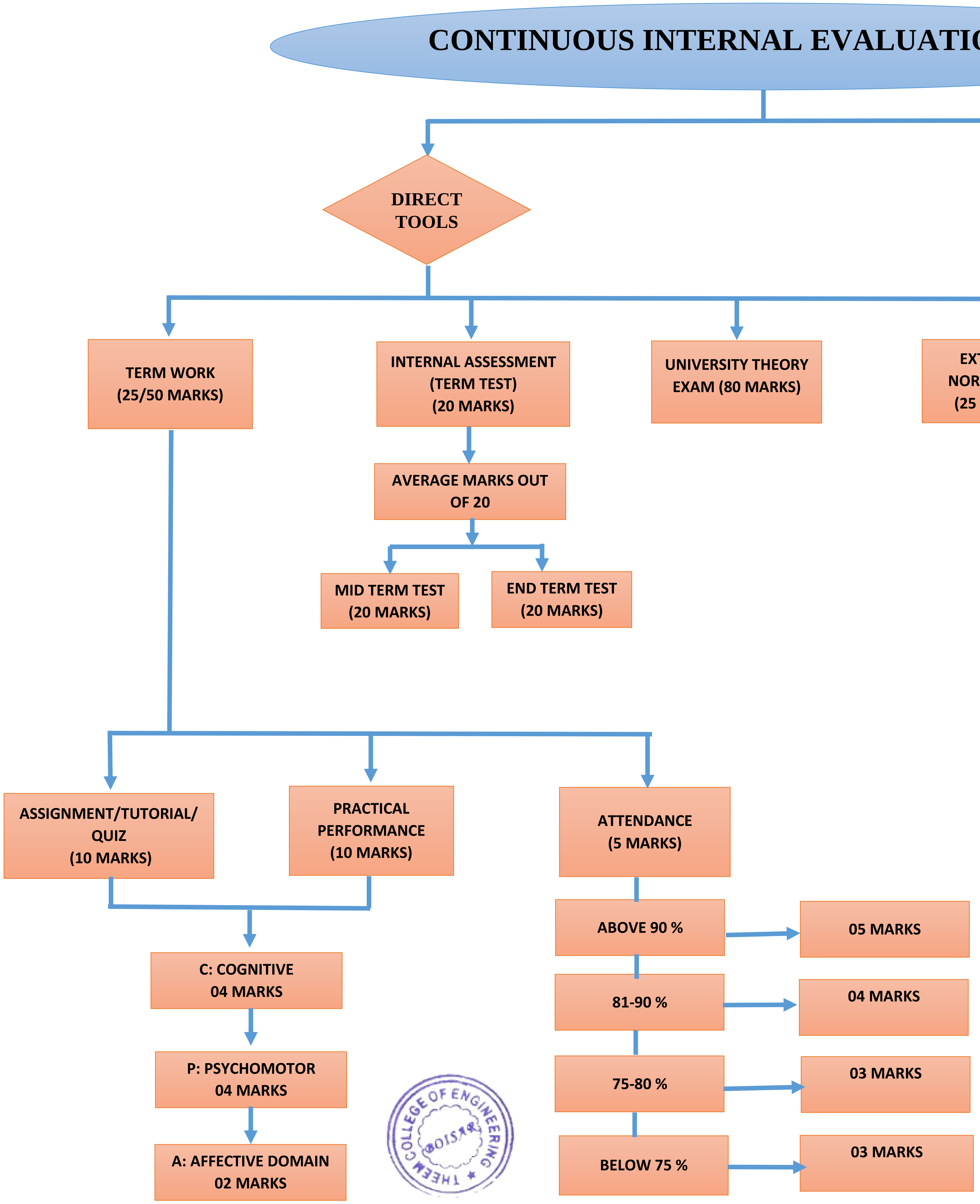

C: COGNITIVE – Content Knowledge, Understanding, Retention parameter of the experiment etc. Weightage 4 marks, 2-3 marks related to question to be asked.

P: PSYCHOMOTOR SKILLS - To draw, To fit, To perform etc. Weightage 4 marks. Observe hand on skills performance and asked questions.

A: AFFECTIVE DOMAIN – Punctuality, timely submission, neatness etc. Weightage 2 marks

Mechanism of Continuous Internal Evaluation (CIE)

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Department of Electronics and Telecommunication Engineering

Continuous assessment
(Experiment /Assignment / Tutorial /Project activity etc.)

- Candidate shall be assessed continuously for his sincerity, punctuality, and discipline along with the understanding of facts, principles, theories and application.
- Term Work and presentation for each practical made by candidates shall be assessed on following parameters.
  C: Cognitive – Content Knowledge, Understanding, Retention parameters of the experiment etc. Weightage 4 marks, 2-3 related questions to be asked.
  P: Psychomotor Skills – To draw, To fit, To perform etc. Weightage 4 marks. Observe hands on skills performance & ask questions.
  A: Affective Domain – Such as punctuality, Timely submissions, Neatness etc, weightage 2 marks.

PARAMETER	C	P	A	Total	Sign. With Date
MARKS OBTAINED					
MAX.MARKS	4	4	2	10	

1. Each practical should be assessed for maximum of 10 marks.
2. Total marks of practical work are calculated at the end of the term and converted to a base as per teaching Examination Scheme.
3. Record of continuous assessment of candidates should be maintained by lecturer in charge and kept in the custody of Head of the Department after completion of the term.
4. Marks obtained by candidate after assessment of each practical work shall be shown to candidate for improvement in subsequent practical.
5. Term work marks shall not be kept confidential. Marks obtained by candidate in term work after continuous assessment shall be displayed on notice board and true marks are sent to MU.

Experiment No.: 3 Verification of Thevenin'sTheorem

Aim:

To verify Thevenin's theorem and to find the load current for the givencircuit.

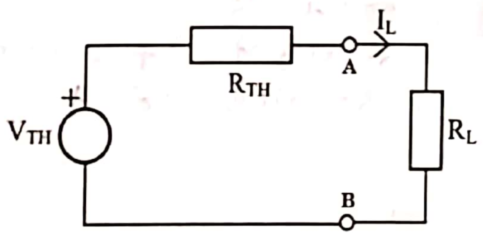
Apparatus Required:

Sr. No.	Apparatus	Range	Quantity
1	RPS (regulated power supply)	(0-30V)	2
2	Ammeter	(0-40mA)	1
3	Resistors	100Ω–100KΩ	4
4	Bread Board	--	Required
5	DRB	--	1

Theory:

Thevenin'stheoremasappliedtoDCcircuit,itstatesthatanylinearbilateraltwoterminal networks can be replaced by a voltage source (V_{TH}) in series with resistance(R_{TH}).

V_{TH} is the open circuit voltage or thevenin's equivalent voltage (i.e. voltage across terminal AB when R_L is removed) and R_{TH} is the by equivalent resistance of the network as viewed from the open circuited load terminals i.e. from terminal AB by deactivating all independent source.



Mathematically current through the load resistance R_L is given by the equation –

$$I_L = \frac{V_{TH}}{R_{TH} + R_L}$$

Where,

$I_L = Load\ current$

$V_{TH} = Open\ circuit\ voltage\ across\ the\ terminals\ AB$

$R_{TH} = Theveni's\ Resistance$

$R_L = Load\ Resistance$

Circuit Diagram:

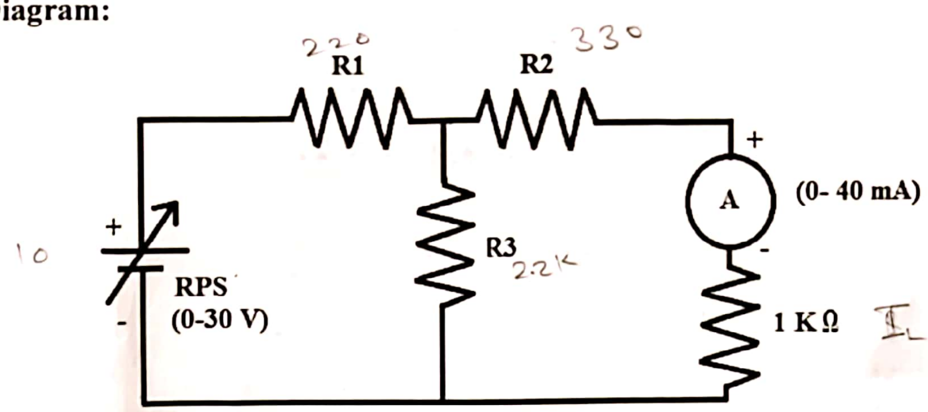


Figure 3.1

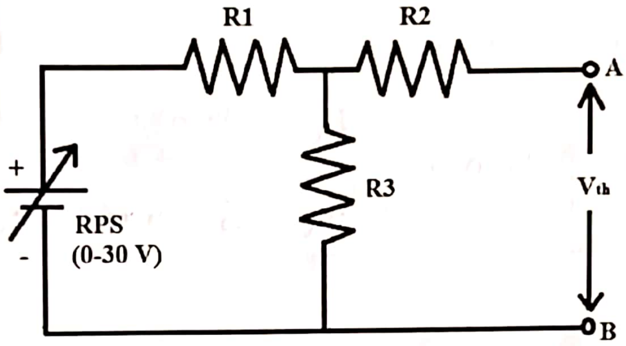


Figure 3.2

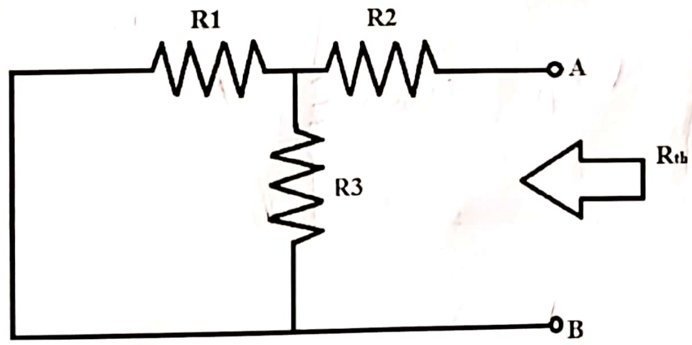


Figure 3.3

Procedure:

1. Select appropriate value of R1, R2 and R3.
2. Connectthecircuitasshownin Figure3.1.SwitchONthepowersupply.Setaparticular value of voltage and note down the value of load current I_L usingammeter
3. Tofind V_{TH},removetheloadresistance(1kΩ)andmeasuretheopencircuitvoltage(V_{TH}) using multi-meter. Refer figure3.2
4. To find the Thevenin's resistance R_{TH}, remove the power supply and short circuit the terminals of circuit where power supply is connected and find the equivalent resistance R_{TH} at open circuit load resistance terminals using multi-meter. Refer figure3.3

Precautions:

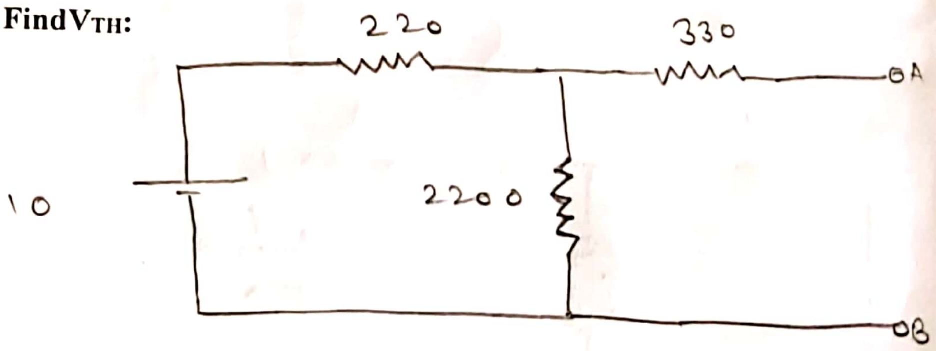
1. Voltage control knob of RPS should be kept at minimumposition
2. Current control knob of RPS should be kept at maximumposition
3. All connections should be tight andcorrect.
4. Switch off the supply when not inuse.
5. Reading should be takencarefully

Observation Table:

Thevenin's Voltage V_{TH} (volt)	Equivalent Resistance R_{TH} (Ω)	Load Resistance R_L(Ω)	Load current, I_L	
			Calculated value $I_L = \frac{V_{TH}}{R_{TH} + R_L}$	Observed value (Ammeter reading)
9.11	521	1000	$I_L = \frac{9.086}{530 + 1000}$ $I_L = 5.94\ mA$	$I_L = \frac{9.11}{521 + 1000}$ $I_L = 5.989\ mA$

Calculations:

1. **FindV_{TH}:**



$$I = \frac{V}{R_{eq}}$$

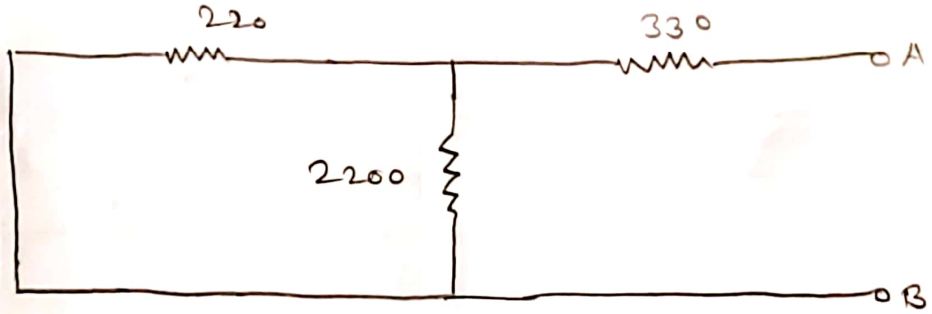
$$= \frac{10}{220 + 2200}$$

$$= 4.13\ mA$$

$$V_{th} = 2200 \times 4.13 \times 10^{-3}$$

$$= 9.086\ V$$

2. Find R_{TH}:



$220 \parallel 2200$

$\frac{220 \times 2200}{220 + 2200} = 200\Omega$

200Ω series with 330Ω

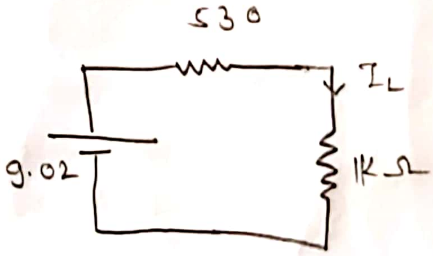
$200 + 330$
$= 530\Omega$

$R_{th} = 530\,\Omega$

3. Calculate I_L:

$I_L = \frac{V_{th}}{R_{th} + R_L} = \frac{9.086}{1530}$

$I_L = 5.94\,mA$



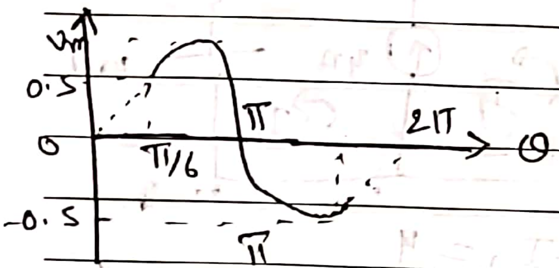
Result:

Result	Thevenin's Voltage V_{TH} (V)	Equivalent Resistance R_{TH} (Ω)	Load current, I_L (mA)
Theoretical	9.086	530	9.94
Practical	9.11	521	5.99

Parameter	C	P	A	Total	Sign. With Date
Marks Obtained	4	3	2	9	
Max. Marks	4	4	2	10	

Assignment 2. (A)

① Avg val of wave form.



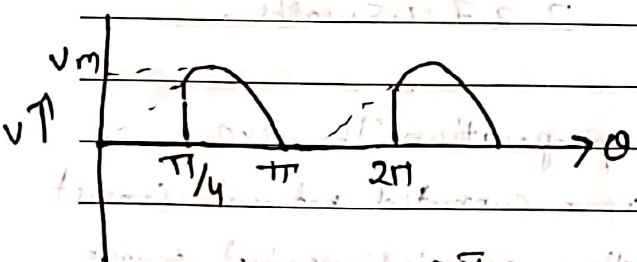
$V_{avg} = \int_0^{\pi} \frac{v\,d\theta}{\pi}$

$= \int_0^{\pi} \frac{0\,d\theta}{\pi} + \int_{\pi/6}^{\pi} \frac{V_m \sin\theta\, d\theta}{\pi}$

$= \frac{V_m}{\pi} \int_{\pi/6}^{\pi} \sin\theta\, d\theta$

$\therefore V_{avg} = 0.594\, V_m$

② find rms value of wave form



Solⁿ :- $V_{rms}^2 = \int_0^{2\pi} \frac{v^2\, d\theta}{(2\pi)}$

$= \frac{1}{2\pi} \int_{\pi/4}^{\pi} V_m^2 \sin^2\theta\, d\theta$

$= \frac{V_m^2}{2\pi} \int_{\pi/4}^{\pi}$

$= \frac{V_m^2}{2\pi} \times 1.4280$

$\therefore V_{rms} = 0.476\, V_m$.

3) $v = 141.4 \sin 377t$. find ① time period ② frequency ③ Instantaneous voltage at $t = 3ms$ ④ max value

Solⁿ :- $v = 141.4 \sin 377t$

comp. wit $v = V_m \sin \omega t$

$\therefore V_m = 141.4 \quad \omega = 377$.

$\omega = 377$

$2\pi f = 377$

$f = 60\ Hz$

$T = \frac{1}{f} = \frac{1}{60} = 0.016\ sec.$

At $t = 3\ msec$

$\therefore v = 141.4 \sin(377 \times 3 \times 10^{-3})$

$= 127.8\ V$

4) Three sinusoidal voltage acting in series are given by $v_1 = 10 \sin 440t$, $v_2 = 10\sqrt{2} \sin(440t - 45)$, $v_3 = 20 \cos 440t$. Derive expression for the resultant voltage and determine frequency and rms value of resultant voltage.

Solⁿ :-

$v_1 = 10 \sin 440t$

$v_2 = 10\sqrt{2} \sin(440t - 45^\circ)$

$v_3 = 20 \cos 440t = 20 \sin(440t + \pi/2)$

$\bar{v} = \bar{v}_1 + \bar{v}_2 + \bar{v}_3$

$= (7.07) + (7.07 - 7.07j) + (14.14j$

$\therefore \bar{v} = 15.80 \angle 26.57$

$v = 15.80\sqrt{2} \sin(440t + 26.57)$

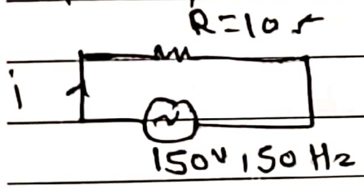
$V_{rms} = 15.8V$

$\omega = 440$

$\therefore f = 70.03\ Hz$

5) A 50Hz, alternating voltage of 150V is applied independently to (1) resistance of 10 Ω (2) Inductance of 0.2H (3) capacitance of 50 μF. find the expression for instantaneous current in each case.

Soln :- $V = 150V$, $f = 50Hz$, $R = 10\Omega$, $L = 0.2H$, $C = 50\mu F$



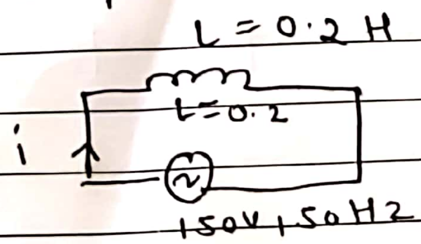
$i = I_m \sin \omega t$

$= \frac{V_m}{R} \sin(2\pi f t)$

$\therefore i = 21.213 \sin 100\pi t\ A.$

$V_{rms} = 150V$

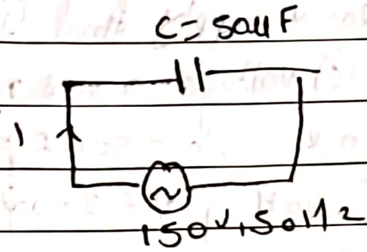
$\therefore V_{peak} = 212.13$



$i = \frac{V_m}{X_L} \sin(100\pi t - \pi/2)$

$= \frac{150\sqrt{2}}{68.8} \sin(100\pi t - \pi/2)$

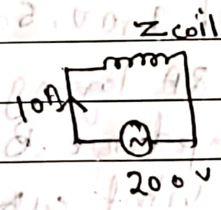
$= 3.37 \sin(100\pi t - \pi/2) A$



$i = I_m \sin(\omega t + \pi/2)$

$= \frac{V_m}{X_C} \sin(100\pi t + \pi/2)$

6) An inductor coil draws 10A current and consume 1000W power from 200V, 50 Hz ac supply determine Impedance, resistance, reactance, inductance of coil, power factor, reactive and apparent power.



$P = VI\cos\phi$ $\therefore 1000W = 200 \times 10 \cos\phi$

$\therefore \phi = 60°$.

$Z_{coil} = \frac{200\angle 0}{10\angle -60} = 20\angle 60 = 10 + j17.32$

$\therefore$ 1000 is power.

$X_L = 17.31$

$\omega L = 17.31$

$P = VI = 200 \times 10 = 2000\ W$

$Q = VI\sin\phi = 1000\ VAR$

7) A resistor of 100Ω is connected in series with a 50uF capacitor to a 50Hz, 200V supply find ① Impedance ② current ③ P.F ④ phase angle ⑤ voltage across resistor and across capacitor.

sol^n :- $R = 100\,\Omega$, $C = 50\,\mu F = 50\times10^{-6} F$

$F = 50\,Hz$, $V = 200\,V$

$X_C = \frac{1}{\omega L} = 63.66\,\Omega$ $X_C = X_L$

$Z = 100 + j(63.66)$

$= 118.54 \angle 32.48$

$P.F = \cos(32.48) = 0.843$ (leading)

$\phi = 32.48$

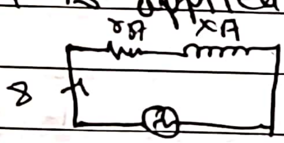
$I = \frac{V}{Z} = \frac{200}{118.54} = 1.69\,A$

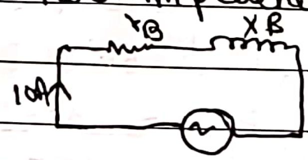
Voltage

$V = IR = 100\times1.69 = 16.9\,V$

$V = I X_C = 1.69\times63.66 = 107.59\,V$.

8) When a voltage of 100V, 50Hz is applied to an impedance A current taken is 8A lagging and power is 120W. what it is connected to an impedance B the current is 10A leading and power is 500W. What current and power will be taken if it is applied to two impedence connected in series.





$V = 100\,V$
$P_A = 120\,W$

$V = 100\,V$

$P_B = 500\,W$

$P_A = I_A^2 r_A$

$120 = 8^2 \times r_A$

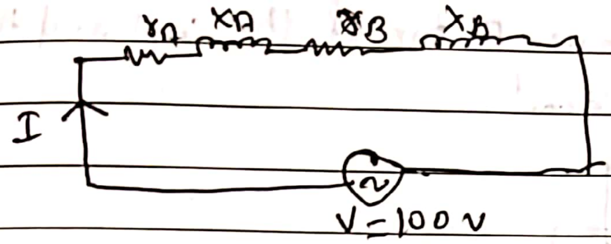
$r_A = 1.875\,\Omega$

$X_A = \sqrt{Z_A^2 - r_A^2} = \sqrt{12.5^2 - (1.875)^2}$

$= 12.36\,\Omega$

For coil B, $Z_B = \frac{V_B}{I_{B_2}} = \frac{100}{10} = 10\,\Omega$, $P_B = I_B^2 r_B$, $r_B = 5\,\Omega$

$x_B = \sqrt{Z_B^2 - r_B^2} = \sqrt{10^2 - 5^2} = 8.66\,\Omega$.



$Z = r_A + jx_A + r_B + jx_B$

$= 1.8 + 5 + j12.56 + 5 + j8.66.$

$= 22.11 \angle 71.89\,\Omega$

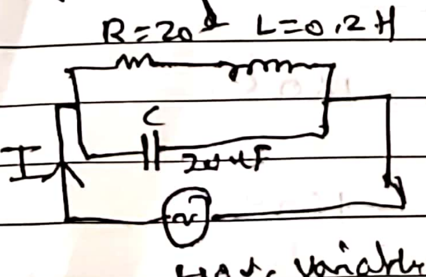
$Z = 22.11$

$\phi = 71.89^0$

$I = \frac{V}{Z} = \frac{100}{22.11} = 4.52\,A$

$P = I^2 (r_A + r_B) = (4.52)^2 (6.875) = 140.64\,W.$

Q) An inductor coil has a resistance of 20 Ω and inductance of 0.2H. It is connected in parallel with a capacitor of 20 μF. This combination is connected across a 230V supply having variable frequency. Find the frequency at which the total current drawn from the supply is in phase with voltage. What is condⁿ called. Find value of current drawn and impedence of circuit.

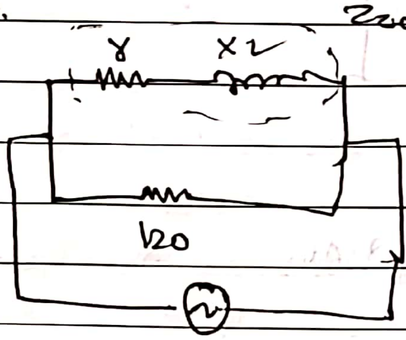


This condition is called Resonance

$Z = \frac{L}{CR} = \frac{0.2}{20\times10^{-6}\times20} = 500\,\Omega$, $I = \frac{V}{Z} = 0.46\,A$

$f_r = \frac{1}{2\pi}\sqrt{\frac{1}{LC} - \frac{R^2}{L^2}} = \frac{1}{2\pi}\sqrt{\frac{1}{0.2\times20\times10^{-6}} - \frac{20^2}{0.2^2}} = 77.06\,Hz$

10) A coil is connected across a non-conductive resistance of 120Ω, when a 240V, 50Hz Supply is applied to this circuit the coil draws a current of 5A and total current is 6A. Determine the power and power Factor of the coil and the whole circuit.



$\bar{Z}_{coil} = \sqrt{r^2+X_L^2} \angle \tan^{-1}\frac{X_L}{R}$

$Z_{coil} = \frac{V}{I} = \frac{240}{5} = 48 = \sqrt{r^2+X_L^2}$

$\therefore r^2+X_L^2 = 48^2$ — (1)

$\bar{Z}_{CKT} = Z_{CKT} \angle \phi_{CKT}$

$Z_{CKT} = \frac{V}{I} = \frac{240}{6} = 40\Omega$

Also, $\bar{Z}_{CKT} = \sqrt{\frac{(120r)^2+(120X_L)^2}{(r+120)^2+(X_L)^2}} = 40\Omega$

$\therefore \frac{(120r)^2+(X_L 120)^2}{r^2+240r+120^2+X_L^2} = 1600$

$\frac{(120)^2(r^2+X_L^2)}{(r^2+X_L^2)+240r+120^2} = 1600$

$\therefore \frac{(120)^2(48^2)}{(48)^2+240r+120^2} = 1600$

$\therefore r = 16.8\Omega$

$\Rightarrow X_L = 44.96\Omega$

$\phi = \tan^{-1}\frac{X_L}{r} = \tan^{-1}\left(\frac{44.96}{16.8}\right) = 69.51$

$P.F = \cos\phi = \cos 69.51 = 0.35$ lag

$P = VI\cos\phi = 240 \times 0.35 \times 5 = 420W$

$Z_{ckt} = \frac{5762.36 \angle 69.58}{143.99 \angle 18.19} = 40 \angle 51.33^\circ$

$\phi_{ckt} = 51.33^\circ$

PF = cos φ = cos 51.33 = 0.624 (lagging)

P = VI cos φ = 240 × 6 × 0.624 = 898.56 W.

11 A circuit consist of a resistance of 4 Ω and inductance of 0.5 H and a variable capacitance in series across a 200 V, 50 Hz supply calculate ① value of capacitance to produce resonance ② voltage across capacitor ③ Q-Factor of the circuit.

Soln :- R = 4 Ω, L = 0.5 H, V = 100 V, F = 50 Hz

The Resonance across f_r:

$f_r = \frac{1}{2\pi\sqrt{LC}} = \frac{1}{2\pi\sqrt{0.5 \times C}}$

$\therefore 50 = \frac{1}{2\pi\sqrt{0.5 \times C}}$ $\therefore C = 20.26\,\mu F$

Q. Factor $Q = \frac{1}{R}\sqrt{\frac{L}{C}} = \frac{1}{4}\sqrt{\frac{0.5}{20.26 \times 10^{-6}}} = 39.26$

voltage across capacitor:

$V_C = X_C \times I = 157.11 \times 25$

$\therefore V_C = 3927.75\,V$

$X_C = \frac{1}{2\pi f C} = \frac{1}{2\pi \times 50 \times 20.26 \times 10^{-6}}$

$\therefore X_C = 157.11$

$I = \frac{V}{R} = \frac{100}{4} = 25\,A$.

Parameter	C	P	A	Total	sign. with Date
Marks obtained	4	3	2	9	
Max. marks	4	4	2	10	