FEDERAL UNIVERSITY OF TECHONOLOGY OWERRI
SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY
DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING
ECE 302 (Theory of Electronic Instrumentation and Measurement) Examination

Instruction: Answer any two questions from Section A and any two questions from Section B. Each question carries 20 marks
Date: 21/09/16   Session: 2015/2016   Unit: 2   Time Allowed: 3 Hours

SECTION A: *Answer any two questions from this section*

1. (a) Define measurement. (b) Draw a neat circuit diagram of Haye's bridge, deduce the equation when the bridge is under balanced condition. (c) Explain Self-inductance can be measured using the Haye's bridge bridge. (d) In a four arms of Haye's A.C bridge, AB-Coil is unknown impedance, BC-Non reactive resistance of 1000 Ω, CD- Non reactive resistance of 833 Ω in series with a standard capacitor of 0.38 μf, DA is a non-reactive resistance of 16,800 Ω. if the supply frequency is 50 Hz, determine the inductance and resistance at the balance condition.

2. (a) What is a multimeter? Name a type of Ohmmeter used for measuring (i) low resistance (ii) high resistance value. (b) Briefly explain the operation of attractive and repulsive type moving-iron indicating instrument with the aid of appropriate diagrams.(c) Derive the expression for torque equation in a moving iron instrument when there is a small increment in the current supplied to the instrument. Comment upon the nature of scale. (d) The moving system is provided with control springs. Find the deflection of a moving-iron Ammeter having the following data: Control Spring Constant is $8x10^{-6}\ Nm/rad$, Current is 6 A, $L = (6 + 3\theta - 0.5\theta^2)\mu H$.

3. (a) With a neat diagram, explain the construction and principle of operation of a dynamometer type wattmeter. (b) An electrodynamometer wattmeter is employed to measure power in a single circuit, if the load voltage is 200 V and the load current is 5 A at a lagging power factor of 0.1. The wattmeter potential coil has a resistance of 12,000 Ω and inductance of 120 mH. Determine the percentage error in the wattmeter reading. (c) Give the possible circuit diagram of connecting pressure coil of wattmeter and compare the error. (d) Briefly describe how the measurement of Q-factor may be achieved. A Q-meter measures the Q-factor of a series L-R-C circuit to be 200 at a resonance frequency of 200kHz. If the capacitance of the Q-meter is set to 300pF determine (i) the inductance L; (ii) the resistance R of the inductor.

SECTION B: *Answer any two questions from this section*

1. (a) Differentiate between Electrical and Electronic Instruments.
   (b) Give three advantages of Electronic Instruments over Electrical Instruments.
   (c) AC voltmeters can broadly be divided into three categories, name the categories.
   (d) What is an electronic recorder? Why is the strip chart recorder also called the X-t recorder?

2.   (a) Draw the block diagram of the True RMS Reading Voltmeter. What is the function of the thermocouple in the diagram? What is the specific function of the balancing thermocouple?
   (b) How does the True RMS Reading Voltmeter measure the true value of non-sinusoidal waveform?
   (c) What are the factors to be considered in the selection of analog voltmeter?
   (d) What is noise in measurement?

3. (a) What are the common characteristics of the various types of signal generators?
   (b) Briefly describe how an oscillator produces an output signal without an external input. What are the conditions for sustained oscillation?
   (c) Differentiate between Alternator, Amplifier, and Oscillator.
   (d) The 555 timer can be configured as an astable or free-running multivibrator. Diagrammatically show how the 555 timer can be configured or connected as an astable multivibrator. In not more than 10 bullet points describe the operation of the 555 timer in the astable mode.

ECE 302 EXAM 2013/2014

FEDERAL UNIVERSITY OF TECHNOLOGY OWERRI
DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING
RAIN SEMESTER 2013/2014 EXAMINATION
ECE 302: ELECTRICAL MEASUREMENT AND MEASURING INSTRUMENT
INSTRUCTIONS: : ANSWER FOUR QUESTIONS ONLY   Time: 2 Hrs.

OBJ

1a. Mention and explain the three basic sections of a measuring instrument. (b) Explain the following terms used in characterizing an instrument system (i) Accuracy (ii) Resolution (iii) Hysteresis (iv) Sensitivity (v) Precision (c) Mention and explain two sources of random errors and five sources of systematic errors in an instrument, (d) A set of independent current measurements taken by four observers was recorded as 117.11A, 117.08A and 117.05A and 117.11A calculate (i) the average current (ii) the range of error (e) Measurement of a resistance over a period of time gave the following results in ohms 10.16, 10.15, 10.14, 10.05, 10.00, 9.99. What is (i) the arithmetic mean (ii) the mean deviation (iii) the standard deviation for the resistance over that period of time.

2a. Mention and explain the functions of the various parts of a permanent magnet moving coil meter (b) List the three torques produced in a moving coil instrument. What are the functions of this torques? (c)With simple diagrams show how the range of a basic PMMC meter can be extended as (i) An Ammeter (ii) A Voltneter (d) A basic movement meter with internal resistance $R_m = 100\Omega$ and full scale deflection current I=ImA is to be converted into a multirange dc voltmeter with voltage ranges of 0 – 15v, 0 – 60v, 0 – 250v and 0 – 600v. Draw the circuit for such a multirange voltmeter with multipliers of R1, R2, R3 and R4 and determine the values of these resistances.

3 Explain with diagram the principles of operation of (i) electrostatic voltmeter (ii) electrodynamometer. State their basic advantages over the moving iron meters and PMMC.

4. What will be the out-of-balance current through the galvanometer for the wheatstone bridge shown in fig.4. If the galvo has a current sensitivity of 10mm/mA and an internal resistance of 100Ω, calculate the deflection of the galvo.

(b) Draw a circuit diagram of Maxwell- wien bridge. A Maxwell-wien bridge with a 1KHz ac supply is used to determine the inductance and series resistance of an inductor. At balance the bridge arms are AB 2.0MF in parallel with 10KΩ, BC 200Ω, CD the inductor, and DA 300Ω. What are the inductance, series resistance and Q-factor of the inductor. (c) Explain how the following measurements can be carried out using basic counter. (i) Period measurement (ii) Time interval measurement (iii) Frequency measurement

5a. Explain using well drawn circuit/block diagrams the operation of (i) successive approximation type voltmeter (ii) digital frequency meter. (b) What is a signal generator. Mention two conditions for a circuit to function as an oscillator. (c) Draw a Colpit LC oscillator and use it to explain how the conditions in 5(b) are satisfied. (d) Draw the block diagram of a basic electronic counter. Explain the function of each block.

6a. Draw a basic diagram of a Cathode Ray Oscilloscope. Explain using diagrams and equations the following functions in an Oscilloscope (i) focusing (ii) deflection (horizontal/vertical) (iii) beam acceleration (iv) Brightness (b) Why is signal to be measured connected through the vertical deflecting plates.

Fig.4
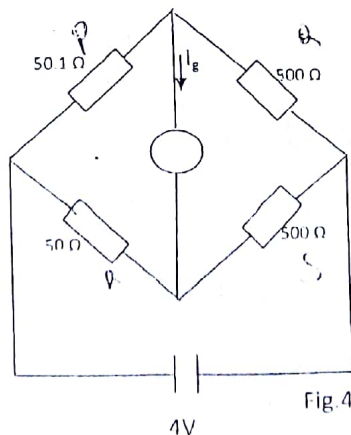
OBS

FEDERAL UNIVERSITY OF TECHNOLOGY, OWERRI
SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY
DEPARTMENT OF ELECTRICAL/ELECTRONIC ENGINEERING
SECOND SEMESTER EXAM, 2012/2013 SESSION
COURSE: ECE 302: INSTRUMENTATION AND MEASUREMENT   OBJ

(10)

INSTRUCTION: ANSWER 4 QUESTIONS.   TIME: 2 HRS

1a.   (i)Distinguish between these two types of Electrical and Electronic Measuring Instruments a). Ammeter b). Voltmeter . (ii) what are the similarity between a and b

1b.   The impedance of an a.c bridge Z1 = 400Ω <50° , Z2 = 200 Ω < 40° Z3 = 800 <-50, Z4 = 400Ω<20°, find whether the bridge is balance under these condition or not.

1c.   List three conditions necessary for a balanced bridge circuit.

2   A bridge with a1kHz a.c supply is used to determine the inductance and series resistance of an inductor. At balanced the bridge arms are MN 2.0μF in parallel with 10kΩ. NO 200Ω, OP the inductor, and PM 400Ω.(i) What are the inductance, resistance and Q-Factor of the inductor? (ii) What is the name of this bridge and give reason for chosen the name.

3a.   Comment on the following: (i)What are the three essential elements of an instrument. (ii)Why are direct measuring instruments most widely used in engineering practice. (iii)What is the difference between analog and digital signals. (iv)List the classification of instruments based on their functions. (v)What is meant by transducer.

3b.   A Multimeter having an input resistance of 25kΩ is used to measure the voltage across a circuit having an output resistance of 1.0kΩ and an open-circuit voltage of 12V. Find the error in measurement.

4a.   Comment on the following: (i)What are the essentials of indicating instrument   (ii) Why is control mechanism provided in an indicating instrument   (iii) What are the various techniques by which damping torque is provided in electrical instrument (iv) What are the materials used for control springs (v) Why is damping mechanism provided in electrical measuring instruments?

4b.   (i)Draw a circuit diagram for measurement of low impedance component using Q-meter. Explain the procedures involved in carrying out the test. (ii) Compare a Hartley Oscillator and a Colpit oscillator using circuit diagram only

5a.   (i) Mention 2 areas of application of the Cathode Ray oscilloscope (CRO)   (ii)What are the 2 parts of the CRO, and briefly state the component parts and their functions.

5b.   (i)Differentiate between the fluorescent characteristic of a material and its phosphorescence characteristic. (ii)What is the use of Delay-Line circuit?

6a.   (i)The X-deflecting plates in a CRT are 30mm long and 5mm apart. The centre of the plates is 15cm from the screen. Determine the deflection sensitivity and deflection factor of the CRT if the accelerating voltage is 2000V. (ii)Draw deflection patterns for the following conditions (assume that vertical and horizontal voltage components V_v & V_h are sinusoidal, with equal amplitude and frequency)

$V_v = 0°$; $V_h = 180°$
$V_v = 90°$; $V_h = 180°$
$V_v = 0°$; $V_h = 0°$

6b.   The voltage across the horizontal deflection plates of the cathode ray oscilloscope is $V_1 \sin(\omega t + \Phi_1)$ and that across the vertical plates is $V_2 \sin(\omega t + \Phi_2)$. Prove that the trace on the screen is an ellipse.

Pu Electronics and Electrical Measurements / Instrumentation
TEXTBOOK: Electrical/Electronic measurement / testing by W. Baton

OBJ

Chr Suif, = Pu FEDERAL UNIVERSITY OF TECHNOLOGY OWERRI
ELECTRICAL/ELECTRONIC DEPARTMENT
ECE302 ELECTRICAL/ELECTRONIC INSTRUMENTATION PRINCIPLES
RAIN SEMESTER EXAMINATION 2011/2012   TIME ALLOWED: 2HOURS

CTION: ANSWER FOUR QUESTIONS ONLY.
ne the following terms as regards to electrical instrumentation: (i) Resolution (ii) Accuracy (iii) Hysteresis error
cision (v) repeatability

is desired to measure the value of current in 1000Ω resistor as shown in fig.Q1 by connecting an Ammeter of 200 Ω
ance. Determine: (i) actual value of current (ii) measured value of current (iii) percentage error in the measurement (v)
racy.

raw the circuit diagrams of the following DC Voltmeters: (i) Direct coupled amplifier transistorized dc voltmeter (ii)
nced bridge triode vacuum tube voltmeter (VTVM).

A meter movement has an internal resistance of 100Ω and requires 1mA dc for full scale deflection. Shunting resistance R_{sh}
ced across the movement has a value of 100Ω. Diodes D_1 and D_2 have an average forward resistance of 400Ω each and
umed to have infinite resistance in the reverse direction. For a 10V ac range evaluate (i) the multiplier value (ii) the
tmeter sensitivity on the ac range. Use fig.Q2

FigQ1   FigQ2
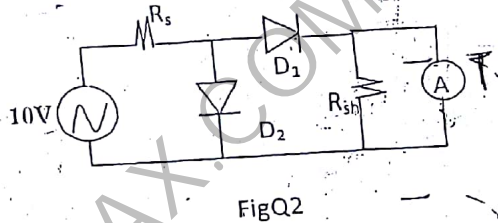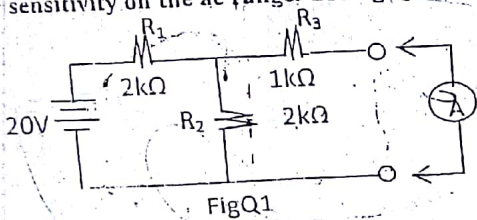
(i) What is potentiometer?

bridge with a 1kHz a.c supply is used to determine the inductance and series resistance of an inductor. At bala
bridge arms are MN 2.0µF in parallel with 10kΩ, NO 200Ω, OP the inductor, and PM 400Ω. What are the inducta
resistance and Q-Factor of the inductor? What is the name of this bridge and give reason for chosen the name. maxwell wien bridge.

iii) If MN 2.0µF is in series with 10kΩ and all other data remain same. What are the inductance, and resistance of the
inductor? Also what is this bridge called? Hay bridge.

a. i. Mention any 2 applications of the Cathode Ray oscilloscope (CRO)
ii. Define the following: (1) AQUADAG (2) LISSAJOUS PATTERNS
iii. Differentiate between the fluorescent characteristic of a material and its phosphorescence characteristic.
iv. What is the use of Delay-Line circuit?
b. (i) The X-deflecting plates in a CRT are 15mm long and 6mm apart. The centre of the plates is 20cm from the screen. The
accelerating voltage is 2500V. Determine the deflection sensitivity and deflection factor of the CRT.

(ii) Draw deflection patterns for the following conditions (assume that vertical and horizontal voltage components V_v & V_h are
sinusoidal, with equal amplitude and frequency)

$V_v = 0°$; $V_h = 180°$, $V_v = 90°$; $V_h = 180°$, $V_v = 0°$; $V_h = 0°$
c. The voltage across the horizontal deflection plates of the cathode ray oscilloscope is $V_1\sin(\omega t + \Phi_1)$ and that across the
vertical plates is $V_2\sin(\omega t + \Phi_2)$. Prove that the trace on the screen is an ellipse.

With suitable block diagrams identify the major difference between Frequency and Period measurements.

tate how Period measurement can be modified for Time Interval measurement.

) Mention any transducer and its area of application.

typical Galvanometric Recorder, show how controlling and deflecting torques are related.
above instrument has a coil of resistance 15Ω and a given current causes a 45° deflection. Assuming constants for th
and springs are 1000 and 20 respectively, determine the voltage the instrument will record when used as a
voltmeter.

$L_S V_d = 2y dV_a$
$\dfrac{y}{V_d}$
$= \dfrac{L_S}{2\cancel{y} d}$