Module 57022

PROBLEM SHEET 5

Phasors

1. Two sinusoidal EMFs of peak values 50 V and 20V respectively but differing in phase by 30^o are induced in series in the same circuit. Draw the phasor diagram and find the peak and r.m.s values of the resultant EMF.
2. Three EMFs $e_A = 50\sin\omega t$, $e_B = 80\sin(\omega t - \pi/6)$ and $e_C = 60\cos\omega t$ are induced in three coils connected in series. Determine a) the maximum value of the resultant EMF, b) its phase relative to the first EMF by means of plotting the phasor diagram to scale.
3. Four EMFs, $e_1 = 25\sin\omega t$, $e_2 = 30\sin(\omega t + \pi/6)$, $e_3 = 30\cos\omega t$ and $e_4 = 20\sin(\omega t - \pi/4)$ are connected in series, so that the sum of the four EMFs is obtained. Find (graphically or otherwise) a) the amplitude of the total voltage; b) its phase difference with respect to e_1; c) its phase difference with respect to e_3.
4. A coil of inductance 0.1 H and negligible resistance is connected in series with a 25 Ω resistor. The circuit is connected to a voltage source 230 V, 50 Hz. Draw to scale the phasor diagram and determine: a) the current in the circuit; b) the potential difference across the coil; c) the potential difference across the resistor; d) the phase angle in the circuit.
5. A 15 Ω resistor is connected in series with a coil of inductance 0.08 H and negligible resistance. The circuit is connected to a 240 V, 50 Hz supply. Draw to scale the phasor diagram and determine: a) the reactance of the coil; b) the impedance of the circuit; c) the current in the circuit; d) the phase difference for the current with respect to the supply voltage.
6. A 90 Ω resistor is connected in series with a 22 μF capacitor. The circuit is connected to a 240V, 50 Hz supply. Draw to scale the phasor diagram and determine: a) the reactance of the capacitor; b) the impedance of the circuit; c) the current in the circuit; d) the phase difference for the current with respect to the supply voltage.
7. A circuit having a resistance of 12 Ω, an inductance of 0.15 H and a capacitance of 100 μF in series, is connected across a 100 V, 50 Hz supply. Draw to scale the phasor diagram and determine: a) the impedance; b) the current; c) the voltages across the resistor, the capacitor and the coil; d) the phase difference between the current and the supply voltage.
8. **ASSIGNMENT.** A metal-filament lamp is rated at 120 V, 600 W. It is to be connected in series with a capacitor to a power supply 240 V, 60 Hz. Determine: a) the capacitance required; b) the phase difference between the current and the supply voltage. Draw the phasor diagram.
9. **ASSIGNMENT.** When a direct current of 2 A is passed through a coil, the potential difference across the coil is 20 V. When an alternating current of 2 A at frequency 40 Hz is passed through a coil, the potential difference across the coil is 140 V. Find the current in the coil if it is connected to a 230 V, 50 Hz supply.
10. The currents in three circuits connected in parallel to a voltage source are : a) 4 A in phase with the applied voltage; b) 6 A lagging the applied voltage by 30^o; c) 2 A leading the applied voltage by 45^o. Plot the phasor diagram for these currents. Determine (graphically or otherwise) the total current taken from the source and its phase angle with respect to the supply voltage.