



PRACTICE QUESTIONS

for SSC-JE : CBT-2

Measurement and Measuring Instrument

Electrical Engineering



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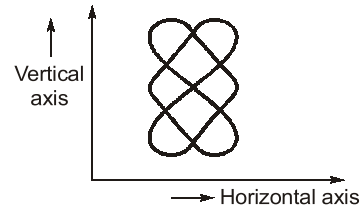
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Measurement and Measuring Instrument

1. The total current $I = I_1 + I_2$ in a circuit is measured as $I_1 = 150 \pm 1$ A, $I_2 = 250 \pm 2$ A, where the limits of error are given as standard deviations. I is measured as
 - (a) (400 ± 3) A
 - (b) (400 ± 2.24) A
 - (c) $(400 \pm 1/5)$ A
 - (d) (400 ± 1) A
2. Torque/Weight ratio of an instrument indicates
 - (a) Selectivity
 - (b) Accuracy
 - (c) Fidelity
 - (d) Sensitivity
3. The difference between the indicated value and the true value of a quantity is
 - (a) Gross error
 - (b) Absolute error
 - (c) Dynamic error
 - (d) Relative error
4. A current $i = 5 + 14.14 \sin(314t + 45^\circ)$ is passed through a centre-zero PMMC, hot-wire, and moving iron instrument, the respective readings are
 - (a) $-5, 15$ and $\sqrt{125}$
 - (b) $5, \sqrt{125}$ and $\sqrt{125}$
 - (c) $-5, \sqrt{125}$ and 19.14
 - (d) $5, 10$ and 10
5. A 0-150 V voltmeter has a guaranteed accuracy of 1% of full scale reading. The voltage measured by this instrument is 75 V. What is the percentage of limiting error?
 - (a) 1%
 - (b) 2%
 - (c) 3%
 - (d) 4%
6. Instrument transformers are
 - (a) Used to extend the range of the AC measuring instruments only.
 - (b) Used to isolate the measuring instruments from the high voltage only.
 - (c) Used to extend the range and isolate the measuring instruments.
 - (d) Not used at generating stations and transformer stations.
7. The accuracy of Kelvin's double bridge for the measurement of low resistance is high because the bridge
 - (a) uses two pairs of resistance arms.
 - (b) has medium value resistance in the ratio arms.
 - (c) uses a low resistance link between standard and test resistances.
 - (d) uses a null indicating galvanometer.
8. Which one of the following is measured by the loss of charge method ?
 - (a) Low R
 - (b) High R
 - (c) Low L
 - (d) High L
9. For low resistance (from few micro ohms to one ohm) measurement, which bridge is used?
 - (a) Wheatstone bridge
 - (b) Kelvin bridge
 - (c) Guarded Wheatstone bridge
 - (d) Maxwell bridge
10. Inductance is measured by which one of the following?
 - (a) Wien bridge
 - (b) Schering bridge
 - (c) Maxwell bridge
 - (d) Owen bridge
11. The imperfect capacitance which is shunted by a resistance can be measured by which one of the following?
 - (a) Carey Foster bridge
 - (b) Owen bridge
 - (c) Schering bridge
 - (d) Wien bridge

12. Which one of the following is a frequency sensitive bridge ?
(a) De-Sauty bridge (b) Schering bridge
(c) Wien's bridge (d) Maxwell's bridge
13. Which one of the following transducers can be used for measurement of pressures as high as 100,000 atmosphere?
(a) McLeod gauge (b) Pirani gauge
(c) Bridgman gauge (d) Knudsen gauge
14. What is the series resistance required to extend the 0-100 V range of a $20000 \Omega/V$ meter to 0-1000 V?
(a) $10 M\Omega$ (b) $16 M\Omega$
(c) $18 M\Omega$ (d) $20 M\Omega$
15. How can a milli-ammeter be used as a voltmeter?
(a) By connecting a low resistance in parallel with the instrument
(b) By connecting a high resistance in parallel with the instrument
(c) By connecting a low resistance in series with the instrument
(d) By connecting a high resistance in series with the instrument
16. In a PMMC instrument, the swamping resistor is used to
(a) increase the damping of the instrument.
(b) reduce the current within the limits.
(c) compensate for temperature variations.
(d) increase the full-scale sensitivity.
17. The moving iron instruments when measuring voltages or currents,
(a) indicate the same values of the measurement for both ascending and descending values of current.
(b) indicate higher values of the measurement for ascending values of current.
(c) indicate higher values of the measurement for descending values of current.
(d) indicate lower values of the measurement for both ascending and descending values of current.
18. Which one of the following instruments is the most sensitive of the moving iron mechanism and has the most linear scale?
(a) Moving coil
(b) Hot wire
(c) Electrodynamometer
(d) Radial vane repulsion
19. In a single-phase power factor meter, the controlling torque is
(a) provided by spring control
(b) provided by gravity control
(c) provided by stiffness of suspension
(d) not required
20. When two-Wattmeter method of measurement of power is used to measure power in a balanced three phase circuit; if the Wattmeter reading is zero, then
(a) power consumed in the circuit is zero
(b) power factor of the circuit is zero
(c) power factor is unity
(d) power factor is 0.5
21. The pressure coil of an induction type energy meter is
(a) Highly resistive (b) Highly inductive
(c) Purely resistive (d) Purely inductive
22. Which one of the following is used for the measurement of 3-phase power factor?
(a) Power factor meter
(b) Crossed-coil power factor meter
(c) Phase-angle watt hour meter
(d) Polarised-vane power factor meter
23. A 3-phase moving coil type power factor meter has three fixed and symmetrically spaced current coils, inside of which are three other similarly placed moving potential coils. While in operation, rotating magnetic field is produced
(a) in the current coils but not in the potential coils.
(b) in the potential coils but not in the current coils.
(c) in both potential coils and the current coils.
(d) in neither the potential coils nor the current coils.

24. In a low power factor wattmeter, some-times compensating coil is connected in order to
- neutralize the capacitive effect of pressure coil.
 - compensate for inductance of pressure coil.
 - compensate for power loss in the pressure coil.
 - reduce the error caused by eddy current.
25. The current coil of a single-phase energy meter is wound on
- one limb of the laminated core
 - both the limbs of the laminated core with same number of turns
 - both the limbs of the laminated core with different number of turns
 - the center of the limb on the laminated core
26. Two wattmeters are used to measure the power in a 3-phase balanced system. What is the power factor of the load when one wattmeter reads twice the other?
- 0
 - 0.5
 - 0.866
 - 1
27. A screen pattern oscillogram, shown in the given figure is obtained when a sine-wave signal of unknown frequency is connected to the vertical input terminals, and at the same time, a 600 Hz sine-wave voltage is connected to the horizontal input terminals of an oscilloscope.



What is the value of unknown frequency?

- 300 Hz
 - 400 Hz
 - 600 Hz
 - 900 Hz
28. What is the approximate input impedance of a CRO?
- Zero
 - 1 M Ω
 - 10 Ω
 - 10 $\mu\Omega$
29. In a vibrating reed type frequency meter, all the reeds
- are of identical dimensions and weight
 - have different natural frequencies
 - have the same natural frequencies
 - are not placed closed to an electromagnet
30. Which one of the following instruments is commonly used to measure primary current of a transformer connected to mains?
- Electrostatic meter
 - Current transformer
 - Moving coil type meter
 - Moving iron meter



Answer Keys

1. (b)	2. (d)	3. (b)	4. (b)	5. (b)	6. (c)	7. (a)
8. (b)	9. (b)	10. (c)	11. (c)	12. (c)	13. (c)	14. (c)
15. (d)	16. (c)	17. (c)	18. (d)	19. (d)	20. (d)	21. (b)
22. (d)	23. (c)	24. (c)	25. (b)	26. (c)	27. (b)	28. (b)
29. (b)	30. (d)					

Detailed Solutions

1. (b)

$$\sigma_I = \sqrt{\left(\frac{\partial I}{\partial I_1}\right)^2 \sigma_{I_1}^2 + \left(\frac{\partial I}{\partial I_2}\right)^2 \sigma_{I_2}^2}$$

$$\frac{\partial I}{\partial I_1} = \frac{\partial I}{\partial I_2} = 1$$

$$\therefore \sigma_I = \sqrt{(1)^2(1)^2 + (1)^2(2)^2} = 2.24 \text{ A}$$

$$\therefore I = (400 \pm 2.24) \text{ A}$$

2. (d)

Torque/weight ratio of instrument simply represents sensitivity.

4. (b)

$$i = 5 + 10\sqrt{2} \sin(314t + 45^\circ)$$

PMMC will measure: $i_{\text{avg}} = 5$

Hot-wire and moving iron instrument will measure:

$$i_{\text{rms}} = \sqrt{5^2 + \left(\frac{10\sqrt{2}}{\sqrt{2}}\right)^2} = \sqrt{125}$$

5. (b)

Absolute error at full scale = Absolute error at reading value

$$= \frac{1 \times 150}{100} = 1.5 \text{ V}$$

Limiting error at reading value

$$= \frac{\text{Absolute error} \times 100}{\text{Reading value}}$$

$$= \frac{1.5 \times 100}{75} = 2\%$$

OR

Limiting error at reading value (75 V)

$$= \frac{\text{Full scale value} \times \text{Limiting error at full scale}}{\text{Reading value}}$$

$$\therefore \% \epsilon_r \text{ at } 75 \text{ V} = \frac{150 \times 1}{75} = 2\%$$

6. (c)

Use of instrument transformer is the extension of instrument range. So that current, voltage, power and energy can be measured with instruments or meters of moderate size is of very great importance in commercial metering.

7. (a)

Kelvin bridge overcomes the difficulties that arise in a Wheatstone bridge on account of the resistance of the leads and the contact resistances while measuring low valued resistors. The Kelvin double bridge incorporates the idea of a second set of ratio arms hence the name double bridge and the use of four terminal resistors for the low resistance arms. The second set of ratio arms eliminate the effect of connecting lead resistance.

14. (c)

Initial resistance = $20000 \times 100 = 2 \text{ M}\Omega$

Final resistance = $20000 \times 1000 = 20 \text{ M}\Omega$

\therefore Series resistance = $20 - 2 = 18 \text{ M}\Omega$

15. (d)

So by connecting a high resistance in series milli ammeter is used as voltmeter.

19. (d)

There will be two deflecting torques, one acting on coil A and the other on coil B . The coil windings are so arranged that the torques due to the two coils are opposite in direction. So, there is no controlling torque.

20. (d)

In two-wattmeter method

$$W_1 = V_{RY} I_R \cos(30^\circ + \phi)$$

$$W_2 = V_{BY} I_B \cos(30^\circ - \phi)$$

For p.f. = 0.5 or $\phi = 60^\circ$

W_1 reads zero.

22. (d)

Crossed coil is used for 1- ϕ supply. Polarized vane power factor meter needs rotating field so primarily used for three phase.

26. (c)

$W_1 \propto \cos(30 + \phi)$ and $W_2 \propto \cos(30 - \phi)$

if $\phi = 30^\circ$

$$W_1 = \frac{1}{2}; \quad W_2 = 1$$

i.e. one is twice the other,

$$\text{p.f. of load} = \cos\phi = \cos 30^\circ = \frac{\sqrt{3}}{2} = 0.866$$

27. (b)

Refer Lissajous Pattern

$$\frac{f_y}{f_x} = \frac{\left(\text{No. of intersections of the horizontal line with the curve} \right)}{\left(\text{No. of intersections of the vertical line with the curve} \right)} = \frac{2}{3}$$

$$\therefore f_y = \frac{2}{3} \times 600 = 400 \text{ Hz}$$

28. (b)

CRO has high input impedance.

29. (b)

Vibrating reed frequency meter indicates the supply frequency by means of individual reeds, when rated voltage is applied across the terminals of the meter, the particular reed whose natural frequency of vibration coincides with the supply frequency, vibrate with full amplitude.

30. (d)

Primary current is AC.

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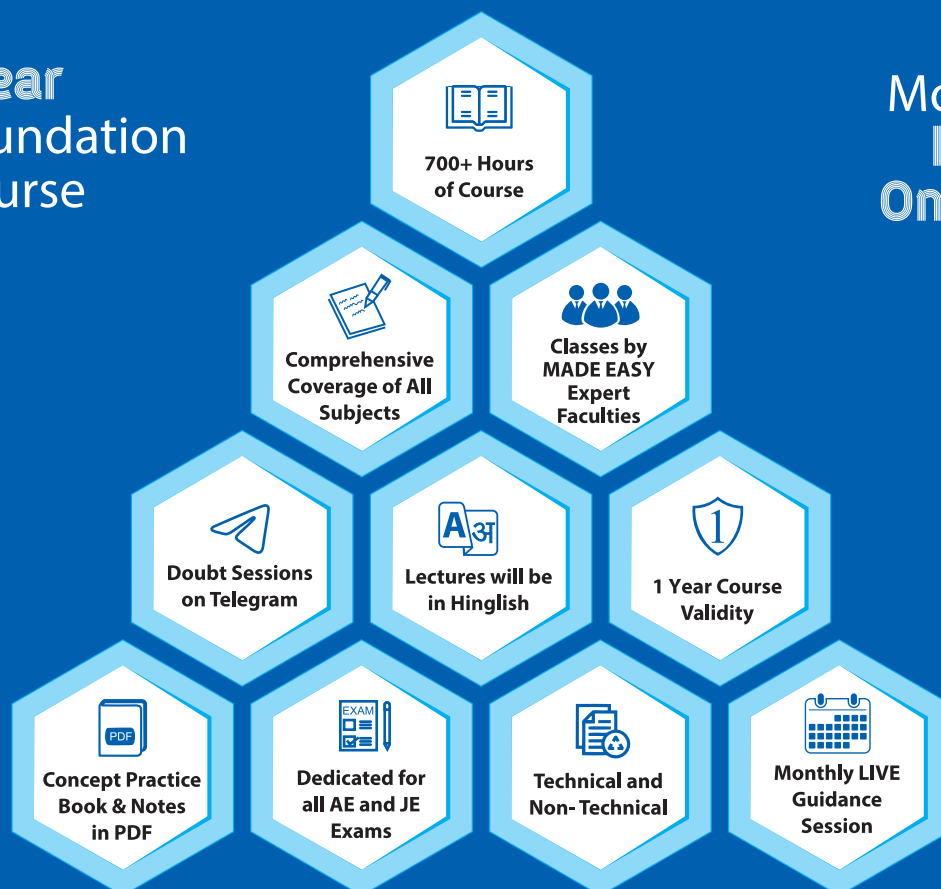
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