U.G. 3rd Semester Examination - 2024

PHYSICS

[MAJOR]

Course Code : PHS-MAJ-P-03

(Electricity and Magnetism)

(PRACTICAL)

[NEP-2020]

Full Marks : 20 Time : 2 Hours

[Marks Distribution: Experiment-10, Viva-voce-05, Lab. Note Book-05]

1. Use a Multimeter for measuring (i) Resistance, (ii) AC and DC voltage, (iii) DC current and (iv) Capacitance. Also check an electrical fuse by a Multimeter.

   Follow the instructions given below:

   a) Take a suitable resistance. Mention its value from its colour code. Measure the value of the resistance by Multimeter thrice and compare the experimental value with the value obtained from colour code.

   b) Construct a simple resistive circuit with a D.C. source. Measure D.C. voltage and current across the resistance (three times). Compare the experimental values with the theoretical values. Replace the voltage source by an A.C. voltage source and measure the A.C. voltage across the resistance.

   c) Choose a suitable capacitor. (The exact value will be supplied). Measure the capacitance of the capacitor with the help of a multimeter and

compare the obtained value with the standard value supplied.

d) Take an electrical fuse and check it either it is ok or not with the help of a multimeter mentioning its resistance.

[w.f 1, Data - 7, Results - 02]

2. Determine the resistance of a low resistor supplied to you with the help of a potentiometer. Find the null points beyond the wire. Take readings for three different currents through the potentiometer. Resistance of the potentiometer wire will be measured by a P.O. box.

[w.f - 1, Circuit - 02, Data for unknown resistance - 03, Data for potentiometer wire's resistance - 2, Calculations - 02]

3. Determine the resistance per unit length of the Meter Bridge wire by Carey-Foster method and also measure the resistance of a low resistor supplied. Take three arm resistances in each case.

[w.f - 1, Circuit - 01, Data for meter bridge wire's resistance - 03, Data for unknown resistance - 03, Calculations - 02]

4. Use De' Sauty's bridge for the measurement of a capacitor by comparing it with a standard capacitor. Follow the following instructions:

a) Construct a De' Sauty's bridge with a standard capacitance C_0 and a known resistance R_1. Measure the variable resistance (R_2) at balanced condition by multimeter. Measure the value of unknown capacitance supplied.

b) Repeat the step-a for five different values of standard resistance. Find the value of unknown resistance - by drawing a plot between R_1 and R_2.

[w.f - 1, Circuit - 01, Data- 04, Graph - 02, Calculations - 02]

5. Construct a suitable circuit and measure the field strength B and its variation $\frac{dB}{dx}$ in solenoid.

[w.f. - 1, Circuit - 01, Data - 06, Calculations - 02]

6. Verify Thevenin's theorem:

Instructions:

a) Set up a suitable simple network containing linear impedances and a voltage source. Measure the load voltage V_L for different load resistances R_L.

b) Draw a plot between load voltage V_L and load current I_L. Hence from the plot find the Thevenin's voltage (V_T) and Thevenin's resistance (R_T).

c) Verify Thevenin's voltage and Thevenin's resistance by multimeter. Estimate maximum percentage of error.

[w.f - 1, Circuit - 01, Data - 02, Graph - 02, Verification - 02 and maximum percentage of error -02]

7. Verify Norton's theorem:

Instructions:

a) Set up a simple suitable network containing linear impedances and a voltage source. Measure load voltage V_L and load current I_L

across load resistance R_L for different values of R_L.

b) Draw a plot between load current I_L vs. load voltage V_L. Hence from the plot find the Norton's resistance R_N and Norton's current I_N.

c) Verify Norton's current I_N and Norton's resistance R_N by multimeter. Estimate the maximum percentage of error.

[w.f - 1, Circuit - 01, Data - 02, Plot - 02, Verification - 02 and maximum percentage of error - 02]

8. Verify the Superposition and Maximum power transfer theorem:

Instructions:

a) Set up a suitable simple circuit containing linear impedences and two voltage sources. Verify super-position theorem for at least three values of load resistances.

b) Set up a suitable simple circuit containing a fixed resistance, a load resistance and a voltage source. Measure load voltage V_L for different load resistances keeping input voltage fixed. Plot a graph between load resistance vs. Power across the load. Find the resistance for which maximum power is drawn across the load from the plot. Compare this value with the fixed resistance.

[w.f - 1+1, Circuit - 1+1 Data - 2+2, Plot -1, Results - 1]

9. Determine the self inductance of a coil by Anderson-Bridge method following the instructions given below:

a) Construct the circuit for d.c. and a.c. balance successively.

b) Obtain coil resistance from d.c. balance.

c) For a.c. balance take at least four different values of capacitance.

d) Plot $\frac{1}{c}$ vs. r (variable non inductive resistance) and hence find the values of L.

[w.f - 01, Circuit - 01, d.c. balance - 02, a.c. balance - 03, Plot - 02, Results - 01]

10. Set up a series C-R-circuit with a given capacitor, resistor and a a.c. source:

a) Record V_R, V_C data for two different frequencies. Plot V_C-I diagram for two different frequencies.

b) Draw two phasor diagrams for two frequencies. Calculate the loss factor.

c) Determine the value of capacitor.

d) Estimate the maximum percentage of error in C.

[w.f - 01, Circuit - 01, Data - 02, Plot - 02, Phasor diagrams - 02, Results - 01; Maximum percentage of error - 01]

11. Set up a series L-R circuit containing a resistor R, a coil of inductance L and an a.c. source:

a) Record V_L-V_R data for two supply frequencies. Draw the plot V_L vs. I for different frequencies.

b) Draw two phasor diagrams for two frequencies. Obtain ohomic losses.

c) Find the value of the inductor and estimate maximum percentage of error in L.

[w.f - 01, Circuit - 01, Data - 02, Graph - 02, Phasor diagrams - 02, Calculation - 01, Error calculation - 01]

12. Set up a series L-C-R circuit consisting a capacitor C, resistor R and a coil of inductance L:

a) Draw the resonance curve hence find the resonance frequency.

b) From resonance curve find the Q value and band width of the circuit.

c) Find the impedence at resonance.

d) Estimate maximum percentage of error in value of Q.

[w.f - 01, Circuit - 01, Data - 02, Plot - 02, Calculation - 03, Error calculation - 01]

13. Set up a parallel L-C-R circuit consisting a capacitor C, a resistor R and a coil of inductance L:

a) Draw the response curve and hence find the Anti-resonance frequency.

b) Find the quality factor, Q and bandwidth of the circuit.

c) Calculate the maximum percentage of error in the value of quality factor Q.

[w.f - 01, Circuit - 01, Data - 03, Plot - 02, Calculation - 02, Error calculation - 01]

14. Construct a suitable circuit with Ballistic Galvanometer and measure the charge density current density and CDR of ballistic galvanometer.

[w.f - 01, Circuit - 01, Data - 05, Calculation - 03]

15. Determine the value of a high resistance by the method of leakage of change of a charged condenser following the given instructions:

a) Adjust the charging voltage of the condenser to get a reasonably large deflection of the spot of

light on the scale. Note the deflection (d.) at least thrice.

b) Charge the capacitor, allow it to leak for a suitable time and then discharge the reduced charge through the galvanometer and note the throw (d) at least for five leakage times.

c) Plot leakage time (t) vs. log 10 (dad) graph and calculate the natural leakage resistance of the condenser.

d) Connect the given high resistance in parallel to the capacitor and repeat the procedures above to determine the effective resistance. Calculate the value of the high resistance.

[w.f - 01, Circuit -01, Data - 05, Graph -01, Calculation - 02]

16. Determine the self inductance of a coil by Rayleigh's method following the given instructions:

a) Find the time period (T) of oscillation of galvanometer coil under open circuit condition.

b) Detennine the logarithmic decrement '4'.

c) Record steady deflections for different values of small resistance introduced.

d) Records galvanometer throws for at least five times to measure the self inductance of the supplied coil.

e) Calculate the value of self inductance of the coil supplied.

[w.f - 01, Circuit - 01, Data - 06, Calculation - 02]

17. Find the mutual inductance (M) between two coils by absolute method following the given instructions:

a) By choosing different resistances properly construct the circuit.

b) Find the time period of oscillation (T) of the galvanometer coil under open circuit condition.

c) Determine the logarithmic decrement (X).

d) Records M-Q data for different dial reading.

e) Draw a plot between M vs. Q after calculating M for each dial reading

[w.f - 01, Circuit - 01, Data - 06, Graph - 01, Calculation - 01]

18. Measure the resistance of a mirror galvanometer by the half deflection method and also determine its figure of merit.

Instructions:

a) Adjust the circuit resistance R to get the full scale deflection V.

b) Adjust the shunt resistance 'S' to obtain the deflection exactly half of 0.

c) Take five sets of observation by repeating steps- a and b and records the value of R, S, 0 and % in tabulated form.

d) Calculate the galvanometer resistance G and figure of merit K.

[w.f - 01, Circuit - 01, Data - 06, Calculation - 02]
