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UF-6225

B. E. - II (Sem. - III) (Instrumentation & Control) Examination

May/June – 2012

Measurement & Instruments - IC 304 IC

Time : **3** Hours] [Total Marks : **100**

Instructions :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ **B. E. - II (Sem. - III) (Instrumentation & Control)**

Name of the Subject :

☛ **Measurement & Instruments-IC (304 IC)**

☛ Subject Code No. : **6 2 2 5** ☛ Section No. (1, 2,.....) : **1, 2**

Seat No. :

Student's Signature

(2) Attempt all questions.

(3) Figures to the right indicate marks.

(4) Answer of two sections must be written in separate answer books.

SECTION - I

1 (a) Give the answer in brief. **10**

(i) The high torque to weight ratio in an analog indicating instrument indicates **1**

(a) high friction loss

(b) low friction loss

(c) nothing as regards friction loss

(d) none of these

(ii) A reversed biased diode in addition to a forward biased diode is used in rectifier type voltmeter using half wave rectification. The use of reverse biased diode is : **1**

(a) It does not allow any current to flow through the meter during negative half cycle.

(b) It short circuits the meter during negative half cycle.

(c) It does not allow the reverse leakage current to flow through the meter during negative half cycle.

(d) all of above.

(iii) In an electrodynamometer type of wattmeter. **1**

(a) the current coil is made fixed

(b) the pressure coil is made fixed

(c) any of the two coils i.e. current or pressure coil can be made fixed.

(d) Both the coils should be movable.

(iv) The power in a 3-phase 4-wire ckt can be measured by using **1**

(a) 2 watt meters

(b) 4 watt meters

(c) 3 watt meters

(d) 1 watt meters

(v) A make break switch is provided to disconnect the battery when the meter is not in use in **1**

(a) both series and shunt type ohmmeters.

(b) only in series type ohmmeters.

(c) only in shunt type ohmmeters.

(d) none of the above.

(vi) A d'Arsonval movement has a sensitivity of 40,000 Ω/V and its lateral resistance is 4000 Ω. The resistance of multiplier to convert it to 1 V voltmeter is : **1**

(a) 44,000 Ω

(b) 36,000 Ω

(c) 3,600 Ω

(d) None of the above

(vii) What is a d'Arsonval galvanometer ? 2

(viii) Define 'actual transformation ratio' with respect to instrument transformer. 2

(b) Explain different types of errors. How they can be minimized ? 8

2 (a) Describe the constructional detail and working of a moving iron attraction type meter. Derive its torque eqation. 8

(b) The inductance of a moving iron ammeter is given by the expression : 8

$L = (12 + 5\theta - 2\theta^2)\mu H$,

Where θ is the angular deflection in radians from zero position.

Determine (i) the spring constant (ii) the angular deflection in radians for a current of 10 A if the deflection for a current of 5A is $30°$.

OR

2 (a) Describe the three ammeter method for measurement of power and power factor in a single phase circuit. Derive the expression for power and power factor. 8

(b) A 50V range spring controlled electrodynamic voltmeter has an initial inductance of 0.25 H, the full scale deflection torque of 0.4×10^{-4} Nm and full scale deflection current of 50mA. 8

Determine the difference d.c. and 50Hz a.c. readings at (i) 50V and (ii) 25V if the voltmeter inductance increases uniformly over the full scale of $90°$.

3 Give answers of any **two** : 16

(i) Explain the construction and principle of operation of a dynamometer type wattmeter. How it can be made to read dc as well as ac.

(ii) Explain the principle of operation of the moving iron power factor meter.

(iii) Explain clothier median method for testing potential transformers.

SECTION - II

4 (a) Give the answers in brief : **10**

(i) The ratio of transformation in the case of potential transformers **1**

(a) increases with increase in power factor of secondary burden.

(b) remain constant irrespective of the power factor of secondary burden.

(c) decreases with increase in power factor of secondary burden

(d) none of the above.

(ii) Turns compensation used in current transformers primarily for reduction of **1**

(a) phase angle error

(b) both ratio and phase angle errors

(c) ratio error, reduction in phase angle error is incidental

(d) none of the above

(iii) Post acceleration is needed in a CRO if the frequency of the signal is **1**

(a) Less than 1 MHz

(b) More than 1 MHz

(c) More than 10 MHz

(d) More than 10 Hz

(iv) P_1 phospher material is used for display in CRTs for **1**

(a) photographic application

(b) general purpose application

(c) television application

(d) all of the above

(v) Frequency can be measured by using 1

(a) Maxwell bridge

(b) Schering bridge

(c) Heaviside Campbell bridge

(d) Wien bridge

(vi) A wheatstone bridge has ratio arms of 1000 Ω and 100 Ω resistances, the standard resistance arm consists of 4 decade resistance boxes of 1000, 100, 10, 1 Ω steps. The maximum and minimum values of unknown resistance which can be determined with this setup are 1

(a) 111100 Ω, 1 Ω

(b) 11110 Ω, 10 Ω

(c) 111100 Ω, 10 Ω

(d) none of the above

(vii) Give two important advantages of Maxwell bridge. 2

(viii) Name four fluorescent materials used for CRT screen. 2

(b) Draw the block diagram of CRO and explain the function of different blocks. 8

5 (a) With the help of block diagram, explain the working of Dual beam oscilloscope. 8

(b) In a low voltage Schering bridge designed for the measurement of permittivity, the arm ab consists of two electrodes between which the specimen under test may be inserted; arm bc is a non-reactive resistor R_3 in parallel with a standard capacitor C_3 arm cd is a non-reactive resistor R_4 in parallel with a standard capacitor C_4; arm da is a standard air capacitor of capacitance C_2. 8

Without the specimen between the electrodes, balance is obtained with the following values; $C_3 = C_4 = 120pF$, $C_2 = 150 = pF$, $R_3 = R_4 = 5000\Omega$. With the specimen inserted, these values become; $C_3 = 200pF$, $C_4 = 1000pF$, $C_2 = 900pF$ and $R_3 = R_4 = 5000\Omega$. In each test, $\omega = 5000$ rad/s. Find the relative permittivity of the speciment.

OR

5 (a) Describe in detail the vertical amplifier used in CRO. **8**

(b) (i) a bridge consists of the following : **4**

Arm ab- a choke coil having a resistance R_1 and inductance L_1

Arm bc- a non-inductive resistance R_3

Arm cd- a mica condenser C_4 in series with a non-inductive resistance R_4

Arm da -a non inductive resistance R_2

When this bridge is fed from a source of 500 Hz, balance is obtained under following conditions :

$R_2 = 2410\Omega$; $R_3 = 750\Omega$; $C_4 = 0.5\mu F$; $R_4 = 64.5\Omega$

The series resistance of capacitor is $= 0.4\Omega$. Calculate the resistance and inductance of the choke coil. The supply is connected between a and c and detector between b and d.

(ii) A sheet of bakelite 4.5 mm thich is tested at 50 Hz between electrodes 0.12m in diameter. The Schering bridge employs a standard air capacitor C_2 of 106pF capacitance, a non-reactive resistance R_4 of $1000/\prod\Omega$ in parallel with a variable capacitor C_4 and a non-reactive variable resistance R_3. Balance is obtained with $C_4 = 0.5\mu F$ and $R_3 = 260\Omega$.

Calculate the capacitance, power factor and relative permittivity of sheet. **4**

6 Attempt any **two** : **16**

(i) Explain how 'Hay bridge' can be used for the measurement of inductance.

(ii) Describe the following :

(1) Blanking circuit

(2) Astigmation control

(3) Sources of synchronization

(4) Z-axis modulation.

(iii) Explain :

(1) Series type ohmmeter

(2) Multirange voltmeter.