LC Oscillations and RC circuit

Group 12

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Aim:

RC circuit

To measure the charging current over time:

1. Using different capacitance values C, with constant voltage U and constant resistance R

2. Using different resistance values (C and U constant)

3. Using different voltages (R and C constant).

To determine the equation representing the current when a capacitor is being charged, from the values measured.

LC circuit

The natural frequency of the induced oscillation has to be measured each induction coil. From the natural frequency and the known capacitance calculate the inductances of the coils and determine
the relationships between
1. Inductance and number of turns,
2. Inductance and solenoid length
3. As well as inductance and solenoid radius.

Apparatus:

RC circuit

Connection box, Two-way switch, single pole, Carbon resistor [100 Ohm, 1 MOhm], Capacitor, Power supply, Stopwatch, Digital multimeter, Connecting cord.

LC circuit

Digital frequency generator, Induction Coil, Capacitor, Oscilloscope, Connection box, Adapter, Measuring tape, Vernier calliper, Connecting cord.

Procedure:

RC circuit

1. The connections were made properly such that the resistor and capacitance are in series with the battery.
2. The value of the resistance, capacitance and battery voltage was varied to get seven set of readings.

3. The following seven graphs were plotted to get a RC circuit charging curve.

LC oscillations

1. The connections were made appropriately. The function generator was set to square wave function with a amplitude of 10V and 500 Hz with signal as output.
2. The time period of oscillations were found out by the oscilloscope for 10 solenoids.

Observation:

Experiment 1 RC circuit

Part 1	v=8v	c=30microF	r=1Mohm
time	current (microA)		
0	8		
5	7		
10	5.93		
15	4.99		
20	4.24		
25	3.56		
30	3.02		
35	2.54		
40	2.16		
45	1.83		
50	1.54		
55	1.29		
60	1.08		
65	0.91		
70	0.81		
75	0.65		
80	0.55		
85	0.46		
90	0.4		
95	0.33		
100	0.27		
105	0.23		
110	0.19		
115	0.15		
120	0.12		
125	0.1		
130	0.09		
135	0.07		
140	0.06		
145	0.04		

Refer Graph 1(a)

Part 2	v=8v	c=15microF	r=1Mohm
time	current(microA)		
0	7.21		
5	6.74		
10	5.89		
15	5.07		
20	4.26		
25	3.67		
30	3.03		
35	2.51		
40	2.1		
45	1.73		
50	1.47		
55	1.26		
60	1.08		
65	0.91		
70	0.79		
75	0.67		
80	0.57		
85	0.5		
90	0.4		
95	0.34		
100	0.3		
105	0.26		
110	0.22		
115	0.17		
120	0.14		
125	0.12		
130	0.1		
135	0.09		
140	0.07		

Refer graph 1(b)

Part 3	v=8v	c=60microF	r=1Mohm
Time	current(microA)		
0	8.06		
5	7.46		
10	6.9		
15	6.52		
20	5.93		
25	5.37		
30	4.91		
35	4.52		
40	4.17		
45	3.82		
50	3.49		
55	3.22		
60	2.98		
65	2.71		
70	2.5		
75	2.33		
80	2.19		
85	1.97		
90	1.8		
95	1.66		
100	1.51		
105	1.38		
110	1.27		
115	1.19		
120	1.08		
125	0.97		
130	0.9		
135	0.84		
140	0.77		
145	0.7		
150	0.65		
155	0.57		
160	0.54		
165	0.49		
170	0.46		
175	0.42		
180	0.37		
185	0.34		
190	0.31		

Refer graph 1(c)

Part 4	v=8v	c=30microF	r=1Mohm+2.2kohm
Time	current(microA)		
0	7.92		
5	6.92		
10	5.97		
15	5.01		
20	4.32		
25	3.58		
30	2.963		
35	2.52		
40	2.12		
45	1.82		
50	1.51		
55	1.26		
60	1.09		
65	0.92		
70	0.77		
75	0.66		
80	0.53		
85	0.45		
90	0.38		
95	0.32		
100	0.27		
105	0.23		
110	0.19		
115	0.16		
120	0.12		
125	0.1		
130	0.08		

Refer graph 1(d)

Part 5	v=8v	c=30microF	r=1Mohm+1.5kohm
time	current(microA)		
0	7.94		
5	6.75		
10	5.99		
15	5.08		
20	4.27		
25	3.54		
30	3		
35	2.53		
40	2.15		
45	1.79		
50	1.51		
55	1.27		
60	1.05		
65	0.9		
70	0.75		
75	0.63		
80	0.53		
85	0.44		
90	0.36		
95	0.31		
100	0.26		
105	0.21		
110	0.17		
115	0.14		
120	0.12		
125	0.1		
130	0.08		
135	0.06		

Refer graph 1(e)

Part 6	v=7v	c=30microF	r=1Mohm
time	current(microA)		
0	6.9		
5	6.26		
10	5.11		
15	4.41		
20	3.69		
25	3.11		
30	2.6		
35	2.18		
40	1.8		
45	1.55		
50	1.32		
55	1.1		
60	0.93		
65	0.78		
70	0.64		
75	0.54		
80	0.45		
85	0.38		
90	0.32		
95	0.27		
100	0.23		
105	0.18		
110	0.15		
115	0.12		
120	0.1		
125	0.08		
130	0.06		

Refer graph 1(f)

Part 7	v=6v	c=30microF	r=1Mohm
time	current(microA)		
0	5.95		
5	5.14		
10	4.5		
15	3.89		
20	3.24		
25	2.76		
30	2.32		
35	1.97		
40	1.68		
45	1.22		
50	0.99		
55	0.81		
60	0.66		
65	0.58		
70	0.49		
75	0.42		
80	0.34		
85	0.28		
90	0.24		
95	0.19		
100	0.16		
105	0.13		
110	0.11		
115	0.09		
120	0.07		
125	0.05		
130	0.04		

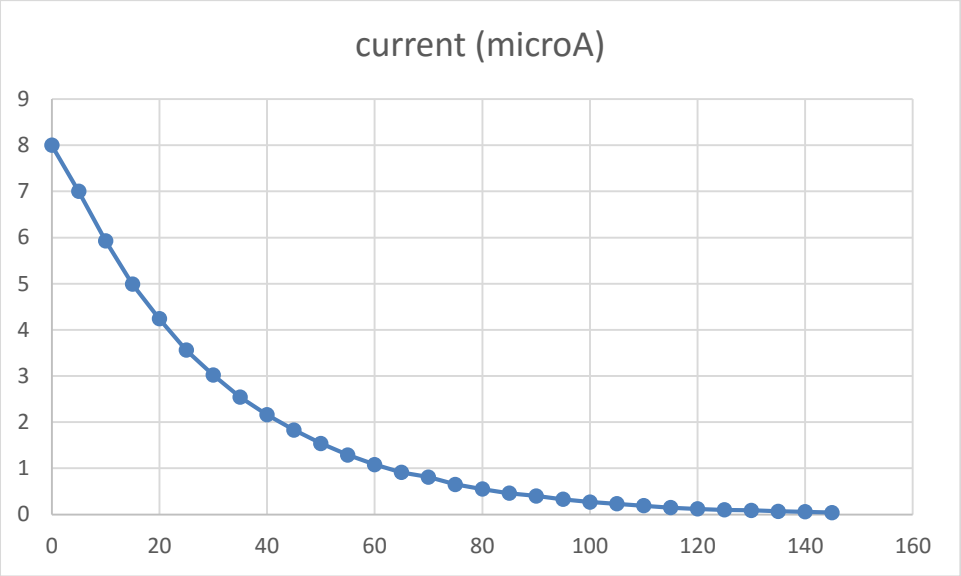
Refer graph 1(g)

Experiment 2 LC circuit

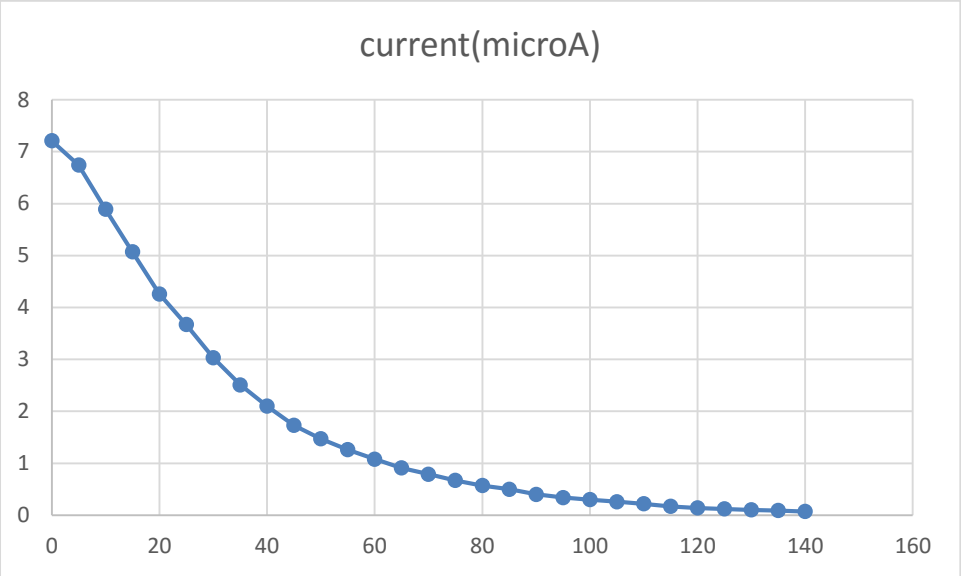
coil no.	no. of turns	length (cm)	diameter(mm)	time period(microsec)	L=t^2/[4*(pie)^2*C] (mircoH)
1	300	16	41	47	1.87
2	200	11	41	34	0.9796
3	300	16	41	45	1.716
4	100	5.5	41	44	1.6406
5	75	16	26	32	0.8677
6	300	16	33	48	1.9525
7	300	16	26	45	1.7161
8	100	5.5	41	42	1.4949
9	150	16	26	45	1.7161
10	300	16	26	47	1.87

Graphs:

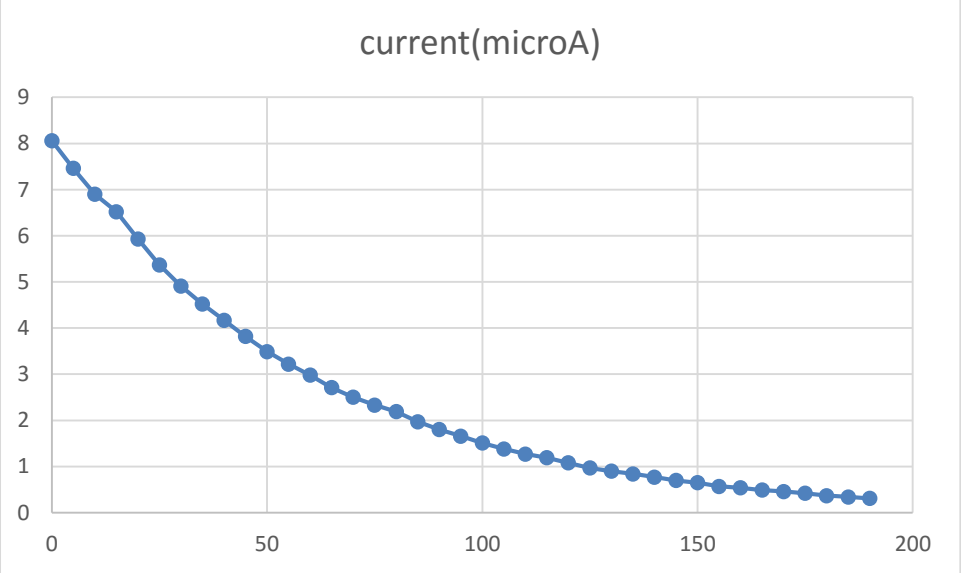
Experiment 1(a)



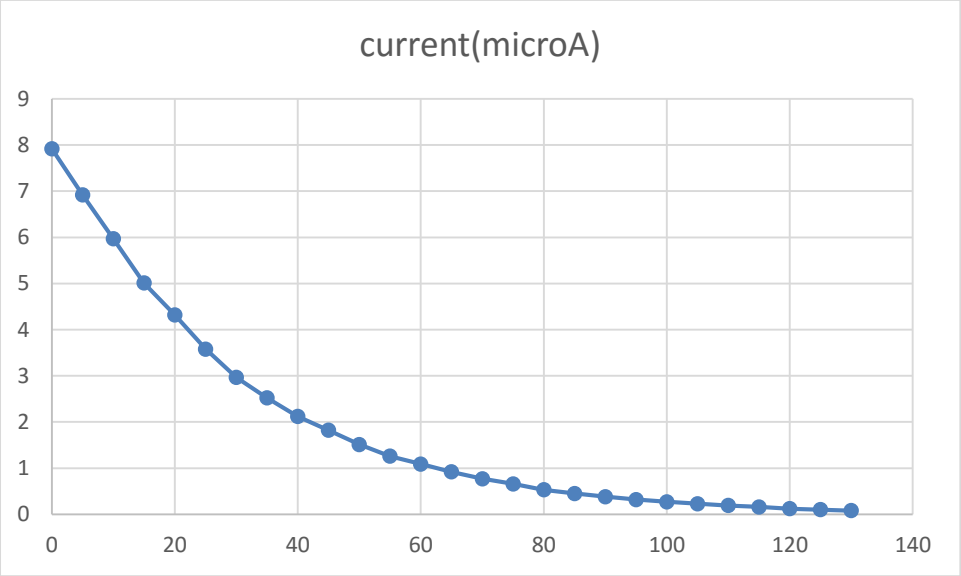
1(b)


current(microA)
8
7
6
5
4
3
2
1
0
0
20
40
60
80
100
120
140
160

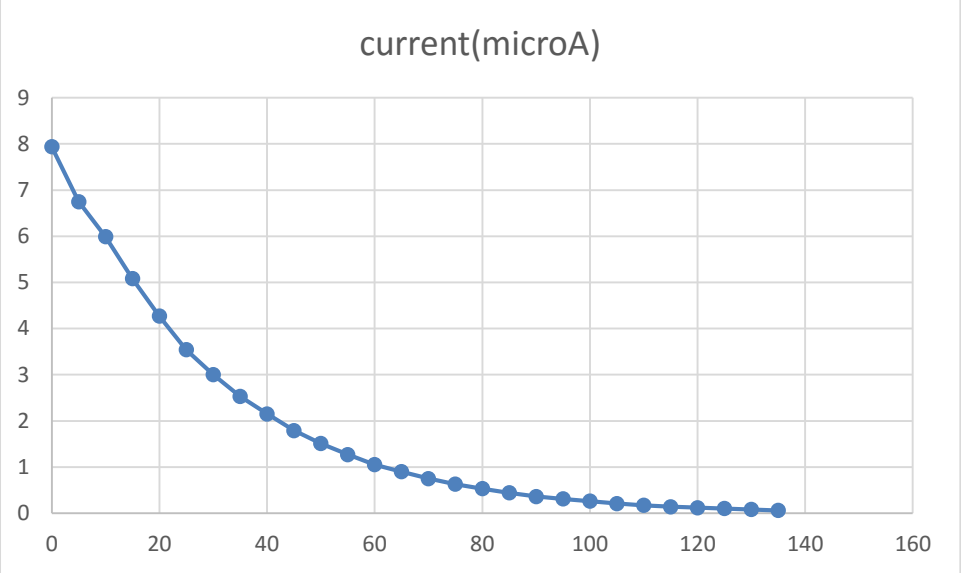
1(c)


current(microA)
9
8
7
6
5
4
3
2
1
0
0
50
100
150
200

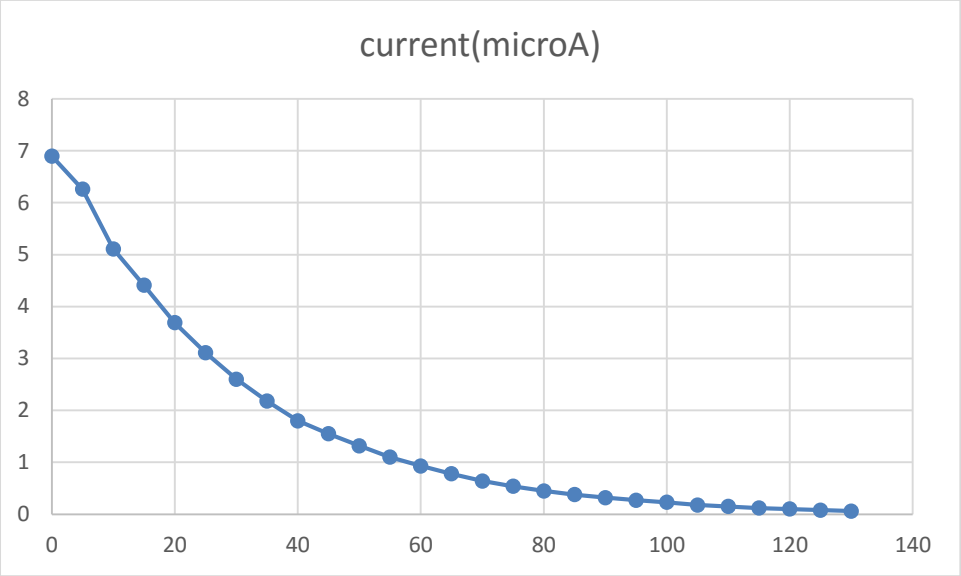
1(d)


current(microA)
9
8
7
6
5
4
3
2
1
0
0
20
40
60
80
100
120
140

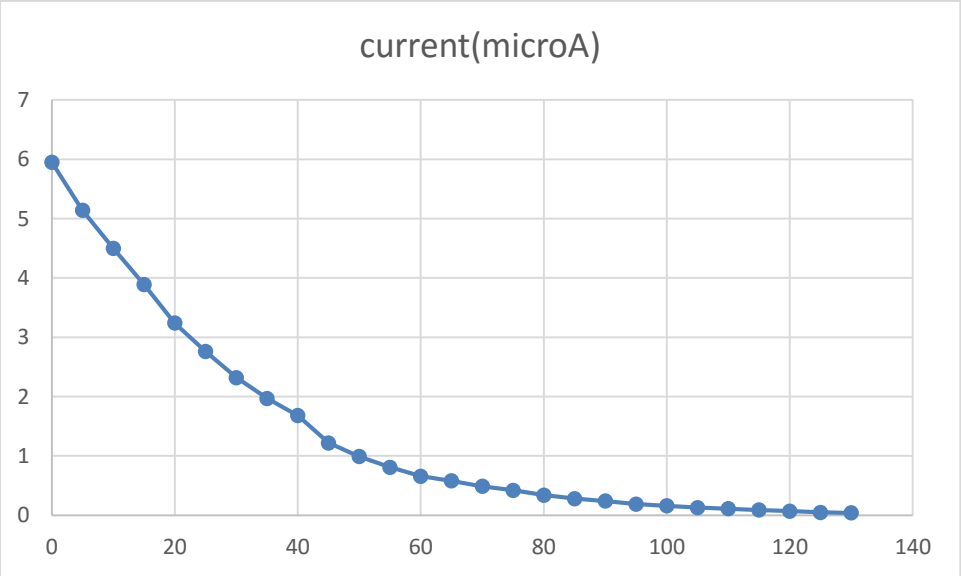
1(e)


current(microA)
9
8
7
6
5
4
3
2
1
0
0
20
40
60
80
100
120
140
160

1(f)


current(microA)
8
7
6
5
4
3
2
1
0
0
20
40
60
80
100
120
140

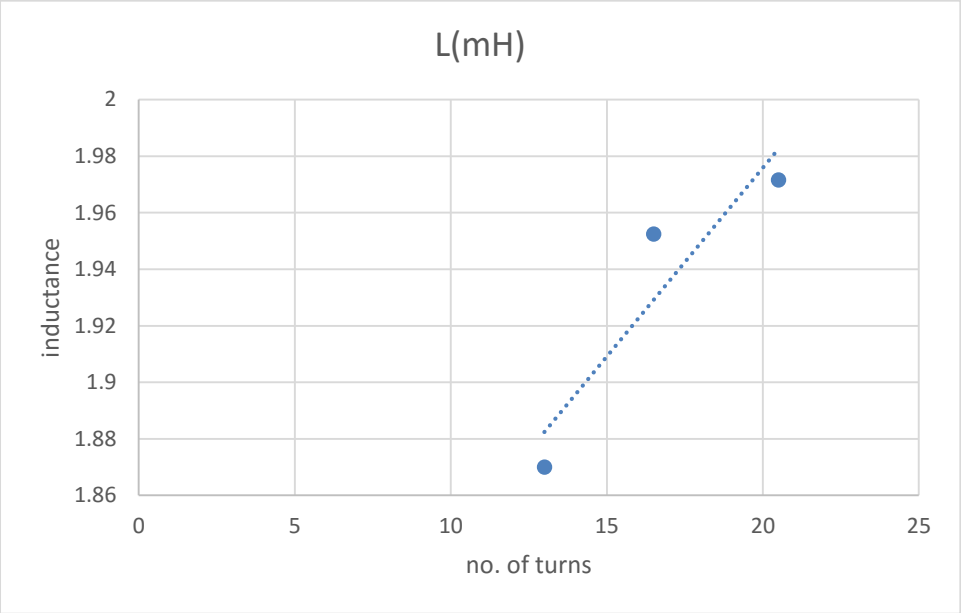
1(g)


current(microA)
7
6
5
4
3
2
1
0
0
20
40
60
80
100
120
140

Experiment 2

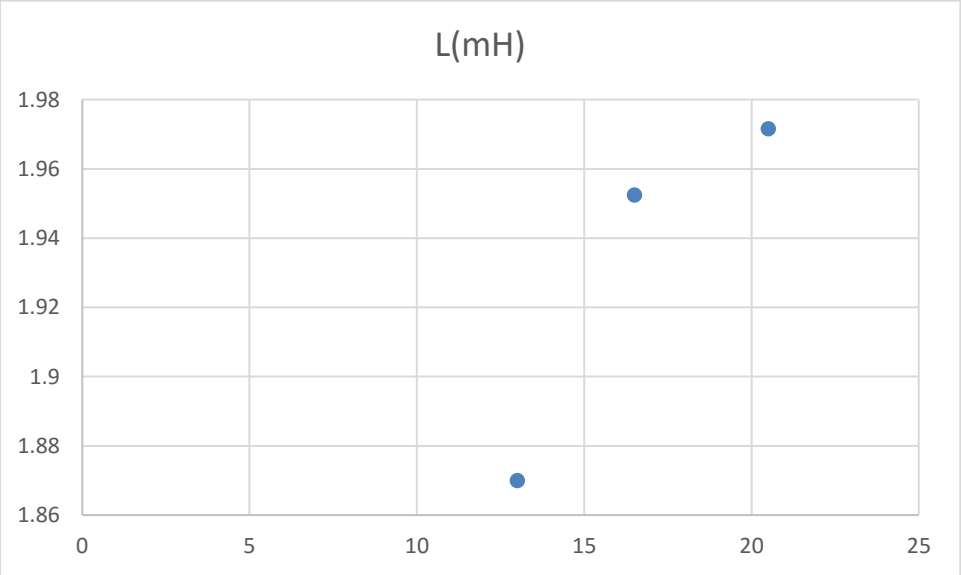
2(a)

Radius and length constant



2(b)

Length and no. of turns constant



Precautions:

1. The solenoid has to align carefully with the primary coil so as to couple the magnetic field effectively.
2. There should be no iron components in the vicinity of the coil.
3. The distance between two coils should be maximised so that the effect of the excitation coil on the resonant frequency can be disregarded.