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ENG 281 16/ENG06/1063

MATHEMATICS ASSIGNMENT

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Assignment Questions

1) 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 ohms, find the change in P resulting from a drop of 5 volts 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 loaded is given in Equation (2),

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

where w = total load, d = diameter of plate, t = thickness and K is a constant.
Calculate the approximate percentage change in y if w is increased by 3 per cent, d is increased by $2\frac{1}{2}$ per cent and t is increased by 4 per cent, ~~d~~ ~~increased~~ by.

soln

1) $\delta V =$ ~~$\delta P = \delta P$~~

~~P.T.O~~

Soln

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

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

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

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

$\delta E = -5$ Volts

$\delta R = 0.2$ ohm

$E = 200$ volt ; $R = 8$ ohms

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

$$\frac{\partial P}{\partial R} = -(200)^2(8^2)^{-1} = -625$$

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

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

$$\delta P = -375 \text{ V}^2/\text{ohms} \text{ or } -375 \text{ watts}$$

$$\delta P = -375 \text{ watts}$$

$\therefore$ P decreases by 375 Watts from a drop of 5 volts in E and an increase of 0.2 ohms in R.

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

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

$$\frac{\partial y}{\partial w} = kd^4t^{-3}$$

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

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

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

$$\delta d = \frac{2.5}{100} \text{ of } d = \frac{2.5d}{100}$$

$$\delta t = \frac{4}{100} \text{ of } t = \frac{4t}{100}$$

$$\delta y = kd^4t^{-3} \times \frac{3w}{100} + 4kwd^3t^{-5} \times \frac{2.5d}{100}$$

$$* \quad -3kwd^4t^{-4} \times \frac{4t}{100}$$

~~$\delta y = kd^4t$~~

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

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

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

Recall $y = kwd^4t^{-3}$

$$\delta y = y\left(\frac{1}{100}\right)$$

$\delta y = \pm 1\%$ of y

∴ There is an approximate percentage increase of 1% i.e 1 percent of y increase.