

Name _____

SN _____

EE 221 – Circuits II**Exam #1**

September 22, 2017

11:00-11:50 PM

100 points

Turn off and store out of sight your mobile telephone and all other electronic devices, other than your calculator. A calculator is the only electronic device you may operate during this exam. Write your name and student number where indicated above. This exam is to be an individual effort and is closed book, closed notes, and no formula sheets. Using pre-programmed equations (symbolic or otherwise) on your calculator is prohibited. Show all of your work on the supplied sheets of paper. **Do not write on the back of any sheet of paper.**

Prob. #1	Prob. #2	Prob. #3	Prob. #4	TOTAL
25	25	25	25	100 pts.

-
- $P_{\max} = \frac{|\mathbf{V}_{\text{Th}}|^2}{8R_{\text{Th}}}, \quad \frac{\partial P}{\partial X_L} = 0 \Rightarrow X_L = -X_{\text{Th}}, \quad \frac{\partial P}{\partial R_L} = 0 \Rightarrow R_L = \sqrt{R_{\text{Th}}^2 + (X_{\text{Th}} + X_L)^2}$
 - $X_{\text{rms}} = \sqrt{\frac{1}{T} \int_{t_0}^{t_0+T} x^2(t) dt}$
 - $\mathbf{S} = \frac{1}{2} \mathbf{V} \mathbf{I}^* = P + jQ$
 - $\text{pf} = \cos(\theta_v - \theta_i)$
 - $C = \frac{Q_C}{\omega V_{\text{rms}}^2} = \frac{P(\tan \theta_1 - \tan \theta_2)}{\omega V_{\text{rms}}^2}$
 - $\mathbf{Z}_Y = \frac{\mathbf{Z}_\Delta}{3}$
 - $\mathbf{S} = 3\mathbf{S}_p = 3\mathbf{V}_p \mathbf{I}_p^* = \sqrt{3} V_L I_L \angle \theta$

Connection	Phase voltages/currents	Line voltages/currents
Y-Y	$\mathbf{V}_{an} = V_p \angle 0^\circ$ $\mathbf{V}_{bn} = V_p \angle -120^\circ$ $\mathbf{V}_{cn} = V_p \angle +120^\circ$ <p>Same as line currents</p>	$\mathbf{V}_{ab} = \sqrt{3} V_p \angle 30^\circ$ $\mathbf{V}_{bc} = \mathbf{V}_{ab} \angle -120^\circ$ $\mathbf{V}_{ca} = \mathbf{V}_{ab} \angle +120^\circ$ $\mathbf{I}_a = \mathbf{V}_{an} / \mathbf{Z}_Y$ $\mathbf{I}_b = \mathbf{I}_a \angle -120^\circ$ $\mathbf{I}_c = \mathbf{I}_a \angle +120^\circ$
Y- Δ	$\mathbf{V}_{an} = V_p \angle 0^\circ$ $\mathbf{V}_{bn} = V_p \angle -120^\circ$ $\mathbf{V}_{cn} = V_p \angle +120^\circ$ $\mathbf{I}_{AB} = \mathbf{V}_{AB} / \mathbf{Z}_\Delta$ $\mathbf{I}_{BC} = \mathbf{V}_{BC} / \mathbf{Z}_\Delta$ $\mathbf{I}_{CA} = \mathbf{V}_{CA} / \mathbf{Z}_\Delta$	$\mathbf{V}_{ab} = \mathbf{V}_{AB} = \sqrt{3} V_p \angle 30^\circ$ $\mathbf{V}_{bc} = \mathbf{V}_{BC} = \mathbf{V}_{ab} \angle -120^\circ$ $\mathbf{V}_{ca} = \mathbf{V}_{CA} = \mathbf{V}_{ab} \angle +120^\circ$ $\mathbf{I}_a = \mathbf{I}_{AB} \sqrt{3} \angle -30^\circ$ $\mathbf{I}_b = \mathbf{I}_a \angle -120^\circ$ $\mathbf{I}_c = \mathbf{I}_a \angle +120^\circ$
Δ - Δ	$\mathbf{V}_{ab} = V_p \angle 0^\circ$ $\mathbf{V}_{bc} = V_p \angle -120^\circ$ $\mathbf{V}_{ca} = V_p \angle +120^\circ$ $\mathbf{I}_{AB} = \mathbf{V}_{ab} / \mathbf{Z}_\Delta$ $\mathbf{I}_{BC} = \mathbf{V}_{bc} / \mathbf{Z}_\Delta$ $\mathbf{I}_{CA} = \mathbf{V}_{ca} / \mathbf{Z}_\Delta$	<p>Same as phase voltages</p> $\mathbf{I}_a = \mathbf{I}_{AB} \sqrt{3} \angle -30^\circ$ $\mathbf{I}_b = \mathbf{I}_a \angle -120^\circ$ $\mathbf{I}_c = \mathbf{I}_a \angle +120^\circ$
Δ -Y	$\mathbf{V}_{ab} = V_p \angle 0^\circ$ $\mathbf{V}_{bc} = V_p \angle -120^\circ$ $\mathbf{V}_{ca} = V_p \angle +120^\circ$ <p>Same as line currents</p>	<p>Same as phase voltages</p> $\mathbf{I}_a = \frac{V_p \angle -30^\circ}{\sqrt{3} \mathbf{Z}_Y}$ $\mathbf{I}_b = \mathbf{I}_a \angle -120^\circ$ $\mathbf{I}_c = \mathbf{I}_a \angle +120^\circ$

¹Positive or *abc* sequence is assumed.