1 For the circuit shown in Fig. (2) Answer the following questions:

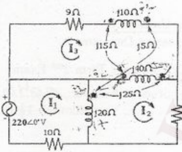


Fig. (2)

1. The 1^{st} mesh equation:
   a) $j20(I_2 - I_1) - j25(I_2 - I_3) - j5I_3 + 10I_1 = 220\angle 0^0$
   b) $j20(I_1 - I_2) - j25(I_2 + I_3) - j5I_3 + 10I_1 = 220\angle 0^0$
   c) $(10 + j20)I_1 + j45I_2 + j20I_3 = 220\angle 0^0$
   d) $(10 + j20)I_1 - j45I_2 + j20I_3 = 220\angle 0^0$

2. The 2^{nd} mesh equation:
   a) $30I_2 + j20(I_1 - I_2) + j25(I_2 - I_3) + j5I_3 + j40(I_2 - I_3) - j25(I_1 - I_2) + j15I_3 = 0$
   b) $30I_2 + j20(I_2 - I_1) + j25(I_2 - I_3) + j5I_3 + j40(I_2 - I_3) - j25(I_1 - I_2) + j15I_3 = 0$
   c) $j45I_1 - (30 + j110)I_2 - j45I_3 = 0$
   d) $j45I_1 + (30 + j110)I_2 - j45I_3 = 0$

3. Assume that the currents $I_1 = 16.4447\angle - 5.1^0 A$, $I_2 = 4.1813\angle 1.6807^0 A$ and $I_3 = 6.4526\angle - 165.42 A$, the voltage across $|V_{j40\Omega}|$ is:
   a) 4825 V b) 248.5 V c) 2486 V d) 2856V

2 For the circuit shown in Fig.(3) all resistances and reactances are given in Ω. Answer the following questions:

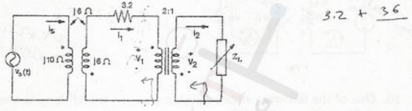


Fig.4

4. The load impedance Z_L is adjusted to absorb the average maximum power, so $\bar{Z}_L$ is equal to:
a) $1\angle-36.87^0\Omega$ b) $4\angle-36387^0\Omega$ c) $2\angle36.87^0\Omega$ d $0.8+j0.6\Omega$

5. The impedance looking by source terminals, when the load impedance Z_L is adjusted to absorb the average maximum power is:
a) $8.52\angle-60^0\Omega$ b) $7.82\angle60^0\Omega$ c) $5.82\angle-60.4^0\Omega$ d) $8.72\angle60^0\Omega$

3 For Fig.(4) $V_s = 102\angle-36.87^0)\text{V}_{rms}$.

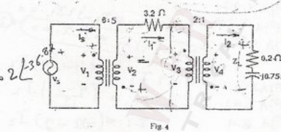


Fig.4

6. The current source I_1 is
a) 14.167A b) -17 $\angle36.87^0 A$ c) $-17\angle0^0 A$ d) $-14.67A$

7. The load current $|I_2|$ is
a) 34 A b) 13.33 A c) 17 A d) -3.4 A

8. The voltage $|V_3|$ is ≈
a) $122\angle-36.87^0$ V b) $-26\angle36.87^0$V c) $53\angle105^0$V d) no answer

9. The reactive power delivered by the source Q_s is ≈
a) 0 VAr b) 870 VAr c) -433.5 VAr d) -867 Var;

17. If the pole zeros plot of $Z_{in}(\sigma)$ is shown in Fig.5 , then transfer function of $Z_{in}(\sigma)$ is.

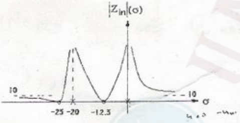
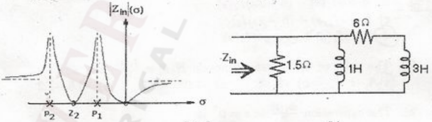


Fig. 5

a) $10\frac{\sigma^2+37.5\sigma+312.5}{\sigma^2+20\sigma}$ b) $100\frac{\sigma^2+37.5\sigma+312.5}{\sigma^2+20\sigma+200}$ c) $10\frac{\sigma^2-37.56+312.5\sigma}{\sigma^2+20\sigma+200}$
d) none of them

18. The poles and zeros configuration of $|Z_{in}(\sigma)|$ shown in Fig.6(a) represents the input impedance of the circuit shown in Fig. 6(b). The poles p_1, p_2 are:



(a) Fig. 6 (b)

a) 0, -2Np/s b) -1, -3Np/s c) -0.5, -1.5 Np/s d) 0.5, 1.5 N/s

$6+3s // s$

$\frac{6s+3s^2}{6+4s} // 1.5$

$9+4.5s^2$

$\frac{6s+3s^2+1.5}{(6+4s)/6}$

$6s+3$

$3s^2+6s+1.5=0$

$s^2+2s+0.5=$

19. The zeros of $|Z_{in}(j\omega)|$ shown in Fig.7 are:

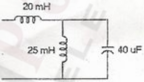


Fig. (7)

a) -750, 750 rad/s b) -500, 500 rad/s c) -1000, 1000 rad/s d) 1500, -1500 rd/s

20. The poles of $|Z_{in}(j\omega)|$ shown in Fig.7 are:
a) -750, 750 b) -1500, 0, 1500 rad/s c) -500, 500 rad/s d) 1000, -1000 rad/s

4 For the circuit shown in Fig.1, if the voltage source $v_s(t) = 24\cos 377t\ V$. Answer the following questions:

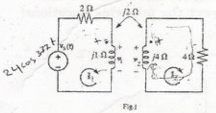


Fig.1

10. One of the following equations that describe the 1[st] loop is wrong, that is:
  a) $V_1 = jI1 - j2I_2$
  b) $24\angle 0^0 = (2 + j1)I_1 - j2I_2$
  c) $24\angle 0^0 = 2I_1 + V_1$
  d) $24\angle 0^0 = (2 + j1)I_1 + j2I_2$

11. One of the following equations that describe the 2[nd] loop is wrong, that is:
  a) $V_2 = -j4I_2 + 4I_2 - j2I_1$
  b) $0 = (-4 - j4)I_2 + j2I_1$
  c) $0 = 4I_2 - V_2$
  d) $V_2 = j2(I_1 - 2I_2)$

12. The current $i_1(t) =$
  a) $i_1(t) = 2.17sin(377t - 21.2^0)A$
  b) $i_1(t) = 4.91cos(377t + 22.5^0)A$
  c) $i_1(t) = 9.41cos(377t) - 11.31^0)A$
  d) $i_1(t) = 6.47cos(377t + 51.2^0)A$

13. The current $i_2(t)=$
  a) $i_2(t) = 3.33cos(377t + 33.69^0)A$
  b) $i_2(t) = 2.19cos(377t - 30.13^0)A$
  c) $i_2(t) = 9.13cos(377t - 13.69^0)A$
  d) $i_2(t) = 1.31cos(377t + 63.19^0)A$

14. The current $i_1(t = 5ms) =$
  a) 1.2A b) 2.1A c) -1.1A d) -2.2A

15. The current $i_2(t = 5ms) =$
  a) -3.2A b) -2.61A c) 3.2A d) 32A

16. The energy stored in the perfectly coupled circuit at $w(t = 5ms)$ is:
  a) 100 mj b) 10 mj c) 22.5 mj d) -10 mj

For the circuit shown in Fig. 8., the forced source is $V_s(t) = 10e^{-2t}$V and $i_1(0) = i_2(0) = 10$A. Answer the following questions:

$A + B = 10$ — ①

$10e^{-2t}$

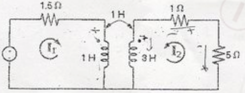


Fig. (8)

$-V_s + 1.5I_1 + sI_1 + 3sI_2 = 0$

$V_s = 1.5$

$V_s = (1.5 + s)I_1 + 3sI_2$

21. The 1^{st} mesh equation in s-domain may be expressed as
    a) $V_s = (1.5 + s)I_1(s) - sI_2(s)$
    b) $V_s = (1.5 + s)I_1(s) + sI_2(s)$
    c) $V_s = (1.5 + s)I_1(s) + 3sI_2(s)$
    d none of them

22. The 2^{nd} mesh equation in s-domain may expressed as
    a) $0 = -sI_1(s) + (6 + 3s)I_2(s)$
    b) $0 = sI_1(s) - (6 + 3s)I_2(s)$
    c) $0 = sI_1(s) + (6 - 3s)I_2(s)$
    d) $0 = sI_1(s) + (6 + 3s)I_2(s)$

$3sI_2 + 5I_2 + I_2 + 3sI_2 + 6I_2 + sI_1 = 0$

$3sI_2 + 6I_2 + sI_1 = 0$

$(6 + 3s)I_2 + sI_1 = 0$

23. The poles of the transfer function $H(s) = \frac{I_2(s)}{V_s}$ are:
    a) 4, -1 b) -2, -5 c) -1.08, -4.17 d) -0.5, -1.2

24. The expression $\frac{di_2(t)}{dt}$ at $t = 0^+$ is:
    a) 22.5 b) 32 c) -12 d) $\frac{-33}{2}$

25. Assume that $i_2(t) = Ae^{-5t} + Be^{-6t} + 80e^{-2t}$ and $\frac{di_2(0)}{dt} = 32$, then constants A and B are:
    a) 0, 40 b) -228, 158 c) 96, -128 d) -158, 0

$i_2(0) = A + B + 80 = 10$

$\frac{di_2(0)}{dt} = -5Ae^{-5t} - 6(B)e^{-6t} - 2(80)e^{-2t} = 32$

$A + B = -70$ — ① 6

$-5A - 6B = 192$ — ②