

Code No: R1642042

**R16**

**Set No. 1**

**IV B.Tech II Semester Advanced Supplementary Examinations, Aug/Sep - 2022**  
**ELECTRONIC MEASUREMENTS AND INSTRUMENTATION**  
(Electronics and Communication Engineering)

**Time: 3 hours**

**Max. Marks: 70**

*Question paper consists of Part-A and Part-B*  
*Answer ALL sub questions from Part-A*  
*Answer any FOUR questions from Part-B*

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**PART-A (14 Marks)**

1. a) Define the terms Accuracy and Precision. [2]
- b) Draw the basic wave analyzer? [2]
- c) What are the different controls available on CRO panel? [2]
- d) What is Schering bridge? Write the equation of balance for the bridge? [2]
- e) List any three classifications of transducers? [3]
- f) How do you measure humidity? [3]

**PART-B (4x14 = 56 Marks)**

2. a) List the different types of errors in measurements? Explain in detail. [7]
- b) How the range of DC ammeter and DC voltmeter can be extended. Derive the expression to find the shunt resistance and multiplier resistance? [7]
3. a) Draw the block diagram of a spectrum analyzer and explain its working. [7]
- b) With the help of neat sketch explain the working principle of harmonic distortion analyzer. [7]
4. a) Write short notes on Lissajous patterns. Explain how are they used for the measurement of frequency and phase angle? [7]
- b) Draw a neat block diagram of a Cathode Ray Oscilloscope and specify the function of each block. Also Explain its working principle [7]
5. a) What is the criterion for balance of a Wheatstone bridge? State the limitations of a Wheatstone bridge. How is it overcome? [7]
- b) What is Maxwell's bridge? Derive the equation of balance for the bridge? [7]
6. a) Describe the construction, theory and working of thermocouples. Explain the different types of compensations used in the measuring system? [7]
- b) Briefly discuss about the working of piezoelectric transducers and draw its electric equivalent circuit? [7]
7. a) Explain the significance of load cell in static and dynamic force measurement. [7]
- b) What do you understand by multichannel DAS? State the different ways in which multichannel DAS are used. [7]

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**R16**

**Set No. 1**

**IV B.Tech II Semester Regular/Supplementary Examinations, June - 2022**  
**ELECTRONIC MEASUREMENTS AND INSTRUMENTATION**  
**(Electronics and Communication Engineering)**

**Time: 3 hours**

**Max. Marks: 70**

*Question paper consists of Part-A and Part-B*  
*Answer ALL sub questions from Part-A*  
*Answer any FOUR questions from Part-B*

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**PART-A(14 Marks)**

1. a) Explain the importance of Ohmmeters [3]
- b) Draw the Basic wave analyzer and explain its operation [2]
- c) Define deflection sensitivity of a CRT? [2]
- d) Derive the balance condition of Bridge [2]
- e) Explain the different Advantages of Electrical Transducers in detail [2]
- f) Explain any one of the method for the measurement of humidity? [3]

**PART-B(4x14 = 56 Marks)**

2. a) Explain the following terms in detail [7]  
(i) Accuracy (ii) Resolution (iii) Precision (iv) Expected value
- b) List out different AC voltmeters and explain the working of any one voltmeter in detail [7]
3. a) What is Heterodyning and explain the use of Heterodyning in spectrum analyzer along with its circuit diagram [7]
- b) Write short notes on Function Generator in detail [7]
4. a) Explain the concept of Storage oscilloscope along with circuit diagram [7]
- b) Draw the circuit diagram of Sampling oscilloscope and explain its operation in detail. [7]
5. a) Draw and explain the operation of Wien Bridge and derive the bridge balance condition [7]
- b) In the case of a Schering Bridge, arm AC has  $R=7.7k\Omega$ . Arm CD has unknown elements. Arm BD has  $C=0.01\mu F$  Arm AB= $4.7K\Omega$  is shunt with 1MF. Determine Values of components in the arm CD [7]
6. a) Explain the Resistive position Transducer along with circuit diagram. [7]
- b) List out different types of Strain Gauges used Transducer and explain any one in detail. [7]
7. a) With the help of a neat sketch explain the principle and working of Electromagnetic Flow meter. What are the advantages and Limitations of this Method? [7]
- b) Briefly explain the working principles and measurement of force by any two nonelectric techniques? [7]

**IV B.Tech II Semester Regular/Supplementary Examinations, June - 2022**  
**ELECTRONIC MEASUREMENTS AND INSTRUMENTATION**  
**(Electronics and Communication Engineering)**

Time: 3 hours

Max. Marks: 70

*Question paper consists of Part-A and Part-B*  
*Answer ALL sub questions from Part-A*  
*Answer any FOUR questions from Part-B*

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**PART-A(14 Marks)**

1. a) Explain the term Dynamic error in detail [3]
- b) Distinguish between spectrum analyzer and harmonic distortion analyzer [2]
- c) Explain the concept of delay line in CRO [2]
- d) Define Quality factor and give the expressions for the inductive and capacitive Quality factors [2]
- e) List out difference between active and passive transducer in detail [2]
- f) Explain the significance of load cell in force measurement [3]

**PART-B(4x14 = 56 Marks)**

2. a) Draw the Sketch and explain the principle and operation of Thermocouple type Ammeter. [7]
- b) Two ammeters are joined in series in a circuit carrying 150 A. one ammeter has a resistance of 20000 ohm shunted by 0.10 ohm while the other ammeter has a resistance of 100 ohm shunted by 0.02ohm. if the shunts are interchanged what would be the readings of the instruments? [7]
3. a) What is AF oscillators and explain its operation along with circuit diagram. [7]
- b) Draw the circuit diagram of Digital Fourier Analyzers and explain its operation. [7]
4. a) Explain the Measurement procedure of Lissajous patterns with one example. [7]
- b) Explain the principle and working of a storage oscilloscope [7]
5. a) Draw the circuit diagram of Schering's Bridge and explain the operation of it. [7]
- b) Explain the "parallel-connection" method of using Q-meter and Obtain the expressions for resistance, reactance and Q factor. [7]
6. a) Draw the Linear variable differential Transducer and explain its operation in detail. [7]
- b) What is Thermistor and explain its importance along with advantages of it? [7]
7. a) What is proximity? Explain the operation of proximity transducer. [7]
- b) How angular speed shall be measured using the digital method? [7]

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**Set No. 3**

**IV B.Tech II Semester Regular/Supplementary Examinations, June - 2022**  
**ELECTRONIC MEASUREMENTS AND INSTRUMENTATION**  
(Electronics and Communication Engineering)

**Time: 3 hours**

**Max. Marks: 70**

*Question paper consists of Part-A and Part-B*  
*Answer ALL sub questions from Part-A*  
*Answer any FOUR questions from Part-B*  
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**PART-A(14 Marks)**

1. a) Draw the series type Ohmmeter and explain its operation [3]
- b) Define the terms Dynamic range and Harmonic mixing [2]
- c) List out specifications of CRO [2]
- d) What are the problems associated with shielding? And explain the remedies [2]
- e) Define Gauge factor for transducer and explain its significance [2]
- f) List the applications of Hydraulic force meter [3]

**PART-B(4x14 = 56 Marks)**

2. a) Draw the Block diagram of successive approximation type Digital voltmeter and explain its operation [7]
- b) Differentiate between a true R.M.S meter and an average responding meter. [7]
3. a) Draw the circuit diagram and explain the operation of Digital spectrum analyzer' [7]
- b) Explain the requirements of pulse with reference to generator along with block diagram. [7]
4. a) Draw the circuit diagram of Sampling oscilloscope and explain its operation in detail. [7]
- b) Explain various types of probes used for CRO. [7]
5. a) Explain the operation of Maxwell's Bridge and derive the condition for balance of a Bridge. [7]
- b) In the case of Hay's Bridge one arm has resistance of  $100\text{K}\Omega$  .Another arm has a resistance of  $6.7\text{K}\Omega$ . The third arm  $16\text{K}\Omega$  in series with a capacitor of  $0.5\mu\text{F}$ . Determine the values of the elements  $R_x$  and  $L_x$  in the fourth arm. [7]
6. a) What is Piezo-electric effect? Explain the operation of Piezo-electric transducer. [7]
- b) Explain the working of capacitive transducers. [7]
7. a) Define and explain about Absolute humidity, Relative humidity, Specific humidity. Elaborate how humidity is measured. [7]
- b) Explain in detail about the stroboscope for the measurement of speed. [7]

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**Set No. 4**

**IV B.Tech II Semester Regular/Supplementary Examinations, June - 2022**  
**ELECTRONIC MEASUREMENTS AND INSTRUMENTATION**  
(Electronics and Communication Engineering)

**Time: 3 hours**

**Max. Marks: 70**

*Question paper consists of Part-A and Part-B*  
*Answer ALL sub questions from Part-A*  
*Answer any FOUR questions from Part-B*

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**PART-A(14 Marks)**

1. a) Give a classification of voltmeters [3]
- b) List the applications of wave analyzers [2]
- c) List out the different Futures of CRT in detail [2]
- d) Explain the limitations of Wheatstone bridge [2]
- e) Write short notes on Sensistor's and Thermistor's [2]
- f) Explain the concept of Data acquisition systems in detail [3]

**PART-B(4x14 = 56 Marks)**

2. a) Explain in detail about DC voltmeters with the suitable example [7]
- b) A Voltmeter having a sensitivity of 30k/V reads 80V on a 100V scale, when connected across an unknown resistor. The current through the resistor is 2mA. Calculate the % of error due to loading effect [7]
3. a) Explain the working principle of a harmonic distortion analyzer along with circuit diagram [7]
- b) Explain the significance and working of frequency selective wave analyzer [7]
4. a) Illustrate about construction of Cathode Ray Oscilloscope. [7]
- b) Explain the operation of trigger pulse circuit along with circuit diagram [7]
5. a) Describe the method of measuring high impedance using Q-meter. [7]
- b) Draw the circuit diagram of Maxwell's bridge and derive conditions of balance [7]
6. a) What is the difference between photo-emissive, photo-conductive and photovoltaic transducers? [7]
- b) Derive the expression for Gauge factor of a strain Gauge. [7]
7. a) Define moisture and explain a method to measure it [7]
- b) Explain the working principle of an accelerometer along with diagram [7]

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**Set No. 1**

**IV B.Tech II Semester Advanced Supplementary Examinations, October - 2021**  
**ELECTRONIC MEASUREMENTS AND INSTRUMENTATION**  
**(Electronics and Communication Engineering)**

**Time: 3 hours**

**Max. Marks: 70**

*Question paper consists of Part-A and Part-B*  
*Answer ALL sub questions from Part-A*  
*Answer any FOUR questions from Part-B*  
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**PART-A(14 Marks)**

1. a) Define the terms Accuracy and Resolution. [ 2]  
b) What are the applications of spectrum analyzer? [ 2]  
c) Compare analog and digital storage oscilloscopes. [ 3]  
d) What is a Q-meter? [ 2]  
e) Define Gauge factor for transducer and explain its significance. [ 3]  
f) What are the objectives of a DAS? [ 2]

**PART-B(4x14 = 56 Marks)**

2. a) Explain the working of a potentiometer type digital voltmeter. [7]  
b) Two ammeters are joined in series in a circuit carrying 100A. One ammeter has a resistance of 10000ohm shunted by 0.10ohm while the other ammeter has a resistance of 150ohm shunted by 0.02ohm. If the shunts are interchanged what would be the readings of the instruments. [7]
3. a) What is AF oscillator? Explain its operation with a circuit diagram. [7]  
b) Draw the circuit diagram of Digital Fourier Analyzers and explain its operation. [7]
4. a) Explain the concept of Storage oscilloscope along with circuit diagram. [7]  
b) Draw the circuit diagram of Sampling oscilloscope and explain its operation in detail. [7]
5. a) Illustrate the method of measurement of unknown inductance by Maxwell's bridge. [7]  
b) In the case of Hay's Bridge one arm has resistance of 10KΩ .Another arm has a resistance of 6.7KΩ. The third arm 8KΩ in series with a capacitor of 0.5μF. Determine the values of the elements Rx and Lx in the fourth arm [7]
6. a) Explain how the piezoelectric transducer can be used to measure force and pressure. [7]  
b) Explain the working of resistance thermometer. [7]
7. a) With a neat sketch explain the working of force measuring instrument. [7]  
b) Explain in detail about the stroboscope for the measurement of speed. [7]

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**Set No. 1**

**IV B.Tech II Semester Regular/Supplementary Examinations, July - 2021**  
**ELECTRONIC MEASUREMENTS AND INSTRUMENTATION**  
**(Electronics and Communication Engineering)**

**Time: 3 hours**

**Max. Marks: 70**

*Question paper consists of Part-A and Part-B*

*Answer ALL sub questions from Part-A*

*Answer any FOUR questions from Part-B*

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**PART-A (14 Marks)**

1. a) Explain the procedure how to find Errors in Measurement with example. [3]
- b) Formulate an equation for the measured value of total harmonic distortion. [2]
- c) Distinguish between analog and digital storage oscilloscope. [2]
- d) List out the different Precautions to be taken when using a Bridge with one example. [2]
- e) What is a Transducer? Give the classification of transducers. [2]
- f) Explain the characteristics of Digital Data Acquisition System. [3]

**PART-B (4x14 = 56 Marks)**

2. a) Draw the circuit diagram of series type, and shunt type Ohmmeters and explain its operation in detail. [7]
- b) With necessary block diagram, explain the function of differential voltmeter. [7]
3. a) Describe the circuits and working of wave analyzers used for audio frequency and megahertz range. [7]
- b) Discuss in detail about the fixed and variable type of signal generators. [7]
4. a) Explain the Measurement procedure of Lissajous patterns with one example. [7]
- b) Explain the operation of vertical amplifier used in a CRO. [7]
5. Draw the circuit of Schering bridge and explain its utility, also derive expressions for unknown components. [14]
6. a) Explain the principle of operation of strain gauges with the help of neat diagrams. [7]
- b) What is a thermistor? Explain. Write about its advantages and disadvantages. [7]
7. a) With neat sketch explain the measurement of Velocity [7]
- b) Define Humidity. Explain the procedure for the measurement of humidity. [7]

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Code No: 125AM

**R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, May - 2018

**ELECTRONIC MEASUREMENTS AND INSTRUMENTATION**

(Electronics and Communication Engineering)

Time: 3 hours

Max. Marks: 75

**Note:** This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

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**PART - A**

(25 Marks)

- 1.a) Define and derive static and Dynamic error. [2]
- b) Give a classification of voltmeters. [3]
- c) Distinguish between spectrum analyzer and harmonic distortion analyzer. [2]
- d) List out the difference between fixed frequency and variable AF oscillator. [3]
- e) Define deflection sensitivity of a CRT. [2]
- f) Summarize the advantages of dual beam for multiple trace oscilloscopes. [3]
- g) List the applications of inductive transducers. [2]
- h) Summarize the main elements of velocity transducer. [3]
- i) Derive the balance condition of Bridge. [2]
- j) List out the different Precautions to be taken when using a Bridge with one example. [3]

**PART - B**

(50 Marks)

- 2.a) What is the principle and operation of a thermocouple type RF ammeter.
- b) A voltmeter having a sensitivity of  $1K\Omega/V$  is connected across an unknown resistance in series with a milli ammeter reading 80V on 150V scale. When the milli ammeter reads 10mA, Calculate the (i) apparent resistance of the unknown resistor (ii) Actual resistance of the unknown resistor, and (iii) Error due to the loading effect of the voltmeter? [5+5]

**OR**

- 3.a) Discuss basic characteristics of measuring devices.
- b) A  $200\Omega$  basic movement is to be used as an ohmmeter requiring full scale deflection of 1 mA and internal battery voltage of 5 V. A half scale deflection marking of 2 k is desired. Calculate
  - i) The values of  $R_1$  and  $R_2$
  - ii) Maximum value of R to compensate for a 3% drop in battery voltage. [5+5]

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- 4.a) Discuss square wave and pulse generator with neat block diagrams.  
b) How the fundamental frequency is suppressed using fundamental suppression distortion analyser? Explain. [5+5]

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- 5.a) Discuss how function generator generates sine wave, triangular wave and square wave.  
b) Describe the functions of an attenuator in a signal generator. [5+5]

- 6.a) Describe the Measurement procedure of Lissajous patterns with one example.  
b) Discuss the principle and working of Q-meter. [5+5]

AG AG AG OR AG AG AG AG A

- 7.a) Explain the internal structure of CRT and describe the principle of electrostatic focusing.  
b) Sketch the basic block diagram for a digital storage oscilloscope and explain the operation. [5+5]

- 8.a) Explain the working of capacitive transducers.  
b) Discuss the operation of potentiometric transducer. [5+5]

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- 9.a) A thermistor has a resistance of  $3980 \Omega$  at the ice point ( $0^\circ\text{C}$ ) and  $749 \Omega$  at  $50^\circ\text{C}$ . The resistance temperature relationship is  $R_T = a R_0 e^{b/T}$ . Find the values of a and b. Calculate the resistance to be measured in case the temperature varies from  $400^\circ\text{C}$  to  $100^\circ\text{C}$ ?  
b) Describe the construction and working of LVDT. [5+5]

AG AG AG OR AG AG AG AG A

- 10.a) Explain the operation of wheat stone bridge with derivations.  
b) Derive the expression for unknown resistance in Kelvin double bridge. [5+5]

- OR  
11.a) Explain the sources of errors and their minimizing methods.  
b) Discuss various methods of connecting components to a Q-meter for measurement. [5+5]

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# R16

Set No. 1

IV B.Tech II Semester Regular Examinations, September - 2020  
**ELECTRONIC MEASUREMENTS AND INSTRUMENTATION**  
(Electronics and Communication Engineering)

Time: 3 hours

Max. Marks: 70

*Question paper consists of Part-A and Part-B*

*Answer ALL sub questions from Part-A*

*Answer any FOUR questions from Part-B*

\*\*\*\*\*

**PART-A**(14 Marks)

1. a) Define any two static characteristics. [2]
- b) Where are spectrum analyzers commonly used? [2]
- c) Why is a delay line important in a CRO? [2]
- d) What type of errors can occur while using bridges? [3]
- e) What are active and passive transducers? Give examples. [2]
- f) Mention any three objectives of a Data Acquisition System. [3]

**PART-B**(4x14 = 56 Marks)

2. Write notes on the following  
a) Series type Ohmmeters. [7]  
b) Shunt type Ohmmeters. [7]
3. a) What are fixed and variable signal generators? Discuss briefly. [7]  
b) Explain the working of AF Sine and square wave generator with neat block diagram. [7]
4. a) Draw and explain the block diagram of vertical amplifier used in oscilloscopes. [7]  
b) Describe in detail the Lissajous method of frequency measurement. [7]
5. a) Explain the measurement of Inductance using Maxwell's bridge. [10]  
b) A Maxwell's bridge is used to measure an inductive impedance. The bridge constants at balance are  $C1=0.01\mu F$ ,  $R1=470K\Omega$ ,  $R2=5.1K\Omega$  and  $R3=100K\Omega$ . Find the series equivalent of the unknown impedance. [4]
6. Discuss the principle of operation of  
a) Thermistors. [7]  
b) Sensistors. [7]
7. Explain in detail the measurement of  
a) Proximity. [7]  
b) Speed. [7]

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# R16

Set No. 2

IV B.Tech II Semester Regular Examinations, April - 2020  
**ELECTRONIC MEASUREMENTS AND INSTRUMENTATION**  
(Electronics and Communication Engineering)

Time: 3 hours

Max. Marks: 70

*Question paper consists of Part-A and Part-B*

*Answer ALL sub questions from Part-A*

*Answer any FOUR questions from Part-B*

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**PART-A**(14 Marks)

1. a) What is dynamic error? Plot it with respect to time delay. [3]
- b) What is the difference between a simple signal generator and a sweep generator? [2]
- c) What is the purpose of a trigger pulse in a CRO? [2]
- d) What are the disadvantages of a Wheatstone bridge? [2]
- e) Define Transducer? What are the various characteristics of a transducer? [3]
- f) Why is signal conditioning of inputs necessary in a DAS? [2]

**PART-B**(4x14 = 56 Marks)

2. a) Explain the working of a basic DC voltmeter. How can its range be extended? [10]
- b) Calculate the value of multiplier resistance on the 50V range of a dc voltmeter that uses a  $200\mu\text{A}$  meter movement with an internal resistance of  $100\Omega$ . [4]
3. a) What is a Spectrum Analyzer? Discuss in detail its working principle with a neat block diagram. [10]
- b) What are the applications of Spectrum Analyzer? [4]
4. Write short notes on the following
  - a) Delay line. [4]
  - b) Sync Selector circuit. [5]
  - c) CRO probes. [5]
5. a) What are the various errors and precautions to be taken while using bridges? [7]
- b) Explain briefly the working of Schering bridge. [7]
6. a) Explain the working principle of Piezo electric transducer in detail. [7]
- b) Discuss briefly the working of Resistance thermometer. [7]
7. Explain the measurement procedure of the following parameters with suitable figures.
  - a) Pressure. [7]
  - b) Displacement. [7]

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**R16**

**Set No. 3**

**IV B.Tech II Semester Regular Examinations, September - 2020**  
**ELECTRONIC MEASUREMENTS AND INSTRUMENTATION**  
**(Electronics and Communication Engineering)**

**Time: 3 hours**

**Max. Marks: 70**

*Question paper consists of Part-A and Part-B*

*Answer ALL sub questions from Part-A*

*Answer any FOUR questions from Part-B*

\*\*\*\*\*

**PART-A(14 Marks)**

1. a) What is the difference between accuracy and precision? [2]
- b) What are the various requirements of a pulse? [3]
- c) List various features of a CRT. [2]
- d) What is a bridge circuit and what are its advantages? [2]
- e) What are the advantages and disadvantages of a semi-conductor Strain gauge? [3]
- f) Define humidity and moisture. [2]

**PART-B(4x14 = 56 Marks)**

2. a) What are the different types of errors in measurement? Explain briefly. [7]
- b) A 100Ω basic movement is to be used as an ohmmeter requiring a full scale deflection of 1mA and internal battery voltage of 3V. A half-scale deflection marking of 2K is desired. Calculate (i) Values of R1 and R2 (ii) maximum value of R2 to compensate for a 5% drop in battery voltage. [7]
3. Write notes on the following  
a) Wave Analyzers [7]  
b) Harmonic Distortion Analyzers [7]
4. Explain the working of the following in detail with neat block diagrams  
a) Digital Storage Oscilloscope [7]  
b) Dual Trace Oscilloscope [7]
5. Write notes on the following Bridges  
a) Wien Bridge [7]  
b) Anderson Bridge [7]
6. a) Explain the working of LVDT in detail. [8]
- b) An AC LVDT has the following data: Input=6.3V, output=5.2V, range ±0.5in. Determine (i) The output voltage vs core position for a core movement going from +0.45in to -0.30in (ii) The output voltage when the core is -0.25in from the centre. [6]
7. Explain in detail about Data Acquisition Systems. [14]

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# R16

Set No. 4

IV B.Tech II Semester Regular Examinations, September - 2020  
**ELECTRONIC MEASUREMENTS AND INSTRUMENTATION**  
(Electronics and Communication Engineering)

Time: 3 hours

Max. Marks: 70

*Question paper consists of Part-A and Part-B*

*Answer ALL sub questions from Part-A*

*Answer any FOUR questions from Part-B*

\*\*\*\*\*

**PART-A**(14 Marks)

1. a) Define Fidelity and Lag. [2]
- b) What is meant by duty cycle? [2]
- c) List the standard specifications of a CRO. [3]
- d) What is a Q-meter? [2]
- e) Draw the stress-strain curve for typical metals. [2]
- f) Define the terms Proximity, displacement and pressure. [3]

**PART-B**(4x14 = 56 Marks)

2. Explain the measurement of the following parameters in a circuit using a multi-meter  
a) Voltage [5]  
b) Current [5]  
c) Resistance [4]
3. Explain the operation of function generator with a neat block diagram. [14]
4. a) Draw the block diagram of a simple CRO and describe its parts. [8]  
b) Explain the working of a CRO in detail. [6]
5. a) Draw and explain the working of a Wheatstone bridge in detail. [10]  
b) What resistance range must resistor R3 have in order to measure unknown resistor in the range 1-100K $\Omega$  using a Wheatstone bridge. Given R1=1K and R2=10K. [4]
6. a) Explain the construction and working of Unbonded and Bonded resistance wire strain gauges in detail. [10]  
b) Discuss the advantages and disadvantages of LVDT. [4]
7. Describe in detail the measurement of  
i) Force [7]  
ii) Velocity [7]