ANSWERS

1.1 (*b*)	1.2 (*b*)	1.3 (*c*)	1.4 (*d*)	1.5 (*d*)	1.6 (*d*)	1.7 (*c*)	1.8 (*a*)	1.9 (*a*)	1.10 (*a*)
1.11 (*b*)	1.12 (*b*)	1.13 (*a*)	1.14 (*d*)	1.15 (*c*)	1.16 (*d*)	1.17 (*b*)	1.18 (*b*)	1.19 (*b*)	1.20 (*c*)
1.21(*c*)	1.22 (*c*)	1.23 (*a*)	1.24 (*c*)	1.25 (*d*)	1.26 (*a*)	1.27 (*c*)	1.28 (*d*)	1.29 (*c*)	1.30 (*a*)
1.31 (*a*)	1.32 (*a*)	1.33 (*c*)	1.34 (*a*)	1.35 (*d*)	1.36 (*b*)	1.37 (*c*)	1.38 (*b*)	1.39 (*d*)	1.40 (*b*)
1.41 (*b*)	1.42 (*a*)	1.43 (*b*)	1.44 (*c*)	1.45(*b*)	1.46 (*)	1.47 (*c*)	1.48 (*b*)		

EXPLANATIONS

EE.1.

1.1. $C(t) = -te^{-t} + 2e^{-t}$, $(t \geq 0)$

$$C(s) = -\frac{1}{(s+1)^2} + \frac{2}{s+1^2} = \frac{2s+1}{(s+1)^2}$$

$$C(s) = \frac{G(s)}{1+G(s)},$$

$$G(s) = \frac{C(s)}{1-C(s)} = \frac{\frac{2s+1}{(s+1)^2}}{1-\frac{2s+1}{(s+1)^2}} = \frac{2s+1}{s^2}$$

1.2. $\frac{C(s)}{R(s)} = \frac{G(s)}{1+G(s)},$

$$\frac{G(s)}{1-G(s)} = \frac{\frac{1}{s(s+1)}}{1+\frac{1}{s(s+1)}} = \frac{1}{s^2+s+1}$$

$$\omega_n = 1, \qquad \omega_n = \frac{1}{2}, \qquad \zeta = \frac{1}{2}$$

$$M_p = e^{-\xi\sqrt{1-\zeta^2}} = e^{(-\pi/2)/\sqrt{1-(1/4)}}$$

$$= e^{-\pi/\sqrt{3}} = 0.163$$

1.4. $\frac{C(s)}{R(s)} = \frac{1}{1+s}, \qquad \frac{C(j\omega)}{R(j\omega)} = \frac{1}{1+j\omega}$

From $r(t)\sin t$, $\omega = 1$, $\left|\frac{C(j\omega)}{R(j\omega)}\right| = \frac{1}{\sqrt{1+1}} = \frac{1}{\sqrt{2}}$

$$\angle\frac{C(j\omega)}{R(j\omega)} = -\tan^{-1}1 = -\frac{\pi}{4}$$

$\therefore$ SS value of $c(t) = \frac{1}{\sqrt{2}}\sin\left(t-\frac{\pi}{4}\right)$

1.5. The Periodic time = 4 ms = 4×10^{-3} sec.

$\therefore$ Fundamental frequency

$$= \frac{10^3}{4} = 250 \text{ Hz}$$

$\therefore$ Frequency of the 5th harmonic

$= 250 \times 5 = 1250$ Hz

1.6. As the element absorbs power, let it be R_x.

$$i = 1 = \frac{6}{R_x+1}$$

$$R_x = 5\,\Omega$$

$$P = \left(\frac{6}{6}\right)^2 2 \times 5 = 5 \text{ W}.$$

For 5 A, $P = 52 \times 5 = 125$ W

For $3+\sqrt{14}$, $P = 227$ W

For $3-\sqrt{14}$, $P = 2.75$ W.

Hence none of the above is correct

1.7. $P = \frac{1}{2}(1-\cos 2\omega t) = 100$ Hz

1.8. Voltage across the capacitor at any time t

$$v_c = V(1-e^{-t/RC})$$
$$= 1 - e^{-t/RC}$$

since $V = 1$ volt

$$\therefore \quad \frac{dv_c}{dt} = \frac{1}{RC}e^{-t/RC}.$$

At $t = 0^+$, $\frac{dv_c}{dt} = \frac{1}{RC}$

1.9. $R = \frac{8}{4 \times 10^{-3}} = 2000\,\Omega.$

Time constant $= \frac{L}{R} = \frac{6 \times 10^{-3}}{2 \times 10^3} = 3\,\mu$ sec.