AMIETE – ET (OLD SCHEME)

Code: AE12 **Subject: INSTRUMENTATION AND MEASUREMENT**
Time: 3 Hours **Max. Marks: 100**

DECEMBER 2009

NOTE: There are 9 Questions in all.

- **Question 1 is compulsory and carries 20 marks. Answer to Q. 1 must be written in the space provided for it in the answer book supplied and nowhere else.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

Q.1 Choose the correct or the best alternative in the following: (2×10)

a. Example of an active transducer is

(A) strain gauge **(B)** LVDT
(C) piezoelectric transducer **(D)** resistance transducer

b. In an amplified dc meter, the role of the amplifier is to provide

(A) high gain **(B)** large bandwidth
(C) high input impedance **(D)** low input impedance

c. The purpose of providing a varactor diode in a signal generator is to facilitate

(A) amplitude modulation **(B)** tuning the main signal
(C) frequency multiplication **(D)** frequency modulation

d. For horizontal deflection system of a CRO, the waveform of voltage to be applied should be

(A) rectangular **(B)** ramp
(C) impulse **(D)** sinusoidal

e. To extend the frequency range of a frequency counter one may use

(A) a prescalar which is a digital counter
(B) an amplifier with suitable gain
(C) a comparator with zero crossing detection
(D) an amplifier with large bandwidth

f. Bolometer measures RF power using

(A) magnetic field of RF
(B) heating effect of RF
(C) induced emf by RF field
(D) heterodyning with another RF source

g. The receiver parameter 'image' refers to

(A) reflection of RF from unmatched load
(B) uncontrolled change in local oscillator frequency
(C) spurious response to heterodyning process
(D) shift of carrier frequency

h. The IF amplifier used in spectrum analyzer is

(A) a high gain large bandwidth amplifier
(B) successive limiting type logarithmic amplifier
(C) a narrow band tuned amplifier
(D) a unity gain high input impedance amplifier

i. An example of a magneto resistive material is

(A) Quartz **(B)** Nichrome alloy
(C) Bismuth **(D)** Mu-metal

j. The input to an 8-bit A/D converter with 10 V reference is 3.797 volts. The digital output from the converter is

(A) 1000 0011 **(B)** 0110 0001
(C) 00110111 **(D)** 1001 1001

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

Q.2 a. Distinguish between systematic and random errors in measurement systems. State briefly the scientific approaches to minimize these errors. **(10)**

b. Define the term 'settling time' of an instrument and indicate the factors determining its value in a system. **(6)**

Q.3 a. What are the advantages of using a chopper-stabilized amplifier in voltage measurements? Describe using a neat circuit diagram, the operation of a series-shunt chopper based on MOSFETs. **(10)**

b. Find the values of C_X and R_X in the capacitance comparison bridge shown in Fig.1 below which is balanced with the following parameters. $R_1 = 12\ K\Omega;\ R_2 = 60\ K\Omega; R_3 = 120\ K\Omega;\ C_3 = 80\ \mu F$. **(6)**

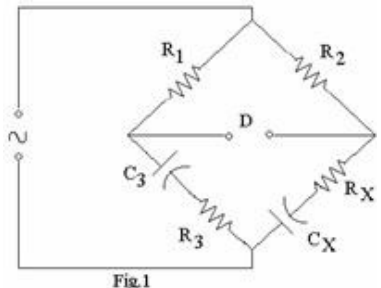

Fig.1

Q.4 a. Why linearizing c[illegible]ıcy generator? Explain using circuit diagram, the working of a linearizing circuit connected to a sweep generator. **(8)**

b. Draw block schematic of a frequency counter and delineate its operation. **(8)**

AB and BC are non reactive resistor of 100Ω each, DA is standard variable inductor L of resistance 32.7Ω and CD comprises a standard variable resistor R in series with a coil of unknown impedance. Balance

Q.5 a. Derive an expression for deflection sensitivity of a CRO with electrostatic deflection. **(9)**

b. What is the difference between 'dual-beam' and 'dual trace' oscilloscopes? Show a scheme to derive dual trace for a CRO and explain its operation. **(7)**

Q.6 a. Draw a neat figure to illustrate an experimental set-up to measure magnetic flux by measuring emf induced by the flux. **(10)**

b. Explain how RF power is measured by RF volt-meter. **(6)**

Q.7 a. Describe measurement set-up and procedure to measure sensitivity of a radio receiver by Quieting method. **(7)**

b. Explain Harmonic distortion. What are the causes by which harmonic distortion may result? Show a block schematic of heterodyne harmonic analyzer and explain its operation. **(9)**

Q.8 a. Taking a minimum of 4 bits inputs, show any one type of D/A converter and explain its operation. **(8)**

b. Draw a Hay's bridge circuit and obtain expressions for unknown inductance and resistance in one arm of the bridge. **(8)**

Q.9 a. Discuss applications of capacitive transducers for displacement measurement. Show a scheme of capacitive transducer in a bridge by which outputs
proportional to linear displacements may be obtained. **(10)**

b. Find the bridge offset voltage in the strain gauge bridge shown in Fig.2 when a strain of 1450 $\mu m/m$ is applied on the SG, whose GF = 2.03 and nominal resistance is 350 Ω. The bridge is balanced when the gauge is unstrained. **(6)**

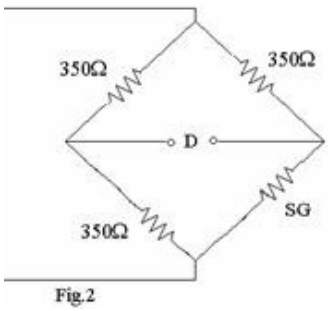

Fig.2