

EE1101: Circuits and Network Analysis**Assignment - 04****Handed out: 30 - Aug - 2024****Due : 09 - Sep - 2024 (before 5 PM)****Instructions :**

1. Please upload your assignment solutions to the course page on the Canvas platform. Only solutions submitted through this page will be reviewed. For specific guidelines, refer to the instructions provided on the course page.
2. It is suggested that you attempt all the problems. However, it is sufficient to submit solutions for problems that total 10 points.
3. Submissions received after the deadline will attract negative marking. Ensure that your submissions are named in the following format: RollNo-Assignment-04.pdf.

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1. (10 points) Consider a two terminal element between nodes a and b . Let $v_a(t) = V_a \cos(\omega t + \theta_a)$ and $v_b(t) = V_b \cos(\omega t + \theta_b)$ be the instantaneous voltage at the terminals a and b respectively. Let the current from a to b be represented as $i(t) = I \cos(\omega t + \phi_i)$. Compute
 - (a) (5 points) The active and reactive power flow between nodes a and b (from a to b).
 - (b) (3 points) The active and reactive power flow between nodes b and a (from b to a).
 - (c) (2 points) Derive the condition (in terms of θ_a , θ_b and ϕ_i , assuming V_a , V_b and I to be fixed) under which the active power flow between a to b is positive.
 2. (3 points) Given the phasor representations of two signals, $v_a(t)$ and $v_b(t)$, with a frequency of 50 Hz, where $\mathbf{V}_a = 10\angle\frac{\pi}{4}$ and $\mathbf{V}_b = 2\angle\frac{-\pi}{4}$, calculate the time difference between the positive peaks of these two signals.
 3. (3 points) The phasor representation of a signal with a given time reference is $10\angle\frac{\pi}{6}$. Find the phasor representation of the signal when the time reference is shifted 3.33 ms to the right. Assume the frequency of the signal to be 50 Hz.
 4. (3 points) The phasor representation of a signal with a given time reference is $10\angle\frac{\pi}{6}$. How should the time reference be shifted such the phasor representation of the same signal is $10\angle 0$. Assume the frequency of the signal to be 50 Hz.
 5. (6 points) Consider two signals $v_a(t) = V_a \cos(\omega t + \theta_a)$ and $v_b(t) = V_b \cos(\omega t + \theta_b)$. Define $v_c(t) = V_c \cos(\omega t + \theta_c) = v_a(t) + v_b(t)$.
 - (a) (3 points) Derive expressions for V_c and θ_c in terms of V_a , V_b , θ_a , and θ_b .
 - (b) (3 points) Can the expressions for V_c and θ_c be derived using phasors? If so, derive these expressions using phasor notation.