III BSC SEMESTER-V

ELECTRICITY, MAGNETISM & ELECTRONICS

PHYSICS PRACTICAL MANUAL

(PAPER V)

2022-2023

(Old Syllabus)

Department of Physics
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Index ...

MAHAVEER

CAREY FASTER'S BRIDGE

Expt. No. 1 Name. Date. 22-10-2021 Page No. 1

Aim:- To Compare two nearly equal resistance and to determine the specific resistance of a wire.

Apparatus:- Carry Fosters bridge, Two nearly equal resister resistance, sensitive galvanometer, jokey, unknown resistance wire, standard resistance.

Formula:- Resistance of the given wire

$$X = Y + (l_2 - l_1)\rho\,\Omega$$

Where, x = known standard Resistance

l_1 = Balancing lenght of the left side.

l_2 = Balancing length of the Right side

Specific resistance of the material of the wire is

$$S = \frac{X \cdot a}{L} \text{ ohms.cm}$$

Where, X = resistance of the wire.

a = area of cross-section of the wire

$= \pi r^2$

r = radius of the wire.

l = length of the wire.

Theory:- The carey faster's bridge is in a defined from a metre bridge in which effective resistance of bridge wire is considered without increasing the actual length of the wire if consists of four gaps two equal resistance on connected two gaps G_1 and G_2. Two neary equal resistance X and Y which have to be compared and are connected in gaps G_3 and G_4. The cell connected

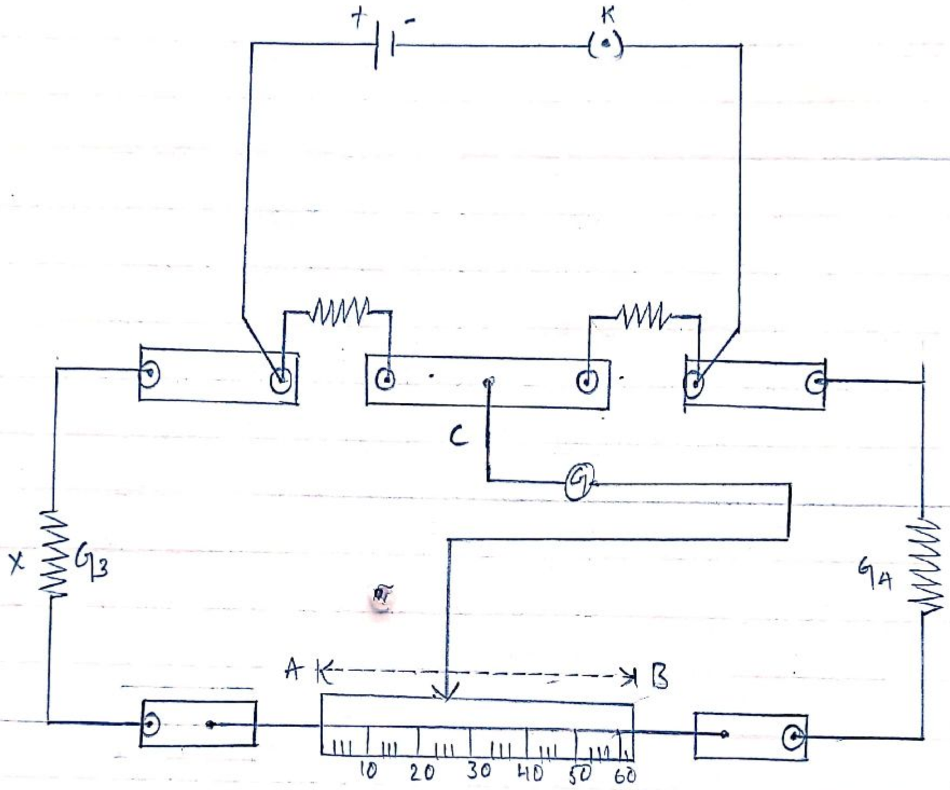

Fig :- Circuit diagram for carey faster's Bridge b/a. A and B through key. The point C between P and Q is connected to a jockey through a resistive galvanometre G.

Principle:- Let l_1 be the balancing length from the end A and B ρ to be linear density of the bridge box.

Acc to be principle of wheat stone's bridge, we have

$$\frac{P}{Q} = \frac{x + l_1\rho + a}{y + (100 - l_1)\rho + b} \longrightarrow ①$$

Now, If the resistance x and y if the gaps G_3 and G_4 ar Interichcharged, let the corresponding balancing length be l_2 then,

$$\frac{P}{Q} = \frac{y + l_2\rho + a}{x + (100 - l_2)\rho + b} \longrightarrow ②$$

From equation ① and ②, we have

$$\frac{x + l_1\rho + a}{y + (100 - l_1)\rho + b} = \frac{y + l_2\rho + a}{x + (100 - l_2)\rho + b}$$

Adding 1 on both sides, we get

$$\frac{x + l_1\rho + a + y + (100 - l_1)\rho + b}{y + (100 - l_1)\rho + b} = \frac{y + l_2\rho + a + x(100 - l_2)\rho + b}{x + (100 - l_2)\rho + b}$$

$$\frac{x + y + 100\rho + a + b}{y + (100 - l_1)\rho + b} = \frac{x + y + 100\rho + a + b}{x + (100 - l_2)\rho + b}$$

Now, equating the denominators, we get

$$x + (100 - l_2)\rho + b - y + (100 - l_1)\rho + b$$

$$\therefore x = y = (l_2 - l_1)\rho$$

Thus the difference between the two resistance (x and y) is equal to the resistance of the bridge wire b/a the two balance points.

To determine the linear resistance ρ (resistance per cm) of the bridge wire (or) collibration of the bridge wire:-

S.No	Standard Resistance (x)	Balancing length		linear Resistance $\rho = \frac{x}{(l_2 - l_1)}$ ohm/cm
		When x is in G_3 (l_1 cm)	When x is in G_4 (l_2 cm)	
1	0.1	45.6	50	0.02
2	0.2	71.8	66.7	0.039
3	0.3	65.5	76	0.028

Mean value of ρ = 0.029

To determine the resistance of x of the given wire :-

S.No	Resistance (Ω) Y	Balancing length (cm)		$X = Y + (l_2 - l_1) \rho$ (ohm)
		left (l_1)	Right (l_2)	
1	0.1	61.7	23.2	~~1.6165~~
2	5	44.9	88.4	2.2615

Resistance of the wire = 1.939

proceding and whole down the balancing length l_2 for the same value of the standard resistance.

13. Note down the observations in the table.

14. Calculate the linear resistance ρ of the bridge wire in each base and their fixed the main value of ρ.

→ To determine the resistance of the given wire:-

1. Keep the circuit connections the same as above.
2. Connect the wire for x is in the gap G_3 and standard resistance of 1 ohm for Y in the gap G_4.
3. Close the circuit by means of the key.
4. Press the jockey along, the bridge bridge wire as different until the galvanometre shows zero deflections.
5. Find the balancing length with the M.R in the wire.
6. Cut off the H.R and fixed the exact balancing length the scale from the left end A of the bridge wire.
7. Interchanged the unknown resistance wire and the standard resistance (1Ω) so that the standard resistance is in the gap G_3 and the wire in gap G_4.
8. Fixed the balancing length with the M.R and by short circuting the H.R.
9. Find the exact balancing length l_2.
10. Repeat the above procedure, using known resistance.
11. Note down the observations in the table.
12. Calculate the resistance of the given wire using the relation

$$X = Y + (l_2 - l_1)\rho$$

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Calculation:-

$$\rho = \frac{X \pi r^2}{L}$$

$$= \frac{3.2207 \times 10^{-3}}{66}$$

$$= 4.8799 \times 10^{-5} \text{ ohm-cm}$$

KIRCHOFF'S LAWS

Expt. No. 2 Name. Date. 29-10-2021 Page No. 6

Aim:- To verify Kirchoff's laws.

Apparatus:- 1. Battery - 1 (0-30V)
2. Bread Board
3. Digital multimetre - 1
4. Resistor - 3 (560 Ω, 1 kΩ, 3.3 kΩ)
5. Connecting wires.

Formula:-

1. Kirchoff's current law (KCL) or Point law:-

$$I_1 = I_2 + I_3 + I_4$$

Where, I_1 = The current entering the common mode (or) junction in the circuit.
I_2, I_3 = currently leaving the common node (or) junction in the circuit.

2. Kirchoffs voltage law (KVL) or Mesh law:-

$$V = V_1 + V_2 + V_3 + V_4$$

Where, V = voltage applied to the close circuit.
V_1, V_2, V_3, V_4 = PDS accross the resistor in the closed circuit.

Theory:- An application of ohm's law for the calculation of current in possible only in the case of simple circuit where in the resistance can be reduced to simple series or parallel arrangements. The currents in the different branches of a complicated mesh (or) network of conductor one to

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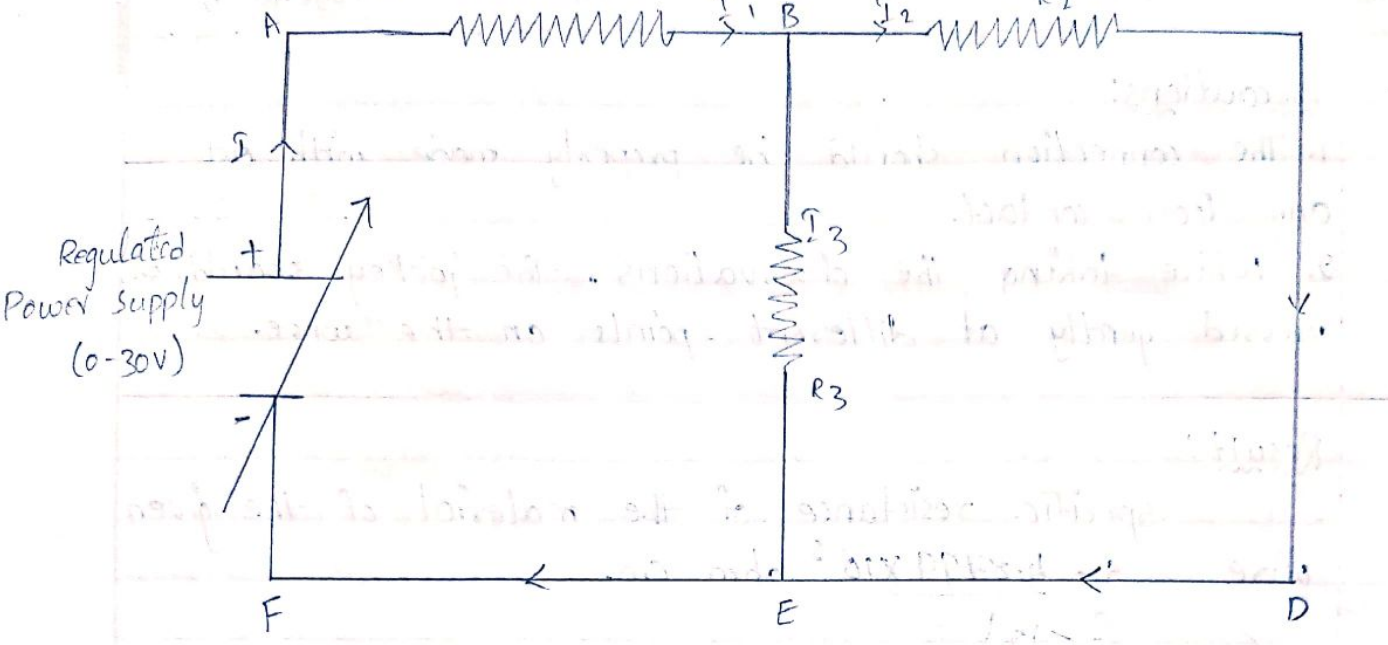
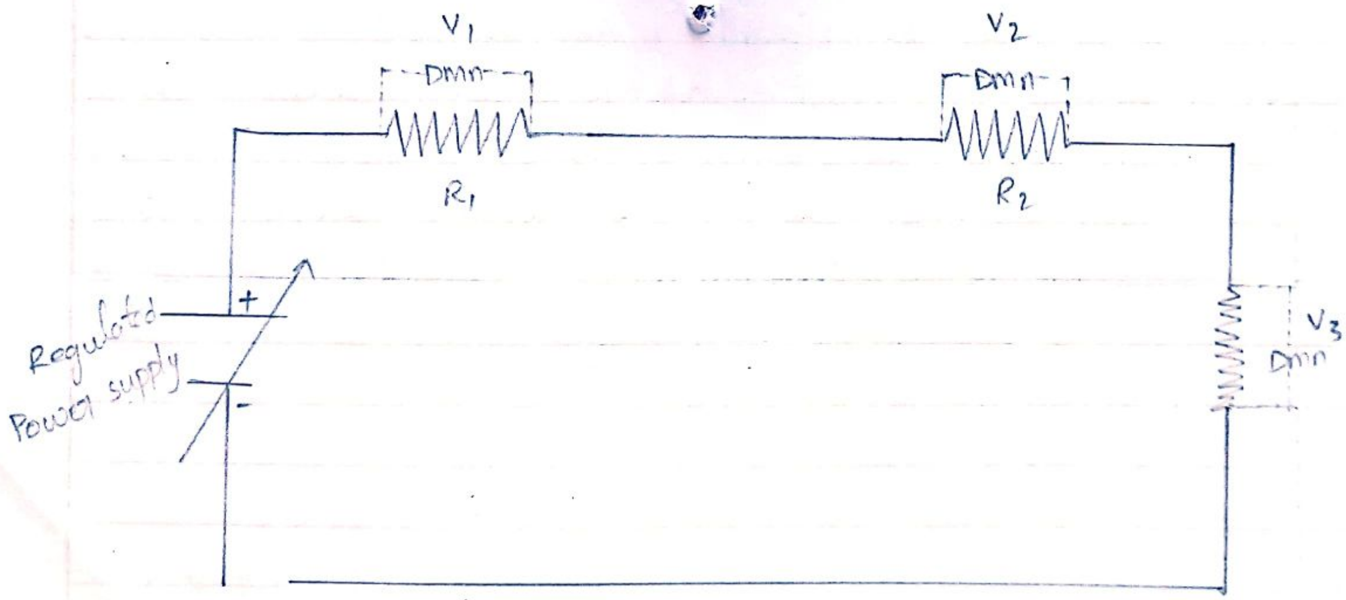
Circuit diagram to verify kirchoff's current law:-



Circuit diagram to verify kirchoff's voltage law



To verify kirchoff's voltage law (KVL) (or) Point law:-

S.NO	Applied voltage (v)	Current flowing out of the node				$I = I_1+I_2+I_3+I_4$ (amp)
		I_1	I_2	I_3	I_4	
1	1.36	0.44	0.36	0.27	0.29	1.36
2	1.39	0.45	0.37	0.27	0.30	1.39
3	1.41	0.48	0.38	0.28	0.27	1.41
4	1.45	0.47	0.38	0.28	0.31	1.45
5	1.54	0.49	0.40	0.30	0.32	1.52
6	1.63	0.50	0.47	0.31	0.34	1.63

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be calculated. Ohm's law will be in adequate.
Kirchoff's law is very useful to calculated with the study currents flowing in different in branches of a network and also voltage, drops accross different branches in a network. Then can be started in the flowing way.

1. Kirchoff's Current law (KCL) (or) Point law:-
The algebric sum of the current meeting at any node (point (or) junction) in an electrical circuit is zero. Mathematically, this law can be expressed as $\Sigma x = 0$
The sum of the currents flowing towa-rds a node is equal to the sum of the currents out of the node mathematically, this law can be expressed as Σ
∴ According to kirchoff's current law

$$I_1 + I_5 + I_6 = I_2 - I_3 - I_4 = 0 \quad (or)$$
$$I_1 + I_5 + I_6 = I_1 + I_3 + I_4 = 0$$

2. Kirchoff's Voltage law (KVL) (or) Mesh law:-
If any closed circuit, the algebric sum of the products of the current of the resistance in each point of the circuit is equal to the total e.m.f in the circuit +. this law can be expressed as $\Sigma IR = 0$

(or)

The algebric sum of the voltage drops around

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To verify Kirchoff's voltage law (KVL) (or) Mesh law:-

S.NO	Applied voltage (V) volts	P.D accross the resistor				$V = V_1 + V_2 + V_3 + V_4$ (volts)
		V_1	V_2	V_3	V_4	
1	1.08	0.02	0.04	0.80	0.16	1.08
2	1.02	0.02	0.04	0.75	0.15	1.02
3	1.10	0.02	0.04	0.81	0.17	1.10
4	1.15	0.02	0.04	0.85	0.17	1.15
5	1.24	0.03	0.05	0.92	0.19	1.24
6	1.28	0.03	0.05	0.95	0.20	1.28

any closed loop of a network will be equal to zero at all instants of line. Mathematically, this law can be expressed as $\Sigma u = 0$.

As the current passes through the circuit, the sum of the voltage drops around this is equal N_3 in the loop.

Procedure:-

To verify kirchoffs current law(KCL):-

→ Make the circuit connection as shown in fig.

→ A battery of e.m.f E volt 10-30 and two resistance R_1 and R_2 are to be connected in series.

→ Connect another resistor R_3 at the junction of R_1 and R_3, then the circuit is called as T-networks.

→ switch on the regulated power supply and set the applied voltage to the circuit $V=2V$

→ Measure the current I_1, I_2 and I_3 passing through the resistors R_1, R_2 and R_3 using digital Multi-meter.

→ Find the sum of the current (I_2+I_3) passing through R_2 and R_3, which should be equal to I_1.

→ If the value I_2+I_3 is equal to I_1, then kirchoff's current law is set to be verified.

→ Repeat above procedure by applying various voltages to the T-Network for the same values of ~~R for~~. R_1, R_2, R_3 and R_4.

→ Note down the observations in the table.

To verify Kirchoff's voltage law (KVL) (or) Mesh law:-

→ Make the circuit connections as shown in fig.

→ Convert the three resistaors R_1, R_2 and R_3.

→ Switches on the power supply and set applied digital multimeter.

→ Find the sum of the P.D.S $(V_1+V_2+V_3+V_4)$

→ If the value of $(V_1+V_2+V_3+V_4)$ is equal the applied voltage (V) the kirchoff's voltage law is said to be verified.

→ Read the above procedure by applying various voltages to the circuit for the same values of R_1, R_2 and R_3.

→ Note down the observations in the table.

1. The ends of the connecting wire should be cleaned well with a sand paper.
2. The connection should be tight and neat.

Result:-

1. As the current flowing towards the node is equal to the sum of the currents flowing out of the node in circuit.

2. As the algebric sum of the P.D in the closed circuit is equal to the total e.m.f in the circuit.

∴ Kirchoff's voltage law (KVL) is verified.

FIGURE OF MERIT OF A MOVING COIL GALVANOMETRE

Aim:- To determine the figure of a moving coil galvanometre.

Apparatus:- moving coil galvanometre (Ballistic galvanometre or spot galvanometre), two high resistances boxes, low resistance box (1 to 10Ω) battery, plug-key, Commutator and connecting wires.

Formula:- $\eta = i/\theta$ micro amp/m.m

Where η = figure of merit of the galvanometre.

i = current passing through the galvanometre

$$i = \frac{Ep \times 10^6}{(P+Q)(R+G)} \text{ micro-amp}$$

E = E.M.F of the battery (1.6 volts)

P.Q.R = Resistance

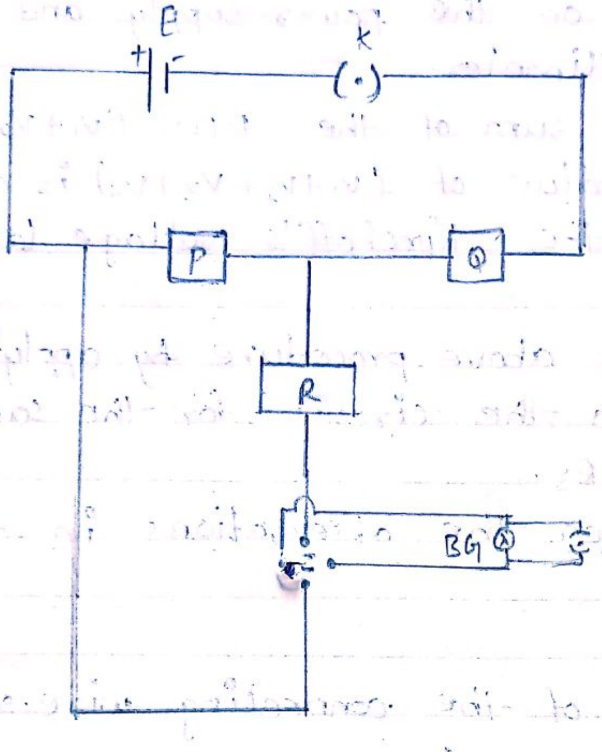
G = resistance of the galvanometre (to be determine by ½ = deflection method)

θ = deflection of the galvanometre.

Procedure:- This experiment is to be performed in two parts (i) determination of the resistance of the galvanometre by half-deflection method and

(ii) determination of the figure of the merit of the galvanometre.

- Two resistance boxes P and Q are to be connected is series with a battery of E.M.F. E volts and plug


E
k
+
P
Q
R
BG
K

To determine the figure of merit of the galvanometre

$P+Q = 10000$ ohm :-

Resistance			deflection		Mean	current =	figure of Merit
P	Q	R	left θ_1	Right θ_2	$\theta = \frac{\theta_1+\theta_2}{2}$	$i = \frac{EP \times 10^6}{(P+Q)(R+G)}$ (micro amp)	$\eta = i/\theta$
5	9995	1000	9.2	9.3	9.25	0.666	0.0723
4	9996	1000	7.4	7.5	7.45	0.533	0.071
3	9997	1000	5.7	5.8	5.75	0.4	0.069
2	9998	1000	3.8	3.8	8.8	0.266	0.07
1	9999	1000	2.2	2.2	2.2	0.133	0.060

Mean value of η = 0.0684 amp/m.m.

To determine the resistance of the galvanometre:-

Resistance		Resistance in R		$G = R_2 - 2R_1$ (ohm)
P	Q	full deflection (R_1)	halfdeflection (R_2)	
5	9995	1000 (9.2)	2200 (4.6)	200

key. K as shown in the fig 13.1 connect area material of P to one of the terminals of the commutator C, through a resistance R, and other terminals of P to the opposite terminals of the commutator. Between the other two opposite terminals of the commutator, connect the moving coil galvanometre G and the droping key.

E = Battery (1.6V), K = Plug key
P = law range resistance box (10Ω)
R = Resistance box (5000Ω)
Q = High range resistance box (10.000Ω)
C = Commutator
G = moving coil galvanometre.

Before taking the observations, the loop and scale arrangme-nt should be made properly at given below.

Priliminary adjustments of lamp and scale arrangement:- Place the lamp and scale arrangement at a distance of 1 water from the mirror of lamp moving coil galva-nometre switch on the lamp and close the galvanometer key, How the spot of light moves on the transparement scale. Adjust the lamp and scale arrangement so that the incident light from the lamp to reflected from the mirror so to the scale and the centre of the cross wires is the light spot coinside with the centre of the scale (and the centre) i.e., the spot read zero on the scale.

1. To determine the resistance G of the galvanometre by half - deflection method :- In order to determine the resistance G of the galvanometre, keep $P = 1$ ohm and $Q = 9999$ ohm with $R = 0$. Set the commutator is one direction close the main circuit and note the full deflections of the spot of light on the left side of the scale. Then reverse the direction of the current by means of the commutator and note the full deflection of the spot light on the right side of the scale.

Now plug out a suitable resistance from the resistance box, R (say R_1) until the deflection is Reduced to half of its value note the value of R_1 in the table 13.1 reverse the direction of the current and note the value of resistance R_2 for half-deflection. Find the average value of the resistance R. i.e. $(R_1+R_2/2)$. This value is equal to the resistance G of the Galvanometre. Repeat the experiment with $P = 2, 3$ and 4 $Q = 9998, 9997, 9996$ keeping $P+Q = 10000$. Find the average value of G. Note the observations in the table 13.1

Note:- If the deflection of the spot light doesnot lie within the scale limit, when $R=0$ then introduce suitable resistance in R (say R_1) so the spot of light values equal distance (in R_2) on either side of the centre of the transparent scale, with in the scale limit of the transparent scale, within the scale value (say R_2) till the deflection is reduced to half of its value. Then the resistance of the galvanometre $G = R_2 - R_1$.

2. To determine the figure of merit m of the galvanometre:

LCR CIRUIT - SERIES RESONANCE

Expt. No. 4 Name Date. 9-11-2021 Page No. 14

Aim:- To study frequency response characterstics of L.C.R series resonance circuit and to determine the resonance frequency and quality factor.

Apparatus:- A singual Aquator (corillator for function operator) V.T. V.M (vaccum tube voltmetre) a milli--meter condenser, an distance coil, a resistance box and connecting wires.

Formula:-

(i) Theoritical Formula:-

1. Resonance frequency of the series resonant circuit is $f_0 = \frac{1}{2\pi\sqrt{LC}}$ Hz.

2. Quality factor of the circuit is

$$Q = \frac{1}{R}\sqrt{L/C}$$

where, R = resistance of the resistor (Ω)
L = Inductance of the coil (henry) — 9.53×10^{-3}
C = Capacitence of the coudeser (found) — 0.55×10^{-6}

(ii) Experimental Formula:-

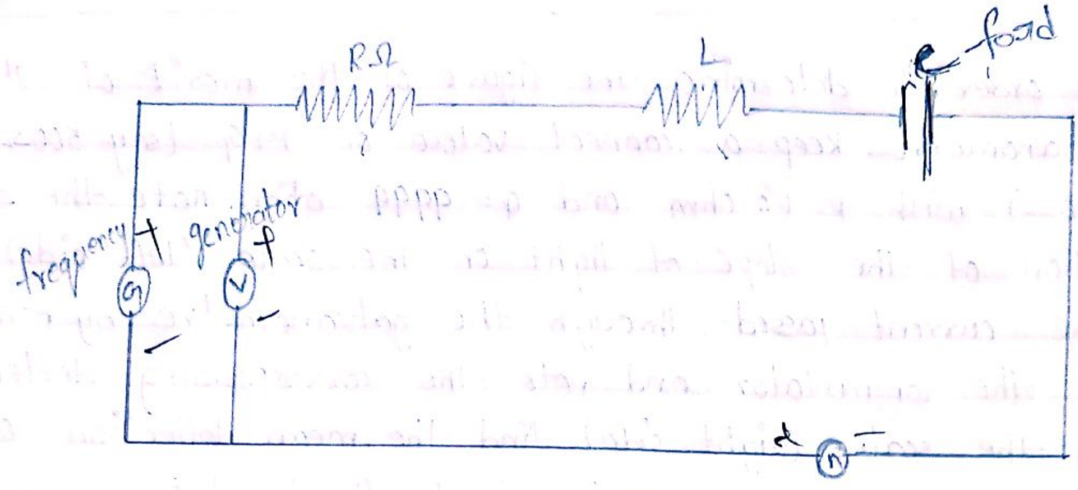
1. Resonance frequency of the circuit of

F_0 = ________ Hz (from the graph)

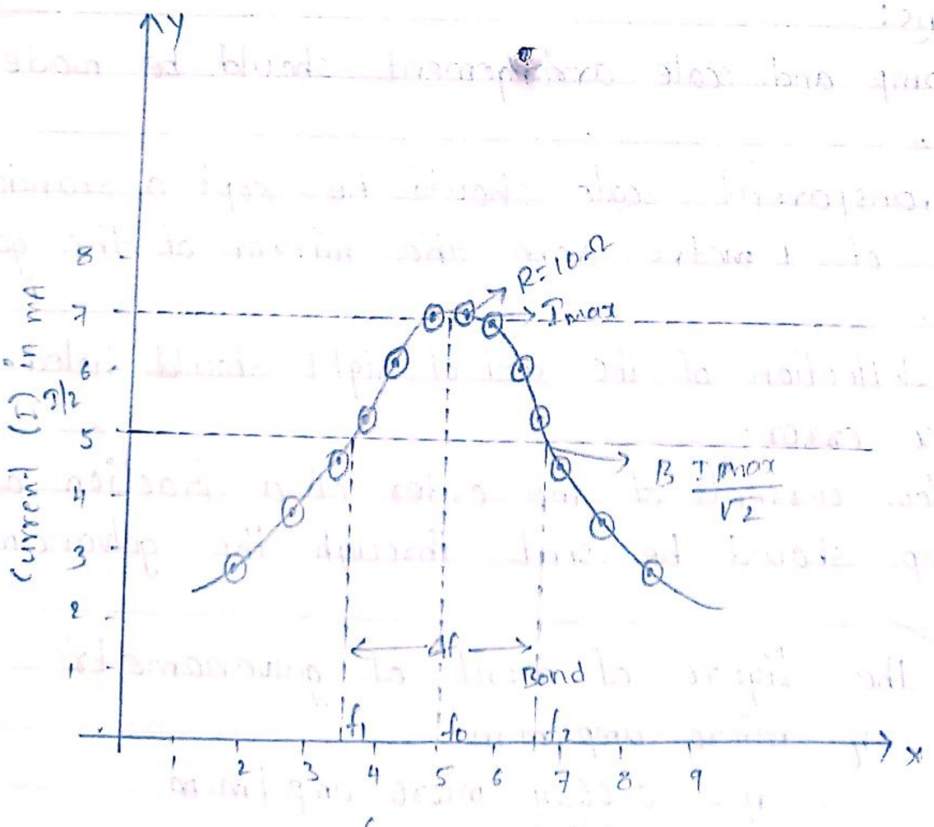
2. Bond width of the resonant circuit

$\Delta f = (f_2 - f_1)$ Hz (from the graph)

where, F_1 = lower holy power frequency.
F_2 = upper holy power frequency.


R Ω
L
C
fixed
frequency generator
G
V
+
-
mA

Graph:


Y
X
Current (I) in mA
frequency (F) in kHz
R=10Ω
Imax
B Imax/√2
Δf
Band
f1
f0
f2

Frequency (Hz)	Current (mA)
200	1.2
300	1.8
400	2.2
500	2.8
600	3.2
700	3.8
800	4.2
900	4.8
1000	5.2
2000	7.2
2200	7.2
2400	7.2
2600	7.2
2800	7.2
3000	7
4000	7.2
5000	6.4
6000	5.8
7000	5.2
8000	4.6
9000	4.2
10000	3.8

3. Quality factor of the circuit $Q = \frac{f_0}{\Delta f}$

Theory:- A coil of the self inductance L resistance R and a condunser of capacitence C are connected in series with a source of AC supply as shown in fig. This circuit is known as series L.C.R circuit where an altemating voltage of a pure shine wall from which is represent by $E = E_0 \sin wt$

Procedure:- A coil of self inductance L (15mh), a condunser of capacity e (0.01 uf) a resistance R (10Ω) and m.m A are to be connected in series with the signal generator as shown in the fig. Switch on the signal generator. Adjust the frequency and of the signal generator so that the frequency, f of the AC signal is to 2KHZ "Adjust the amplitude of the input signal to a convinient value by means of VB.T.V.M. i.e, the input voltage V_i then, of the current I is the circuit shown by the m.m A.

Increase the frequency of, f of input signal in convinient steps, keeping the input voltage, V_i Constant throught the experiment. Then the in current increase slowly at the bigining after words increase sharply and then reaches a peak value called the sharpness of the resonanance. This will happen when the frequency of the applied voltage is equal to the natural frequency of the circuit i.e. resonance occurs this frequency of which the current reaches a peak

Calculation:-

From Graph:-

$f_1 = 1000$

$f_0 = 2400$

$f_2 = 7300$

$$= \frac{f_2 - f_1}{f_0} = \frac{7300 - 1000}{2400}$$

$$= 2.625 \text{ Hz.}$$

Experimental:-

$$f_0 = \frac{1}{2\pi\sqrt{LC}}$$

$$= \frac{1}{2 \times 3.14 \sqrt{9.53 \times 10^{-3} \times 0.55 \times 10^{-6}}}$$

$$f = 2199.44 \text{ Hz}$$

value is called the resonance frequency f_0. At the resonance frequency, the current is maximum and the independence is minimum. again increase the frequency of the input signal beyond the resonance frequency then the current through the circuit gradually decreases. Note the observations in table.

Repeat the experiment by introducing different values of R in the circuit, for the same values of L an C, keeping the input voltage V_i constant through out the experiment the thereotical values of the reson-ance frequency, f_0 and the quality factor Q can be calculated using the formulas.

Graph:- Draw a graph with frequency, f on the x-axis the current I on the Y-axis. A sharp resonance curves as an figure, will be obtained from the graph. Note the maximum current I_0 and the corresponding frequency at which the current is maximum. This frequency is called as resonance frequency f_0.

To determine the both width (Δf) and quality factor Q.

From the graph, find the values of $I_0/\sqrt{2}$ (or) ($0.707/I_0$) usark the value of $0.707/I_0$ on the Y-axis from the value draw a line parallel to axis on x. This line cuts the curve at two parts A, B called the half power point from the point. A and B draw lines parallel to Y-axis, which needs the x-axis at two points correspo-nding to the frequency f_1 and f_2 call the half power

frequencies on either side of the resonance frequency fo.
Board width of the circuit $\Delta f = (f_2 - f_1)$ Hz
quality factor of the circuit, $Q = f_0$
The theoreotical and experimental values of the resonance frequency fo and the quality factor Q are to be compared.

Precautions:-
1. A field amplitude of the input signal should be applied to the circuit for the selected values of L.C and R at different frequency.
2. The input voltage applied to the circuit should be checked at all the frequencies.

Result:- The theoreotical and experimental values of the resonance frequency fo and the quality factor Q are calculated, they are found to be equal.

Perametre Resonance	Theoritical	Experimental
frequency of (HZ)	2199.44 HZ	2.625 HZ
quality factor (Q)		

SONOMETRE FREQUENCY OF A.C SUPPLY

Expt. No. 5 Name Date. 16-11-2021 Page No. 18

Aim:- To determine the frequency of the A.C supply using a sonometre.

Apparatus:- A sonometre a steel wire, an electromagnet, a weight hanger with suitable slotted weights a stepdown transformer (230 v to 6 volts) and a screw guage.

Formula:- $f = n/2$ Hz

Where f = frequency of AC supply.

n = natural frequency of the vibrations of the wire

$$n = \frac{1}{2l}\sqrt{\frac{T}{m}} \text{ Hz} \quad (\text{or}) \quad \frac{1}{2\sqrt{m}} = \sqrt{\frac{T}{l}}$$

Where T = mg

l = length of the vibrating sigment of the steel wire.

Where T = Tension applied to the sonometre.

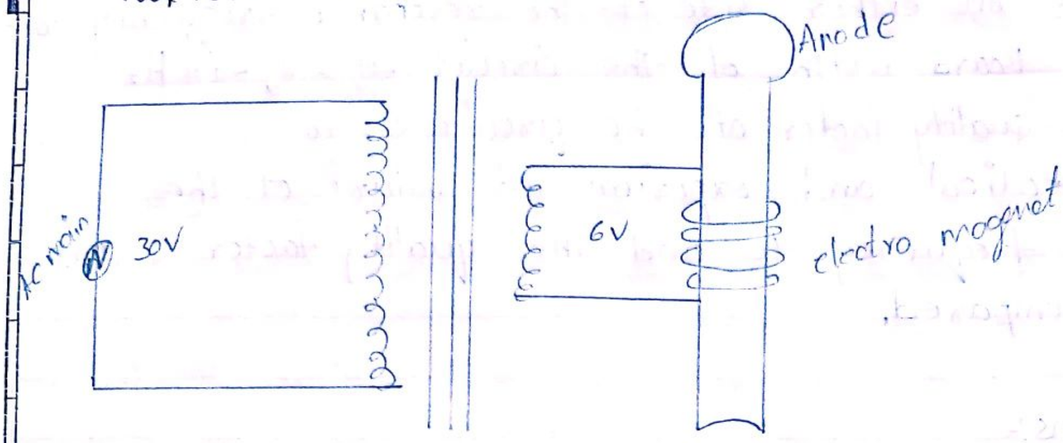
m = mass suspend to the weight hanger.

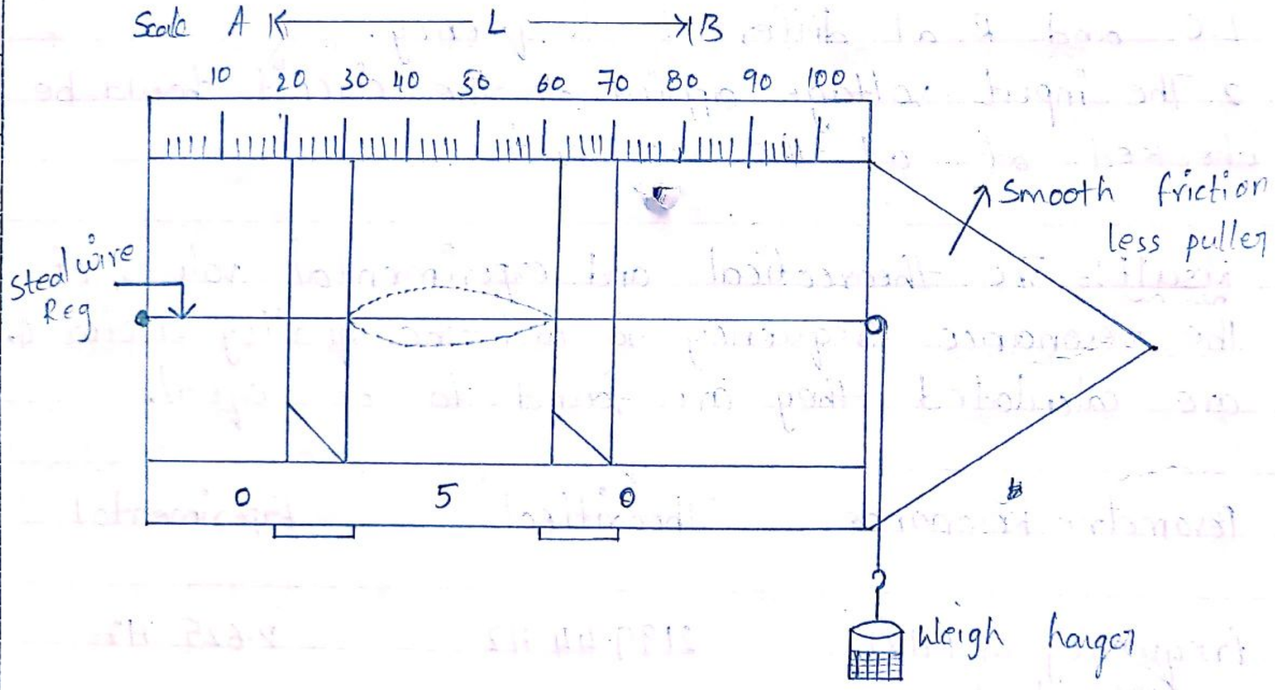
r = radius of the given wire.

ρ = density of the given wire.

Description:- A sonometre consists of a hallow rectangular wooden box's a beat 125 cm 100g and 15 cm with two edges shaped wooden bridge A and B with metallic edges projecting upwards are place on the top of the box, A steel wire of uniform cross section is stretched parallel to the length of the box which passes ares the two bridges A and B are end of the steel wire is tastered to a peg, G at are and of the sounding box and the other end of the steel. Wire passes over a smooth friction less pulley P and

Step-down Transformer:-





Determine the value of $\sqrt{T}/l$:-

Mass attatched mgm	Tension $T = mg$ dines	Distance b/w two knife edges at resonancy		Average $l = \frac{l_1+l_2}{2}$	$\sqrt{T}$	$\sqrt{\frac{T}{l}}$
		While decreasing load $= l_1$	While increasing load $= l_2$			
3000	2940000	73	75	74	1714.64	23.170
2500	2450000	68	69	68.5	1565.25	22.850
2000	1960000	55	59	57	1400	24.561
1500	1470000	50	53	51.5	1212.43	23.542
1000	980000	43	44	43	989.94	22.757
500	490000	30	30	30	700	23.333

Avg: 23.3688

carries a weight barger 'w' by placing a suitable load on the weight hanger tension can be produced in the wire. A meter scale is fixed parrallel to the length of the box at the top to measure the length of the vibration segment of the wire between the measuring bridges Mouls are provided are side of the box through which the energy of vibration is communicated to the external air which intesifies the sound of not product on the top of the box. A cylindrical electromagnet which is supported by measure a report stand is kept perpendicular to the length of the steel wire. The AC supply mains whose frequency is to be determine is connected in the primary of the stepdown transfo--rmer of 230 volts and secondary is connected to electromag--net.

Principal:- When as alternating current of low voltage, passing through an electromagnet is kept vertically the sono metre wire stretched boder a constant tension then it gets magn--etised during each cycle of the i.e., the end of the electro--magnet falling the wire altequally becomes a worth pole and a south pole. Then the wire is attracted and pulled in their in each cycle of the A.C if the distance between the two bridges of the sonometre wire is so adjusted that the natural frequency of vibration of the wire becomes equal to double the frequency of A.C supply. The resonance accury and the wire is thrown zata resonance vibrations i.e., the wire vibrating with minimum which appearly in the force of a loop at the resonance position the frequency

To determine the radius of the wire using Screw Guage:-

L.C = 0.01

Error :- 9 Correction: +9

P.S.R (a) mm	H.S.R		a+n.(L.C) mm
	observed	Correction	
0	32	41	0.41
0	30	39	0.39
0	29	38	0.38

Avg D = 0.3933 cm

radius r = D/2 = 0.196 cm

= 0.0196 cm

of the AC supply $f = n/2$

Procedure:- Take a steel of uniform cross-section a resonance the lock's if any streter the steel wire on the wedge shaped bridge A and B by placing a suitable box d in the weigth hanger. So that the wire is within the elastic limit, support the electromagnet by means of a retort stand and keep in the near the middle of the wire arrange the bridg-es so the the wires at equal distances on either side of the electromagnet cannot the primary coil of the stepdown transformer to the AC mains and the secondary of the electromagnet as shown in figure first keep the two bridges A and B at small distances on both sides of the middle of the wire switch on the AC mains and gradually move the bridges. At a particular length onwards the wire begins to vibrate with a small amplitude finally at one position on wire vibration with maximum amplitudes which appers in the A and B that will happen when resonance occurs i.e. when the natural frequency (n) of the vibrating segment of the wire segment of this wire between the two bridges A and B. The exact resonance position can be easily identified by the placing v-shaped light paper rides on the fluterly violated and is thrown off from the wire.

Repeat the experiment by increasing the load in equal steps of 500 gm on the weight hanger upto the elastic limit of the wire and in each case the correspond-ing length l_1 of the vibrating segment of the tabular the observations in the table, Now decrease the load in

Calculation:-

$$f = n/2$$

$$n = \frac{1}{2\sqrt{m}} \cdot \sqrt{\frac{T}{l}}$$

$$m = \pi r^2 \rho$$

$$m = (3.14)(0.0196)^2(7.85)$$

$$\sqrt{m} = 0.0973$$

$$n = \frac{1}{2\sqrt{m}} \times \sqrt{\frac{T}{l}}$$

$$= 5.1387 \times 23.3688$$

$$n = 120.018$$

$$f = n/2$$

$$= 120.018/2$$

$$= \underline{60.009} \ Hz$$

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the same steps as was done be force 500gms and in each case not the same between the bridges A and B. in find the mean length l for each load.

For each load find the value of $\sqrt{T}/l$ find the diameter of the steel wire using a screw guage and note the observations in the table. The linear dencities m of the steel wire can be as experiment below the AC supply can be calculated the formula.

Precautions:-

1. The wire should be uniform throughout and free from knots.
2. The pully should be frictionless.
3. The electromagnet should be place vertically above the centre of the wire.

Result:- Frequency of AC supply f = 60.009 Hz

STEWARD AND GEE'S GALVANOMETRE

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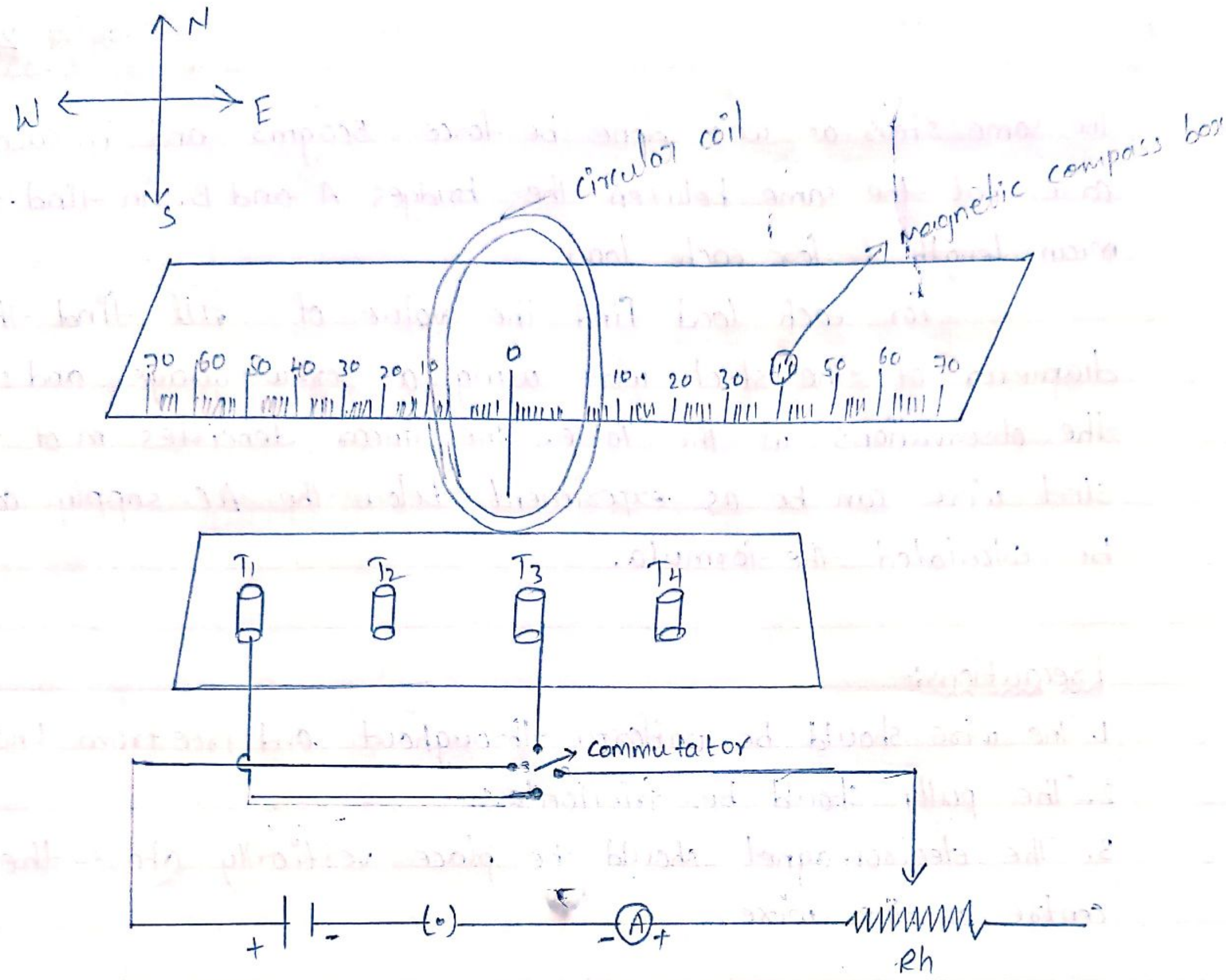
Aim:- To study the verification of the intensity of field along the axis of a circular coil carring current using steward and Gee's ~~galvo~~ type of tangent galvanometre.

Apparatus:- steward and gee's type of tangent galvanometre, battery, commutator, ammeter (0 to 30) plug key and connecting wire.

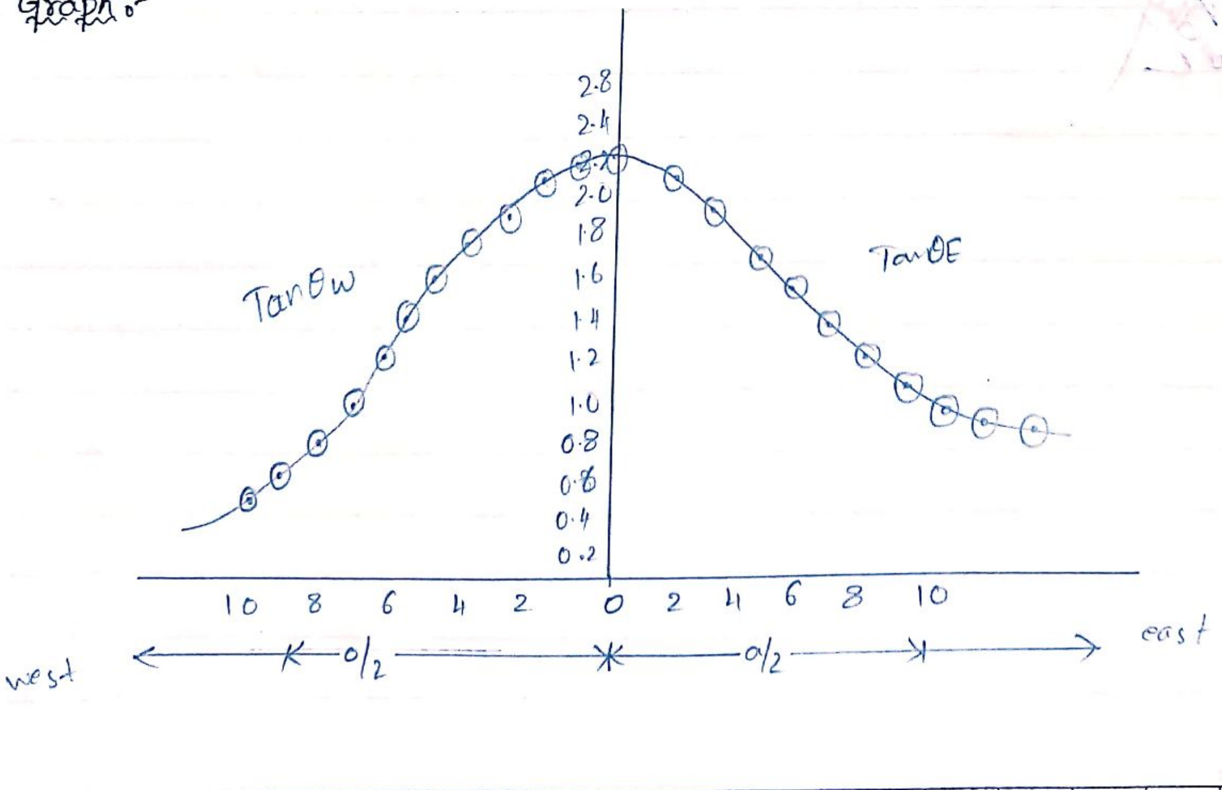
Formula:- $B = \frac{2\pi n i a^2}{10(x^2+a^2)^{3/2}}$

Where, B = intensity of the magnetic field of a point on the axis of circular coil carring current.
n = number of turns of the coil.
i = current flowing to the coil.
a = radius of the coil
x = distance of magnetic needle from the coil towards to tangent law
H = Horizontal component of the earth magnetic field.
θ = Average angle of deflection when magnetic needle $(\theta_E + \theta_W)/2$
θ_E = Average angle of deflection when the magnetic compass box is placed on the east of the coil.
θ_W = Average angle of deflection when the magnetic compass box is placed on the west of the coil.

Procedure:- To set the circular coil in magnetic meridian (T.o.A Position):- level the wooden base B so that it is perfectly horizontal by means of the leveling screws L_1 and


N
W
E
S
circular coil
magnetic compass box
70 60 50 40 30 20 10 0 10 20 30 40 50 60 70
T1
T2
T3
T4
commutator
+
-
A
Rh

Graph :-


2.8
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
Tanθw
TanθE
10 8 6 4 2 0 2 4 6 8 10
west
east
θ/2
θ/2

Position of the tangent	Distance of magnetic needle from the current of the coil (a)	Deflection of the magnetic needle				Mean θ	Tan θ	$H = 0.38$ $B = H \tan\theta$ exp	$B = \frac{2\pi n i a^2}{10(x^2+a^2)^{3/2}}$
		East of the coil		West of the coil					
		θ_1	θ_2	θ_3	θ_4				
	0	52	52	62	62	57	1.539	0.584	0.6187
	2	49	49	63	63	56	1.482	0.563	0.6140
	4	45	45	60	60	52.5	1.303	0.495	0.5830
	6	36	36	58	58	47	1.072	0.406	0.5125
	8	26	26	48	48	37	0.753	0.286	0.4153
	10	17	17	43	43	30	0.577	0.219	0.3162
	2	47	47	62	62	54.5	1.401	0.532	0.6140
	4	39	39	59	59	49	1.072	0.406	0.5330
	6	32	32	52	52	42	0.900	0.342	0.5127
	8	22	22	46	46	34	0.674	0.256	0.4153
	10	13	13	38	38	25.5	0.476	0.180	0.3167

L_2. Place the magnetic compass box on the sliding plate from P and keep it at the centre of the coil in the obsence external magnetic field, the vertical plane of the circular coil must be along the magnetic meridian. When current is passed through the circular coil, the resultant magnetic field will be along the axis of the coil of the circular coil the following procedure be adopted.

Rotate the wooden base B in the horizontal place within the areas of the base are parallel to the aluminium pointer in the magnetic compass box and the magnetic needle is parallel to the vertical place of the circular coil in this position, the coil magnetic needle and its image all the vertical place, alluminium pointer a=0 on both sides of the circular scale of the deflection magnetometre.

To determine the angle of deflection B. of the magnetic needle:- Connect the terminals T_1 and T_2 (a=50) to the turns opposite terminals of a commutator. A battery B, rheostart B, ammeter A and plug key K to be connected in series in the other tures opposite terminals at the commutator close the key K, As the current flow through the coil it behaves as a magnetic with north pole on face and south pole on other face. adjust the rheostart till the alluminium pointer shows a deflections θ_1 and θ_2 adjust the ends of the aluminium pointer on the circular scale and kept deflection θ_3 and θ_4.

If the mean deflections of the aluminium pointer before and after reversing the directions of the current are equal it the vertical plane of the magnetic meridian.

Calculation:-

$$\frac{2\pi n i a^2}{10(x^2+a^2)^{3/2}}$$

① → $= \frac{2\times3.14\times50\times0.2\times103.02}{10(0+103.02)^{3/2}}$

$= \frac{6.469.656}{10456.7}$

$= 0.6187$

② → $= \frac{6469.656}{10(8+1045.67)}$

$= \frac{6469.656}{10536.7}$

$= 0.6140$

③ → $= \frac{6469.656}{10(64+1045.67)}$

$= \frac{6469.656}{11096.7}$

$= 0.5830$

④ → $= \frac{6469.656}{10(216+1045.67)}$

$= \frac{6469.659}{12616.7}$

$= 0.5127$

Then, slightly turns the base B of the apparatus till the deflection before and other several of the direction of current through the coil are equal.

Now, open the key, mone the platform towards east along the scale and place. It at a distance x (say 2 cm) from the centre of the coil close key and note deflection before and reversal of the distances (say 4 cm, 6 cm, 8 cm, 10 cm, 12 cm and 14 cm) until the deflection falls to about 30°. At each position field the mean deflection θ_e beyond 60°, the value of θ can not be taken Tan 90° happend to be infinity. similarly the deflection below 30°, can not be taken as Tan 0° happend to be zero.

Move the flat form towards west from the centre of the coil and note the readings in the table for the same distances as was done an east at each position field the ocean deflection θ_w and diameter of the circular coil by using scale.

Graph:- Plot a graph with distance x along x-axis with origin taking at the centre extending to east and west and the corresponding value of tan θ along y-axis a symmetrical curve of the shape as shown in fig will be obtained mark the points of inflection A and B. when the slope of the curve changes its connecting suddenly on the two broaches of the curve. The distance between the two points of inflection gives the radius of the coil.

⑤ → $\frac{6469.656}{10(512+1045.67)}$

$= \frac{6469.656}{15576.7}$

$= 0.4153$

⑥ → $= \frac{6469.656}{10(1000+1045.67)}$

$= \frac{6469.656}{20456.7}$

$= 0.3162$

Observations:-

Number of turns in the coil $n = 50$

current flowing through the coil $= 0.4$ amp

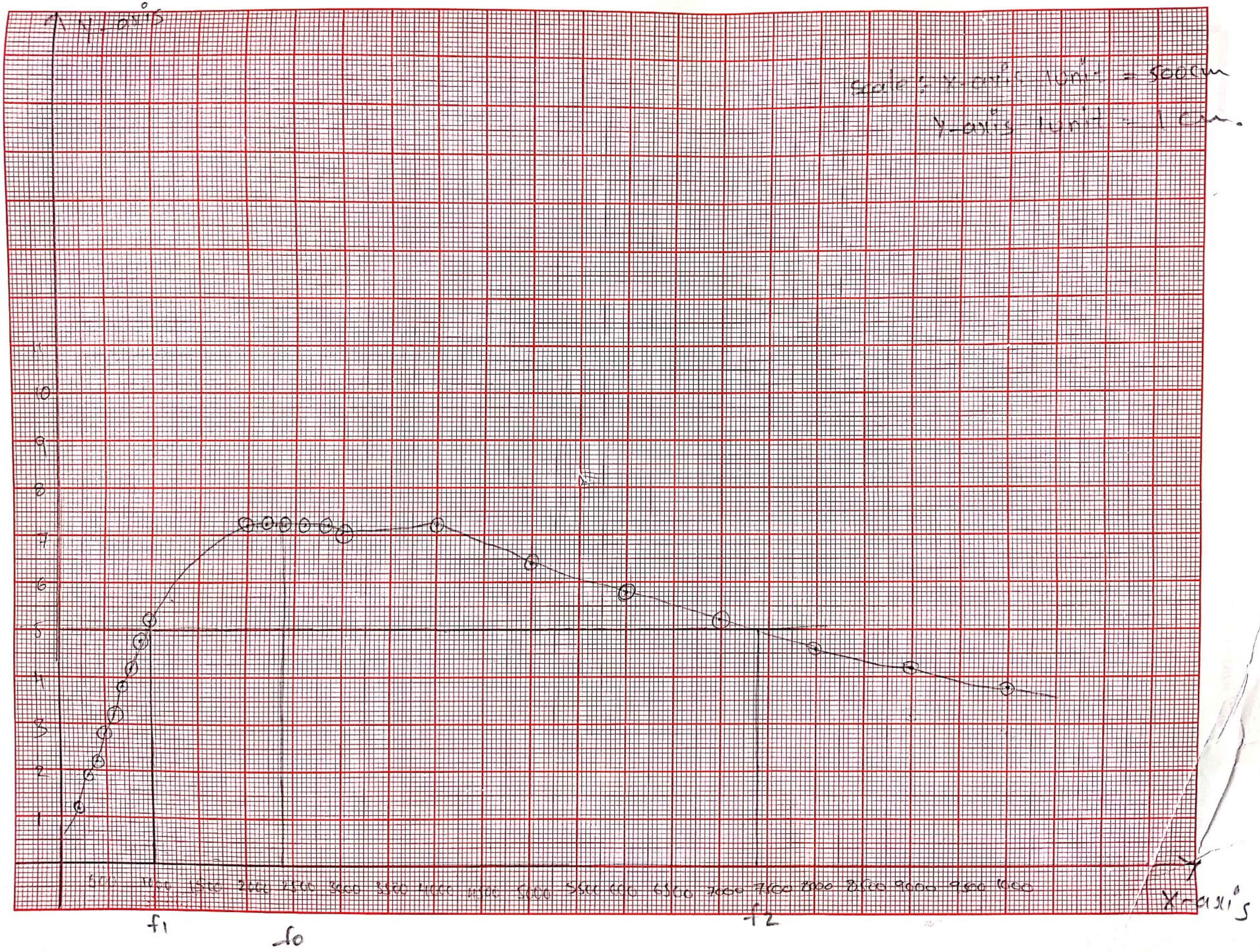
Radius of the coil $a = 9.37$ cm.

Horizontal component of earth's magnetic field $H = 0.38$ oersted

Precautions:-

1. Deflection should be kept away from the coated without parallel between the aluminium pointer and its image.
2. The place of the coil should be set in the magnetic meridian properly otherwise the magnetic needle does not obey the tangent law.

Result:- The value of $H \tan\theta$ and $\frac{2\pi n i a^2}{10(x^2+a^2)^{3/2}}$ are calculated and compared. They are found to be equal.


Y-axis
Scale: X-axis 1 unit = 500cm
Y-axis 1 unit = 1 cm.
1 2 3 4 5 6 7 8 9 10 11
500 1000 1500 2000 2500 3000 3500 4000 4500 5000 5500 6000 6500 7000 7500 8000 8500 9000 9500 10000
X-axis
f1
fo
f2

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$f_1 = 1000$

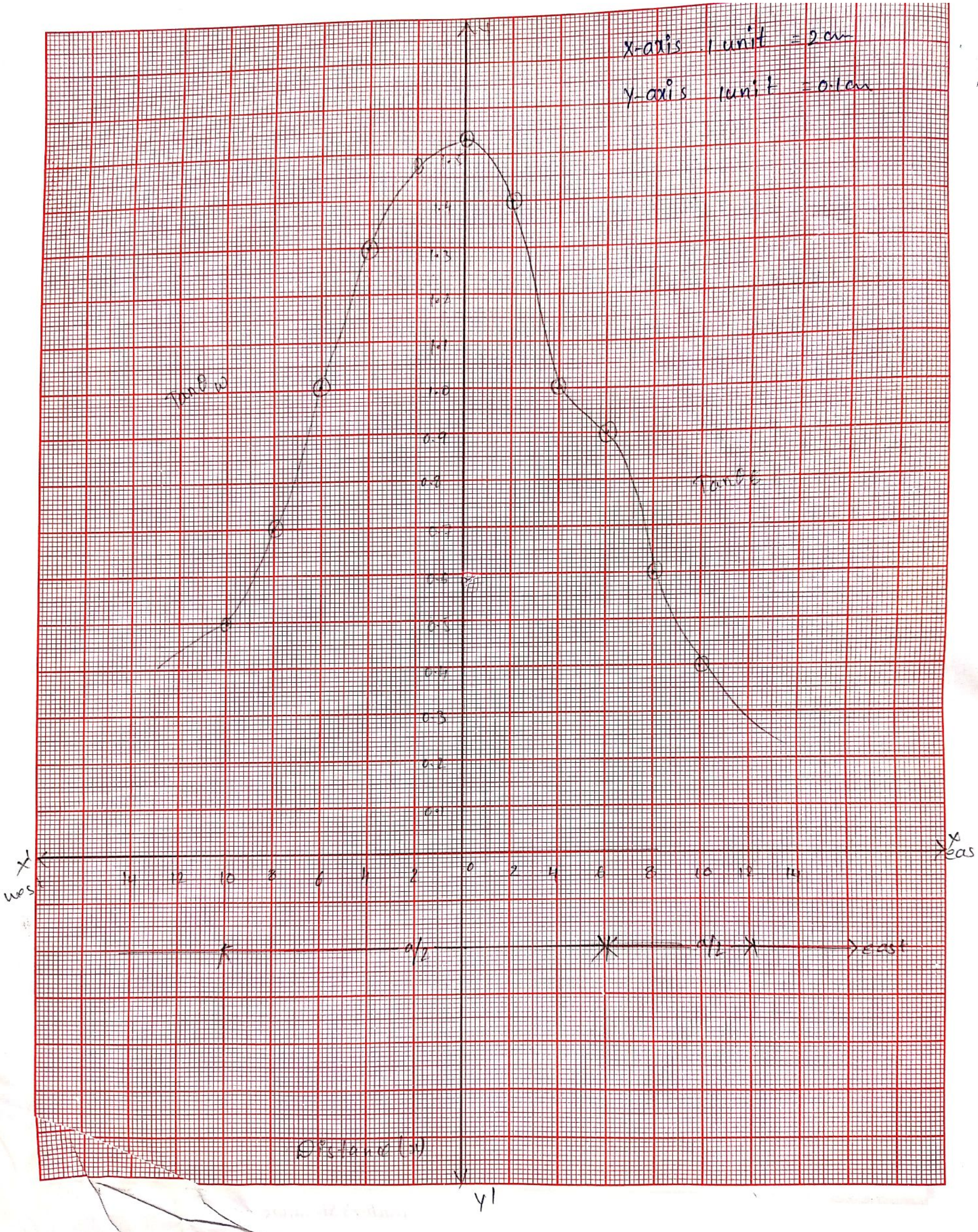
$f_0 = 2400$

$f_2 - 7300$

$$Q\ fac = \frac{f_2 - f_1}{f_0} = \frac{7300 - 1000}{2400}$$

$= 2.625$ Hz

Teacher's Signature


X-axis 1 unit = 2 cm
Y-axis 1 unit = 0.1 cm
Tanθw
Tanθe
X
west
X
east
Y
Y'
d/2
d/2
east
Distance (x)

Steward and Gee's Galvanometre

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Position of the tangent	Distance of magnetic needle form the centre of the coil (x)	tanθ
West	0	1.539
	2	1.482
	4	1.303
	6	1.072
	8	0.753
	10	0.577
East	2	1.401
	4	1.072
	6	0.900
	8	0.674
	10	0.476

Teacher's Signature