



SNS COLLEGE OF TECHNOLOGY



16ME207- STRENGTH OF MATERIALS

UNIT I - STRESS STRAIN DEFORMATION OF SOLIDS

Stresses in Stepped shafts and varying sections



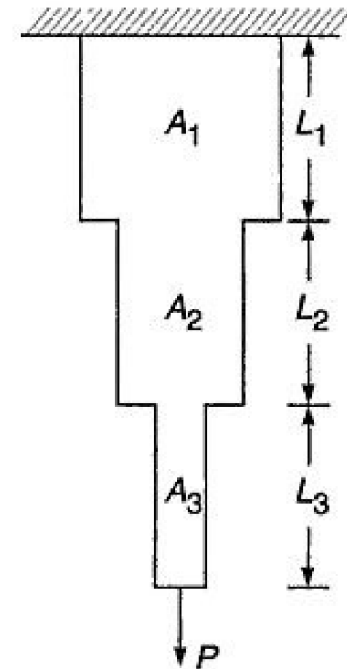
BARS WITH CROSS SECTIONS VARYING IN STEPS

Consider a bar of varying three sections of lengths L_1 , L_2 and L_3 having respective areas of cross-sections A_1 , A_2 and A_3 subjected to an axial pull P . Let δL_1 , δL_2 , δL_3 be the changes in length of the respective three sections of the bar, then we have

$$\delta L_1 = \frac{PL_1}{A_1 E}, \quad \delta L_2 = \frac{PL_2}{A_2 E}, \quad \delta L_3 = \frac{PL_3}{A_3 E}$$

Now the total elongation of the bar,

$$\delta L = \delta L_1 + \delta L_2 + \delta L_3 = \frac{PL_1}{A_1 E} + \frac{PL_2}{A_2 E} + \frac{PL_3}{A_3 E} = \frac{P}{E} \left(\frac{L_1}{A_1} + \frac{L_2}{A_2} + \frac{L_3}{A_3} \right)$$





BARS WITH CONTINUOUSLY VARYING CROSS SECTIONS

Bars with varying Circular cross section

A bar uniformly tapering from a diameter D_1 at one end to a diameter D_2 at the other end is shown in Figure.

Let P = Axial tensile load on the bar

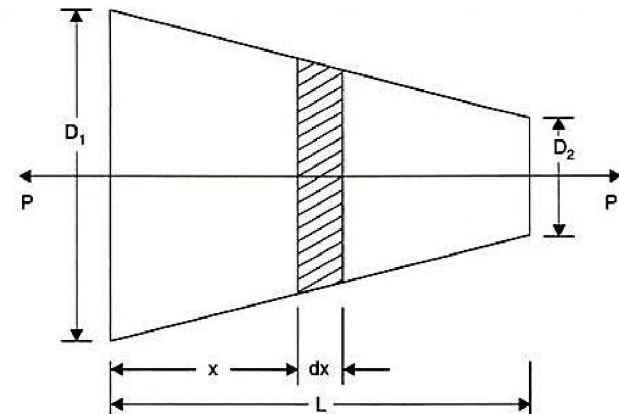
L = Total length of the bar

E = Young's modulus.

Consider a small element of length dx of the bar at a distance x from the left end. Let the diameter of the bar be D at a distance x from the left end.

$$D_x = D_1 - \left(\frac{D_1 - D_2}{L} \right) x$$
$$= D_1 - kx$$

$$\text{where } k = \frac{D_1 - D_2}{L}$$

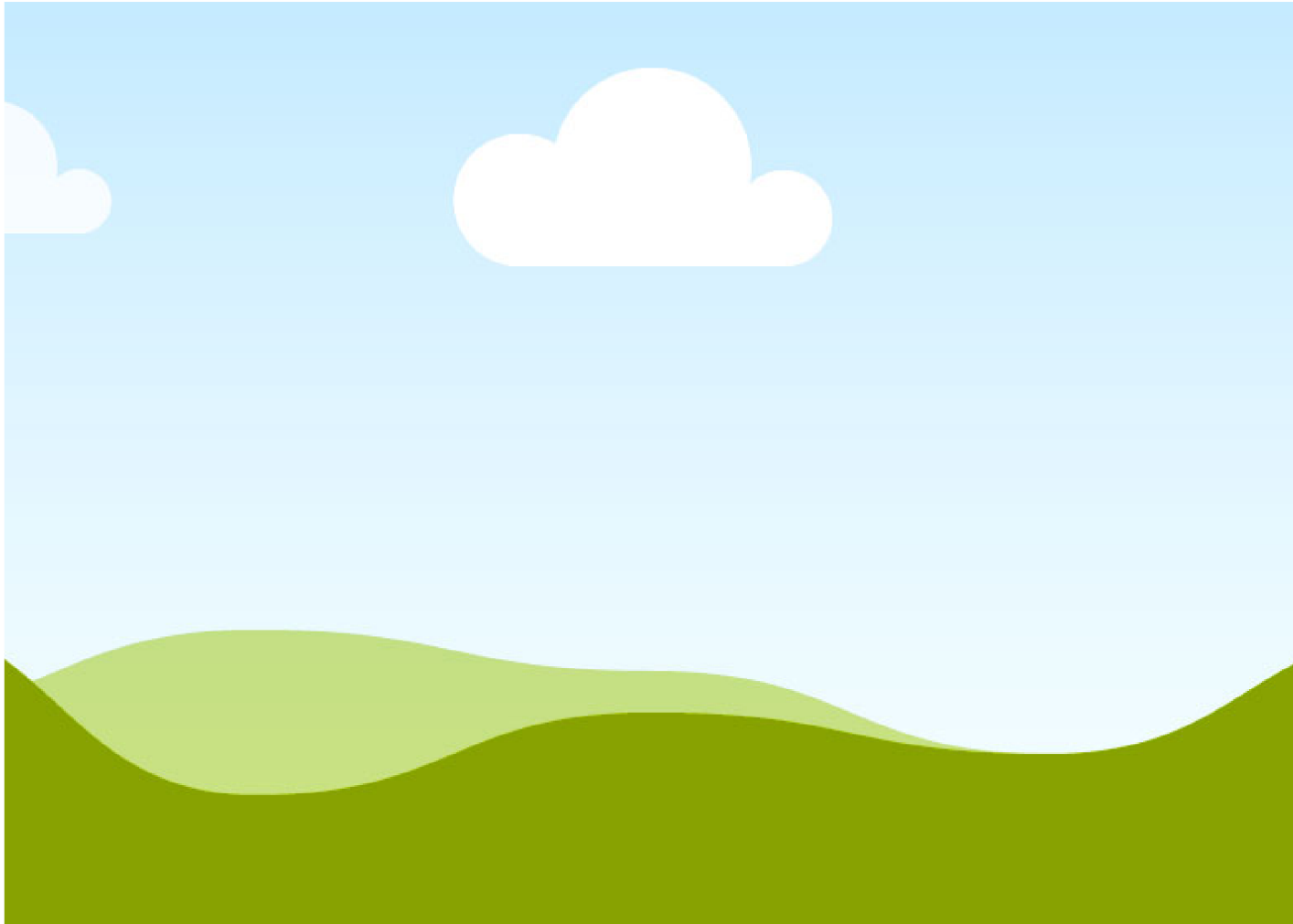




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BARS WITH CONTINUOUSLY VARYING CROSS SECTIONS

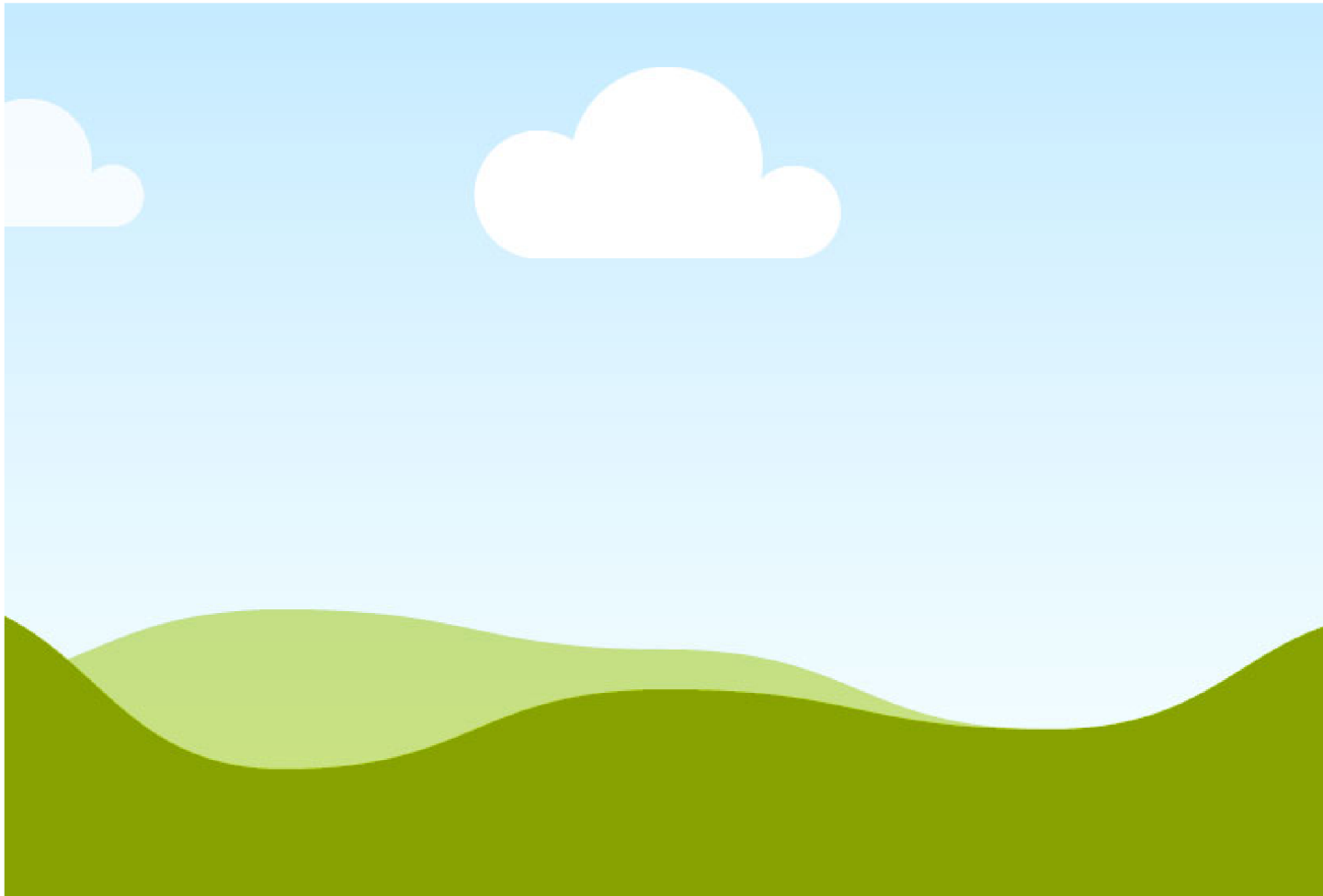




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BARS WITH CONTINUOUSLY VARYING CROSS SECTIONS





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