Subject: INSTRUMENTATION AND MEASUREMENTS

Time: 3 Hours **Max. Marks: 100**

JUNE 2011

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.**
- **The answer sheet for the Q.1 will be collected by the invigilator after 45 Minutes of the commencement of the examination.**
- **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. Null type of the instrument as compared to a deflection type instrument has a:

(A) Higher accuracy **(B)** Lower sensitivity
(C) Faster response **(D)** Low accuracy

b. A 0-300V Voltmeter has an error of ±2% of full scale deflection. What would be the range of reading if true voltage is 30V?

(A) 24V to 36V **(B)** 29.4V to 30.6V
(C) 20V to 40V **(D)** none of the above

c. Frequency can be measured by using:

(A) Maxwell's bridge **(B)** Schering bridge
(C) Heavy side Campbell bridge **(D)** Wein's bridge

d. A wheat stone bridge cannot be used for precision measurement because measurement errors are introduced on account of:

(A) Resistance of connecting leads
(B) Thermo electric emf
(C) Contact resistance
(D) all of the above

e. In Electronic Voltmeter use of rectifier and negative feedback is done:

(A) to increase the overall gain
(B) to improve stability
(C) to overcome non linearity of diode
(D) none of the above

f. The source of emission of electrons in a CRT is:

(A) PN junction diode **(B)** Barium strontium oxide coated cathode
(C) Accelerating anodes **(D)** post-accelerating anodes

g. In signal generators:

(A) Energy is created
(B) Energy is generated
(C) Energy is converted from DC to AC at some specific frequency
(D) All of the above

h. The Q factor of the coil at the resonant frequency 1.5 MHz of an RLC series circuit is 150. The band width is:

(A) 225 MHz **(B)** 1.05MHz
(C) 10 KHz **(D)** none of the above

i. An inverse transducer converts:

(A) Electrical energy to any other form of energy
(B) Electrical energy to light energy
(C) Mechanical displacement in to electrical
(D) Electrical energy to mechanical energy

j. An LVDT:

(A) Exhibits linear characteristics up to a displacement of ± 5mm.
(B) Has a linearity of 0.05%
(C) Has an infinite resolution and high sensitivity of the order of 40V per mm.
(D) all of the above

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

Q.2 a. Differentiate between the direct and indirect method of measurement. **(4)**

b. A thermocouple reads 95.45ºC and the static correction given in the correction current is -0.08ºC. Determine the true value of the temperature? **(4)**

c. Define limiting errors. Derive the expression for relative limiting error? **(8)**

Q.3 a. Briefly explain the limitations of Wheatstone bridge. **(4)**

b. A sample of bakelite was tested by the Schering bridge method at 25KV, 50 c/s. Balance was obtained with a standard condenser of 109μμF capacitance, a condenser of capacitance 0.5 μF in parallel with a non reactive resistance of 309Ω and a non reactive resistance of 100 Ω. Determine the capacitance, the equivalent series resistance and the power factor of the specimen. **(6)**

c. List the various factors causing errors in AC bridge circuit. What precision techniques are used for reducing errors?

Q.4 a. What are the various effects of frequency on calibration? **(8)**

b. Explain with the help of block diagram, the operation of basic Digital Multimeter. **(8)**

Q.5 a. What is a Universal Counter? Explain its operation with help of block diagram. **(8)**

b. Explain the working principal of a Q-meter. Also outline the factors that cause errors during a Q measurement. **(8)**

Q.6 a. Explain Function Generator with help of a block diagram. How it can be used for producing sine wave? **(8)**

b. Explain in detail the principal of operation of a single beam CRO. **(8)**

Q.7 a. What is the purpose of Spectrum Analyzer? Explain the working of RF Spectrum Analyzer with the help of a diagram. **(8)**

b. Briefly explain Bolometer. How it is used to measure power. **(8)**

Q.8 a. Write brief notes on:

(i) Circular Chart Recorder
(ii) Magnetic Recorder **(4+4)**

b. What are the objectives and requirements of Recording Data? **(8)**

Q.9 a. What is LVDT? Where it is used and what are its advantages? **(4)**

b. A displacement transducer with a shaft stroke of 10cm is applied to the circuit. The total resistance of potentiometer is 5kΩ. The applied voltage V_t is 5V. When the wiper is 2cm from point B, what is the value of the output voltage? **(4)**

c. What is Signal conditioning? What is its importance in Data Acquisition Systems? List the 2 methods which are used in Signal Conditioning. **(8)**