- UNIVERSAL JOINTS
- Universal joints are mainly used to make a flexible connection between two rigid shafts at an angle.
- It permits the transmission of constantly varying power.
- It is used to connect the propeller shaft with the gear box shaft to transmit rotary motion.
- In case of an automobile, a gearbox is rigidly mounted. Due to the action of the road springs, the position of the rear axle is constantly varied and the allowance is provided if the gearbox is mounted to the rear axle by a propeller shaft.
- Hence, universal joints are used for connecting two shafts inclined to one another at angle and also for transmitting the rotary motion from engine to road wheels throughout the variations in position of the rear axle with respect to gearbox and chassis.
- The transmission of power under varying condition is impossible without using of a flexible device or universal joint.
- This flexible device is also used in vehicles having coupling shaft between clutch and gearbox, between main gearbox and auxiliary gearbox and also on riving shafts of the driven front axle.
- A universal joint consists of two yokes. These yokes are connected to each end of the shaft.
- The two yokes are joined by a central or connecting cross piece.
- The connecting cross piece will tum bearings of the yoke with the change in angularity between shafts.
- They do not transmit motion uniformly if the shafts are operating at an angle.
- Hence, the driven shaft increases to maximum and then it decreases to minimum.
- The rise and fall of driven shaft are twice in each revolution due to rotation of pivot pins in different plane

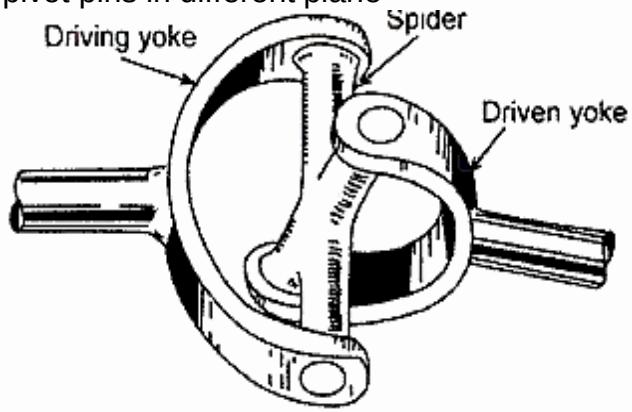

Figure 3.45 Universal joints

- Types of Universal Joints
- Universal joints are classified as follows.
- (a) Variable velocity joints,
- (b) Constant Velocity (CV) joints.

- (a) Variable velocityjoints:
- In this case, both the driven and driving shafts do not turn at the same speed even though each part of a revolution is at the same rpm.
- The driven and driving shafts should be placed in a straight line to turn at the same speed through each part of a revolution. But in actual practice, it will not be feasible in any automobiles.
- The drive shaft is always inclined. If there is an angle between driven and driving shafts, the driven shaft will tum lower than driving shaft through half a revolution and it is faster than driving shaft throughout the half revolution.
- Hence, the average speed of the driven shaft is equal to the driving shaft.
- The speed variation in the driven shaft increases with increase in flex angle of the universal joint.
- The yokes on the shafts connected with the universal joints should not be in different planes if two variable velocity universal joints are used in one drive line. It provides the balancing to the speed variations.
- Variable velocity joints are of the following types.
- (a) Cross or spider type
- (b) Ring type
- (c) Ball and trunion type

- (i) Cross or spider type:
- In universal joints, the two yokes in which one is connected to the driving shaft and the other one is connected to the driven shaft at right angle to each other by a cross or spider.
- Needle type bearings are mounted between yokes and cross ends.
- These types of joints are generally used in driving shafts.

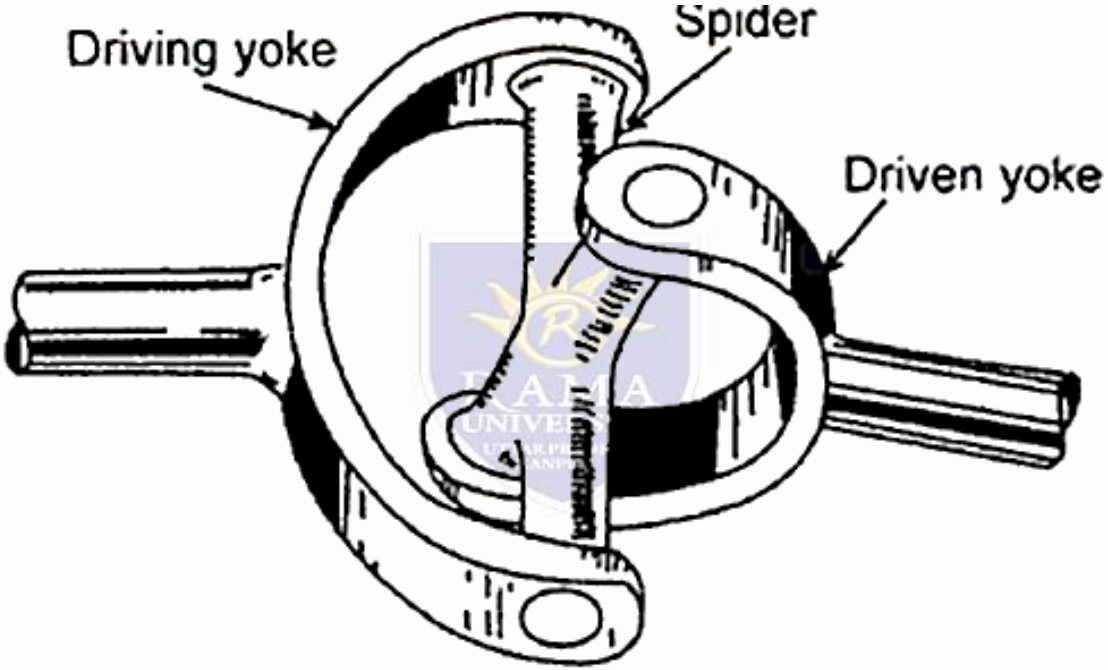

Figure 3.45 Universal joints

- (ii) Ring type:
- This type of joint uses a flexible ring. The shafts are having two or three armed spiders.
- The arms are bolted to opposite faces of flexible ring.
- The arms of one spider are arranged midway between the arms of the other shown in Figure 3.46.
- The flexible ring is made of one or more rings of rubber to provide enough strength.
- A number of thin steel discs are used instead of fabric rings.
- This joint itself provides a considerable amount of axial movement of the shaft.
- It smoothens the torque fluctuations and it needs no lubrication.
- The main drawback is that the ring does not withstand for longer period.

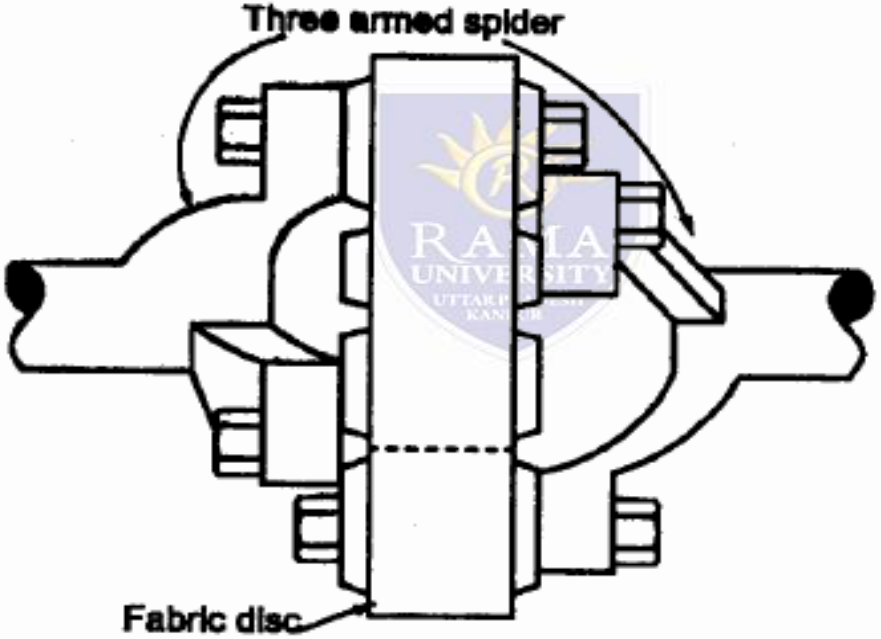

Figure 3.46 Ring type universal joint

- **(iii) Ball and trunion type:**
- A combination of both universal and slip joint in one assembly is used in this type.
- A pin or cross shaft is connected crosswise in 'T' fashion in the end of universal joint shaft.
- Each end of the cross shaft has a ball mounted on needle bearings.
- The complete assembly freely slides in grooves machined in the outer body of the joint.
- A heavy spring resists excessive longitudinal movement of the shaft.
- The power is transmitted through the trunion, balls and cross shaft.
- The bending moment occurs in one direction by rolling action of balls.
- It is also in the other direction by moving balls lengthwise in trunion grooves.
- The open end of the shaft is covered by leather or rubber boot covers.

- **(b) Constant velocity joints:**
- In this type of joint, the driven shaft is turned at the same speed as the driving shaft turns through each part of revolution at any degree of flex. These joints are mainly used in front drive axles for transmitting power through a large angle required. Cadillac cars use ball and socket type constant velocity joints in their propeller shafts. These types of joints are of the following main types.
- (i) Rzeppa,
- (ii) Bendix Weiss,
- (iii) Tracta.
- (i) Rzeppa: