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ASSIGNMENT I

1.) The power P dissipated in a resistor is given as eqn (i)

$$P = \frac{\mathcal{E}^2}{R}$$

If $\mathcal{E} = 200$ volts and $R = 8$ ohms, find the change in P resulting from a drop of 5 volts in $\mathcal{E}$ and an increase of 0.2 ohm in R.

2.) The deflection y at the centre of a circular plate suspended at the edge and uniformly

$$y = \frac{K w d^4}{t^3}$$

where;

w = total load.

d = diameter of plate.

t = thickness

K = constant.

Calculate the approximate percentage change in y if w is increased by 3 percent, d is increased by 2½ percent and t is increased by 4 percent.

SOLUTION)

1.) $P = \frac{\mathcal{E}^2}{R} = \mathcal{E}^2 R^{-1}$

$$\delta P = \frac{\partial P}{\partial \mathcal{E}} \cdot \delta \mathcal{E} + \frac{\partial P}{\partial R} \cdot \delta R$$

$$\frac{\partial P}{\partial \mathcal{E}} = 2\mathcal{E}R^{-1} = \frac{2\mathcal{E}}{R} = \frac{2(200)}{8} = 50$$

$$\partial P/\partial R = -\mathcal{E}^2 R^{-2} = -\mathcal{E}^2/R^2 = -(200)^2/8^2 = -625.$$

$$\delta P = \partial P/\partial \mathcal{E} \cdot \delta \mathcal{E} + \partial P/\partial R \cdot \delta R$$

$$\delta P = 50(-5) + (-625)(0.2)$$

$$\delta P = -250 * -125.$$

$$\delta P = -375 W.$$

2) $$y = \frac{K w d^4}{t^3} = K w d^4 t^{-3}.$$

$$\delta y = \partial y/\partial w \cdot \delta w + \partial y/\partial d \cdot \delta d + \partial y/\partial t \cdot \delta t.$$

$$\partial y/\partial w = K d^4 t^{-3} = K d^4/t^3.$$

$$\partial y/\partial d = 4 K w d^3 t^{-3} = 4 K w d^3/t^3.$$

$$\partial y/\partial t = -3 K w d^4 t^{-4} = -3 K w d^4/t^4.$$

$$\delta w = 3/100 \text{ of } w = 3w/100$$

$$\delta d = 2.5/100 \text{ of } d = 2.5d/100.$$

$$\delta t = 4/100 \text{ of } t = 4t/100.$$

$$\delta y = \partial y/\partial w \cdot \delta w + \partial y/\partial d \cdot \delta d + \partial y/\partial t \cdot \delta t$$

$$\delta y = \frac{K d^4}{t^3}\left(\frac{3w}{100}\right) + \frac{4 K w d^3}{t^3}\left(\frac{2.5d}{100}\right) + \left(\frac{-3 K w d^4}{t^4}\right)\left(\frac{4t}{100}\right)$$

$$\delta y = \frac{K w d^4}{t^3}\left(\frac{3}{100}\right) + \frac{K w d^4}{t^3}\left(\frac{10}{100}\right) * - \frac{K w d^4}{t^3}\left(\frac{12}{100}\right)$$

$$\delta y = \frac{Kwd^4}{t^3}\left(\frac{3}{100} + \frac{10}{100} - \frac{12}{100}\right)$$

$$\delta y = \frac{Kwd^4}{t^3}\left(\frac{1}{100}\right)$$

Recall that;

$$\frac{Kwd^4}{t^3} = y$$

$$\delta y = y\left(\frac{1}{100}\right) = 1 \text{ percent of } y.$$