

# SYED AMMAL ENGINEERING COLLEGE

(Approved by the AICTE, New Delhi, Govt. of Tamilnadu and Affiliated to Anna University, Chennai)

Established in 1998 - An ISO 9001:2008 Certified Institution

E.M.Abdullah Campus, Ramanathapuram – 623 502.

Phone: 304001, 304002 (04567 ) Fax: 304123(04567)

Website: [www.syedengg.ac.in](http://www.syedengg.ac.in) E.mail: [saec@syedengg.ac.in](mailto:saec@syedengg.ac.in)



## ME6601 DESIGN OF TRANSMISSION SYSTEMS

### PART-A

**1. How is a Wire rope specified?**

**Ans:** They are specified by the no. of strands & the no. of wires in each strand.

**2. Sketch the cross section of a V-belt and label its important parts.**

**Ans:** Refer pg. no. 2.1 Dots by V.Jayakumar

**3. Why is the face of a pulley crowned?**

**Ans:** The crowning tends to keep the belt in centre on a pulley rim while in motion.

**4. What are the five parts of roller chain?**

**Ans:** Pin link, Roller link, Pins, Bushes & Roller

**5. Give the relationship of ratio of tensions in a V-belt drive.**

**Ans:**  $T_1/T_2 = e^{\mu\alpha \cdot \text{cosec}\beta}$

**6. What is a silent chain? In what situations, silent chains are preferred?**

**Ans:** i) Inverted tooth chains are called silent chains because of their relatively quiet operation.

ii) They are preferred for high-power, high speed & smooth operation.

**7. Define maximum tension in a belt.**

**Ans:** Tension on tight side of the belt + Centrifugal tension

**8. Give the condition for maximum power transmission in terms of centrifugal tension in case of belt drive.**

**Ans:** The power transmitted shall be maximum when the centrifugal tension ( $T_c$ ) is one third of the maximum belt tension ( $T$ ).

**9. Why tight side of the flat belt should be at the bottom side of the pulley?**

**Ans:** Because the driving pulley pulls the belt from bottom side and delivers it to the upper side. So it is obvious that the bottom side of the belt is tight.

**10. What is meant by 'chordal action of chain'?**

**Ans:** When chain passes over the sprocket, it moves as a series of chords instead of a continuous arc as in the case of a belt drive. It results in varying speed of the chain drive. This phenomenon is known as chordal action.

## **UNIT -II**

### **PART-A**

**1. Mention a few gear materials.**

**Ans:** Metallic gears – steel, cast iron

Non-Metallic gears – wood, compressed paper & synthetic resins

**2. State an advantage and disadvantage of helical gear.**

**Ans:** Advantage: Produce less noise than spur gears

Dis Advantage: Subjected to axial thrust loads

**3. Why is tangential component of gear tooth force called useful component?**

**Ans:** Because it transmits power.

**4. Compare the contact between mating teeth of spur and helical gears.**

**Ans:** i) In spur gears the line of contact is parallel to the axis of rotation. The total length of contact line is equal to the face width.

ii) In helical gears the line of contact is diagonal across the face of the tooth. The total length of contact line is greater than the face width. This lowers the unit loading & increases load carrying capacity.

**5. What is backlash in gears?**

**Ans:** It is the difference between the tooth space and the tooth thickness along the pitch circle.

**6. What is the advantage of helical gear over spur gear?**

**Ans:** i) Helical gears produce less noise than spur gears.

ii) Helical gears have a greater load capacity than equivalent spur gears.

**7. Why is a gear tooth subjected to dynamic loading?**

**Ans:** Inaccuracies of tooth spacing, Irregularities in tooth profiles, Misalignment between bearings.

**8. State the law of gearing or conditions of correct gearing.**

**Ans:** It states that for obtaining a constant velocity ratio, at any instant of teeth the common normal at each of contact should always pass through a pitch point, situated on the line joining the centres of rotation of the pair of mating parts.

**9. What are the commonly used gear tooth profiles?**

**Ans:** Involute & Cycloidal

**10. State about herring bone gear.**

**Ans:** The double helical gears connecting two parallel shafts are known as herringbone gears. They are used in heavy machinery and gear boxes.

## **UNIT -III**

### **PART-A**

**1. When do we employ crossed helical gear?**

**Ans:** A pair of crossed-helical gears also known as spiral gears are used to connect and transmit motion between two non-parallel and non-intersecting shafts. As the contact between the mating teeth is always a point, these gears are suitable only for transmitting a small amount of power.

**2. Mention two characteristics of hypoid gear.**

**Ans:** They are similar in appearance to spiral-bevel gears. Their pitch surfaces are hyperboloids rather than cones. Axis of pinion is offset from the axis of the gear.

**3. What are the various forces acting on a bevel gear?**

**Ans:** Tangential force, Axial force & Radial force

**4. Usually worm is made of hard material and worm gear is made of softer material – justify.**

**Ans:** A material strength is set so that an amount of wear of the worm becomes larger than that of the worm wheel.

**5. When is bevel gear preferred?**

**Ans:** They are used to transmit power between two intersecting shafts.

**6. Calculate the angle between the shafts of a crossed helical gears made of two right handed helical gears of 15° helix angle each.**

**Ans:** Shaft angle,  $\Theta = \beta_1 + \beta_2 = 2\beta = 2(15^\circ) = 30^\circ$

**7. State the use of bevel gears.**

**Ans:** They are used to transmit power between two intersecting shafts.

**8. State the advantage of worm gear drive in weight lifting machine.**

**Ans:** The worm gear drives are irreversible. It means that the motion cannot be transmitted from worm wheel to the worm. This property of irreversible is advantageous in load hoisting applications like cranes and lifts.

**9. Why is the crossed helical gear drive not used for power transmission?**

**Ans:** As the contact between the mating teeth of crossed helical gears is always a point, these gears are suitable only for transmitting a small amount of power. That's why mostly these gears are not used for power transmission.

**10. Why is the efficiency of a worm gear drive comparatively low?**

**Ans:** Because of power loss due to friction caused by sliding.

## **UNIT -IV**

### **PART-A**

- 1. What are the points to be considered while designing a sliding mesh type of multi-speed gear box?**

**Ans:** i) The transmission ratio in a gear box is limited by  $\frac{1}{4} < i < 2$   
ii) Speed ratio of any stage should not be greater than 8.

- 2. Which type of gear is used in constant mesh gear box? Justify.**

**Ans:** Helical gears are used in constant mesh gear boxes to provide quieter and smooth operation.

- 3. Compare sliding mesh and synchromesh gear box.**

**Ans: sliding mesh gear box:** It derives its name from the fact that the meshing of the gears take place by sliding of gears on each other. With sliding mesh gear box, double de-clutching is necessary to bring the two sets of dog teeth to the same speed so that they can be slid into engagement quietly.

**synchromesh gear box:** To eliminate the need to de-clutch, the synchromesh gear box was introduced. The basic gear box is laid out in the same manner as the constant mesh, but with the addition of a cone clutch fitted between the dog and gear members.

- 4. Where is multi-speed gear boxes employed?**

**Ans:** They are employed wherever the variable spindle speeds are necessary.

- 5. Name the series in which speeds are arranged in multi-speed gear boxes.**

**Ans:** Basic series of preferred numbers are R5, R10, R20, R40 & R80.

- 6. List six standard speeds starting from 18 rpm with a step ratio 1.4.**

**Ans:** For the step ratio  $\Phi = 1.4$ , the R20 series, the standard speeds are 18, 20, 22.4, 25, 28 & 31.5 rpm.

- 7. Sketch the kinematic layout of gears for 3 speeds between two shafts.**

**Ans:** Refer pg.no: 9.11 Dots by V.Jayakumar

- 8. Differentiate ray diagram and structural diagram.**

**Ans:** Ray diagram is a graphical representation of the structural formula. Structural diagram is a kinematic layout that shows the arrangement of gears in a gear box.

- 9. List out the basic rules to be followed for optimum gear box design.**

**Ans:** i) The transmission ratio in a gear box is limited by  $\frac{1}{4} < i < 2$   
ii) Speed ratio of any stage should not be greater than 8.

**10. What is step ratio? Name the series in which speeds of multi-speed gear box are arranged.**

**Ans:** When the spindle speeds are arranged in geometric progression, then the ratio between the two adjacent speeds is known as speed ratio.

Basic series are R5, R10, R20 & R40.

## **UNIT -V**

### **PART-A**

**1. Name the profile of cam that gives no jerk.**

**Ans:** Circle –arc cam gives no jerk. Because the derivative of acceleration of cam is zero.

**2. Give the reasons for left and right shoes of the internal expansion brakes having different actuating forces.**

**Ans:** Depending upon the direction of the drum rotation, one shoe would be a leading shoe and another shoe is a trailing shoe. The leading shoe is self energizing whereas the trailing shoe is not. In the leading shoe, the friction force helps the applied force and hence more actuating force than the trailing force.

**3. What are the effects of temperature rise in clutches?**

**Ans:** i) Excessive surface temperature results in premature clutch failure.  
ii) May cause the individual plates to be welded together in metal clutches.  
iii) May cause excessive wear in non-metal clutches.

**4. What is the significance of pressure angle in cam design?**

**Ans:** The pressure angle is very important in cam design as it represents steepness of the cam profile. If the pressure angle is too large, a reciprocating follower will jam in its bearings.

**5. State the advantage of cam mechanisms.**

**Ans:** Cams are used for transmitting desired motion to a follower by direct contact. Cam mechanisms are used in the operation of IC engine valves.

**6. How the ‘uniform rate of wear ‘assumption is valid for clutches?**

**Ans:** In clutches, the value of normal pressure, axial load for the given clutch is limited by the rate of wear that can be tolerated in the brake linings. Moreover, the assumption of uniform rate wear gives a lower calculated clutch capacity than the assumption of uniform pressure. Hence clutches are usually designed on the basis of uniform wear.

7. **Name four profiles normally used in cams.**

**Ans:** Uniform velocity, Simple harmonic motion, Uniform acceleration & retardation, Cycloidal motion.

8. **Under what condition of a clutch, uniform rate of wear assumption is more valid?**

**Ans:** If the clutch is old one.

9. **When do we use multiple disk clutches?**

**Ans:** It is used when large amount of torque is to be transmitted. In a multiplate clutch, the number of frictional linings and the metal plates are increased which increases the capacity of the clutch to transmit torque.

10. **Differentiate between self-energizing and self-locking brakes.**

**Ans:** When the frictional force is sufficient enough to apply the brake with no external force, then the brake is said to be **self-locking brake**.

When the frictional force helps in applying the brake, then the brake is said to be **self-energised brake**.