

1 Which of the following is NOT the characteristic of a musical note?

- (a) Polarization (b) Timbre (c) Loudness (d) Quality

2 The equation of a plane, progressive wave is given as:  $y = 3.5 \sin(6t + 1.5\pi x)$ .

The frequency of the wave in term of  $\pi$  is ~~0.9843~~  $\frac{3}{\pi}$  Hz

3. Which of the following waves polarizes

- (a) Waves in spring (b) Sound waves (c) Water wave  
(d) light waves.

\* [4] A concave shaving mirror has a radius of curvature of 35.0 cm. It is positioned so that the (upright) image of a man's face is 2.50 times the size of the face. How far is the mirror from the face?

- (a) 10.5 cm (b) 11.0 cm (c) 12.0 cm (d) 13.0 cm.

\* [5] The condition at which concave mirror produces virtual image is when the mirror is close

\* [6] Suppose the lens of a biconcave lens has  $n = 1.52$  and the absolute values of the radii of curvature of its lens surface are both equal to 10 cm. What is the focal length of this lens? -9.6 cm

16. Add  $825 \pm 1\%$  to  $625 \pm 2\%$   
 a)  $1,450 \pm 3\%$ , ☒ b)  $1,450 \pm 20.75$ , c)  $1,450 \pm 14.50$ , d)  $1,450 \pm 1.43\%$ , e)  $1,450 \pm 1\%$
17. Subtract  $625 \pm 16.5$  from  $825 \pm 16.5$   
 a)  $200 \pm 3\%$ , b)  $200 \pm 10.25$ , c)  $200 \pm 1\%$ , d)  $200 \pm 5.125\%$ , e) b & d
18. In a moving iron instrument, the scale could be if spring is used as the control element.  
 a) Linear b) Quadratic c) Linear/Quadratic d) Trigonometric/Linear  
 e) Quadratic/Trigonometric
19. In a moving iron instrument (attraction type), how many possible type of scale can it be designed and why?  
 a) 1, because all meters traditionally have one scale.  
 b) 3, because there are three different ways of producing the control torque for the instrument.  
 c) 2, because there are two different ways of producing the deflection torque for the instrument.  
 d) 3, because there are three different ways of producing the deflection torque for the instrument.  
 e) 2, because there are two different ways of producing the control torque for the instrument.
20. Name types of instrument that are suitable for alternating current measurements  
 a) Electromagnet Moving Coil b) Moving Iron ☒ c) All of the above  
 d) Permanent Magnet Moving Coil e) None of the above
21. The common methods/ways of eliminating instrument (Systematic) errors is  
 a) By selecting a suitable instrument for the particular measurement application, By applying correction factor after determining the amount of instrument error and by appropriate adjustment  
☒ b) By selecting a suitable instrument for the particular measurement application, By applying correction factor after determining the amount of instrument error and by calibrating the instrument against standard instrument  
 c) By changing the aging part of the instrument, By applying correction factor after determining the amount of instrument error and by calibrating the instrument against a non-standard instrument  
 d) All of the above e) None of the above
22. The common methods/ways of eliminating environmental (Systematic) errors is  
 a) By air-conditioning to maintain controlled temperature, pressure and humidity, By hermetically sealing certain components in the instrument and by the use of magnetic shields  
 b) By using specially manufactured components with specific characteristics to build the instrument, By using the instruments in controlled environment and by provision of appropriate shields to prevent unwanted signals in the environment  
 c) By air-conditioning to maintain controlled temperature, pressure and humidity, By using the instruments in controlled environment and by provision of appropriate shields to prevent unwanted signals in the environment  
 d) By using specially manufactured components with specific characteristics to build the instrument, By hermetically sealing certain components in the instrument and by provision of appropriate shields to prevent unwanted signals in the environment  
☒ e) All of the above
23. The common methods/ways of eliminating random errors is  
 a) By hermetically sealing certain components in the instrument  
 b) By using specially manufactured components with specific characteristics to build the instrument and by provision of appropriate shields to prevent unwanted signals in the environment  
 c) By air-conditioning to maintain controlled temperature, pressure and humidity  
 d) By increasing the number of measurements and using statistical methods to obtain the best approximation of the true value of the quantity under measurement

- e) All of the above
24. To specify and/or calculate measured quantities, the quantities must be defined both in kind and magnitude. Therefore, all measurements are expressed in specific kind (units) otherwise it would be difficult to differentiate one measurement from another particularly if the measurements have the same magnitude. Example, 2 meter is different from 2s simply because of their units (meter and s respectively). These units could be fundamental or derived. Identify which of the following groups is completely formed from derived units.  
 a) Length, velocity, mass, b) Time, Current, Temperature, c) Force, Pressure, Velocity d) Area, Acceleration, Length, e) Velocity, Volume, Mass,
25. Name four standards of measurement that are available world over and their levels of accuracy  
 a) International Standard ( $5:10^5$ ), National Standard ( $1:10^6$ ), Local Standard ( $1:10^8$ ), Factory Standard ( $1:10^{15}$ )  
 b) International Standard ( $1:10^{15}$ ), Basic Standard ( $1:10^6$ ), Secondary Standard ( $1:10^8$ ), Factory Standard ( $5:10^6$ )  
 c) International Standard ( $1:10^8$ ), National Standard ( $1:10^{12}$ ), Reference Standard ( $1:10^6$ ), Working Standard ( $5:10^6$ )  
 d) International Standard ( $1:10^{15}$ ), Primary Standard ( $1:10^8$ ), Secondary Standard ( $1:10^6$ ), Working Standard ( $5:10^6$ )  
 e) All of the above
26. Standard of measurement is kept somewhere in Britain. This place is called  
 a) National Chemical Laboratory, in Paddington b) National Physical Laboratory in Paddington c) National Biological Laboratory, Paddington d) National Bureau of Standards, Paddington e) National Bureau of Weights and Measures, Paddington
27. Standard of measurement is kept somewhere in the United States of America. This place is called  
 a) National Chemical Laboratory, Washington b) National Bureau of Standards, Washington c) National Biological Laboratory, Washington d) National Physical Laboratory, Washington e) National Bureau of Weights and Measures, Washington
28. Standard of measurement is kept somewhere in Germany. This place is called  
 a) Physikalisch Technische Reichsanstalt b) Chemikalisch Technische Reichsanstalt c) National Bureau of Standards d) Physikalisch Technische Reichsanstalt e) Bureau International des Poids
29. Permanent Magnet Moving Coil (PMMC) assembly is basically a current measuring device because  
 a) The magnet produces current.  
 b) The torque required to move the pointer is produced by the effect of the combination of magnetic flux produced by the permanent magnet and the current in the moving coil  
 c) The applied voltage driving the current through the moving coil is very small compared with the current flow, hence current overrides the applied voltage  
 d) The moving coil resistance is low, hence current is high for a given voltage.  
 e) The moving coil carries the current to be measured.
30. PMMC can only measure small current (milliampere range) because  
 a) The moving coil is made of very thin wire in order to reduce the weight of the assembly for effective torque required to produce appreciable movement of the pointer  
 b) The coil is made of a light material like Aluminum in order to reduce the weight of the assembly for effective torque required to produce appreciable movement of the pointer  
 c) The total length of moving coil is required to be large in order to produce adequate torque required to move the pointer. This has the tendency of increasing the total resistance of the coil, thereby limiting the current flow  
 d) The assembly is miniature in size for effective use, hence it can only carry small current  
 e) None of the above
31. What produces the counter torque to balance the pointer movement in PMMC



- a) One requires specially manufactured design components while the other can use commercially available components, thereby making the former less expensive than the latter. In addition, the maintenance of the latter is less expensive than the former
- b) One requires specially manufactured design components while the other can use commercially available components, thereby making the former more expensive than the latter. In addition, the maintenance of the latter is more expensive than the former
- c) One requires specially manufactured design components while the other can use commercially available components, thereby making the former more expensive than the latter. In addition, the maintenance of the latter is less expensive than the former
- d) One is readily available in the market and rugged.
- e) One is more accurate, precise and sensitive to produce adequate resolutions for different applications
48. What is meant by 'Loading Effect' of a circuit?
- a) When a circuit demands more energy in order to maintain the same status-quo or when a circuit is connected to an additional network
- b) Loading effect of a circuit means connecting instruments to the circuit for the purpose of measurement
- c) When a circuit is connected to an additional network with a very low impedance compared with the impedance of the circuit, the state of the circuit will not change considerably. When this happens, the additional network is said to have no 'Loading Effect' on the circuit
- d) c & b
- e) When a circuit is connected to an additional network with an impedance comparable with the impedance of the circuit, the state of the circuit will surely change. When this happens, the additional network that caused this effect is said to have a 'Loading Effect' on the circuit
49. Name two methods that are employed to adapt PMMC assembly to measure alternating quantities.
- a) Rectification and Approximations
- b) Rectification and Heating Effect
- c) Rectification and Linearization
- d) Heating Effect and Approximations
- e) Heating effect and Approximations
50. An experimental alternating current voltmeter uses a full-wave bridge rectification circuit where the PMMC assembly has an internal resistance of 50 ohms and requires a direct current of 1mA for full-scale deflection. Assuming ideal diodes, calculate the value of the multiplier resistor required to obtain full-scale deflection with an alternating voltage of  $10V_{rms}$  applied to the input terminals of the rectifier.
- a) 9 kilo-ohms
- b) 9.05 kilo-ohms
- c) 8.95 kilo-ohms
- d) 9 ohms
- e) 8.95 ohms
51. Name two major disadvantages of using a rectifier network as an interface between alternating quantities to be measured and direct current/voltage meter
- a) Losses due to ripple effect and diode capacitance effect
- b) Magnetic losses in the step-down transformers and losses due to lighting effect in the transformer's coils
- c) Environmental effect such as temperature increases the error since the diode performance is temperature dependent. Similarly, frequency of quantity being measured will also affect the accuracy of the meter due to diode resistance that is susceptible to frequency
- d) The meter is more bulky and occupies more space due to additional components
- e) All of the above
52. Electro-dynamometer, EDM uses the principle of ..... to be able to measure alternating quantities
- a) Rectification
- b) Heating Effect
- c) Linearization
- d) Approximations
- e) None
53. Name two disadvantages of electro-dynamometer over PMMC
- a) EDM has a higher power consumption than PMMC, EDM produces a higher torque than PMMC
- b) EDM has a quadratic scale of measurement, EDM produces a higher torque than PMMC
- c) EDM is more sensitive to frequency than PMMC, EDM produces a higher torque than PMMC

- d) EDM has a higher power consumption than PMMC, EDM produces a weaker magnetic flux than PMMC
- e) EDM is lighter than PMMC since soft iron is not incorporated into its design, EDM has a higher power consumption than PMMC

54. Name two types of principle used to construct Moving-Iron Instrument
- a) Force of attraction between two magnets and Force of attraction between two charged bodies
  - b) Force of repulsion between two magnets and Force of attraction between two charged bodies
  - c) Force of attraction between two magnets and Force of attraction between a magnet and a charged body
  - d) Force of attraction between two magnets and Force of repulsion between two magnets
  - e) Force of attraction between two magnets and Force of repulsion between two charged bodies
55. In an Electrical Bridge Instrument, if the arm elements are placed at random, which of the following possibilities that may be encountered in the course of measurement irrespective of which configuration is employed is considered most disadvantageous?
- a) Difficulty in achieving a null condition.
  - b) The characteristic equation resulting in negative values of the measurement even if the instrument is easy to balance.
  - c) Measured values can be dependent on supply source parameters
  - d) Galvanometer may be burnt, thereby making measurement impossible.
  - e) b & d.
56. Name the control mechanism of an Electrical Bridge Instrument?
- a) The arms of the Bridge.
  - b) The galvanometer of the Bridge.
  - c) The power supply of the Bridge.
  - d) The current flow into the Bridge.
  - e) a & b.
57. What will be the reading on an Electrical Bridge Instrument that indicates the appropriate time to read-off the value of what is being measured if EDMC is used instead of a galvanometer?
- a) Full Scale Deflection.
  - b) Zero Scale Deflection.
  - c) Middle Scale Deflection.
  - d) Any convenient position on the Instrument indicator.
  - e) None of the above.
58. What is the characteristic equation of an Electrical Bridge Instrument?
- a)  $Z_1 Z_3 = Z_2 Z_4$ .
  - b)  $Z_1 Z_2 = Z_3 Z_4$ .
  - c) The product of the opposing arms must be equal.
  - d) The product of the adjacent arms must be equal.
  - e) a & c.
59. By extension, name other electrical parameters that an Electrical Bridge Instrument can measure.
- a) Frequency.
  - b) Temperature, Phase Angle.
  - c) Time, Impurities of Inductors/Capacitors, Voltage.
  - d) a & c
  - e) a & b.
60. What determines the accuracy of the measurements of an Electrical Bridge that is adequately designed?
- a) Accuracy of the detector.
  - b) Accuracy of the arms elements.
  - c) Accuracy of the source supply.
  - d) All of the above.
  - e) None of the above.

- d) An appropriate resistor is connected in parallel to the PMMC to carry the excess current e) An appropriate resistor is connected in parallel to the PMMC to carry the excess voltage
39. What is the sensitivity of a voltmeter  
 a) It is the sensitivity per unit full scale deflection of the voltmeter b) It is the ratio of the total input resistance of the meter to the full scale deflection of the meter c) It is the ratio of change of output to change of input of the meter and it is dimensionless d) a & b e) b & c
40. A 1mA meter movement with an internal resistance of 100 ohms is to be converted into a 0-100mA ammeter. What is the design parameter needed to achieve this?  
 a) 0.99 ohms, b) 1.0 ohm, c) 99mA, d) 101mA, e) 1.01 ohms,
41. A 1mA meter movement with an internal resistance of 100 ohms is to be converted into a two-range meter of 0-10mA and 0-50mA. What are the design parameters needed to achieve this if parallel resistors are used?  
 a) 1.11 ohms, 9mA b) 49mA, 2.0 ohms c) 11.11 ohms, 2.04 ohms d) 101mA, 2.04 ohms e) 2.04 ohms, 9mA
42. A 1mA meter movement with an internal resistance of 100 ohms is to be converted into a two-range meter of 0-10mA and 0-50mA. What are the design parameters needed to achieve this if series resistors are used?  
 a) 9.07 ohms, 9mA b) 9.07 ohms, 2.04 ohms c) 11.11 ohms, 2.04 ohms d) 101mA, 2.04 ohms e) 2.04 ohms, 9mA
43. A 1mA meter movement with an internal resistance of 100 ohms is to be converted into a 0-100V voltmeter. What is the design parameter needed to achieve this?  
 a) 99.9 k $\Omega$ , b) 1mA, c) 100 k $\Omega$ , d) 101mA, e) None of the above
44. In a multi-range ammeter, there are two types of design. Name these designs  
 a) Combination of Resistors in **Parallel** is in **Series** with the meter: Parallel/Series and Combination of **Series** resistors is in **Series** with the meter: Series/Series  
 b) Combination of Resistors in **Series** is in **Parallel** with the meter: Series/Parallel and Combination of **Parallel** resistors is in **Parallel** with the meter: Parallel/Parallel  
 c) Parallel/Parallel and Series/Series d) Series/Series and Parallel/Parallel e) Series/Series and Parallel/Series
45. In a multi-range voltmeter, there are two types of design. Name these designs  
 a) Combination of Resistors in **Series** is in **Series** with the meter: Series/Series and Combination of **Parallel** resistors is in **Parallel** with the meter: Parallel/Parallel  
 b) Combination of Resistors in **Parallel** is in **Series** with the meter: Parallel/Series and Combination of **Series** resistors is in **Series** with the meter: Series/Series  
 c) Parallel/Parallel and Series/Series d) Parallel/Series and Series/Series e) Series/Parallel and Parallel/Parallel
46. In a multi-range ammeter, there are two types of design. One of these designs requires modifications in order that the PMMC assembly may not be subjected to over current and experience burn-out. Name the most economical modifications to be made in design  
 a) The rotary switch must have a fast switching response  
 b) The input lead of the meter must carry a separate 'on-off' switch with appropriate instructions on how to use this switch in connection with the rotary switch.  
 c) The rotary switch must carry 'make-before-break contact'  
 d) a & c e) b & c
47. In a multi-range voltmeter, there are two types of design. Name the advantages of one design over the other



- a) Counter movement      b) Damping Mechanism      c) Pointer's weight      d) Bearing on which the moving coil assembly is suspended      e) Control spring
32. The air gap between the magnet pole shoes and moving coil assembly of PMMC must be as small as possible, just enough to allow movement of the coil assembly. Why?
- a) To damp pointer's movement      b) To reduce the reluctance of the channel through which magnetic flux passes and to aid the production of uniform and undistorted flux.      c) To prevent magnetic flux from passing through stray paths      d) To minimize the non-uniformity of the magnetic flux      e) b & d
33. The moving coil of PMMC is wound round a format. Of what material must the format be made?
- a) It must be made of a cylindrical form.  
 b) It must be made of a material with magnetic property such as soft iron so that the magnetic flux might have low reactance path, thereby increasing the torque required to produce adequate pointer movement  
 c) It must be made of heavy material like Lead so that the moment of inertia of the assembly will be high, thereby counterbalancing the torque produced by measured current  
 d) It must be made of high resistant material so that it will limit the current flowing in the moving coil to stay within its limit without the meter experiencing burn-out  
 e) It must be made of light material, like Aluminum so that the moment of inertia of the assembly will be less, thereby requiring less torque to produce pointer movement
34. What is the function of the bearing on which the moving coil assembly is suspended?
- a) To hold the assembly in position & make frictionless motion possible      b) To support the weight of the assembly while in motion      c) To counter the torque produced by the measuring current      d) To reduce the friction to the assembly & make motion possible      e) To act as center of equilibrium to balance the assembly
35. If PMMC is to be used to measure bigger current, what modification is required in order not to damage the PMMC?
- a) The PMMC is redesigned to have different parameters that will accommodate the required magnitude of the measured variable/current      b) An appropriate resistor is connected in series to the PMMC to carry the excess current      c) An appropriate resistor is connected in parallel to the PMMC to carry the excess current      d) A step down transformer is used to reduce the current to the full scale deflection of PMMC      e) All of the above
36. PMMC device can only measure direct current quantities except some other modifications are made to measure alternating current. Why?
- a) PMMC assembly has a moment of inertia that cannot follow the rate of change that is peculiar to alternating quantities      b) The developed torque in PMMC is a function of current.      c) PMMC produces uniform magnetic flux from the permanent magnet at right angle to that produced from the current flowing through the moving coil by design. Any change of this angle will reduce the required torque, thereby restricting the pointer's movement      d) All of the above      e) None of the above
37. PMMC device can only measure direct current quantities except some other modifications are made. What modifications are required for the PMMC in order to make it adaptable to measure alternating current?
- a) The PMMC is preceded by another electronic device      b) The alternating current is rectified before it is allowed to flow into the moving coil of the PMMC      c) The heating effect of the alternating current is measured by PMMC      d) All of the above      e) None of the above
38. If PMMC is to be used to measure voltage, what modification is required since PMMC can only measure small current?
- a) The PMMC is redesigned to have different parameters that will accommodate the required magnitude and unit of the measured variable/current      b) An appropriate resistor is connected in series to the PMMC to carry the excess voltage      c) An appropriate resistor is connected in series to the PMMC to carry the excess current