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COURSE CODE: ENG 281

DEPARTMENT: MECHANICAL ENGR.

ASSIGNMENT III

1) The Power P ~~desc~~ dissipated in a resistor in 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 dop of 5 Volts in E and an increase of 0.2 ohm in R

Soln

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

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

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

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

$R = 8,\ E = 200,\ \delta r = 0.2\ \ \delta e = -5$

$\delta P = \frac{2(200)(-5)}{8} - \frac{(200)^2(0.2)}{8^2}$

$= -250 - 125 = -375$ W

Power dissipated by 376 Watts

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 percent, d is increased by 2½ per cent and t is increased by 4 percent.

Soln

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

$$\frac{\partial y}{\partial W} = \frac{d}{t^3}, \quad \frac{\partial y}{\partial d} = \frac{4Wd^3}{t^3}, \quad \frac{\partial y}{\partial t} = \frac{-3Wd^4}{t^4}$$

$$\delta W = {}^{3W}/_{100}, \quad \delta d = {}^{5d}/_{200} \quad \delta t = {}^{4t}/_{100}.$$

$$\delta y = \left[\frac{Kd^4}{t^3}\left[\frac{3W}{100}\right] + \frac{K4Wd^3}{t^3}\left[\frac{5d}{2W}\right] - \frac{K^3Wd^4}{t^4}\left[\frac{4t}{100}\right]\right]$$

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

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

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

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

$$\delta y = 1/100\ y$$

y increases by 1/100 Percent.