List of engine parts, materials, method of manufacture and functions :

Name of the part		Material	Function	Method of manufacture
1.	*Cylinder*	Hard grade cast-iron	Contains gas under pressure and guides the piston.	Casting
2.	*Cylinder head*	Cast-iron or aluminium	Main function is to seal the working end of the cylinder and not to permit entry and exit of gases on overhead valve engines.	Casting, forging
3.	*Piston*	Cast-iron or aluminium alloy	It acts as a face to receive gas pressure and transmits the thrust to the connecting rod.	Casting, forging
4.	*Piston rings*	Cast-iron	Their main function is to provide a good sealing fit between the piston and cylinder.	Casting
5.	*Gudgeon pin*	Hardened steel	It supports and allows the connecting rod to swivel.	Forging

6.	*Connecting rod*	Alloy steel; for small engines the material may be aluminium	It transmits the piston load to the crank, causing the latter to turn, thus converting the reciprocating motion of the piston into rotary motion of the crankshaft.	Forging
7.	*Crankshaft*	In general the crankshaft is made from a high tensile forging, but special cast-irons are sometimes used to produce a light weight crankshaft that does not require a lot of machining.	It converts the reciprocating motion of the piston into the rotary motion.	Forging
8.	*Main bearings*	The typical bearing half is made of steel or bronze back to which a lining of relatively soft bearing material is applied.	The function of bearing is to reduce the friction and allow the parts to move easily.	Casting
9.	*Flywheel*	Steel or cast-iron.	In engines it takes care of fluctuations of speed during thermodynamic cycle.	Casting
10.	*Inlet valve*	Silicon chrome steel with about 3% carbon.	Admits the air or mixture of air and fuel into engine cylinder.	Forging
11.	*Exhaust valve*	Austenitic steel	Discharges the product of combustion.	Forging

- Necessity of Transmission
- When a vehicle is running, various resistances oppose it
- . In order to keep vehicles moving at a uniform speed, a driving force or tractive effort is equal to the sum of all opposing forces. If the tractive effort increases the total opposing resistance, the excess tractive effort will accelerate the vehicle.
- If the tractive effort is less than the total resistance, the excess of the resistances will lower the speed of the vehicle.
- When a vehicle starts to move from rest, it needs more force or high torque and also for hill climbing, accelerating or carrying heavy loads due to various opposing resistances.
- It can be achieved by running the engine at high speed and wheels at low speeds. After starting the vehicle,
- it is moving due to momentum gained by the weight of vehicle.
- The same force or torque does not need to keep the vehicle in moving. So, the speed of the road wheels has to be progressively increased when the vehicle gains speed gradually.
- The gearbox is mainly provided for high torque at the time of starting, hill climbing, acceleration and pulling a load.
- It can be achieved by a set of gears which are enclosed in a gearbox and gear changing mechanism.

- Purposes of Transmission
- 1. It helps the engine to disconnect from driving wheels.
- 2. It helps the running engine to be connected to the driving wheel smoothly and without shock.
- 3. It provides the leverage between engine and driving wheels to be varied.
- 4. It helps to reduce the engine speed in the ratio of 4:1 in case of passenger cars and in a greater ratio in case of heavy vehicles such as trucks and lorries.
- 5. It helps the driving wheels to be driven at different speeds.
- 6. It gives the relative m

- CLUTCH
- Clutch is a mechanism used to connect or disconnect the engine from the rest of transmission elements.
- It is located between engine and gearbox. During normal running and stationary position, it is always in engaged condition.
- The clutch is disengaged when the driver processes the clutch pedal.
- The clutch is disengaged for starting, changing gears, stopping and idling.

- When the clutch is engaged, the engine will be connected to the transmission and power flows from engine to rear wheels through a transmission system.
- When 'the clutch is disengaged by pressing the clutch pedal, the engine will be disengaged from the transmission.
- Thus, the power does not flow to rear wheels while the engine is still running.

- Principles of Operation of Friction Clutch

- The clutch works on the principle of friction. In Figure 3.2, the driving shaft A with flange C is rotating at 'N' rpm and shaft B with the flange 0 is keyed to the driven shaft which is in stationary position when the clutch is not engaged. Now, external force is applied to the flange 0 so that it comes in contact with flange C, As soon as the contact is made, they are united due to friction between them and the flange 0 starts rotating with flange C. The rotational speed of flange D depends on the friction between surfaces C and D which in turn proportional to the external force applied.

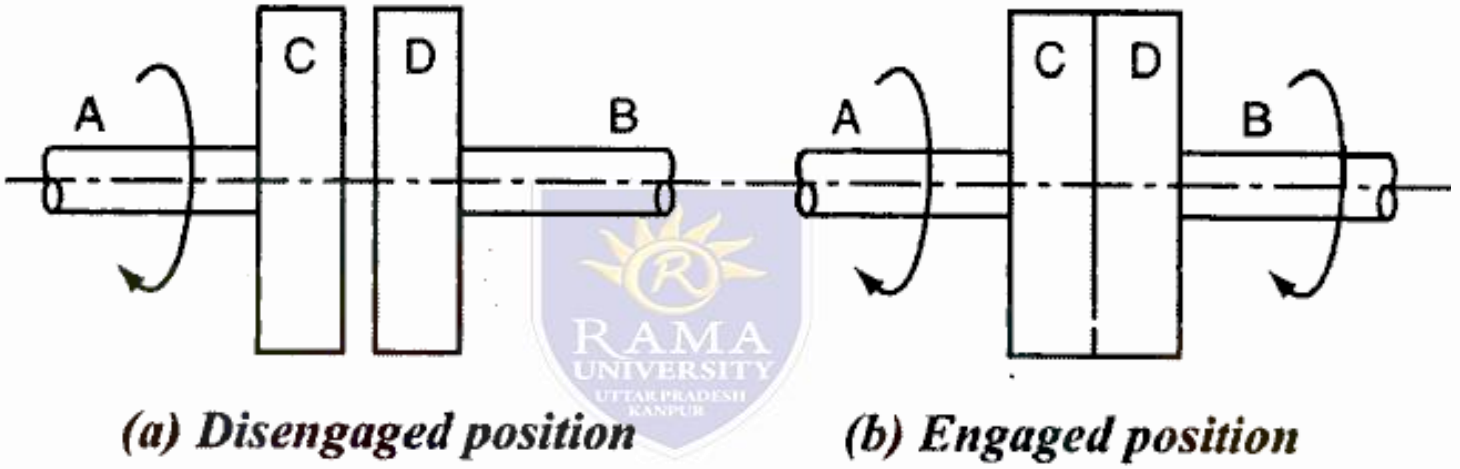

Figure 3.2 Principle of friction clutch

- If the force is gradually increased, the speed force transmitted will a.so be increased gradually. The torque transmitted by the friction clutch depends on pressure applied on flange, coefficient of friction of the surface materials and radius of the flange. By increasing anyone of them, the force transmitted can be increased.