SNS COLLEGE OF TECHNOLOGY

16ME207- STRENGTH OF MATERIALS

UNIT- IV DEFLECTION OF BEAMS AND BUCKLING OF COLUMNS

Equivalent length of a column - Euler equation

Equivalent length of a column

TABLE : 1

Case	End Conditions.	Equivalent length, l_e	Buckling load, Euler.
1.	Both ends hinged (or) Pin jointed (or) rounded (or) free.	l	$\frac{\pi^2 EI}{l_e^2} = \frac{\pi^2 EI}{l^2}$
2.	One end fixed, Other end free	$2l$	$\frac{\pi^2 EI}{l_e^2} = \frac{\pi^2 EI}{4l^2}$
3.	One end fixed, Other end Pin jointed.	$\frac{l}{\sqrt{2}}$	$\frac{\pi^2 EI}{l_e^2} = \frac{2\pi^2 EI}{l^2}$
4.	Both ends fixed (or) encastered.	$\frac{l}{2}$	$\frac{\pi^2 EI}{l_e^2} = \frac{4\pi^2 EI}{l^2}$

SNS COLLEGE OF TECHNOLOGY

EULER EQUATION

The Euler column formula predicts the critical buckling load of a long column with pinned ends.

EULER'S FORMULA.

Euler's formula is used for calculating the Critical load for a Column (or) Strut, and is as follows:

$$P_{Euler} = \frac{\pi^2 EI}{l_e^2} \longrightarrow (1)$$

where,

P = Critical load.
E = Modulus of Elasticity.
I = Least moment of Inertia of a Section of the Column.
l_e = Equivalent length of the Strut.

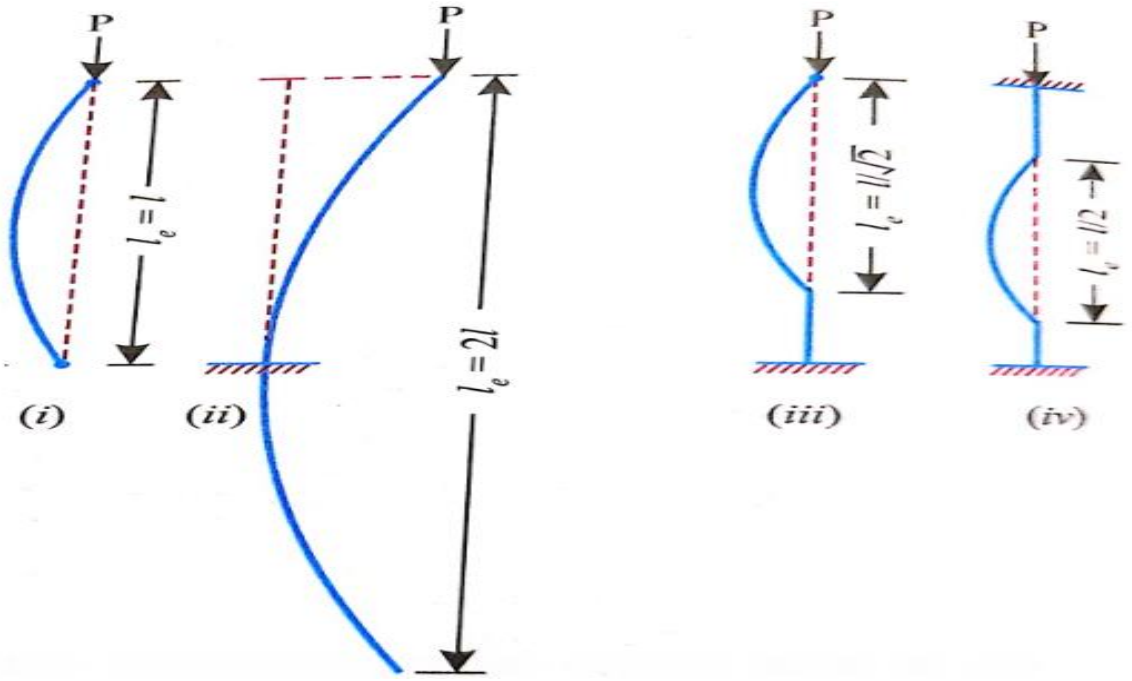
Equivalent length (l_e)

i) Both ends pin joined (or) hinged (or) rounded (or) free

ii) One end fixed and other end free.

iii) One end fixed and the other pin jointed

iv) Both ends fixed.



End conditions

i) **Both ends hinged**

Equivalent length = Actual length.

$l_e = l$

ii) **One end fixed and Other end free.**

$l_e = 2l$, the free end will sway sideways and the curvature in the length l will be similar to that of the upper half of the simple column.

iii) **One end fixed and Other pin jointed.**

$l_e = \frac{l}{\sqrt{2}}$, between the top of the column and inflexion point.

iv) **Both ends fixed.**

$l_e = \frac{l}{2}$, the distance between the two inflexion points