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Question Paper Code : **57319**

7/6/16
FN

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2016

Fourth Semester

Electrical and Electronics Engineering

EE 6404 – MEASUREMENTS AND INSTRUMENTATION

(Regulations 2013)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions.

PART – A ($10 \times 2 = 20$ Marks)

1. Name the dynamic characteristics of measurement systems.
2. What is meant by calibration of an instrument ?
3. Define creeping in energy meter ?
4. How are basic instruments converted into higher range ammeter ?
5. What is called a volt-ratio box ?
6. What is meant by grounding ?
7. Mention the role of Data loggers in Instrumentation system.
8. Distinguish between LED and LCD.
9. What are the factors to be considered for selection of transducers ?
10. List the types of Analog to Digital Converter ?

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PART – B (5 × 16 = 80 Marks)

11. (a) (i) Explain the static characteristics of an instrument. (10)
(ii) Explain in detail the calibration technique. (6)

OR

- (b) What are the different types of errors ? Explain how to eliminate errors in instruments. (16)

12. (a) With neat sketch, explain the construction and operation of repulsion type moving iron instrument. Give the advantages and limitations of such instruments. (16)

OR

- (b) (i) Obtain B-H curve of ring specimen. (8)
(ii) Describe how to obtain iron loss of a ring specimen (8)

13. (a) Draw the diagram of Co-ordinate type A.C. potentiometer and explain its working principle. (16)

OR

- (b) (i) Explain how the inductance is measured in terms of known capacitance using maxwell's bridge. Derive the conditions for balance. (12)
(ii) Why Hay's bridge is suited for measurement of inductance of high Q coils. (4)

14. (a) With neat diagram, explain the basic components and working principle of magnetic tape recorders. (16)

OR

- (b) Describe the construction and working of LCDs. Mention the difference between light scattering and field effect types of LCDs, also explain the advantages of LCDs.

15. (a) Explain in detail about construction and working of LVDT. (16)

OR

- (b) Explain smart sensors with built in features. Compare with conventional sensors. (16)

Question Paper Code : 71775

Fourth Semester

EE 6404 — MEASUREMENTS AND INSTRUMENTATION

Time : Three hours

Maximum : 100 marks

PART A — (10 × 2 = 20 marks)

1. Define the terms accuracy and precision.
2. What is calibration?
3. State the reason for the two types of errors in a potential transformer.
4. List out various causes which incur errors in a dynamometer wattmeter.
5. What are the main causes of ground loop currents?
6. State the features of Ratio Transformers which make them popular for bridge applications.
7. A 3-1/2 digit voltmeter is used for measurement. What is its resolution? How it would display a reading of 12.57 V in 100 V scale?
8. Why is a delay line used in the vertical section of an oscilloscope?
9. What are the basic requirements of a transducer?
10. Arrange the following ADCs in the descending order of speed?
 - (a) Integrating Type
 - (b) Counter Type
 - (c) Successive Approximation Type and
 - (d) Flash Type.

PART B — (5 × 13 = 65 marks)

11. (a) Explain in detail the types of errors and sources of errors in measurement techniques. (13)

Or

- (b) (i) Discuss in detail various dynamic characteristics of a measurement system. (8)
- (ii) A set of ten readings were recorded while measuring the stator temperature of an electric machine. The readings were 52.4, 55.1, 56, 55.4, 57, 54, 53.7, 51.7, 54.9, 53.7 degree Celsius. Calculate :
- (1) The standard deviation,
 - (2) The probable error of one reading and
 - (3) The probable error of mean. (5)

12. (a) Describe the construction and working of an induction type wattmeter. Also derive an expression for the average torque which is proportional to power. (13)

Or

- (b) (i) Discuss the step by step method of determination of B-H curve of a magnetic specimen with necessary circuit arrangement. (7)
- (ii) Explain briefly any one method of measurement of iron losses each from Wattmeter method with neat schematic arrangements. (6)
13. (a) With the help of Schering bridge explain how loss angle of a dielectric can be determined. (13)

Or

- (b) Explain the different types of interferences and their screening methods to reduce them. (13)
14. (a) (i) Describe various types of sweep used in CRO. (5)
- (ii) Explain the theory of LCD displays. Compare LCD displays with LED displays. (8)

Or

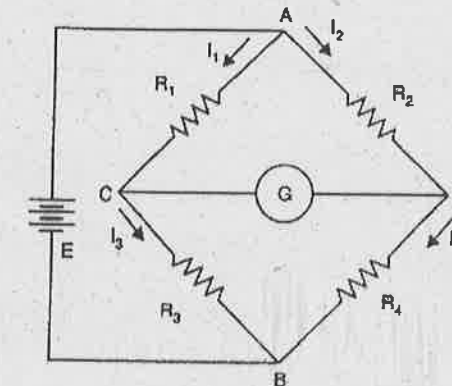
- (b) (i) Describe any one recording method in magnetic tape recorder. (5)
- (ii) Write a short note on Plotter. Compare it with a printer and state its uses. (8)
15. (a) Explain with neat illustrations the working principle of LVDT. (13)

Or

- (b) With a functional block diagram explain the concept of Data Acquisition System. (13)

PART C — (1 × 15 = 15 marks)

16. (a) (i) Explain briefly different classifications of standards. (7)
- (ii) In the Wheatstone bridge shown below the value of $R_1 = 200 \Omega$, $R_2 = 800 \Omega$ and $R_3 = 300 \Omega$. The bridge is excited by a 200 V DC source. Determine the power dissipated by the resistor R_4 when the bridge is balanced. (8)



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Or

- (b) (i) Draw the block diagram of a CRO and explain briefly its vertical deflection system. (8)
- (ii) Discuss briefly the three types of operating torque needed for the satisfactory operation of an indicating instrument. (7)



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Question Paper Code : 41002

09/05/18
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B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2018
Fourth Semester
Electrical and Electronics Engineering
EE6404 – MEASUREMENTS AND INSTRUMENTATION
(Regulations 2013)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions

PART – A

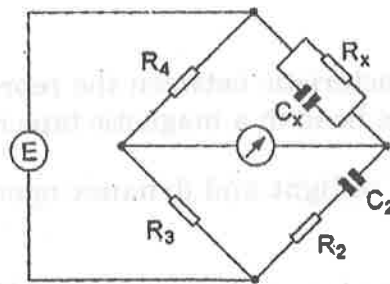
(10×2=20 Marks)

1. A voltmeter reads 152 volts for a particular measurement. If the true value of the measurement is 154 volts, determine the percentage static relative error and static correction.
2. What is average deviation ? What does it indicate on a measuring instrument ?
3. Which type of frequency meter is used over a wide range of voltage ? Why ?
4. What makes the scale of MI instruments cramped at both the lower and upper ends ?
5. Calculate the reactance of a coil from the measurements made on an AC potentiometer. The impedance of the coil is found to be 25 ohms, the phase angle of the voltage across the coil and a standard resistance connected in series with the coil are 55° and 25° respectively.
6. How grounding is implemented in the case of a transformer whose windings on one side is connected in delta ?
7. State the reason for having complementary characteristic between the reproduce head and the amplifier connected to the reproduce head in a magnetic tape recorder ?
8. State the advantages of LED from the intensity of light and dynamic operation point of view.
9. In Capacitive transducer, which principle exhibits linear characteristic ? How ?
10. It is required to convert a range of 0 – 10V DC into digital output with a 10V reference volt. Determine the error caused when the converter used is i) 5 bit converter and ii) 10 bit converter.

PART – B

(5×13=65 Marks)

11. a) i) What is measurement standard ? Explain various classification of standard ? (7)
 ii) With functional block diagrams explain briefly a generalized measurement system. (6)
 (OR)
- b) i) Discuss in detail various static characteristics of a measurement system. (7)
 ii) An electric current of 3 Ampere is flowing through a resistance of 10 ohms. It was found that the resistance was 0.2% greater than what was specified as rated and the ammeter measurement was 0.5% more than the true value. Determine the relative error in power measurement. (6)
12. a) i) Prove that for lagging power factor an electrodynamometer reads more than the true power. Also determine an expression for correcting factor to correct the error caused. (7)
 ii) What is the need for lag adjustment devices ? Explain the concept of lag adjustment using "Shading Bands". (6)
 (OR)
- b) i) Discuss the effect of the following on the errors of Current Transformer.
 1) Change of primary winding current and
 2) Change in secondary winding circuit burden. (7)
 ii) Explain the measurement of iron losses through Wattmeter method with test setup and derive the expression for total iron losses. (6)
13. a) The AC Bridge shown below is used to measure the unknown capacitance C_x and resistance R_x .
 1) Derive an expression for balance equations of the bridge
 2) Determine the value of R_x and C_x , if $R_3 = R_4$, $R_2 = 2.5 \text{ K}\Omega$, $C_2 = 0.2 \mu\text{F}$ and the frequency of the supply is 1 KHz. (7+6)



Question 13 (a)

(OR)

- b) Explain the interference caused due to Electrostatic coupling and Electromagnetic induction and describe protection against such effects.

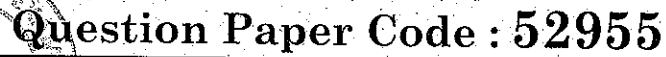
14. a) i) What is a plotter ? Discuss the operation of a Drum type plotter. (7)
 ii) Explain the theory of seven segment LED display. Draw the circuit diagram of a common anode display. (6)
 (OR)
- b) i) With the help of a functional block diagram explain the operation of a Cathode Ray Oscilloscope. (8)
 ii) What is a Data logger ? What are its basic components ? What are the functions of data logger ? (5)
15. a) i) What are Rosettes type strain gauges ? Under which condition rosettes are used ? Draw any two types of rosettes. (7)
 ii) Explain how a Hall effect Transducer is used to measure electric current with a schematic representation. (6)
 (OR)
- b) i) What are the different types of A/D converters ? Compare them with respect to speed, resolution, Noise immunity and cost. (7)
 ii) Discuss Active and Passive Transducers with an example briefly for each type. (6)

PART – C

(1×15=15 Marks)

16. a) Write in detail about the construction and working principle of LVDT. List the advantages and disadvantages of LVDT. (12+3)
 (OR)
- b) i) Describe the different modes of operation of Piezo-electric transducer. (5)
 ii) Explain in detail the working principle of any two digital transducers. (10)

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Fourth Semester

EE 6404 — MEASUREMENTS AND INSTRUMENTATION

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

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PART B — (5 × 13 = 65 marks)

11. (a) (i) With a suitable illustration elaborate the significance of calibrations. (8)
- (ii) Discuss the different types of standards of measurements. (5)

Or

- (b) Classify and explain the different types of errors of measurements. Also mention its compensation methods. (13)
12. (a) Discuss the construction and its working principle of electro-dynamometer type wattmeter. Also derive its expression. (13)

Or

- (b) (i) How to measure the power using instrument transformers? Explain. (5)
- (ii) How do you demonstrate the B-H curve using "step by step" method. (8)
13. (a) (i) A terminal resistor of approximately $50 \mu \Omega$ resistance was measured by means of a kelvin bridge having the following component resistance. Standard resistor = $100.03 \mu \Omega$, inner ratio arms = 100.31Ω and 200Ω , outer ratio arms = 100.24Ω , resistance of link connecting the standard and the unknown resistance = $700 \mu \Omega$. Calculate the unknown resistance to the nearest $0.01 \mu \Omega$. (3)
- (ii) Consider a kelvin double bridge consists each of the ratio arms $P=Q=p=q=1000\Omega$. The emf of the battery is 100V and a resistance of 5Ω included in the battery circuit. The galvanometer has a resistance of 500Ω and the resistance of the link connecting the unknown resistance to the standard resistance may be neglected. The bridge is balanced when the standard resistance $s = 0.001\Omega$.
- (1) Determine the value of unknown resistance.
 - (2) Determine the current through the unknown resistance R balanced.
 - (3) Determine the deflection of the galvanometer when the unknown resistance R is changed by 0.1 percent from its value at balance the galvanometer has a sensitivity of $200 \text{ mm}/\mu\text{A}$. (10)

Or

- (b) (i) In the measurement of power by a polar potentiometer, the following reading were obtained. Voltage across a 0.2 ohm standard resistance in series with the load = $1.46/32^\circ\text{V}$. Voltage across a 200 : 1 potential divider across the line = $1.37/56^\circ\text{v}$. Estimate the current, voltage, power and power factor of the load. (7)

- (ii) A co-ordinate type potentiometer is used for determination of impedance of coil and result obtained are, voltage across a 1.0 ohm resistor in series with the coil +0.238 V on in-phase dial and 0.085 V on quadrature dial. Voltage across a 10 : 1 potential divider used with the coil : +0.3375 V on in-phase dial and 0.232 v on quadrature. Calculate the resistance and reactance of the coil. (6)

14. (a) With neat diagram, explain the parts of CRT in detail. (13)

Or

- (b) Discuss in detail about the various types of magnetic tape recorders. (13)
15. (a) Discuss about the selection criteria for the transducer? Explain the working principles and characteristics of LVDT with neat sketch. Give advantages, disadvantages and applications of LVDT. (13)

Or

- (b) Design the Block diagram arrangement of DAS and describe the function of each component and also state its applications. (13)

PART C — (1 × 15 = 15 marks)

16. (a) The following data refers to a moving coil galvanometer whose resistance is 460 ohm and a resistance of 1970 ohm is connected in series with it.

No.of.turns	=	250
Flux density density	=	0.1 wb/m ²
Control constant	=	0.15*10 ⁻⁶
Dimension of coil	=	30*30 mm
Moment of inertial of coil	=	0.2*10 ⁻⁶ kg m ²

Calculate :

- (i) the resistance to be connected to galvanometer for critical damping,
- (ii) relative damping,
- (iii) logarithmic decrement,
- (iv) frequency of free damped oscillation
- (v) period of undamped and damped
- (vi) first maximum deflection. (15)

Or

- (b) In a test temperature is measured 100 times with variation in apparatus and procedure. After applying the correction the results are

Temp (degree)	397	398	399	400	401	402	403	404	405
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Frequency	1	3	12	23	37	16	4	2	2
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Calculate :

- (i) arithmetic mean,
- (ii) mean deviation
- (iii) standard deviation
- (iv) the probable error of one reading
- (v) the standard deviation and the probable error of the mean
- (vi) the standard deviation of the standard deviation. (15)

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Question Paper Code : 80376

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Fourth Semester

Electrical and Electronics Engineering

EE 6404 — MEASUREMENTS AND INSTRUMENTATION

(Regulations 2013)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Define static sensitivity.
2. What is the significance of calibration?
3. Write any four types of analog ammeter used for instrumentation.
4. Define transformation ratio of an instrument transformer.
5. How are AC potentiometers classified? List them.
6. What are the sources of Electromagnetic interference?
7. What is the principle of operation of an ink-jet printer?
8. What are the functions of data logger?
9. What are the basic requirements of a transducer?
10. Define piezo electric effect.

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) Explain the functional elements of an instrument with a neat block diagram. (10)
(ii) Explain the dynamic characteristics of an instrument in detail. (6)

Or

- (b) A circuit was tuned for resonance by eight different students and the values of resonant frequency in KHZ were recorded as 532, 548, 543, 535, 546, 531, 543 and 536. Calculate (i) Arithmetic mean (ii) Deviation (iii) Average deviation (iv) Standard deviation.

12. (a) With circuit and phasor diagram, explain the working of single phase AC Energy meter.

Or

- (b) Write a short notes on :
- (i) Current Transformer. (8)
 - (ii) Weston frequency meter. (8)
13. (a) (i) Sketch the circuit of Wheatstone bridge, explain its operation and derive the equation for the unknown resistance. (10)
- (ii) Explain Grounding technique. (6)

Or

- (b) Write short notes on :
- (i) Electrostatic interference. (8)
 - (ii) Electromagnetic interference. (8)
14. (a) With neat figure explain the working principle of a digital CRO. What are its advantages over analog CRO?

Or

- (b) Explain the working of Dot matrix display. List its application.
15. (a) (i) Explain in detail, the working principle of piezoelectric transducers. (8)
- (ii) Describe the different criteria for selection of transducer for a particular application. (8)

Or

- (b) Explain Successive approximation type ADC with its characteristics.



Question Paper Code : 50484

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017

Fourth Semester

Electrical and Electronics Engineering

EE6404 – MEASUREMENTS AND INSTRUMENTATION

(Regulations 2013)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions

PART – A

(10×2=20 Marks)

1. List any four static characteristics of a measurement system.
2. Define resolution.
3. What are the sources of errors in DC voltage measurement ?
4. Define creeping.
5. Write the condition for an AC bridge to be balanced.
6. Name the faults that occur in the cables.
7. List the components of a magnetic tape recorder.
8. What are Lissajous figures ?
9. Give any two applications of smart sensors.
10. How are transducers classified ?

PART – B

(5×13=65 Marks)

11. a) i) Describe the functional elements of an instrument with its block diagram. (8)
ii) Explain the dynamic characteristics of an instrument in detail. (5)
- (OR)
- b) i) What is a standard ? Explain the different types of standards. (8)
ii) Explain in detail the different calibration techniques. (5)



12. a) Describe the construction and working principle of single phase induction type energy meter. Write a short note on any adjustment required in energy meter. (13)

(OR)

- b) i) How do you determine the B-H curve using 'step by step' method ? (8)
ii) Explain with neat sketch any one type of instrumentation transformer. (5)
13. a) i) Draw a neat sketch of a modern slide-wire D.C. potentiometer and discuss how the potentiometer is standardized. (8)
ii) Describe the operation of A.C. potentiometer. (5)

(OR)

- b) Explain in detail about the interference and screening in measurements. (13)
14. a) i) Explain the features of digital plotters and printers. (8)
ii) Explain the construction and working principle of Magnetic tape recorder. (5)

(OR)

- b) Describe the LED and LCD display devices. (13)
15. a) What are the selection criteria for a transducer ? Explain the working principle of LVDT with neat sketch. Mention the advantages and applications of LVDT. (13)
- (OR)
- b) What are the performance parameters of analog to digital converter ? Explain any two basic A/D conversion techniques in detail. (13)

PART – C

(1×15=15 Marks)

16. a) Explain in detail about Hall effect transducer and mention some applications of Hall effect transducer. (15)

(OR)

- b) Explain in detail the elements of Data Acquisition System. (15)



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Question Paper Code : 91490

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019

Fourth Semester

Electrical and Electronics Engineering

EE 6404 – MEASUREMENTS AND INSTRUMENTATION

(Regulations 2013)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions

PART – A

(10×2=20 Marks)

1. What is calibration ?
2. A 600V voltmeter is specified to be accurate within $\pm 2\%$ at full scale. Calculate the limiting error when the instrument is used to measure a voltage of 250V.
3. What is loading effect ?
4. Define creeping.
5. List any four applications of AC potentiometers.
6. What is meant by transformer Ratio Bridge ?
7. Define deflection sensitivity.
8. List any two advantages of direct recording.
9. For a 5 bit ladder, if the input levels are $0 = 0V$ and $1 = +10V$. What are the output voltages for each bit ?
10. What is piezoelectric effect ?



PART – B

(5×13=65 Marks)

11. a) i) What is standard and explain in detail about different types of standards ? (5)
ii) What are the different types of error in measurement ? Explain. (6)
iii) A set of ten measurements were recorded in the laboratory with the following values : 98, 101, 102, 97, 101, 100, 103, 98, 106 and 99. Calculate the precision of the 6th measurement. (2)

(OR)

- b) i) Explain the static and dynamic characteristics of an instrument ? (10)
ii) The expected value of the voltage across a resistor is 80V. However the measurement gives a value of 79V. Calculate :
i) absolute error,
ii) percentage of error,
iii) relative error and
iv) percentage of accuracy. (3)

12. a) With a neat diagram, explain in detail the construction of a PMMC instrument ? (13)

(OR)

- b) With a neat diagram explain the construction and working of an electro-dynamometer type wattmeter. (13)

13. a) What is Hay's bridge ? Derive its balance equation. When it is preferred over Maxwell bridge ? (13)

(OR)

- b) i) Explain the different techniques of grounding. (7)
ii) Write short notes on Electromagnetic interference. (6)

14. a) With a neat block diagram, explain the function of a general purpose oscilloscope. (13)

(OR)

- b) Explain the operating principle of liquid crystal display. Discuss the advantage, disadvantage and various application of LCD. (13)

15. a) With a neat diagram, explain the construction and working principle of LVDT. State the advantage and disadvantage of LVDT. (13)

(OR)

- b) Explain schematic block diagram of a general Data Acquisition System (DAS) and give its objectives. (13)

16. a) i) Explain with a neat block diagram, the operation of linear ramp digital voltmeter. (8)
- ii) A $4\frac{1}{2}$ digital voltmeter is used for voltage measurements. (4)
- i) Find its resolution.
- ii) How would 12.98V be displayed on a 10V range ?
- iii) How would 0.6973 be displayed on 1V and 10V range ?
- iii) Calculate the unknown inductance and resistance measured by Hay's bridge. The bridge elements at the balancing conditions are $C_1 = 1\mu F$, $R_1 = 2k\Omega$, $R_2 = 10k\Omega$, $R_3 = 1k\Omega$. The supply angular frequency is 3000 rad/sec. (3)
- (OR)
- b) i) Write brief notes on optical encoders. (6)
- ii) A 12 bit DAC has a step size of 8mV. Determine the full scale output voltage and percentage resolution. Also find the output voltage for the input of 010101101101 ? (4)
- iii) A moving coil ammeter has fixed shunt of 0.01Ω with a coil resistance of 750Ω and a voltage drop of 400 mV across it, the full scale deflection is obtained. Calculate the current through shunt and the resistance of meter to give full scale deflection if the shunt current is 50A. (5)