1. C ✓ Since to relates to coil, AC should be implement.

2. A ✗ $\frac{R \times \frac{1}{j\omega C}}{R + \frac{1}{j\omega C}} = \frac{\frac{R}{j\omega C}}{R + \frac{1}{j\omega C}} = \frac{R}{Rj\omega C + 1}$ $\omega = 2\pi f$. as $f \uparrow$ $\omega \uparrow$ $V_{out} \downarrow$.

Low pass falter ✓ R ↓ $V_i = V_o$

3. B. ✓

4. A ✓ $Z_{eq} = \frac{1}{j\omega C} + j\omega L + R_1$

$= \frac{1}{j\omega 2\times10^{-6}} + j\omega \times 20\times10^{-3} + 30$

$= 30 + \frac{1}{j2\times10^{-6}\omega} + j20\times10^{-3}\omega$

$V_{out} = \frac{30}{30 + \frac{1}{j2\times10^{-6}\omega} + j20\times10^{-3}\omega}$

$f_c = f_r = \frac{1}{2\pi\sqrt{LC}}$.

Resonance frequency $= \frac{1}{2\pi\sqrt{RC}}$

$= 800\ Hz$.

5. B ✓ $T \propto I_a^2$ servier motor.

6. B ✓ $V_e = k_e \cdot \omega$

$= 50\times10^{-3} \times 210 \times \frac{1200}{60}$

$= 6.28\ V$.

$I_a = \frac{V - V_e}{10}$

$= 0.57$.

$T_e = k_t (I_a)$

$= 0.02858$

$= 29\ mNm$.

7. A ✓ $T_e = 30\times10^{-3}(1.2)$ at $\omega = 0$.

$= 0.036$.

$R = \frac{12}{1.2} = 10\ \Omega$.

$V_e = V - I_a R$.

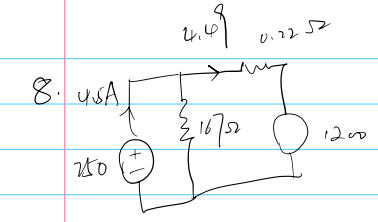
$k_e \omega = V - \frac{T_e}{k_t} R$.

$\omega = \frac{V}{k_e} - \frac{T_e}{k_t k_e} R$.

$= 333.3$

$= 3183\ RPM$.

8. 4.5A



$I_a = \frac{16.7}{16.7+0.22}(4.5)$

$= 4.49\,A$

$V_e = k_e \omega$

$250 - 4.49(0.22) = k_e\left(250 \times \frac{1200}{60}\right)$

$k_e = 1.981$

New $I_a = 56.9\,A$.

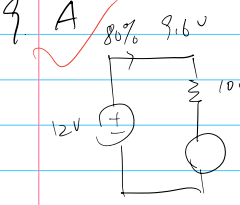
$V_e = 237.5$.

$\omega = \frac{V_e}{k_e}$

$= 119.87$

$= 1145$ RPM ✓

9. A



$k_e = 30 \times 10^{-3}$ → 2400.

$V_e = 30\times10^{-3} \times 250\frac{2000}{60} = 6.28\,V$

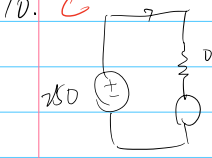
$V_{enew} = 7.50\,V$

$\omega = \frac{V_e}{k_e}$.

$\omega = \frac{V - I_a R}{k_e}$.

$V = 8.34$. $= 70\%$.

10. C



$T_e = 2\pi B l^2 \sin\theta$.

$T_{new} = 0.9\,T_e$ $T_e = k_t I_a$.

$0.9\,T_e = k_t\, 0.9\,I_a$.

$V_e = k_t \omega$.

$\omega = \frac{V_e}{k_t}$

$= \frac{250 - 45(0.2)}{3.055 \times 0.9}$

$= 833$ RPM.

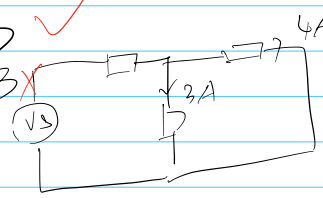
$k_e = \frac{V_e}{\omega}$

$= \frac{250 - 50(0.2)}{2\pi\frac{750}{60}}$

$= 3.055$.

11. D

12. B ✗



$I_1 = I_2 + I_3$ (in phase)

Not in term of magnitude only).

$\therefore I_1 \neq 3+4$.

13. $i_1 = 2\sin(100t - 45^\circ) = 2\cos(100t - 135^\circ)$ C

$i_2 = 0.5\cos(100t - 60^\circ)$

$i_3 = 1\cos(100t - 30^\circ)$

$= -0.298 - j2.34$

$= 2.37 \angle -97.24$

14. B $I_s = I_1 + I_2$ $V_s = 5\angle 0$.

$= 1\angle 45^\circ + 1\angle -45^\circ$

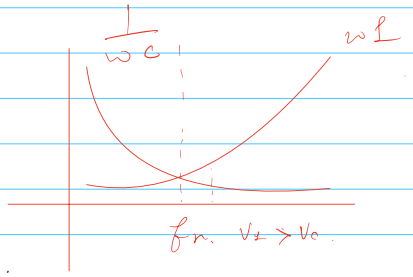
$= 1.414 + j(0)$

$= 1.414\angle 0$

$Z = \frac{V_s}{I_s}$

$= \frac{5\angle 0}{1.414\angle 0}$

$= 3.54$.



15. B $Z_c = \frac{1}{j\omega C}$ $Z_L = j\omega L$

$V_L > V_C$, i Lags. V_s Leading I_s.

16. B $Z_{eq} = \frac{(10 - j10)(10 + j10)}{20 + 0}$

$= 10$.

$V_2 = 5 \times \frac{10}{20}$

$= 2.5\,V. = 5/2\,V$

17. B $V_s - V_1 - V_2 = 0$

$10\angle 45^\circ - 5\angle 0 - V_2 = 0$.

$V_2 = 10\angle 45^\circ - 5\angle 0$

$= 2.071 + j7.071$

$= 7.37 \angle 73.68^\circ$

$V_2 + V_3 - V_4 = 0$.

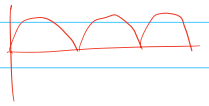
$7.37\angle 73.68^\circ + 5\angle 45^\circ = V_4$

$V_4 = 12 \angle 62.1$

$V_{o,max} = 230 \times \sqrt{2}$.

V_o peak to peak = highest to lowest

$V_{o,avg} = \frac{2 \cdot V_m}{\pi}$



(18) B ✓

19 C ✓ RC Low pass filter.

(20) B ~~$\Delta V = \frac{V}{2fRC}$~~

$= 2.4V$.

因為是DC. 純以沒有 ΔV_o.

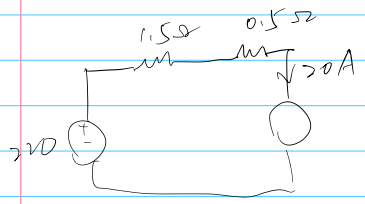
$V_e = k_e \omega = 480 - 0.5(2)$

$k_e \, 40\pi = 479$.

$k_e = 3.81$.

$k_t = k_t \cdot I_a$

$T_{dep} = T_{loss} = k_t \cdot I_a = 1.906 \, Nm$.



$V_e = 220 - 20(2)$

$= 180$.

$P_{dep} = 3600 \, W$

$P_{out} = 3450$

$\frac{3450}{220 \times 20} \times 100\% = 78.4\%$.