Subject : BEEE

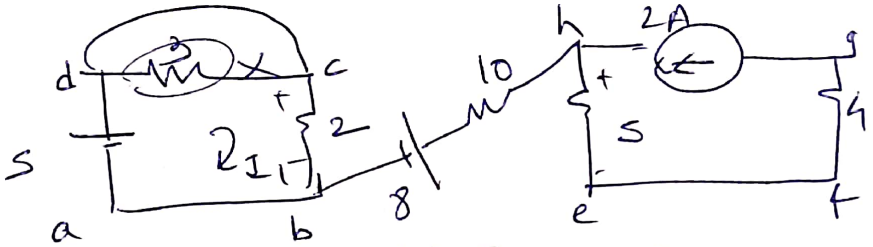
Subject code : FEC103

Solution key 3 - SH2025

Q.1 A) Compare ~~at~~ least 6 to 7 Points.
- 5M.

Q.1 B) Current through branch bh is zero as no close path.

3Ω resistor is short circuited. } 2M



$-2I_1 + 5 = 0$ $\quad I_2 = 2A$.

$I_1 = 2.5\,A$

$V_{ce} = 5 \times 2 - 8 + 2 \times 2.5$

$= 10 - 8 + 5$

$= \underline{\underline{7V}}$ } 3M.

Q.1 C) Working — 3M
with diagram
construction of single phase transformer
— 2M

Q.1 d) Construction — 2M
with diagram
Working Principle of BJT — 3M.

Q. 2 A) $\phi = 37^0$

$$Z_{coil} = \frac{V_{bail}}{I} = \frac{171}{3} = 57\Omega$$

$$Z = V/I = 240/3 = 80\Omega$$

2M

$$(pf)_{ckt} = \frac{R+r}{Z}$$

$$R+r = \cos 37 \times 80 = 63.89\Omega \quad — \quad 2M$$

$$Z = \sqrt{(R+r)^2 + X_L^2}$$

$$Z^2 = (R+r)^2 + X_L^2$$

$$\boxed{X_L = 48.15\Omega} \quad — \quad 2M$$

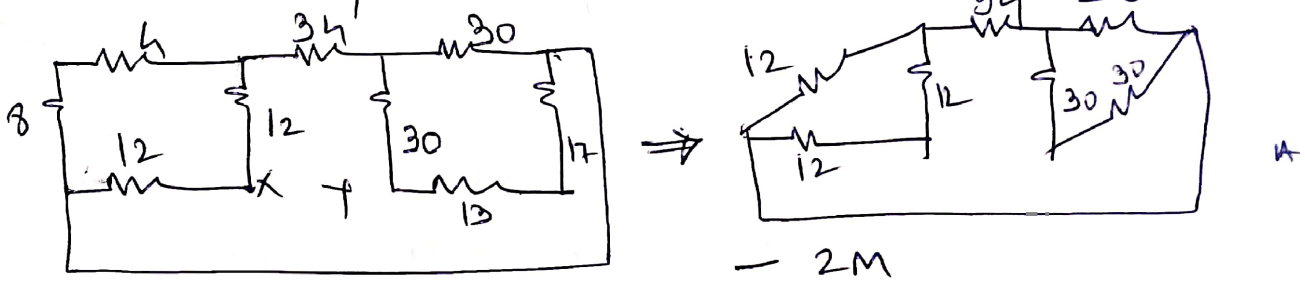
$$Z_{coil} = \sqrt{r^2 + X_L^2}$$

$$\boxed{r = 30.51\Omega} \quad — \quad 2M$$

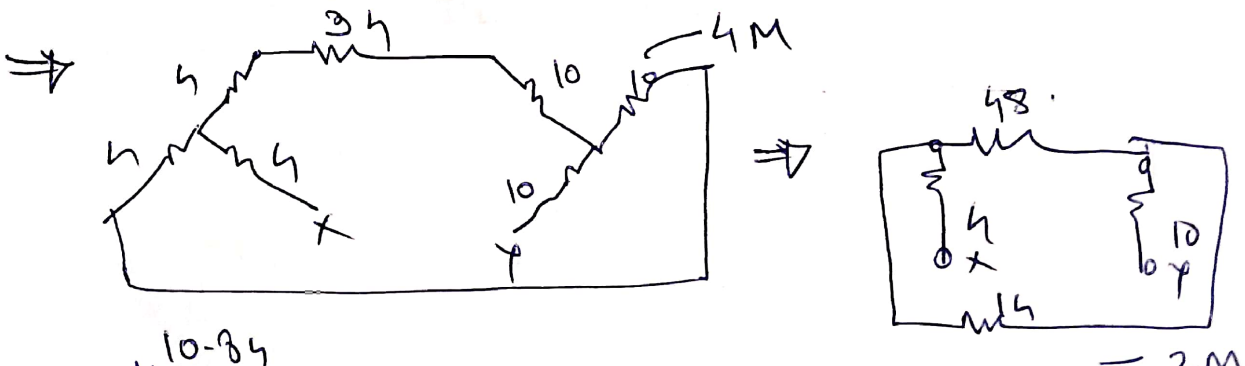
$$r + R = 63.89$$

$$\boxed{R = 33.38\Omega} \quad — \quad 2M.$$

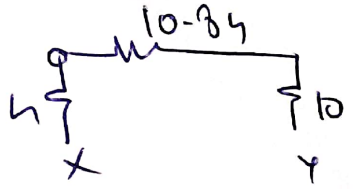
Q. 2 B) Find R_{xy}



— 2M



— 2M



$R_{xy} =$ 24.84Ω

— 2M

RMS Value derivation — 3M. Sk 3-(2)

Q. 2 c) $i = 14.14 \sin 377t$.

$I_m = 14.14\ A$ — 1M

i) $I_{rms} = I_m/\sqrt{2} = 9.99A$

$\omega = 2\pi f$

$377 = 2\pi f$

ii) $f = 60.03\ Hz$ — 1A

iii) $T = \frac{1}{f} = \frac{1}{60} = 0.0166$ sec.

$t = 3 \times 10^{-3}$

$i = 14.14 \sin 377 \times 3 \times 10^{-3}$

$= 14.14 \sin\left[377 \times 3 \times 10^{-3} \times \frac{180}{\pi}\right]^\circ$ 2M

$= 14.14 \sin 64.83$

$i = 12.86A$

iv)

$10 = I_m \sin 377t$

$10 = 14.14 \sin 377t$

$\sin 377t = 0.707$ — 3M.

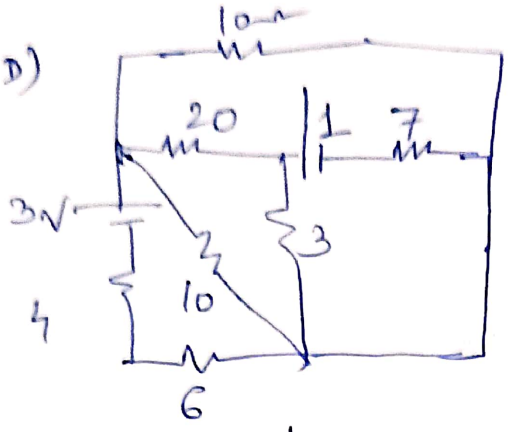
$\sin\left(377t \times \frac{180}{\pi}\right) = 0.707$

$377t \times \frac{180}{\pi} = \sin^{-1} 0.707 = 0.7852$

$t = \frac{2.4656}{377 \times 180} = 3.6 \times 10^{-5}$ sec.

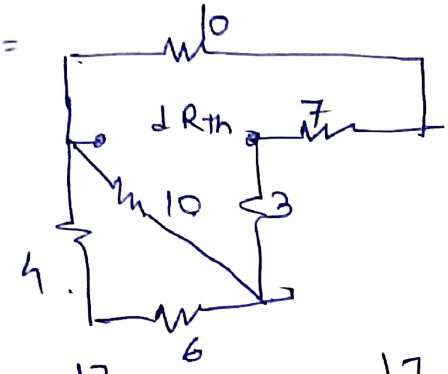
$t = 2.083\ ms$

(Q 2 D)

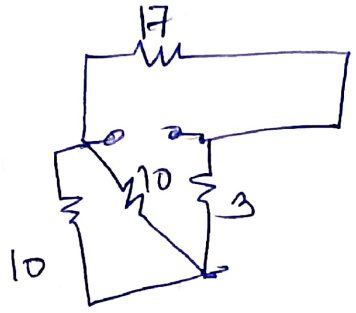


$I_{20\Omega}$

⇒ R_{Th} =

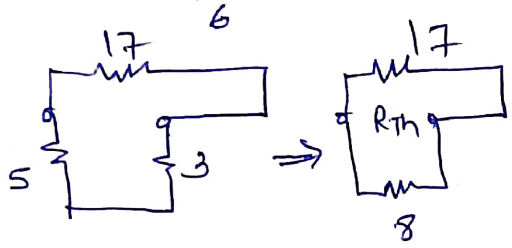


⇒



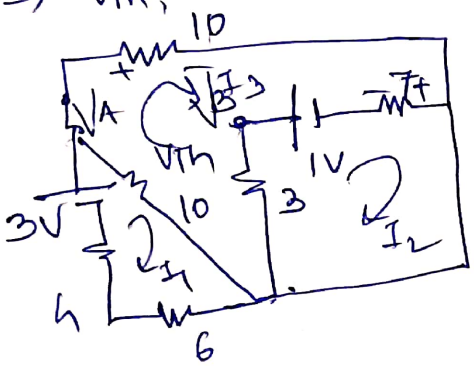
— 3M

⇒



$R_{Th} = 5.44\Omega$

⇒ V_{Th},



$-20I_1 + 10I_3 = -3$ — (1)

$0I_1 - 10I_2 + 10I_3 = 1$ — (2)

$10I_1 + 10I_2 - 30I_3 = -1$ — (3)

$I_1 = 0.2A$, $I_2 = 0$, $I_3 = 0.1$

$V_{Th} = -1 + 0 + 10I_3$

$= -1 + 10 \times 0.1$

— 4M

$V_{Th} = V_A - V_B = 0.7V$

$V_A\left(\frac{1}{10} + \frac{1}{10} + \frac{1}{10}\right) = \frac{3}{10}$

$V_A = 1V$

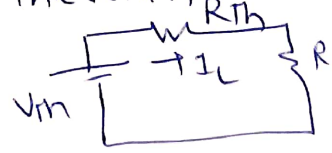
$V_B\left(\frac{1}{3} + \frac{1}{7}\right) = \frac{1}{7}$

$V_B = 0.1428$

0.476

$V_B = 0.3V$

Thevenin



— 3M

$I_L = V_{Th}/R_{Th} + R_L$

$= 0.0275A$

Q.2 E) $R = V_R / I = 125/5 = 25\ \Omega$

i) $Z_{coil} = \frac{200}{5} = 40\ \Omega$

$Z = V/I = 50\ \Omega$ — 1M

$Z_{coil} = \sqrt{r^2 + X_L^2}$

$40^2 = r^2 + X_L^2$ — (1)

$Z = \sqrt{(R+r)^2 + X_L^2}$

$50^2 = (R+r)^2 + X_L^2$ — (2)

— 2M

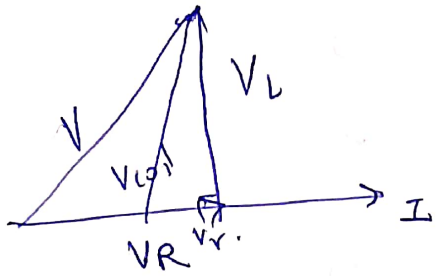
Solve eqn (1) & (2)

$r = 5.5\ \Omega$ — 2M

$X_L = 39.62\ \Omega$

ii) $P_{coil} = I^2 r = 5^2 \times 5.5 = 137.5\ W$ — 2M

$PF(coil) = r / Z_{coil} = 0.137$ lagging



— 3M

Q.3 A)

$I \times 15 = 30$ — 1M

$I = 2A$

$I_{5\Omega} = 7A$ — 1M

$-(7 \times 5) - IR + 140 - 30 = 0$ — 3M

$R = 17.5\ \Omega$

B) Derivation of emf equation — 5M.

C) Working — 5M with diagram

D) Working of 3ϕ Induction motor with diagram — 5M.