ROLL NO. _____

Code: DE59/DE109 Subject: ELECT. INSTRUMENTATION & MEASUREMENT

DipIETE – ET (Current & New Scheme)

Time: 3 Hours **JUNE 2016** **Max. Marks: 100**

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

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. In measurement system which of the following are undesirable static characteristics:
(A) Sensitivity and accuracy
(B) Drift, Static error and dead zone
(C) Reproducibility and non-linearity
(D) Drift, Static error, dead zone and non-linearity

b. Advantage of Anderson bridge over Maxwell's bridge is
(A) A fixed capacitor can be used instead of variable capacitor
(B) It is much easier to obtain balance for low Q coils
(C) It is used for accurate determination of capacitance in terms of inductance
(D) All of these

c. Multimeters are provided with separate scale for low a.c. voltages
(A) To improve the readability of the scale
(B) To have high accuracy
(C) To take into account the high value of resistance of rectifier at low voltages (and currents) and also the fact that at low voltages (and currents) the value of rectifier resistance is not constant but varies considerably even for small changes in voltages.
(D) None of these

d. In digital frequency meter the multi period average mode of operation, the main gate is held open for more than one period of the unkown signal so that
(A) Period is extended in order that counter shows more digits thereby an increased accuracy is obtained.
(B) Resolution is increased
(C) Range of the instrument is extended
(D) Errors on account of dead time are eliminated

e. Thermocouples are
(A) Passive transducers **(B)** Active transducers
(C) Both **(A)** & **(B)** **(D)** Output transducers

f. The horizontal amplifier in a CRO should be designed for
(A) High frequency signals with a fast rise time
(B) High amplitude signals with a slow rise time
(C) High amplitude signals with a fast rise time
(D) Low amplitude signals with a fast rise time

g. Full form of VSWR is
(A) Voltage source wave ratio **(B)** Variable source wattage ratio
(C) Voltage standing wave ratio **(D)** Variable standing wave ratio

h. A transducer converts
(A) Mechanical energy into electrical energy
(B) Mechanical displacement into electrical signal
(C) One form of energy into another form of energy
(D) Electrical energy into mechanical form

i. In an LVDT the core is made up of a
(A) Non-magnetic material
(B) A solid ferro-electric material
(C) High permeability, nickel-iron hydrogen annealed material in order to produce, low harmonics, low null voltage and high sensitivity. The core is slotted to reduce eddy current loss
(D) Insulated material

j. The capacitive transducers have a high output impedance and therefore
(A) To reduce loading effects long lengths of cable should be used.
(B) To increase the value of resonant frequency long lengths of cables should be used.
(C) Long cable lengths should be used in conjunction with capacitive transducers in order to improve their frequency response
(D) None of these

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

Q.2 a. What are the various errors in Measurements? Explain these errors and discuss the methods to minimise them. **(8)**

b. A voltmeter having a sensitivity of 1000Ω/V reads 100V on its 150V scale when connected across an unknown resistor in series with a multi-ammeter. When the milli-ammeter reads 5mA, calculate: **(6)**
(i) apparent resistance of unknown resistor
(ii) actual resistance of the unknown resistor
(iii) error due to the loading effect of voltmeter

c. Write the dimensions of following mechanical quantities in terms of length (L), Mass (M) and Time (T) **(2)**
(i) Surface tension
(ii) Energy
(iii) Power
(iv) Torque

Q.3 a. Write down the difficulties faced during measurement of high resistance. **(4)**

b. Describe the working of Low voltage schering bridge. Derive the equation for capacitance. **(6)**

c. A 4 terminal resistor of approximately 50μΩ resistance was measured by means of Kelvin bridge having the following component resistance:
standard resistor = 100.03 μΩ, Inner ration arms = 100.31Ω and 200Ω, Outer ratio arms = 100.24Ω and 200Ω . Calculate the unknown resistance to the nearest 0.01 μΩ. **(6)**

Q.4 a. With the help of circuit diagram explain working of AC Voltmeter using **(4+4)**
(i) Half wave rectifier and
(ii) Full wave rectifier
Also, derive the equation of average value of output voltage of voltmeter in each case. Assume any data not given.

b. Describe the working of multi-range ammeter. Write expressions for resistances of different sections of shunt used for three range ammeter. **(8)**

Q.5 a. Write the names of different types of digital voltmeters with the help of block diagram. Explain working of integrating type digital voltmeter. **(8)**

b. Discuss the working principle of the following: **(4+4)**
(i) Digital frequency meter
(ii) Q meter

Q.6 a. Draw the block diagram of a general purpose CRO and explain the functions of following controls: **(10)**
(i) Syhronization (ii) Intensity control
(iii) Vertical deflection system (iv) Horizontal deflection system

b. What is a function generator? Draw block diagram showing basic elements of a function generator. **(6)**

Q.7 a. What is a bolometer? Explain any one application of bolometer. **(4)**

b. Describe the basic circuit of a spectrum analyser. Explain how the spectra of the following is displayed **(12)**
(i) Amplitude modulation
(ii) Frequency modulation

Q.8 a. What is X-Y recorder? Explain with suitable block diagram working of X-Y recorder. Also, write applications of X-Y recorder. **(8)**

b. Explain the functioning of a basic type strip chart recorder. **(6)**

c. What is a thermistor? Write various applications of thermistors. **(2)**

Q.9 a. A Strain gauge having a resistance 100 Ω and gauge factor of 2 is connected in series with a ballast resistance of 100 Ω across a 12 volt supply. Calculate the difference between the output voltage with no stress applied and a stress of 140 MN/m^2. The modulus of elasticity is 200 GN/m^2. **(6)**

b. Explain how inductive transducers are used for measurement of pressure. **(6)**

c. Write short note on digital Data Acquisition System. **(4)**