

Printed Pages—5

TEC303

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

PAPER ID : 3075

Roll No.

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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  $1\text{ M}\Omega$  shunted by  $50\text{ pF}$  capacitance is connected across a circuit having an effective output resistance of  $10\text{ k}\Omega$  shown in Fig. 1. If the open circuit voltage has  $1.0\text{ V}$  peak for a  $100\text{ kHz}$  sine wave, what will be the voltage indicated on the oscilloscope when the frequency is (i)  $100\text{ kHz}$  and (ii)  $1\text{ MHz}$ ?

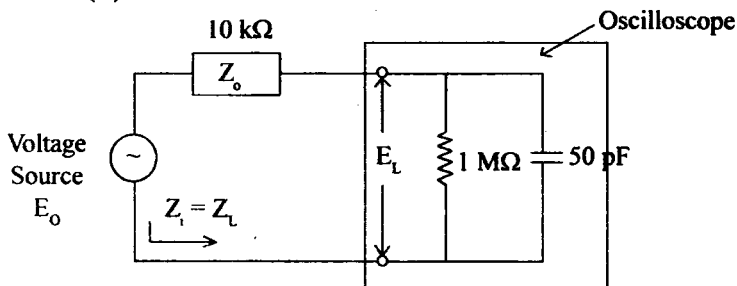


Fig. 1

- (c) A multimeter having a sensitivity of  $2000 \Omega/V$  is used for the measurement of voltage across a circuit having an output resistance of  $10 \text{ k}\Omega$ . The open circuit voltage of the circuit is  $6 \text{ V}$ . Find the reading of multimeter when it is set to its  $10 \text{ V}$  scale. Find the percentage error.
- (d) What is the true value of voltage across the  $500 \text{ k}\Omega$  resistance connected between terminals A and B as shown in Fig. 2. What would a voltmeter with a sensitivity of  $20 \text{ k}\Omega/V$  read on the following ranges :  $50, 15, 5 \text{ V}$  when connected across terminals C and D ?

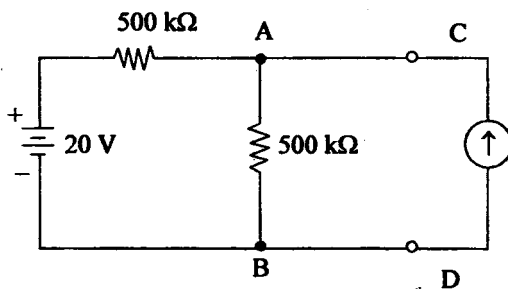


Fig. 2

- (e) Prove that when an ammeter is introduced into a circuit for measurement of current the measured value of current

$$\text{is given by } I_L = \frac{I_o}{1 + Y_o/Y_L} \text{ where}$$

$I_o$  = 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  $100\ \Omega$ . Arm cd consists of standard inductor  $L$  of resistance  $32.7\ \Omega$ . Balance is obtained when  $L_2 = 47.8\ \text{mH}$  and  $R = 1.36\ \Omega$ . Find the resistance and inductance of the coil in arm ab.

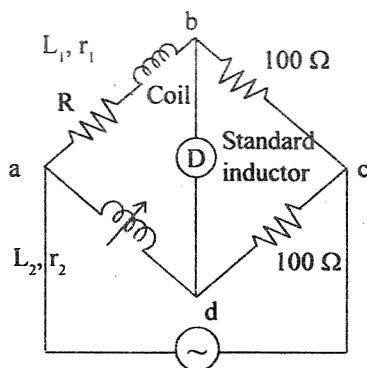


Fig. 3

- (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  $2000\ \text{pF}$  and a charge sensitivity of  $100 \times 10^{-12}\ \text{C/N}$ . The resistance of transducer is  $10^6\ \text{M}\Omega$  and the impedance of the measuring system consists of a capacitance of  $500\ \text{pF}$  in parallel with a resistance of  $1\ \text{M}\Omega$ . Find the response if

the applied force is  $F = 0.1 \text{ N}$  for  $0 < t < 2 \text{ ms}$  and  $F = 0 \text{ N}$  for  $2 \text{ ms} < t < \infty$ . 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 twistors.
- (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  $3\frac{1}{2}$  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  $\pm 1$  in the final digit. Readout is in s, ms and  $\mu\text{s}$ . Assuming that the instrument meets its specifications, what are the maximum likely errors when the reading is (a) 05000000  $\mu\text{s}$ , (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.

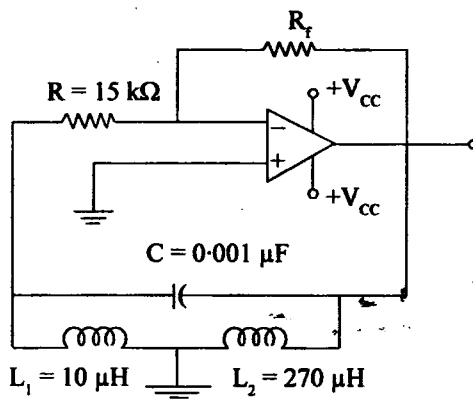


Fig. 4

(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.