B.E. (Inst. & Electronics Engg.) Examination 2024
Second Year Second Semester
Subject: Measurements and Electronic Instrumentation
Time: 3 hours, Full Marks 100

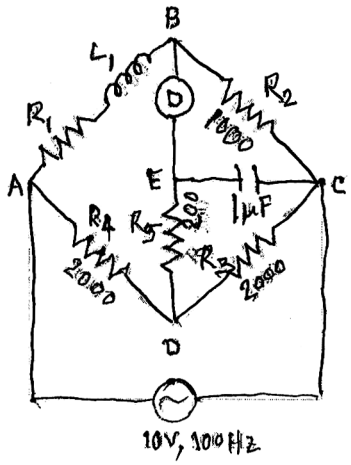
Group A: 50 Marks

Answer any five questions

1. a) A moving-coil ammeter has a fixed shunt of 0.02 Ω. With a coil resistance of R = 1000 Ω and a potential difference of 500 mV across it, full-scale deflection is obtained. (a) To what shunted current does it correspond? (b) Calculate the value of R to give full-scale deflection when shunted current I is (i) 10 A, and (ii) 75 A, (c) With what value of R, 40% deflection is obtained with I = 100 A. 6

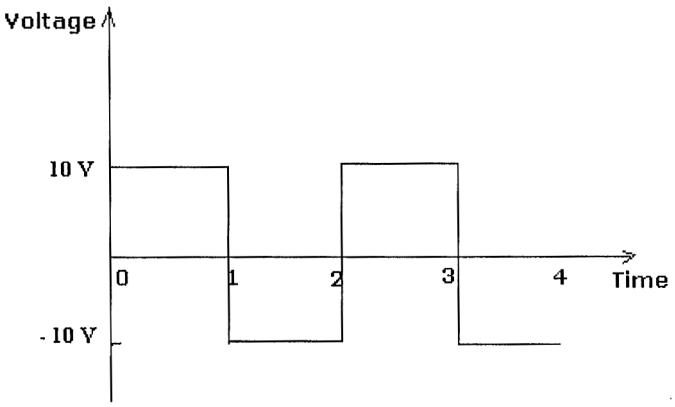
b) A moving-coil voltmeter has a resistance of 100 Ω. The scale is divided into 150 equal divisions. When a potential difference of 1 V is applied to the terminals of the voltmeter a deflection of 100 divisions is obtained. Explain how the instrument could be used for measuring up to 300 V. 4

2. The figure in the next page gives the connection of Anderson's bridge for measuring the inductance L1 and resistance R1 of a coil. Find R1 and L1, if balance is obtained when R3 = R4 = 2000 ohms, R2 = 1000 ohms R5=200 ohms and C =1μF. 10



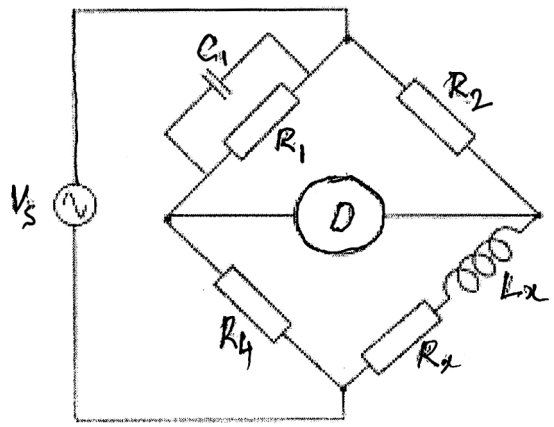
3. A square waveform as shown in the figure below is applied to the following voltmeters:
   (i) Full-wave rectifying type ac voltmeter
   (ii) True RMS voltmeter
   (iii) DC voltmeter.

What would be the reading displayed on each voltmeter? Obtain the percentage error of the full-wave rectifying type ac voltmeter with respect to the true rms value.



4. a) Design an attenuator to be used with an electronic voltmeter. The total impedance of the attenuator is 1 MΩ and it will have ranges 1V, 2V, 5V, 10V, 20V. The maximum voltage that can be applied to the voltmeter (after attenuation) is 1 V. 5
   b) Briefly describe a current transformer (CT). Why the secondary of a CT cannot be kept open? 3+2

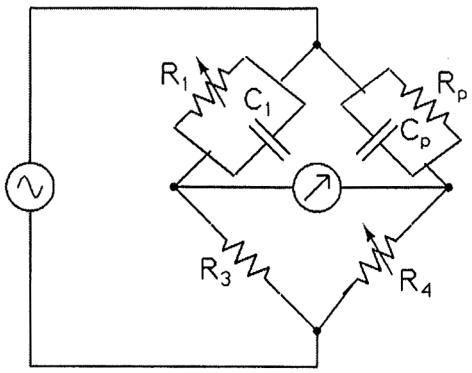
5. The inductance of a coil is measured using the bridge shown in the figure. Balance ($D = 0$) is



   obtained with C1 = 1 nF, R1 = 2.2 MΩ, R2 = 22.2 kΩ, R4 = 10 kΩ. Find the value of the inductance Lx (in mH) and Rx. 10

6. The parallel resistance-capacitance bridge shown below has a standard capacitance value of C1=0.1μF. The bridge is balanced at a supply frequency of 100 Hz for R1=375 kΩ, R3=10 kΩ and R4=14.7 kΩ. Obtain Rp, Cp and the Dissipation factor of the parallel combination of Rp and Cp.

   10



Group B: 30 Marks

Answer any three questions

7. a) Explain the principle of operation of a Phase locked loop. How is frequency synthesis done in a DPLL? 3+3

b) What are Lissajous figures and how are they obtained in a Cathode Ray Oscilloscope? 4

8. Explain with a diagram the triggering section of an oscilloscope. State the difference between Normal mode and Auto mode of triggering. 10

9. Derive the transfer function of the equivalent circuit of a 10:1 attenuator probe and an oscilloscope input. Obtain the condition when it becomes an all-pass filter. How is this probe tuned in an oscilloscope? 8+2

10. a) Discuss with a diagram the scheme of measurement of frequency of a signal using direct counting method. 6

b) The periods of 10 ms and 1 sec. are to be measured with a frequency meter (in direct counting mode) with the time base error of 1 ppm. Calculate the error in each case. 4

Group C: 15 Marks
Answer any three questions

11. i) Why the signal lines and power lines are kept perpendicular to each other in a measuring setup? 1.5

ii) Why a small capacitor is connected between V_{cc} and ground terminals with digital ICs? 1.5

iii) The earth pin of a 3-pin plug is longer than the other two pins. Why? 2

12. What are the sources of inductively coupled interference signal and what are the methods of elimination? 3+2

13. Discuss the following serial interference standards briefly: 3+1+1

    i) RS-232C

    ii) RS 422

    iii) iii) RS 485

14. Explain with an example the conductively coupled interference. 5

Group D: 5 Marks

16. What is a virtual instrument? Mention the advantages. 5