KING FAHD UNIVERSITY OF PETROLEUM & MINERALS

ELECTRICAL ENGINEERING DEPARTMENT

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EE-360

Quiz 1 ser#: I.D.: Name:

A balanced three phase, 866-V, 60-Hz, Y-connected source feeds a balanced Δ-connected load via a 100-km long three wire transmission line. The impedance of each wire of the transmission line is $1 + j\,2\ \Omega$. The per phase impedance of the load is $177 - j\,246\ \Omega$. Determine the line and phase currents of the source and the load, the power absorbed by the load, and the power dissipated by transmission line.

Solution:

$$Z_Y = \frac{Z_\Delta}{3} = 59 - j82\ \Omega$$

$$V_{ph} = \frac{866}{\sqrt{3}} = 500\angle 0$$

$$Z_{tot} = 1 + j2 + 59 - j82 = 60 - j80 = 100\angle -53.13^\circ\ \Omega$$

$$I = \frac{500}{60 - j80} = 5\angle 53.13^\circ\ A$$

$$I_{ph\ source} = I_L = 5\angle 53.13^\circ$$

$$I_{ph\ load} = \frac{I_L}{\sqrt{3}\angle -30} = \frac{5}{\sqrt{3}}\angle 83.13^\circ = 2.887\angle 83.13^\circ$$

$$V_{L_{load}} = V_{ph_{load}} = I_{ph} * (177 - j246)$$

$$= 874.93\angle 28.87^\circ$$

$$P_{load} = 3\, I_{ph}^2 R_{ph} = 3 * (2.887)^2 * 177 = 4425.75\ W$$

$$P_{line} = 3 * I_L^2 R_{Line} = 3(5)^2 * 1 = 75\ W$$