ENG 281

Assignment 3 (1mk)

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

$$P = E^2/R$$

If E = 200volts and R = 8ohms, find the change in P resulting from a drop of 6 volts in E and an increase of 0·2ohm 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).

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

where w = total load, d = diameter of plate, t = thickness and k is a constant. Calc. the approximate percentage change in y if w is increased by 3 per cent, d is increased by 2½ per cent and t is increased by 4 per cent.

Soln:

$$P = \frac{E^2}{R} \quad \text{i.e.} \quad P = f(E^2, R)$$

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

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

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

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

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

$$= -250 - 125$$

$$\delta P = -375$$

Therefore, P decreases by 375 Watts

2) $\delta y = \frac{\partial y}{\partial W} \cdot \delta W + \frac{\partial y}{\partial d} \cdot \delta d + \frac{\partial y}{\partial t} \cdot \delta t$

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

$\frac{dy}{\partial W} = \frac{kd^4}{t^3}$

$\frac{dy}{\partial d} = \frac{4kWd^3}{t^3}$

$dy/dt = \frac{-3kWd^4}{t^4}$

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

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

$= \frac{3Wkd^4}{100t^3} + \frac{20kWd^4}{200t^3} - \frac{3 \cdot 4kWd^4}{100t^3}$

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

$= \frac{kWd^4}{t^3}\left[\frac{6 + 20 - 24}{200}\right]$

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

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

Therefore, y increases by 1 per cent.