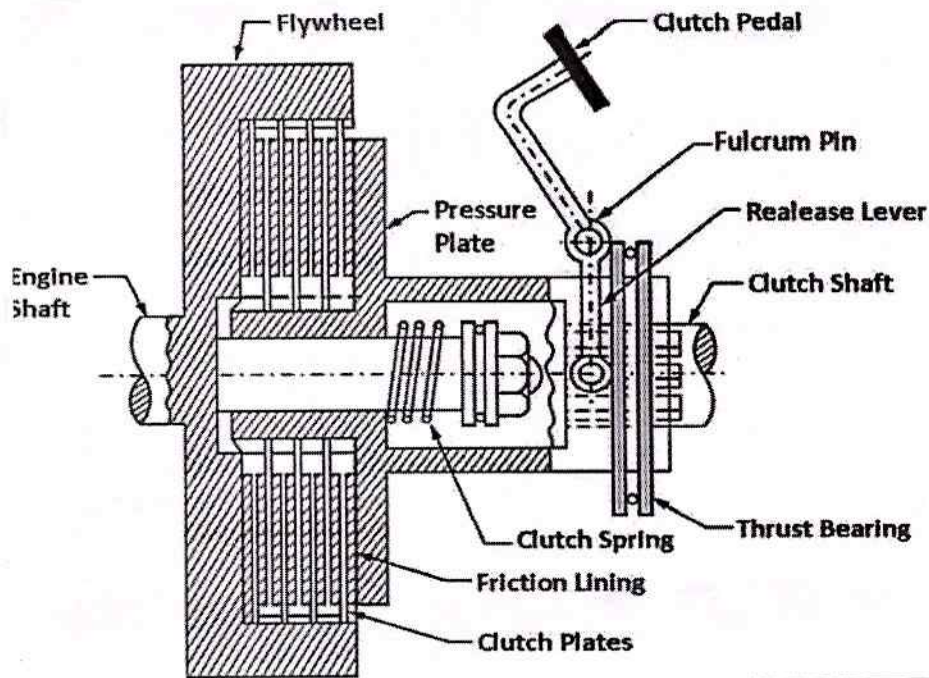
- Slightly complex construction, Costlier than coil Spring Clutch.

2. Multiplate Clutch :

Construction -

- It consist of multiple frictional plates & steel plates arranged alternately.
- Friction plates are connected to the clutch shaft, while steel plates are connected to the flywheel or clutch drum.

- A pressure plate & springs are provided to apply force.
- The entire assembly is enclosed in a clutch housing.



Working -

- Engaged position - springs press the pressure plate, forcing all plates together. The friction betⁿ multiple plates transmits higher torque from engine to gearbox.
- Disengaged position - when the clutch pedal pressed, the pressure plate moves away, separating the plates & stopping power transmission.

Advantages -

- High torque transmission, compact size

Disadvantages -

- complex design, Heat generation.

2.3 Gear box: Manual Transmission, classification, const-
ruction & working of constant mesh gear box &
Synchromesh gear box, Automatic transmission,
Torque converter, Epicyclic gear box (Gear Train).

* Gear Box :

It is a mechanical device used to transmit power from engine to wheels with different speed & torque ratios.

* Classification of Gear Box :

1. Selective gear transmission

- a) Sliding mesh type
- b) Constant mesh type
- c) synchromesh type.

- i) Three speed gear box
 - ii) Four speed gear box
 - iii) Six speed gear box

2. Planetary gear Transmission

- a) Epi-cyclic gear box
- b) Automatic transmission

- i) Fluid type or Torque converter
 - ii) Electric type.

3. Twin top gear box

4. Pre-selective gear box.

* Constant Mesh Gear Box :

Construction:

• The gear box consist of 3 shafts :

1. Clutch shaft - Receives power from engine

2. Lay shaft - carries fixed gears.

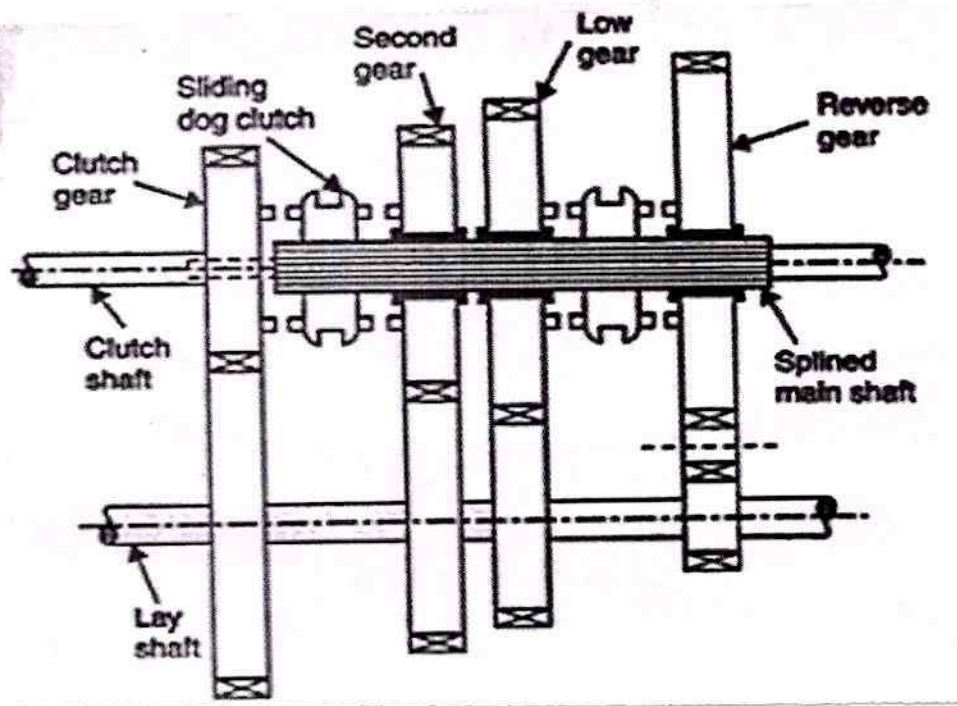
3. Main shaft - delivers power ~~from~~ to propeller shaft.

• All gears on layshaft are rigidly fixed, while gears on main shaft are free to rotate.

• The gears on layshaft & main shaft are always in mesh (hence constant mesh)

- Dog clutches (sliding sleeves) are provided on main shaft to engage gears.
- Bearing support shafts & reduce friction.

Diagram:



Working:

- When engine runs, power is transmitted to clutch shaft, which rotates the lay shaft.
- Since gears are always meshed, all gears on main shaft also rotate freely.
- When driver selects a gear, the dog clutch slides & locks a particular gear with main shaft.
- This transmits power from lay shaft → selected gear → main shaft.

Note - Only dog clutch moves, gears don't slide → reduces wear.

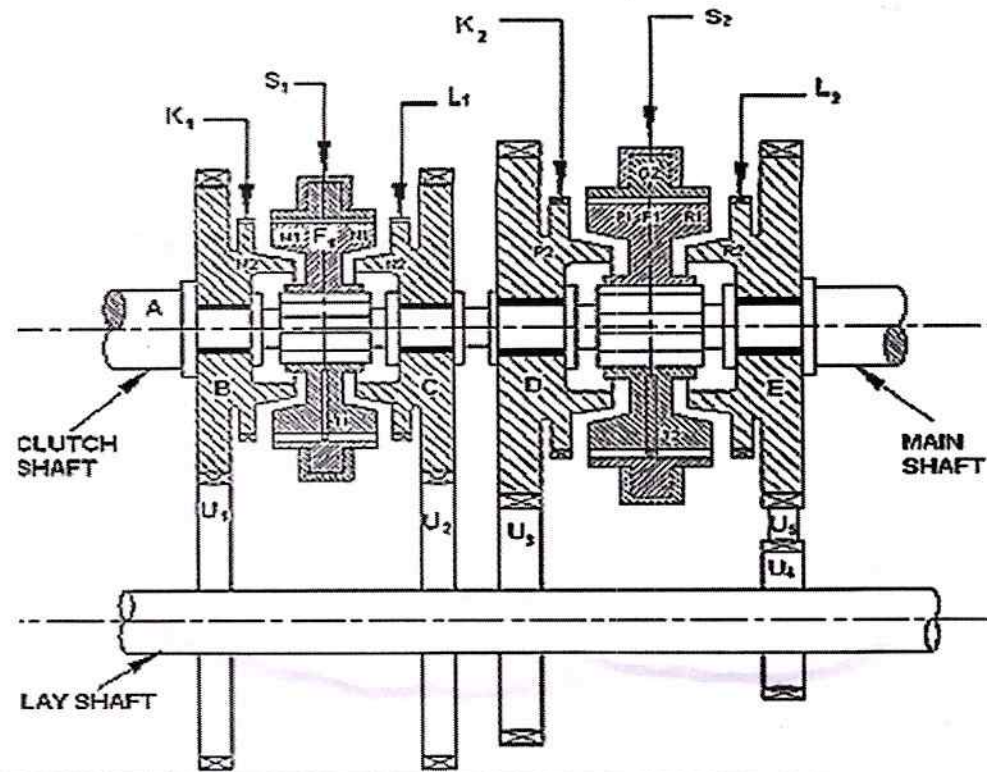
Advantages -

- Less wear & noise than sliding mesh.
- Smooth operation.

Disadvantages -

- Gear engagement still causes slight shock.

* Synchromesh Gear Box:



Construction -

- Similar to constant mesh gear box but includes -
 - Synchronizer unit (synchromesh device)
 - Hub (splined to main shaft)
 - Sleeve (slides over hub)
 - Cone clutch surfaces.
- Gears are always in mesh but are not directly engaged; synchronizer controls engagement.

Working -

- When driver shifts gear, selector fork moves sleeve towards desired gear.
- Cone clutch comes in contact first, creating friction.
- This friction equalizes the speed of gear & shaft.
- Once speed matches; sleeve engages gear smoothly.

Advantages -

- Smooth & noiseless gear shifting
- No gear clash, easy driving

Disadvantages -

- Costlier
- Complex construction.

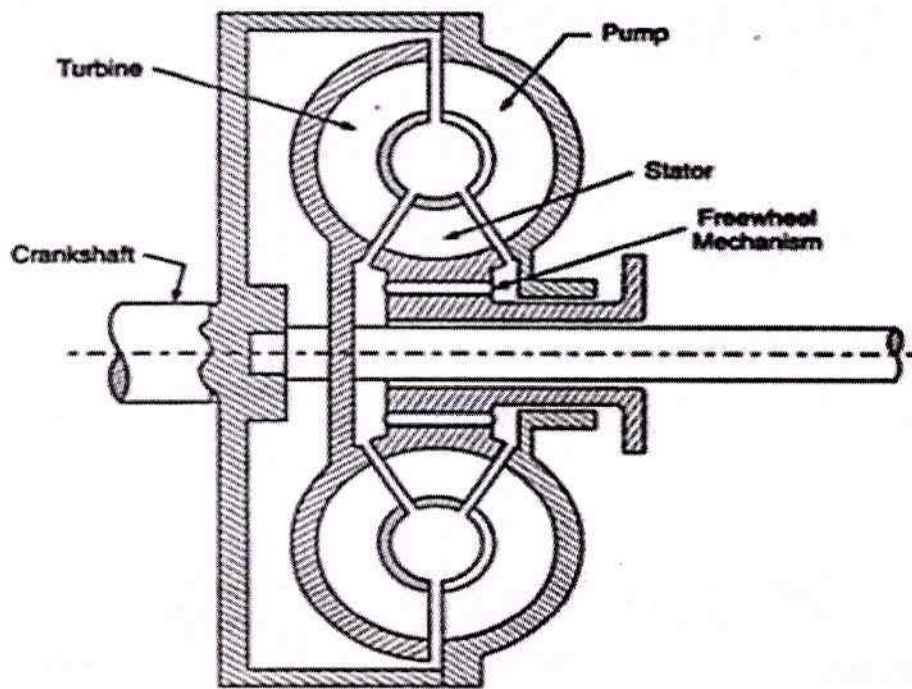
* Automatic Transmission -

Transmission system which automatically changes gears without driver intervention.

Main components -

- Torque converter
- Epicyclic gear train
- Hydraulic control system.

* Torque Converter:



Construction -

1. Impeller (Pump) -
 - Connected to engine crankshaft
 - Rotates with engine & throws fluid outward
2. Turbine -
 - Connected to gearbox i/p shaft.
 - Receives fluid energy from impeller.
3. Stator -
 - Located betⁿ impeller & turbine
 - Mounted on one-way clutch
 - Redirects fluid to increase torque.
4. Casing & fluid -
 - Enclosed housing filled with transmission oil.

Working -

- Engine rotates the impeller, causing fluid to move outward due to centrifugal force.
- The moving fluid strikes the turbine blades, causing turbine to rotate & transmit power to gearbox.
- Fluid leaving turbine flows back towards impeller.
- Stator redirects fluid flow, increasing velocity & improving torque o/p.
 - At low speed $\rightarrow$ Torque multiplication occurs
 - At high speed $\rightarrow$ Acts like fluid coupling.

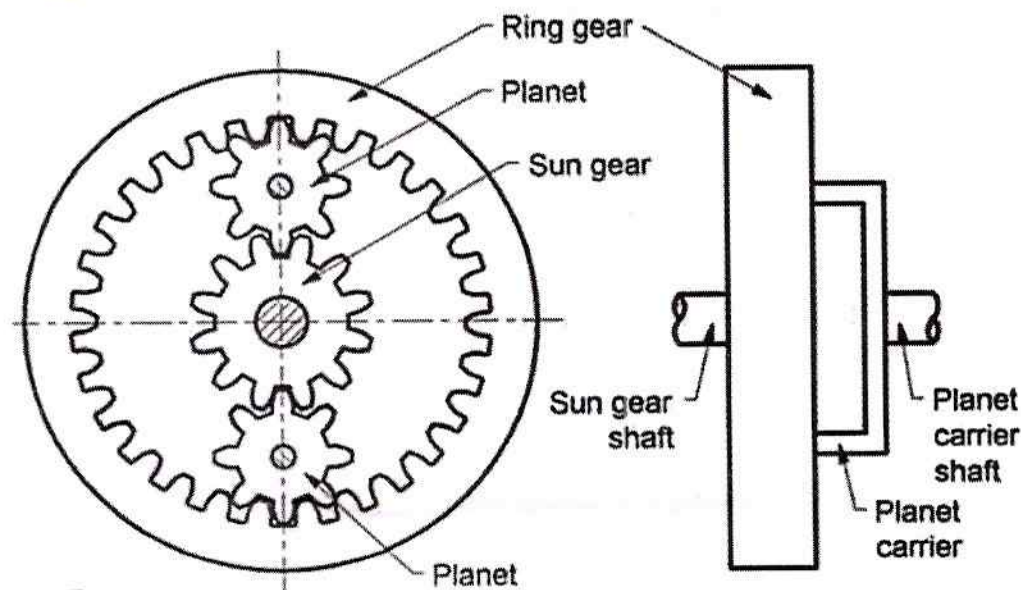
Advantages -

- No need of clutch pedal
- Smooth & shock free power transmission.

Disadvantages -

- Lower efficiency due to fluid losses
- More complex & costly.

* Epicyclic Gear Box / Planetary Gear Train:



Construction -

1. Sun Gear - Central gear mounted on shaft
2. Planet Gears - Surround the sun gear & rotate on their own axis
3. Planet carrier - Holds planet gears - transmit motion
4. Ring Gear - Internal gear surrounding planets.

Working -

Speed variation is obtained by fixing one element & rotating another.

Case 1 -

- Ring gear fixed, & sun gear rotates
- Planet carrier gives o/p $\rightarrow$ speed reduction.

Case 2 -

- Sun gear fixed, ring gear rotates
- Carrier gives o/p $\rightarrow$ different speed ratio

Case 3 -

- Carrier fixed
- Reverse motion possible

Advantages -

- Compact & lightweight, high torque capacity
- Smooth operⁿ

Disadvantages -

- Complex design, difficult maintenance.

2.4 Propeller Shaft: Function & Necessity, Construction of propeller shaft, functions of universal joint & Slip Joint.

* Function of Propeller Shaft:

It is used to transmit rotary motion & torque from gearbox to the differential in an automobile.

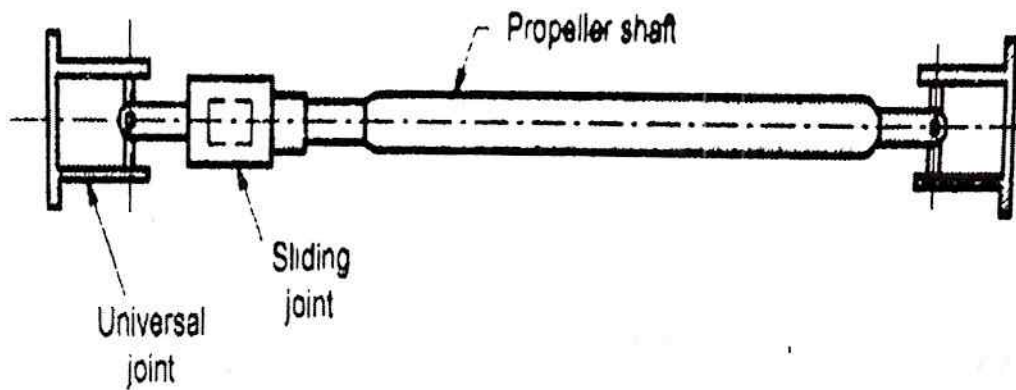
* Necessity of Propeller Shaft:

It is required due to:

1. Distance betⁿ gearbox & rear axle.
2. Misalignment of gearbox & differential shafts.
3. Due to road irregularities, the rear axle moves up & down, changing the angle & distance.

4. A rigid shaft can't accommodate these changes → hence propeller shaft with joints is reqd.

* Construction



- Made of hollow steel tube (light weight + high strength)

- Main parts :

- Shaft tube
- Universal joints (at both ends)
- Slip joint (splined joint)
- Flanges to connect gearbox & differential.

- Designed to withstand :

- Torsional stress - due to torque transmission
- Bending stress - due to misalignment & weight.

* Function of Universal Joint :

- Transmit power betⁿ two shafts which are inclined at an angle.
- Allows angular movement betⁿ gearbox & differential.

* Function of Slip Joint :

- Allows change in length of propeller shaft.
- Adjusts for movement of rear axle due to suspension.

2.5 Differential: function & Necessity, construction working principle.

* Differential :

◦ function -

- To transmit power from propeller shaft to wheels.
- Allow rear wheels to rotate at diff. speeds.

◦ Necessity -

A differential is reqd due to following reasons:

1. Turning of vehicle -

- when vehicle turns, outer wheel travels more distance than inner wheel.
- Hence outer wheel must rotate faster.

2. Avoid Tyre Wear -

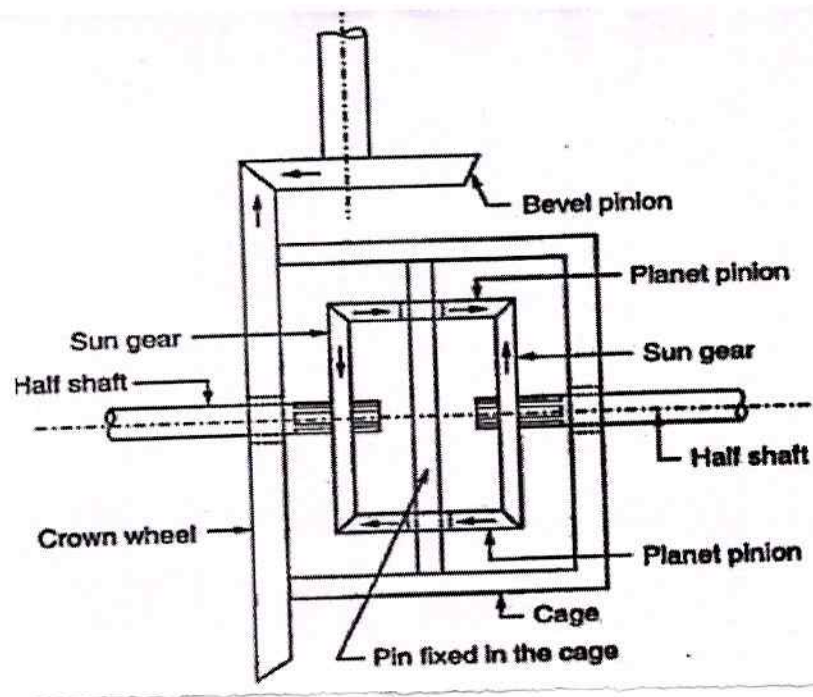
- Without differential, wheel ~~could~~ slip - causing tyre wear & damage.

3. Smooth Driving -

- Prevents jerks & ensures smooth cornering.

∴ Differential allows diff. wheel speeds while transmitting power.

◦ Diagram :



◦ Construction :

1. Crown wheel (Ring Gear) -
 - Connected to propeller shaft via pinion.
2. Drive Pinion -
 - Receives power from propeller shaft.
3. Differential case (Carrier) -
 - Holds internal gears.
4. Sun Gears (Side Gears) -
 - Connected to axle shafts.
5. Planet Gears (Spider Gears) -
 - Mounted on cross shaft.
 - Rotate betⁿ sun gear.

◦ Working :

Case 1 - Straight Line motion

- Both wheels rotate at same speed.
- Planet gears do not rotate on their own axis.
- Entire unit rotates as a single body.

Case 2 - Turning (Cornering)

- Outer wheel needs to rotate faster
- Planet gears rotate on their axis.
- This allows :
 - Outer wheels → higher speed
 - Inner wheels → lower speed

◦ Advantages :

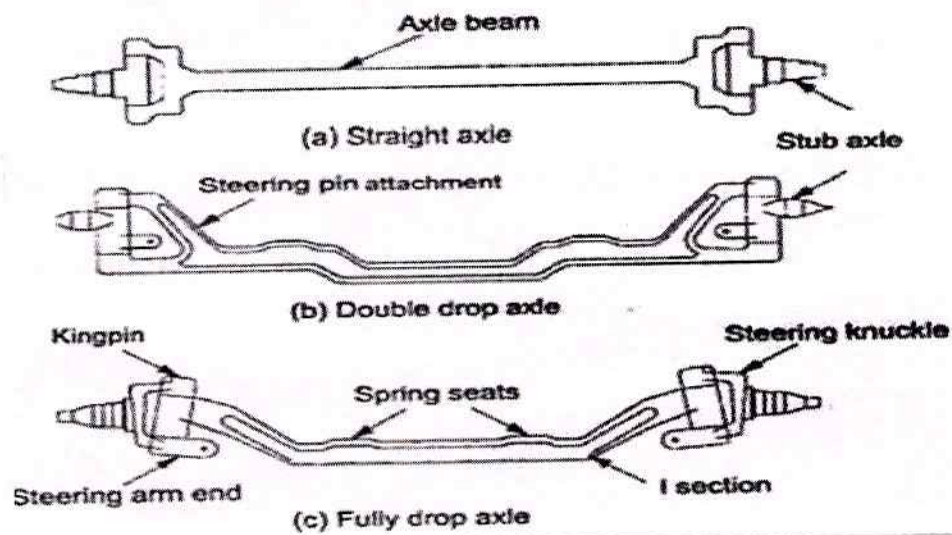
- Smooth turning
- Reduces tyre wear.
- Improves vehicle stability.

◦ Disadvantages :

- Complex mechanism
- Slight power loss.

2.6 Axle: front axle construction & requirements, & Types of front (stub axle), construction & working of semi-floating, fully floating type of rear axle.

* Front Axle :



Construction -

Front axle is a rigid beam that supports the front part of the vehicle & helps in steering.

Main parts -

- Axle Beam - strong steel member (generally I-section)
 - Stub Axles - fitted at both ends of axle beam
 - Spring pads - for mounting leaf springs.
 - Kingpin - connects stub axle to axle beam.
 - Steering arm - used for steering movement.
- Usually made of drop-forged steel for strength.

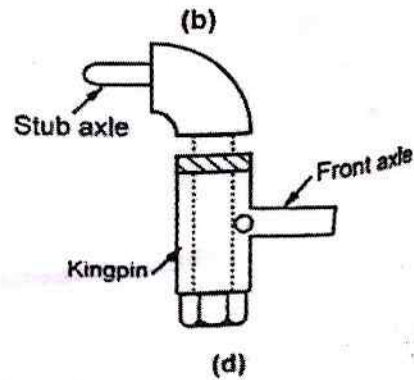
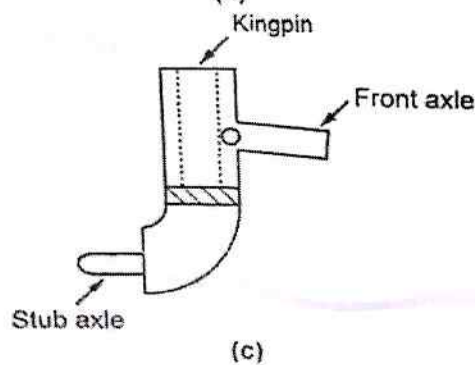
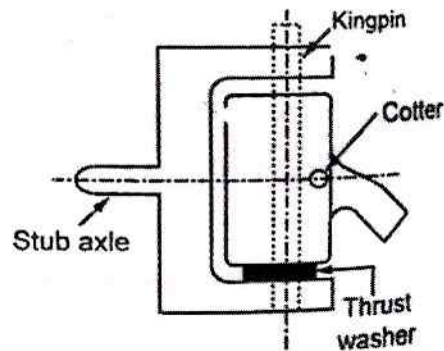
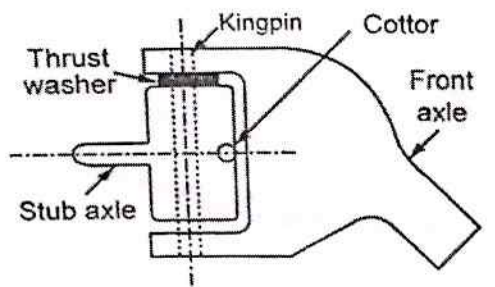
Requirements of front axle :

- Must be strong & rigid
- Should withstand bending & torsional loads.
- Must provide proper steering geometry.
- Should be light in weight.
- Must ensure stability & safety.

* Stub Axle:

- Defⁿ - It is a short axle attached to front axle beam, on which the front wheel is mounted & which helps in steering movement.

* Types of Stub Axle:



1. Elliot Type Stub Axle :-

Construction -

- Stub axle is connected to the axle beam using yoke (fork).
- A kingpin passes through the yoke & stub axle.
- Stub axle fits betⁿ the arms of axle beam,

Features -

- simple & widely used (light & medium vehicles)
- strong & easy to manufacture.

2. Reverse Elliot Type Stub Axle :-

Construction -

- Opposite arrangement of Elliot type.
- Stub axle has the yoke, & axle beam is placed betⁿ it.
- kingpin connects both.

Features -

- More rigid & stronger than Elliot type,
- Better load distribution
- Used in heavy vehicles.

3. Lamoine Type Stub Axle :-

Construction -

- Uses an L-shaped connection,
- Stub axle is connected to axle beam through kingpin at one side only.

Features -

- Simpler design
- Less strong compared to Elliot type,
- Rarely used in modern vehicles.

4. Inverted Elliot Type Stub Axle :-

Construction -

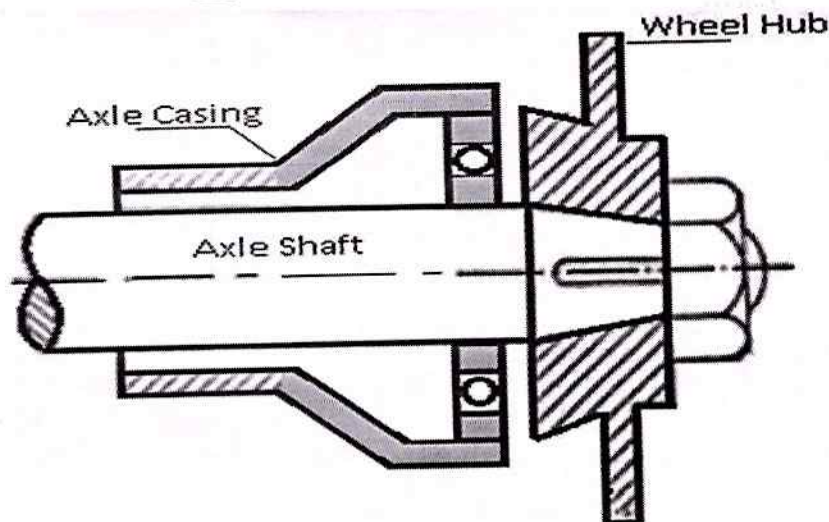
- Similar Elliot type but placed below the axle beam,
- Stub axle is mounted in inverted position,

Features -

- Lower center of gravity,
- Improved vehicle stability,
- Used in some special vehicle designs,

* Types of Rear Axle :-

1. Semi-Floating Rear Axle -



Construction -

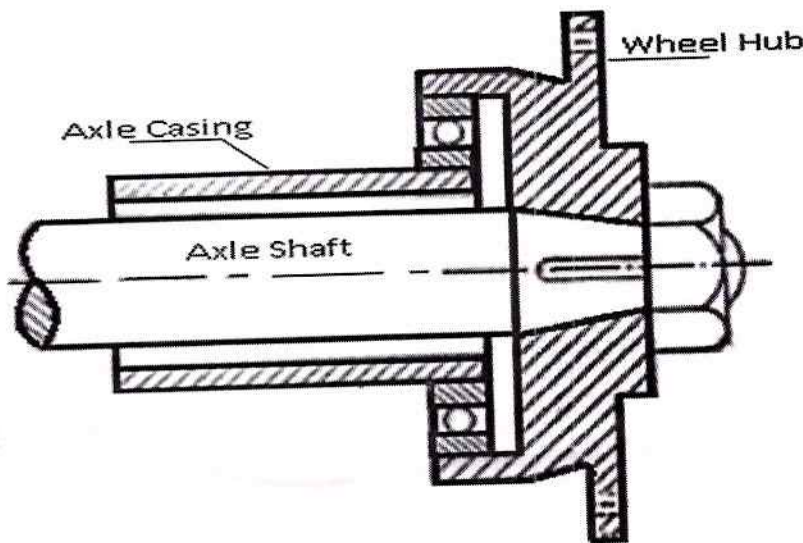
- The axle shaft is connected to the differential at inner end & wheel hub at outer end.
- Supported by one bearing placed betⁿ axle casing & shaft.
- Wheel is directly mounted on the axle shaft flange.

Functions -

- Transmits driving torque from differential to wheels.
- Supports vehicle load (partially or fully)
- Also resists bending & side thrust.

Note → Shaft carries both load + torque.

2. Three-Quarter floating Rear axle :-



Construction -

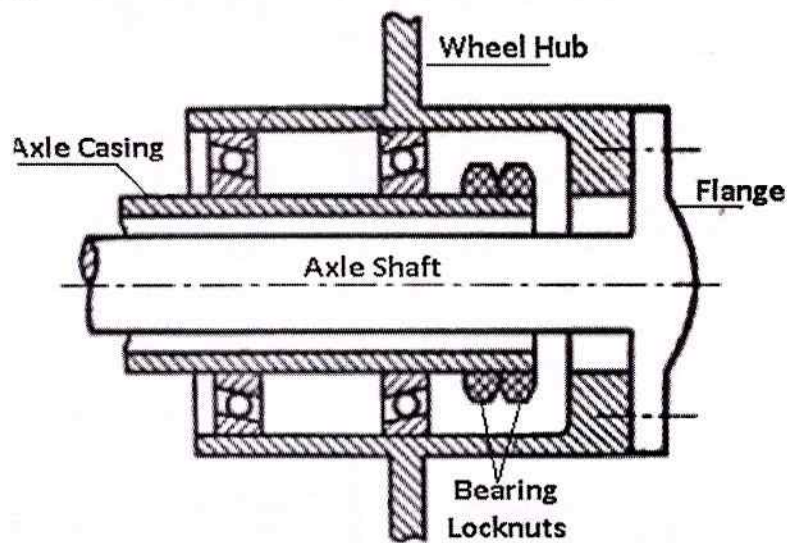
- Similar to semi-floating but with additional bearing support.
- Axle shaft is partially relieved from bending load
- Wheel hub is supported by bearing, but shaft still carries some load.

Functions -

- Transmits torque to wheels.
- Supports partial vehicle load.
- Reduces bending stress compared to semi-floating axle.

Note → shaft carries torque + partial load.

3. Fully Floating Rear axle :-



Construction -

- Axle shaft is connected only to differential & wheel hub for torque transmission.
- Wheel hub is mounted on two bearings on axle casing.
- Axle shaft is free from bending load.

Functions -

- Transmits only driving torque.
- Vehicle load is supported by axle casing, not shaft.
- Provides max^m strength & reliability.

Note → shaft carries only torque (no load).

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