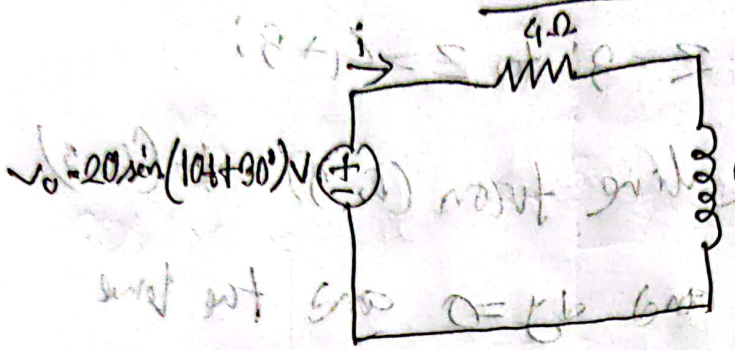
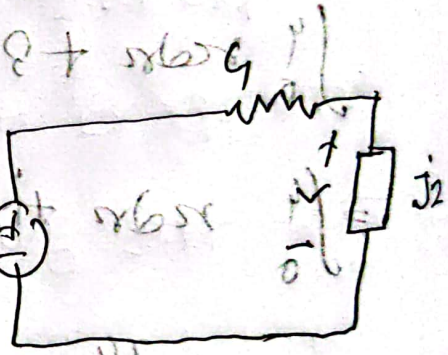
Omar Rafat Adnan
ID: 2020-2-60-037

Answer to the q NO: 01



$Z_L = j\omega L = j \times 10 \times 0.2$

Now using VDR,



$$V = \frac{j_2}{4+j_2} \times 20\angle 30° \qquad 20\angle 30°$$

$$= 8.95\angle 93.5°$$

$$i = \frac{20\angle 30°}{4+2j} = 4.48\angle 23.46$$

$$\therefore v(t) = 8.95 \sin(10t + 93.5°)$$

$$i(t) = 4.48 \sin(10t + 3.46°)$$

$$P_{Avg}(V_s) = \frac{1}{2} V_m I_m \sin(\theta_v - \theta_i)$$

$$= \frac{1}{2} \times 20 \times 4.48 \sin(30 - 3.46)$$

$$= 20.0176 \text{ W}$$

$$P_{Avg}(V) = \frac{1}{2} \times 8.95 \times 4.48 \sin(93.5° - 3.46°)$$

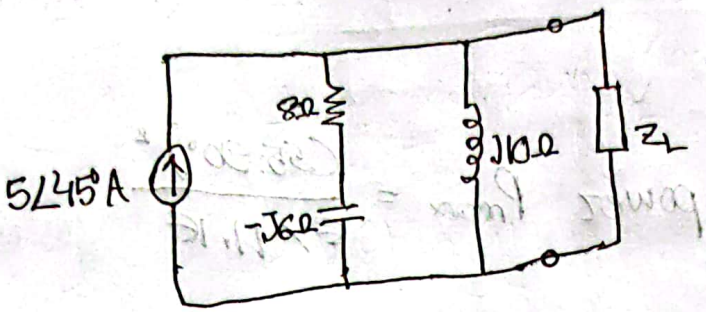
$$= 20.048 \text{ W}$$

$$P_{Avg}(\text{Resistor}) = \frac{1}{2} (I_m)^2 R$$

$$= \frac{1}{2} \times (4.48)^2 \times 4$$

$$= 40.1408 \text{ W} \quad (\text{Ans})$$

Answer to the question NO: 05



Here,

$Z_1 = (8 - j6)\Omega$ and $Z_2 = j10$

$\therefore Z_{th} = (8 - j6) \,||\, j10$

$= \frac{j10(8-j6)}{8-j6+j10} = \frac{100\angle 53.13}{8+j4}$

$= 11.18\angle 26.56°$

$= 10 + 5j$

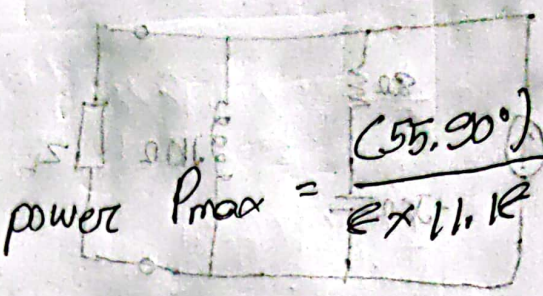
So, Here,

$Z_L = \text{conj}\{Z_{th}\}^* = 10 - 5j$

So, $V_{oc} = 5\angle 45° \times 11.18\Omega$

$= 55.90\angle 45°$

$\therefore V_{oc} = |V_{th}| = 55.90$



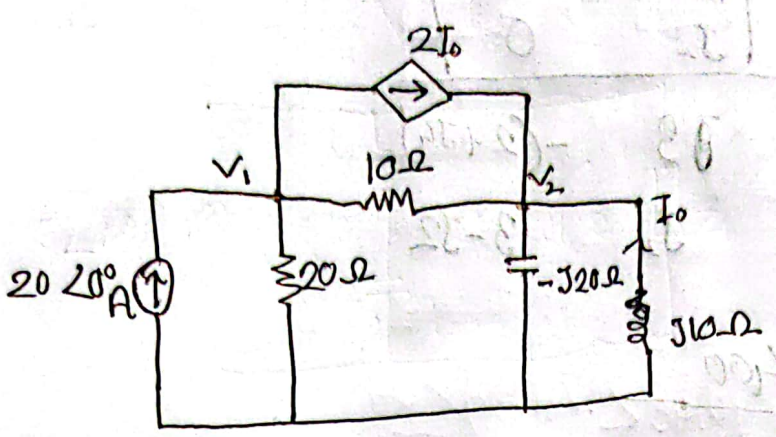
We know,

Maximum power $P_{max} = \frac{(55.90)^2}{4 \times 11.1\Omega}$

$W = \frac{3124.81}{89.44W}$

$= 34.9375\,W$

Answer to the question No: 03



Nodal analysis for V_1

$$20 = 2I_0 + \frac{V_1}{20} + \frac{(V_2 - V_2)}{10}$$

$$\Rightarrow 20 = \frac{2V_2}{J10} + \frac{V_1}{20} + \frac{V_1 - V_2}{10} \quad \left[I_0 = \frac{V_2}{J10}\right]$$

$$\Rightarrow 400 = 3V_1 - (2 + J4)V_2 \quad \text{---} (5)$$

Nodal analysis for V_2

$$\frac{2V_2}{J10} + \frac{V_2 - V_1}{10} = \frac{V_2}{-J20} + \frac{V_2}{J10}$$

$$J2V_1 = (-3 + J2)V_2$$

$$\Rightarrow J2V_1 - (-3 + J2)V_2 = 0 \quad \text{---} (6)$$

$$V_2 = \frac{\begin{vmatrix} 3 & 400 \\ J_2 & 0 \end{vmatrix}}{\begin{vmatrix} 3 & -(2+J4) \\ J_2 & 3-J2 \end{vmatrix}}$$

$$= \frac{400}{1+J0.5}$$

$$I_0 = \frac{V_2}{J10} = \frac{40}{J(1+J0.5)}$$

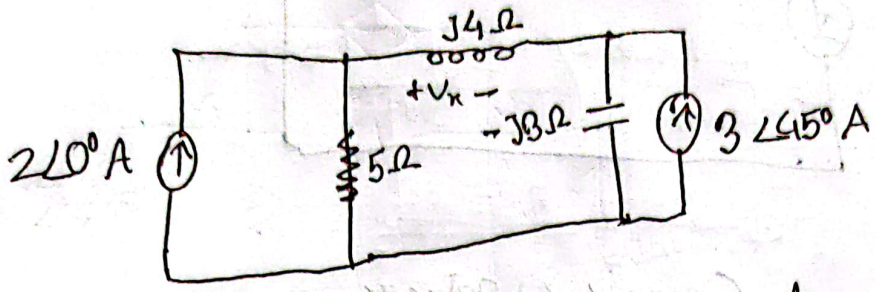
$$= 35.74\angle -116.6^\circ$$

Therefore, $I_0 = 35.74\angle -116.6^\circ$

$$V_2 = \frac{400}{1+J0.5}$$

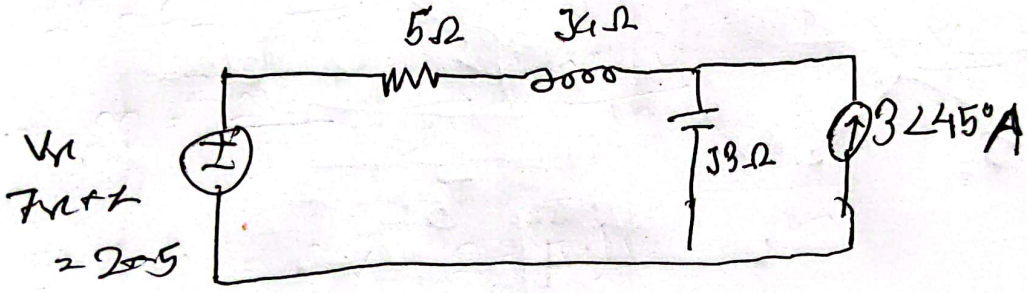
(Ans)

Answer to the question no - 04

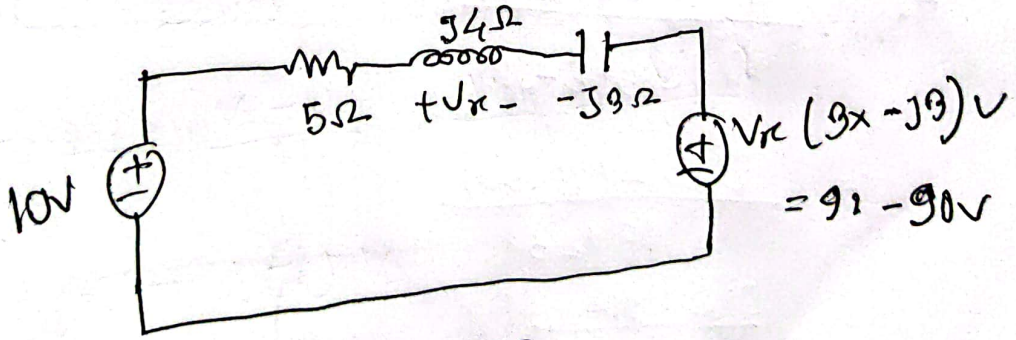


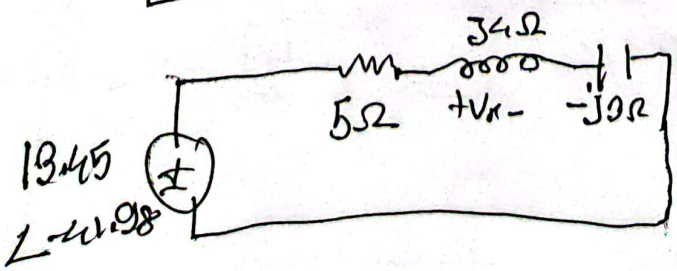
Applying source transformation.

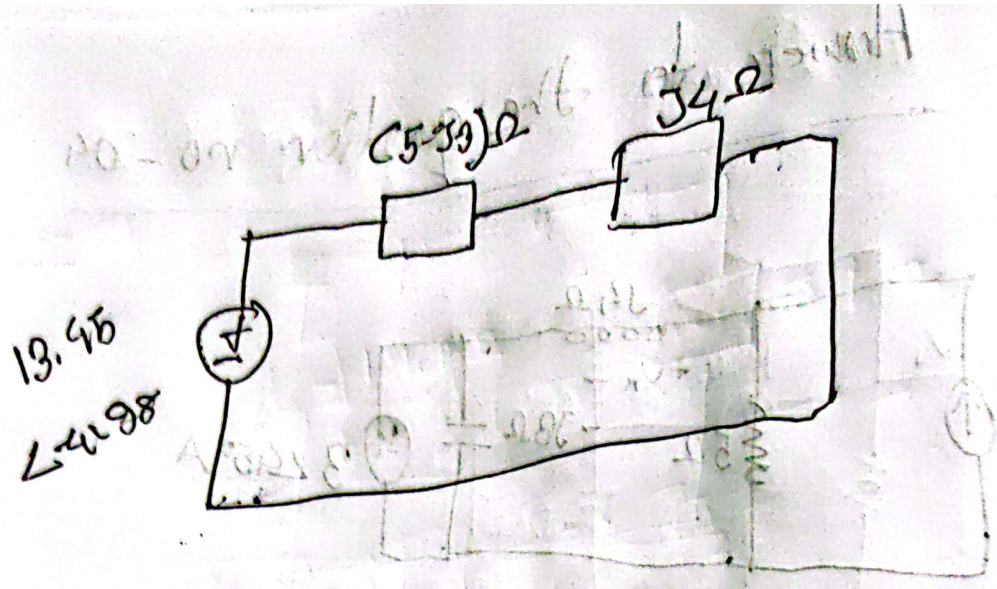
we get,



Vx
$= 2 \angle 0 \times 5$
$= 10V$

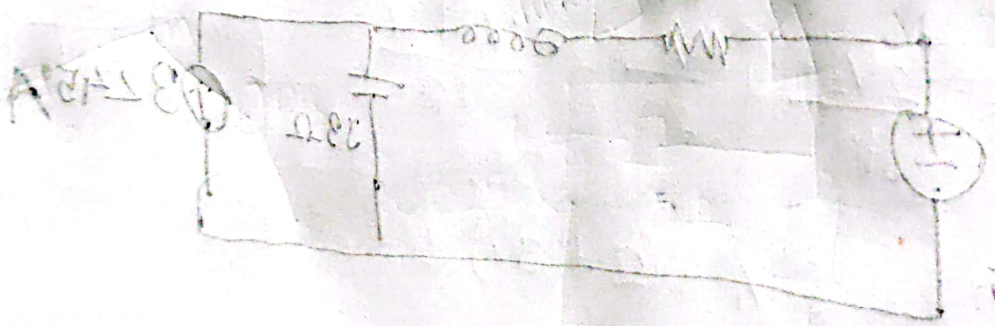


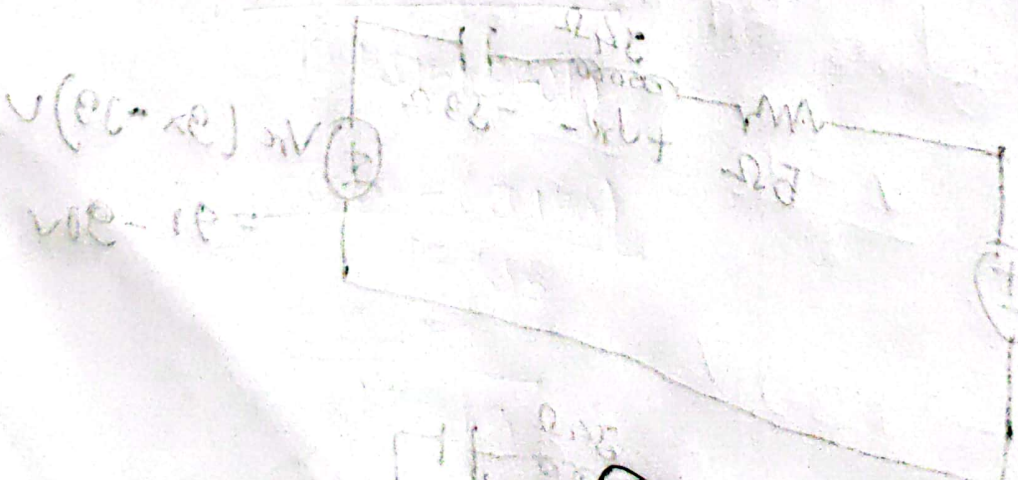




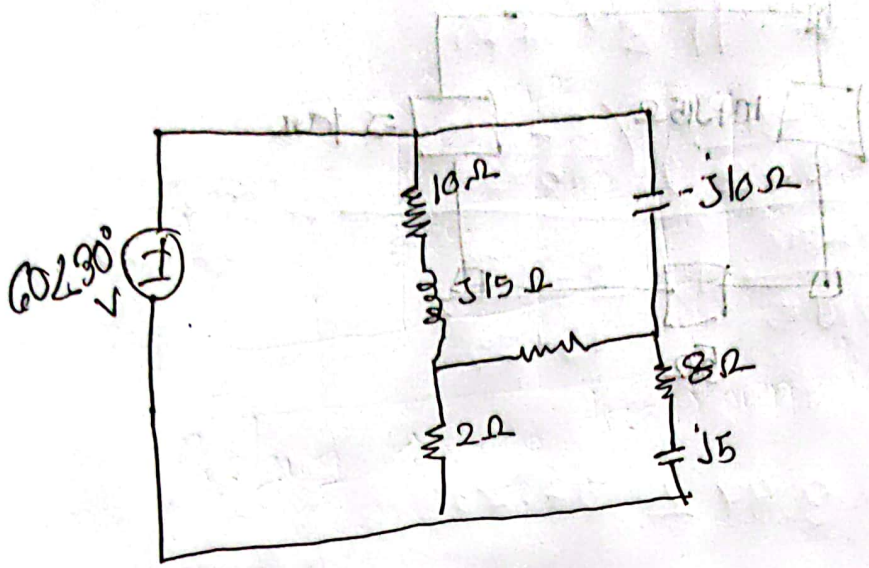
$$V_{oc} = \frac{(13.45\angle -41.98)\times j4}{j4+5-j3}$$

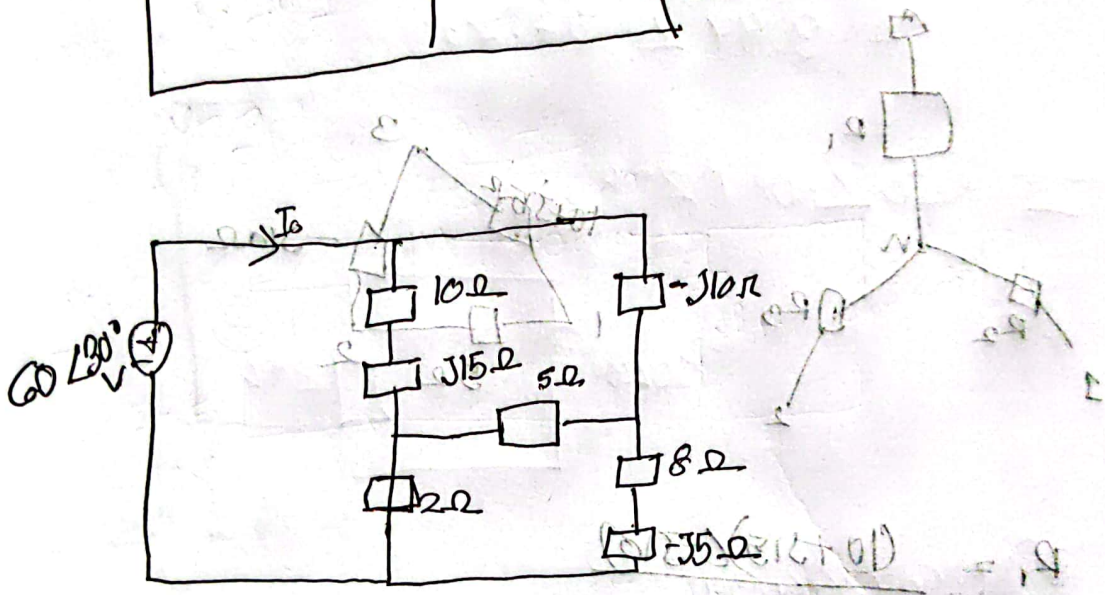
$$= 10.55\angle 36.71$$



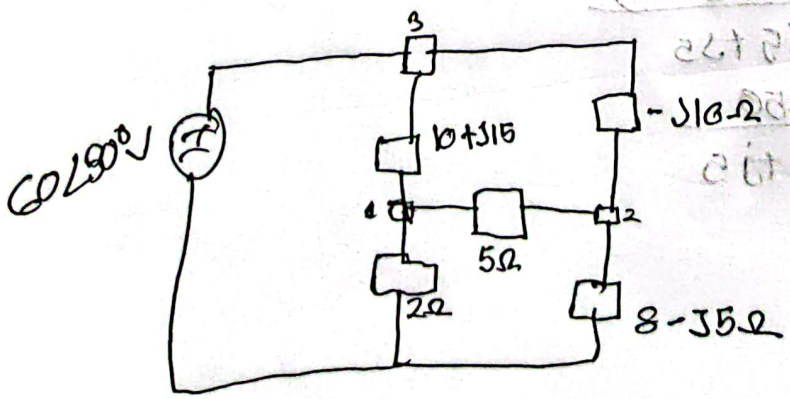


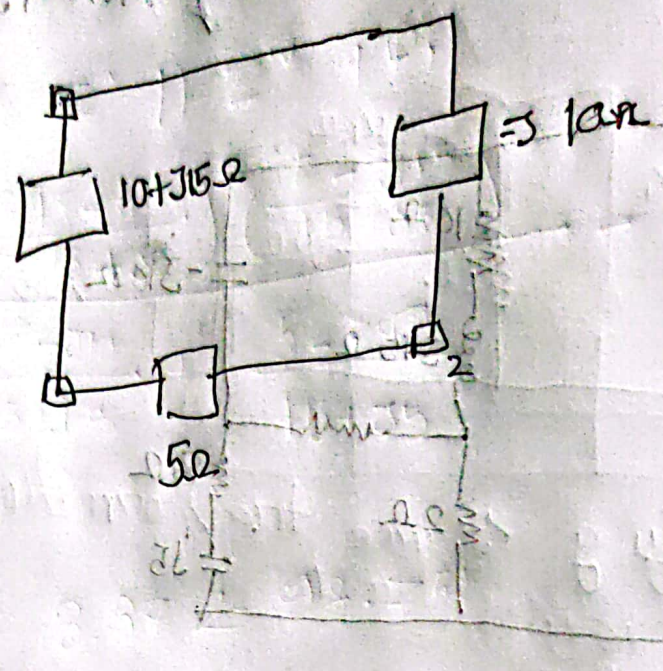
Answer to the question no: 02

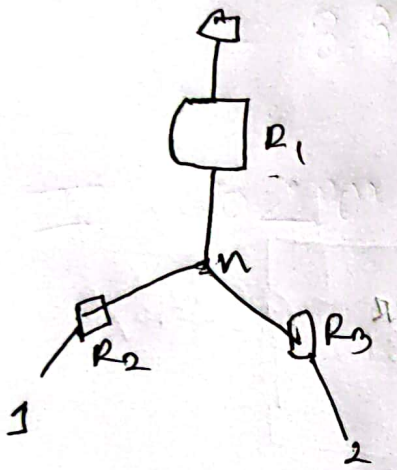


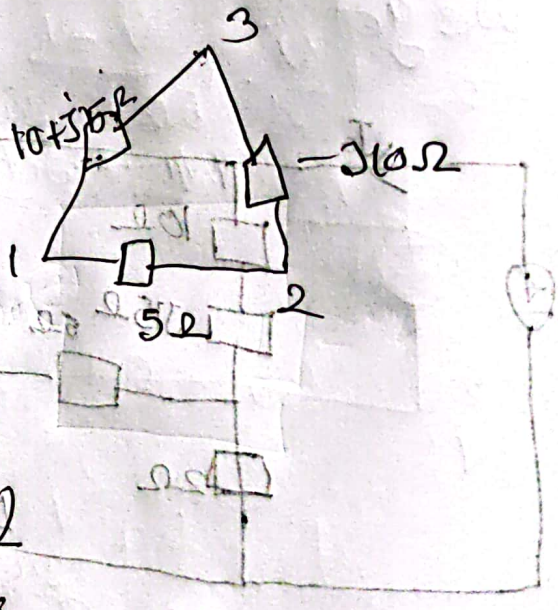


$Z = 10 + j15 \quad , \quad Z'' = 8 - j5$





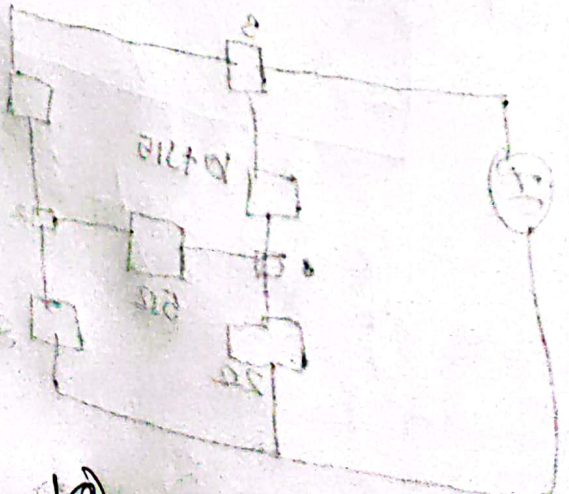




$$R_1 = \frac{(10+J15)(-J10)}{10+J15+5-J10}$$

$$= \frac{J100-(J150)}{15+J5}$$

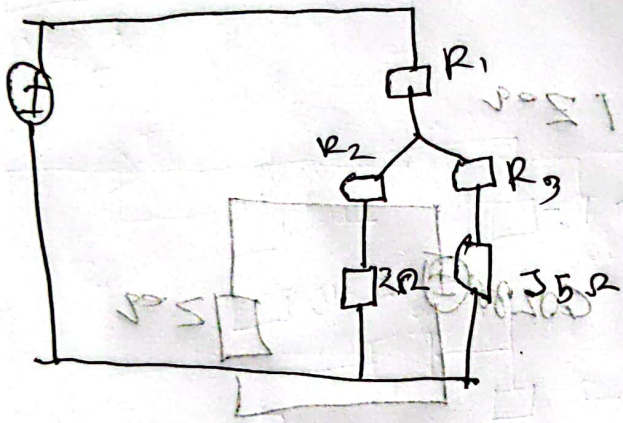
$$= \frac{-J250}{10+j5}$$



$$R_2 = \frac{10 + j15 + 5}{15 + j5}$$

$$R_2 = \frac{15 + j15}{15 + j5}$$

$$R_3 = \frac{5 - j15}{15 + j5}$$



$$Z'' = R_2 + 2\Omega$$

$$= \frac{15 - j10}{15 + j5} + 2$$

$$= \frac{17 - j10}{15 + j5}$$

$$Z''' = \frac{5 - j10}{15 + j5} - j5$$

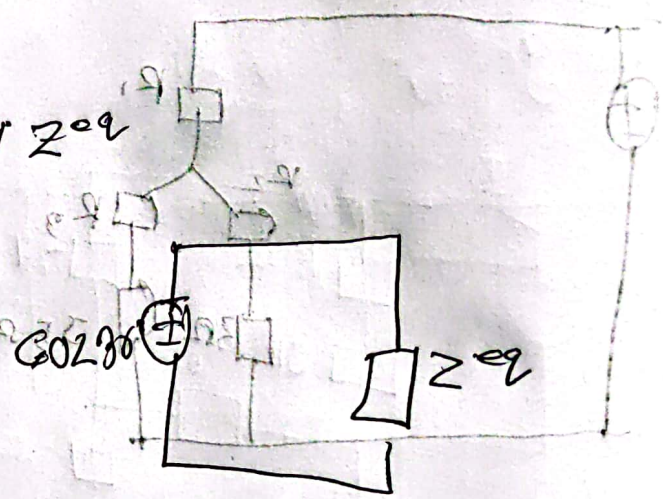
$$= \frac{5 - j15}{15 + j5}$$

$$Z_{eq} = Z'' \,||\, Z''' + 0.1$$

$$= \frac{\left(\frac{17-j10}{15+j5}\right)\left(\frac{5-j15}{15+j5}\right)}{\frac{17-j10}{15+j5} + \frac{5-j15}{15+j5}} + \frac{j2\pi 50}{15+j5}$$

$$= 3.37 \angle -88.75^\circ$$

$$I = 60\angle 30^\circ / Z_{eq}$$



$$= 10.13072 \angle 64.94^\circ$$

Ans