Green University

Final Assignment

Course Title: Introduction to Electrical Engineering Lab

Course Code: EEE 202

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Submitted To :	Submitted By
Name : Md. Tariqul Islam	Name : Jakirul Islam
Designation : Lecturer	Id : 193002101
Department of EEE	Section : DC
Green University of Bangladesh	Department of CSE
	Green University of Bangladesh

Ans to the Q.no:1

a) we know,

Here,

$V_{rms} = 110\angle 85^\circ V$

$I_{rms} = 0.4\angle 15^\circ A$

complex power, $S = V_{rms} \times I_{rms}^*$

$= (110\angle 85^\circ) \times (0.4\angle 15^\circ)$

$= 15.05 + 41.35$

$= 44\angle 70$ VA

Ans.

b) Apparent power,

44 VA

b) real power = 15.05 W

reactive power = 41.35 VAR

c) Power factor,

$pf = \cos(\theta)$

$= \cos(70) = 0.34$

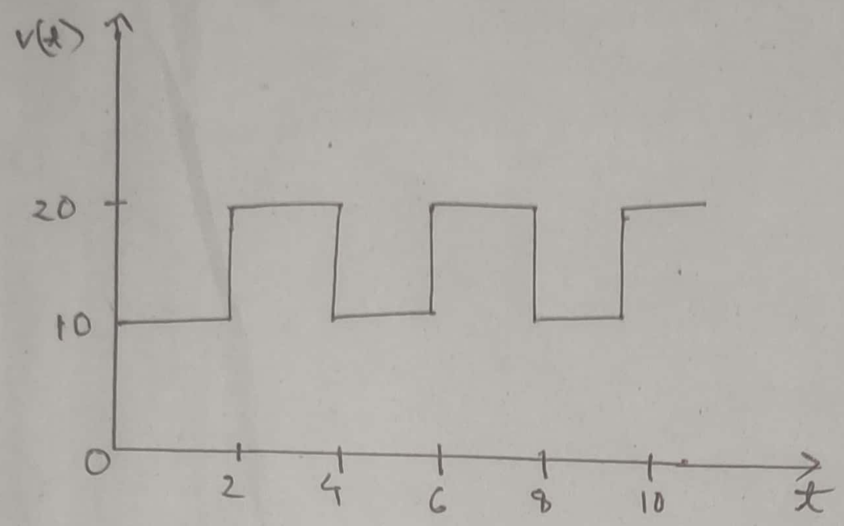
and; load impedance, $= \dfrac{V_{rms}}{I_{rms}} = \dfrac{110\angle 85^\circ}{0.4\angle 15^\circ} = 94.05 + j258.4\,\Omega$

Ans: a) $44\angle 70^\circ$ VA, 44 VA

b) 15.05 W, 41.35 VAR

c) 0.342 lagging, $94.06 + j258.4\,\Omega$

Ans to the Q.no:2



Time Period, $T = 4$

$$v(t) = \begin{cases} 10, & 0 < t < 2 \\ 20, & 2 < t < 4 \end{cases}$$

we know,

$$V_{rms}^2 = \frac{1}{4} \int v^2(t)\, dt$$

Now,

$$v_{rms}^2 = \frac{1}{4} \int_0^2 (10)^2 dt + \int_2^4 (20)^2 dt$$

$$V_{rms}^2 = \frac{1}{4} [200 + 800]$$

$$V_{rms}^2 = \frac{1}{4} [1000]$$

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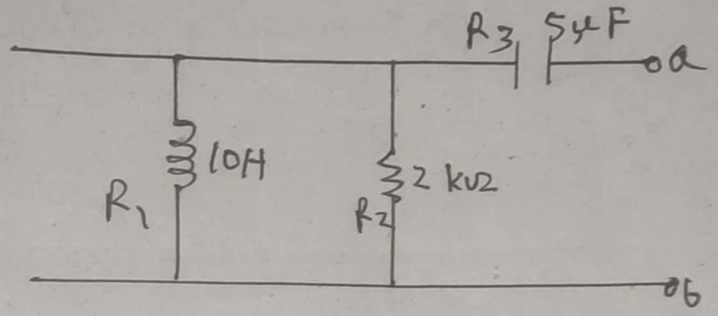
$V_{rms}^2 = 250$

$\therefore V_{rms} = 15.81 V$

Ans: 15.81 V

Ans to the Q.No: 3



Calculating Z_n, the current source as open circuit,

Here,

$I = 4\cos(200t + 30°)$ A

$= 4\angle 30°$ A

$\omega = 200$

$10H = j \times 200 \times 10$

$= j2000\ \Omega$

$5\mu F = \dfrac{1}{j \times 200 \times 5 \times 10^{-6}}$

$= -j1000\ \Omega$

R_1 and R_2 parallel

$\therefore Z_1 = \dfrac{j200 \times 2000}{j2000 + 2000}$

$= 1000 + j1000\ \Omega$

and, Z_1 and R_3 are series,

$Z_{th} = (1000 + j1000 - j1000)\ \Omega$

$= 1000\ \Omega$

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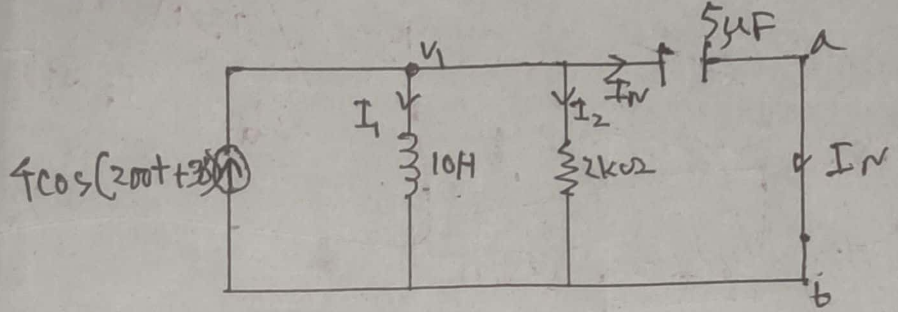
calculating I_N,



using nodal Analysis,

$$4\angle 30^\circ = I_1 + I_2 + I_N$$

$$4\angle 30^\circ = \frac{v_1 - 0}{j2000} + \frac{v_1 - 0}{2000} + \frac{v_1 - 0}{-j1000}$$

$$4\angle 30^\circ = -j5\times10^{-4} v_1 + 5\times10^{-4} v_1 + j1\times10^{-3} v_1$$

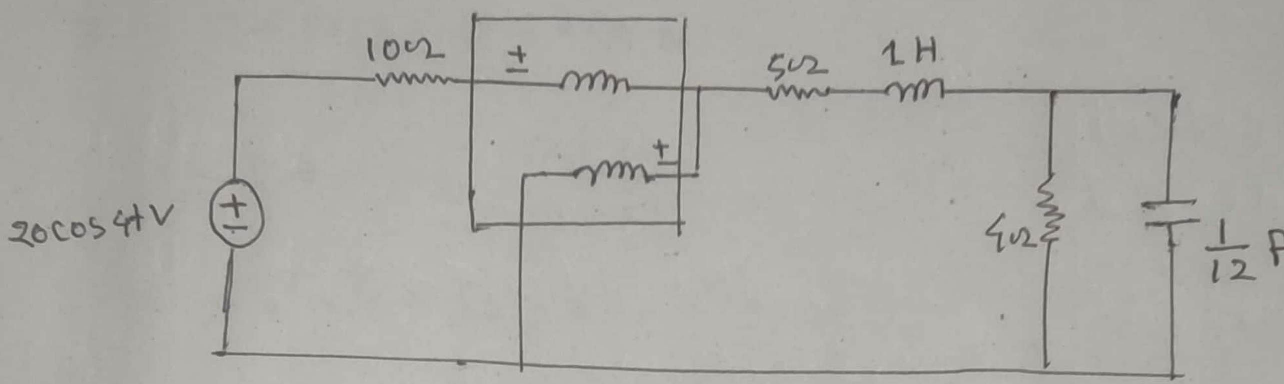
$$\therefore v_1 = 1892.82 - j1678.46\,V$$

$$\therefore I_N = \frac{1892.82 - j16178.46}{-j1000}$$

$$= 1.678 + j1.89\ A$$

Ans.

Ans to the Q.No: 4



The wattmeter reads the power absorbed by the element to its right side.

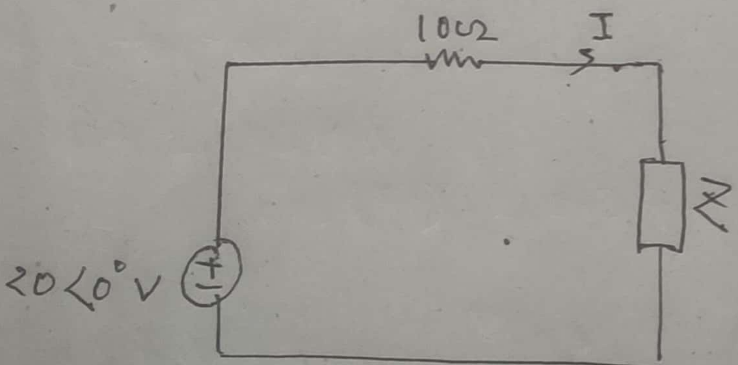
$\omega = 4$

$20\cos(4t) \rightarrow 20\angle 0^\circ$

$1H \rightarrow j\omega L = j \times 4 \times 1 = j4$

$\frac{1}{12}F \rightarrow \frac{1}{j\omega C} = \frac{1}{j \times 4 \times \frac{1}{12}} = -j3$

Consider the following circuit.



Now,

$$Z = 5 + j4 + 4 \| -j3$$

$$= 5 + j4 + \frac{4 \times (-3)}{4 - j3}$$

$$\therefore Z = 6.44 + j2.08$$

$$I = \frac{20}{6.44 + j2.08}$$

$$= 1.207 \angle -7.21^{\circ}$$

$\therefore$ complex power,

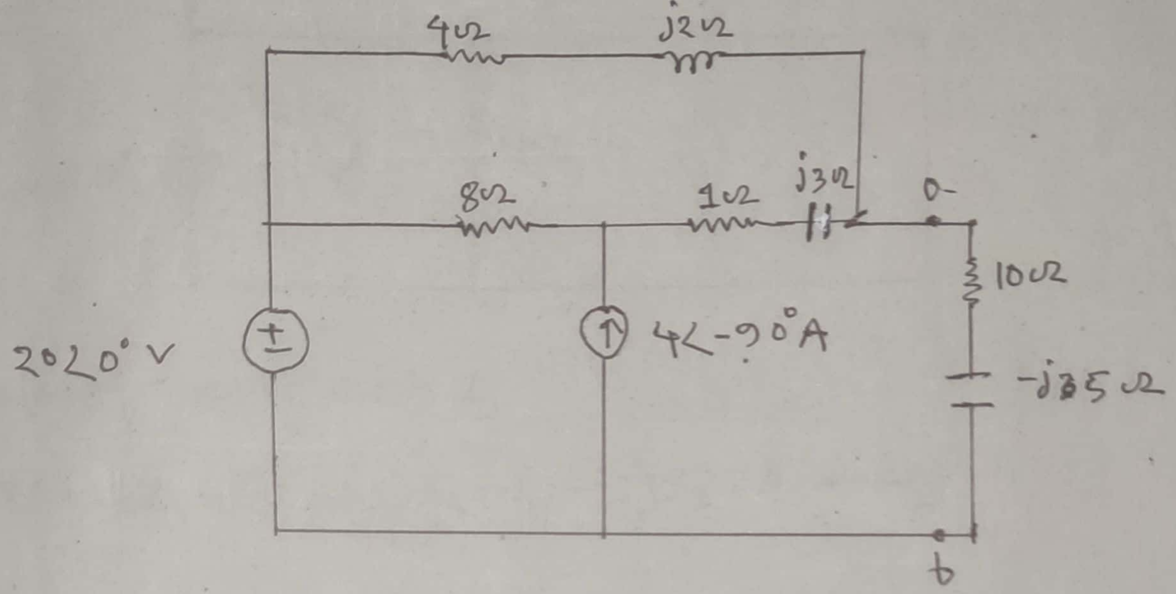
$$S = \frac{1}{2} |I|^2 Z$$

$$= \frac{1}{2} \cdot (1.207)^2 \cdot (6.44 + j2.08)$$

$$= 4.691 \text{ W}$$

$\therefore$ Ans.

Ans to the Q.no:5



Now,

voltage source short circuit and current source open circuit.

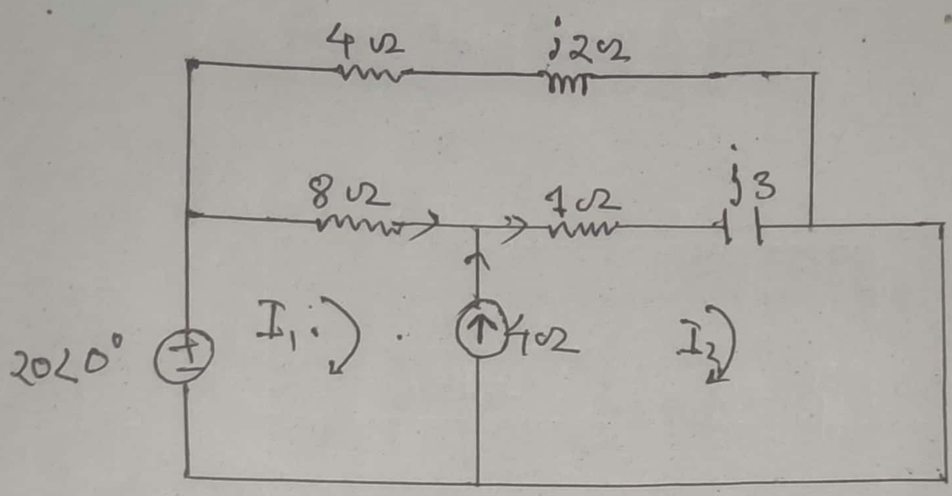
$$Z_n = Z_{th} = (4+j2) \parallel (3+1-j3)$$

$$= \frac{(4+j2)\times(9-j3)}{(4+j2)+(9-j3)}$$

$$\therefore Z_n = 3.1764 + j0.7058\ \Omega$$

Again, ~~now~~

short circuit terminal ab. Solve I_n using mesh Analysis.



Calculate super mesh 1,

$$20 + 8I_1 + (7 - j3)I_2 - (9 - j3)I_3 = 0 \quad \text{— (I)}$$

mesh 2 calculate KCL

$$I_1 = I_2 + 4 \quad \text{— (II)}$$

now, mesh 3 calculate,

$$-8I_1 - (7 - j3)I_2 = 0 \quad \text{— (III)}$$

$$\therefore I_N = I_2 = \frac{50 - j62}{9 - j3}$$

$$= \frac{79.65\angle -51.11^\circ}{9.487\angle -18.43^\circ}$$

$$= 8.396\angle -32.68^\circ \text{ A}$$

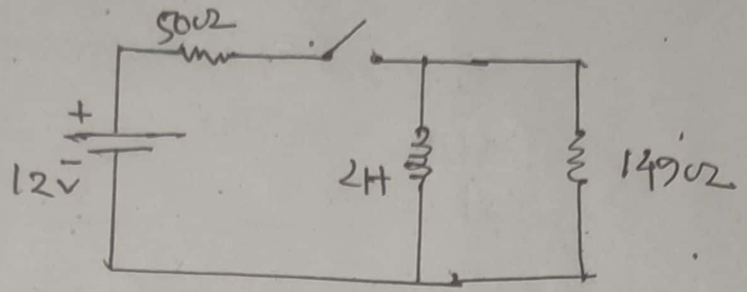
Norton equivalent, find I_0

$$I_0 = \frac{Z_N}{Z_N + 10 - j5} \times I_N$$

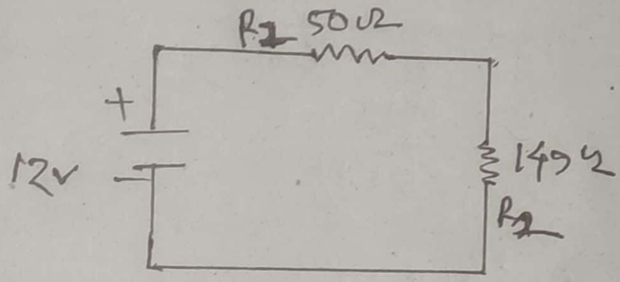
$$= \frac{3.1764 + j0.7058}{3.1764 + j0.7058 + 10 - j5} \times (8.396\angle -32.68^\circ)$$

$$= 1.971\angle -2.101^\circ \text{ A Ans.}$$

Ans to the Q.NO: 6



In DC circuit Inductance is = 0



we can see

$R = R_1 + R_2$ is series

$\therefore R = 50 + 149\Omega$

$= 199\Omega$

we know,

$V = IR$

$I = \frac{V}{R} = \frac{12}{199}$

$\therefore I = 0.06A$

voltage accross $R_2 = V_2$

$$V_2 = \frac{I}{R_2}$$

$$= \frac{0.06A}{149}$$

$$= 0.0004V$$

And,

$$\text{current}, I_2 = \frac{V_2}{R_2}$$

$$= \frac{0.0004}{149}$$

$$= 2.68 \times 10^{-6} A$$

∴ total corrent ~~o~~ is $= 0.06A$

current following ~~through~~ through the ~~for~~ R_2 of $= 2.68 \times 10^{-6} A$

Ans,