



MOTHER TERESA

INSTITUTE OF SCIENCE AND TECHNOLOGY

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DEPARTMENT OF CIVIL ENGINEERING

ACADEMIC YEAR: 2018-19

A SUMMARY REPORT

Course Name: STRUCTURAL ANALYSIS - I

Name of the Resource Person: Mr.G.Hathiram, Head Of The Department, KLR College,
Bhadradi Kothagudem (Dist),Palwancha.

Gap Identified: Different Types of Support Conditions and Analysis for Slope and
Deflection of Different Conditions

No. of Students attended: 43 members

Summary: On the day of the session (i.e 26-03-2018) Mr. Mr.G.Hathiram, Head Of The Department, KLR College, Bhadradi Kothagudem (Dist), Palwancha. Delivered a lecture on the basics of Introduction to the course of Different Types of Support Conditions and Analysis for Slope and Deflection of Different Conditions The simply supported beam is one of the most modest structures. The configuration of a simply supported beam is so simple having one hinge support at an end and roller support at the other end. With this setup the beam can only rotate horizontally, any vertical moment is restrained.

A simply supported beam rests on two supports(one end pinned and one end on roller support) and is free to move horizontally. The deflection and slope of any beam(not particularly a simply supported one) primary depend on the load case it is subjected upon. If the load case varies, its deflection, slope, shear force and bending moment get changed.

This article will help you find the deflection and slope developed at any point of a simply supported beam, subjected to any load. This roller support also helps the beam expand or contract axially, although the free horizontal movement is prevented by the other support. This is a determinant structure, which means that if an internal hinge is inserted or any of these supports(pin or roller) is removed, the beam cannot carry the load anymore. In this case, the beam will freely move under loading.

In the afternoon session, he explained the practical exposure of Finding Deflection and Slope: There are multiple methods like double integration method, Macaulay's method, Conjugate beam method, Castigliano's theorem, Principle of superposition which help us find the deflection and slope of a beam. Here we will use the double integration method, which is a simple, effective and straight forward method, that can be used to solve any type of question.

From the Euler-Bernoulli bending theory, at a point along a beam, we have:

$$1/R = M/EI$$

Where: R is the radius of curvature of the point

M is the bending moment at that point

EI is the flexural rigidity of the member, E is Young's modulus of the beam material, I is the second moment of area. We also have $dx = R d\theta$ and so $1/R = d\theta/dx$. Again for small displacements, $\theta \approx \tan \theta \approx dy/dx$ and so:

$$1/R = d^2y / dx^2 = M / EI$$

❖ **The formula used to find slope and deflection of the beam**

The bending moment at any point of the beam section can be found using the double integration formula, that is given below.

$$M = EI \frac{d^2y}{dx^2}$$

- M is the Bending Moment at a particular section, which is a function of x
- EI is the flexural rigidity of the member
- y represents the vertical deflection of the beam and x is the lateral direction.
- dy/dx represents the slope of the beam at that particular point.

Using this relation, upon integrating, the function for dy/dx (slope) can be found. Then, putting the appropriate value of x we can find the slope. Upon integrating again and putting the value of x, the deflection(y) can be determined.

❖ **Deflection of Beams - Formula, Methods:**

Deflection of Beams is the representation of deflection of the structure from its original unloaded position. Beams are widely used in different types of structures. Therefore, it is very important to know how to predict the deflection of beams when different types of load and their load combinations are applied.

It is very important to limit the deflection of beams as too much deflection might cause damage to other parts of the structures. If too much deflection of the beam is allowed, it will fail the serviceability criteria; even though the stresses acting in the beam are low and safe, the structure will fail to serve the purpose of its construction. Let us know more about the deflection of beams discussed in the upcoming sections.

❖ **Deflection of Beams:**

The deflection is measured from the beam's original neutral surface to the deformed beam's neutral surface. The configuration assumed by the deformed neutral surface is known as the elastic curve of the beam.



❖ Deflection of Beams Definition:

Deflection of beams is the transverse deformation that occurs due to the shear force and bending moment. Deflection of beams due to the shear force is insignificant compared to deflection of beams due to bending moment. Therefore, the deflection of beams due to shear force is ignored. Let us now see the slope and deflection of beams in brief.

- **The slope of a Beam:** The slope of a beam is the angle between deflected beam to the actual beam at the same point.
- **Deflection of Beam:** Deflection is defined as the vertical displacement of a point on a loaded beam. Many methods determine the slope and deflection at a section in a loaded beam.

The maximum deflection occurs where the slope is zero. The maximum deflection position is found by equating the slope equation to zero. Then the value of x is substituted in the deflection equation to calculate the maximum deflection. "Deflection of Beams" is an essential topic in the "**Strength of Materials**" subject.

❖ Deflection of Beams Formula:

The deformed shape of the beam is known as an elastic curve. The slope and deflection of beams formula for some of the standard cases are listed below. These formulae can be directly for solving many problems of deflection of beams.