

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**K.S.R. COLLEGE OF ENGINEERING: TIRUCHENGODE – 637 215.****COURSE / LESSON PLAN SCHEDULE****NAME: Dr.R.ESWARAMOORTHY & Mr.KP.UVARAJAN****CLASS:III ECE A & B****SUBJECT: ELECTRONIC INSTRUMENTATION****A).TEXT BOOKS:**

1. A.K.Sawhney,"Electrical, Electronic measurement & Instrumentation", Dhanpat Rai&sons, 18th Edition, Reprint 2012.
2. David A. Bell, "Electronics Instrumentation and measurements", Oxford University press, 3rd Edition, 2013.

B). REFERENCES:

1. Albert D.Helfrick and William D.Cooper,"Modern Electronic Instrumentation and Measurement Techniques", Pearson / Prentice Hall of India, 2007.
2. JovithaJerome,"Virtual Instruments using LabVIEW",PHI Learning Pvt. Ltd., 2010.
3. H.S.Kalsi "Electronic Instrumentation" Tata McGraw Hill, 2nd Edition, 2012
4. PrithiwirajPrukait, BudhadityaBiswas, Santanu Das &ChiranjibKoley, "Electrical and Electronics Measurement and Instrumentation" Tata McGraw Hill, 2013.

C). LEGEND:

L - Lecture BB - Black Board Tx -Text
 OHP -Over Head Projector pp - Pages Rx - Reference

Sl. No	Lecture Hour	Topics to be covered	Teaching Aid Required	Book No./Page No
UNIT I - BASIC INSTRUMENTATION AND MEASUREMENTS				
1	L1	Introduction to Functional elements of a measurement system	BB	T _{x1} /pp(7-10), R _{x4} / pp(1.9-1.11)
2	L2	Units and standards of instruments	BB	T _{x1} /pp(125-140.142-143), T _{x2} /pp(1-12), R _{x1} /pp(21-23,32-45), R _{x3} /pp(15-19), R _{x4} / pp(1.1-1.9)
3	L3	Errors and types	BB	T _{x1} /pp(49-57), T _{x2} /pp(16-31)R _{x1} / pp(6-10), R _{x3} /pp(2-8), R _{x4} / pp(1.17-1.22)
4	L4	Permanent magnet moving coil and moving iron instruments	BB	T _{x1} /pp(238-250,257-267),T _{x2} /pp(41-44,49-52), R _{x3} /pp(26-31,35-38),R _{x4} / pp(2.12-2.18,2.23-2.29)
5	L5	DC ammeters - DC voltmeters - Voltmeter sensitivity	BB	T _{x2} /pp(73-83), R _{x1} / pp(57-66), R _{x3} /pp(64-71,79-86),
6	L6	Series type ohmmeter - Shunt type ohmmeter	BB	T _{x1} /pp(250-253), T _{x2} /pp(90-98), R _{x1} / pp(67-72), R _{x3} /pp(110-120),
7	L7	Calibration of DC instruments Electronic multimeter	BB	T _{x1} /pp(620-621),T _{x2} /pp(128-131), R _{x1} /pp(76-77.140-146), R _{x3} /pp(120-124),
8	L8	Bridge measurements: Maxwell, Hey,	BB	T _{x1} /pp(482-485), T _{x2} /pp(244-248),R _{x1} /pp(117-120), R _{x3} /pp(340-345),R _{x4} / pp(6.4-6.11)
9	L9	Schering, Anderson and Wien bridge	BB	T _{x1} /pp(485-486,489-492,496), T _{x2} /pp(248-250),R _{x1} / pp(121-127), R _{x3} /pp(345-354),R _{x4} / pp(6.11-6.13,6.20-6.25)
10	L10	Megger	BB	T _{x1} /pp(256)
UNIT II- TRANSDUCER AND ANALYTICAL INSTRUMENTS				
11	L11	Transducers: LVDT	BB	T _{x1} /pp(805-810), T _{x2} /pp(479-482), R _{x1} / pp(350-353), R _{x3} /pp(433-437),R _{x4} / pp(11.3-11.5)
12	L12	Capacitive Transducers	BB	T _{x1} /pp(815-826),T _{x2} /pp(482-485),R _{x1} / pp(349), R _{x3} /pp(446-448),R _{x4} / pp(11.23-11.24)
13	L13	Hall Effect transducers	BB	T _{x1} /pp(835-836), T _{x2} /pp(459-460)

14	L14	Piezo Electric transducers Photo optic transducer	BB	$T_{x1/pp}(587-588)$,
15	L15	Computer aided measurements, Data acquisition	BB	$T_{x1/pp}(1203-1208, 1212-1215)$, $R_{x3/pp}(626-636)$,
16	L16	Probe analyzers	BB	$T_{x1/pp}(1249-1251)$,
17	L17	Spectrophotometer	BB	$T_{x1/pp}(1251-1253)$,
18	L18	Chromatography	BB	$T_{x1/pp}(1255-1256)$,
19	L19	Differential refractometers	BB	$T_{x1/pp}(1251)$,
20	L20	Piezoelectric & Photo Optic Transducers	BB	$T_{x1/pp}(826-835)$, $R_{x3/pp}(450-456)$ $T_{x1/pp}(857-858)$
UNIT III - ELECTRONIC MEASUREMENT INSTRUMENTS				
21	L21	Function Generators, RF signal generators	BB	$T_{x1/pp}(702-704)$, $T_{x2/pp}(345-351, 357-362)$, $R_{x1/pp}(277-279)$, $R_{x3/pp}(239-243)$, $R_{x4/pp}(13.26-13.29)$
22	L22	Sweep generators, Wave analyzer	BB	$T_{x1/pp}(704-707, 713-715)$, $T_{x2/pp}(362-364)$, $R_{x1/pp}(264-268, 282-286)$, $R_{x3/pp}(243-245, 260-265)$, $R_{x4/pp}(13.29-13.35)$
23	L23	Harmonic distortion analyzer	BB	$T_{x1/pp}(715-717)$, $T_{x2/pp}(408-411)$, $R_{x1/pp}(286-290)$, $R_{x3/pp}(265-267)$, $R_{x4/pp}(13.35-13.37)$
24	L24	Spectrum analyzer	BB	$T_{x1/pp}(718-721)$, $T_{x2/pp}(411-417)$, $R_{x1/pp}(291-313)$, $R_{x3/pp}(267-269)$, $R_{x4/pp}(13.37-13.43)$
25	L25	Digital voltmeters and its types	BB	$T_{x1/pp}(1029-1034)$, $T_{x2/pp}(162-167)$, $R_{x1/pp}(146-159)$, $R_{x3/pp}(128-139)$, $R_{x4/pp}(10.9-10.14)$
26	L26	Digital multimeters	BB	$T_{x2/pp}(167-171)$, $R_{x3/pp}(148-149)$, $R_{x4/pp}(10.5-10.7)$
27	L27	Q meters - Vector meters	OHP	$T_{x1/pp}(732-735, 627-629)$, $T_{x2/pp}(223-228)$, $R_{x1/pp}(165-181)$, $R_{x3/pp}(286-295)$,
28	L28	Frequency synthesizer, Frequency counters	LCD	$T_{x1/pp}(707-708)$, $T_{x2/pp}(364-367)$, $R_{x1/pp}(257-260, 315-327)$, $R_{x4/pp}(10.7-10.9)$
29	L29	Measurement of frequency and time interval.	BB	$T_{x1/pp}(661-664)$, $T_{x2/pp}(285-292)$, $R_{x3/pp}(206-208)$, $R_{x4/pp}(9.12-9.14)$
30	L30	Measurement of Standing wave ratio	BB	$T_{x1/pp}(721-722)$
UNIT – IV STORAGE AND DISPLAY INSTRUMENTS				
31	L31	Cathode Ray Oscilloscope	BB	$T_{x1/pp}(641-661)$, $T_{x2/pp}(271-279)$, $R_{x1/pp}(186-227)$, $R_{x3/pp}(184-193)$, $R_{x4/pp}(9.1-9.11)$
32	L32	Dual Trace Oscilloscopes	BB	$T_{x1/pp}(664-666)$, $T_{x2/pp}(279-282)$, $R_{x3/pp}(194-201)$, $R_{x4/pp}(9.21-9.23)$
33	L33	Analog and Digital Storage Oscilloscope	BB	$T_{x1/pp}(669-675)$, $T_{x2/pp}(317-319, 324-331)$, $R_{x1/pp}(235-237)$, $R_{x3/pp}(202-206, 224-226)$, $R_{x4/pp}(9.18-9.21)$
34	L34	Sampling CRO	BB	$T_{x1/pp}(666-669)$, $T_{x2/pp}(320-324)$, $R_{x1/pp}(233-235)$, $R_{x3/pp}(201-202)$, $R_{x4/pp}(9.17-9.18)$

35	L35	Frequency Modulation Recording	BB	$T_{x1/pp}(1045-1046), R_{x3/pp}(388-390), R_{x4/pp}(15.13-15.14)$
36	L36, L37	Electromechanical servo type XT & XY recorders,	BB	$T_{x1/pp}(10349-1040), T_{x2/pp}(402-407), R_{x3/pp}(382-384), R_{x4/pp}(15.7-15.8)$
37	L38	LCD and LED	BB	$T_{x1/pp}(1012-1014), T_{x2/pp}(146-148), R_{x3/pp}(39-43), R_{x4/pp}(15.19-15.21, 15.23-15.25)$
38	L39	Dot matrix display	BB	$T_{x1/pp}(1010-1011), R_{x3/pp}(48-49), R_{x4/pp}(15.22)$
39	L40	Strip chart recorders	BB	$T_{x1/pp}(1035-1039), R_{x3/pp}(371-377)$
UNIT – V VIRTUAL INSTRUMENTATION				
40	L41	Basics of Lab VIEW	BB	$R_{X2/PP}(20-46)$
41	L42	For loop and while loop , Other structures	BB	$R_{X2/PP}(65-90)$
42	L43	Arrays and clusters	BB	$R_{X2/PP}(91-130)$
43	L44	Graphs and charts ,State machine	BB	$R_{X2/PP}(131-159),$
44	L45	File I/P and O/P	BB	$R_{X2/PP}(204-208)$
45	L46	String handling	BB	$R_{X2/PP}(194-204)$
46	L47	Data acquisition with Lab VIEW	BB	$R_{X2/PP}(253-292)$
47	L48	Interfacing with DAQ assistance	LCD	www.ni.com/download/traditional-ni-daq-legacy-6.9.0/827/en/
48	L49	Case study Lab VIEW in Signal processing	LCD	http://search.ni.com/nisearch/app/main/p/bot/no/ap/global/lang/en/pg/1/q/CasestudyLabVIEWinSignalprocessing/decibel.ni.com/content/docs/DOC-17962
49	L50	Lab VIEW in Traffic light controller.	LCD	www.ni.com/example/31178/en/

UNIT I: BASIC INSTRUMENTATION AND MEASUREMENTS

1. What are the primary standards? Where are they used? (Remembering)(CO1)

The main functions of primary standards are the calibration and verification of secondary standards. Primary standards are maintained at the national standards laboratories in different countries. These primary standards are absolute standards of high accuracy that can be used as ultimate reference standards.

2. What is primary sensing element? (Remembering) (CO1)

The primary sensing element is called as transducer that senses and converts the desired input to a more convenient and practicable form to be handled by the measurement system.

3. What is calibration? (Remembering) (CO1)

Calibration is the process of checking the accuracy of instrument by comparing the instrument reading with a standard or against a similar meter of known accuracy. It is also defined as marking the scale of an instrument.

4. Why calibration of instrument is important? (CO1)(Understanding) (DEC 2015/JAN 2016)

The calibration of all instruments is important since it affords the opportunity to check the instrument against a known standard and subsequently to errors in accuracy.

5. Define the terms precision and sensitivity. (Remembering) (CO1)

Precision: It is a measure of the consistency or repeatability of a series (successive) of measurements. Although accuracy implies precision, precision does not necessarily imply accuracy. A precise instrument can be very inaccurate. The precision of a given measurement can be given by

$$\text{Precision} = 1 - \left| \frac{x_i - \bar{X}}{x_i} \right| \quad \text{Where } x_i = \text{the value of the } i^{\text{th}} \text{ measurement, } \bar{X} = \text{the average value of measurement}$$

Sensitivity: It is a measure of the change in reading of an instrument for a given change in the measured quantity.

6. Define static error (MAY 2008) (Remembering) (CO1)

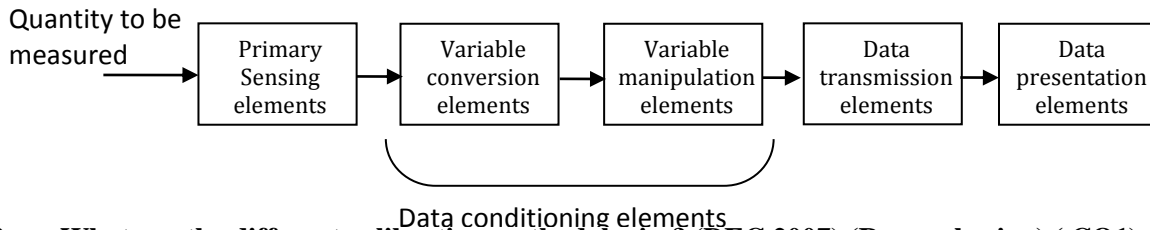
The static error of a measuring instrument is the numerical difference between the true value of a quantity and its value as obtained by measurement, i.e., required measurement of the same quantity gives different indications.

7. Define error. (CO1) (DEC 2015/JAN 2016) (Remembering)

The algebraic difference between the indicated value and the true value of the quantity to be measured is called an error.

8. Distinguish between reproducibility and repeatability (DEC 2004) (Analyzing) (CO1)

Reproducibility: It is defined as the degrees of closeness with which a given value may be repeatedly measured. It is specified in terms of unit for a given period of time. Perfect reproducibility means that the instrument has no drift. **Repeatability:** It is defined as a variation of scale reading and is random in nature.

9. Show the block diagram indicating functional elements of measurement system. (CO1) (Remembering)**10. What are the different calibration methodologies? (DEC 2007) (Remembering) (CO1)**

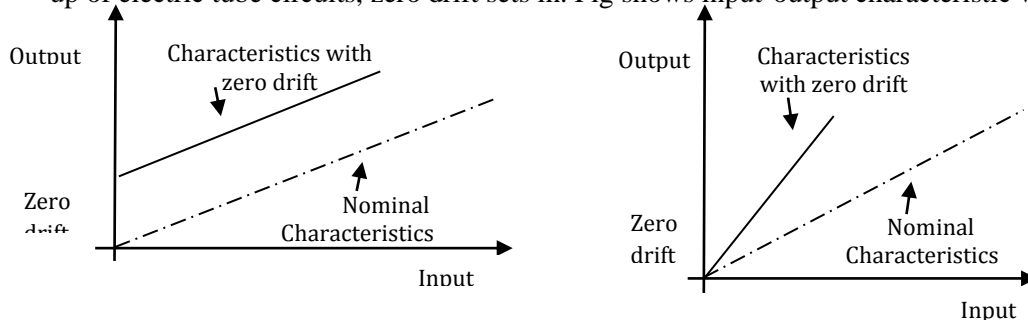
(i) Primary calibration (ii) Secondary calibration (a). Direct calibration (b). Indirect calibration

11. Define Instrumental errors. (MAY 2008) (Remembering) (CO1)

These errors arise due to inherent short comings in the instrument, misuse of the instruments and loading effects.

12. Differentiate between zero drift and span drift. (MAY 2005) (Analyzing) (CO1)**Zero drift:**

If one whole calibration gradually shifts due to slippage, permanent set, or due to undue warming up of electric tube circuits, zero drift sets in. Fig shows input-output characteristic with zero drift.

**Span drift:**

Span drift is also called sensitivity drift. Here, there is proportional change in the indication all along the upward scale. Figure shows input –output characteristics of span drift

13. Define limiting errors. (MAY 2008) (Remembering) (CO1)

Instruments having analog meters are usually guaranteed to be accurate within certain percentage limits, called limiting errors or guarantee errors.

Limiting error = accuracy x full-scale value

14. Mention any four static characteristics of measuring instruments. (MAY 2008, Dec 2013) (CO1)

- | | | | |
|--------------|----------------|----------|----------|
| 1. Accuracy | 3. Sensitivity | 5. Error | 7. Span |
| 2. Precision | 4. Resolution | 6. Range | 8. Drift |

15. When does static characteristics play important role in instruments? (Remembering) (May/June 2015) (CO1)

The Instruments measure the quantity which does not vary with time; the static characteristics of instruments play an important role.

16. Distinguish between the direct and indirect methods of measurements. (AU/EEE- DEC 2007) (Analyzing) (CO1)

S.No	Direct method	Indirect method
01.	In this method, the unknown quantity is directly compared against a standard.	In this type of method, the parameter to be measured is compared with the standard through the use of a calibrated system.
02.	Less sensitive	More sensitive

17. What is the significance of calibration? (AU/EEE- MAY 2008) (Remembering) (CO1)

All measuring instruments are to prove themselves their ability to measure reliably and accurately. For this, the results of measurement are to be compared with higher standards which are traceable to national or international standards. The calibration of a measuring instrument means introducing an accurately known sample of the variable that is to be measured and then observing the system's response.

18. What is the importance of dynamic characteristic of systems? (Remembering) (CO1)

When an instrument is required to measure a time varying process variable, one has to be concerned with dynamic characteristics; these characteristics quantify the dynamic relation between the input and output.

19. Why must instruments be calibrated? (Remembering) (CO1)

Instruments must be calibrated since it gives the opportunity to check the instrument against a known standard and subsequently to find errors and accuracy.

20. Define the term accuracy. (Remembering) (CO1) (JAN 2018)

It is a measure of the closeness with which an instrument measures the true value of a quantity.

21. Define international standard ohm. (Remembering) (CO1)

It is defined as the resistance offered by a column of mercury having a mass of 14.4521gm, uniform cross sectional area and length of 106.300 cm, to the flow of constant current at the melting point of the ice.

22. Differentiate accuracy from precision (AU CHENNAI/ECE-DEC 2009) (June 2017) (Analyzing) (CO1)

S.No	ACCURACY	PRECISION
01.	Accuracy refers to degree of closeness of the measured value to the true value.	Precision refers to degree of agreement among group of readings.
02.	Accuracy gives the maximum error that is maximum departure of the final result from its true value.	Precision of a measuring instrument system gives its capability to reproduce a certain reading with a given accuracy.

23. List the different types of errors in measurement systems? (May/June 2016) (DEC 2009) (CO1) (Analyzing)

1. Gross error
2. Systematic error
3. Environmental error
4. Observation error
5. Random error
6. Limiting error

24. Define environmental error. (MAY 2008) (Remembering) (CO1)

This error occurs due to conditions external to the measuring device including conditions in the area surrounding the instrument. This error is called environmental error. These may be effects of temperature, pressure, humidity, dust, vibration or of external magnetic or electrostatic fields.

25. Define static error and how is it classified. (AU/ECE-MAY 2008) (CO1)

The static error if a measuring instrument is the numerical difference between the true value of a quantity and its value as obtained by measurement. **Types**

1. Gross error
2. Systematic error
 - (i) Instrumental error
 - (ii) Environmental error
 - (iii) Observational error
3. Random error

26. What is the difference between analog and digital instruments? (AU/ECE- MAY 2008) (Remembering) (CO1)

S.No	Aspects	Analog Instruments	Digital Instruments
1.	Information form	As the position of pointer against a calibrated scale or dial.	As a number
2.	Human error	Exists	Does not exist
3.	Accuracy	+0.25%	+0.005%
4.	construction	Simple in construction	Construction is complex

27. What is the need for measurement? (AU/ECE- MAY 2007) (JAN 2018) (Remembering) (CO1)

The need for measurement is to know about the unknown magnitude.

28. Write the need for calibration. (AU/ECE- MAY 2007) (CO1)

The need for calibration means is to check the accuracy and reliability.

29. List the main functional elements used in most of the measurement systems.

1. Primary sensing element
2. Variable conversion element
3. Variable manipulation element
4. Data transmission element
5. Data presentation element

30. state the advantages of electronic measurements(DEC 2014/JAN 2015) (CO1)

(i) An electrical signal or electronic signal can be amplified, filtered, multiplexed, sampled and measured. (ii) Many measurements can be carried either simultaneously or in rapid succession (iii) The measurement can be obtained in or converted into digital form for automatic analyzing and recording

31. What is measurement? (MAY 2009) (June 2017) (Remembering) (CO1)

Measurement is an act or the result of quantitative comparison between unknown magnitude and the predefined standard.

32. What are the methods of measurements? (Remembering) (CO1)

1. Direct method.
2. Indirect method.

33. What do you mean by direct method of measurement? (Remembering) (CO1)

In this method, the unknown quantity (measured) is directly compared against a standard.

34. What do you mean by indirect method of measurement? (Remembering) (CO1)

In this type of method, the parameter to be measured is compared with the standard through the use of a calibrated system.

35. Classify measurement types? (Understanding) (CO1)

1. Primary measurements
2. Secondary measurements
3. Tertiary measurements

36. Define instrument. (Remembering) (CO1)

An instrument is a device for determining the value or magnitude of a quantity or variable.

37. Classify the instrument types? (Analyzing) (CO1)

1. Mechanical instruments
2. Electrical instruments
3. Electronic instruments

38. What are the main classifications of instruments? (Analyzing) (CO1)

1. Absolute instruments
2. Secondary instruments

39. What is an absolute instrument? (Remembering) (CO1)

It is a measures the quantity in terms of physical contents of the instruments. Use of these instruments is time consuming since every time a measurement is made, it takes lot of time to compute the magnitude of measurand. Eg:(i) Tangent Galvanometer,(ii) Rayleigh's current balance

40. What is a secondary instrument? (Remembering) (CO1)

This type of instruments are designed in such a manner that measured can be measured by observing the output indicated by the instrument. The examples of secondary instruments are voltmeter, ammeter, glass thermometer and pressure gauge etc.

41. How are secondary instruments classified? (Remembering) (CO1)

1. Indicating instruments,
2. Recording instruments,
3. Controlling instruments.

42. What is meant by sensitivity? (DEC 2010) (Remembering) (CO1)

It is a measure of the change in reading of an instrument for a given change in the measured quantity.

43. What are the standards and lists their classification? (DEC 2016/JAN 2017) (Remembering) (CO1)

A standard of measurement is a physical representation of a unit of measurement. A standard means known accurate measure of a physical quantity. Other physical quantities are compared with the standards to obtain their values. The different types of standards of measurement are classified as 1) International Standards 2) Primary standards 3) Secondary standards 4) Working standards

44. State the importance of sensitivity while selecting voltmeters for measurement.**(DEC 2016/JAN 2017) (Remembering) (CO1)**

The sensitivity range is specified on the meter dial and it indicates the resistance of the meter for a one volt range. The reciprocal of the full scale deflection current of the meter i.e. $1/I_m$ is called sensitivity of the voltmeter

$$S = 1/\text{Full scale deflection current}$$

45. What is sensitivity of voltmeters?(DEC 2014/JAN 2015) (May/June 2015) (Remembering)

The reciprocal of the full scale deflection current of the meter is called sensitivity of voltmeter

46. What is the difference between primary and secondary standard? (DEC 2009) (M/J 2013) (Remembering) (CO1)

S.No	Primary standards	Secondary standards
01.	The main function of primary standards is becalibration and verification of secondary Standards.	Secondary standards are basic reference standards used by measurement and calibration of working standards.
02.	Primary standards are maintained at the National Standards Laboratories in different countries.	Secondary standards are maintained at the industries. Each industry has its own secondary standard.

47. Compare threshold and resolution. (DEC 2006) (JAN 2018) (Understanding) (CO1)

Threshold: It is clear that if the instrument is increased very gradually from 0, there will be some minimum value below which no output change can be detected. This minimum value defines the threshold of the instrument.

Resolution: It is the smallest change in the measured quantity that will produce a deductible change in the instrument reading.

48. How are the analog instruments classified on the basis of method used for comparing the unknown quantity? (Remembering) (CO1)

1. Electrostatic Type instruments
2. Instruments using heating effect
3. Electromagnetic type instruments
4. Instruments using hall effect
5. Instruments using Hall Effect.

49. List out few merits of permanent magnet moving iron instruments. (DEC 2010) (Analyzing) (CO1)

Various advantages of moving iron instruments are,

- 1) The same instrument can be universally Used for both A.C and D.C measurement
- 2) Torque/weight ratio is very high and hence errors due to friction are very small.
- 3) As the single moving system can be used for wide range of measurement, these instruments are cheaper than other types of instruments.
- 4) These instruments are robust and simple in construction as there is no current carrying moving part.
- 5) These instruments are highly accurate.
- 6) They are available with 240° circular scales.

50. How a PMMC meter can be used as voltmeter and ammeter? (Remembering) (CO1)

When a shunt resistance is connected across the basic PMMC meter then it will act as a D.C. ammeter and when a resistance is connected in series with the basic PMMC meter then the meter will act as a D.C. voltmeter.

51. What are the various principles of analog type electrical instruments? (Remembering) (CO1)

- | | |
|-------------------------|---------------------------|
| 1. Magnetic effect | 4. Electromagnetic effect |
| 2. Heating effect | 5. Hall effect |
| 3. Electrostatic effect | |

52. What is the reason for using MI instruments on both A.C and D.C? (Remembering) (CO1)

MI instruments can be used for both a.c and d.c Measurement because, whatever may be the direction of the current through the coil in the instrument, the iron vanes get magnetized and there will be a force of attraction in the attraction type instrument and will be a force of repulsion in the repulsion type instrument.

53. Why the PMMC instruments are not used for A.C. Measurements? (Remembering) (CO1)

When the PMMC instruments are connected to A.C. the torque reverses as the current reverses and the pointer cannot follow the rapid reversals. Hence the deflection corresponding to mean torque is zero thus making the PMMC instrument not suitable for A.C. measurements.

54. What are the basic requirements of measuring instruments? (Remembering) (CO1)

- 1) The measuring instrument should not affect the quality to be measured when it is connected to the circuit.
- 2) Power consumption of the measuring instrument should be very small.

55. What are the classifications of analog measurements? (Remembering) (CO1)

- a. Indicating instruments b. Recording instruments c. Integrating instruments

56. What are the operating forces or torque needed for indicating instruments? (Remembering) (CO1)

1. Deflecting force
2. Controlling force
3. Damping force

57. What are the various damping methods in analog instruments? (Remembering) (CO1)

1. Air friction damping
2. Fluid friction damping
3. Eddy current damping

58. What are the various types of instruments? (Remembering) (CO1)

The main types of instruments used as ammeters and voltmeters are,

- | | |
|--|------------------------------------|
| i) Permanent magnet moving coil (PMMC) type instrument | v) Thermocouple type instrument |
| ii) Moving iron type instrument | vi) Induction type instrument |
| iii) Electro dynamometer type instrument | vii) Electrostatic type instrument |
| iv) Hot wire type instrument | viii) Rectifier type instrument |

59. What are the errors in PMMC instruments? (May/June 2013) (Remembering) (CO1)

- 1) Weakening of permanent magnets due to ageing and temperature effects.
- 2) Weakening of springs due to ageing and temperature effects and
- 3) Change of resistance of moving coil with temperature.

60. List the various advantages of PMCC instruments. (Remembering) (CO1)

- 1) Uniform scale
- 2) Low power consumption in the order of 25microW to 200 microW
- 3) High torque/weight ratio which in turn gives high accuracy.
- 4) Extension of instrument range is possible with the help of different values of shunts and multipliers.
- 5) Operating forces are large which lead to large flux density in the order of 0.5 wb/m²
- 6) Not affected by external magnetic fields called stray magnetic fields because of high flux density.
- 7) Sensitivity is high.
- 8) Instrument is free from hysteresis error.
- 9) Effective damping is provided because of eddy current.

61. List the disadvantages of PMMC instruments. (Remembering) (CO1)

- 1) It can be used only for D.C.measurement.
- 2) the torque reverses if the current reverses. Hence if the instrument is connected to A.C., the pointer cannot follow the rapid reversals and hence the deflection corresponds to mean torque which is zero. Hence PMMC instruments cannot be used for A.C.
- 3) Cost of PMMC instrument is higher than that of moving iron instrument.

62. What are the two basic classifications of MI instruments? (Remembering) (CO1)

- (i) Moving iron attraction type instruments
- (ii) Moving iron repulsion type instruments

63. What are the errors occur in MI instruments? (Remembering) (CO1)

- | | |
|-----------------------|-----------------------|
| i) Hysteresis error | iv) Frequencies error |
| ii) Temperature error | v) Eddy current error |
| iii) Stray error | |

64. Mention the disadvantages of MI instruments. (Remembering) (CO1)

- 1)The scale of the moving iron instruments is not uniform and is cramped at the lower end and therefore accurate readings are not possible at this end
- 2)These instruments are subjected to series errors due to hysteresis change in frequency and stray magnetic fields.
- 3)The non-linearity of B-H curve of iron leads to the fact that the deflecting torque is not exactly proportional to the square of the current.
- 4)Difference between d.c. and a.c. calibration occurs on account of effect of inductance of the meter and the eddy currents when the meter is used on a.c. Hence, the meter should be calibrated for frequencies at which they are used.

65. What is a multimeter? (Remembering) (CO1)

The ammeter, voltmeter and the ohm meter all use basic d'Arsonval movement. The difference between these instruments is the circuit in which the basic movement is used. Hence it is obvious that an instrument can be designed to perform these three measurement functions. Such an instrument is

called a multimeter, volt-ohm-milli-ammeter (VOM) which contains a functional switch to connect the circuit to the d'Arsonval movement to perform the corresponding operation.

66. Compare attraction and repulsion type instrument (MAY 2006) (Understanding) (CO1)

Attraction type:

The moving iron is a flat disc which is eccentrically mounted. When the current to be measured flows through the coil, magnetic field is produced which attracts the moving iron towards it, thus making the pointer to move. Controlling torque is provided by springs.

Repulsion type:

Moving the iron repulsion type instrument consists of two vanes inside the coil. Among the two vanes, one is fixed and the other is movable. When the current to be measured flows through the coil, both the vanes get magnetised in a similar way and hence a force of repulsion exists between the two vanes which results in the movement of the moving vane and thus the movement of the pointer.

67. Bring out the difference between moving coil and moving iron instruments. (DEC 2007, MAY 2011)(N/D 2013) (Understanding) (CO1)

S.No	PMMC	MI
1.	Uniform scale	Non uniform scale.
2.	It can be used only for dc measurement.	It can be used both ac and dc measurement.
3.	Cost is high	Cost is less
4.	It is free from hysteresis error	Serious error occur due to hysteresis

68. What is an electronic multimeter? (Remembering) (CO1)

The solid state electronic multimeter or VOM (Voltage-ohm meter) is one of the most versatile general purpose shop instruments capable of measuring

1. d.c voltage and current
2. a.c voltage and current
3. resistance

69. What are the elements in the electronic multimeter? (Remembering) (CO1)

- i. Balanced –bridge DC amplifier and Indicating meter
- ii. Input attenuator or Range switch – It is used to limit the magnitude of the input voltage to the desired value.
- iii. Rectifier section-It is used to convert an ac input voltage to a proportional dc value.
- iv. Internal battery and additional circuitry –It is used to provide the capability of resistance measurement.
- v. Function switch- This switch is used to select the various measurement functions of the instrument such as voltage, current, or resistance.

70. Summarize the advantages and disadvantages of electronic multimeter (CO1)

Advantages: (Understanding)

- | | |
|-----------------------------|-------------------------|
| i) Less cost | iv) Rugged construction |
| ii) Total circuit is simple | v) High frequency range |
| iii) High input impedance | vi) Less electric noise |

Disadvantages:

- | | |
|--------------------------------|--|
| i) Accuracy not high | iv) Poor reliability and repeatability |
| ii) Poor resolution | v) Interfacing of the output with external devices is difficult. |
| iii) Meter size is not compact | |

71. What is bridge circuit? (Remembering) (CO1)

A bridge circuit in its simplest form consists of a network of four resistance arms forming a closed circuit with a DC source of current applied to two opposite junctions and a current detector connected to the other two junctions.

72. What are the uses of bridge circuits? (Remembering) (CO1)

The bridge circuits are mainly used for measuring unknown quantities such as resistance, inductance and capacitance.

73. What are the advantages of bridge circuits? (Remembering) (CO1)

1) High measurement accuracy. 2) The accuracy is independent of null detector's characteristics. 3) The balance equation is independent of the magnitude of the input voltage or its source impedance, the sensitivity and impedance of null detector or any impedance shunting the detector. 4) The interchange of source and detector does not affect the balance condition. 5) The bridge circuit can be used in control circuits.

73. What are the applications of Wheatstone bridge?(Apr-May 2007) (Remembering) (CO1)

- To measure the DC resistance of various types of wire either for the purpose of quality control of the wire itself, or of some assembly and relay coils.
- E: Measurement of resistance of motor windings, transformers, solenoids and relay coils.
- This bridge is also used extensively by telephone companies and others to locate cable faults.

74. What is Kelvin Bridge? (Remembering) (CO1)

Wheatstone bridge is not suitable for measurement of very low resistance. Kelvin's bridge is a modification of Wheatstone bridge and is used to measure of resistance below 1Ω .

75. What is kelvin's double bridge? (Remembering) (CO1)

The circuit consists of double bridge because it incorporated a second set of ratio arms. This circuit is mainly used for measuring very low resistance from 1Ω to 0.00001Ω .

76. What are the two conditions must be satisfied to make an AC bridge balance? (Remembering) (CO1)

1) Two conditions must be met for the AC Bridge to be balanced. The first condition requires that the magnitudes of the four impedances satisfy this relationship $Z_1 Z_3 = Z_2 Z_4$ 2) The second condition relates to the impedance angles. 3) As a consequence, when the bridge is balanced, the voltage across Z_1 and Z_2 must be equal both in magnitude and phase.

77. What is Schering Bridge? (Remembering) (CO1)

The Schering Bridge, one of the most important AC bridges, is used extensively for measurement of capacitors with a low dissipation factor. Besides capacitors and dissipation factors it also measures the insulating properties of the electrical cables (for phase angle very close to 90°) and equipments.

78. What are the advantages of Schering Bridge? (Remembering) (CO1)

1. The balance equation is independent of frequency. 2. It is used for measuring the insulating properties of electrical cables and equipments.

79. What is Maxwell Bridge? (Remembering) (CO1)

The Maxwell Bridge or Maxwell-Wien Bridge is used to measure both a given inductance (with a Q between 1 and 10) and its series resistance by comparison to a standard capacitance. Using a capacitance as a standard offers several advantages. Capacitors are easy to shield and they produce almost no external field of their own. In addition, they are compact and fairly expensive.

80. What are the advantages and disadvantages of Maxwell Bridge? (May/June 2016) (Remembering) (CO1)**Advantages:**

- The frequency does not appear in any of the two equations.
- The two balance equations are independent, if the values of R_1 and C_1 as variable elements.
- This bridge yields simple expression for unknown L_x and R_x in terms of known bridge elements.
- This bridge is very useful for measurement of a wide range of inductance at power and audio frequencies.

Disadvantages:

- This bridge is limited to measurement of low Q coils ($1 < Q < 10$).
- It requires a variable standard capacitor which may be very expensive if calibrated to a high degree of accuracy.

81. What is Hay Bridge? (Remembering) (CO1)

The Hay Bridge or opposite-angle Bridge is used for the measurement of high- Q inductor ($Q > 10$).

The bridge arm opposite to the unknown inductance contains a capacitive reactance.

82. What are the advantages and disadvantages of Hay Bridge? (Remembering) (CO1)

Advantages: 1) This bridge gives very simple expression for unknown inductance for high Q coils, and is suitable for coils having $Q > 10$. 2) It also gives a simple expression for Q factor, $Q = \frac{1}{\omega C_4 R_4}$

Disadvantages:

- This bridge is not suited for the measurement of coil having Q less than 10.

83. What is Anderson Bridge? (Remembering) (CO1)

It is a modified version of the Maxwell's inductance capacitance bridge. In this method, the self-inductance is measured in terms of a standard capacitor. It is applicable for precise measurement of self-inductance over a very wide range of values.

84. What are the advantages and disadvantages of Anderson Bridge? (Remembering) (CO1)

Advantages: 1) A fixed capacitor can be used instead of a variable capacitor as in the case of Maxwell's bridge. 2) This bridge may be used for accurate determination of capacitance in terms of inductance. 3) It is much easier to obtain balance in case of Anderson's bridge than in Maxwell's bridge for low Q coils.

Disadvantages: 1) The Anderson's bridge is more complex than its prototype Maxwell's bridge.

- An additional junction point increases the difficulty of shielding the bridge.

85. What is Wien Bridge? (Remembering) (CO1)

The Wien Bridge is not only used to measure frequency as an AC bridge but also for its application in various other useful circuits. For example a Wien bridge in the harmonic distortion analyzer, where it is used as a notch filters discriminating against one specific frequency. The Wien Bridge also finds application in audio and HF oscillators as the frequency-determining element

86. What is RTD? (Remembering) (CO1) (JAN 2018)

A Resistance Temperature Detector (RTD) is a device with a significant temperature coefficient (that is, its resistance varies with temperature). It is used as a temperature measurement device, usually by passing a low-level current through it and measuring the voltage drop. A thermistor is a common type of RTD

87. What are standards and list their classification. (Remembering) (CO1) (JAN 2018)

Primary & Secondary

Primary Standard: A primary standard quantity will have only one value and it is fixed. An instrument which is used to measure the value of primary standard quantity is called primary standard instrument. It gives the accurate value of the quantity being measured. No precalibration is required for this instrument. It is used to calibrate the instruments having less accuracy. By comparing the readings of the two instruments, the accuracy of the second instrument can be determined.

Secondary Standard: The value of the secondary standard quantity is less accurate than primary standard one. It is obtained by comparing with primary standard. For measurement of a quantity using secondary standard instrument, pre-calibration is required. Without calibration, the result given by this instrument is meaningless. Calibration of a secondary standard is made by comparing the results with a primary standard instrument or with an instrument having high accuracy or with a known input source. In practical fields, secondary standard instruments and devices are widely used. Using calibration charts, the error in the measurement of these devices can be reduced.

UNIT 1 16 MARK QUESTIONS

1. What is the need for standards of measurements? How they are classified? Explain. (Apr 2011) (Remembering)(CO1)
2. How the unknown frequency is measured using Wien bridge method? (Apr 2011) (M/J 2013) (Remembering) (CO1)
3. What are the different types of errors in measurement? Explain. (Apr 2011) (Remembering) (CO1)
4. Explain the working of Hay Bridge for measurement of inductance. Derive the equations for balance and draw the phasor diagram under conditions of balance why is this bridge suited for measurement of inductance of high Q-coils. (Apr-May 2009) (Apr-May 2011) (Understanding)(CO1)
5. Draw the block diagram showing the basic functional elements of an instrument and explain the functions of each. (Applying) (CO1) (DEC 2015/JAN 2016)
6. Define limiting errors. Derive the expression for relative limiting error. (Remembering) CO1
7. Classify and explain the different types of standards. (DEC 2014/JAN 2015) (Understanding) (CO1)
8. Explain in detail the different types of errors in measuring instruments. (Understanding) (CO1) (DEC 2015/JAN 2016)
9. Describe about errors and its types in measurement with means adopted to minimize them. (DEC 2016/JAN 2017) (Remembering) (CO1)
10. Discuss in detail various types errors associated in measurement and how there errors can be minimized? (Remembering) (CO1)
11. What are the three categories of systematic errors in the instrument and explain in detail. (Remembering) CO 1)
12. Define and explain the following static characteristics of an instrument (Nov/Dec 2013) (Remembering) CO1)
(1) Accuracy (2) Resolution (3) Sensitivity (4) Linearity
13. Explain the following: (i) Instrumental errors.(ii)Limiting errors and environmental errors. (Evaluating) CO1)
14. Define the following static characteristics. (DEC 2009) (Remembering) (CO1)
(1) Accuracy (2) Resolution (3) Hysteresis (4) Sensitivity
15. Discuss the dynamic characteristics o the measurement system. (DEC 2009) (Remembering) (CO1)
16. Mention about the static and dynamic characteristics of an instrument. Explain about them in detail. (Remembering) (CO1)

17. Discuss the errors in measurement by giving suitable examples. Discuss the means adopted to minimize the errors. **(MAY 2009) (Remembering) (CO1)**
18. With a neat sketch explain the construction and operation of a permanent magnet moving coil instrument. Also show that the deflection is directly proportional to the current passing through the meter. **(DEC 2010) (Understanding) (CO1)**
19. Explain the operation of permanent magnet moving coil and moving iron instrument. **(May/June 2015) (May/June 2016) (Evaluating) (CO1)**
20. With a neat diagram explain the (1) construction, (2) working and disadvantages of a PMMC instrument. **(MAY 2006) (DEC 2014/JAN 2015) (June 2017) (Understanding) (CO1)**
21. Derive an expression for torque and angle of deflection in moving iron instruments **(DEC 2016/JAN 2017) (Understanding) (CO1)**
22. Bring out the difference between moving coil and moving iron instruments, **(DEC 2007) (Analyzing) (CO1)**
23. Explain the construction and working of moving iron meter. Derive its torque expression. **(DEC 2007) (May/June 2013) (Nov/Dec 2013) (Evaluating) (CO1)**
24. What are the different effects used in producing torque in an analog instrument. Give the examples in which these effects are used. **(MAY 2009) (Remembering) (CO1)**
25. What are the various operating forces of indicating instruments? Explain. **(Remembering) (CO1)**
26. With neat sketch explain the operation of series type and shunt type ohm meter **(May/June 2015) (May/June 2016) (Evaluating) (CO1)**
27. Discuss about the measurement of low resistance using shunt type ohmmeter **(DEC 2016/JAN 2017) (Remembering) (CO1)**
28. Explain with the help of block diagram the various parts of the electronic multimeter **(MAY-2009) (Remembering) (CO1)**
29. Explain the operating principle of a solid state electronic multimeter with necessary diagrams **?(JUNE 2013) (Remembering) (CO1)**
30. Derive the bridge balance condition for the Maxwell Bridge and Schering bridge. **(Dec 12, May 13) (Remembering) (CO1)**
31. Draw Maxwell's AC Bridge and give the balance equation in terms of resistance. **(Nov-Dec 2007) (Understanding) (CO1)**
32. Describe the circuit of Kelvin double bridge used for measurement of low resistance. Derive the conditions for balance **(Nov-Dec 2008) (Remembering) (CO1)**
33. With a neat sketch of a bridge, explain how high Q inductance can be measured. **(Nov-Dec 2008) (Understanding) (CO1)**
34. Explain how the inductance is measured in terms of known capacitance using Maxwell's bridge **(Apr-May 2008) (Remembering) (CO1)**
35. Explain the working of a Schering bridge and how it is to measure power factor and dissipation factor series RC combination. **(Apr-May 2008) (Remembering) (CO1)**
36. Which ac bridge is used to measure frequency and explain the measurement procedure? List the applications for the AC Bridge. **(Apr-May 2008) (Remembering) (CO1)**
37. Which measurements can be carried out by MAXWELL bridge. Explain how Maxwell's Bridge is used for the measurement of unknown inductance. Derive its Balance equation. What are the advantages and limitations? **(DEC 2014/JAN 2015) (June 2017) (Evaluating) (CO1)**
38. Explain how self inductance can be measured in terms of a standard capacitor using an AC bridge and detectors commonly used in AC bridges. **(Apr-May 2007) (Evaluating) (CO1)**
39. Explain in detail about Kelvin double bridge **(Apr-May 2007) (Evaluating) (CO1)**
40. Derive the expression for unknown capacitance. **(Nov-Dec 2007) (Remembering) (CO1)**
41. Derive the expression for unknown inductance. **(Nov-Dec 2007) (Remembering) (CO1)**
42. With a neat sketch describe a bridge to determine the unknown inductance and a bridge to determine the unknown capacitance **(CO1) (Remembering) (DEC 2015/JAN 2016)**

43. Explain how to determine frequency using Wein Bridge with neat circuit diagram. Obtain expression. (Nov-Dec 2007) (May/June 2016) (Evaluating) (CO1)
44. With a suitable bridge determine the self inductance of a coil in terms of Standard fixed capacitance (DEC 2016/JAN 2017) (Remembering) (CO1)
45. Explain how the quality factor can be calculated using Schering bridge. (Nov-Dec 2006) (Evaluating) (CO1)
46. Explain the method of measuring the insulating property of capacitor by relevant bridge circuit. (Apr-May 2005) (Evaluating) (CO1)
47. Explain any one bridge circuit for measurement of inductance. (Nov-Dec 2004) (Remembering) (CO1)
48. With a neat circuit diagram and phasor diagram discuss in detail about Schering bridge. Find an expression for the capacitance and dissipation factor. (Apr-May 2006) (Evaluating) (CO1)
49. Sketch the circuit diagram of a Maxwell bridge. Derive the equations for the resistive and inductive components of the measured inductor. (Nov-Dec 2006) (CO1)
50. Mention the significance of measurements (Apr-May 2011) (Remembering) (CO1)
51. Mention the errors in moving coil meter? (JUNE 2013) (Remembering) (CO1)
52. Describe in detail about the moving iron meters with suitable example (JUNE 2013) (Remembering) (CO1)
53. How to convert the PMMC meter into a voltmeter and ammeter? How to extend the range of these meters? (DEC-2012) (Remembering) (CO1)
54. Explain the conditions of bridge balance? (DEC 2012) (Evaluating) (CO1)
55. Design a Q factor for Hay's bridge with supporting equations (May/June 2016) (Evaluating) (CO1)
56. Explain in detail about the various error measurement system with statistical analysis. (May/June 13, April/May 11) (Evaluating) (CO1) (DEC 2015/JAN 2016)

UNIT II TRANSDUCER AND ANALYTICAL INSTRUMENTS

1. Define the term 'Transducer' and explain its parts or elements of a transducer. (May/June 13) (Remembering) (CO 2) (JAN 2018)

Transducer is defined as a device which converts a non-electrical quantity into an electrical quantity. Transducer consisting of two important and closely related parts. These two parts are (i) Sensing element (ii) Transduction element.

2. Define the term 'output impedance' in a transducer. (Nov 2003) (Remembering) (CO 2)

The output impedance Z_o of the transducer determines the extent the subsequent stages of instrumentation is loaded. If the output impedance is low compare to the forward Z of the system the transducer has the characteristics of the constant voltage source, while in case forward impedance is high as compared with the output impedance of transducer it behaves as constant current source.

3. Mention the use of capacitive transducer. (Apr 2005) (Nov/Dec 2010) (Remembering) (CO 2)

1) It is mainly used to measure the both linear and angular displacement. 2) It is used for the measurement of force and pressure. 3) It can be used directly as a pressure transducer. 4) Used for the measurement of humidity in gas. 5) It is also used in measurement of volume, density, liquid level, weight etc..

4. Interpret the applications of capacitive transducers. (DEC 2016/JAN 2017) (Understanding) (CO2)

Capacitive transducers can be used for measurement of both angular and linear displacement

(i) It can be used for the measurement of force and pressure (ii) It can be used for measurement of humidity in gases with change in humidity thereby producing a change in capacitance (iii) It can be used for measurement of volume, density, liquid level, weight etc.

5. What are the main advantages of electrical transducer? (Nov 2005) (Remembering) (CO 2)

- (i) Electrical amplification and attenuation can be done easily
- (ii) Frictions are minimized
- (iii) The electrical system can be controlled with the very small power level.
- (iv) The mass inertia effects are minimized.
- (v) Electrical output can be easily used, transmitted and processed for the power of measurement.

6. What are the characteristics or factors to be considered while selecting a transducer? (Nov2004) (May2007) (Remembering) (CO 2)

- Input characteristics : Type of input and operating range, Loading effects
- Transfer characteristics : Transfer function, Error, Transfer response
- Output characteristics : Type of electrical output, Output impedance, Useful range

7. Classify the types of strain gauges. (Understanding) (CO 2)

- 1) Unbounded metal strain gauges
- 2) Bonded metal wire strain gauges
- 3) Bonded metal foil strain gauges.
- 4) Vacuum deposited thin metal film strain gauges.
- 5) Bonded semiconductor strain gauges.
- 6) Diffused metal strain gauges.

8. State the advantages of LVDT. (Nov/Dec 10) (Remembering) (CO 2)

- 1) High range
- 2) Friction and electrical isolation
- 3) Immunity from external effects
- 4) High input and high sensitivity
- 5) Ruggedness
- 6) Low hysteresis
- 7) Low power consumption

9. Mention the uses of LVDT. (Understanding) (CO 2) (DEC 2015/JAN 2016)

- a) Its displacement ranging from few mm to cm is to be measure
- b) Use to measure force, weight, and pressure.

10. What is the principle of operation of capacitive transducer? (May/June 2016) (May/June 2016) (Remembering) (CO 2)

The principle of operation of capacitive transducer is based upon the familiar equation

$C = \epsilon A/d = \epsilon_0 \epsilon_r A/d$. The capacitive transducer work on the principle of change of capacitance which can be caused by: (1) Change in overlapping area. (2) Change in the distance d between the plates. (3) Change in dielectric constant.

11. Define piezoelectric effect. (Remembering) (CO 2)

If a varying potential is applied to the proper axis of the crystal, it will change the dimensions of the crystal thereby deforming it. This effect is known as piezo-electric effect. Elements exhibiting piezo-electric quantities are called as electro resistive elements.

12. Define encoders. Give the classification of encoders. (Remembering) (CO 2)

Digital transducers are called encoders. It enables a linear or rotary displacement to be converted into digital form without intermediate forms of analog to digital conversion. Such digitizers may be known as digital encoder or linear digitizer or for rotary applications, shaft digitizer or shaft encoder. The encoders are classified as three categories (i). Tachometer transducer (ii) Incremental transducer (iii) Absolute transducer

13. Define Hall Effect Sensor. (Remembering) (May/June 2015) (CO 2)

A Hall Effect sensor is a transducer that varies its output voltage in response to a magnetic field. Hall Effect sensors are used for proximity switching, positioning, speed detection, and current sensing applications

14. What is the principle of Hall Effect Transducer (Remembering) (May/June 2017) (JAN '18) (CO 2)

The principle of Hall Effect transducer is that if a strip of conducting material carries a current in the presence of a transverse magnetic field, a difference of potential is produced between the opposite edges of the conductor

15. Define inverse transducer. Give Example. (Remembering) (CO 2)

An inverse transducer is defined as a device which converts an electrical quantity into a non electrical quantity. Ex : Piezo electric transducer.

16. Give the difference between active transducer and passive transducer. (Analyzing) (CO 2)

Active Transducer	Passive transducer
It derives the power required for transduction from an auxiliary power source.	It do not require an auxiliary power source to produce their output.
They also derive the part of power required from the physical quantity under measurement. They are also known as "Externally powered transducer".	They develop their own voltage or current output. The energy required for production of output signal is obtained from the physical quantity being measured. They are also known as "self generating type".
Example : POT	Example: Thermocouple, Photovoltaic cells and Piezoelectric crystals.

17. List out the applications of passive transducers? (June 2017) (Remembering) (CO 2)

Measurement of displacement, pressure, force, position

18. What is a primary sensing element? (Apr2005) (Remembering) (CO 2)

A detector or a sensing element is that part of a transducer which responds to a physical Phenomenon or a change in a physical phenomenon. The response of the sensing element must be closely related to physical phenomenon is known as primary sensing element.

19. What are the two groups of materials used for piezo electric effect (Nov/Dec 2010) (Remembering) (CO 2)

1. Natural Group 2. Synthetic group

20. What is data acquisition system? (Remembering) (CO 2)

A typical data acquisition system consists of individual sensors with the necessary signal conditioning, data conversion, data processing, multiplexing, data handling and associated transmission, storage and display systems.

21. What are the objectives of data acquisition system? (Remembering) (CO 2)

- a. It must acquire the necessary data, at correct speed and at the correct time
- b. Use of all data efficiently to inform the operator about the state of the plant.
- c. It must monitor the complete plant operation to maintain on-line optimum and safe operations.
- d. It must provide an effective human communication system and be able to identify problem areas thereby minimizing unit availability and maximizing unit through point at minimum cost.

22. What is the classification of data acquisition system? (Remembering) (CO 2)

- i) Analog data acquisition system ii) Digital data acquisition system

23. Justify the significance of data acquisition in computer aided measurements (DEC 2016/JAN 2017) (Analyzing) (CO2)

1]The data acquisition system must acquire the necessary data at correct speed and at correct time 2]It must use all the data efficiently to inform the operator about the state of the plant 3]It must monitor the operation of complete plant so that optimum online safe operations are maintained. 4]It must be able to collect, summarize and store data properly for diagnosis and record purpose of any operation.

24. List the performance parameters of data acquisition card. (Remembering) (May/June 2015) (CO 2)

1. Resolution 2. Monotonicity 3. Conversion time 4. Settling time 5. Stability 6. Accuracy

25. List the various functional operations of a digital data acquisition system. (Remembering) (CO 2)

- i) It handles the analog signals iii) It converts analog signal to digital data and handles it
- ii) It performs measurement iv) It performs internal programming and control

26. What are the various components of the digital data acquisition system? (N/D 2013) (Remembering) (CO 2)

- i) Transducer iv) Signal converter
- ii) Signal conditioner v) Auxiliary equipments
- iii) Multiplexer vi) Digital recorder

27. What are the factors decide the configuration of DAS? (Remembering) (CO 2)

- i) Resolution and accuracy iv) Signal conditioning requirement of each channel
- ii) The number of channels to be monitored v) Cost
- iii) Sampling rate per channel

28. Mention applications of DAS (Remembering) (CO 2)

- i) Aerospace application iii) Telemetry industries
- ii) Biomedical field iv) Industries

29. What are the techniques used for A/D conversion? (Remembering) (CO 2) (Dec 2015/Jan 2016)

- 1) Single slope 2) Dual slope 3) Successive approximation 4) Flash 5) Delta modulation

17. What are the types of loss measurements in optical fibers? (Remembering) (CO 2)

1. Cut-back metho 2. Insertion loss method 3. Optical time domain reflect meter (OTDR) method

18. In a linear voltage differential Transducer the output voltage 1.8V at maximum displacement. At a certain load the deviation from linearity is maximum and it is ± 0.0045 V from a straight line

through the origin. Find the linearity at the given load. (Remembering) (CO 2) (Dec 2015/Jan 2016)

Ans: $\pm 0.25\%$

19. How long would be required for a reflection from a break in a fiber to return to an optical time domain reflectometer if the distance to the break is 1.2 km and the index of refraction of the fiber is 1.33 ((Remembering) (CO 2)

Ans: $L = 1/2 \times C/n_1 \times t$

Where n_1 = core refractive index

C = velocity of light in free space

T = Time taken for reflection

$$= 2 \times 1.2 \times (10)^3 \times 1.33 / 3 \times (10)^8$$

L = Length of the break

$$t = 2Ln_1/C$$

$$t = 10.64 \mu \text{ sec}$$

20. What are the different types of spectrophotometers. (Remembering) (CO 2)

1) UV visible spectrophotometers. 2) Infrared spectrophotometers. 3) FIFR spectrophotometers. 4) Atomic absorption spectrophotometers. 5) Flame emission spectrophotometers

30. What is Chromatography? (DEC 2014/JAN 2015) (Remembering) (CO 2)

Chromatography is a physical method of separation that distributes components to separate between two phases, one stationary phase, the other is moving in a definite direction.

31. Write short note on chromatography. (Remembering) (CO 2)

Chromatography is defined as the physical and chemical method of separation Between various components of a mixture into pure fractions or bands of each component.

32. What are the different types of gas chromatography? (Remembering) (CO 2)

The different types of gas chromatography are Gas liquid chromatography Gas solid chromatography.

31. Define retention time (Remembering) (CO 2)

The time required for each of the components to emerge from sample or mixture is called as the retention time.

32. Name the different parts of gas chromatography? (Remembering) (CO 2)

- Sample injection system • Chromatographic column
- Thermostat • Detector • Recorder

33. Explain chromatographic column. (Evaluating) (CO 2)

The column acts as the heart of a gas chromatography, where the fundamental Process of separation takes place. Its action is based on the fact that when a sample of gas or vapor is introduced into the column, it spreads by molecular diffusion to give a Concentration profile. As the sample moves through the column, additional spreading takes place. But, the band maintains the general shape, which is detected and recorded as a chromatographic peak.

34. What is pyrolysis? (Remembering) (CO 2)

Pyrolysis is an accepted method of handling solid samples. It extends gas Chromatographic analysis to compounds such as rubber, soil, textiles, coals, resins, Polymers, paint films etc. The method lends itself to studies on heat stability and thermal decomposition. It is also called as controlled thermal fragmentation.

35. List some detectors in gas chromatography. (Remembering) (CO 2)

1) Thermal conductivity detector 2) Flame ionization detector 3) Thermionic emission detector 4) Electron capture detector 5) Flame photometer detector 6) Photo ionization detector 7) Electrolytic conduction type of detection

36. Give the principle of Gas-Solid chromatography. (Remembering) (CO 2)

When a gas or vapour comes in contact with an adsorbent, certain amount of it get adsorbed on the solid surface. this takes place according to a phenomenon called Langmuir phenomenon given by $x/m = k_1 c + k_2 c^2$ x Æ mass of gas or vapour adsorbed c Æ vapour concentration in gas phase

37. Give the principle of Gas-Liquid chromatography. (Remembering) (CO 2)

If the vapour or gas comes in contact with a liquid, a fixed amount of it gets Dissolved in the liquid. This takes place according to Henry's law of partition given by $x/m = k c$ Where m Æ mass of liquid used c Æ vapour concentration in the gas phase, x Æ mass of gas k Æ constant .

38. What are advantages of gas chromatography? (Remembering) (CO 2)

The advantages of gas chromatography are

- Good accuracy and precision
- High sensitivity
- Apparatus cost is cheaper than liquid chromatography
- Shorter time of analysis
- Longer life of the instrument.

39. Write the features of thermal conductivity detector. (Remembering) (CO 2)

It is simple, inexpensive, non-selective and non-destructive and displays a Universal response

Being non-destructive, the column effluent can be passed through a TCD and then into a second detector

The sensitivity is 0.3 ng/ml. The linearity is between 10^4 to 10^5

It is particularly suitable for fraction correction and preparative gas Chromatography.

40. On what factor does the choice of detector will depend on liquid chromatography? (Analyzing) (CO 2)

- Good sensitivity, • Better selectivity ,
- The detector must be able to operate in the presence of background signal
- The response time of the detector must be compatible with chromatography event.

41. What are the limitations of bulk property detector? (Remembering) (CO 2)

Limitations: It is insensitive It requires good temperature control.

42. Write the limitations of gas chromatography. (Remembering) (CO 2)

Only about 20% of known compounds lend themselves to analysis by gas Chromatography. This is because the compounds are volatile and they cannot pass through the column. Also they are thermally unstable and decompose under certain conditions of separation.

43. What are the different types of liquid chromatography? (Remembering) (CO 2)

The different types of liquid chromatography are

- Liquid-liquid chromatography
- Liquid-solid chromatography
- Ion exchange chromatography or Bonded phase chromatography
- Exclusion chromatography

44. Name the different types of pumps used for mobile-phase delivery system in liquid Chromatography. (Understanding) (CO 2)

The different types of pumps used for mobile-phase delivery system in liquid Chromatography is • Reciprocating pump • Syringe type pump • Constant-pressure pump.

45. What are the different types of columns used in liquid chromatography? (CO 2) (Understanding)

The different types of columns used in liquid chromatography are

1) Radial compression column 2) Standard column 3) Narrow bore column 4) Short, fast column

46. What is Optical Time Domain Reflectometer? (Remembering) (CO 2)

An OTDR is a fiber optic tester characterizing fiber and optical networks. The aim of this instrument is to detect, locate and measure events at any location in the fiber link.

16 marks Questions

1. Why setting time is important in data acquisition system? (Apr-may 2009) (Remembering) (CO 2)
2. What is a digital data acquisition system? List the various functional operations of a digital data acquisition system and explain them. (Apr-may 2009)? (Apr-may 2010) (Analyzing) (CO 2)
3. Draw the structure of data acquisition system and explain the functions of each block in detail. (Understanding) (May/June 2015) (May/June 2016) (CO 2)
4. With a neat schematic diagram explain the functioning of multichannel Data acquisition system (Nov-Dec 2007) (Understanding) (CO 2)
5. Give the objective of data acquisition system and explain in detail the different types of data acquisition system. (DEC 2014/JAN 2015) (Evaluating) (CO 2)

6. Describe the basic operation of hall effect transducer and photo optic sensor with neat diagram **(Remembering) (CO 2) (DEC 2015/JAN 2016)**
7. List the elements needed for the computer controlled instrumentation **(Nov-Dec2008) (Analyzing)(CO 2)**
8. Briefly specify the analog data acquisition systems element **(Nov-Dec2008) (Remembering) (CO 2)**
9. What is data acquisition ? **(Nov-Dec2009) (Remembering) (CO 2)**
10. What are the basic objectives of DAS ? **(Apr-May 2009) (Remembering) (CO 2)**
11. Explain briefly the difference between the analog and digital DAS **(Apr-May 2009) (Evaluating) (CO 2)**
12. What is need for multiplexing? How is it classified? **(Apr-May 2009) (Remembering) (CO 2)**
13. What is the need for interfacing of transducers? What are the techniques used? **(Apr-May 2010) (JUNE 2013) (Remembering) (CO 2)**
14. Explain the optical time domain reflectometer **(Apr-May 2008)(May 2011) (Remembering) (CO 2)**
15. With a block diagram explain the power meter and how can it be modified to display logarithmic power? **(Apr-May 2008) (Evaluating) (CO 2)**
16. Explain in detail the fiber optic measurement for power and system loss? **(Nov-Dec 2010) (Evaluating) (CO 2)**
17. List the elements of digital data acquisition system? **(Nov-Dec2012) (Remembering) (CO 2)**
18. Draw and explain the block diagram of analog and digital data acquisition system **(JUNE 2013) (Remembering) (CO 2)**
19. Describe the operation of capacitive transducer and LVDT with neat diagram. **(Remembering) (May/June 2015) (JUNE 2017) (CO 2)**
20. Illustrate the operation of LVDT and explain how residual voltage is eliminated using a circuit **(DEC 2016/JAN 2017) (JUNE 2017) (Remembering) (CO 2)**
21. Explain about Hall Effect transducer and piezo electric transducer in detail with neat diagram. **(DEC 2014/JAN 2015) (May/June 2016) (Remembering) (CO 2)**
22. What is DAC? Give the block diagram arrangement of the DAC and describe the function each component **(JUNE 2017) (Remembering) (CO 2)**
23. Design a direct probe with supporting diagram for achieving high impedance. **(May/June 2016)**
24. Explain the working principle of Gas Chromatography **(May/June 2016) (Remembering) (CO 2)**
25. Demonstrate the construction and working of Gas chromatography and its Detector **(DEC 2016/JAN 2017) (Remembering) (CO 2)**
26. Explain various types of spectrophotometer. **(Evaluating) (CO 2)**
27. Explain the construction and working of single – pass and two – pass differential refractometers **(Remembering) (CO 2) (DEC 2015/JAN 2016)**

UNIT – III ELECTRONIC MEASUREMENT INSTRUMENTS

1. What is signal generator? (Remembering) (CO3)

Signal generator provides variety of different signals for testing various electronic circuits at low powers. The signal generators is an instrument which provides several different output waveforms including sine wave, square wave, triangular wave, pulse train and an amplitude modulated waveform.

2. What are the various requirements of a signal generator?(DEC-2006) (Remembering) (CO3)

- The output frequency of a signal generator should be very stable.
- The amplitude of the output should be controllable from very small to relatively large values.
- The output signal should be free from distortion.
- The amplitude of the output signal must be stable.

3. What are the applications of signal generators? (Dec-2010) (Remembering) (CO 3)

- To provide appropriate signal for calibration, testing and trouble shooting of the amplifier circuits used in communication, electronics such as radio and television amplifiers.
- To be employed as power source for the measurement of gain, bandwidth, signal to noise ratio and standing wave ratio and other properties of circuits.
- To measure the characteristics of antennas and transmission lines.

4. What are the types of four signal generating instruments. (MAY-2006) (Remembering) (CO 3)

- | | |
|---|--------------------------------|
| 1. Low frequency (LF) sine wave generators. | 4. Pulse generators. |
| 2. Radio frequency (RF) sine wave generators. | 5. Sweep frequency generators. |
| 3. Function generators. | |

5. What are the advantages of AF signal generators? (Remembering) (CO3)

1. Stable and simple operation.
2. Low distortion.
3. Good amplitude stability.
4. Relatively easily achievable audio frequency variation.

6. What is a function generator? (MAY-2008) (Remembering)(May/June 215) (CO 3)

A function generator is a versatile instrument. It delivers different waveforms frequencies whose frequencies are adjustable over a wide range. The most required common output waveforms are the sine, triangular, square and saw tooth waves. The frequencies of these waveforms may be adjusted from a fraction of hertz to several hundred kilohertz.

7. List any four features of the functions generator.(MAY-2008) (JAN 2018) (Remembering) (CO 3)

- The frequency range is 0.01 Hz to 100 kHz.
- Can produce various waveforms such as sine wave; saw tooth wave, triangular wave, square wave etc.
- The accuracy is within $\pm 1\%$ in low frequency range.
- The distortion is less than 1% for the sine wave.
- Can be phase locked to another external signal source.
- A continuous adjustable d.c offset is available between -5v to +5v.

8. What are the basic elements of function generator?(MAY-2008) (Remembering) (CO 3)

1. Frequency control network.
2. Upper and lower constant current source.
3. Integrator.
4. Voltage comparator multivibrator
5. Resistance diode shaping circuit.
6. Output amplifier.

9. Define duty cycle for pulse value.(DEC-2008) (Remembering) (CO 3)

The duty cycle is defined as the ratio of the average value of the pulse over one cycle to the peak value. It is also defined as ratio of the pulse width to the period of one cycle.

$$\text{Dutycycle} = \frac{\text{pulsewidth}}{\text{pulseperiod}}$$

10. Define pulse rise and fall time. (Remembering) (CO 3)

The pulse rise time is the time needed for the pulse to go from 10% to 90% of its amplitude. The fall time is the time need for the trailing edge to go from 90% to 10%. These times are also called leading edge and trailing edge transition times.

11. Define pulse undershoot. (Remembering) (CO 3)

A distortion of the base value immediately following a falling edge.

12. Define Ringing. (Remembering) (CO 3)

The positive and negative peak distortion, excluding overshoot or undershoot, on the pulse top or base line.

13. Define Droop or Sag. (Remembering) (CO 3)

Droop or sag occurs when the peak value gradually decreases during the pulse.

14. Define pulse repetition rate. (Remembering) (CO 3)

The rate at which pulses are produced.

15. Define settling time. (Remembering) (CO 3)

The time required for a signal to decrease to a given percentage typically 1% to 5% of its peak value.

16. What are the features of pulse generator? (Remembering) (CO 3)

- The frequency range of the instrument is covered in seven decade steps from 1 Hz to 10 MHz, with a linearly calibrated dial for continuous adjustment on all ranges.
- The duty cycle can be varied from 25% to 75%.
- Two independent outputs are available:
 - A 50Ω source that supplies pulses with rise and fall times of 5 ns at 5 V peak amplitude.
 - A 600 Ω source that supplies pulses with rise and fall times of 70ns at 30 V peak amplitude.
- The instrument can be operated as a free running generator or it can be synchronized with external signals.
- Trigger out pulses for synchronization are also available.

17. What is RF signal generator? (Remembering) (CO 3)

A radio frequency (RF) signal generator has a sinusoidal output with a frequency range between 100 kHz to 40GHz.

18. What is a sweep frequency generator? (Remembering) (CO 3)

The process of testing the frequency response of amplifiers and filters can be simplified and speeded up by using signal generators that automatically varies its frequency over a predetermined range. Such an instrument is known as a sweep frequency generator.

19. List out the types of frequency synthesizer. (Remembering) (May/June 2015) (CO 3)

- Free running
- Synthesizer 1. Direct synthesizer, 2. Indirect synthesizer

20. What is a frequency synthesized generator? (Remembering) (CO 3)

Frequency synthesized generators produce a very accurate and very stable output frequency derived from either multiples or submultiples of one or more crystal controlled oscillator, a process referred to as frequency synthesis.

21. What are the applications of function generator? (Remembering) (CO 3)

1) To test the bandwidth of the audio frequency amplifier. This method is commonly known as square wave testing. 2) to be used as an important instrument in the trouble shooting of different analog and digital circuits and instruments. 3) To act as a source for the alignment of receiver.

22. Compare audio generator and function generator. (DEC-2006) (DEC 2016/JAN 2017) (Understanding) (CO 3)

S.NO	ASPECTS	SIGNAL GENERATORS	FUNCTION GENERATORS
1	Type of wave generator	Sine wave	Sine, square, saw tooth, triangular etc.
2	Frequency stability	limited	high
3	Method of frequency control	By frequency range control and vernier dial setting (by varying capacitor in LC or RC circuit)	By varying the magnitude of the current which drives the integrator.
4	Phase locking capability	No	Yes

23. What is signal analyzer? (Remembering) (CO 3)

Analysis of the signals in the frequency domain, signal amplitude versus frequency is another important measurement technique widely used for providing information about the overall performance of electrical and physical systems.

24. Mention the various types of signal analyzer. (Understanding) (CO 3)

1. Wave analyzer
2. Distortion analyzer
3. spectrum analyzer
4. Digital Fourier analyzer

25. What is a wave analyzer? (MAY-2010) (Remembering) (CO 3)

A wave analyzer is an instrument designed to measure the relative amplitudes of single frequency components in a complex or distorted waveform

26. What are the two basic configurations of wave analyzer? (CO 3)

- (i) Frequency-selective wave analyzer
- (ii) Heterodyne wave analyzer

27. What is the use of wave analyzer? (MAY-2010) (JUNE 2017) (JAN/JUNE 2018) (Remembering) (CO 3)

- Measuring the amplitudes of individual components of a complex frequency system.
- Measuring the signal amplitudes in the presence of noise and interfering signals. Measuring the energy in a specific well defined bandwidth., electrical measurements, vibration measurements, sound measurements

28. What is harmonic distortion? (MAY-2010) (DEC-2009) (Remembering) (CO 3)

Non linear elements in a system create harmonic frequencies from a pure sine wave this is known as harmonic distortion. The amount distortion due to particular harmonic, as a percentage of the fundamental component is given by $\% N^{th} \text{ harmonic distortion} = \frac{V_N}{V_1} \times 100\%$

Where, V_N = RMS voltage of the N^{th} harmonic, V_1 = RMS voltage of the fundamental component.

29. What are harmonic distortion analyzers? (DEC 2016/JAN 2017) (Remembering) (CO 3)

If the signal of fundamental frequency 'f' has the other frequency components present in it, which multiples of fundamental frequency, such as 2f, 3f... then it is called harmonic

distortion. The Distortion factor meter is useful to measure total distortion. It is useful only for the analysis of fundamental wave and its harmonics. It can be used to find total harmonic distortion caused by amplifiers or other electronic equipments

30. Define THD.(MAY-2008) (Remembering) (CO 3)

Rather than specifying the amount of distortion at a particular harmonic, a more generalized measure, called percent total harmonic distortion, takes into account all harmonic components above the fundamental. In terms of the percent distortion at each harmonic, percent total harmonic distortion is determined from

$$\%D = \sqrt{(\%2^{nd})^2 + (\%3^{rd})^2 + \dots + (\%n^{th})^2}$$

$$= \sqrt{D_2^2 + D_3^2 + \dots + D_n^2}$$

31. What are the methods to measure the harmonic distortion? (Remembering) (CO 3)

- (i) Tuned -circuits harmonic analyzer
- (ii) Heterodyne harmonic analyzer or wave meter.
- (iii) Fundamental-suppression harmonic distortion analyzer.

32. What are the disadvantages of tuned-circuits harmonic analyzer? (Remembering) (CO 3)

- i. At low frequencies, very large values for L and C are required and their physical size becomes rather impractical.
- ii. Harmonics of the signal frequency are often very close in frequency, so that it becomes extremely difficult to distinguish between them.

33. What are the major sections of fundamental suppression harmonic distortion analyzer? (Remembering) (CO 3)

The instrument consists of four major sections.

- 1. The input circuit with impedance converter
- 2. The rejection amplifier.
- 3. The metering circuit.
- 4. Power supply.
- 5. Demodulator (AM detector).

34. What is spectrum analyzer? (MAY-2010) (ADEC-2010) (Remembering) (CO 3)

A spectrum analyzer separates an a.c signal into its various frequency components and displays each component as a vertical line on a CRT screen. The amplitude of each vertical line in the display represents the amplitude of each frequency component and the horizontal position of each line defines the frequency.

35. Mention the types of spectrum analyzer. (Understanding) (CO 3)

1) Swept tuned ratio frequency spectrum analyzer. 2) Swept super heterodyne spectrum analyzer 3) High frequency spectrum analyzer.

36. What are the advantages of spectrum analyzer? (Remembering) (CO 3)

i) High sensitivity. ii) Better performance since it is operated at IF frequency only.

37. What are the applications of spectrum analyzer?(MAY-2008) (Remembering) (CO 3)

i).Radars. ii). Oceanography. iii).Bio-medical fields.

It is also used for

1.	Observing purity of a signal.	3.	Studying harmonic components of a signal.
2.	Analyzing modulated signals.	4.	Finding the intermodulation content.

38. What is digital spectrum analyzer? (Remembering) (CO 3)

The conventional spectrum analyzer is called a 'real-time' spectrum analyzer, while the analyzer using a computer algorithm and A/D conversion is usually called an FFT spectrum analyzer. Alternative names are 'digital spectrum analyzer' and 'fourier analyzer'.

39. What is digital LCR meter? (Remembering) (CO 3)

This meter is mainly used to measure the resistance, inductance, capacitance and dissipation factor.

40. What is the difference between a wave analyzer and a harmonic distortion analyzer? (Understanding) (CO 3)

A wave analyzer is an instrument that measures amplitudes of the harmonic components of complex signal. A harmonic distortion analyzer is an instrument that measures total harmonic distortion by determining the harmonic components of a given waveform.

41. What is known as 'window' in FFT spectrum analyzer? (Remembering) (CO 3)

The FFT analyzer samples the data for fixed amount of time. The resultant spectrum determination represents a spectrum of a periodic function repeated infinitely. The sample represents a window and the data is considered as a periodic function, where the data in the window is repeated. Some common window functions are rectangle, Hanning, Hamming and Kaiser.

42. What is meant by a Fourier analyzer? (Remembering) (CO 3)

It is a computer driven instrument that determines the Fourier-series components of any periodic function.

43. What is a digital voltmeter? (May/June 2013) (Remembering) (CO 3)

Digital voltmeters are the instruments which convert the analog signal into digital and display the voltage to be measured as discrete numerical on the digital display instead of pointer deflection. It is also called DVM. Digital voltmeters can be used to measure both AC and DC voltages.

44. What are the advantages of digital voltmeter? (Remembering) (CO 3)

•	Highly accurate reading can be taken	•	Better resolution
•	Higher input impedance	•	Reading speed is very high
•	Digital display eliminates observational errors, interpolation errors and parallax errors committed by operators	•	They can be used for the measurement of quantities like current, impedance, capacitance, temperature, pressure etc.
•	Digital output can be directly recorded.	•	The development of IC chips has reduced the cost, size and power requirement of DVM
•	Due to small size, they are portable		

45. What are the parameters to be deciding the classification of DVM? (Remembering) (CO 3)

- | | |
|------------------------|---------------------------------|
| i) Voltage range | iv) Normal mode noise rejection |
| ii) Accuracy | v) Common mode noise rejection |
| iii) Digitizing period | vi) Digital output |

46. Mention the advantages and disadvantages of successive approximation type DVM (Remembering) (CO 3)**Disadvantages of successive approximation type DVM:**

- If noise is introduced in the input, the reading will be inaccurate because of incorrect decisions made by the comparator.
- If electromechanical switches are used, speed of measurement is less.

Advantages of successive approximation type DVM:

- General range of digits is 3 to 5 and it decides the resolution of the instrument.
- Inexpensive method.

47. Define duty cycle. (Remembering) (CO 2) (DEC 2015/ JAN 2016)

A Duty cycle is the percentage of one period in which a signal is active. A period it takes for a signal to complete an on and off cycle.

$$D = \frac{T}{P} \times 100\%$$

48. Mention the two types of Ramp type DVM (Understanding) (CO 3)

- Linear ramp type DVM
- Staircase ramp type DVM

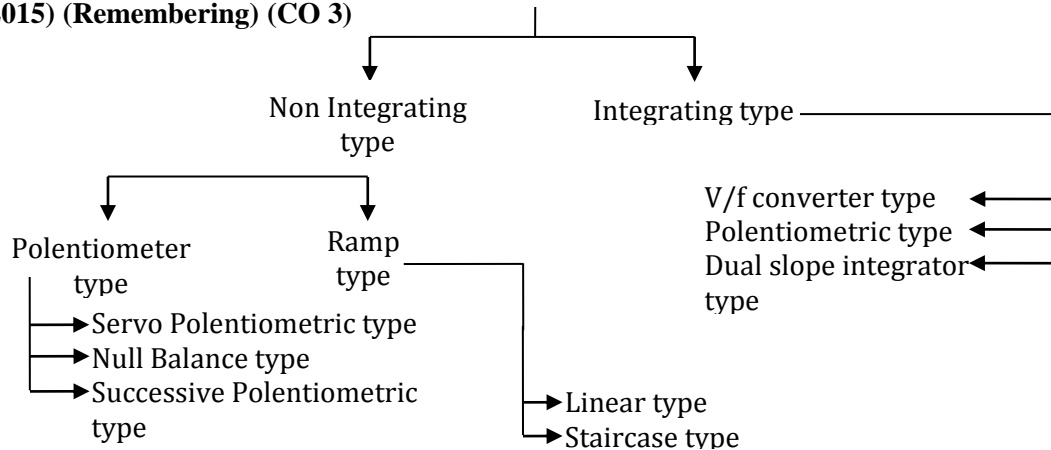
49. Mention the advantages and disadvantages linear ramp type DVM (Remembering) (CO 3)**Advantage of linear ramp type DVM:**

- Low cost
- Easy circuit design
- Voltage is converted to time, which can be easily digitized
- As the resolution is directly proportional to the frequency of the local oscillator, better resolution can be obtained by adjusting the frequency of the oscillator.

Disadvantages of linear ramp type DVM:

- i. Accuracy of the reading depends on slope of the ramp and stability of the local oscillator.
- ii. Large errors are possible because of interruption of noise with input signal
- iii. Highly linear ramp signal is require. A small non-linearity in the ramp signal will affect the reading.
- iv. Errors may be produced because of drifts and offsets in the comparator
- v. Measurement speed is low
- vi. For a measurement $\pm 10V$, range of the ramp should be $\pm 12V$.

50. List the different types digital DVM voltmeter.(May 2011) (DEC 2014/JAN 2015) (Remembering) (CO 3)



51. List out the advantages and disadvantages of staircase ramp type DVM (Remembering)(CO 3)

Advantages of staircase ramp type DVM:

- | | |
|--|--------------------------|
| i) Highly accurate than linear ramp type DVM | iii) Cost is cheap |
| ii) Simple in design | iv) High input impedance |

Disadvantages of staircase ramp type DVM: 1) Accuracy of this meter depends on the accuracy of the D/A converter. Hence a highly accurate D/A converter should be used. 2) Speed of measurement is less 3) Introduction of noise in the input will cause error

52. List out the advantages and disadvantages of dual slope type DVM. (Remembering) (CO 3)

Advantages:

- a. Errors due to noise is very less as it is averages out by the process of integration
- b. Time constant of the integrator does not affect the voltage measurement.
- c. Offset voltage is nil because of electronic switch and zero capacitor
- d. Need of sample and hold circuit is eliminated because of the use of integrator.
- e. Highly accurate

Disadvantages 1) Slow speed, 2) Circuit is little bit complex compared to other types of DVM

53. List out the general characteristics of DVM. (Remembering) (CO 3)

- | | |
|-----------------------|-----------------------|
| i) Input range | v) Input resistance |
| ii) Absolute accuracy | vi) Input capacitance |
| iii) Resolution | vii) Calibration |
| iv) Stability | |

54. Define resolution of DVM (Remembering) (CO 3)

Resolution of digital voltmeter is given by,

$$R = 1/(10)^n$$

Where, R=resolution of DVM, N=number of full digits in a digital display

55. Define sensitivity of DVM (Remembering) (CO 3)

Sensitivity is the smallest changes in the input which a DVM can be detect.

Sensitivity, $S = (fs)_{min} \times R$

Where, S=Sensitivity, $(fs)_{min}$ =full scale value of minimum range, R=Resolution

56. What is a digital multimeter? (Remembering) (CO 3)

Digital multimeter is an instrument which can be measuring dc and ac voltages and currents, and resistance over several ranges.

57. What are the specifications of a digital multimeter. (Remembering) (CO 3)

- | | |
|----------------|-----------------------|
| i) Diode test | iv) Bar graph display |
| ii) Touch hold | v) Digital interface |
| iii) Peak hold | |

58. What are the parts of digital multimeter? (Remembering) (CO 3)

- | | |
|---------------------------------|--|
| i) Current to voltage converter | v) Resistance to voltage converter(ohms converter) |
| ii) DC voltage attenuator | vi) Analog to digital converter |
| iii) AC Voltage attenuator | vii) Display devices |
| iv) AC to DC converter. | |

59. What are the advantage sand disadvantages of digital multimeter? (Remembering) (CO 3)**Advantages of DMM:**

- | | |
|---|---|
| i) Highly accurate and the accuracy is around $\pm 0.03\%$ | v) Measurement speed is more |
| ii) Loading effect is nil because of high impedances | vi) Easily portable |
| iii) Easy to interface with other devices | vii) Very cheap |
| iv) A single measurement can be used to measure various ranges a.c and d.c voltages, alternating and direct current and resistances | viii) Resolution is high in the order of $10/\mu\text{V}$ |

Disadvantages of DMM over analog instruments:

- | | |
|--|--------------------------------------|
| i) Interruption of electric noise | iii) Isolation problem occurs in DMM |
| ii) Requirement of external power supply | |

60. What is Q-meter? Draw its Circuit diagram. (Nov-Dec 2009) (JUNE 2017) (Remembering) (CO 3)

The overall efficiency of the coils and capacitors intended for the RF applications is best evaluated using Q value .The Q meter is an instrument designed to measure some of the electrical properties of coils and capacitors. The basic principle of the Q-meter is based on 'series resonance', the voltage drop across the coil or capacitor is Q times the input voltage .If a fixed voltage is applied to the circuit, a voltmeter across the capacitor can be calibrated to read Q directly. (For Circuit Refer Book)

61. What are the various sources of error in Q-meter?(Apr-May 2010) (Remembering) (CO 3)

- | | |
|---|---|
| • Error due to distributed capacitances | • Error due to shunt resistor |
| • Error due to residual inductances | • Error due to conductance of Q-voltmeter |

62. List the applications of Q-meter?(Apr-May 2006) (Analyzing) (JUNE 2018) (CO 3)

- | | |
|--|--|
| • To measure the Q of a coil | • To measure the coefficient of coupling |
| • To measure the inductance and capacitance | • To measure the mutual inductance of coupled circuits |
| • To measure the distributed capacitance of a coil | • To measure the critical coupling |
| • To measure the Q and power factor of a dielectric material | |

63. What is vector meter? (Remembering) (CO 3)

Vector meter is also used to measure the impedance and voltage.

64. Mention the types of vector meter. (Understanding) (CO 3)

- | | |
|--------------------------|--------------------|
| • Vector impedance meter | • Vector voltmeter |
|--------------------------|--------------------|

65. List out the applications of vector meters. (Remembering) (CO 2) (DEC2015/JAN 2016)

It is used to measure insertion loss, complex impedance of mixers, S parameters of transistors, radio frequency distortion, and amplitude modulation index

66. What is a vector impedance meter? (Nov-Dec.2007) (Remembering) (CO 3)

The meter used for complex impedance measurements at high frequencies is called vector impedance meter.

67. What are the two modes of operation in vector impedance meter? (Remembering) (CO 3)

- Constant-current mode
- Constant-voltage mode

68. What are the applications of vector impedance meter? (Nov-Dec.2007) (Remembering) (CO 3)

- This meter used to measure the impedance over wide frequencies range from 400 kHz to 110MHz.
- This meter can also used to obtain sweep frequency plots, i.e., magnitude and phase angle against frequency band of interest.
- This measure can measure the magnitude and the phase angle of the impedance simultaneously.
- Using the oscilloscope, displaying the Lissajous pattern, the reactance can be calculated by the use of this meter.

69. What is a vector voltmeter?(Nov-Dec.2009) (Remembering) (CO 3)

A vector voltmeter measures the magnitude of a signal at two points in a circuit and simultaneously measures the phase difference between the voltage waveforms at these two points.

70. What are the major sections of vector voltmeter? (Nov/Dec 2013) (Remembering) (CO 3)

- Two RF-to-IF converters
- A phase meter circuit
- An automatic phase control section
- A voltmeter circuit

71. Mention the some applications in of vector voltmeter. (Understanding) (CO 3)

Vector voltmeter is very useful in very high frequency (VHF) applications and can be used successfully in such measurements as

- Amplifier gain
- Filter transfer functions
- Phase shift
- Two port network parameters
- Complex insertion loss

72. Mention the two types of instruments that are used for measurement of power at RF.(May 2009) (Understanding) (CO 3)

- Bolometer
- Calorimeter

73. What is true rms voltmeter?& draw its block diagram.(May/June 2013) (Remembering)(CO 3)

True rms voltmeter is mainly used for measurement of complex AC inputs.

74. What is basic principle of the true rms voltmeter? (Remembering) (CO 3)

True rms voltmeter is mainly used for measurement of complex AC inputs. This instrument produces a meter indication by sensing waveform heating power, which is proportional to the square of the rms value of the input voltage. This heating power can be measured by amplifying and feeding it to a thermocouple, whose output voltages is then directly proportional to the rms input voltage.

75. What are the two methods of frequency synthesizer? (Remembering) (CO 3)

1. Direct method 2. Indirect method.

76. Why is period mode preferred for measurement of very low frequency in frequency counter? (DEC 2014/JAN 2015) (Remembering) (CO 3)

When the frequency to be measured is low then accuracy of frequency counter decrease because with low frequency. Very less number of pulses gets connected to the gating circuit. So it is more suitable to measure period than frequency.

77. What are the advantages of frequency counter? (Remembering) (CO 3)

- i) Give accurate reading
- iii) Electronic counter has a high speed of operation
- ii) Simple in operation
- iv) High frequency signals can be measured

78. What are the methods used to increase the frequency range of frequency counter? (Remembering) (CO 3)

- i) Pre scaling
- ii) Heterodyne converter
- iii) Automatic divider
- iv) Transfer oscillator

79. What is the principle involved in time interval measurements? (Remembering) (CO 3)

In this time interval measurement, the electronic counter used to change its range for getting a reading with the optimum resolution under all circumstances

80. What is automatic zeroing? (Remembering) (CO 3)

Automatic zeroing is the ability of the digital instrument to reset its digital display when a new measurement is carried out is when a new input signal is given to the digital meter

81. What are the four components for a computer test system? (Remembering) (CO 3)

- a) Computer-compatible test equipment
- b) Computer
- c) Software to perform the desired test and present the data in correct form
- d) Communication system to connect the computer and the test equipment

82. Identify talkers and/or listeners from the following instruments.(a)Frequency counter (b)Voltmeter. (May2006) (Analyzing) (CO 3)

Frequency counter can be either a listener or a talker.

16-Mark Questions

1. What are the various requirements of a signal generator? (DEC-2006) (MAY-2010) (Remembering) (CO 3)
2. Discuss in detail about working of a RF signal generator and sweep generator.(MAY-2010)(JUNE 2013) (MAY-2011 (DEC 2015/JAN 2016) (May/June2016)(Creating) (CO 3)
3. Describe the operation of RF signal generator and spectrum analyzer (Remembering) (May/June 2015) (CO 3)
4. What are the applications of signal generator? (DEC-2010) (Remembering) (CO 3)
5. Describe the working of function generator with the help of a block diagram.(DEC-2010) (Remembering) (CO 3)
6. Mention any four signal generating instruments. (MAY-2006) (Understanding) (CO 3)
7. Explain the function generator generates sine wave, triangular wave and square wave (MAY 2011) (Evaluating) (CO 3)
8. Explain in detail about block diagram sweep frequency generator its linearizing circuit, broad band sweep generator and few applications of sweep frequency generator. (MAY-2006)(MAY 2011) (DEC 2015/JAN 2016) (JUNE 2017) (Remembering) (CO 3)
9. With a neat block diagram, explain signal generator. (MAY-2006) (Applying) (CO 3)
10. Write any four features of the function generator.(MAY-2008) (Remembering) (CO 3)
11. Explain the operation of a sweep frequency generator with a neat block diagram. (MAY-2008) (Remembering) (CO 3)
12. Why is a fixed alternator inserted between a piston alternator and the oscillator of a signal generator? (MAY-2008) (Remembering) (CO 3)
13. What are the basic elements of function generator?(MAY-2008) (Remembering) (CO 3)
14. Discuss the principle of pulse and square wave generators and also the pulse characteristics required to analyze the quality of the pulse. (MAY-2008) (N/D 2011, 13)) (Creating) (CO 3)
15. What is frequency synthesizer and describes its types with circuits in detail(DEC-2008) (Remembering) (CO 3)
16. Describes a signal generator using feedback for amplitude modulation.(DEC-2008) (Remembering) (CO 3)
17. How can frequency be synthesized using indirect method? (DEC-2008) (Remembering) (CO 3)
18. Develop the working principle of a sine generator and extend the principle to develop a function generator. Illustrate them with neat sketches.(DEC-2008) (Creating) (CO 3)
19. List two differences between an audio generator and function generator.(DEC-2006) (Analyzing) (CO 3)
20. What are sweeper errors? (DEC-2006) (Remembering) (CO 3)
21. What are signal sources? What are the desirable characteristics of a signal?(MAY-2004) (Remembering) (CO 3)
22. Draw simplified block diagram of a sweep frequency generator. (DEC-2004) (Understanding) (CO3)
23. Discuss briefly various kinds of signal generators.(DEC-2005) (Creating) (CO 3)
24. What are the applications of spectrum analyzer ?(MAY-2008) (Remembering) (CO 3)
25. Explain with the help of block diagram, fundamental suppression distortion analyzer. Explain its two modes of operation.(MAY-2008) (N?D 2012,13) (Evaluating) (CO 3)
26. Explain the parts of a fundamental suppression HD analyzer, its working and its advantages. (MAY-2008) (Remembering) (CO 3)

27. What is spectrum analysis? (MAY-2010) (DEC-2010)(May/J 2013) (Nov/Dec 2011) (Remembering) (CO 3)
28. What is harmonic distortion? Draw the block diagram of heterodyne harmonic distortion analyzer and explain its working. (MAY-2010) (DEC-2009) (Remembering) (CO 3)
29. Explain the working of super heterodyne type spectrum analyzer mention about the information provided by a spectrum analyzer.(MAY-2010) (Evaluating) (CO 3)
30. What is wave analyzer? What is its use?(MAY-2010) (Remembering) (CO 3)
31. Explain the working of a frequency selective wave analyzer mention about its applications.(MAY-2010) (Evaluating) (CO 3)
32. Explain the distortion analyzer with the help of suitable diagrams.(DEC-2010) (Evaluating) (CO 3)
33. Describe the functioning of total harmonic distortion meter with a diagram.(MAY-2009) (Remembering) (CO 3)
34. Describe the engineering applications of a wave analyzer. (MAY-2009) (Remembering) (CO 3)
35. Write the function of distortion analyzer (MAY-2007) (Remembering) (CO 3)
36. Write the short notes on the following.(JUNE 2013) (Remembering) (CO 3)
 - (i) Frequency synthesizer (ii) spectrum analyzer. (iii) Harmonic Distortion Analyzer
41. Draw the block diagram of a general spectrum analyzer and explain. (DEC-2009)(MAY 2011) (May/June 2016) (Understanding) (CO3)
42. Explain the function generator generates sine wave, triangular wave and square wave (MAY 2011) (Evaluating) (CO3)
43. What is wave analyzer? How it analyzes the harmonics? Explain (MAY 2011) (Remembering) (CO 3)
44. What are the wave analyzers? Brief about the wave analyzers used for RF ranges and above. (DEC 2016/JAN 2017) (Remembering) (CO3)
42. Explain the working of frequency selective wave analyzer with a neat block diagram(DEC 2012) (Remembering) (CO 3)
43. Explain the working of a Q-meter with a neat diagram.(N/D 2011, 2013) (Remembering) (CO 3)
44. Depict the determination of Q factor of a coil using Q meters. (DEC 2016/JAN 2017) (Remembering) (CO3)
45. List the application of Q-meter.(Apr-May-2006) (DEC 2014/JAN 2015) (Analyzing) (CO 3)
46. Draw the block diagram of True RMS reading voltmeter and explain its operation (MAY 2011) (Understanding) (CO 3)
47. How to measure the large capacitors and small coils using Q-meter (DEC-2012) (Remembering) (CO 3)
48. With a neat sketch explain the working of digital voltmeter and its types (May/June 2015) (May/June 2016)(Remembering) (CO 3)
49. Explain the vector impedance meter with a neat block diagram (DEC-2012) (May/June 2015)(Evaluating) (CO 3)
50. How to measure the RF voltage and power using RF millivoltmeter?(DEC-2012) (Remembering) (CO 3)
51. Draw a test setup to measure power at high frequencies. (Apr-May 2006) (Understanding) (CO 3)
52. Mention the two types of instruments that are used for measurement of power at RF? (MAY-2009) (CO3)
53. Explain the principle of time period measurement with a basic block diagram and show how its accuracy can be improved (DEC 2016/JAN 2017) (Understanding) (CO3)
54. Discuss in detail about the working principle of Q-meter. What are the various sources of errors in Q-meter?(MAY-2010) (May/June 2013) (N/D 2011) (DEC 2014/JAN 2015) (Creating) (CO 3)
55. Explain the working of a vector voltmeter with necessary block diagram. Mention its applications (MAY-2010) (N/D 2011, 2012, 2013) (Evaluating) (CO 3)
56. List the applications of frequency synthesizer. (May/June-2010) (Analyzing) (CO 3)
57. Explain direct and indirect frequency synthesizer and explain briefly about frequency counter. What are the different types of decade counters used in frequency counters? .(MAY-2009) (May/June 2013) (DEC 2015/JAN 2016) (JUNE 2017) (Remembering)(CO3)

58. (i) How the spectrum analyzer generates RF signal? Explain in detail
 (ii) Draw the block diagram and discuss in detail about basic digital multimeter (May/June 2016) (Remembering) (CO3)
59. How is voltage estimated in successive approximation type voltmeters? (DEC 2016/JAN 2017) (Remembering) (CO3)
60. Discuss in detail about various blocks using a digital frequency counter (Nov/Dec 2013) (Creating) (CO3)

UNIT IV – STORAGE AND DISPLAY INSTRUMENTS

1. **What is CRO? (Remembering) (CO4)**
 - The cathode ray oscilloscope (CRO) is probably the most versatile tool for the development of electronic circuits and systems.
 - The CRO allows the amplitude of electrical signals whether they are voltage, current, power, to be displayed as a function of time.
2. **What are the major parts of CRO? (Remembering) (CO4)**

1. CRT	5. time base generator
2. vertical amplifier	6. trigger circuit
3. delay line	7. power supply
4. Horizontal amplifier	
3. **What are the main parts of CRT? (MAY 2004, MAY 2009) (Remembering) (CO4)**

1. Electron gun assembly	3. Fluorescent screen
2. Deflection plate assembly	4. Glass envelope
4. **List a few applications of CRO. (MAY 2005)(MAY-2009) (Analyzing) (CO4)**
 Using a single channel oscilloscope, it is capable of making measurements of voltage, current, time, frequency and rise/fall.
5. **Why delay line is used in CRO? (DEC 2016/JAN 2017) (Understanding) (CO4)**
 The delay line is used to delay the signal in the vertical sections. As the signal is delayed, the sweep generator output gets enough time to reach to the horizontal plates before signal reaches the vertical plates. This ensures that no part of the signal lost from the display
6. **Define the deflection sensitivity. (MAY 2005)(MAY-2006) (Remembering) (CO4)**
 The deflection sensitivity of a CRT is defined as the deflection of the screen per unit deflection voltage.
7. **What is special purpose oscilloscope? (Remembering) (CO4)**
 A storage oscilloscope can retain the trace caused by a single sweep for a long period of time. This feature is particularly useful in studying non-repetitive events such as turn-on transients or very low speed phenomena where the required sweep time is very long compared to the persistence of the standard oscilloscope phosphor. There are two basic methods used for retaining a trace on the oscilloscope screen for a long period of time. One method makes use of storage oscilloscopes with special CRTs and the other uses of digital storage oscilloscope.
8. **What is sampling oscilloscope? (Remembering) (CO4)**
 Above the range of 50-300MHz. Sampling techniques have to be employed to obtain suitable display and CRO employing such sampling methods are called sampling oscilloscopes.
9. **What are the advantages and disadvantages of sampling oscilloscope? (DEC 2014/JAN 2015) (Remembering) (CO4)**
ADVANTAGES:
 - The display produced is clear and High speed electrical signals can be produced.
 - Very high frequency performance can be achieved.
 - By controlling the size of the steps of the staircase generator, the number of samples and hence the resolution can be controlled.
 - The sampling technique allows the design of the oscilloscope with wide bandwidth, high sensitivity even for low duty cycle pulses.**DISADVANTAGE:**
 - This oscilloscope cannot be used to display the transient waveforms.
10. **What are uses of analog storage oscilloscope? (Remembering) (CO4)**
 Analog storage oscilloscope uses the phenomenon of secondary electron emission to build up and store electrostatic charges on the surface of an insulated target. Such oscilloscopes are widely used (i) for real-time observation of events that occur only once and (ii) for displaying the waveform of very low frequency(VLF) signal.

11. What is digital storage oscilloscope? (Remembering) (CO4)

The digital storage oscilloscope stores a signal by converting successive samples to binary numbers, which are stored in a digital memory and used to recreate a composite waveform in much the same manner as the sampling oscilloscope display is created.

12. How the current and voltage can be measured using CRO? (JUNE 2017) (Remembering) (CO4)

The deflection of the beam is directly proportional to the deflection voltage. Thus the CRT tube will measure voltage

The value of a current can be obtained by measuring the voltage drop across a known resistance connected in the circuit.

13. What are the advantages of digital storage oscilloscope?(MAY 2010)(N/D 2013) (JAN 2018) (Remembering) (CO4)

- Infinite storage time
- Easy to operate
- Pre triggering feature allows display of waveform, before the trigger pulse.
- Signal processing is possible.
- Cursor measurement is possible.
- It is capable of displaying X-Y plots, P-V diagrams and B-H curve.
- A number of traces depending on the memory size can be stored and recalled.

14. Distinguish between analog and digital storage oscilloscope (DEC 2016/JAN 2017) (Understanding) (CO4)

Analog storage oscilloscope	Digital storage oscilloscope
In this oscilloscope heavy amount of power is to be supplied to storage tube	It can store the given signal indefinitely as long as the small amount of power is supplied to the memory
It always collect the data only after triggered	It always collect the data & stops when triggered
The cost of the tube is costlier than the storage tube used in DSO	It employs normal CRT, hence the cost of the tube is much cheaper than the storage tube used in ASO
It cannot produce bright image even for high frequency signals	It can produce bright image even for high frequency signals
In this oscilloscope, time base is generated by the Ramp circuit	In this oscilloscope, time base is generated by the crystal clock
It has lower resolution than DSO	It has higher resolution than ASO
It has high operating speed	It has less operating speed

15. State the limitations of analog storage oscilloscope.(May/June 2015) (Remembering) (CO4)

Low writing speed, Low Brightness

16. What are the applications of digital storage oscilloscope? (Remembering) (CO4)

1) It can be used to measure.(i) AC as well as DC voltages and currents.(ii)Frequency, time period, time interval between two signals etc.2)It is used to give the visual representation for a target of radar such as aero plane, strip, etc.3)In medical fields, it is used to display cardiograms that are useful for diagnosis of heart disease in the patient.4)It is used to observe the radiation pattern generated by the transmitting antenna. 5) It can be used to check the faulty component in various circuits. It can be used to analyze TV waveforms.

17. Give the principle of operation of digital oscilloscope. (Remembering) (DEC 2015/JAN 2016)(CO4)

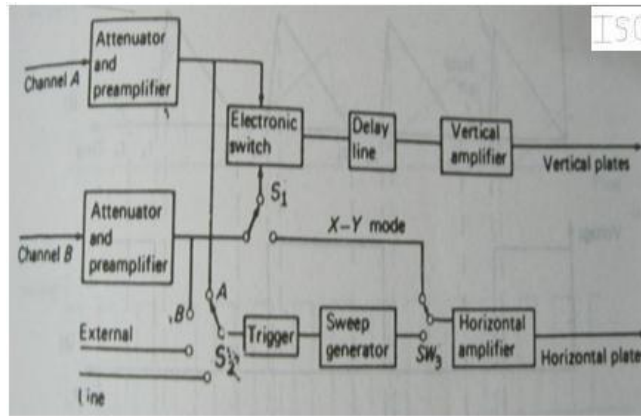
The input analogue signal is applied and then converted into a digital record of the amplitude of the signal at each sample time. The sampling frequency should be not less than the nyquist rate to avoid aliasing. These digital values are then turned back into an analogue signal for display on a CRT or transformed as needed for the various possible types of output –Liquid Crystal Display, chart recorder, plotter or network interface.

18. What is the frequency modulation recording? (JUNE 2017) (Remembering) (CO4)

A particular frequency, selected as the center frequency, corresponds to a zero signal input signal. A DC signal causes the carrier frequency to vary in one direction. An AC signal causes the carrier frequency to vary on both sides of the center frequency. Thus all information presented to the tape is presented in the frequency domain

19. List out the controllers normally found in XY recorder. (Analyzing) (CO4)

- Servo controller.
- Chopper controller.

20. Draw the block diagram of dual trace oscilloscope (Evaluating)(CO4) (DEC 2015/JAN 2016)**21. Define X-Y recorder. Or what is an X-Y recorder? (DEC 2014/JAN 2015) (May/June 2016) (Remembering)(CO4)**

It is used to study the behavior of one variable with respect to another variable instead of recording them separately as function of time. There are two types of X-Y recorders namely. a) Analog X-Y recorders. b. Digital X-Y recorders.

22. What is magnetic tape recorder? (Remembering) (CO4)

Magnetic tape recorder is a recorder which records analog data in such a manner that they can be reproduced in electrical form again.

23. What is the basic operating principle of digital tape recording? (Remembering) (CO4)

Digital data can be recorded and stored in magnetic tapes using a variety of techniques. The basic principle used to modulate the digital data in some form and then record this modulated data in the tape.

24. What are the various methods of recording data? (Remembering) (CO4)

- Direct recording.
- Frequency modulated (FM) recording.
- Pulse duration modulation (PDM) recording.

25. Write the basic components of magnetic tape recorder. (Remembering) (CO4)

Following are the basic components of magnetic tape recorder:

- Recording head
- Magnetic tape
- Reproducing head
- Tape transport mechanism
- Conditioning devices.

26. Give the advantages of LCD. (May/June 2015) (May/June 2016) (DEC 2016/JAN 2017) (Remembering) (CO4)

- Poor reliability
- Limited temperature range
- Poor visibility in low ambient temperature
- Slow speed
- Requires an AC drive

27. What is a LED? (Remembering) (CO4)

A PN junction diode which emits light when forward biased is known as Light emitting diode (LED).

28. Write two advantages of LED in electronic displays. (May2007) (Remembering) (CO4)

- The LED is considerably less expensive than the laser.
- The light output from the LED has a broader spectral bandwidth and emits from the diode in a larger cone than the laser.
- Used for slow speed or lower frequency communication applications.

29. What are the materials used for LED?) (Remembering) (CO4) JAN 2018

Gallium arsenide (GaAs) and Gallium phosphide (GaP)

16-Mark Questions

- Discuss in detail about the various blocks of a general purpose CRO. (MAY-2009) (MAY-2010) (DEC 2014/JAN 2015) (Creating) (CO4)
- Discuss in detail the construction of a storage type oscilloscope. What are the accessories for a CRO? Explain. (May/June 2015) (Creating) (CO4)
- What is lissajous pattern and for what purpose is it used? (DEC-2008) (Remembering) (CO4)
- With a neat sketch explain the working principle of digital storage oscilloscope.(DEC-2008)(JUNE 2013) (Remembering) (CO4)
- Describe the working of a digital storage oscilloscope with a neat sketch and how is it different from an analog storage oscilloscope. (MAY-2008 N/D 2011, 2013) (Remembering) (CO4)

6. Explain lissajous figure as a method of measuring frequency in oscilloscope with necessary diagrams. (MAY-2008) (Evaluating) (CO4)
7. List the disadvantages of storage CRT. (MAY-2006) (Analyzing) (CO4)
8. Give the characteristics of praxes used in CRO. (MAY-2006) (Remembering) (CO4)
9. What is the function of an electron gun? (DEC 2010) (Remembering) (CO4)
10. What are the types of sweeps in oscilloscope? (DEC-2006) (Remembering) (CO4)
11. Write brief notes on: (i) storage oscilloscope (ii)sampling oscilloscope(JUNE 2013) (DEC 2012, 2013) (Remembering) (CO4)
12. Discuss the construction and function of dual trace oscilloscope with necessary waveforms (DEC 2015/JAN 2016) (May/June 2016) (DEC 2016/JAN 2017) (Remembering) (CO4)
13. (i)Predict any five precautions for operating oscilloscopes
(ii) Write the advantages and disadvantages of FM recording. (May/June 2016) (Evaluating) (CO4)
14. Briefly explain the operation of different types of special oscilloscopes. (DEC-2003) (Remembering) (CO4)
15. Draw and explain the block diagram of DSO AND the modes of operation of DSO. Distinguish between analog and digital storage oscilloscope (JUNE 2017) (DEC 2016/JAN 2017) (Understanding) (CO4)
16. What is sampling oscilloscope? (DEC-2003) (Remembering) (CO4)
17. Draw the block diagram and explain the various parts of a sampling oscilloscope. List its advantages and disadvantages. (MAY-2006) (MAY2010)(MAY 2011)(DEC 2012) (Understanding) (CO4)
18. What is the difference between digital and analog oscilloscope? (ECE-DEC-2005) (May/June 2013) (Remembering) (CO4)
19. Explain in detail about analog storage oscilloscope. (Evaluating) (CO4)
20. Explain in detail about delayed time base oscilloscope.(JUNE 2013) (Evaluating) (CO4)
21. Draw the internal structure of CRT and list its functions. (MAY 2011) (Understanding) (CO4)
22. Briefly discuss the function of electro mechanical servo type XT and XY recorder. (May/June 2015) (Creating) (CO4)
23. Explain the construction and working of electromechanical servo type XY recorders and ,magnetic tape recorder4s (DEC 2016/JAN 2017) (JUNE 2017) (Understanding) (CO4)
24. Write a note on frequency modulation recording (DEC 2016/JAN 2017) (Understanding) (CO4)
25. Write short notes on (i) Liquid crystal display (ii) Light emitting diode (DEC 2014/JAN 2015) (DEC 2015/JAN 2016) (May/June 2016) (JUNE 2017) (Remembering) (CO4)

UNIT V VIRTUAL INSTRUMENTATION

68. Define virtual instruments (Nov/Dec 2010) (DEC 2014/JAN 2015) (Remembering) (CO5)
The virtual instruments are the device which are configured from independent hardware components by using appropriate software and performs custom instrumentation functions.
69. Define virtual instrumentation (Nov/Dec 2013) (Remembering) (CO5)
Virtual instrumentation is an interdisciplinary field that merges sensing, hardware and software technologies in order to create flexible and sophisticated instruments for control and monitoring applications
70. What are the functional blocks of virtual instrumentation? (Remembering) (CO5)
A virtual instrument is composed of the following blocks:

i) Sensor Module	iv) Processing module
ii) Sensor Interface	v) Database interface and
iii) Medical information systems interfacci	User interface
71. What are the three update modes of waveform chart? (Remembering) (May/June 2015) (CO5)
Strip Chart: Scrolling display
Scope chart: Retracing display. The plot is erased after reaching the right border of the plotting area.
Sweep chart: Like the scope chart, but the plot is not erased. Instead, a vertical line marks new data and moves across the display as data is added.
72. Differentiate the virtual instruments and the conventional instruments (JUNE 2017) (JAN 2018) (Remembering) (CO4)

The virtual instruments are the device which are configured from independent hardware components by using appropriate software and performs custom instrumentation functions.

The conventional instruments Instrument is a device for determining the value or magnitude of a quantity or variable.

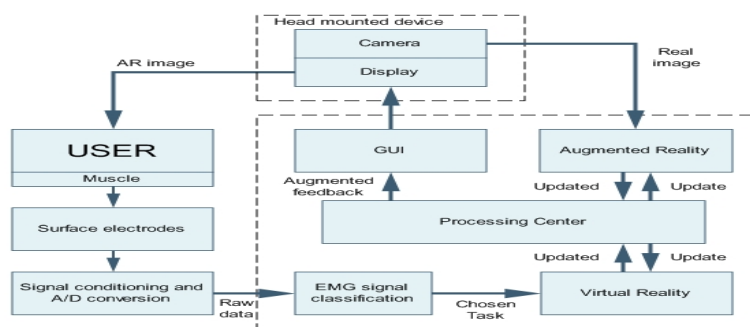
73. List some applications of virtual instrumentation (Analyzing) (CO5)

- A control system for printing holograms on semiconductor wafers
- A portable camera system for operating rooms
- An automated radio test system used by dialer charger
- A weapons detection system for security checkpoints at airports
- An in flight testing and data collection system on Black Hawk helicopters
- A radiation test system for cellular phones

74. State and explain the three components of Lab View VIs. (JUNE 2017) (Remembering) (CO5)

The three components of Lab View VIs are front panel, the block diagram, and the icon and connector panel. The front panel is the user interface of a VI and specifies the inputs and displays the outputs of the VI. The block diagram contains the graphical source code composed of nodes, terminals, and wires.

75. Draw the block diagram of virtual instrumentation. (Understanding) (CO5)



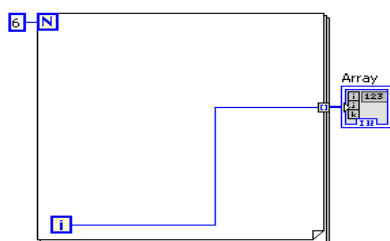
76. Summarize the special features of LabView. (Understanding) (CO5)

- It is used to communicate with hardware such as data acquisition, vision, and motion control devices, and GPIB, PXI, VXI, RS-232, and RS-485 devices.
- Lab VIEW also has built-in features for connecting your application to the Web using
- The Lab VIEW Web Server and software standards such as TCP/IP networking and Active X.
- It is used to create, test and measurement, data acquisitions, instrument control, data logging, measurement analysis, and report generation applications.
- It is also used to create stand-alone executables and shared libraries, like DLLs, because Lab VIEW is a true 32-bit compiler.

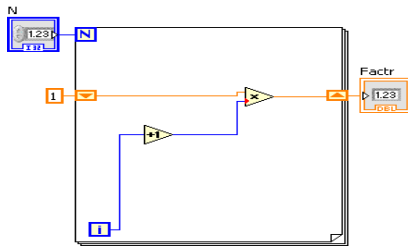
77. Name the components of Lab View dialog Box. (Remembering) (CO5) (JAN 2018)

- A menu with standard items such as **File »Exit**.
- A set of buttons for creating and opening VIs, configuring data acquisition devices, and finding helpful information. **New** button to create a new VI.
 - Open** button to open an existing VI.
 - Configure** button to configure the data acquisition devices.
 - Help** button to launch the Lab VIEW Help.

78. Draw the VI diagram to create an array using for loop. (Evaluating) (DEC 2015/JAN 2016) (May/June 2016) (CO4)



79. Depict a VI to determine the factorial of a given number using FOR loop. (DEC 2016/JAN 2017) (Understanding) (CO5)



80. List out the different string operations in LABVIEW. (DEC 2015/JAN 2016)(Understanding) (DEC 2015/JAN 2016) (CO4)

Format Into string, concatenate strings, and string length, string subset, Match pattern

81. Define Palettes and give their types. (Remembering) (CO5)

Lab VIEW has graphical, floating palettes to create and run VIs. The three palettes include the **Tools**, **Controls**, and **Functions** palettes. We can place these palettes anywhere on the screen.

82. What is Tools Palette? (Remembering) (CO5)

The tool palettes are used to create, modify, and debug VIs using the tools located on the floating **Tools** palette. The **Tools** palette is available on both the front panel and the block diagram. A tool is a special operating mode of the mouse cursor. The cursor corresponds to the icon of the tool selected in the **Tools** palette. The tools are used to operate and modify front panel and block diagram objects.

83. What are the various tools present in the tool palette? (Remembering) (CO5)

- Positioning tool: to select, move, or resize objects.
- Labeling tool: to edit text and create free labels.
- Wiring tool: to wire objects together on the block diagram.
- Object Shortcut Menu tool: to access an object shortcut menu with the left mouse button.
- Scrolling tool: to scroll through windows without using scrollbars.
- Breakpoint tool: to set breakpoints on VIs, functions, nodes, wires, and structures to pause execution at that location.
- Probe tool: to create probes on wires on the block diagram.
- Color Copy tool: to copy colors for pasting with the Coloring tool.

84. Explain the function of Controls and Functions Palettes. (Remembering) (CO5)

The **Controls** and **Functions** palettes contain sub palettes of objects to create a VI. To use an object on the palettes, click the object and place it on the front panel or block diagram.

The **Controls** palette is available only on the front panel. The **Controls** palette contains the controls and indicators to build the front panel. The controls and indicators located on the **Controls** palette depend on the palette view currently selected.

The **Functions** palette is available only on the block diagram. The **Functions** palette contains the VIs and functions to build the block diagram. The VIs and functions located on the **Functions** palette depend on the palette view currently selected. The VIs and functions are located on sub palettes based on the types of VIs and functions.

85. Define controls and indicators. (Remembering) (CO5)

Controls are knobs, push buttons, dials, and other input devices. Controls simulate instrument input devices and supply data to the block diagram of the VI.

Indicators are graphs, LEDs, and other displays. Indicators simulate instrument output devices and display data the block diagram acquires or generates.

86. Classify the various controls and indicators. (Understanding) (CO5)

- (i) Numeric Controls and Indicators
- (ii) Boolean Controls and Indicators

87. Define functions of virtual instrument. (Remembering) (CO5)










Functions are the fundamental operating elements of Lab VIEW. Functions do not have front panels or block diagrams but do have connector panes. Double-clicking a function only selects the function.

88. Write short notes on nodes. (Remembering) (CO5)

Nodes are objects on the block diagram that have inputs and/or outputs and perform operations when a VI runs. They are analogous to statements, operators, functions, and subroutines in text-based programming languages. Nodes can be functions, subVIs, or structures. Structures are process control elements, such as Case structures, For Loops, or While Loops.

89. What is the function of wires? Give their classification. (Remembering) (CO5)

Wires are analogous to variables in text-based programming languages. Wires connect the control and indicator terminals to the Add and Subtract functions. Each wire has a single data source, but wire it to many VIs and functions that read the data. Wires are different colors, styles, and thicknesses, depending on their data types. A broken wire appears as a dashed black line with a red X in the middle. The following examples are the most common wire types.

Wire Type	Scalar	1D Array	2D Array	Color
Numeric				Orange (floating-point), Blue (integer)
Boolean				Green
String				Pink

90. Define dataflow programming in VI. (Remembering) (CO5)

Lab VIEW follows a dataflow model for running VIs. A block diagram node executes when all its inputs are available. When a node completes execution, it supplies data to its output terminals and passes the output data to the next node in the dataflow path. Visual Basic, C++, JAVA, and most other text-based programming languages follow a control flow model of program execution. In control flow, the sequential order of program elements determines the execution order of a program.

91. List the different data types available in labVIEW. (Dec 2014/Jan 2015) (Analyzing) (CO5)

Single integer, Unsigned integer, real floating point, complex floating point, string, RefNum, Variant, cluster of numeric's, cluster of mixed data types, polymorphic

92. Recall the driver softwares used in LABVIEW. (DEC 2016/JAN 2017) (Remembering) (CO5)

- 1] NIELIVS suit 2] NI DAQMAX 3] LABVIEW Development system
- 4] Lab windows/CVI 5] DIAdem 6] NI teststand 7] LABVIEW Run Time Engine

93. What is the single step mode in debugging techniques? (Remembering) (CO5)

Single-step through a VI helps to view each action of the VI on the block diagram as the VI runs. The single-stepping buttons affect execution only in a VI or subVI in single-step mode. Single-step mode is entered by clicking the Step over or Step into button.

94. Mention the three methods of interfacing used in DAQ cards. (Remembering)(May/June 2015) (CO5)

- Differential connections with floating signal sources
- Referenced single Ended connections with floating signal sources
- Non- Referenced single ended connections with floating signal source

95. What is the function of execution highlighting? (Remembering) (CO5)

Execution highlighting shows the flow of data on the block diagram from one node to other using bubbles that move along the wires. Use execution highlighting in conjunction with single-stepping to see how data move from node to node through a VI.

Execution highlighting greatly reduces the speed at which the VI runs.

16 Marks questions

1. Draw the block diagram of virtual instrument and explain their functions and also give their advantages over conventional instruments. **(Understanding) (CO5)**
2. Explain the architecture of virtual instruments and give its relation with the operating system. **(Remembering) (CO5)**
3. Briefly explain the overview of Lab View software and its features. **(Evaluating) (CO5)**
4. With example explain the dataflow model of VIs. **(Remembering) (CO5)**
5. Explain the debugging techniques involved in the VIs. **(Evaluating) (CO5)**
6. With example explain how to create and run a program in Lab View. **(Remembering) (CO5)**
7. Write a short note on (i) Functions and Libraries (ii) Controls and indicators. **(Remembering) (CO5)**
8. Explain about graphical user interface and graphical programming palettes and tools **(Evaluating) (CO5)**
9. Explain about the following (i) labels and texts (ii) data types and format in Vis **(Evaluating) (CO5)**
10. What are the different palettes available in lab VIEW? Explain with neat sketch diagram. **(Dec 2014/Jan 2015) (Remembering) (CO5)**
11. Give the importance of front panel objects with its function. **(Remembering) (CO5)**
12. Discuss the different functions of charts used in LABVIEW. **(May/June 2015) (Creating) (CO5)**

13. Explain in detail about the application of LABVIEW in traffic light control with necessary diagram, **(Evaluating) (May/June 2015) (CO5)**
14. Explain the function of different structures used in LABVIEW **(Remembering) (CO5) (DEC 2015/JAN 2016)**
15. Explain how to interface a DAQ card using DAQ assistance in LABVIEW with an example? **(Remembering) (CO5) (DEC 2015/JAN 2016)**
16. (i) Propose one dimensional and two dimensional array using LABVIEW
17. (ii) Design a VI to compare clusters and switch ON an LED in the output cluster if the n^{th} element of cluster 1 is greater than n^{th} element of cluster 2. **(May/June 2016) (Evaluating) (CO5)**
18. (i) Recall launching of DAQ assistant in virtual instrumentation using LABVIEW **(JUNE 2017) (Remembering) (CO4)**
 (ii) Design two 2D numeric arrays and add them change the number of rows and number of columns of each array **(May/June 2016) (Evaluating) (CO5)**
19. Construct a VI to evaluate the equation $(A+B)/[(A+B)*2]$ using sequence Structure **(DEC 2016/JAN 2017) (Evaluating) (CO5)**
20. Briefly explain about the overview of LABVIEW and its advantages **(JUNE 2017) (Remembering) (CO4)**
21. How arrays are different from clusters? Elucidate with a VI block **(DEC 2016/JAN 2017) (Understanding) (CO5)**
22. Demonstrate any signal processing application using LABVIEW **(DEC 2016/JAN 2017) (Understanding) (CO5)**
23. Explain in detail about arrays and clusters in lab VIEW with examples. **(Dec 2014/Jan 2015) (Evaluating) (CO5)**

Reg. No. :

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K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637 215
(AUTONOMOUS)

Question Paper Code : X5121

B.E. / B.Tech. DEGREE END SEMESTER EXAMINATION, DEC 2014 / JAN 2015

Fifth Semester

B.E. – ELECTRONICS AND COMMUNICATION ENGINEERING

12EC3503 – Electronic Instrumentation

(Regulations 2012)

Time : Three hours

Maximum : 100 Marks

Answer ALL Questions

PART A — (10 x 2 = 20 Marks)

1. State the advantages of electronic measurements.
2. What is sensitivity of voltmeters?
3. In a linear voltage differential transducer the output voltage is 1.8 v at maximum displacement. At a certain load the deviation from linearity is maximum and it is ± 0.0045 v from a straight line through the origin. Find the linearity at the given load.
4. What is chromatography?
5. List the different types of digital voltmeters.
6. Why is period mode preferred for measurement of very low frequency in frequency counter?
7. Mention the advantages of sampling oscilloscope.
8. What is an X-Y recorder?
9. Define virtual instruments.
10. List the different data types available in LabVIEW.

PART B — (5 x 16 = 80 Marks)

11. (a) (i) Classify and explain the different types of standards of measurements. (8)
- (ii) With a neat diagram explain the construction, working, torque equation and advantages and disadvantages of PMMC instrument. (8)
- (Or)**
- (b) Explain how Maxwell's bridge is used for the measurement of unknown inductance. Derive its balance equation. What are its advantages and limitations? (16)
12. (a) What is Hall Effect? With neat diagram explain the construction and operation of Hall effect transducer. (16)
- (Or)**
- (b) Give the objective of data acquisition system and explain in detail the different types of data acquisition system. (16)
13. (a) Explain the working of a Q meter with a neat circuit diagram. List the applications of Q meter. (16)
- (Or)**
- (b) Discuss the working of electronic multimeter with necessary diagrams. (16)
14. (a) With a neat block diagram explain the function of a general purpose oscilloscope. (16)
- (Or)**
- (b) Write short notes on
- (i) Liquid crystal display (8)
- (ii) Light emitting diode (8)
15. (a) What are the different palettes available in LabVIEW? Explain with neat diagram. (16)
- (Or)**
- (b) Explain in detail about arrays and clusters in LabVIEW with examples. (16)

Reg. No. :

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K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637 215
(AUTONOMOUS)

Question Paper Code : B5132

B.E. / B.Tech. DEGREE END SEMESTER EXAMINATION, JUNE 2015

Fifth Semester

B.E. – ELECTRONICS AND COMMUNICATION ENGINEERING

12EC3503 – Electronic Instrumentation

(Regulations 2012)

Time : Three hours

Maximum Marks: 100

Answer ALL Questions

PART A — (10 x 2 = 20 Marks)

1. When does static characteristics play important role in instruments?
2. What is sensitivity of volt meter?
3. Define Hall effect sensor.
4. List the performance parameters of data acquisition card.
5. What is a function generator?
6. List out the types of frequency synthesizer.
7. State the limitations of analog storage oscilloscope.
8. Give the disadvantages of LCD.
9. What are the three update modes of waveform chart?
10. Mention the three methods of interfacing used in DAQ cards.

PART B — (5 x 16 = 80 Marks)

11. (a) Explain the operation of permanent magnet moving coil and moving iron instrument. (16)

(Or)

- (b) With neat sketch explain the operation of series type and shunt type ohm meter. (16)

12. (a) Describe the operation of capacitive transducer and LVDT with neat diagram. (16)

(Or)

- (b) Draw the structure of data acquisition system and explain the functions of each block in detail. (16)

13. (a) Describe the operation of RF signal generators and spectrum analyzer. (16)

(Or)

- (b) (i) With a neat sketch explain the working of digital voltmeter and list its types. (8)

- (ii) Explain the operation of vector impedance meter. (8)

14. (a) Discuss in detail the construction of a storage type oscilloscope. What are the accessories for a CRO? Explain. (16)

(Or)

- (b) Briefly discuss the function of electromechanical servo type XT and XY recorder. (16)

15. (a) Discuss the different functions of charts used in LabVIEW. (16)

(Or)

- (b) Explain in detail about the application of LabVIEW in traffic light control with necessary diagram. (16)

Reg. No. :

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K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637 215
(AUTONOMOUS)

Question Paper Code : 151105

B.E. / B.Tech. DEGREE END SEMESTER EXAMINATION, DEC 2015 / JAN 2016

Fifth Semester

B.E. – ELECTRONICS AND COMMUNICATION ENGINEERING

12EC3503 – Electronic Instrumentation

(Regulations 2012)

Time: Three hours

Maximum Marks: 100

Answer ALL Questions

PART A — (10 x 2 = 20 Marks)

1. Define error.
2. Why calibration of instrument is important?
3. Mention the uses of LVDT.
4. What are the techniques used for A/D conversion?
5. Define duty cycle.
6. List out the applications of vector meters.
7. Draw block diagram of dual trace oscilloscope.
8. Give the principle of operation of digital oscilloscope.
9. Draw VI diagram to create an array using for loop.
10. List out the different string operations in Lab VIEW.

PART B — (5 x 16 = 80 Marks)

11. (a) (i) Draw the block diagram of functional elements of measurement system and explain the function of each block. (8)
(ii) Explain the different types of errors in measurements. (8)

(Or)

- (b) With a neat sketch describe a bridge to determine the unknown inductance and a bridge to determine the unknown capacitance. (16)

12. (a) Describe the operation of Hall effect transducer and Photo optic sensor with neat diagram. (16)

(Or)

- (b) Explain the construction and working of single - pass and Two - pass differential refractometers. (16)

13. (a) Describe the construction and function of
(i) RF signal generator (8)
(ii) Sweep frequency generator (8)

(Or)

- (b) With a neat sketch explain the working of
(i) Frequency synthesizer (8)
(ii) Frequency counter (8)

14. (a) Discuss the construction and function of dual trace oscilloscope with necessary waveforms. (16)

(Or)

- (b) Briefly discuss the use of LED and LCD as display devices in instrumentation. Comment on their relative merits and demerits. (16)

15. (a) Explain the function of different structures used in Lab VIEW. (16)

(Or)

- (b) Explain how to interface a DAQ card using DAQ assistance in Lab VIEW with an example? (16)

Reg. No. :

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K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637 215
(AUTONOMOUS)

Question Paper Code : 152116

B. E. / B.Tech. DEGREE END SEMESTER EXAMINATION, JUNE 2016

Fifth Semester

B.E. – ELECTRONICS AND COMMUNICATION ENGINEERING

12EC3503 – Electronic Instrumentation

(Regulations 2012)

Time: Three hours

Maximum Marks: 100

Answer ALL Questions

PART A — (10 x 2 = 20 Marks)

1. Classify the different types of systemic errors.
2. List the advantages of Maxwell's Inductance - Capacitance bridge.
3. What are the effects present in capacitive transducers used for measurement of linear displacement?
4. Write the features of LVDT transducer.
5. Write a tangential component for refraction of electron beam in cathode ray tube.
6. Calculate the value of the self impedance when the following measurements are performed. $f_1 = 2\text{MHz}$ and $c_1 = 500\text{pf}$; $f_2 = 6\text{MHz}$ and $c_2 = 50\text{pf}$
7. Justify any two applications of X - Y recorders.
8. Recall important features of LCD's.
9. Construct flowchart for FOR loop.
10. List the steps to be followed converting an array to matrix.

PART B — (5 x 16 = 80 Marks)

11. (a) (i) Explain in detail about the working principle of Permanent Magnet Moving Coil (PMMC) instrument. (8)
- (ii) Explain briefly about Wein bridge. (8)

(Or)

- (b) (i) Describe in detail about shunt type ohmmeter with suitable equations. (8)
(ii) Design a Q factor for Hay's bridge with supporting equations. (8)
12. (a) (i) Explain the working principle of Hall effect transducer. (8)
(ii) Design a direct probe with supporting diagram for achieving high impedance. (8)
- (Or)**
- (b) (i) Illustrate the contribution of Data Acquisition System in electronic instrumentation. (8)
(ii) Explain the working principle of Gas Chromatography. (8)
13. (a) (i) Elaborate the construction and working principle of sweep generator. (8)
(ii) Summarize the general specifications of digital voltmeter. (8)
- (Or)**
- (b) (i) How the spectrum analyzer generates RF signal? Explain in detail. (6)
(ii) Draw a block diagram and discuss in detail about basic digital multimeter. (10)
14. (a) (i) Explain the working principle of dual trace oscilloscope. (10)
(ii) Recall advantages of using LED's in electronic displays. (6)
- (Or)**
- (b) (i) Predict any five precautions for operating oscilloscopes. (8)
(ii) Write advantages and disadvantages of FM recording. (8)
15. (a) (i) Propose one dimensional and two dimensional array using LabVIEW. (8)
(ii) Design a VI to compare clusters and switch ON an LED in the output cluster if the n^{th} element of cluster1 is greater than n^{th} element of cluster 2. (8)
- (Or)**
- (b) (i) Design two 2D numeric arrays and add them change the number of rows and number of columns of each array. (8)
(ii) Recall launching of DAQ assistant in virtual instrumentation using LabVIEW. (8)

Reg. No. :

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K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637 215
(AUTONOMOUS)

Question Paper Code : 162194

B. E. / B.Tech. DEGREE END SEMESTER EXAMINATION, JUNE 2017

Fifth Semester

B.E. - ELECTRONICS AND COMMUNICATION ENGINEERING

12EC3503 – Electronic Instrumentation

(Regulations 2012)

Time: Three hours

Maximum Marks: 100

Answer All Questions

PART A — (10 x 2 = 20 Marks)

1. What is measurement?
2. Differentiate Accuracy and Precision.
3. List out the four types of Passive transducers applications.
4. Write the principle of Hall effect transducer.
5. Mention any three applications of Wave Analyzers.
6. Define Q - meter.
7. How the current and voltage can be measured using CRO?
8. What is frequency modulation recording?
9. What are the main components of a Virtual Instrument?
10. Differentiate Virtual Instrument and Traditional Instrument.

PART B — (5 x 16 = 80 Marks)

11. (a) Explain the construction and working principle of PMMC instrument and derive the expression for deflection torque. (16)

(Or)

- (b) Which measurements can be carried out by Maxwell bridge? Derive the balance equation and expressions for the unknown components. (16)

12. (a) Explain the principle, construction and working of LVDT with neat diagrams. (16)

(Or)

- (b) What is data acquisition system? Give the block diagram arrangement of a data acquisition system and describe the function of each component. (16)

13. (a) Explain the Block Diagram, Working and Applications of Sweep Frequency Generator. Draw the linearizing circuit used in a Sweep Generator. (16)

(Or)

- (b) Explain briefly about Frequency Counter. What are the different types of Decade counters used in Frequency Counter? (16)

14. (a) Draw and explain the block diagram of digital storage oscilloscope and the modes of operation of digital storage oscilloscope. (16)

(Or)

- (b) (i) Explain the working principle of magnetic tape recorders. (8)
(ii) Compare and contrast the working, advantages and disadvantages of LED and LCD. (8)

15. (a) Briefly explain about the overview of LabVIEW and its advantages. (16)

(Or)

- (b) Discuss in detail about the Data acquisition with LabVIEW. (16)
