Chapter 12 Answers to Assigned Homework

1. (a) $V_{cb} = 8.35$ V
   (b) $P_{be} = 0.65\ \mu$W

3. (a) $V_{cn} = 400\angle -87°$
   (b) $V_{an} - V_{bn} = 692.82\angle 3°$
   (c) $V_{ax} = 569.2\angle 72.28°$
   (d) $V_{bx} = 724.53\angle 135.71°$

7. (a) $I_{ab} = -9$ A , $I_{cd} = 8$ A , $I_{de} = 9$ A , $I_{fe} = -10$ A , $I_{be} = 1$ A
   (b) $R_{ab} = 13.89\Omega$

11. (a) $V_{an} = 110\angle 0°$ and $V_{bn} = 110\angle 180°$
    (b) $V_{ab} = 220\angle 0°$
    (c) $I_{aA} = 3.586\angle 17.76°$ Arms
    $P_{V_{an}} = 375.66$ W supplied
    $I_{Bb} = 2.237\angle 17.76°$
    $P_{V_{nb}} = 234.34$ W supplied
    (d) $R = 100$ and $C = 29.47\ \mu$F

13. (a) $PF = 0.981$.
    (b) $C = 30.607\mu$F

15. (a) Proof
    (b) Positive phase sequence

17. Phase Voltages: $V_{an} = 208\angle 0°$, $V_{bn} = 208\angle -120°$, $V_{cn} = 208\angle 120°$
    Line Voltages: $V_{ab} = 360.27\angle 30°$ $V_{bc} = 360.27\angle -90°$ $V_{ca} = 360.27\angle 150°$

    (a) $I_{aA} = 0.208\angle 0°$ $I_{bB} = 0.208\angle -120°$ $I_{cC} = 0.208\angle 120°$
    (b) $I_{aA} = 1.8752\angle -25.64°$ $I_{bB} = 1.8752\angle -145.64°$ $I_{cC} = 1.8752\angle 94.36°$
    (c) $I_{aA} = 1.8752\angle 25.64°$ $I_{bB} = 1.8752\angle -94.36°$ $I_{cC} = 1.8752\angle 145.64°$

20. The phase voltage magnitude is $100/\sqrt{3} = 57.735$ V.

    (a) $|I_{aA}| = 6.7924$ A $Z_p = 8.5\angle 31.8°\ \Omega$
    (b) $|I_{aA}| = 5.648$ A $Z_p = 10.22\angle -23.07°\ \Omega$

22. (a) The load power factor is 0.8944.
$|V_{an}| = 106.483$ V $\quad |V_{ab}| = 184.434$ V

27. (a) $I_{AB} = 1256.635\angle 89.96°$ A
(b) $I_{nA} = 2176.6\angle 59.96°$ A
(c) $V_{AB} = 400\angle 0°$.
(d) $PF = 0.0006981$
(e) $P = 1052.8$ W

28. $V_{an} = 400\angle 0°$ V, $V_{ab} = 692.82\angle 30°$ V, $Z_L = 217.04\angle 64.273°\ \Omega$
Y-Connection: $I_{na} = 1.843\angle -64.273°$, $PF = \cos(-64.273°) = 0.4341$
Δ-Connection:
$I_{AB} = 3.1921\angle -34.273°$ A
$V_{CA} = 692.82\angle 150°$ V
$I_{AC} = 3.1921\angle -94.273°$ A
$I_{na} = 5.5289\angle -64.273°$
$PF = 0.4341$

31. $R_w = 0.665\ \Omega$

35. $V_{an} = 138.564\angle 0°$ Vrms
Δ-connected load: $I_{AB} = 19.93\angle 25.24°$ mA $\quad I_{aA} = 34.52\angle -4.76°$ mA
Y-connected load: $I_{aA} = 23.76\angle -30.96°$ mA
Overall: $I_{aA} = 55.9\angle -15.63°$
Total power taken by the combined load: $P = 22.4$ W

36. (a) The wattmeter reads the power absorbed by the 10 ohm resistor (without reversing the leads). The wattmeter reading is $P = 1.539$ kW

(b) The wattmeter reads the power absorbed by all the passive elements (without reversing the leads). $P_{\text{total}} = 2.153$ kW

(c) The wattmeter reads the power absorbed by the parallel combination of the inductor and the 20 ohm resistor (without reversing the leads).
$P_{20} = 614$ W

39. Wattmeter A: $P_A = 849.6$ W
Wattmeter B: $P_B = 225.15$ W
Powers absorbed by the impedances:
Z_A: $P_{Z_A} = 500$ W $\quad Z_B$: $P_{Z_A} = 200$ W $\quad Z_C$: $P_{Z_C} = 375.45$ W