

Steady State AC Analysis

Tutorial sheet No.1

1) (i) $T = \frac{1}{f} = \frac{1}{0.2} = 5 \text{ s}$

(ii) $T = \frac{1}{12 \times 10^3} = 83.3 \mu\text{s}$

(iii) $T = \frac{1}{4.2 \times 10^6} = 238.09 \text{ ns}$

2) 12 cycles $\rightarrow 46 \text{ ms}$
1 " $\rightarrow \frac{46}{12} \text{ ms}$
 $= 3.83 \text{ ms}$

$$T = 3.83 \text{ ms}$$

$$f = \frac{1}{T} = \frac{1}{3.83 \times 10^{-3}} = 0.2608 \text{ Hz}$$

3) $T = 12 \times 10^{-12} \text{ s}$

$$f = \frac{1}{T} = \frac{1}{12 \times 10^{-12}} = 0.0833 \times 10^{+6} = 83.3 \text{ Hz}$$

4) $180^\circ = \pi \text{ rad}$
 $1^\circ = \frac{\pi}{180} \text{ rad}$

(a) $49^\circ = 49 \times \frac{\pi}{180} = 0.855 \text{ rad}$

(b) $-130^\circ = -130 \times \frac{\pi}{180} = -2.27 \text{ rad}$

(c) $435^\circ = 435 \times \frac{\pi}{180} = 7.59 \text{ rad}$

5) $\pi \text{ rad} = 180^\circ$
 $1 \text{ rad} = \frac{180^\circ}{\pi}$

$$(5) (a) \frac{\pi}{18} \times \frac{180}{\pi} = 10^\circ$$

$$(b) -0.562 \times \frac{180}{\pi} = -32.2^\circ$$

$$(6) (a) \omega = 9\pi \text{ rad/s}$$

$$2\pi f = 9\pi$$

$$f = \frac{9\pi}{2\pi} = 4.5 \text{ Hz}$$

$$T = \frac{1}{f} = 0.222 \text{ s}$$

$$(b) \omega = 0.042 \text{ rad/s}$$

$$2\pi f = 0.042$$

$$f = \frac{0.042}{2\pi} = 6.68 \text{ mHz}$$

$$T = \frac{1}{f} = 150 \text{ s}$$

$$(7) (a) 42.1 \sin(377t + 30^\circ)$$

General equation

$$i = I_m \sin(\omega t + \theta)$$

Compare

$$\omega = 377, \quad \theta = 30^\circ$$

$$2\pi f = 377$$

$$f = \frac{377}{2\pi} = 60 \text{ Hz}$$

$$\text{Amplitude} = 42.1$$

$$(b) -6.39 \cos(10^5 t - 20) = \cancel{6.39 \sin} \sin$$

$$= 6.39 \cos(10^5 t - 20 + \pi) = 6.39 \sin(10^5 t - 20 + \pi + \frac{\pi}{2})$$

$$= 6.39 \sin(10^5 t - 20 + \frac{3\pi}{2}) = 6.39 \sin(10^5 t + 250^\circ)$$

$$\omega = 10^5$$

$$2\pi f = 10^5$$

$$f = \frac{10^5}{2\pi} = 15.9 \text{ KHz}$$

$$\text{Amplitude} = 6.39$$

⑧ ① $v = 200 \sin(3393t + \pi/7)$

Put $t = 1.1 \times 10^{-3} \text{ s}$

$$v = 200 \sin(3393 \times 1.1 \times 10^{-3} + \frac{\pi}{7})$$

$$= -172.4 \text{ V}$$

Ans \uparrow rad \uparrow rad

⑥ $i^0 = 67 \cos(3016t - 42^\circ)$

$$= 67 \cos(3016 \times 1.1 \times 10^{-3} - 42^\circ) \text{ degree}$$

\uparrow rad

$$= 67 \cos(3016 \times 1.1 \times 10^{-3} \times \frac{180}{\pi} - 42)$$

\uparrow

$$= -56.9 \text{ mA}$$

Ans

Conversion
from rad to
degree