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BEE TERM WORK

EXPERIMENT NO.1

Study of safety precautions and measuring instruments

1.6 Study of resistors, capacitors and inductors

Sr. No.	Color Code	Tolerance (%)	Resistance Value (KΩ)
1	Red, Black, Yellow, Gold	5%	200 KΩ
2	Brown, Black, Orange, Gold	5%	10KΩ
3	Yellow, Violet, Red, Silver	10%	4.7KΩ

EXPERIMENT NO.3

Verification of Kirchhoff's Laws and Superposition Theorem

3.6 Result Table:

Sr. No.	E_1 (volts)	E_2 (volts)	I_1 (mA)	V_1 (V)	I_2 (mA)	V_2 (V)	I_3 (mA)	V_3 (V)
1	21	0	252	12.6	168	8.4	84	8.4
2	0	24	192	9.6	288	14.4	96	9.6
3	21	24	60	3	-120	-6	180	18

3.7 Verification Table:

1. For calculation 1 i.e. When only E_1 is operative, if $I_1 = I_2 + I_3$, KCL is verified. Similarly, if $E_1 = V_1 + V_3$ then KVL is verified.
2. For calculation 2 i.e. When only E_2 is operative, if $I_2 = I_1 + I_3$, KCL is verified. Similarly, if $E_2 = V_2 + V_3$ then KVL is verified.
3. For calculation 3, if I_3 (with E_1 only applied) + I_3 (with E_2 only applied) = I_3 (with both E_1 and E_2 applied), then Superposition theorem is verified.

- Write the above-mentioned steps in the verification table by putting respective values of currents and voltages for each calculation and complete the verification table.

Calculation No.	Verification of KCL	Verification of KVL
1	192 + 60 = 252	9.6 + 3 = 12.6
2	288 – 120 = 168	14.4 – 6 = 8.4
3	| 252 – 168 | = 84 | 192 – 288 | = 96 | 60 + 120 | = 180	

EXPERIMENT NO.4

Study of single-phase R-C series circuit

4.8 Given Parameters:

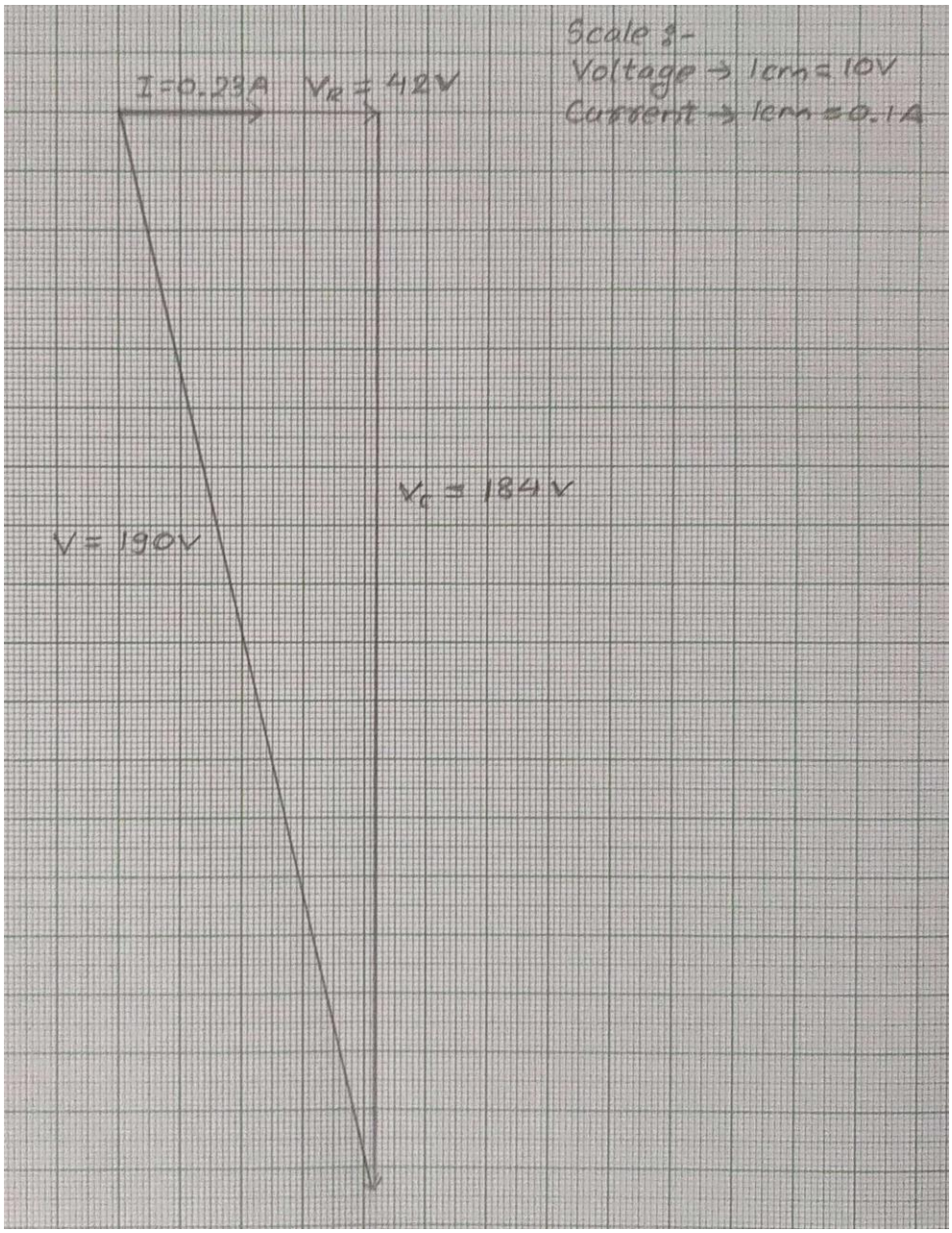
Sr. No.	V (volts)	I (A)	V_R (V)	V_C (V)
1	200	0.23	42	184

4.9 Calculations:

Give appropriate units, as applicable, to different quantities calculated.

1. Resistance of circuit= $R=V_R/ I$ = **182.6 Ω**
2. Capacitive reactance=$X_C= V_C/ I$ = **800 Ω**
3. With frequency f= 50 Hz, Capacitance of circuit=$C=1/2\pi f X_C$ = **3.9 µF**
4. Circuit impedance=$Z=V/ I$ = **869.56 Ω**
5. Power factor of the circuit= cos ø= R/Z = **0.2099 rad leading**

4.10 Phasor Diagram:



4.11 Results:

1. Resistance of the circuit = R= **182.6 Ω**
2. Capacitance of the circuit = C = **3.9 µF**
3. Power factor of the circuit = cos ø= **0.2099 rad**

EXPERIMENT NO. 5

Direct Loading Test on Single Phase Transformer

5.6 Given Parameters:

Sr.No.	V_1 (V)	I_1 (A)	W_1 (W)	V_2 (V)	I_2 (A)	W_2 (W)
1	110	0.22	20*2	216	0	0
2	110	2	115*2	214	0.8	80*2
3	110	3.6	220*2	210	1.7	150*2
4	110	5.2	320*2	200	2.5	260*2
5	110	6.75	430*2	198	3.3	340*2
6	110	8.2	525*2	192	4.15	410*2

5.7 Calculations:

- From circuit diagram, power rating = Q = 1 kVA, rated primary voltage= V_1= 110 V, Rated secondary voltage = V_2 = 220 V

1. Voltage ratio = V_1/V_2 = **0.5**
2. I_1 (rated) = $(Q \times 10^3)$/ (rated V_1) = **9.09 A**
3. I_2 (rated) = $(Q \times 10^3)$/ (rated V_2) = **4.54 A**
4. Current ratio = I_1/I_2 = **2**
5. Percentage Efficiency = $[W_2/ W_1] \times 100$
6. % Regulation = $[(E_2 – V_2)/ E_2] \times 100$ Where, E_2 = Secondary voltage on no load, V_2 = Secondary voltage on load

(Note: value of E_2 will be same i.e., 220 V for all calculations)

5.8 Result Table:

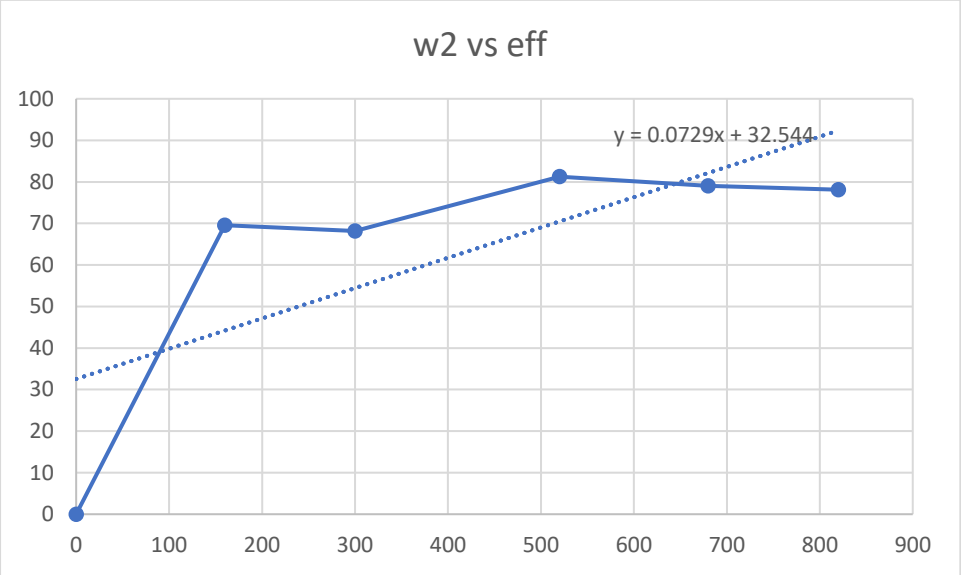
- **Voltage ratio = 0.5**
- **Current ratio = 2**

Sr. No.	Output Current I_2 (A)	Output Power W_2 (W)	Efficiency (%)	Voltage Regulation (%)
1	0	0	0	1.82
2	0.8	160	69.57	2.73
3	1.7	300	68.18	4.55
4	2.5	520	81.25	9.09
5	3.3	680	79.07	10
6	4.15	820	78.1	12.7

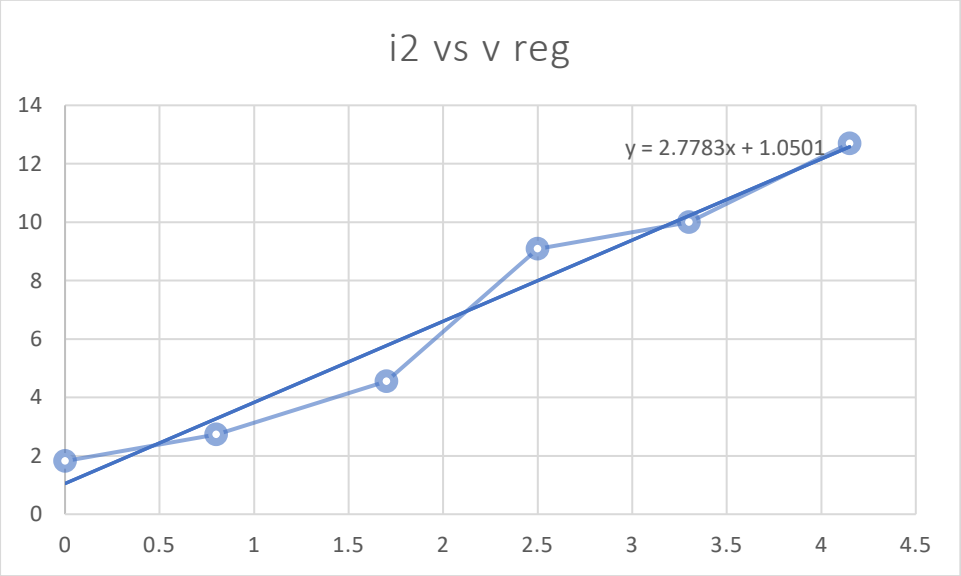
5.9 Graphs:

Draw following graphs by selecting appropriate scales.

1. % Efficiency (on Y-axis) Vs. Power Output (on X-axis)



2. % Voltage Regulation (on Y-axis) Vs. Output Current (on X-axis)



EXPERIMENT NO.6

Verification of Voltage and Current Relations and Power Calculations in Three Phase Star and Delta connected balanced Loads

6.6 Given Parameters:

For Star connection

Sr. No.	Line Voltage (V)	Phase Voltage (V)	Line Current (A)	Phase Current (A)
1	354	200	0.89	0.89
2	392	224	0.93	0.93
3	440	245	1	1

For Delta connection

Sr. No.	Line Voltage (V)	Phase Voltage (V)	Line Current (A)	Phase Current (A)
1	448	448	2.2	1.3
2	448	448	2.9	1.7
3	448	448	3.7	2.1

6.7 Calculations:

For star connection:

$V_L = \sqrt{3}\ V_{PH}$ [calculate line voltage for each reading by using this formula and phase voltage reading]

1) $V_{L1} = \sqrt{3} V_{PH1}$ = 346.410 V, $P_{total} = \sqrt{3}\ V_{L1} I_{L1} \cos\phi$ = **533.99 W**

2) $V_{L2} = \sqrt{3} V_{PH2}$ = 387.979 V, $P_{total} = \sqrt{3}\ V_{L2} I_{L2} \cos\phi$ = **624.95 W**

3) $V_{L3} = \sqrt{3} V_{PH3}$ = 424.352 V, $P_{total} = \sqrt{3}\ V_{L3} I_{L3} \cos\phi$ = **734.99 W**

For delta connection:

$I_L = \sqrt{3}\ I_{PH}$ [calculate line current for each reading by using this formula and phase current reading]

1) $I_{L1} = \sqrt{3} I_{PH1}$ = 2.25 A, $P_{total} = \sqrt{3}\ V_{L1} I_{L1} \cos\phi$ = **1745.9 W**

2) $I_{L2} = \sqrt{3} I_{PH2}$ = 2.94 A, $P_{total} = \sqrt{3}\ V_{L2} I_{L2} \cos\phi$ = **2281.31 W**

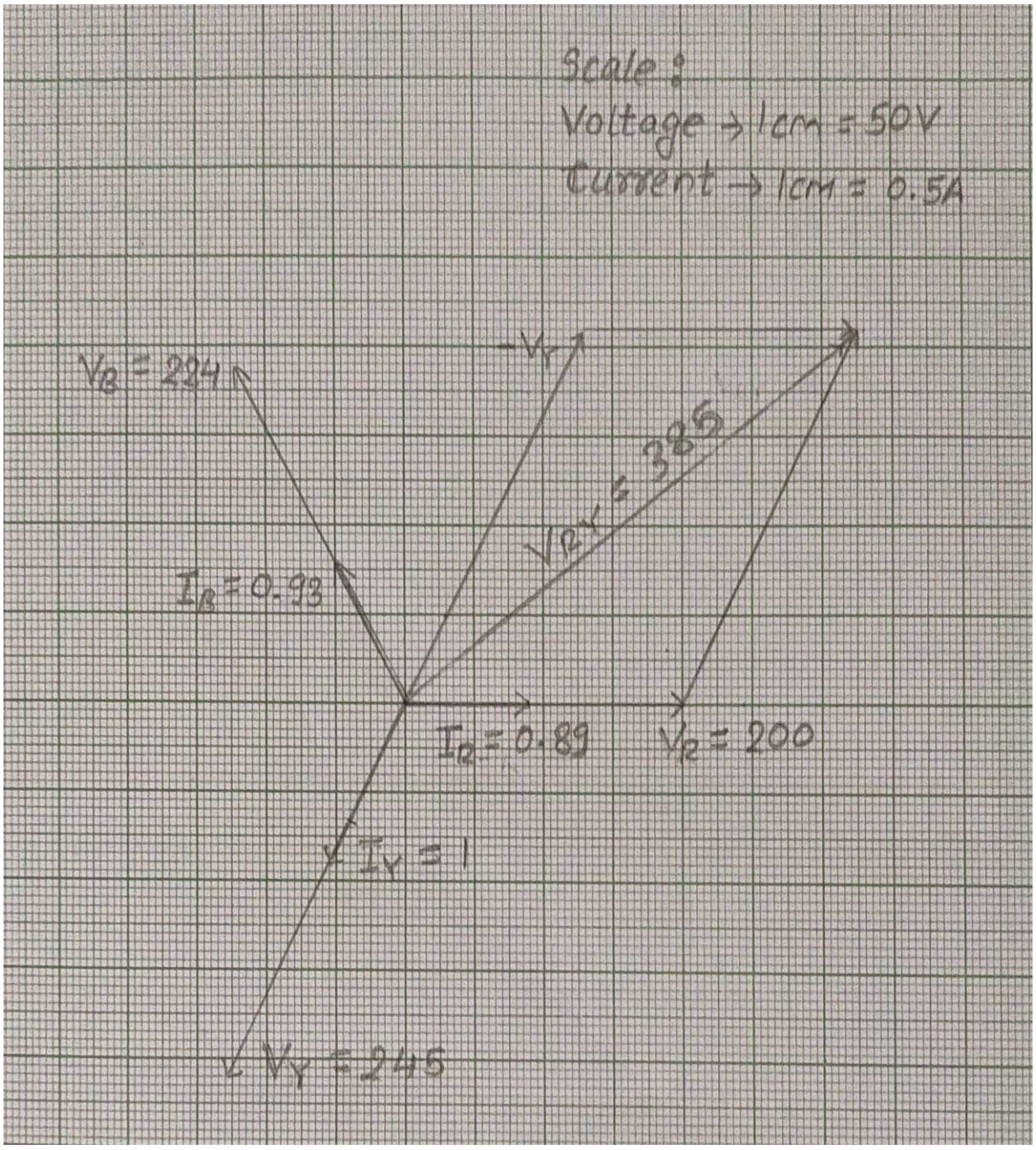
3) $I_{L3} = \sqrt{3} I_{PH3}$ = 3.63 A, $P_{total} = \sqrt{3}\ V_{L3} I_{L3} \cos\phi$ = **2816.73 W**

6.8 Result Table:

Sr. No.	Line for Voltage Given Star (V)	Line Voltage Calculated for Star (V)	Line Current Given for Delta (A)	Line Current Calculated for Delta (A)	Total Power Consumed by Star Load (W)	Total Power Consumed by Delta Load (W)
1	354	346.41	2.2	2.25	533.99 W	1745.9 W
2	392	387.97	2.9	2.94	624.95 W	2281.31 W
3	440	424.35	3.7	3.63	734.99 W	2816.73 W

6. 9 Phasor Diagrams:

- **Phasor diagram for star**



- **Phasor diagram for delta**