

# Alternating Current and Voltage

$$\begin{aligned} 1(a) \quad V_{\text{PEAK}} &= \sqrt{2} V_{\text{RMS}} \\ &= \sqrt{2} \times 16 \\ &= \underline{\underline{22.6V}} \end{aligned}$$

$$\begin{aligned} (b) \quad V_{\text{PEAK}} &= \sqrt{2} V_{\text{RMS}} \\ &= \sqrt{2} \times 28 \\ &= \underline{\underline{39.6V}} \end{aligned}$$

$$\begin{aligned} (c) \quad V_{\text{PEAK}} &= \sqrt{2} V_{\text{RMS}} \\ &= \sqrt{2} \times 50 \\ &= \underline{\underline{70.7V}} \end{aligned}$$

$$\begin{aligned} (d) \quad V_{\text{PEAK}} &= \sqrt{2} V_{\text{RMS}} \\ &= \sqrt{2} \times 1000 \\ &= \underline{\underline{1.4 \times 10^3 V}} \end{aligned}$$

$$\begin{aligned} (e) \quad V_{\text{PEAK}} &= \sqrt{2} V_{\text{RMS}} \\ &= \sqrt{2} \times 0.01 \\ &= \underline{\underline{0.014V}} \end{aligned}$$

$$\begin{aligned} 2(a) \quad I_{\text{PEAK}} &= \sqrt{2} I_{\text{RMS}} \\ &= \sqrt{2} \times 5 \\ &= \underline{\underline{7.1A}} \end{aligned}$$

$$\begin{aligned} (b) \quad I_{\text{PEAK}} &= \sqrt{2} I_{\text{RMS}} \\ &= \sqrt{2} \times 12 \\ &= 17A \end{aligned}$$

$$\begin{aligned} (c) \quad I_{\text{PEAK}} &= \sqrt{2} I_{\text{RMS}} \\ &= \sqrt{2} \times 6.3 \\ &= \underline{\underline{8.9A}} \end{aligned}$$

$$\begin{aligned} (d) \quad I_{\text{PEAK}} &= \sqrt{2} I_{\text{RMS}} \\ &= \sqrt{2} \times 150 \\ &= \underline{\underline{212.1A}} \end{aligned}$$

$$\begin{aligned} (e) \quad I_{\text{PEAK}} &= \sqrt{2} I_{\text{RMS}} \\ &= \sqrt{2} \times 7.5 \times 10^{-5} \\ &= \underline{\underline{1.1 \times 10^{-4} A}} \end{aligned}$$

$$\begin{aligned} 3(a) \quad V_{\text{RMS}} &= \frac{V_{\text{PEAK}}}{\sqrt{2}} \\ &= \frac{40}{\sqrt{2}} \\ &= \underline{\underline{28.3V}} \end{aligned}$$

$$\begin{aligned} (b) \quad V_{\text{RMS}} &= \frac{V_{\text{PEAK}}}{\sqrt{2}} \\ &= \frac{71}{\sqrt{2}} \\ &= \underline{\underline{50.2V}} \end{aligned}$$

$$\begin{aligned} (c) \quad V_{\text{RMS}} &= \frac{V_{\text{PEAK}}}{\sqrt{2}} \\ &= \frac{0.5}{\sqrt{2}} \\ &= \underline{\underline{0.35V}} \end{aligned}$$

$$4(a) \cdot I_{\text{RMS}} = \frac{I_{\text{PEAK}}}{\sqrt{2}}$$

$$= \frac{13}{\sqrt{2}}$$

$$= \underline{\underline{9.2 \text{ A}}}$$

$$(b) I_{\text{RMS}} = \frac{I_{\text{PEAK}}}{\sqrt{2}}$$

$$= \frac{0.075}{\sqrt{2}}$$

$$= \underline{\underline{0.053 \text{ A}}}$$

$$(c) I_{\text{RMS}} = \frac{I_{\text{PEAK}}}{\sqrt{2}}$$

$$= \frac{250 \times 10^{-6}}{\sqrt{2}}$$

$$= \underline{\underline{1.8 \times 10^{-4} \text{ A}}}$$

$$5(a) \quad V_{\text{PEAK}} = \sqrt{2} V_{\text{RMS}} \\ = \sqrt{2} \times 400000 \\ = \underline{\underline{5.66 \times 10^5 \text{ V}}}$$

$$(b) \quad V_{\text{PEAK}} = \sqrt{2} V_{\text{RMS}} \\ = \sqrt{2} \times 133000 \\ = \underline{\underline{1.88 \times 10^5 \text{ V}}}$$

$$6. \quad V_{\text{PEAK}} = \sqrt{2} V_{\text{RMS}} \\ = \sqrt{2} \times 12 \\ = 17 \text{ V}$$

$$V_{\text{PEAK TO PEAK}} = 2 \times 17 \\ = \underline{\underline{34 \text{ V}}}$$

$$7(a) \quad V_{\text{PEAK}} = \text{no. of divisions} \times \text{volts/division} \\ = 2 \times 10 \\ = \underline{\underline{20 \text{ V}}}$$

$$(b) \quad V_{\text{RMS}} = \frac{V_{\text{PEAK}}}{\sqrt{2}} \\ = \underline{\underline{14.1 \text{ V}}}$$

$$8(a) \quad P = \frac{V^2}{R}$$

$$= \frac{(230)^2}{960}$$

$$= \underline{\underline{55.1W}}$$

$$(b) \quad V_{PEAK} = \sqrt{2} V_{RMS}$$

$$= \sqrt{2} \times 230$$

$$= 325.3V$$

$$P = \frac{V_{PEAK}^2}{R}$$

$$= \frac{(325.3)^2}{960}$$

$$= \underline{\underline{110.2W}}$$

9(a) 50 cycles per second

$$(b) \quad \frac{1}{50} s = 0.02s$$

$$(c) \quad V_{PEAK} = \sqrt{2} V_{RMS} = \sqrt{2} \times 230 = 325V$$

$$(d) \quad I_{RMS} = \frac{V_{RMS}}{R} = \frac{230}{57.5} = 4A$$

$$(e) \quad I_{PEAK} = \sqrt{2} I_{RMS} = \sqrt{2} \times 4 = 5.64A$$

$$10(a) i \quad \text{period} = \text{time base setting} \times \text{wavelength}$$

$$= 5ms/cm \times 4cm$$

$$= \underline{\underline{20ms}}$$

$$ii \quad f = \frac{1}{T}$$

$$= \frac{1}{0.02}$$

$$= \underline{\underline{50Hz}}$$

$$\begin{aligned}
 10(a) \text{ iii } \quad V_{\text{PEAK}} &= \text{Amplitude} \times \text{Volts/cm} \\
 &= 3 \times 2 \\
 &= \underline{\underline{6V}}
 \end{aligned}$$

$$\begin{aligned}
 \text{iv } \quad V_{\text{RMS}} &= \frac{V_{\text{PEAK}}}{\sqrt{2}} \\
 &= \frac{6}{\sqrt{2}} \\
 &= \underline{\underline{4.2V}}
 \end{aligned}$$

$$\begin{aligned}
 10(b) \text{ i } \quad T &= t_{\text{bs}} \times \lambda \\
 &= 50 \mu\text{s/cm} \times 5 \text{cm} \\
 &= \underline{\underline{250 \mu\text{s}}}
 \end{aligned}$$

$$\begin{aligned}
 \text{ii } \quad f &= \frac{1}{T} \\
 &= \frac{1}{250 \times 10^{-6}} \\
 &= \underline{\underline{4000 \text{ Hz}}}
 \end{aligned}$$

$$\begin{aligned}
 \text{iii } \quad V_{\text{PEAK}} &= A \times \text{V/cm} \\
 &= 2 \times 200 \\
 &= \underline{\underline{0.4V}}
 \end{aligned}$$

$$\begin{aligned}
 \text{iv } \quad V_{\text{RMS}} &= \frac{V_{\text{PEAK}}}{\sqrt{2}} \\
 &= \underline{\underline{0.28V}}
 \end{aligned}$$

$$\begin{aligned}
 10(i). \quad T &= t_{bs} \times \lambda \\
 &= 20 \text{ms/cm} \times 2 \\
 &= \underline{\underline{40 \text{ms}}}
 \end{aligned}$$

$$\begin{aligned}
 \text{ii} \quad f &= \frac{1}{T} \\
 &= \frac{1}{0.04} \\
 &= \underline{\underline{25 \text{Hz}}}
 \end{aligned}$$

$$\begin{aligned}
 \text{iii} \quad V_{\text{PEAK}} &= A \times V/\text{cm} \\
 &= 2.4 \times 50 \text{mV} \\
 &= \underline{\underline{0.12 \text{V}}}
 \end{aligned}$$

$$\begin{aligned}
 \text{iv} \quad V_{\text{RMS}} &= \frac{V_{\text{PEAK}}}{\sqrt{2}} \\
 &= \frac{0.12}{\sqrt{2}} \\
 &= \underline{\underline{0.085 \text{V}}}
 \end{aligned}$$

10(4) i

$$\begin{aligned} T &= t_{bs} \times \lambda \\ &= 2 \text{ ps/cm} \times 10 \text{ cm} \\ &= \underline{20 \text{ ps}} \end{aligned}$$

ii

$$\begin{aligned} f &= \frac{1}{T} \\ &= \frac{1}{20 \times 10^{-12}} \\ &= \underline{50 \text{ 000 Hz}} \end{aligned}$$

iii

$$\begin{aligned} V_{\text{PEAK}} &= A \times \text{V/cm} \\ &= 1.4 \times 200 \text{ mV} \\ &= \underline{280 \text{ mV}} \end{aligned}$$

iv

$$\begin{aligned} V_{\text{rms}} &= \frac{V_{\text{PEAK}}}{\sqrt{2}} \\ &= \frac{0.28}{\sqrt{2}} \\ &= \underline{0.2 \text{ V}} \end{aligned}$$

$$\begin{aligned} 11. \quad T &= \frac{1}{f} \\ &= \frac{1}{50} \\ &= 0.02 \text{ s} \end{aligned}$$

$$\lambda = 2 \text{ div}$$

$$t.b.s. = \frac{T}{\lambda} = \frac{0.02}{2} = 0.01 \text{ s/div}$$

$$\underline{\underline{t.b.s. = 10 \text{ ms/div.}}}$$

$$12. \quad A = 4 \text{ div.} \quad \text{Voltage setting} = 5 \text{ V/div.}$$

$$V_{\text{PEAK}} = 4 \times 5 = \underline{\underline{20 \text{ V}}}$$

$$\lambda = 4 \text{ div.} \quad t.b.s. = 1 \text{ ms/div.}$$

$$T = \lambda \times t.b.s. = 4 \times 1 = 4 \text{ ms}$$

$$\begin{aligned} f &= \frac{1}{T} \\ &= \frac{1}{0.004} \\ &= 250 \text{ Hz} \end{aligned}$$