SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF

ELECTRONICS AND INSTRUMENTATION ENGINEERING

QUESTION BANK

III SEMESTER

1907302-ELECTRICAL AND ELECTRONIC INSTRUMENTS

Regulation – 2019

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Prepared by

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SRM Nagar, Kattankulathur – 603 203.
DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING

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SUBJECT : 1907302-ELECTRICAL AND ELECTRONIC INSTRUMENTS
SEM / YEAR : III / II

UNIT-1
SCIENCE OF MEASUREMENTS

Units and standards – Classification of errors in measurement, Odds and uncertainty - propagation of errors – Error analysis - Galvanometers - Moving coil meter, Moving iron meter, Dynamometer and Induction type meters - Measurement of voltage, current, power and Energy in single and three phase circuits - AC and DC current probes

S. No	Questions	BTL	Competence
1.	Distinguish re-producibility and repeatability.	**BTL4**	**Analyze**
2.	Why calibration of instrument is important?	**BTL2**	**Understand**
3.	What is the significance of Odds?	**BTL1**	**Remember**
4.	What is standard? What are the different types of standards?	**BTL1**	**Remember**
5.	What are the types of error measurement system?	**BTL2**	**Understand**
6.	How do you infer the term error?	**BTL3**	**Apply**
7.	A permanent magnet moving coil instrument has full scale deflection of 75μA and a coil resistance of 1KΩ. Calculate the required shunt resistance value to convert the instrument into an ammeter with full scale deflection of 75mA.	**BTL 5**	**Evaluate**
8.	List the methods of calibrating a ballistic galvanometer.	**BTL1**	**Remember**
9.	Identify the main sources of errors in PMMC instruments.	**BTL1**	**Remember**
10.	Mention the advantages and disadvantages of moving iron instruments.	**BTL1**	**Remember**
11.	Examine why the scale in the MI instrument is non-linear.	**BTL4**	**Analyze**
12.	Is it possible to measure DC and AC using permanent magnet moving coil type instrument? Convince.	**BTL3**	**Apply**
13.	Compare spring control and gravity control.	**BTL4**	**Analyze**
14.	Differentiate between current coil and pressure coil of electrodynamometer wattmeter.	**BTL3**	**Apply**
15.	An energy meter is designed to make 100 revolutions of disc for one unit of energy. Calculate the number of revolutions made by it when connected to load carrying 40 A at 230 V and 0.4 power factor for an hour.	**BTL 5**	**Evaluate**
16.	How calibration is done in energy meter and List any four adjustments in the energy meter?	**BTL6**	**Create**
17.	Give the expression for deflection in M.I ammeter.	**BTL2**	**Understand**
18.	What are the types of control system and damping system are used in dynamometer instrument?	**BTL2**	**Understand**
19.	Write down the deflecting torque equation in dynamometer type wattmeter.	**BTL6**	**Create**
20.	What is the purpose of copper shading bands in induction type wattmeter?	**BTL1**	**Remember**
21.	How to extend the range of voltmeters?	**BTL3**	**Apply**
22.	What are the requirements of materials used in making shunts for extending range of instruments?	**BTL2**	**Understand**
23.	How to make adjustments in energy meters to reduce the error?	**BTL4**	**Analyze**
24.	How is the compensation for inductance of pressure coil realized on low power factor watt meter?	**BTL 5**	**Evaluate**

<table>
<tr><th colspan="4">PART-B</th></tr>
<tr><td>1.</td><td>What is Error analysis? Also explain their Statistical methods in error analysis. (13)</td><td>BTL3</td><td>Apply</td></tr>
<tr><td>2.</td><td>(i) Discuss about the Odds and uncertainty. (4)
(ii) In a test, temperature is measured 100 times with variations in apparatus and procedures. After applying the corrections, the results are given below. Calculate the arithmetic mean, the average deviation, the standard deviation and the probable error. Classify standards and give example for each level of standard. (9)
<table>
<tr><td>Temperature (°C)</td><td>397</td><td>398</td><td>399</td><td>400</td><td>401</td><td>402</td><td>403</td><td>404</td><td>405</td></tr>
<tr><td>Frequency</td><td>1</td><td>3</td><td>12</td><td>23</td><td>37</td><td>16</td><td>4</td><td>2</td><td>2</td></tr>
</table></td><td>BTL4</td><td>Analyze</td></tr>
<tr><td>3.</td><td>(i)Explain the construction and operation of D’Arsonval galvanometer. (8)
(ii)Obtain expression for deflection of D’Arsonval galvanometer. (5)</td><td>BTL4</td><td>Analyze</td></tr>
<tr><td>4.</td><td>Classify the standards and give example for each level of standard. (13)</td><td>BTL1</td><td>Remember</td></tr>
<tr><td>5.</td><td>Explain the types of errors in measurement system and explain how they are corrected. (13)</td><td>BTL1</td><td>Remember</td></tr>
<tr><td>6.</td><td>Describe with neat diagram the construction and working principle of attraction and repulsion type MI instruments. (13)</td><td>BTL2</td><td>Understand</td></tr>
<tr><td>7.</td><td>Develop the torque equation for a PMMC instrument. Show that its scale is linear if spring control is employed and list out the advantages. (13)</td><td>BTL3</td><td>Apply</td></tr>
<tr><td>8.</td><td>Describe in detail with neat illustration, the construction, working principle of moving coil meters. (13)</td><td>BTL1</td><td>Remember</td></tr>
<tr><td>9.</td><td>Illustrate how MI instruments can be used for both AC and DC measurement using construction diagram with different vane arrangements. Justify why MI instruments cannot be accurate for DC measurement. (13)</td><td>BTL4</td><td>Analyze</td></tr>
<tr><td>10.</td><td>The coil of a 600V M.I meter has an inductance of 1 Henry. It gives correct reading at 50HZ and requires 100mA. For its full-scale deflection, what is % error in the meter when connected to 200V D.C. by comparing with 200V A.C? (13)</td><td>BTL6</td><td>Create</td></tr>
<tr><td>11.</td><td>Explain the operation of dynamometer type ammeter with torque equation. (13)</td><td>BTL1</td><td>Remember</td></tr>
<tr><td>12.</td><td>With neat sketch and phasor diagram discuss the construction and operation of induction type single phase energy meter. (13)</td><td>BTL2</td><td>Understand</td></tr>
<tr><td>13.</td><td>A moving coil instrument gives a full-scale deflection of 10mA when the potential difference across its terminals is 100 mV. Calculate:
(i) Shunt resistance for a full-scale deflection corresponding to 100 A. (7)
(ii) Series resistance for full scale reading with 1000 V. (6)</td><td>BTL 5</td><td>Evaluate</td></tr>
<tr><td>14.</td><td>With a neat sketch describe the construction and working principle of dynamometer type wattmeter. Develop its torque equation. (13)</td><td>BTL2</td><td>Understand</td></tr>
<tr><td>15.</td><td>Describe the construction and working of attraction type MI instrument?</td><td>BTL2</td><td>Understand</td></tr>
<tr><td>16.</td><td>A moving coil instrument has a resistance of 10 ohm and gives a full scale deflection When carrying 50mA. Show how it can be adopted to measure voltage upto 750 V and current of 100 A.</td><td>BTL 5</td><td>Evaluate</td></tr>
<tr><td>17.</td><td>Distinguish between gross error, systematic error and random error with examples. What are the methods for their elimination/reduction?</td><td>BTL3</td><td>Apply</td></tr>
<tr><th colspan="4">PART-C</th></tr>
<tr><td>1.</td><td>Discuss briefly the three types of operating torque needed for the satisfactory operation of the indicating instruments. (15)</td><td>BTL6</td><td>Create</td></tr>
</table>

2.	A moving coil galvanometer gives a deflection of 150 mm on a scale distance 2.5 m for a current of 2.5 μA. The resistance of the moving coil of galvanometer is 250 Ω. Evaluate (i) Current Sensitivity (ii) Voltage Sensitivity (iii) Mega ohm sensitivity (iv) The deflection produced in radians by a current of 5 μA. **(15)**	**BTL 5**	**Evaluate**
3.	Discuss how the range of a PMMC voltmeter and ammeter be extended. **(15)**	**BTL6**	**Create**
4.	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: (i) The Standard deviation (ii) The probable error of one reading and (iii) The probable error of mean. **(15)**	**BTL 5**	**Evaluate**
5.	**(i)** An energy meter is designed to make 100 revolution of the disc for one unit of energy. Calculate the number of revolutions made by it when connected to a load carrying 40 A at 230-V and 0.4 power factor for an hour. If it actually makes 360 revolutions, find the percentage error. **(7)** **(ii)** Derive the torque equation of moving iron instrument and comment on the shape of the scale. **(8)**	**BTL 5**	**Evaluate**

UNIT-II

MEASUREMENT OF RESISTANCE, INDUCTANCE AND CAPACITANCE

DC potentiometer – Measurement of low, medium & high resistance: – Ammeter, voltmeter method – Wheatstone bridge – Kelvin's double bridge – Series and shunt type ohmmeter – Instrument Transformer – AC bridges for the measurement of inductance, capacitance: - Maxwell Bridge – Wein's bridge– Schering bridge – Anderson bridge –Hay's bridge.

S. No	Questions	BTL	Competence
1.	How are basic instruments converted into higher range ammeter?	**BTL2**	**Understand**
2.	How does one extend the range of ammeter and voltmeter?	**BTL6**	**Create**
3.	List the difficulties in high resistance measurement and method to overcome them.	**BTL2**	**Understand**
4.	Mention the limitations of Wheatstone bridge.	**BTL1**	**Remember**
5.	How to calibrate DC Voltmeter using potentiometer?	**BTL4**	**Analyze**
6.	List the modifications required in a D.C potentiometer to be used for A.C applications.	**BTL2**	**Understand**
7.	Infer the expression for unknown resistance connected in Wheat stone bridge.	**BTL4**	**Analyze**
8.	Compare and contrast Kelvin's double bridge from Kelvin Bridge.	**BTL4**	**Analyze**
9.	State the types of bridges involved in low resistance measurement.	**BTL2**	**Understand**
10.	Estimate the range of resistance which a Kelvin's double bridge can measure accurately.	**BTL 5**	**Evaluate**
11.	Show the necessity for a shunt resistor in a series type ohmmeter.	**BTL3**	**Apply**
12.	How resistance is measured by using ohm meter method?	**BTL6**	**Create**
13.	What is the purpose of instrument transformers?	**BTL1**	**Remember**
14.	Name the ac sources used in ac bridges.	**BTL1**	**Remember**
15.	What are the sources of errors in bridge circuit?	**BTL3**	**Apply**
16.	In Maxwell's capacitance bridge for calculating unknown inductance, the various values at balance are, R_1 = 300 Ω, R_2 = 700 Ω, R_3 =1500Ω, C_4 = 0.8 μF. Calculate R_1, L_1 and Q factor, if the frequency is 1100 Hz.	**BTL 5**	**Evaluate**
17.	Which type of detector is used in AC bridges?	**BTL3**	**Apply**
18.	List the advantages of Maxwell bridge.	**BTL1**	**Remember**
19.	State the balance equation used in bridge methods.	**BTL1**	**Remember**
20.	What is Anderson bridge?	**BTL1**	**Remember**

21.	Why Maxwell Bridge is limited to the measurement of medium – Q coils?	**BTL3**	**Apply**
22.	What are the sources of errors in AC bridge measurement?	**BTL2**	**Understand**
23.	Why there are two conditions of balance in ac bridges, where as there is only one for dc bridges?	**BTL4**	**Analyze**
24.	Draw a suitable AC bridge used for measurement of frequency.	**BTL 5**	**Evaluate**
	PART-B		
1.	**(i)** List the difficulties in the measurement of high resistance. **(6)** **(ii)** Examine the direct deflection method for measurement of high resistance. **(7)**	**BTL1**	**Remember**
2.	With neat sketch, explain the measurement of high resistance using loss of Charge method. **(13)**	**BTL4**	**Analyze**
3.	Analyze about the ammeter-voltmeter method of measurement of resistance. **(13)**	**BTL4**	**Analyze**
4.	**(i)** Draw and explain the circuit of a basic potentiometer. **(7)** **(ii)** Explain how the potentiometer should be calibrated and how it is used for the precise measurement of DC voltage. **(6)**	**BTL6**	**Create**
5.	Describe the basic circuit construction and operation of Crompton laboratory type D.C potentiometer. **(13)**	**BTL2**	**Understand**
6.	A shunt type ohmmeter has a D'Arsonval movement of resistance 2Ω. Its full-scale deflection current is 10mA, and the battery voltage is 3 volts. Calculate the value of current limiting resistor so that the meter indicates 0.5Ω at the midpoint of its scale. **(13)**	**BTL 5**	**Evaluate**
7.	Explain the principle, construction and working of shunt type ohmmeter. **(13)**	**BTL2**	**Understand**
8.	List the different types of ratios present in instrument transformers and write how it is calculated. **(13)**	**BTL3**	**Apply**
9.	Explain about the measurement of low resistance using the wheat stone bridge with necessary illustrations and expressions. **(13)**	**BTL1**	**Remember**
10.	Discuss the measurement of resistance using Kelvin double bridge method and obtain expression for unknown resistance. **(13)**	**BTL1**	**Remember**
11.	**(i)** Derive the bridge balance condition for Hay's bridge with necessary illustrations. **(8)** **(ii)** Explain Wein bridge circuit for measurement of frequency. **(5)**	**BTL3**	**Apply**
12.	**(i)** Describe the working of Schering bridge for the measurement of capacitance with neat diagram. **(7)** **(ii)** Derive the equations for capacitance and dissipation factor. **(6)**	**BTL1**	**Remember**
13.	Draw the circuit diagram of Maxwell's bridge and explain the measurement procedure for measuring unknown inductance using this bridge. Derive formula used. **(13)**	**BTL2**	**Understand**
14.	Sketch the circuit diagram of Anderson's bridge. Derive the equations for resistive and inductive components of the inductor to be measured. **(13)**	**BTL4**	**Analyze**
15.	Explain the principle, construction and working of series type ohmmeter. **(13)**	**BTL2**	**Understand**
16.	(i) Derive the equation of balance for Anderson bridge and also draw the phasor diagram. **(7)** (ii) An AC bridge is balanced at 2KHz with the following components in each arm: Arm AB=10KΩ, Arm BC=100μF in series with 100KΩ, Arm AD=50KΩ. Find the unknown impendence R±jX in the arm DC, if the detector is between BD. **(8)**	**BTL3**	**Apply**
17.	In the circuit of series type ohmmeter, a 1mA meter movement with an internal of 50Ω is to be used. The battery voltage is 3V. Half-scale deflection should be for 2500 Ω (i) Calculate the values of R1 and R2	**BTL 5**	**Evaluate**

	(ii) Find the change in the value of R2 if the battery voltage reduces by 10%. (iii) What is the half-scale deflection if battery voltage reduces by 10%? **(13)**		
	PART-C		
1.	Explain how the earth resistance can be measured using three-point fall of potential method. **(15)**	**BTL6**	**Create**
2.	In a Wheatstone bridge circuit, the values of resistances are P= 1000 Ω, Q= 100 Ω, R= 2005 Ω and S= 200 Ω. The battery has an emf of 5V and negligible internal resistance. The galvanometer has a current sensitivity of 10mm/μA and an internal resistance of 100 Ω. Calculate the deflection of galvanometer and the sensitivity of the bridge in the terms of deflection per unit change in resistance. **(15)**	**BTL 5**	**Evaluate**
3.	A capacitor bushing forms arm AB in a Schering bridge and a standard capacitor of 500pF with negligible loss forms arm AD. Arm BC consists of a non-inductive resistance of 300Ω. When the bridge is balance, arm CD has a resistance of 72.6 Ω with a capacitance of 0.148 μF. The supply frequency is 50 Hz. Develop the capacitance and dielectric loss angle of capacitor using appropriate assumption. **(13)**	**BTL 5**	**Evaluate**
4.	**(i)** A Maxwell bridge is used to measure inductive impedance. The bridge constants at balance are: $C_1 = 0.01$ μF, $R_1 = 470K\Omega$, $R_2 = 5.1$ KΩ, $R_3 = 100K\Omega$. Evaluate L_x and R_x. **(7)** **(ii)** Design an Anderson's bridge for measuring the inductance L_1 and resistance R_1 of the coil. Find the L_1 and R_1 if balance is obtained when $R_2 = 1000\Omega$, $R_3 = 2000\Omega$, $R_4 = 2000\Omega$, r = 200Ω and C=1μF. **(6)**	**BTL6**	**Create**
5.	A single range student type potentiometer has 20 step dial switch where each step represents 0.1 V. The dial resistors are 20 Ω. The slide wire of the potentiometer is circular and has 10 turns and a resistance of 10 Ω each. The slide wire has 200 divisions and interpolation can be done to one fourth of a division. The working battery has a voltage of 10 V and negligible internal resistance. Draw the circuit diagram and calculate i) The measuring range of potentiometer ii) The resolution iii) Working current iv) Resistance of series rheostat. **(15)**	**BTL 5**	**Evaluate**

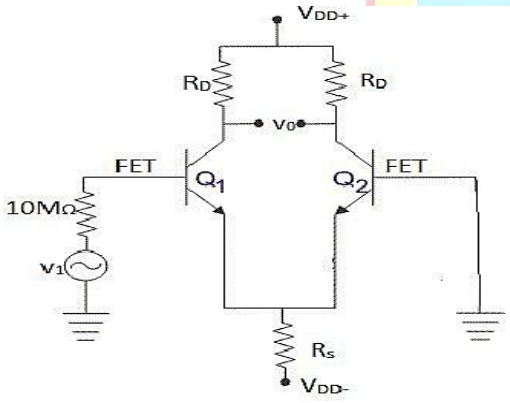
UNIT-III

ELECTRONIC INSTRUMENTS

Electronic Voltmeter and their advantages – Types Electronic Multimeters and ohmmeter Microprocessor based DMM with auto ranging and self-diagnostic features. Cathode ray oscilloscope – Dual trace, dual beam and sampling oscilloscopes–Digital storage oscilloscope.

S. No	Questions	BTL	Competence
1.	In a source follower type electronic voltmeter, the trans conductance of FET is 0.05 mho and the resistance of the meter is 100Ω. Find the value of current through the meter when the input voltage is 1V.	**BTL 5**	**Evaluate**
2.	Give the essential parts of a rectifier type electronic voltmeter.	**BTL2**	**Understand**
3.	What are the general characteristics of digital voltmeter?	**BTL3**	**Apply**
4.	List the advantages and disadvantages of an electronic multimeter.	**BTL1**	**Remember**
5.	State the limitations of multirange electronic voltmeters.	**BTL1**	**Remember**
6.	Write about the significance of sensitivity in voltmeters.	**BTL3**	**Apply**
7.	List the elements present in an electronic ohmmeter.	**BTL1**	**Remember**
8.	Differentiate between a series type ohmmeter and a shunt type ohmmeter.	**BTL4**	**Analyze**
9.	Give the salient features for measurement of power at audio frequencies.	**BTL2**	**Understand**
10.	Generalize the methods of digital measurement of frequency.	**BTL6**	**Create**

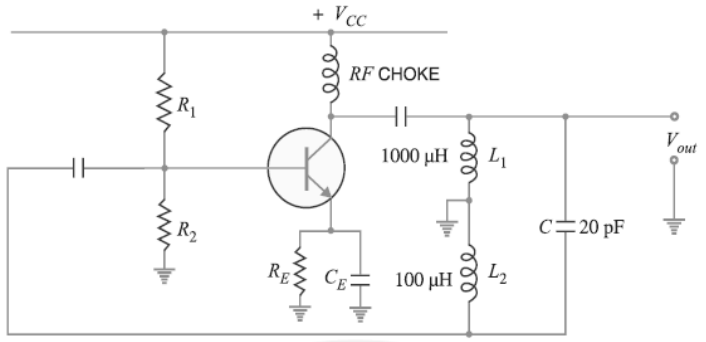
11.	Analyze the automatic ranging in DMM.	**BTL4**	**Analyze**
12.	Illustrate why is a triggering circuit provided in a CRO?	**BTL 5**	**Evaluate**
13.	Compare dual beam and dual trace CRO.	**BTL4**	**Analyze**
14.	State the modes of operation in the block of dual trace oscilloscope.	**BTL1**	**Remember**
15.	Give some applications of sampling oscilloscope.	**BTL2**	**Understand**
16.	State the applications of storage oscilloscope.	**BTL1**	**Remember**
17.	Why storage scopes are necessary in measurements?	**BTL3**	**Apply**
18.	List the major components of CRT.	**BTL1**	**Remember**
19.	What is the function dual trace oscilloscope in X-Y mode?	**BTL2**	**Understand**
20.	State the modes of operation in the block of dual trace oscilloscope.	**BTL6**	**Create**
21.	Which electrical quantity cannot be directly measured by using multimeter?	**BTL3**	**Apply**
22.	List the merits of electronic voltmeter	**BTL2**	**Understand**
23.	How power can be measured using electronic multimeter?	**BTL4**	**Analyze**
24.	State the limitations of multirange electronic voltmeters.	**BTL 5**	**Evaluate**
	PART-B		
1.	Explain the circuit diagram and operation of differential amplifier type electronic Voltmeter. **(13)**	**BTL1**	**Remember**
	(i) What are the advantages of electronic voltmeter over multimeter? **(5)** **(ii)** Classify the various types of electronic voltmeter in detail with neat sketch. **(8)**	**BTL4**	**Analyze**
2.	**(i)** Discuss in detail about the circuit diagram and operation of a source follower type voltmeter. **(8)** **(ii)** Mention the advantages, disadvantages and application of source follower type voltmeter. **(5)**	**BTL2**	**Understand**
4.	Explain with the help of a block diagram, the various parts of an electronic multimeter. **(13)**	**BTL1**	**Remember**
5.	**(i)** Describe the working of electronic Ohmmeter with the help of neat diagram. **(8)** **(ii)** What are the advantages, disadvantages and application of electronic Ohmmeter? **(5)**	**BTL1**	**Remember**
6.	Illustrate the operation of microprocessor based digital multimeter (DMM) with auto ranging and self-diagnostic features, with necessary diagram. **(13)**	**BTL4**	**Analyze**
7.	Explain in detail about the working of various parts of Cathode Ray Tube with its internal structure. **(13)**	**BTL1**	**Remember**
8.	Derive an expression for deflection D in CRO, which is the deflection of the electron beam. **(13)**	**BTL4**	**Analyze**
9.	An electrically deflected CRT has a final anode voltage of 2000V and parallel deflecting plates 1.5 cm long and 5 mm apart. If the screen is 50 cm from the center of deflecting plates, Evaluate: **(i)** Beam speed. **(3)** **(ii)** The deflection sensitivity of the tube **(5)** **(iii)** The deflection factor of the tube **(5)**	**BTL 5**	**Evaluate**
10.	**(i)** What is the principle of secondary emission ratio? **(3)** **(ii)** Describe in detail about the Analog Storage oscilloscopes. **(10)**	**BTL3**	**Apply**
11.	Discuss in detail about the following types Oscilloscopes with neat diagram: **(i)** Dual Trace Oscilloscope **(7)** **(ii)** Dual beam Oscilloscope **(6)**	**BTL2**	**Understand**
12.	**(i)** With block diagram and various waveforms at each block, Explain the operation of sampling oscilloscope. **(7)** **(ii)** Infer the advantages, disadvantages of dual trace over dual beam CROs for multiple trace. **(6)**	**BTL3**	**Apply**

13.	Sketch the basic block diagram for a DSO. Sketch the system wave forms and explain its operation. **(13)**	**BTL2**	**Understand**
14.	**(i)** How does the sampling CRO increase the apparent frequency response of an oscilloscope? **(7)** **(ii)** Obtain the function of the staircase generator using a sampling CRO. **(6)**	**BTL6**	**Create**
15.	Describe the various methods of measurement of power at radio and audio frequencies. **(13)**	**BTL2**	**Understand**
16.	**(i)** With a neat block diagram explain the working of sampling oscilloscope. **(7)** **(ii)** Compare Dual trace and Dual beam oscilloscope. **(6)**	**BTL3**	**Apply**
17.	**(i)** How are the frequency and phase measured in CRO using a Lissajous method? **(5)** **(ii)** Draw the block diagram of an electronic voltmeter and explain its operation. **(8)**	**BTL 5**	**Evaluate**
	PART-C		
1.	Design a series type ohmmeter. The movement requires a 1mA for full scale deflection and has an internal resistance of 100 Ω. The internal battery used has a voltage of 3V. The desired value for half-scale deflection is 2000Ω. Calculate: **(i)** The values of R_1 and R_2. **(8)** **(ii)** Range of R_2 if the battery voltage varies from 2.8V to 3.1 V (R_1 is same as in (i)) **(7)**	**BTL6**	**Create**
2.	A difference amplifier type electronic voltmeter shown in the below Fig (1) has the following data: Voltage applied to left FET V1 = 1 V, a.c drain resistance, rd= 100 kΩ, Resistance of PMMC Meter, Rm = 50 Ω, transconductance, gm = 0.005 mho, R_D = 10 kΩ, **(i)** Evaluate the value of current through ammeter. **(10)** **(ii)** How it can be calibrated as electronic voltmeter? **(5)**  **Fig:1**	**BTL5**	**Evaluate**
3.	Compute the methods to determine the frequency, phase & time delay, signal origins and modulation characteristics using oscilloscope Techniques. **(15)**	**BTL6**	**Create**
4.	**(i)** Explain how frequency can be measured by a CRO using Lissajous pattern. **(7)** **(ii)** The deflection sensitivity of an oscilloscope is 35 V/cm. If the distance from the deflection plates to the CRT screen is16 cm, the length of the deflection plates is 2.5 cm and the distance between the deflection plates is 1.2cm. Evaluate the acceleration anode voltage. **(8)**	**BTL5**	**Evaluate**
5.	Formulate an expression for vertical deflection of an electron beam in a CRT. **(15)**	**BTL5**	**Evaluate**

UNIT-IV
SIGNAL GENERATORS & ANALYZERS

Wien's bridge and phase shift oscillators – Hartley and crystal oscillators –Square wave and pulse generators – Triangular wave-shape generator -frequency selective and heterodyne wave analyzer – Harmonic distortion analyzer – Spectrum analyzer.

S. No	Questions	BTL	Competence
1.	Name the essential parts of an oscillator.	**BTL2**	**Understand**
2.	Write the expression for frequency of oscillation of phase shift oscillator.	**BTL3**	**Apply**
3.	Name two low frequency and High frequency oscillators.	**BTL1**	**Remember**
4.	Classify the different sinusoidal oscillators.	**BTL3**	**Apply**
5.	Distinguish between Wien's bridge and phase shift oscillators.	**BTL4**	**Analyze**
6.	Give the condition of oscillation for Hartley oscillator.	**BTL1**	**Remember**
7.	Examine how oscillations occur in a crystal oscillator?	**BTL6**	**Create**
8.	Crystal oscillators are superior to other oscillators. Justify?	**BTL5**	**Evaluate**
9.	Infer the difference between an oscillator and an amplifier.	**BTL4**	**Analyze**
10.	Define triangular wave-shape generator.	**BTL1**	**Remember**
11.	Which oscillator uses both positive and negative feedback? Justify?	**BTL5**	**Evaluate**
12.	Compare between a function generator and square wave and pulse generator.	**BTL3**	**Apply**
13.	List the various control on the front panel of a pulse generator.	**BTL1**	**Remember**
14.	How does a wave analyzer functionally differ from a spectrum analyzer?	**BTL6**	**Create**
15.	Point out the frequency range of different types of signal analyzer.	**BTL2**	**Understand**
16.	Identify the purpose of Automatic Frequency Control (AFC) in heterodyne wave analyzer.	**BTL4**	**Analyze**
17.	Difference between wave analyzer and harmonic distortion analyzer.	**BTL1**	**Remember**
18.	Mention the different types of distortion.	**BTL1**	**Remember**
19.	How are spectrum analyzer classified?	**BTL1**	**Remember**
20.	What information is provided by the spectrum analysis of a signal?	**BTL2**	**Understand**
21.	What is the purpose of spectrum analyzer?	**BTL3**	**Apply**
22.	Write the use of Harmonic distortion analyzer.	**BTL2**	**Understand**
23.	Formulate an equation for the measured value of total harmonic distortion (THDM).	**BTL4**	**Analyze**
24.	Differentiate between AF wave analyzer and RF wave analyzer.	**BTL 5**	**Evaluate**
	PART-B		
1.	With neat circuit diagram explain the operation of an RC phase shift oscillator and develop the condition for oscillation and resonant frequency with BJT. **(13)**	**BTL3**	**Apply**
2.	**(i)**Write in detail about various types of feedback oscillators. **(7)** **(ii)** Discuss about the operation of wein bridge oscillator. **(6)**	**BTL1**	**Remember**
3.	**(i)** Describe the operation of Hartley oscillator with a neat diagram. **(7)** **(ii)** Derive the expression for frequency of oscillation and condition of oscillation of Hartley oscillator. **(6)**	**BTL2**	**Understand**
4.	Explain the operation of crystal oscillator with neat diagram and write the expression for its frequency of oscillation. **(13)**	**BTL2**	**Understand**
5.	Design an RC phase shift oscillator to generate 5Khz sine wave with 20V peak to peak amplitude. Draw the designed circuit. Assume h_{fe} =150. **(13)**	**BTL6**	**Create**
6.	Design a wein bridge oscillator around the following specifications,	**BTL5**	**Evaluate**

	f = 15kHz, VCC = ±10V, Iin = 1 µA, I_{R4} =100 Iin. **(13)**		
7.	**(i)** Design a square wave generator for generating 1 KHZ signal. **(6)** **(ii)** Describe with block diagram, how different standard waveforms are generated in a typical function generator. **(7)**	**BTL4**	**Analyze**
8.	State with a diagram the working principle of a pulse generator. Describe with the help of a block diagram the operation of a pulse generator. **(13)**	**BTL4**	**Analyze**
9.	Define waveform analyzer and explain in detail about frequency selective type wave analyzer with block diagram. **(13)**	**BTL4**	**Analyze**
10.	**(i)** Label the parts and explain the working of a heterodyne type wave analyzer circuit. **(10)** **(ii)** List the applications of a Spectrum analyzer. **(3)**	**BTL1**	**Remember**
11.	Describe the circuits and working of wave analyzer used for audio frequency and megahertz range. **(13)**	**BTL2**	**Understand**
12.	Explain the procedure of measurement of a harmonic distortion analyzer using a bridged-T Network. **(13)**	**BTL3**	**Apply**
13.	Sketch and explain in detail about the Spectrum analyzer. **(13)**	**BTL1**	**Remember**
14.	Describe briefly about: **(i)** Types of distortion. **(4)** **(ii)** Total harmonic distortion. **(4)** **(iii)** Harmonic distortion analyzer. **(5)**	**BTL1**	**Remember**
15.	**(i)** Design a RC phase shift oscillator for frequency equal to 10kHz. **(7)** **(ii)** The tuned collector oscillator circuit used in the local oscillator of a radio receiver makes use of an LC tuned circuit with L1 = 58.6 µH and C1 = 300 pF. Calculate the frequency of oscillations. **(8)**	**BTL3**	**Apply**
16.	**(i)**Write in detail about various types of feedback oscillators. **(10)** **(ii)**Define oscillator and what are the classifications of oscillator? **(3)**	**BTL2**	**Understand**
17.	 Calculate the (i) operating frequency (ii) Feedback fraction for Hartley oscillator shown in Fig. The mutual inductance between the coils, M = 20 µH. **(13)**	**BTL 5**	**Evaluate**
	PART-C		
1.	**(i)** A Hartley oscillator has L_1 = 3mH and C = 10nF. Determine the frequency of oscillations. **(8)** **(ii)** RC phase shift oscillator uses three identical RC sections in the feedback network. The values of the components are R = 680 Ω and C = 220nF. Determine the frequency of oscillation. **(7)**	**BTL5**	**Evaluate**
2.	Design a signal generator using envelope feedback for amplitude modulation. **(15)**	**BTL6**	**Create**
3.	Deduce how Barkhausen criteria are met with wein bridge oscillator. **(15)**	**BTL5**	**Evaluate**
4.	Develop a circuitry to generate triangular wave of 2Khz frequency. **(15)**	**BTL6**	**Create**
5.	Prove that in an R.C.phase shift oscillator the gain of the amplifier should be at least 29 to sustain oscillations. **(15)**	**BTL5**	**Evaluate**

UNIT-V
VIRTUAL INSTRUMENTATION & TELEMETRY

Virtual instrumentation (VI) – Definition, flexibility – Block diagram and architecture-Software in virtual instrumentation DAQ cards for VI applications-General telemetry system – voltage, current and position telemetry systems-Radio frequency telemetry- modulation Techniques- Frequency and time multiplexing.

S. No	Questions	BTL	Competence
1.	Differentiate between virtual instruments and traditional instruments.	**BTL4**	**Analyze**
2.	Mention the features of virtual instrumentation.	**BTL1**	**Remember**
3.	Define virtual instrumentation.	**BTL1**	**Remember**
4.	Why is virtual instrumentation necessary?	**BTL3**	**Apply**
5.	What are the different forms of output display in a Virtual instrument?	**BTL6**	**Create**
6.	Define clusters. What is the use of clusters?	**BTL2**	**Understand**
7.	What are the advantages of graphical display?	**BTL3**	**Apply**
8.	Classify the tools available in control palette.	**BTL4**	**Analyze**
9.	Using formula nodes implement the function: $\sin 2x + 3cosx$	**BTL5**	**Evaluate**
10.	Point out the components of DAQ Cards.	**BTL3**	**Apply**
11.	Identify the types of signals that can be acquired by DAQ.	**BTL1**	**Remember**
12.	Create sub VI for any real time system.	**BTL6**	**Create**
13.	Define telemetry.	**BTL1**	**Remember**
14.	Name the components of telemetry system.	**BTL2**	**Understand**
15.	List the merits and demerits of voltage telemetry system.	**BTL1**	**Remember**
16.	Criticize about the merits and demerits of current telemetry system.	**BTL4**	**Analyze**
17.	Mention the applications of position telemetry system.	**BTL1**	**Remember**
18.	Give the types of DC telemetry system.	**BTL2**	**Understand**
19.	A broadcast transmitter radiates 50KW of carrier power. What will be the radiation power at 85 percent of modulation?	**BTL5**	**Evaluate**
20.	Express the advantages and disadvantages of frequency division multiplexing.	**BTL2**	**Understand**
21.	Mention the various types of non – electrical telemetry system.	**BTL3**	**Apply**
22.	Compare the advantages of FM over AM.	**BTL2**	**Understand**
23.	List the applications of virtual instrumentation.	**BTL4**	**Analyze**
24.	Point out the need for modulation.	**BTL 5**	**Evaluate**
	PART-B		
1.	**(i)** Briefly describe the case structure, event structure and sequence structure operations**.** **(7)** **(ii)** Write short notes on various application of virtual instrumentation. **(6)**	**BTL3**	**Apply**
2.	With a neat block diagram describe the architecture of a Virtual instrumentation system. Also state its advantages and disadvantages over conventional instruments. **(13)**	**BTL1**	**Remember**
3.	Write a VI to check if a number is positive or negative. If yes, then the VI should calculate and display the square root. Otherwise it should display a message and give a value of -9999.00 as output. Solve using (a) case structure (b) select function and (c) formula node. **(13)**	**BTL4**	**Analyze**
4.	Write in detail about loops and charts. Explain them with an example. **(13)**	**BTL3**	**Apply**
5.	**(i)** Explain arrays and clusters operations in detail. **(7)** **(ii)** Analyze modular programming and show how to create a Sub VI using an example. **(6)**	**BTL4**	**Analyze**

6.	**(i)** Explain how labVIEW can be used to acquire, analyse and present a measurement and automatic application. **(7)** **(ii)** Illustrate the operation of shift register showing the front panel and block diagram to find the current count, previous count, count two iterations ago and count three iterations ago and explain. **(6)**	**BTL4**	**Analyze**
7.	Create a VI to realize digital voltmeter by acquiring the data using DAQ. **(13)**	**BTL6**	**Create**
8.	**(i)** Describe the different methods of data transmission. **(7)** **(ii)**Explain the block diagram of general telemetry system. **(6)**	**BTL2**	**Understand**
9.	**(i)** Classify the different types of telemetering systems. **(7)** **(ii)** Demonstrate in detail about the voltage telemetering system. **(6)**	**BTL1**	**Remember**
10.	Explain the following current telemetering system. **(i)** Basic current telemetering system. **(3)** **(ii)** Motion balance current telemetering system. **(5)** **(iii)** Force balance current telemetering system. **(5)**	**BTL2**	**Understand**
11.	Define and explain the radio frequency telemetry system with its block diagram. **(13)**	**BTL2**	**Understand**
12.	Explain in detail about various types and operation of land line telemetry system. **(13)**	**BTL1**	**Remember**
13.	Mention about the basic working of multiplexing. Explain about the principle and operation of frequency division multiplexing. **(13)**	**BTL1**	**Remember**
14.	Formulate the expressions for modulation index, the power conveyed by the carrier and the power transmitted by upper and lower frequency bands. Find the condition for maximum power in the A.M wave. **(13)**	**BTL5**	**Evaluate**
15.	**(i)** Write shorts notes on Frequency Modulation and amplitude modulation. **(7)** **(ii)** Tabulate the comparison between frequency modulation and amplitude modulation. **(6)**	**BTL3**	**Apply**
16.	Discuss about frequency modulation telemetry system. **(13)**	**BTL2**	**Understand**
17.	**(i)** Develop a VI progam to find the sum and average of 10 Numbers. **(8)** **(ii)** Compare the features of virtual function generator with conventional functional generator. **(7)**	**BTL 5**	**Evaluate**
	PART-C		
1.	Explain in detail with necessary connection diagrams for an industrial application where pressure, flow, velocity and speed are to be controlled. Obtain the above said information to the PC and send the appropriate signal to control the process. **(15)**	**BTL6**	**Create**
2.	Create a VI to develop a bottle filling system with neat diagram. **(15)**	**BTL6**	**Create**
3.	A data signal has a frequency component from d.c to 1kHz is to be transmitted using a modulation method. Evaluate the minimum carrier channel bandwidth using the following methods of modulation: **(i)** Amplitude modulation **(5)** **(ii)** frequency modulation with maximum deviation in carrier frequency being 1.5kHz **(5)** **(iii)** pulse code modulation using an 8 digit code. **(5)**	**BTL5**	**Evaluate**
4.	Explain why it is essential to use radio frequency telemetry. Summarize it with some relevant examples. **(15)**	**BTL5**	**Evaluate**
5.	Summarize about various telemetering system based on the characteristics of electrical signal in a transmission system. **(15)**	**BTL5**	**Evaluate**