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ENGINEERING MATHS ASSIGNMENT III
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Assignment III

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

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

If $E = 200$ volts and $R = 8\,\Omega$, find the charge in P resulting from a drop of 5 volts in E and an increase of $0.2\,\Omega$ in R.

Solution

Given: $E = 200_V$, $R = 8\,\Omega$, $\delta E = -5_V$, $\delta R = 0.2\,\Omega$, $\delta P = ?$

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

$$P = E^2 R^{-1}, \quad \frac{\delta P}{\delta E} = 2ER^{-1}, \quad \frac{\delta P}{\delta R} = -E^2 R^{-2}$$

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

$$\therefore \delta P = \frac{2E}{R}\cdot\delta E + \frac{(-)E^2}{R^2}\cdot\delta R = \delta P = E/R\left[-10 - E/R\,1/5\right] = \frac{200}{8}\left[-10 \cdot \frac{200}{8} \times 1/5\right]$$

$$\therefore \delta P = 25\,[-10-5] = 25 \times -15 = -375\,W$$

2) The deflection y at the centre of a circular plate suspended at the edge and uniformly loaded is given in Equation(i)

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

where; w = total load, d = diameter of plate, t = thickness and k is a constant. Cal the approximate percentage change if w is increased by 3 percent, d is increased by 2½ percent & t is increased by 4%.

Solution

Given:- $\delta w = 3\%$, $\delta d = 2\frac{1}{2}$, $\delta t = 4\%$

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

$$\delta y = \delta y/\delta w \cdot \delta w + \delta y/\delta d \cdot \delta d + \frac{\delta y}{\delta t}\delta t$$

Where K is Constant

$$\delta y/\delta w = \frac{kd^4}{t^3}, \quad \frac{\delta y}{\delta d} = \frac{4kwd^3}{t^3}, \quad \frac{\delta y}{\delta t} = \frac{-3kwd^4}{t^4}$$

$$\delta w = \frac{3w}{100}, \quad \delta d = \frac{2.5d}{100}, \quad \delta t = \frac{4t}{100t}$$

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

$$\delta y = \frac{kwd^4}{t^3}\left[\frac{3}{100} + \frac{20}{200} - \frac{12}{100}\right]$$

$$\delta y = \frac{kwd^4}{t^3}\left[\frac{13-12}{100}\right] = y\left[\frac{1}{100}\right] = 1\%$$