



Maratha Vidya Prasarak Samaj's

Rajarshi Shahu Maharaj Polytechnic, Nashik

Udoji Maratha Boarding Campus, Near Pumping Station, Gangapur Road, Nashik-13.

RSM POLY

Affiliated to MSBTE Mumbai, Approved by AICTE New Delhi, DTE Mumbai & Govt. of Maharashtra, Mumbai.

Subject: - Electronic Instruments & Measurements (22333)



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SYLLABUS

Chapter No.	Name of chapter	Marks With Option
1	Fundamental of Electronics Measurements	12
2	Analog & Digital Meters	10
3	Oscilloscope, Function Generator & Spectrum Analyzer	22
4	Sensors & Transducers	09
5	Application of Sensors & Transducers	25
6	Signal Conditioning & Data Acquisition System	15
Total Marks:-		93



BOARD THEORY PAPER PATTERN FOR ALL BRANCHES

Q.1		Attempt any FIVE	5*2=10
	a)	State need of signal conditioning system	
	b)	State objective of DAS	
	c)	Define Accuracy & Sensitivity	
	d)	Define Random error & Gross Error	
	e)	Define humidity & relative humidity	
	f)	Compare Analog & Digital meter	
	g)	Define speed of response & reproducibility	
Q.2		Attempt any THREE	3*4=12
	a)	Draw & explain AC signal conditioning System	
	b)	Compare Bellows & Bourdon tube	
	c)	Explain working principle of SAR DVM	
	d)	Draw & explain working principle of spectrum analyzer	
Q.3		Attempt any THREE	3*4=12
	a)	Explain with neat block diagram instrumentation system	
	b)	Draw neat clean diagram of CRO	
	c)	Define transducer & state selection criteria of transducer	
	d)	Explain working principle of electromagnetic flowmeter	
Q.4		Attempt any FOUR	3*4=12
	a)	State Seeback & Peltier effect	
	b)	Draw single & multichannel DAS. List its applications	



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	c)	List types of Hygrometer. Explain humidity measurement using Hygrometer
	d)	Draw neat & clean diagram of DSO & explain function of each block
	e)	A 1 mA meter movement with an internal resistance of 100 ohm is to be converted into 0-100mA. Calculate the value of Shunt resistance.
Q.5		Attempt any TWO 2*6=12
	a)	What is pt-100? Explain working principle of RTD with neat diagram
	b)	State how to connect ammeter & voltmeter in electrical circuit diagram justify it.
	c)	Explain with block diagram vertical deflection system & time base generator
Q.6		Attempt any TWO 2*6=12
	a)	i) Explain working of C type bourdon tube with neat diagram. ii) Explain Float type level measurement
	b)	i) Define Calibration state need of calibration ii) list explain different standard of measurements
	c)	i) Compare AC & DC signal conditioning system ii) Classify following transducers into active & passive a) Piezoelectric transducer b) LVDT c) Thermocouple d) thermistor



CLASS TEST - I

PAPER PATTERN

Syllabus:-

Unit No.	Name of the Unit	Course Outcome (CO)
1	Fundamental of Electronics Measurements	333.1
2	Analog & Digital Meters	333.2
3	Oscilloscope, Function Generator & Spectrum Analyzer	333.3

Q.1	Attempt any FOUR 4*2=8Marks	Course Outcome (CO)
a)	Define Accuracy & Resolution	333.1
b)	List Different types of errors	333.1
c)	Explain AC voltmeter with diagram	333.2
d)	Compare analog and digital instruments (any 4 points).	333.2
e)	State any 2 advantages and disadvantages of PMMC instrument	333.2
f)	Write any 2 materials used in CRT screen	333.3
Q.2	Attempt any THREE 3*4=12Marks	
a)	What is calibration? State the need of calibration.	333.1
b)	Describe working principle of PMMC instrument with neat diagram.	333.2
c)	Draw construction of CRT and explain function of control grid, accelerating anode, focusing anode	333.3
d)	Describe method of measurement of frequency and phase also draw Lissajous pattern for 1:2 and 1:1	333.3
e)	Explain operation of integrating type DVM with neat diagram	333.2



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f)	Calculate the value of R_{sh} for a 1mA meter movement with an internal resistance of 100 ohm is to be converted into 0-100mA.	333.2
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CLASS TEST - II

PAPER PATTERN

Syllabus:-

Unit No.	Name of the Unit	Course Outcome (CO)
3	Sensors & Transducers	333.4
4	Application of Sensors & Transducers	333.5
5	Signal Conditioning & Data Acquisition System	333.6

Q.1	Attempt any FOUR	4*2=8Marks	Course Outcome (CO)
a)	Define thermocouple		333.5
b)	Draw & explain piezoelectric transducer.		333.4
c)	Define Transducer & classify it with any 2 examples		333.4
d)	Draw neat & clean diagram of Rotameter.		333.5
e)	Draw Single channel DAS		333.6
Q.2	Attempt any THREE	3*4=12Marks	
a)	Draw & explain working principle of LVDT		333.4
b)	Draw & explain C type Bourdon tube.		333.5
c)	Explain working principle of Venture meter		333.5
d)	Draw & explain DC signal conditioning system		333.6



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COURSE OUTCOME (CO)

COURSE: - Electronic Instruments & Measurements (22533)

PROGRAMME: - EJ

CO.NO	Course Outcome
CO-333.1	Interpret the characteristics of measuring instruments
CO-333.2	Calibrate different electronic instruments
CO-333.3	Use relevant instrument to measure specified parameters
CO-333.4	Interpret the working of various types of sensors & transducers
CO-333.5	Use various sensors & transducers to measure quantities
CO-333.6	Maintain signal conditioning & Data acquisition system



1. Fundamental of Electronics Measurements

Position in Question Paper

Total Marks-08

Q.1.d) 2-Marks

Q.1.g) 2-Marks

Q.2. b) 4-Marks.

Q.6. b) 6-Marks

Descriptive Question

1. List Different types of errors
2. Define calibration
3. What is the need of calibration?
4. List different types of dynamic characteristics
5. Define Absolute & secondary instrument
6. List different types of static characteristics.
7. Define Accuracy, sensitivity, reproducibility
8. Define speed of response, dynamic error
9. List different types of standards
10. Explain international, primary & working standard

MCQ Question

(Total number of Question=Marks*3=8*3=24)

Note: Correct answer is marked with **bold**

1. A measuring system consists of
 - a) Sensors
 - b) Variable conversion elements
 - c) Signal processing elements
 - d) All of these**
2. An instrument in which the value of ethnical quantity to be measured can be determined from the deflection of the instrument when it has been pre-calibrated by comparison with an absolute instrument
 - a) Absolute instrument
 - b) Secondary instrument**
 - c) Recording instrument
 - d) Integrating instrument



3. ___ instruments indicate the instantaneous value of the electrical quantity being measured at the time at which it is being measured?
- a) Absolute
b) Indicating
c) Recording
d) Integrating
4. The use of ___ instruments is merely confined within laboratories as standardizing instruments.
- a) absolute
b) indicating
c) recording
d) integrating
5. ___ instruments measure the total quantity of electricity delivered at a particular time.
- a) absolute
b) indicating
d) integrating
c) recording
6. An ammeter is a ___ instrument.
- a) **secondary instrument**
b) absolute instrument
c) recording instrument
d) integrating instrument
7. In a measurement system,
- a) A single measurement components may have both random errors and systematic errors
b) A measurement system consists of several components with each component having separate errors
c) Both the statement (1) & (2) are true
d) Neither statement (1) nor statement (2) is true
8. The following term(s) is (are) associated with measuring devices
- a) Sensitivity
b) Damping
c) Both 'a' and 'b'
d) None of the above
9. A pointer of an instrument once deflected returns to zero position, when the current is removed due to
- a) Action of gravity
b) Mass of the pointer
c) Controlling Torque
d) Damping Torques
10. The desirable static characteristics of a measuring system are
- a) Accuracy and reproducibility
b) Accuracy, sensitivity and reproducibility
c) Drift and dead zone
d) Static error
11. ___ of the following is the dynamic characteristics of an instrument?
- a) Reproducibility
b) Sensitivity
c) Dead zone
d) Fidelity
12. The degree of closeness of the measured value of a certain quantity with its true value is known as
- a) **Accuracy**
b) Precision
c) Standard
d) Sensitivity
13. Error of measurement =
- a) **True value – Measured value**
b) Precision – True value
c) Measured value – Precision
d) None of the above



14. ___ of the following material will be preferred as a shunt for extending the range of measurement of a voltmeter
- a) Copper
 - b) Steel
 - c) Aluminum
 - d) Manganin
15. ___ are integrating instruments?
- a) Ammeters
 - b) Voltmeters
 - c) Wattmeters
 - d) **Ampere-hour**
16. To compare an unknown with a standard through a calibrated system is called
- a) Direct comparison
 - b) Indirect comparison
 - c) **both 'a' and 'b'**
 - d) None
17. Which of the following is caused by careless handling?
- a) Systematic error
 - b) **Gross error**
 - c) Random error
 - d) None of the mentioned
18. A system will be error free if we remove all systematic error.
- a) True
 - b) **False**
19. Which of the following is not a fundamental quantity?
- a) Length
 - b) **Angle**
 - c) Time
 - d) Luminous intensity
20. Which standard is fixed and used for industrial laboratories?
- a) International standard
 - b) Primary standard
 - c) **Secondary standard**
 - d) Working standard
21. Which of the following error is caused by poor calibration of the instrument?
- a) Random error
 - b) Gross error
 - c) **Systematic error**
 - d) Precision error
22. How systematic errors are eliminated?
- a) Frequent measurement
 - b) **Replacement of instrument**
 - c) Finding mean of reading
 - d) Finding variance of reading
23. Which of the following represents an SI unit of luminous intensity?
- a) Lumen
 - b) **Candela**
 - c) Dioptr
 - d) None of the mentioned
24. In a measuring system quantity under measurement is termed as _____
- a) **Measurand**
 - b) Controllers
 - c) Sensors
 - d) Indicators
25. In a measurement, what is the term used to specify the closeness of two or more measurements?
- a) **Precision**
 - b) Accuracy
 - c) Fidelity
 - d) Threshold
26. In a measuring system what is the term used to specify a difference between higher and lower calibration values?
- a) Range
 - b) **Span**
 - c) Drift
 - d) Threshold



2. Analog & Digital Meters

Position in Question Paper

Total Marks-14

Q.1. f) 2-Marks.

Q.2. c) 4-Marks.

Q.4. e) 4-Marks.

Q.5. b) 6-Marks.

Descriptive Question

1. Describe working principle of PMMC instrument with neat diagram.
2. State any 2 adv. dis-adv. & application of PMMC instrument.
3. Derive torque equation for PMMC instrument.
4. Compare analog & digital meter.
5. Explain operation of integrated type DVM
6. Explain operation of SAR type DVM
7. Derive expression for shunt resistance required in multi range ammeter
8. Draw circuit diagram of multi range current meter with ayrton shunt
9. State how to connect ammeter & voltmeter in electrical ckt. Give its justification.
10. numerical on shunt resistance and D'Arsonval meter.

MCQ Question

(Total number of Question=Marks*3=14*3=42)

Note: Correct answer is marked with **bold**

1. A pointer of an instrument once deflected returns to zero position, when the current is removed due to
 - a) Action of gravity
 - b) Mass of the pointer
 - c) Controlling Torque**
 - d) Damping Torques
2. An ammeter
 - a) Is inserted in series in a circuit and current to be measured flows through it
 - b) Is inserted in series in a circuit and part of the current to be measured flows through it
 - c) Is connected in parallel in a circuit and current to be measured flows through it**



- d) Is connected in parallel in a circuit and only part of the current to the measured flows through it.
3. Which of the following material will be preferred as a shunt for extending the range of measurement of a voltmeter
- a) Copper
b) Steel
c) Aluminum
d) Manganin
4. What should be the size of the slide wire of the potentiometer to make it to achieve high accuracy?
- a) **As long as possible**
b) As short as possible
c) 1 meter
d) Neither too thin nor too thick
5. Which of the following is not an integrating instrument?
- a) Ampere-hour meter
b) Watt-hour meter
c) **Voltmeter**
d) All of the above
6. The deflecting torque in an instrument may be produced
- a) Magnetically
b) Electrostatically
c) Thermally
d) Any of the above
7. To take care of change in frequency of the A.C current, while using a moving iron type instrument
- a) An induction coil is used
b) A condenser of suitable value is used in series with the swamp resistance
c) A condenser of suitable value is used in parallel with the swamp resistance
d) A balancing circuit is provided
8. The advantages of moving coil permanent magnet type instrument are
- a) Low power consumption
b) No hysteresis loss
c) Efficiency eddy current damping
d) All of the above
9. Which of the following types of instrument can be used for D.C only?
- a) Moving iron attraction type
b) Moving Iron repulsion type
c) **Permanent magnet type**
d) Hotwire type
10. Which type of wattmeter cannot be used for both A.C and D.C?
- a) Dynamometer type
b) Electrostatic type
c) Induction Type
d) None of the above
11. Which of the following types of instrument can't be used for D.C
- a) Moving iron-attraction type
b) Moving coil permanent magnets type
c) Hotwire type
d) Induction type
12. The error due to hysteresis in moving iron type instrument is minimized by using
- a) **Stainless steel**
b) High speed steel
c) Silver coating
d) Permalloy
13. If damping torque is not provided in an instrument
- a) An instrument will show full wave of quantity even under small values
b) The pointer will move only when full rated load is provided
c) The pointer will oscillate about its final deflected position and will never come to rest even under steady conditions



- d) The pointer will oscillate about its final deflected position for quite some time before coming to rest**
14. In moving iron type ammeter the coils has
- A large number of turns of thick wire
 - Large number of turne of thin wire
 - Few turns of thin wire
 - Few turns of thick wire**
15. In repulsion type instrument the force of repulsion is approximately proportional to
- Current
 - Square of current**
 - The inverse of the current
 - The inverse of the square of the current
16. Ohmmeter is
- A meter to record ohm
 - Used to measure resistance**
 - Combination of Ohm and Meter
 - An indicatng instrument
17. Which one of the following is the main cause of magnetic decay in PMMC type instrument?
- Variation in the resistance of the moving coil
 - Quality of spring
 - Aging of the spring
 - Aging of the magnets**
18. Which of the following cannot be described as the advantages of moving coil permanent magnets type instrument?
- They have uniform scale
 - They have low torque/weight ratio**
 - They have efficient eddy-current damping
 - They have no hysteresis loss
19. In series type ohmmeter, full-scale deflection current indicator is marked
- Zero**
 - Infinite
 - 100 ohm
 - 1 Megaohm
20. Which of the following meters will require the smallest shunt resistance?
- 0-10 mA
 - 0-100 mA
 - 0-1 mA
 - 0-10 A**
21. In shunt type ohmmeter, full-scale deflection current indicator is marked
- Zero
 - Infinite**
 - 100 m Ω
 - 100 M Ω
22. Least expensive instrument for dc measurements is
- Hot wire instrument
 - Dynamometer type moving coil instrument
 - Attraction type moving instrument**
 - Electrostatic type instrument.
23. What could be the maximum reading on 3 -1/2 digit voltmeter?
- 1000
 - 1111**



- c) 1900
d) 1999
24. The resolution of a digital ammeter with 4 digit display is
a) **1/10000**
b) 1/1000
c) 1/4
d) 1/40
25. ___ is the integrating instrument?
a) Voltmeter
b) Wattmeter
c) **Energy meter**
d) Power factor meter
26. If the instrument has a wide range, the instrument should have ___
a) Square law scale
b) Linear scale
c) Exponential scale
d) **Logarithmic scale**
27. ___ are integrating instruments?
a) Ammeters
b) Voltmeters
c) Wattmeters
d) **Ampere-hour and Watt-hour meters**
28. Resistances can be measured with the help of a ____
a) Wattmeter
b) voltmeter
c) ammeter
d) **ohmmeter and resistance bridge**
29. A moving-coil permanent-magnet instrument can be used as flux-meter by ____
a) using a low resistance shunt
b) using a high series resistance
c) **eliminating the control springs**
d) making control springs of large moment of inertia
30. A moving-coil permanent-magnet instrument can be used as ___ by using a low resistance shunt.
a) **ammeter**
b) voltmeter
c) flux-meter
d) ballistic galvanometer
31. A potentiometer may be used for ____
a) measurement of resistance
b) measurement of current
c) calibration of voltmeter
d) **all of the above**
32. ___ are not used on D.C. circuits.
a) Mercury motor meters
b) commutator motor meters
c) **induction meters**
d) none of the above
33. The pointer of an indicating instrument should be ____
a) **very light**
b) very heavy
c) either 1 or 2
d) neither 1 nor 2
34. A moving iron instrument can be used for ____
a) D.C. only
b) A.C. only
c) **both D.C. and A.C.**
d) none of the above
35. An ohmmeter is a ___ instrument.
a) moving iron
b) **moving coil**
c) dynamometer
d) none of the above
36. To measure a very high resistance, we should use ____



- a) Kelvin's double bridge
b) Wheat stone bridge
37. The indicating instruments with linear scale is _____
a) **PMMC**
b) Electrostatic instrument
c) Dynamometer instrument
d) Thermocouple instrument
38. Electrostatic instruments are generally used as _____
a) **Voltmeters**
b) Ammeters
c) Wattmeters
d) Watt-hour meters
39. Voltmeter is always connected in
a) parallel with load
b) in series
c) both in series and parallel
d) none
40. A/D converter is used for converting
a) **analog to digital converting**
b) digital to analog converting
c) digital to mixed signal mode converting
d) analog to mixed signal mode
41. Peak to peak voltage is given by
a) $V_{p-p} = \text{number of units} \times (1 \text{ division})$
b) $V_{p-p} = \text{number of units} \times \text{volts}$
c) $V_{p-p} = (\text{volts/division})$
d) **$V_{p-p} = \text{number of units} \times (\text{volts/division})$**
42. How is frequency related to time period?
a) square proportional
b) not related directly
c) proportional
d) **inversely proportional**



3 Oscilloscope, Function Generator & Spectrum Analyzer

Position in Question Paper

Total Marks-14

Q.2. d) 4-Marks.

Q.3. b) 4-Marks.

Q.4. d) 4-Marks.

Q.5. b) 6-Marks.

Q.6. c) 6-Marks

Descriptive Question

1. Draw construction of CRT. Explain function of focusing anode, accelerating anode, and Control grid.
2. Write any 2 material used in CRT screen
3. Draw & explain CRO
4. State any 4 applications of CRO
5. Describe methods of measurement of phase & frequency on CRO
6. Draw & explain block diagram of spectrum analyzer
7. Draw & explain block diagram of DSO
8. Draw & explain block diagram of function generator.
9. Compare dual trace & dual beam CRO
10. Explain function of vertical deflection system & time base generator

MCQ Question

(Total number of Question=Marks*3=14*3=42)

Note: Correct answer is marked with **bold**

1. CRO stands for _____

a) **Cathode Ray Oscilloscope**

b) Current Resistance Oscillator

c) Central Resistance Oscillator

d) Capacitance Resistance Oscilloscope

2. C.R.O gives _____

a) actual representation

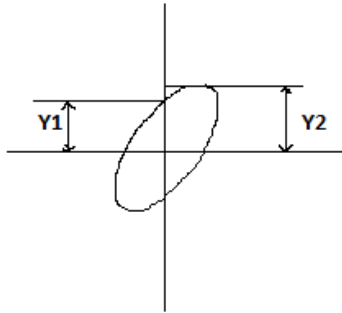
b) visual representation



- c) approximate representation
d) incorrect representation
3. Oscilloscope is _____
a) an ohmmeter
b) an ammeter
c) **a voltmeter**
d) a multimeter
4. Electron beam is deflected in _____
a) 1 direction
b) 4 directions
c) 3 directions
d) **2 directions**
5. CRO is a _____
a) **fast x-y plotter**
b) slow x-y plotter
c) medium x-y plotter
d) not a plotter
6. CRO can't display microseconds time.
a) True
b) **False**
7. CRT is the heart of CRO.
a) **True**
b) False
8. Typically oscilloscope represents _____
a) current and time
b) resistance and time
c) **voltage and time**
d) power and time
9. What is the main advantage of using a digital storage oscilloscope?
a) **uses digital storage**
b) uses analog storage
c) uses mixed mode storage
d) uses disc storage
10. The waveform is stored in _____
a) compressed form
b) analog form
c) **digital form**
d) mixed form
11. A digital storage oscilloscope has _____
a) **3 modes**
b) 2 modes
c) 4 modes
d) 5 modes
12. CRO gives the visual representation of time varying signals. The display of the signal is
a) One dimensional
b) **Two dimensional**
c) Three dimensional
d) Four dimensional
13. Principally CRO is a
a) Ammeter
b) **Voltmeter**
c) Wattmeter
d) Watt-hour meter
14. Which part is called as heart of CRO?
a) **CRT**
b) Sweep generator
c) Trigger circuit
d) Amplifier
15. The Lissajous patterns help in the measurement of
a) Phase difference between two sine wave
b) Frequency of one waveform if the frequency of other waveform is known
c) **Both (a) and (b)**
d) None of these
16. If the two input waveforms of equal amplitude and 90 degree phase difference is applied to the CRO then the Lissajous patterns obtained will be
a) Straight line tilted at 45 degree with respect to X-axis

- b) Circle
- c) Ellipse
- d) Vertical straight line

17.



The phase difference between two waveforms in the above figure is given by

- a) $\phi = \sin^{-1} Y1/Y2$
 - b) $\phi = \sin^{-1} Y2/Y1$
 - c) $\phi = \tan^{-1} Y2/Y1$
 - d) $\phi = \tan^{-1} Y1/Y2$
18. The cathode of a C.R.O. is usually coated with
- a) Alkali metals
 - b) Tungsten or thorium oxide
 - c) Copper oxide
 - d) Barium or strontium oxide**
19. The input impedance of C.R.O. is
- a) Zero
 - b) Around 100 ohms
 - c) Around 1000 ohms
 - d) Around one mega-ohms**
20. A C.R.O. can be used to measure
- a) A.C. voltages only
 - b) D.C. voltages only
 - c) Frequency
 - d) Any of the above**
21. The brightest spot, on a cathode ray screen, occurs at
- a) The centre**
 - b) The outer periphery
 - c) Midway between centre and outer periphery of screen
 - d) Brightness is same all over the screen
22. Phosphor coating for cathode ray tubes is provided on
- a) Inside surfaces only**
 - b) Outside surfaces only
 - c) Both the surfaces
 - d) Within the glass
23. To display heartbeats, waveforms and measuring voltages we use
- a) cystoscope
 - b) gastroscope
 - c) microscope
 - d) cathode-ray oscilloscope**
24. In an electron gun, to accelerate the electrons, the anode is connected to
- a) no potential
 - b) both negative and positive potentials
 - c) negative potential
 - d) positive potential**
25. The more negative potential in the electron gun, the more electrons will be
- a) repel**
 - b) attract
 - c) destroy
 - d) formed
26. By making use of a CRO _____



- a) many characteristics of a signal can be measured
b) only a few characteristics of a signal can be measured
c) no characteristics of a signal can be measured
d) signal can only be displayed
27. How is the waveform adjusted?
a) by adjusting the voltage
b) **through shift controls**
c) by reducing the current
d) by means of a galvanometer
28. Peak to peak voltage is given by _____
a) $V_{p-p} = \text{number of units} \times (1 \text{ division})$
b) $V_{p-p} = (\text{volts/division})$
c) $V_{p-p} = \text{number of units} \times \text{volts}$
d) **$V_{p-p} = \text{number of units} \times (\text{volts/division})$**
29. The amplitude of voltage is given by which of the following relation?
a) **$V_m = V_{p-p} / 2$**
b) $V_m = V_{p-p} / 4$
c) $V_m = 2 \times V_{p-p}$
d) $V_m = 4 \times V_{p-p}$
30. Which of the following instrument measures the amplitude and phase of the signal?
a) **Network analyzer**
b) Spectrum analyzer
c) Oscilloscope
d) Klystron
31. Which of the following is not present in the spectrum analyzer?
a) Swept local Oscillator
b) RF amplifier
c) Sweep voltage generator
d) **Slotted line**
32. In function generator, the output waveform of integrator is
a) Sinusoidal
b) Square
c) **Triangular**
d) Saw-tooth
33. The sweep generator of a CRO is used to produce
a) Sinusoidal voltage for the horizontal deflection of electron beam
b) Saw tooth voltage for the vertical deflection of electron beam
c) Sinusoidal voltage for the vertical deflection of electron beam
d) **Saw tooth voltage for the horizontal deflection of electron beam**
34. The light emitted by the zinc silicate coated fluorescent screen of cathode ray tube is usually of
a) **Green colour**
b) Yellow colour
c) Blue colour
d) White colour
35. If the bombardment of electrons ceases i.e. when the signal becomes zero then the light emitted by the screen will
a) Disappear immediately
b) **Persist for some time then it will disappear**
c) Will not disappear at all
d) None of these
36. In terms of the division on screen, the voltage of the waveform in CRO is
a) Average voltage
b) RMS voltage
c) **Peak to peak voltage**
d) Maximum voltage
37. By making use of a CRO _____



- a) **many characteristics of a signal can be measured**
b) only a few characteristics of a signal can be measured
c) no characteristics of a signal can be measured
d) signal can only be displayed
38. How is the waveform adjusted?
a) by adjusting the voltage
b) through shift controls
c) by reducing the current
d) by means of a galvanometer
39. How is error in measurement reduced?
a) using r.m.s value
b) using absolute value
c) using peak to peak value
d) using a voltmeter
40. Period of a waveform is obtained by which of the following relation?
a) $T = \text{number of divisions occupied by 1 cycle} \times (\text{time})$
b) $T = \text{number of divisions occupied by 1 cycle} \times (1/\text{division})$
c) $T = \text{number of divisions occupied by 1 cycle} \times (\text{time}/\text{division})$
d) $T = \text{number of divisions occupied by 1 cycle}$
41. The input impedance of C.R.O. is
a) Zero
b) Around 100 ohms
c) Around 1000 ohms
d) Around one mega-ohms
42. Phosphor coating for cathode ray tubes is provided on
a) Inside surfaces only
b) Outside surfaces only
c) Both the surfaces
d) Within the glass



4. Sensors & Transducers

Position in Question Paper

Total Marks-12

Q.1. a) 2-Marks.

Q.1. e) 2-Marks.

Q.3. b) 4-Marks.

Q.6 b) 4-Marks

Descriptive Question

1. Define transducer & classify it into electric, magnetic, thermal type?
2. Explain working principle of LVDT with neat circuit diagram?
3. Explain working principle of piezoelectric transducer?
4. Compare active & passive transducer?
5. Compare sensors & transducer?
6. Explain the block diagram of instrumentation system?
7. List out selection criteria of transducer?
8. Explain Hall Effect sensor & write its two applications?
9. Classify following transducer into active, passive & primary, secondary?
 - a. LVDT
 - b. Piezoelectric transducer
 - c. Thermocouple
 - d. Hygrometer
 - e. Thermocouple
 - f. Strain gauge
 - g. Bourdon tube
 - h. Diaphragm
10. Compare LVDT & RVDT

MCQ Question

(Total number of Question = Marks * 3 = 12 * 3 = 36)

Note: Correct answer is marked with **bold**

1. Advantage of LVDT
 - a) 0.05% linearity and finite resolution



- b) High output and high sensitivity
c) Rugged and less friction
d) Low hysteresis and low power consumption
2. Some substance generates the voltage when they are subjected to mechanical forces or stress along specific planes. Such substance is known as
a) Piezoelectric
b) Thermo-electric
c) Photo-electric
d) Radio-active
3. Which of the following instrument can be used for the measurement of a temperature above 1500°K?
a) Mercury thermometer
b) Gas Thermometer
c) Thermoelectric pyrometer
d) Any of the above
4. LVDT which is an instrument for the measurement of displacement, works on the principal of ____
a) Linear inductance
b) Non – linear inductance
c) Mutual inductance
d) Linear capacitance
5. If an instrument transformer is used to extend the ranges of AC instrument, then its reading will depend on ____
a) R
b) L
c) C
d) None of these
6. Self generating type transducers are _____ transducers.
a) Active
b) Passive
c) Secondary
d) Inverse
7. The transducers that converts the input signal into the output signal, which is a discrete function of time is known as _____ transducer.
a) Active
b) Analog
c) Digital
d) Pulse
8. A transducer that converts measurand into the form of pulse is called
a) Active transducer
b) Analog transducer
c) Digital transducer
d) Pulse transducer
9. Which of the following is a digital transducer?
a) Strain gauge
b) Encoder
c) Thermistor
d) LVDT
10. An inverse transducer is a device which converts
a) An electrical quantity into a non electrical quantity
b) Electrical quantity into mechanical quantity
c) Electrical energy into thermal energy
d) Electrical energy into light energy
11. Resolution of a transducer depends on
a) Material of wire
b) Length of wire
c) Diameter of wire
d) Excitation voltage
12. Quartz and Rochelle salt belongs to _____ of piezo-electric materials
a) Natural group
b) Synthetic group



- c) Natural or Synthetic group
d) Fiber group
13. Which of the following are piezo electric substances?
a) Barium titanate
b) Lead titanate
c) Lead Zirconate
d) Cadmium and sulphate
- Choose correct one
a) 1,2 and 4
b) 1,3and4
c) **1,2and 3**
d) 2,3and 4
14. Piezo-electric transducers are
a) Passive transducers
b) **Inverse transducers**
c) Digital transducers
d) Pulse transducers
15. Piezo – electric transducers work when we apply _____ to it.
a) **Mechanical force**
b) Vibrations
c) Illuminations
d) Heat
16. Piezo electric crystal can produce an emf
a) **When external mechanical force is applied to it**
b) When radiant energy stimulates the crystal
c) When external magnetic field is applied
d) When the junction of two such crystals are heated
17. LVDT windings are wound on
a) Steel sheets
b) Aluminium
c) **Ferrite**
d) Copper
18. The size of air cored transducers in comparison to the iron core parts is
a) Smaller
b) Larger
c) **Same**
d) Unpredictable
19. The principle of operation of LVDT is based on the variation of
a) Self inductance
b) **Mutual inductance**
c) Reluctance
d) Permanence
20. LVDT is an/a _____ transducer
a) Magneto-strict ion
b) **Inductive**
c) Resistive
d) Eddy current
21. Which of the following can be measured with the help of piezo electric crystal?
a) **Force**
b) Velocity
c) Sound
d) Pressure
22. S1: Transducer is a device which converts physical into electrical quantity
S2: Transducer is also called as sensor.
a) S1 is true & S2 is false
b) **S2 is true & S1 is false**
c) Both S1 & S2 are true
d) Both S1 & S2 are false
23. In a LVDT, the two secondary voltages
a) Are independent of the core position
b) **Vary unequally depending on the core position**
c) Vary equally depending on the core position
d) Are always in phase quadrature
24. Capacitive transducers are normally employed for _____ measurements



- a) Static
b) Dynamic
25. A radiation pyrometer is used for temperatures
a) Upto 100C
b) 250 - 500C
c) 100 - 250C
d) Above 500C
26. ___ of the following statements is/are true?
a) Pyrometer is a non-contact type of instrument
b) Stroboscope is a contact type of instrument
c) Micrometer is a non-contact type of instrument
d) All of the above
27. The application of LVDT is
a) Joint motion
b) Finger movement
c) **Limb movement**
d) Heart wall motion
28. The principle of operation of variable resistance transducer is
a) Deformation leads to change in resistance
b) Displacement of a contact slider on a resistance
c) Coupling of two coils changes with displacement
d) Movement of magnetic field produces variation in resistance of material
29. LVDT, the two secondary voltages
a) Are independent of the core position
b) Vary unequally depending on the core position
c) Vary equally de
d) Are always in phase quadrature
30. LVDT is an/a _____ transducer
a) Eddy current
b) Resistive
c) Magneto-strict ion
d) Inductive
31. Capacitance sensor can measure very small displacement. It can be formed by varying
a) Separation
b) Area
c) Permittivity
d) Either (a) or (b) or (c)
32. RVDT stands for
a) Rotary Variable Differential Transformer
b) Revolutionary Variable Differential Transformer
c) Range Variable Differential Transformer
d) None
33. A transducer must have _____
a) maximum loading
b) minimum loading
c) **zero loading**
d) infinite loading
34. Transducers must operate under _____
a) zero electromagnetic field
b) constant electromagnetic fields
c) **varying electromagnetic fields**
d) infinite electromagnetic field
35. How can a transducer be used in the environment with vibrations?
a) using shock absorbers
b) using proper grounding
c) using effective voltage
d) using a transformer



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36. How many passive transducers are there?
- a) 1
b) **3**
c) 5
d) 7
37. Rotational potentiometers use _____
- a) Capacitance
b) self inductance
c) mutual inductance
d) **resistance**
38. Errors can be minimized in some transducers through _____
- a) power compensation
b) voltage compensation
c) resistance compensation
d) **temperature compensation**



5. Application of Sensors & Transducers

Position in Question Paper

Total Marks-12

Q.2. b) 4-Marks.

Q.2. d) 4-Marks.

Q.3. c) 4-Marks.

Q.4. a) 4-Marks.

Q.5. a) 6-Marks

Q.6. a) 6-Marks

Descriptive Question

- 1 Explain electromagnetic flow meter with neat diagram?
- 2 .Define humidity absolute humidity &relative humidity?
3. Explain resistive hydrometer?
4. Explain flow measurement using venture meter &also its advantages &disadvantages?
5. Explain capacitive level measurement?
6. What is thermocouple of what see back effect list any two advantage &disadvantage application of thermocouple?
7. Draw difference shapes of thermocouple?
8. Explain working principle of RTD?
9. Explain working principle of Bourdon tube?
10. Draw &explain pressure measurement using bellows write is advantage &disadvantage?
11. Compare Bellows & Bourdon tube

MCQ Question

(Total number of Question=Marks*3=12*3=36)

Note: Correct answer is marked with **bold**

1. ___of the following represents Reynolds number for laminar flow?
 - a) **Less than 2000**
 - b) Greater than 4000
 - c) Infinite
 - d) None of the mentioned
2. The devices used for flow obstruction is/are



- a) Orifice plate
b) Venturi tube
3. ___ is the variable area type flow meter
a) venturi
b) orifice
4. Thermocouple transducer is a
a) temperature transducer
b) pressure transducer
5. Thermistors have
a) positive temperature coefficient
b) negative temperature coefficient
c) zero temperature coefficient
d) infinite temperature coefficient
6. Thermistors sense
a) large changes in temperature
b) cannot sense any change in temperature
c) sense small changes in temperature
d) have a positive temperature coefficient of resistance
7. ___ is humidity sensor?
a) Hygrometer
b) Gyroscope
8. Multichannel data acquisition system has
a) multiple channels
b) single channel
9. Humidity sensors are divided into how many types and depending on what?
a) 2 types depending on output
b) 2 types depending on measurement units
c) 3 types depending on measurement units
d) 3 types depending on output
10. Relative humidity is a function of .
a) Ambient temperature
b) Water vapor pressure
c) Ambient temperature and Water vapor pressure
d) Dryness
11. The point at which gases turn in to liquid is called its
a) peak point
b) dew point
c) converting point
d) equilibrium point
12. Tachometer is used to measure
a) speed
b) force
c) Pressure
d) none
13. Change in output of sensor with change in input is
a) Threshold
b) Slew rate
c) Sensitivity
d) None of the mentioned



14. The thermistor whose resistance increase by increasing temperature:
- a) NTC Thermistor
 - b) **PTC Thermistor**
 - c) None of these
 - d) Any of these
15. ___ of the following conversions take place in float element?
- a) Level to force
 - b) Level to voltage
 - c) **Level to displacement**
 - d) None of the mentioned
16. Diaphragm element is used for a level to pressure conversion.
- a) **True**
 - b) False
17. ___ will happen if the float becomes lighter?
- a) Density variations becomes more important
 - b) **Density variations becomes less important**
 - c) System becomes less efficient
 - d) None of the mentioned
18. ___ of the following quantities can be measured using bellows?
- a) Absolute pressure
 - b) Gauge pressure
 - c) Differential pressure
 - d) **All of the mentioned**
19. ___ of the following conversion take place in bourdon tubes?
- a) **Pressure to displacement**
 - b) Pressure to voltage
 - c) Pressure to strain
 - d) Pressure to force
20. ___ of the following devices convert pressure to displacement?
- a) Diaphragm
 - b) Bellow
 - c) Capsule
 - d) **Both diaphragm and capsule**
21. ___ of the following is a material employed making diaphragm to measure pressure?
- a) tourmaline
 - b) barium titanate
 - c) **phosphor bronze**
 - d) zirconate titanate
22. Strain gauge is used to measure
- a) temperature
 - b) **pressure**
 - c) height
 - d) displacement
23. Transducer is used to convert a _____
- a) **physical quantity into an electrical signal**
 - b) electrical signal into a physical quantity
 - c) physical quantity into a mechanical quantity
 - d) physical quantity into a chemical quantity
24. Transducer produces a _____
- a) proportional current
 - b) **proportional voltage**
 - c) proportional resistance
 - d) proportional power
25. Dipsticks are used for the
- a) Pressure measurement
 - b) Flow measurement
 - c) Displacement measurement
 - d) Level measurement
26. The most common application of float system is
- a) To monitor the fuel tank level in motor vehicle
 - b) To monitor the flow of solid
 - c) To monitor the flow of liquid



- d) All of these**
27. Capacitive devices are used for the level measurement of
- a) Only liquid
 - b) Solid in powdered form
 - c) **Both (a) and (b)**
 - d) None of these
28. In ultrasonic level gauge, the ultrasonic source is placed at the
- a) **Bottom of the vessel containing the liquid**
 - b) Top of the vessel containing the liquid
 - c) Middle of the vessel containing the liquid
 - d) Far from the vessel containing the liquid
29. If the ambient temperature is doubled and pressure fluctuates, then the transmission time of radar through air is
- a) **Almost unaffected and remains same**
 - b) Increases
 - c) Decreases
 - d) None of these
30. In radiation methods, the detector system is located at
- a) The top of the liquid filled tank
 - b) The bottom of liquid filled tank
 - c) Middle of the liquid filled tank
 - d) **Outside a liquid filled tank**
31. A vibrating level sensors consists of
- a) One piezoelectric oscillators
 - b) **Two piezoelectric oscillators**
 - c) Three piezoelectric oscillators
 - d) Four piezoelectric oscillators
32. Contact devices used for the measurement of level are
- a) **Less reliable then devices which does not make contact with the material**
 - b) More reliable then devices which does not make contact with the material
 - c) Less reliable then devices which makes contact with the material
 - d) More reliable then devices which makes contact with the material
33. Instrument which is capable of discriminating temperature differences of even 0.1 degree Celsius is
- a) Fibre-optic level sensors
 - b) Laser method
 - c) **Thermography**
 - d) Vibrating level sensors
34. In fibre-optic level sensors, the amount of light loss depends on
- a) **The proportion of cable that is submerged in the liquid**
 - b) Amount of light which is reflected back
 - c) The proportion of cable that is not in the liquid
 - d) Amount of light which is not reflected back
35. Which of the following conversions take place in float element?
- a) Level to force
 - b) Level to voltage
 - c) **Level to displacement**
 - d) None of the mentioned
36. In _____ system, float whose weight greater than liquid to be displaced is used.
- a) **Inverse float system**
 - b) Displacer system
 - c) Magnifying float system
 - d) None of the mentioned



6. Signal Conditioning & Data Acquisition System

Position in Question Paper

Total Marks-10

Q.1. a) 2-Marks.

Q.2. b) 4-Marks.

Q.3. a) 4-Marks.

Q.4. b) 4-Marks.

Q.6. c) 3-Marks

Descriptive Question

1. Explain need of signal condition & list types of signal conducting?
2. Explain DC signal conditioning system with neat diagram?
3. Explain AC signal conditioner with diagram?
4. Draw signal channel & multichannel data AC acquisition system & applications list?
5. State any four objectives for data acquisition system?
6. Explain DAS with neat diagram & list its applications
7. Differentiate between AC & DC signal conditioning system

MCQ Question

(Total number of Question=Marks*3=10*3=30)

Note: Correct answer is marked with **bold**

1. Transducer is used to convert a _____
 - a) **physical quantity into an electrical signal**
 - b) electrical signal into a physical quantity
 - c) physical quantity into a mechanical quantity
 - d) physical quantity into a chemical quantity
2. Transducer produces a _____
 - a) proportional current
 - b) **proportional voltage**
 - c) proportional resistance
 - d) proportional power
3. Signal conditioner is used for _____
 - a) **attenuating the voltage**
 - b) maintaining a constant voltage
 - c) keeping the voltage zero
 - d) boosting the voltage
4. A multiplexer is used for _____



- a) **accepting multiple inputs**
b) accepting single input
5. Output signal is captured using _____
a) CRO
b) Plotter
c) **Recorder**
d) voltmeter
6. Digital acquisition systems are used when _____
a) bandwidth is high
b) bandwidth is medium
c) bandwidth is zero
d) **bandwidth is low**
7. For lower accuracies _____
a) digital acquisition system is used
b) both digital and analog acquisition systems are used
c) **analog acquisition system is used**
d) mechanical data acquisition system is used
8. Data acquisition systems are not widely used.
a) **True**
b) False
9. What is a digital recorder?
a) **records digital data**
b) records analog data
c) does not record data
d) records both analog and digital data
10. Which frequency is attenuated in a Low-Pass filter?
a) **High frequency**
b) Low frequency
c) Mid-Range frequency
d) No frequency
11. Which filter contains entirely passive elements?
a) **Electrical filter**
b) Mechanical filter
c) Digital filter
d) Optical filter
12. Which signal is obtained after integrating the unit step signal?
a) Square signal
b) Unit Step Signal
c) Ramp Signal
d) **Parabolic Signal**
13. Which signal is obtained after differentiating the ramp signal?
a) Square signal
b) **Unit Step Signal**
c) Ramp Signal
d) Parabolic Signal
14. Which signal is obtained after differentiating the unit step signal?
a) **Unit Impulse signal**
b) Unit Step Signal
c) Ramp Signal
d) Parabolic Signal
15. In closed container type level measuring system, pressure at top of container is due to _____
a) **Vacuum pressure**
b) Vapor pressure
c) Liquid pressure
d) Atmospheric pressure
16. In fibre - optic level sensors, the amount of light loss depends on
a) The proportion of cable that is submerged in the liquid
b) Amount of light which is reflected back
c) The proportion of cable that is not in the liquid
d) Amount of light which is not reflected back
17. A vibrating level sensors consist of



- a) One piezoelectric oscillators
b) Two piezoelectric oscillators
c) Three piezoelectric oscillators
d) Four piezoelectric oscillators
18. In radiation methods, the detector system is located
a) At the top of the liquid filled tank
b) At the bottom of liquid filled tank
c) In middle of the liquid filled tank
d) Outside a liquid filled tank
19. In ultrasonic level gauge, the ultrasonic source is placed at the
a) Bottom of the vessel containing the liquid
b) Top of the vessel containing the liquid
c) Middle of the vessel containing the liquid
d) Far from the vessel containing the liquid
20. For a material capacitance increases with _____
a) Decrease in area of plates, all other factors constant
b) Increase in distance between plates, all other factors constant
c) Decrease in distance between plates, all other factors constant
d) None of the mentioned
21. Which of the following is correct for moisture transducers?
a) Dielectric constant of pure water greater than other materials
b) Dielectric constant of pure water much less than other materials
c) Dielectric constant of pure water and of other materials are equal
d) None of the mentioned
22. Which of the following device is used for measuring relative humidity?
a) Capacitive pressure transducer
b) Hygrometer
c) Capacitive strain transducer
d) Capacitive moisture transducer
23. Which of the following quantities cannot be measured by capacitive transducers?
a) Displacement
b) Speed
c) Moisture
d) None of the mentioned
24. Which of the following have high relative permittivity?
a) Bakelite
b) Marble
c) Paraffin
d) All of the mentioned
25. Capacitive microphone is an application of _____
a) Capacitive displacement transducer
b) Capacitive moisture transducer
c) Hygrometer
d) None of the mentioned
26. Thermometers are not possible using a capacitive transducer.
a) True
b) False
27. Which sensor is LM35?
a) Pressure sensor
b) Humidity sensor
c) **Temperature sensor**
d) Touch sensor
28. A _____ is thermally sensitive resistor that exhibits a large change in resistance.

