**SAM SKRUTI COLLEGE OF ENGINEERING & TECHNOLOGY**

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# Subject Name: BASIC MECHANICAL ENGINEERING FOR CIVIL ENGINEERS

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**Year and Sem, Department: II-II, MECHANICAL ENGINEERING**

**Unit-I: Machine Elements,** **Introduction to engineering materials,** **Riveted joints**

**Important points**

**CAM AND ITS TYPES**

A cam is a rotating or sliding piece in a mechanical linkage used especially in transforming rotary motion into linear motion.

1. **Plate or disk cams:** Plate or disk cams are the simplest and most common type of cam. A plate cam is illustrated in figure 3 (a). This type of cam is formed on a disk or plate. The radial distance from the center of the disk is varied throughout the circumference of the cam. Allowing a follower to ride on this outer edge gives the follower a radial motion.
2. **Cylindrical or drum cam:** A cylindrical or drum cam is illustrated in figure 3 (b). This type of cam is formed on a cylinder. A groove is  cut into the cylinder, with a varying location along the axis of rotation. Attaching a follower that rides in the groove gives the follower motion along the axis of rotation.
3. **Linear cam:** A linear cam is illustrated in figure 3 (c). This type of cam is formed on a translated block. A groove is cut into the block with a distance that varies from the plane of translation. Attaching a follower that rides in the groove gives the follower motion perpendicular to the plane of translation.

**Types of Followers**

1 A. According to surface in contact  
1. Knife edge follower  
2. Roller follower  
3. Flat follower  
4. Spherical follower  
  
B. According to type of follower motion  
1. Translatory motion type follower  
2. Oscillatory motion type follower  
  
C. According to line of follower motion  
1. Radial follower  
2. Offset follower

Engineering materials refers to the group of materials that are used in the construction of manmade structures and components. The primary function of an engineering material is to withstand applied loading without breaking and without exhibiting excessive deflection. The major classifications of engineering materials include metals, polymers, ceramics, and composites.

## Metals

Metals are the most commonly used class of engineering material. Metal alloys are especially common, and they are formed by combining a metal with one or more other metallic and/or non-metallic materials. The combination usually occurs through a process of melting, mixing, and cooling. The goal of alloying is to improve the properties of the base material in some desirable way.

Metal alloy compositions are described in terms of the percentages of the various elements in the alloy, where the percentages are measured by weight.

**CERAMIC MATERIAL**

A ceramic material is an inorganic, non-metallic, often crystalline oxide, nitride or carbide material. Some elements, such as carbon or silicon, may be considered ceramics. Ceramic materials are brittle, hard, strong in compression, and weak in shearing and tension.

**Heat treatment  process**

Heat treatment is the process of heating and cooling metals to change their microstructure and to bring out the physical and mechanical characteristics that make metals more desirable. The temperatures metals are heated to, and the rate of cooling after heat treatment can significantly change metal's properties.

**Riveted joint**

It is permanent joint with mainly two components (parts to be joined) which are held together by a rivet with the head at top and tail at the bottom.

failures

**Failures in Riveted (Bolted) Joints**

There are four types of stresses occur at riveted joints. Therefore, the failure is possible in four locations as follows:

1. Shearing stress failure in rivets
2. 2- Tension stress failure in plate.
3. 3- Bearing stress failure between plate and rivet.
4. 4- Shearing stress failure in plate.

**STRENGTH EQUATION AND EFFICIENCY**

Number of rivets under crushing is equal to the number of rivets under shear. The efficiency of a riveted joint is defined as the ratio of the strength of the joint (least of calculated resistances) to the strength of the solid plate. ptσ ' is the strength of the solid plate per pitch length.

**Eccentricity OF RIVETED JOINTS**

Meaning of eccentricity in loading. Procedure for designing a screw/bolted joint in eccentric loading. Procedure for designing riveted joint under eccentric loading. bracket about the lowermost point in left (say point O), which in an indirect way introduces tension in the screws.

**Short Questions (minimum 10 previous JNTUH Questions**

1. What is cam?write types of cam?
2. Define follower?
3. Classify followers in different aspects?
4. Classify engineering materials?
5. Write mechanical properties of engineering materials?
6. What are ceramics? Give example?
7. What are composites? Give an example?
8. What are riveted joints?
9. What are methods of failure in riveted joints?
10. What is efficiency of riveted joints?
11. What are eccentrically loaded riveted joints?

**Long Questions (minimum 10 previous JNTUH Questions – Year to be mentioned)**

1. Define cam?Explain about cams?
2. Define follower? Explain about different types of followers?
3. What are engineering materials?
4. Briefly explain about mechanical properties of engineering materials?
5. Explain about ceramics and composites?
6. Describe about different types of heat treatment of materials?
7. Write common Applications of engineering materials?
8. Explain about methods of failure in riveted joints?
9. How to calculate efficiency of riveted joints?
10. Explain about eccentrically loaded riveted joints?

**Fill in the Blanks / Choose the Best: (Minimum 10 to 15 with Answers)**

1. The size of a cam depends upon----------------(base circle)
2. The angle between the direction of the follower motion and a normal to the pitch curve is called----------------------------------(pressure angle)
3. A radial follower is one--------------(that reciprocates in the guides)
4. The permanent mode of deformation of a material known as---------------------------(Plasticity)
5. Which of the following is a property of ceramics?( Resistant to corrosion)
6. The ability of materials to develop a characteristic behavior under repeated loading known as \_\_\_\_\_\_\_\_\_\_\_(fatigue)
7. Which of the following isn’t a main part of rivet------------------------(head)
8. The amount by which the two rods to be joined are drawn together is called as--------------
9. ---- ------------------ are used in light sheet metal work.( Tinmen’s rivets)
10. Unwin’s formula is used to find \_\_\_\_\_ of rivets.( Diameter)

**Unit-II: Power Transmission Elements, Material Handling equipment:**

**GEAR**

A gear or cogwheel is a [rotating](https://en.wikipedia.org/wiki/Rotating) [machine](https://en.wikipedia.org/wiki/Machine_(mechanical)) part having cut teeth or, in the case of a cogwheel, inserted teeth (called cogs), which mesh with another toothed part to transmit [torque](https://en.wikipedia.org/wiki/Torque).

**Gears terminology of spur**

Spur gears or straight-cut gears are the simplest type of gear. They consist of a cylinder or disk with teeth projecting radially. Though the teeth are not straight-sided (but usually of special form to achieve a constant drive ratio, mainly [involute](https://en.wikipedia.org/wiki/Involute_gear) but less commonly [cycloidal](https://en.wikipedia.org/wiki/Cycloid_gear)), the edge of each tooth is straight and aligned parallel to the axis of rotation. These gears mesh together correctly only if fitted to parallel shafts.[[15]](https://en.wikipedia.org/wiki/Gear#cite_note-15) No axial thrust is created by the tooth loads. Spur gears are excellent at moderate speeds but tend to be noisy at high speeds.

**Helicalgears**

### Helical or "dry fixed" gears offer a refinement over spur gears. The leading edges of the teeth are not parallel to the axis of rotation, but are set at an angle. Since the gear is curved, this angling makes the tooth shape a segment of a [helix](https://en.wikipedia.org/wiki/Helix). Helical gears can be meshed in parallel or crossed orientations. The former refers to when the shafts are parallel to each other; this is the most common orientation. In the latter, the shafts are non-parallel, and in this configuration the gears are sometimes known as "skew gears".

**BEVEL GEARS**

A bevel gear is shaped like [a right circular cone with most of its tip cut off](https://en.wikipedia.org/wiki/Frustum). When two bevel gears mesh, their imaginary vertices must occupy the same point. Their shaft axes also intersect at this point, forming an arbitrary non-straight angle between the shafts. The angle between the shafts can be anything except zero or 180 degrees.

**GEAR TRAINS**

A gear train is a mechanical system formed by mounting gears on a frame so the teeth of the gears engage. Gear teeth are designed to ensure the pitch circles of engaging gears roll on each other without slipping, providing a smooth transmission of rotation from one gear to the next.

belt drives

**Belt Drives** are a type of frictional drives used for transmitting powers from one shaft to another by means of pulleys which rotate at the same speed or at the different speed.

### ****Types of Belts****

There are four commonly used types of belts are:

Flat belt

V belt

Circular

**Chain drives**

Chain drive is a way of transmitting mechanical power from one place to another. It is often used to convey power to the wheels of a vehicle, particularly bicycles and motorcycles. It is also used in a wide variety of machines besides vehicles.

**Material-handling equipment.** Material handling equipment (MHE) is mechanical equipment used for the movement, storage, control and protection of materials, goods and products throughout the process of manufacturing, distribution, consumption and disposal.

**Belt conveyors**

A belt conveyor system consists of two or more pulleys (sometimes referred to as drums), with an endless loop of carrying medium—the conveyor belt—that rotates about them. One or both of the pulleys are powered, moving the belt and the material on the belt forward.

**Cranes**

A crane is a type of machine, generally equipped with a hoist rope, wire ropes or chains, and sheaves, that can be used both to lift and lower materials.

**industrial trucks**

Industrial truck, carrier designed to transport materials within a factory area with maximum flexibility in making moves. Most industrial trucks permit mechanized pickup and deposit of the loads, eliminating manual work in lifting as well as transporting

**bull dozers**

A bulldozer is a tractor equipped with a substantial metal plate (known as a blade) used to push large quantities of soil, sand, rubble, or other such material during construction or conversion work and typically equipped at the rear with a claw-like device (known as a ripper) to loosen densely compacted materials.

**Short Questions**

1. Define pressure angle?
2. Short note on bevel gears**?**
3. Write about gear trains?
4. What is velocity ratio in gear trains?
5. Write types of belt drives?
6. Write short note on chain drive?
7. How works belt conveyor?
8. What is function of cranes?
9. What are industrial trucks?
10. What are bull dozers?

**Long Questions**

1. List out the terminology of spur gear?

2. Explain different types of material handling equipements

3. Briefly Explain different types of belt conveyors?

4. Explain about spur gears with neat sketch?

5. Explain about helical gears with neat sketch

6. Explain about bevel gears with neat sketch?

7. Explain about gear trains?

8. Write a note on industrial trucks, bull dozers?

9. Write a note about belt drives &cranes?

10. Explain different types of belt drives?

**Fill in the Blanks / Choose the Best: (Minimum 10 to 15 with Answers)**

1. ……………….is used for power transmission in intersecting shafts.  
    ( Bevel Gear)
2. Bevel gears impose \_\_\_\_ loads on the shafts.  
   ( Radial and thrust)
3. Due to slip of the belt, the velocity ratio of the belt drive……….(decreases)
4. V-belts are usually used for……………..( short drives)

5…………….belt conveyors have low volume carrying capacity (flat)

6.lifting and lowering & vertical transportation purpose…………………are used (cranes)

7……………... **used to transport materials having flat bottoms (roller conveyor)**

**8.Wheel barrows is used for……………………….(** lifting and lowering)

9. **The gears are used to connect two parallel shafts except….(bevel gears)**

**10.** **The gear used to convert rotary motion into translating motion is…..(rock and pinion)**