

Code: A-12 Subject: INSTRUMENTATION AND MEASUREMENTS**Time: 3 Hours Max. Marks: 100****NOTE: There are 11 Questions in all.**

Question 1 is compulsory and carries 16 marks. Answer to Q. 1. must be written in the space provided for it in the answer book supplied and nowhere else.

Answer any THREE Questions each from Part I and Part II. Each of these questions carries 14 marks.

Any required data not explicitly given, may be suitably assumed and stated.

Q.1 Choose the correct or best alternative in the following: (2x8)

a. If in a Wien bridge circuit the resistors are each equal to $50\text{ K}\Omega$ and the capacitors are each equal to $0.02\text{ }\mu\text{F}$, then the resonant frequency is nearly _____.

- (A) 159.2 Hz. (B) 512.5 Hz.
(C) 178.3 Hz. (D) 234.5 Hz.

- b. The purpose of the trigger circuit in a CRO is _____
(A) to generate an electronic beam from a heated cathode.
(B) to increase the potential of the input signal to the required level.
(C) to synchronize the horizontal deflection with the vertical input.
(D) to switch from the vertical channel to the horizontal channel.

c. The circuit diagram given in Fig.1 is that of _____

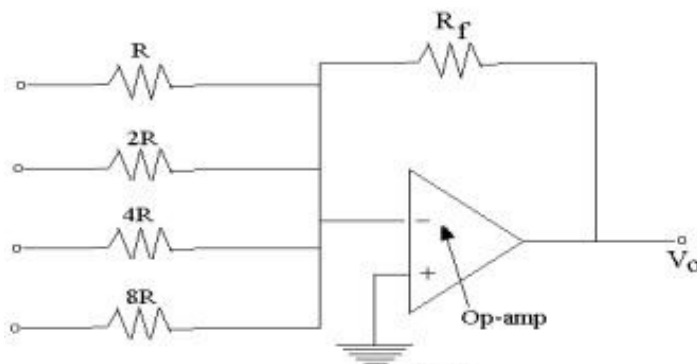
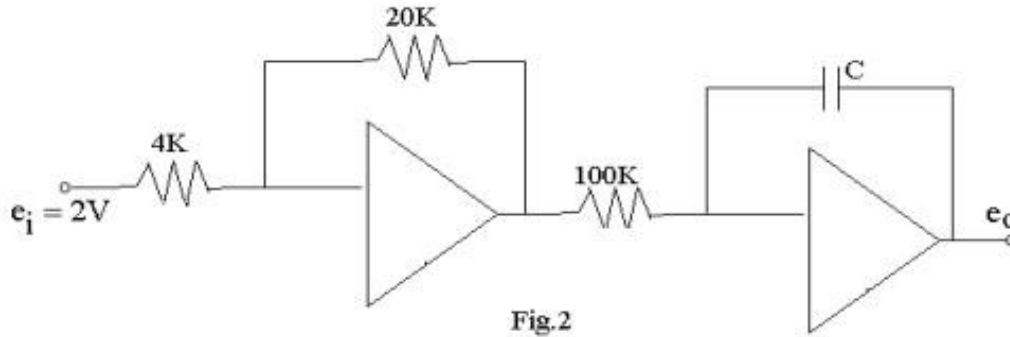


Fig.1

- (A) an A/D converter. (B) an analog multiplexer.
(C) a digital multiplexer. (D) a D/A converter.
- d. The principle of a frequency counter is that of _____.
(A) enabling the input signal to appear at the output when the gate pulse appears.
(B) generating an output frequency which is proportional to the analog input.
(C) passing several independent signals through a common circuit.
(D) facilitating gating of input frequency into the counter for a predetermined time.
- e. Considering the radio receiver characteristics, the ability to reject unwanted signals is indicated by the parameter namely _____.

- (A) noise figure. (B) selectivity.
 (C) image response. (D) sensitivity.

f. In the op-amp circuit of Fig.2 the value of the capacitor that is required for the voltage e_o to be a ramp of 40 V/sec is _____.



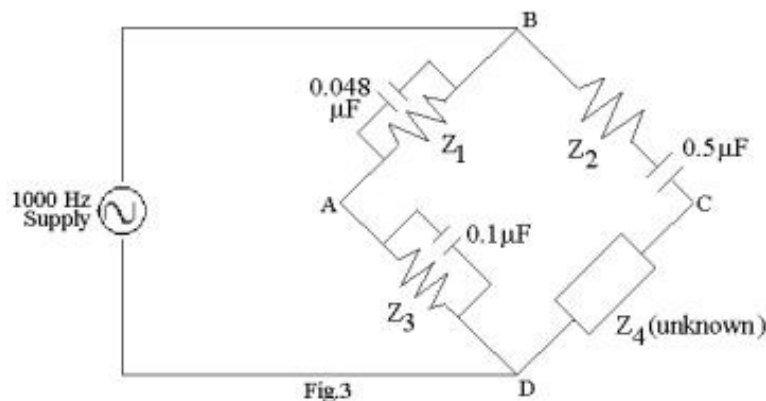
- (A) 12.5 μ sec . (B) 5.0 m sec.
 (C) 2.5 μ sec . (D) 4.8 m sec.
- g. The desirable characteristics of a wire type of strain gauge are _____ and _____.
- (A) high gauge factor, high temperature coefficient.
 (B) high gauge factor, low temperature coefficient.
 (C) low gauge factor, high temperature coefficient.
 (D) low gauge factor, low temperature coefficient.
- h. A comparison of a square wave generator and a pulse generator shows that the former has a duty cycle which is _____ and also _____.
- (A) higher, variable. (B) lower, constant.
 (C) lower, variable. (D) higher, constant.

PART I

Answer any THREE Questions. Each question carries 14 marks.

- Q.2 a.** List out the various dynamic characteristics of a measuring system. Explain the terms : bandwidth, speed of response and settling time. (6)
- b. Distinguish between the following pairs of transducers :
 (i) Active and Passive. (ii) Piezoelectric and Photoelectric.
 (iii) Inductive and Capacitive. (iv) Input and Output. (8)
- Q.3 a.** Give the block diagram of a sweep frequency generator and the circuit diagram of a typical linearizing circuit used with it. (6)
- b. Explain how the hysteresis loop of a material is obtained under AC operating conditions. (8)
- Q.4 a.** Define dissipation factor and power factor of a series RC combination, also describe the special features of a Schering bridge. Derive the balance equation for this bridge. (6)

- b. The bridge shown in Fig.3 is balanced at 1000 Hz. Determine R and C or L constants of arm C D, considered as a series circuit. The given data is : arm AB, R = 2010 Ω is parallel with C = 0.048 μF , arm BC, R = 1020 Ω in series with C = 0.5 μF , arm DA, R = 290 Ω in parallel with 0.1 μF . (8)



- Q.5** a. Explain the words acquisition time, aperture time and holding time as applied to a sample and hold circuit. (6)
- b. Give the voltage vs time diagram of a successive approximation A/D converter, explain how it is to be interpreted. (8)
- Q.6** a. Give the block diagram of a general purpose CRO and identify the various parts. Briefly describe their important features. (8)
- b. A CRT has parallel deflecting plates 3.6 cm long and 0.36 mm apart. If the screen is 60 cms from the centre of the deflecting plates, accelerating voltage is 270 V and the deflection on the screen 25 cms, determine the deflection voltage and deflection factor. Derive any formula used. (6)

PART II

Answer any **THREE** Questions. Each question carries **14** marks.

- Q.7** a. Give the block diagram of a ramp type DVM; compare its features with the stair case ramp DVM. (6)
- b. Describe the various measurement methods that are presently adopted in measurement systems. (8)
- Q.8** a. List out the various methods for measurement of R.F. power and describe in detail the method that involves a thermal sensor. (8)
- b. What are the features of a bolometer element and its support? (6)
- Q.9** a. Describe the AM alignment and FM receiver alignment for radio receivers. (7)
- b. Give the set up for the quieting method and explain the related steps. (7)
- Q.10** a. Explain what is meant by harmonic distortion. Also with the help of a block diagram explain the features of a harmonic distortion analyser. (6)

b. A resistance strain gauge with a gauge factor of 2.2 is fastened to a steel member which is subjected to stress. If the Young's modulus of elasticity of steel is $2.4 \times 10^6 \text{ Kg / Cm}^2$, change in resistance per unit of resistance $\left(\frac{\Delta R}{R}\right)$ of the strain gage is 0.12%, determine the stress in Kg / Cm^2 of the steel member. **(8)**

Q.11 Write notes on any **TWO** of the following:

- (i) Time base error in frequency and time measurements.
- (ii) Storage oscilloscope.
- (iii) Hall effect transducers. **(2 × 7)**

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