(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 3075 Roll No.

B. Tech.

(SEM. III) ODD SEMESTER THEORY EXAMINATION 2010-11

ELECTRONIC MEASUREMENTS & INSTRUMENTATION

Time : 3 Hours *Total Marks : 100*

Note : Attempt **all** questions.

1. Attempt any **four** questions : **(5×4=20)**

   (a) Define the term "true value". Explain why it is not practically possible to know the true value of quantity.

   (b) An oscilloscope having an input resistance of 1·7 MΩ shunted by 50 pF capacitance is connected across a circuit having an effective output resistance of 10 kΩ shown in Fig. 1. If the open circuit voltage has 1·0 V peak for a 100 kHz sine wave, what will be the voltage indicated on the oscilloscope when the frequency is (i) 100 kHz and (ii) 1 MHz ?

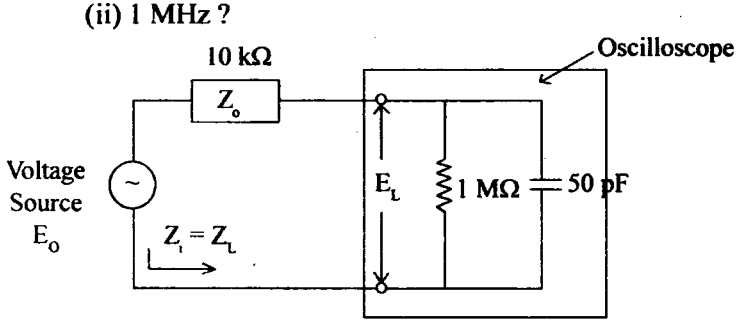

Fig. 1

(c) A multimeter having a sensitivity of 2000 Ω/V is used for the measurement of voltage across a circuit having an output resistance of 10 kΩ. The open circuit voltage of the circuit is 6 V. Find the reading of multimeter when it is set to its 10 V scale. Find the percentage error.

(d) What is the true value of voltage across the 500 kΩ resistance connected between terminals A and B as shown in Fig. 2. What would a voltmeter with a sensitivity of 20 kΩ/V read on the following ranges : 50, 15, 5 V when connected across terminals C and D ?

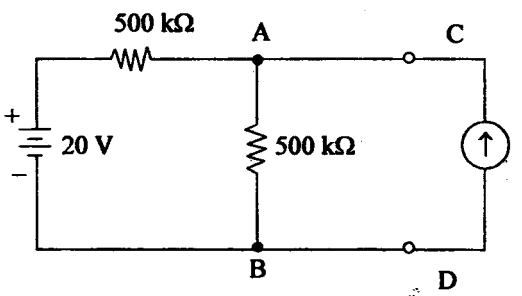

Fig. 2

(e) Prove that when an ammeter is introduced into a circuit for measurement of current the measured value of current is given by $I_L = \frac{I_o}{1 + Y_O / Y_L}$ where

I_o = actual value of current

Y_o = output admittance of ckt

Y_L = input admittance of ammeter.

Prove that the loading error can be reduced to about 1 percent if the input admittance of ammeter is at least 100 times the output admittance of the source.

(f) Explain the terms Johnson noise, shot noise, white noise and what is S/N ratio, explain it.

2. Attempt any **four** parts : **(5×4=20)**

(a) A Maxwell's inductance comparison bridge is shown in Fig. 3. Arm ab consists of a coil with inductance L_1 and resistance r_1 in series with a non-inductive resistance R. Arm bc and ad are each a non-inductive resistance of 100 Ω. Arm ad consists of standard inductor L of resistance 32·7 Ω. Balance is obtained when L_2 = 47·8 mH and R = 1·36 Ω. Find the resistance and inductance of the coil in arm ab.

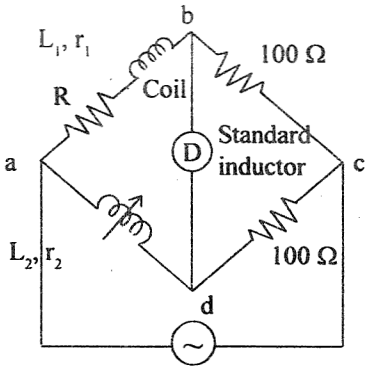

Fig. 3

(b) Describe what do you understand by term "Ratio Transformer" Explain the construction of a Ratio transformer and describe its uses.

(c) What are the modifications and additional features incorporated in low voltage Schering bridge for it to be used on high voltage ?

(d) A piezo-electric transducer has a capacitance of 2000 pF and a charge sensitivity of 100×10^{-12} C/N. The resistance of transducer is 10^6 MΩ and the impedance of the measuring system consists of a capacitance of 500 pF in parallel with a resistance of 1 MΩ. Find the response if

the applied force is F = 0·1 N for $0 < t < 2$ ms and F = ON for 2 ms $< t < \infty$. Find the value of voltage just before and just after the impulse is terminated. Also find the voltage after 10 ms of application of the pulse.

(e) Describe the different modes of operation of piezo-electric transducers. Define and sketch binders and twisters.

(f) Differentiate between the following :

(i) Transducers and inverse transducers.

(ii) Primary and secondary transducers.

3. Attempt any **two** parts : **(2×10=20)**

(a) Explain the working of a source follower electronic voltmeter. Describe how the range of this voltmeter can be extended. Explain the use of zero adjustment and calibration resistors.

(b) What would a true rms reading voltmeter indicate if a pulse waveform of 5 V peak and a duty cycle of 25% is applied to it ?

(c) Explain the construction and working of the following types of peak reading VTVMS : (i) Series type, (ii) Compensated shunt type.

4. Attempt any **two** parts : **(2×10=20)**

(a) Explain the following terms as applied to digital displays : (i) Resolution, (ii) Difference between 3½ digit and 4 digit display, (iii) Sensitivity of digital meters.

(b) A digital timer with eight digit readout is stated to have an accuracy of 0·005 percent of reading ±1 in the final digit. Readout is in s, ms and μs. Assuming that the instrument melts its specifications, what are the maximum likely errors when the reading is (a) 05000000 μs, (b) 00000500 s ?

(c) Describe with the help of suitable diagram, how the following types of measurements are carried out using a digital frequency meter :

(i) Single and multiple period measurements

(ii) Time interval measurements.

5. Attempt any **two** parts : **(2×10=20)**

(a) Determine the frequency of oscillations and the minimum value of R_f to sustain oscillations in Hartley oscillator in Fig. 4.

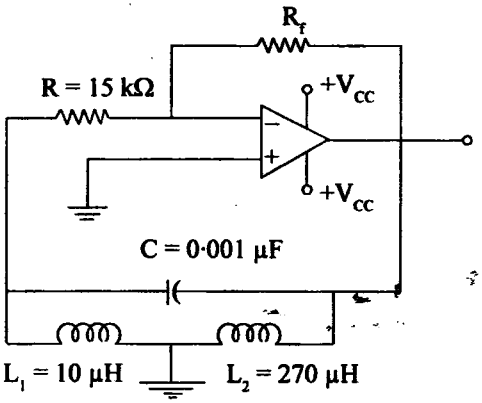

Fig. 4

(b) Describe the working of a sweep frequency generator. What are the sweeper errors ?

(c) Explain the working of a laboratory type square wave and pulse generator. Explain the working of current source.