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COURSE ENG 281
DEPT ELECTRICAL / ELECTRONICS ENGINEERING
MATRIC NO 16/ENG04/001

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

$$P = E^2/R \quad \cdots (1)$$

If E = 200 volts and R = 8Ω, find the change in P resulting from a drop of 5 volts in E and an increase of 0.2 ohms in R

Solution

$$P = E^2/R \quad \cdots (1)$$

$$\delta P = \frac{\delta P}{\delta E} \cdot \delta E + \frac{\delta P}{\delta R} \cdot \delta R \quad \cdots (2)$$

$$\frac{\partial P}{\delta E} = \frac{2E}{R} \quad \cdots (3)$$

$$\delta E = \frac{2E}{R} \quad \cdots (4)$$

$\delta E = -5$ volts $= {}^{-5}/_{200} \times 100\% = -2.5\%$ of $E = \frac{-2.5}{100} E$ (4)

$$\delta P/\delta R = -E^2/R^2 \quad \cdots (5)$$

$\delta R = 0.2\Omega = {}^{0.2}/_{8} \times 100\% = 2.5\%$ of $R = \frac{2.5}{100} R$ (6)

Substituting equation (3), 4, 5 and 6 into Eqn (2)

Equation (2)

$$\delta P = \frac{2E}{R}\left(\frac{-2.5E}{100}\right) + \left(\frac{-E^2}{R^2}\right)\left(+2.5R/100\right)$$

$$\delta P = E^2/R\left(\frac{-2.5 \times 2}{100} - 2.5/100\right)$$

$$\delta P = E^2/R\left(\frac{-5 - 2.5}{100}\right) = E^2/R\left(-7.5/100\right)$$

But $P = E^2/R$

$$\therefore \delta P = -\frac{7.5}{100} P$$

$E = 200$ V
$R = 8\Omega$

∴ The actual change in P with respect to 5 volts drops