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Elect/Elect Engr.
Engineering Maths I
[illegible] 281
Assignment III

1 The power P dissipated in a resistor is given as in Equation (1)

$$P = E^2/R$$

If E = 200volts & R = 3 ohms, find the voltage in P resulting from a drop of 5volts in E & an increase of 0.2 ohm in R

Soln

$P = \frac{E^2}{R}$ ie $P = f[E^2, R]$

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

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

$\frac{\partial P}{\partial E} = \frac{2 \times 200}{8} = 50$ & $\frac{\partial P}{\partial R} = -625$

$\delta E = -5$, $\delta R = +0.2$

$\delta P = [50 \times -5] - [625 \times 0.2]$

$= -250 - 125$

$\delta P = -375$

Therefore P decreases by 375 Watts.

2 The deflection at the centre of a circular plate suspended at the edge & was forcab loaded given in Equation [2].

$$y = \frac{k w d^4}{t^2}$$

where w = total load t = thickness
d = diameter of plate k is a constant
Calculate the approximate % change in y of w is increased by 3%, d is increased by 2½% percent & t is increased by 4%

Soln

$$\delta y = \frac{\partial y}{\partial k} \delta k + \frac{\partial y}{\partial d} \delta d + \frac{\partial y}{\partial t} \delta t$$

But $y = \frac{k w d^4}{t^3}$ where k is constant

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

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

$$\frac{\partial y}{\partial t} = \frac{-3 k k d^4}{t^4}$$

$$\delta k = \frac{3}{100} \text{ of } k, \quad \delta d = \frac{5}{200} \text{ of } d, \quad \delta t = \frac{4}{100} \text{ of } t$$

$$\delta y = \frac{k d^4}{t^3}\left[\frac{3k}{100}\right] + \frac{4 k k d^3}{t^3}\left[\frac{5d}{200}\right] + \left[\frac{-3 k k d^4}{t^4}\right]\left[\frac{4t}{100}\right]$$

$$= \frac{3k(k d^4}{100 t^3} + \frac{20 k k d^4}{200 t^3} - \frac{3 \cdot 4 k k d^4}{100 t^3}$$

$$= \frac{k k d^4}{t^3}\left[\frac{3}{100} + \frac{20}{200} - \frac{12}{400}\right]$$

$$= \frac{\text{[illegible]}}{t^3} \left[\frac{\text{[illegible]}}{200} \right]$$

$$= J \left[\frac{1}{100} \right]$$

$$\therefore J = J \left[\frac{1}{100} \right]$$