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### Assignment III

1) The power  $P$  dissipated in a resistor is given as in equation

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

If  $E = 200$  volts and  $R = 80$  ohms. Find the change in  $P$  arising from a drop of 5 volts in  $E$  and an increase of 0.2 ohms in  $R$ .

Soln

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

$$P = E^2 R^{-1}$$

$$\frac{\partial P}{\partial R} = \frac{-E^2}{R^2}$$

$$\frac{\partial P}{\partial E} = 2ER^{-1}$$

$$\delta P$$

$$= \frac{\partial P}{\partial E} \delta E$$

$$R = 80, E = 200, \delta R = 0.2, \delta E = -5$$

$$\delta P = \frac{2(200)(-5)}{80} - \frac{(200)^2(0.2)}{80^2}$$

$$= -25 - 125 = -150$$

Power dissipated by 375 volts

2) The deflection  $y$  at the centre of a circular plate suspended at the edges and uniformly ~~traced~~ loaded is given

in Equation 2

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

where  $w =$  total load,  $d =$  diameter of plate,  $t =$  thickness and  $k$  is a constant.

Calculate the approximate percentage change in  $y$  if  $w$  increases by 2 percent,  $d$  is increased by 2 1/2 percent and  $t$  is increased by 4 percent

soln

$$\delta y = K \left[ \frac{\partial y}{\partial w} \delta w + \frac{\partial y}{\partial d} \delta d + \frac{\partial y}{\partial t} \delta t \right]$$

$$\frac{\partial y}{\partial w} = \frac{\partial}{\partial w} \left( \frac{3w}{t^3} + \frac{10wd^3}{t^3} - \frac{12w^2d^4}{t^3} \right) = \frac{3}{t^3} - \frac{24wd^4}{t^3}, \quad \frac{\partial y}{\partial d} = \frac{30w^2d^2}{t^3}$$

$$\delta w = \frac{2}{100}, \quad \delta d = \frac{2.5}{100}, \quad \delta t = \frac{4}{100}$$

$$\delta y = \left[ \frac{Kd^4}{t^3} \left[ \frac{3w}{100} \right] + \frac{10Kwd^3}{t^3} \left[ \frac{2.5d}{100} \right] - \frac{24K^2wd^4}{t^3} \left[ \frac{4w}{100} \right] \right]$$

$$\delta y = \frac{3Kwd^4}{100t^3} + \frac{10Kwd^4}{200t^3} - \frac{12K^2wd^4}{100t^3}$$

$$\delta y = \frac{1}{100} \left[ \frac{3Kwd^4}{t^3} + \frac{10Kwd^4}{t^3} - \frac{12K^2wd^4}{t^3} \right]$$

$$\delta y = \frac{1}{100} [3y + 10y - 12y]$$

$$\delta y = \frac{1}{100} [y]$$

$$\delta y = \frac{1}{100} y$$

$y$  increase by 1/100 percent