



PES
UNIVERSITY

ELEMENTS OF ELECTRICAL ENGINEERING

Course Code : UE25EE141A/B

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ELEMENTS OF ELECTRICAL ENGINEERING (UE25EE141A/B)



Numerical Examples

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Question:

Write an equation to represent the following sine waves of 50Hz frequency.

- i) A sinusoidal current with RMS value 10A & starting at 5ms
- ii) A sinusoidal current with peak value 20A & starting at -2.5ms

Also, comment on the phase relation between them.

Solution:

$$\omega = 2\pi f = 100\pi \text{ rad/s}$$

$$\text{Case (i)} : \text{Angle} = \omega * t = (100\pi * 0.005) = \frac{\pi}{2} \text{ rad}$$

$$i_1(t) = 10\sqrt{2}\sin(100\pi t - \frac{\pi}{2}) \text{ A}$$

$$\text{Case (ii)} : \text{Angle} = \omega * t = (100\pi * 0.0025) = \frac{\pi}{4} \text{ rad}$$

$$i_2(t) = 20\sin(100\pi t + \frac{\pi}{4}) \text{ A}$$

Question:

There are 3 conducting wires connected to form a junction. The currents flowing into the junction in two wires are $i_1 = 10\sin 314t$ A and $i_2 = 15\cos(314t - 45^\circ)$ A. What is the current leaving the junction in the third wire? What is its value at $t=0$?

Solution: 1) Using Time-Domain Method

By KCL at the junction, $i_3(t) = i_1(t) + i_2(t)$

$$i_3(t) = 10\sin(314t) + 15\cos(314t - 45^\circ)$$

$$i_3(t) = 10\sin(314t) + 15 * (\cos 314t * \cos 45^\circ + \sin 314t * \sin 45^\circ)$$

$$i_3(t) = 20.61\sin(314t) + 10.61\cos(314t)$$

$$i_3(t) = 23.18 * \left(\frac{20.61}{23.18} \sin(314t) + \frac{10.61}{23.18} \cos(314t) \right)$$

$$i_3(t) = 23.18 * (\cos(27.24^\circ) * \sin(314t) + \sin(27.24^\circ) * \cos(314t))$$

$$i_3(t) = 23.18 * \sin(314t + 27.24^\circ) \text{ A}$$

Its value at $t = 0$ is $i_3(0) = 23.18\sin(27.24^\circ) = 10.61\text{A}$

Numerical Example

Solution: 2) Using Phasor Domain Method

By KCL at the junction, $i_3(t) = i_1(t) + i_2(t)$

In Phasor form, $\bar{I}_3 = \bar{I}_1 + \bar{I}_2$

$$i_1(t) = 10\sin(314t) \Rightarrow \bar{I}_1 = \frac{10}{\sqrt{2}} \angle 0^\circ A$$

$$i_2(t) = 15\cos(314t - 45^\circ) = 15\sin(314t + 45^\circ) \Rightarrow \bar{I}_2 = \frac{15}{\sqrt{2}} \angle 45^\circ A$$

$$\bar{I}_3 = \frac{10}{\sqrt{2}} \angle 0^\circ + \frac{15}{\sqrt{2}} \angle 45^\circ = 16.39 \angle 27.24^\circ A$$

$$i_3(t) = 23.18 \sin(314t + 27.24^\circ) A$$

Its value at $t = 0$ is $i_3(0) = 23.18 \sin(27.24^\circ) = 10.61 A$

Text Book:

1. "Basic Electrical Engineering" S.K Bhattacharya, 1st Edition Pearson India Education Services Pvt. Ltd., 2017
2. "Basic Electrical Engineering", D. C. Kulshreshta, 2nd Edition, McGraw-Hill. 2019
3. "Special Electrical Machines" E G Janardanan, PHI Learning Pvt. Ltd., 2014

Reference Books:

1. "Engineering Circuit Analysis" William Hayt, Jack Kemmerly, Jamie Phillips and Steven Durbin, 10th Edition McGraw Hill, 2023
2. "Electrical and Electronic Technology" E. Hughes (Revised by J. Hiley, K. Brown & I.M Smith), 12th Edition, Pearson Education, 2016.



THANK YOU

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