1. Two voltmeters with ranges of 0 to 100 V has sensitivities as 10 kΩ/V and 20 kΩ/V. What is the maximum voltage that can be measured when these voltmeters are connected in series?

A. 200 V
B. 150 V
C. 100 V
D. None of the above

Ans. B

Sol. Current flowing through voltmeter 1 = $\frac{1}{10000} = 0.1\text{mA}$

Current flowing through voltmeter 2 = $\frac{1}{20000} = 0.05\text{mA}$

⇒ In series combination maximum current can be 0.05 mA.

Resistance of voltmeter 1 = 100× 10 = 1000 kΩ

Resistance of voltmeter 2 = 100× 20 = 2000 kΩ

Maximum voltage rating

$= I_{max}(R_{m1} + R_{m2}) = 0.05\times10^{-3}(1000+2000)\times10^{3} = 150\,V$

2. Centre zero PMMC read current of –4 + 3 √2 sin (ωt + 30°) Amp as _____ amp.

A. –4
B. 4
C. –5
D. 5

Ans. A

Sol.

PMMC reads avg. DC value

So, I = –4 Amp

3. The primary of 200/1 A, 10 VA, 0.8 pf current transformer (CT) carries 100 A. The secondary current is 0.45A . The ratio error of the CT is _____?

A. 5%
B. – 5%
C. 10%
D. – 10%

Ans. D

Sol.

CT Rating I_1 = 100 A, I_2 = 0.45 A

⇒The ratio error of CT is given by

⇒ Ratio error $= \frac{k-R}{R}\times100$

⇒ Where k = Nominal ratio = $\frac{200}{1}$ =200

R = Actual Ratio $= \frac{100}{0.45} = 222.22$

⇒ Ratio error $= \frac{200 - 222.22}{222.22} \times 100$

$\Rightarrow = -9.99\% \simeq -10\%$

4. A Q meter having a resistance of 5 Ω is used to measure the inductance of a coil. Resonance occurs at an angular frequency of 10^4 rad/sec with a capacitance of 10 pF. The inductance of coil is _____?

A. 1000 H B. 1050 H

C. 5000 H D. 3000 H

Ans. A

Sol.

Given,

Q - meter

R = 5 Ω

$\omega_0 = 10^4$ rad/sec

C = 10 pF

⇒ We know that resonance frequency in Q-meter

$$\omega_0 = \frac{1}{\sqrt{LC}}$$

$$10^4 = \frac{1}{\sqrt{LC}}$$

$$10^8 = \frac{1}{L \times 10 \times 10^{-12}}$$

$$L = \frac{1}{10^9 \times 10^{-12}} = \frac{1}{10^{-3}}$$

$$L = 1000H$$

5. For electrodynamometer wattmeter consider:

(i) Voltage across pressure coil = 250 sin (ωt + 10°) + 400 sin(3ωt) V

(ii) Current through current coil = 8 sin (ωt – 20°) + 10 sin(2ωt – 10°) A

then meter reading = _____ watts.

A. 500 B. –500

C. –866 D. 866

Ans. D

Sol.

V = 250 sin (ωt + 10°) + 400 sin(3ωt) v

I = 8 sin (ωt – 20°) + 10 sin (2ωt – 10°) A

Since, power is due to same frequency components of voltage and current,

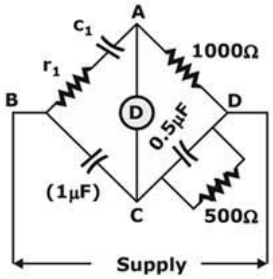
$$\therefore P = \frac{250}{\sqrt{2}} \times \frac{8}{\sqrt{2}} \times \cos(10° - (-20°))$$

$$= \frac{250 \times 8}{2} \times \cos 30°$$

= 250 × 4 × 0.866

= 1000 × 0.866 = 866 W

6. For the Schering bridge should below, dissipation factor of branch AB is _____, if supply frequency = 100 Hz.



A. 0.157 B. 0.314

C. 0.0785 D. None of the above

Ans. A

Sol.

For the given Schering bridge,

$R_4 = 500\,\Omega,\ C_4 = 0.5\,\mu F$

$R_3 = 1000\,\Omega,\ C_2 = 1\,\mu F$

Under balance condition,

$z_1 z_4 = z_2 z_3$

$$\therefore r_1 = \frac{R_3 C_4}{C_2}$$

And $C_1 = \dfrac{C_2 R_4}{R_3}$

Dissipation factor = $\omega r_1 c_1 = 2\pi f\ r_1 c_1$

$$= 2\pi f \left(\frac{R_3 C_4}{C_2}\right)\left(\frac{C_2 R_4}{R_3}\right)$$

$$= (2\pi f)(R_4 C_4)$$

$$= 2\pi \times 100 \times 500 \times 0.5 \times 10^{-6}$$

= 0.157

7. For a balanced star load with 3-φ, 400V and 5 A current, 2-wattmeter method is used to calculate power. If the nature of the load is lagging, with one wattmeter indicating 1000W reading then load power factor is

A. 0.5 B. 0.3

C. 0.707 D. 0.866

Ans. D

Sol.

Lagging load so reading of wattmeter 2,

VI cos (30° + φ) = 1000

400 × 5 × cos (30 + φ) = 1000

cos(30° + φ) = 0.5

φ = 30°

So, PF = cos φ = cos 30° = 0.866

8. A single slide wire is used for measurement of current in a circuit. The voltage drops across a standard resistance of 2 Ω is balanced at 70 cm. What is the magnitude of current if standard cell having an emf of 1.8 V is balanced at 50 cm?

A. 1.05 A B. 1.26 A

C. 0 A D. 2.2 A

Ans. B

Sol.

Since standard cell is balanced at 70 cm.

i.e. 70 cm of wire have resistance of 2 Ω.

So, the 50 cm of wire have resistance = $\frac{50}{70} \times 2$ = 1.428 Ω

Since it is balanced by emt of 1.8V

So, V = IR

I = $\frac{1.8}{1.428}$ = 1.26 A

9. A wattmeter has current coil of 0.03 Ω resistance and pressure coil of 4500 Ω resistance. The load voltage is 300 V and 0.6 power factor. What will be the value of load current when error due to both connections will be equal?

A. 20 A B. 25.81 A

C. 38.5 A D. 15.7 A

Ans. B

Sol.

The two possible connection is-

1) When voltmeter is connected at source end.

2) When voltmeter is connected at load end.

Error in connection (1) is-

$I^2 \times R_C$

error in the connection (2) is-

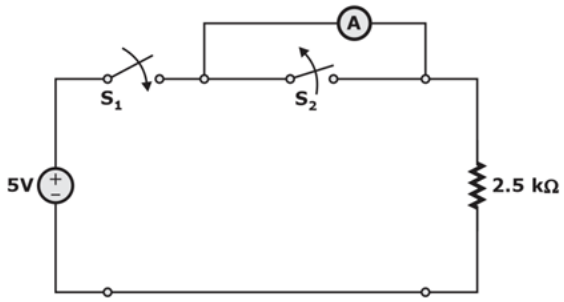
= $\frac{V_p^2}{R_p}$

For equal error

$I^2 \times 0.03 = \frac{(300)^2}{4500}$

I = 25.81 A

10. In a below circuit when switch S1 is closed and switch S2 is opened, the PMMC meter deflects till 2 mA and settles at 1.9 mA . Calculate the coil resistance and identify the damping.



A. 141.57 Ω and under damping

B. 131.57 Ω and critical damping

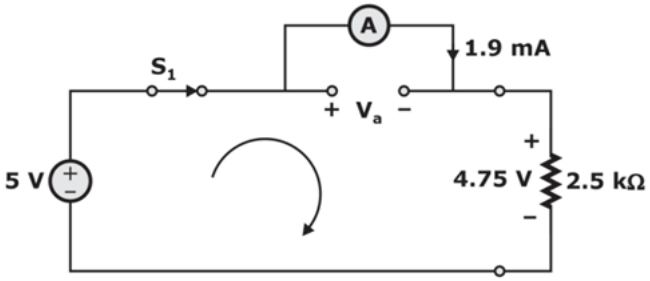
C. 141.75 Ω and critical damping

D. 131.57 Ω and under damping

Ans. D

Sol.

At steady state the circuit will be :-



By KVL :

+5 – Va – 4.75 = 0

Va = 0.25V

ImRm = 0.25

$Rm = \frac{0.25}{1.9 \times 10^{-3}}$ = 131.57 Ω

As the pointer has swing in deflection, the damping will be under damping.

11. A first order instrument is characterized by

A. Time constant only

B. Static sensitivity and time constant

C. Static sensitivity and damping coefficient

D. Static sensitivity, damping coefficient and natural frequency of oscillations

Ans. B

Sol.

A first-order instrument experiences a time delay between its output and a time-varying input. So it is characterized by Static sensitivity and time constant.

12. Calculate the power factor of the cable if loss angle is δ = 60 °.

A. Unity

B. 0.5

C. 0.707

D. 0.866

Ans. D

Sol. power factor ($\cos\theta = \cos(90° - \delta) = \sin\delta$

$\cos\theta = \sin\delta = \sin 60° = 0.866$

13. The slope and level detector circuit in a CRO has a delay of 100 ns. The start-stop sweep generator has a response time of 50 ns. In order to display correctly, a delay line of

A. 150 ns has to be inserted into the y-channel

B. 150 ns has to be inserted into the x-channel

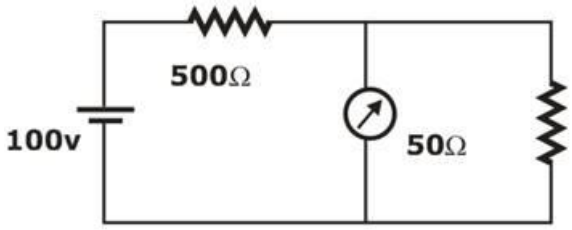
C. 150 ns has to be inserted into both x and y channels

D. 100 ns has to be inserted into both x and y channels

Ans. A

Sol. The delay line should be inverted in VDP (Y-channel) only.

14. For a shunt type Ohmmeter as shown below, what is the value of R for which meter shows half scale deflection?



A. 50Ω

B. 45Ω

C. 25Ω

D. 20Ω

Ans. B

Sol.

When $R_n = \infty$, Full scale current in meter

$$I_m = \frac{E}{500 + 50} = \frac{100}{550} = \frac{2}{11} A$$

Current in the meter = I_m

$$I_m = \frac{E}{500 + 50 \| R} \times \frac{R}{R + 50}$$

$$I_m = \frac{100\,R}{500\,R + 25000 + 50\,R}$$

$$= \frac{100\,R}{500\,R + 25000}$$

At half scale deflection

$$I_m = \frac{I_{fs}}{2} = \frac{1}{11}\,A$$

$$\frac{1}{11} = \frac{100\,R}{220\,R + 25000}$$

25000 = 550R

R = 45.454Ω

15. The anode voltage of 1800V is shown by an electrically deflected cathode ray tube. The parallel deflecting plates are 1.8 cm long which are separately by 7.5 mm apart. If the distance of the screen is 40 cm from the centre of the deflecting plate. What will be the deflecting factor of tube?

A. 3.745 V/mm

B. 4.120 V/mm

C. 4.685 V/mm

D. 5.125 V/mm

Ans. A

Sol.

Length of the deflecting plate l_d = 1.8 cm

Distance b/w deflecting plate d = 7.5 mm

Anode voltage E_a = 1800V

Distance of screen = 40 cm = 40 × 10^{-12} m

Since deflecting factor G = $\frac{1}{s}$

Where δ is deflection sensitivity.

$$S = \frac{Ll_d}{2dE_a} = \frac{40 \times 10^{-2} \times 1.8 \times 10^{-2}}{2 \times 7.5 \times 10^{-3} \times 1800}$$

= 0.267 × 10^{-3} m/V

Or S = 0.267 mm/V

So, deflecting factor,

$$G = \frac{1}{S} = \frac{1}{0.267}\,V/mm$$

= 3.745 V/m

16. An LPF wattmeter of power factor 0.2 is having three voltage settings 300 V, 150 V and 75 V, and two current settings 5 A and 10 A. The full scale reading is 150. If the wattmeter is used with 150 V voltage setting and 10 A current setting, the multiplying factor of the wattmeter is _____.

A. 5 B. 2

C. 7 D. 9

Ans. B

Sol. In low power factor (LPF) wattmeter, the multiplying factor is given by

M.F. = Power Setting/power for maximum deflection

$$= \frac{voltage\ range\ used \times current\ range\ used \times power\ factor}{Full\ scale\ reading}$$

$From\ the\ given\ data,\ we\ have\ Full\ scale\ reading = 150$

$Voltage\ range\ used = 150\ V$

$Current\ range\ used = 10\ A$

$Power\ factor = 0.2$

$Substituting\ these\ values\ in\ above\ expression,\ we\ get$

$$= \frac{150 \times 10 \times 0.2}{150}$$

$$= 2$$

17. An analog voltage signals whose highest significant frequency is 1 kHz is to be coded with a resolution of 0.01 percent for a voltage range of 0 - 100 V. The minimum sampling frequency and the minimum number of bits should respectively be

A. 1 kHz and 12 B. 1 kHz and 14

C. 2 kHz and 12 D. 2 kHz and 14

Ans. D

Sol. Minimum sampling frequency = Nyquist sampling rate = 2 kHz

$$\text{resolution} = 0.01 = \frac{1}{2^n - 1} \times 100$$

$$\Rightarrow \quad n \approx 14$$

18. Which of the following statement is not true with respect to an ammeter?

A. The range of an ammeter can be extended using external shunts.

B. The temperature coefficients of shunt and instrument should be low and nearly identical.

C. If an ammeter is connected across a source of emf, it provides highest accuracy.

D. The current through the shunt is greater than the current through the meter.

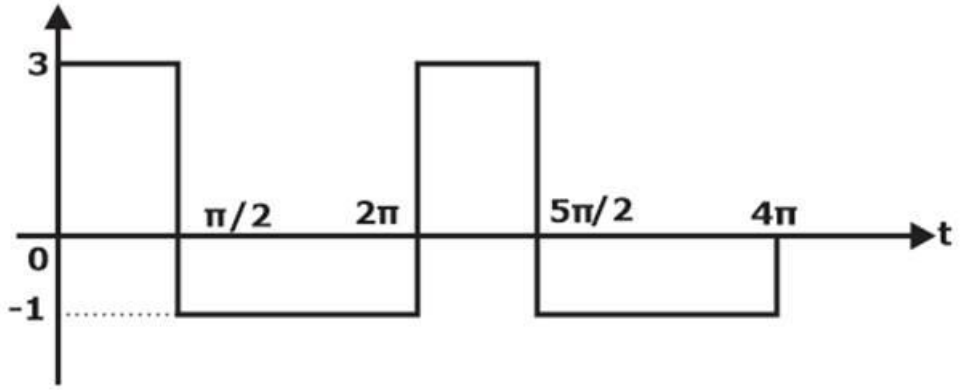
Ans. C

Sol. An ammeter should never be connected across a source of emf. Because of its low resistance, it will draw a high current and destroy the meter.

The ammeter should always be connected in series with a load capable of limiting the current.

19. The following waveform is applied to (a) True rms meter, (b) Average measuring and rms indicating, (c) peak measuring and rms indicating meter. Determine reading of each instrument?

Given waveforms:



A. $\sqrt{3}$, 1.665, 2.12

B. $\sqrt{3}$, 0, 2.12

C. $\sqrt{3}$, 0, 3.33

D. $\sqrt{3}$, 1.665, 3.33

Ans. A

Sol.

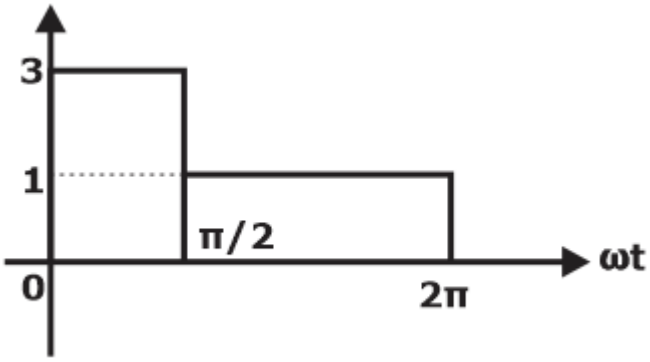
(a) Power $= \frac{1}{2\pi}\left[\int_0^{\pi/2}(3)^2 dt + \int_{\pi/2}^{2\pi}(1)^2 dt\right]$

$$P = \frac{1}{2\pi}\left[\frac{9\pi}{2} + \frac{3\pi}{2}\right] = \frac{1}{2\pi}(6\pi) = 3$$

Hence RMS $= \sqrt{\text{Power}} = \sqrt{3}$

True RMS meter reading $= \sqrt{3}$

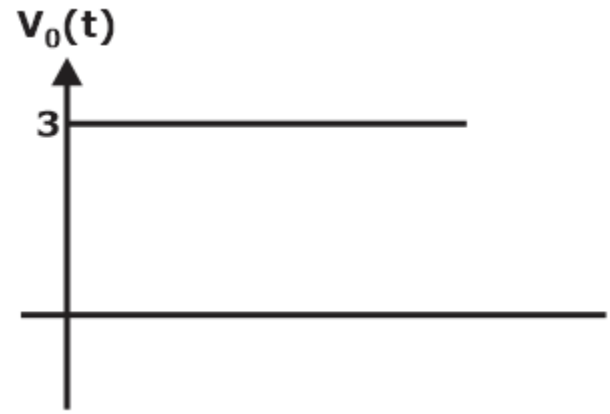
(b)When full wave rectifier is used and PMMC instrument for average measuring and RMS indicating, then the resultant waveform after rectification.



$$V_{0(avg)} = \frac{\frac{3\pi}{2} + \frac{3\pi}{2}}{2\pi} = 1.5$$

Then $V_{D(RMS)} = FF \times V_{D(avg)} = 1.11 \times 1.5 = 1.665 \text{ volt}$

(c) for peak measuring V_0 waveform will b



Then $V_{rms} = \frac{V_{max}}{\sqrt{2}} = \frac{3}{\sqrt{2}}$

$V_{rms} = 2.12 \text{ volts}$

For peak measuring and RMS indicating $V_{0(rms)} = 2.12 \text{ volts}$

Hence, the correct option is (A).

20. A wattmeter is used to measure the power supplied to a coil having resistance of 4 Ω. The supply frequency is 50 Hz. The wattmeter potential coil has resistance of 5000 Ω and inductance of 2.5 H. If expected error in the reading is 5%. Find the value of inductance of load coil?

A. 4.05 H

B. 0.125 H

C. 12.5 mH

D. 4.05 mH

Ans. D

Sol.

Given f = 50 Hz

R_P = 5000 Ω

L_P = 2.5 H

$\omega L_p = 2\pi \times f \times L_p = 785\ \Omega$

The % error in wattmeter is given by

$\%e_r = \tan\phi \times \tan\beta \times 100$

$$\tan\beta = \frac{\omega L_p}{R_p} = \frac{785}{5000} = 0.157$$

Where

0.05 = tan φ × 0.157

Φ = 17.66°

$$\phi = \tan^{-1}\left(\frac{X_L}{R}\right)$$

$$\tan\phi = \frac{X_L}{R}$$

$$0.318 = \frac{\omega L}{R} = \frac{2\pi \times 50 \times L}{R}$$

L = 4.05 mH

21. The seebeck voltage generated in a thermocouple is the sum of:

A. Two voltages
B. Three voltages
C. Four voltages
D. None of the above

Ans. C

Sol. At the junctions of dissimilar conductors, electrons diffuse across the junction from the conductor with higher electron density. The conductor thus acquires a positive voltage with respect to the other conductor. This is referred as Peltier emf. Thus, each of the junctions is a voltage source.

When the temperature of one end of a conductor is increased, the electrons will diffuse from the hot end to the cold end, thereby inducing a positive voltage at the hot end with respect to the cold end. This induced voltage in each of the conductor is referred as Thomson emf.

Therefore, the output voltage generated in a thermocouple is a sum of four voltage sources.

22. The voltage phasor of a circuit is 20∠ 15 °V and the current phasor is 5∠-45 °A the Reactive power in the Circuit is –

A. 100 VAR
B. 50 VAR
C. 96.6 AR
D. 86.6 VAR

Ans. D

Sol. complex power (P) = VI*

P + jQ = 20∠ 15 °× 5∠45 = 100∠60 °

P + jQ = 50 + j86.6

Q = 86.6 VAR

23. A PMMC instrument has a coil of dimension 15mm x 12 mm. The flux density in an air gap is 1.8 x 10^{-3} wb/m^2 and the spring constant is 0.14 x 10^{-6} Nm/rad. Determine the number of turns required to produce an angular deflection of 90°, when a current of 5 mA flowing through the coil.

A. 152 B. 176

C. 250 D. 136

Ans. D

Sol. Td = NBAI

Td = N (1.8 *10 -3)(15*10-3*12*10 -3)(5/810 -3)

Td = N *1.62 *10 -9

Tc = 0.14 * 10 -6 *θ = 2.199 *10 -7

TD = Tc

N* 1.62 * 10 -9 = 2.199 *10 -7

N = 2.199 *10 -7/1.62 *10 -9

N = 135.7407 = 136

N = 136

24. A Manganin swamp resistance is connected in series with a moving coil ammeter consisting of a milli–ammeter and a suitable shunt in order to

A. minimize the effect of temperature variation

B. obtain large deflecting torque

C. reduce the size of the meter

D. minimize the effect of stray magnetic fields

Ans. A

Sol. Coil is made of copper

A swamping resistance (R_{sw}) of manganin (which has a negligible temperature coefficient) having a resistance 20 to 30 times the coil resistance is connected in series with the coil and a shunt of manganin is connected across the combination. Since copper forms a small fraction of the series combination, the proportion in which the currents would divide between the meter and the shunt would not change appreciably with the change in temperature.

25. A resistance strain gauge has an original resistance of 150 Ω. When a strain of 2×10^{-6} is applied to the gauge, the resistance changes by 900 μΩ. Determine the gauge factor.

A. 2 B. 3

C. 5 D. 6

Ans. B

Sol. Given, Strain = 2×10^{-6}

For a strain gauge, ratio of change in resistance to original resistance is given as,

$\Delta R/R = K \times$ strain

Where K is the gauge factor.

Substituting values,

$$\Rightarrow \frac{900\times10^{-6}}{150} = K\times2\times10^{-6}$$

$$\Rightarrow K = \frac{900}{150\times2} = 3$$

26. The pointer in an indicating instrument is brought to zero position by

A. Deflecting torque

B. damping torque

C. controlling torque

D. combination of A and B

Ans. C

Sol.

Controlling torque is used to

i) bring the pointer to steads state

ii) bring the pointer to zero position when no load is applied to the instrument.

27. For power measurements in high voltage circuits, wattmeter is connected through the instrument transformers. Which of the following connection is not correct?

A. The primary winding of the current transformer is connected in series with the load.

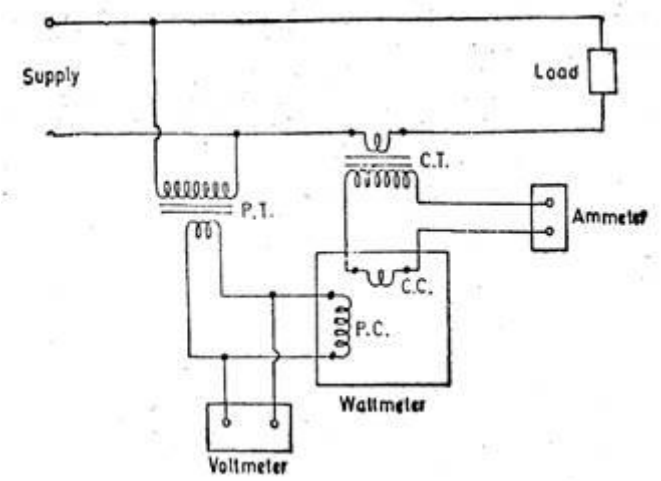
B. The secondary winding of the current transformer is connected in series with an ammeter and current coil of wattmeter.

C. The primary winding of the potential transformer is connected across the supply lines.

D. The secondary winding of the potential transformer is connected in series with a voltmeter and the potential coil of wattmeter.

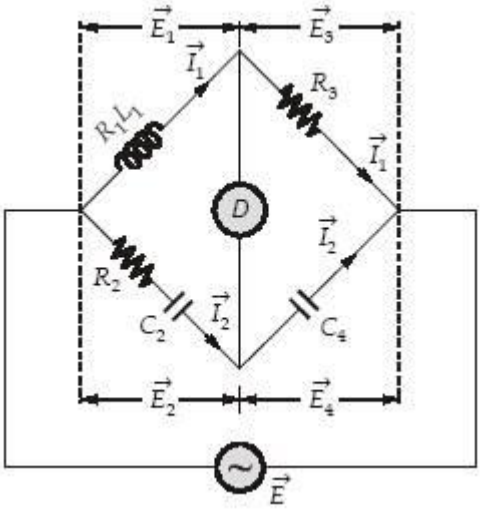
Ans. D

Sol. Power measurements is done in high voltage circuits by connecting the wattmeter through the instrument transformers as shown below.



It can be easily derived from the above circuit that The primary winding of the current transformer is connected in series with the load. The secondary winding of the current transformer is connected in series with an ammeter and current coil of wattmeter. The primary winding of the potential transformer is connected across the supply lines. The secondary winding of the potential transformer is connected in parallel with a voltmeter and the potential coil of wattmeter.

28. In the balanced AC Bridge shown below which of the following statements are correct regarding phasor quantities



1) The phasor voltage $\bar{E}_1$ and $\bar{E}_2$ are same.

2) Phasor $\bar{E}$ lag behind phasor $\bar{I}_2$ by some angle and leads by some angle from phasor $\bar{I}_1$.

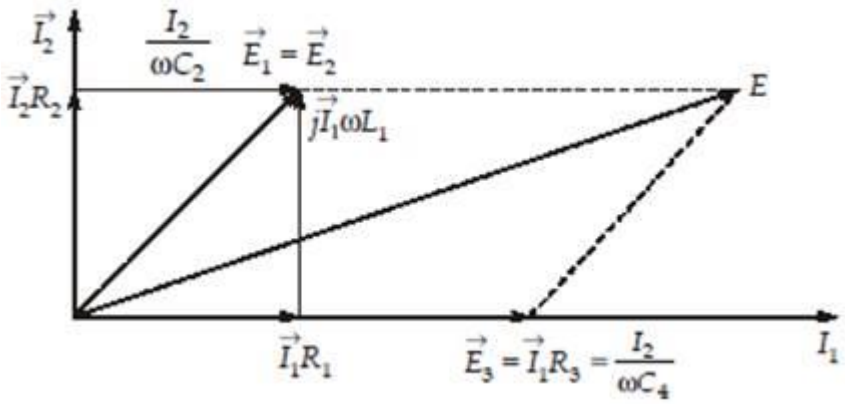
3) Phasor $\bar{I}_1$ and $\bar{I}_2$ have a phase difference of 90° between them.

A. 1 only
B. 2 only
C. 1 and 3 only
D. 1, 2 and 3

Ans. D

Sol.

The given bridge is Owen's Bridge and the phasor diagram of this bridge is given as



So we can see from diagram, all the statements are correct.

29. In wein's bridge the formula for frequency f is

A. F = 1/ √c1 c2 R1 R2 B. F = 1/2pi√ c1 c2 R1 R2

C. F = 1/ 2pi√c1 c2 D. F = 1/ √R1R2

Ans. B

Sol.

In Wien's bridge method, ω =1/ √c1c2R1R2 where, (ω= 2 pi f)

F= 1/2pi √c1 c2 R1 R2

30. A moving-coil voltmeter has a resistance of 80 Ω. The scale is divided into 120 equal divisions. When a potential difference of 0.8 V is applied to the terminals of the voltmeter a deflection of 80 divisions is obtained. Explain how the instrument could be used for measuring up to 220 V.

A. 10.365 KΩ B. 10.365 KΩ

C. 10.365 KΩ D. 14.586 KΩ

Ans. D

Sol. Let Rsc be the multiplier resistance that would be connected in series with the voltmeter.

Volt/ division = 0.8/80

Voltage across the meter for producing the full-scale deflecting current v = 120 * 0.8 / 80 = 1.2 V

Full scale meter current Im = 1.2/80amp

Meter resistance Rm = 80 Ω

Rsc = V- ImRm/ Im = V/Im - Rm

= 220 – 1.2/80* 80 / 1.2 /80 = 14.586 KΩ

31. The measured value of a capacitor is 156.2 x10 $^{-6}$ F given its true value is 152.3 x10 $^{-6}$ F. Determine the relative error.

A. 1.36 % B. 2.56 %

C. 5.69 % D. 3.25 %

Ans. B

Sol. Measured value A_m = 156.2 x10 $^{-6}$ F

True value, A = 152.3 x10 $^{-6}$ F

Absolute error = A_m – A

Absolute error = 156.2 x10 $^{-6}$ – 152.3 x10^{-6} = 3.9 x10 $^{-6}$ F

Relative error, ξ_r = 3.9 x10 $^{-6}$ / 152.3 x10 $^{-6}$ = 0.0256 or 2.56%

32. The dc sensitivity of a rectifier – type instrument is

A. S dc = I fs Ω/v B. S dc = 1 / I fs Ω/v

C. S dc = 1 / I + Ifs Ω/v D. none of the above

Ans. B

Sol. The dc sensitivity of a rectifier-type instrument is

S dc = 1 / I fs Ω/v where I fs is the current required to produce full-scale deflection.

33. Which of the following is most inexpensive and widely used method of correcting the power factor is?

A. Use of one fixed resistive bank connected to incoming transformer or switch gear bus.

B. Use of one fixed capacitor bank connected to incoming transformer or switch gear bus.

C. Use of one fixed inductive bank connected to incoming transformer or switch gear bus.

D. None of these

Ans. B

Sol. The method we use which is most inexpensive and widely for correcting the power factor is through by adding one fixed capacitor bank connected to the incoming transformer or switch gear.

34. The limiting errors for a four dial resistance box are:

Units: ± 0.2% Tens: ±0.1%

Hundreds: ±0.05% Thousands: ±0.02%

If the resistance value is set at 4325 Ω then Calculate the percentage limiting error for this value.

A. 0.013% B. 0.011%

C. 0.023% D. 0.033%

Ans. C

Sol. units $= \pm 0.2\%$

$$\text{Tens} = \pm 0.1\%$$
$$\text{Hundreds} = \pm 0.05\%$$
$$\text{Thousands} = \pm 0.02\%$$
$$400\,\Omega \text{ error} = \pm 4000 \times \frac{0.02}{100} = \pm 0.8\,\Omega$$
$$\text{For hundred error} = \pm 300 \times \frac{0.05}{100} = \pm 0.15\,\Omega$$
$$\text{For tenth error} = \pm 20 \times \frac{0.1}{100} = \pm 0.02\,\Omega$$
$$\text{For unit error} = \pm 5 \times \frac{0.2}{100} = \pm 0.01\,\Omega$$
$$\text{total error} = \pm(0.8 + 0.15 + 0.02 + 0.01)$$
$$= \pm 0.98\,\Omega$$
$$\text{Limiting error} = \frac{0.98}{4325} \times 100 = 0.0226\%$$

Hence,

35. Which of the following instrument have linear scale

A. Moving iron instrument

B. Moving coil instrument

C. Thermocouple instrument

D. Electrodynamometer instrument

Ans. B

Sol.

PMMC instrument have linear scale.

Hence, moving coil instrument have linear scale.

36. Which of the following is true about CRO

A. The Lissajous pattern obtained on a CRO is used to measure distortion in the input signal.

B. The time base signal in a CRO is a square waveform

C. The purpose of the synchronizing control in a CRO is to lock the display of the signal

D. None of these

Ans. C

Sol.

37. Which bridge is most suitable for measurement of inductance of a coil with a large time constant -

A. Maxwell Inductance Bridge

B. Kelvin Double bridge

C. Schering Bridge

D. Hay Bridge

Ans. D

Sol. Hay's Bridge is used for measurement of inductance with a large time constant. Schering bridge is used to measure capacitance. Kelvin double bridge used for measurement of low resistances.

38. A repulsion type moving iron instrument when used with AC circuits, the deflecting torque is?

A. Directly proportional to the rms current

B. Directly proportional to the square of rms current

C. Directly proportional to the peak current

D. Directly proportional to the square of the peak current

Ans. B

Sol. A repulsion type moving iron instrument when used with AC circuits, the deflecting torque is directly proportional to the square of rms current.

39. A lissajous pattern on oscilloscope is stationary and has 6 horizontal tangencies and 4 vertical tangencies. The frequency of horizontal input is 1200 Hz. determine the frequency of vertical input.

A. 1500 Hz B. 1000 Hz

C. 1800 Hz D. 2000 Hz

Ans. C

Sol. frequency of horizontal input

f_x= 500Hz

vertical line = 4

horizontal line = 6

frequency of vertical input, $f_y = f_x \times \frac{Horizontal\ tangencies}{vertical\ tangencies}$

$f_y = 1200 \times \frac{6}{4} = 1800Hz$

40. A voltage 100sinωt + 60cos (3ωt – 30°) + 40sin(5ωt + 45°) V is applied to the pressure coil circuit of a wattmeter and through the current coil a current of 8sinωt + 6cos(5ωt + 120°) is passed . The reading of wattmeter will be?

A. 470W B. 431W

C. 450W D. 500W

Ans. B

Sol.

$$P = V.I = \frac{1}{2}V_1 I_1 \cos\theta_1 + \frac{1}{2}V_2 I_2 \cos\theta_2 + \ldots\ldots\ldots$$

So,

$$P = \left(\frac{1}{2} \times 100 \times 8\right) + \left(\frac{1}{2} \times 60 \times 0\right) + \left(\frac{1}{2} \times 40 \times 6\cos\left(120° - 45°\right)\right)$$

P = 431W

41. In a CRO astigmatism is?

A. a source of generating fast electrons

B. a medium for absorbing secondary emission electrons

C. An additional focus control

D. a time delay control in the vertical deflection system.

Ans. C

Sol.

In modern oscilloscope, this is an additional focusing control and is analogous to astigmatism in optical lenses. A beam that is focused at the centre of the screen would be defocused at the edges of the screen because the lengths of the electron paths are different for the centre and the edges. Adjustment of this control gives a sharp focus over the entire screen. This control is affected by varying the potential of deflection plates and accelerating anodes.

So, Astigmatism provides additional focus control to the CRO.

42. A 230 V, 10 A, 1-φ energy meter makes 90 revolution in 3 minutes at half load rated voltage and unity power factor. If meter constant is 1800 rev/kWh. Then error at half load will be

A. meter is moving fast, and error is 13 %

B. meter is moving slow and error is 10 %

C. meter is moving fast, and error is 10 %

D. meter is moving slow and error is 13 %

Ans. D

Sol.

Energy consumed in 3 min at half load= $230 \times \frac{10}{2} \times 1 \times \frac{3}{60}$

E_T = 0.0575 kWh.

Energy measured by the meter= $\frac{\text{No. of revolution}}{\text{Energy meter constant}}$

$E_m = \frac{90}{1000}$ = 0.05 kWh

Error = $\frac{0.05 - 0.0575}{0.0575} \times 100$ = –13 %

43. For an instrument transformer: Accuracy class is the maximum allowable percentage composite error in Measured value.

Which of the following is impermissible value of measured current for 100 A of primary current in metering CT of Accuracy class 0.1?

A. 99.8 B. 99.9

C. 100.05 D. 100.01

Ans. A

Sol. Accuracy class is the maximum allowable percentage composite error in the measured value of metering CT at rated current.

Percentage Error = $\frac{MV-TV}{TV}$ x 100

Where, MV= Measured Value

TV = True Value

For, M_V= 99.8

Percentage Error = $\frac{99.8-100}{100}$ x 100

⇒ Magnitude of error in percent = 0.2

⇒ Since, 0.2 > Maximum Permissible error of 0.1

Following, Measured value is impermissible.

44. Instrument transformers are known to introduce magnitude and phase errors in measurements. These are primarily due to

A. improper connections on the primary side

B. measurement errors inherent in the meter connected to the transformer secondary

C. open and short circuit parameters of the instrument transformers

D. None of the above

Ans. C

Sol. Instrument transformers are high accuracy class electrical devices used to isolate or transform voltage or current levels.

The most common usage of instrument transformers is to operate instruments or metering from high voltage or high current circuits, safely isolating secondary control circuitry from the high voltages or currents. The primary winding of the transformer is connected to the high voltage or high current circuit, and the meter or relay is connected to the secondary circuit.

Instrument transformers may also be used as an isolation transformer so that secondary quantities may be used in phase shifting without affecting other primary connected devices

The magnitude and the phase errors in measurement of instrument transformer are due to open and short circuit parameters of the instrument transformer.

45. A dual trace oscilloscope is set to operate in the alternate mode. The control input of the multiplexer used in the y-circuit is fed with a signal having a frequency equal to

A. The highest frequency that the multiplexer can operate properly

B. Twice the frequency of the time base (sweep) oscillator

C. The frequency of the time base (sweep) oscillator

D. Half the frequency of the time base (sweep) oscillator

Ans. D

Sol. It is dependent on the frequency of time base oscillator.

46. The inductance of a 15 A electrodynamic ammeter changes uniformly at the rate of 0.0015 μH/radian. The spring constant is 10^{-6} N-m/radian. Determine the angular deflection at full scale.

A. 22 °

B. 18 °

C. 19 °

D. 25 °

Ans. C

Sol.

dM / dθ = 0.0015 * 10^{-6} H/rad

Now the deflection θ = $\frac{I^2}{K} \times \frac{dM}{d\theta}$

Angular deflection at full scale current of i = 15 A is given by:

θ = $\frac{15^2}{10^{-6}} \times 0.0015 \times 10^{-6} \times \frac{180^o}{\pi}$ = 19 degree.

47. The sensitivity of a moving coil galvanometer is 60 divisions/ampere. When a shunt is used, the sensitivity becomes 10 divisions/ampere. If the galvanometer resistance is 20Ω, the value of shunt is

A. 15Ω

B. 20Ω

C. 4Ω

D. 5Ω

Ans. C

Sol.

$$\frac{I_g}{I} = \frac{S}{S+G} \; Here \; \frac{I_g}{I} = \frac{10}{60} = \frac{1}{6}; G = 20\Omega$$

$$\therefore \frac{1}{6} = \frac{S}{S+20} \; or \; S = 4\Omega$$

48. The most accurate method to measure resistance is –

A. V-I method
B. Megger
C. Balance Bridge Method
D. Ohm meter method.

Ans. C

Sol.

The most accurate method of measuring resistance is balance bridge method.

49. Which of the following does not lie in the category of systematic errors.

A. Instrumental error
B. Environment error
C. Observational error
D. Random error

Ans. D

Sol. There are 3 major types of errors:

1. Gross Error
2. Systematic Error:

a) Instrumental error
b) Environmental error
c) Observational error

3. Random Error

50. Multimeters cannot measure the value of _____.

A. voltage
B. current
C. resistance
D. phase angle

Ans. D

Sol. multimeter can't measure phase angle.

51. Determine the bandwidth (in Hz) of a sine wave that is reproduced by a CRO having a rise time of 70 msec.

A. 5
B. 10
C. 15
D. 20

Ans. A

Sol.

$$t_r = \frac{0.35}{B.W.}$$

$$B.W. = \frac{0.35}{t_r} = \frac{0.35}{70\times10^{-3}} = 50$$

52. In Optical pyrometer temperature is measured by

A. photocell principle
B. thermocouple effect
C. comparing the brightness of the source with the bright of a standard source

D. none of the above

Ans. C

Sol. Optical pyrometer temperature is measured by comparing the brightness of the source with the bright of a standard source. I n an optical pyrometer, a brightness comparison is made to measure the temperature. As a measure of the reference temperature, a color change with the growth in temperature is taken. The device compares the brightness produced by the radiation of the object whose temperature is to be measured, with that of a reference temperature. The reference temperature is produced by a lamp whose brightness can be adjusted till its intensity becomes equal to the brightness of the source object. For an object, its light intensity always depends on the temperature of the object, whatever may be its wavelength. After adjusting the temperature, the current passing through it is measured using a multimeter, as its value will be proportional to the temperature of the source when calibrated.

53. DVM is the abbreviation for which of the following?

A. Digital voltmeter

B. Digital volume meter

C. Digital voltage meter

D. Digital vacuum meter

Ans. A

Sol. DVM is the abbreviation for Digital voltmeter. DVM is essentially an Analog to digital converter (A/D) with a digital display. Digital Voltmeters (DVMs) are a special case of A/Ds. DVMs are voltmeters - i.e. they measure voltage - and are general purpose instruments commonly used to measure voltages in labs and in the field. DVMs display the measured voltage using LCDs or LEDs to display the result in a floating point format.

54. Which of the following statement about the internal resistance of measuring instrument is true?

A. The internal resistance of ammeters should be very small and that of the voltmeters very high

B. The internal resistance of ammeters should be very high and that of the voltmeters very small

C. The internal resistance of ammeters and voltmeters should be very small

D. The internal resistance of ammeters and voltmeters should be very high

Ans. A

Sol. An ammeter measures the current flowing through a device. So as not to interfere with this, it should be in series with the device, and restrict the current as little as possible, so it needs a low resistance, preferably zero. Just like a meter measuring

how much water you use. By contrast, a voltmeter measures the voltage difference between two points in a circuit, and should have as high a resistance as possible, so as not to drain extra current, divert current between the two points and reduce the voltage.

55. Meggar is an instrument to measure

A. Very low resistance

B. Insulation resistance

C. Q of a coil

D. Inductance of a coil

Ans. B

Sol. Meggar device enable us to measure electrical leakage in wire, results are very reliable as we shall be passing electric current through device while we are testing. The equipment basically use for verifying the electrical insulation level of any device such as motor, cable, generator winding, etc.

56. In hot wire instruments the sensing wire is made of

A. copper nickel

B. silver

C. copper

D. platinum-iridium

Ans. D

Sol. The materials which are most commonly used in hot wire instruments are: tungsten, platinum and platinum-iridium alloys.

The platinum-iridium ally is a compromise

Between tungsten and platinum with good oxidation resistance and higher tensile strength than platinum, but it has a low temperature coefficient of resistance (0.00085/ °C).

57. A consumer is connected to an alternating voltage. The power consumed is measured with the help of wattmeter. Which of the following powers is indicated by the wattmeter?

A. Apparent Power

B. True Power

C. Reactive Power

D. The product of voltage and current V x I

Ans. B

Sol. A modern digital electronic wattmeter/energy meter samples the voltage and current thousands of times a second. For each sample, the voltage is multiplied by the current at the same instant; the average over at least one cycle is the real power. The real power divided by the apparent volt-amperes (VA) is the power

factor. A computer circuit uses the sampled values to calculate RMS voltage, RMS current, VA, power (watts), power factor, and kilowatt-hours.

58. Assertion (A): Random errors can be minimized by statistical methods.
Reason (R): These are caused by arithmetic error while taking readings.
A. Both A and R and true and R is the correct explanation of A
B. Both A and R are true but R is NOT a correct explanation of A
C. A is true but R is false
D. A is false but R is true

Ans. C

Sol. Random errors or uncertainities are computed using statistical methods. Random errors indicates precision of instrument.

59. Statement (I): A hot-wire instrument gives the rms value of the current measured.
Statement (II): The heat generated is dependent on the average value of the current.
A. Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I).
B. Both Statement (I) and Statement (II) are individually true but Statement (II) is not the correct explanation of Statement (I).
C. Statement (I) is true but Statement (II) is false.
D. Statement (I) is false but Statement (II) is true.

Ans. C

Sol. The expansion in the wire is proportional to the heating effect of current and to the square of the rms value of the current. Therefore, the meter may be calibrated to read the rms value of the current.

60. An aquadag is used in a CRO to collect
A. Primary electrons only
B. Secondary emission electrons only
C. Both primary electrons and secondary emission electrons
D. Heat emission electrons

Ans. B

Sol. Boundary of CRT screen is coated by aquadag coating to protect CRT from secondary emission electrons.

61. For measuring current at high frequency we should use
A. moving iron instrument
B. electrostatic instrument
C. thermocouple instrument
D. PMMC instruments

Ans. C

Sol.

Thermocouple instruments are used at high frequency as their operation is based on heating effects and emf generation due to dissimilar conductor function.

62. A 0-20 mA PMMC ammeter reads 8 mA in a circuit. Its bottom control spring snaps suddenly. The meter will now read nearly

A. 20 mA B. 8 mA

C. 4 mA D. zero

Ans. D

Sol. When control spring breaks, the meter current flowing circuit gets open therefore the meter will read zero.

63. A resistance of 10 kΩ with 5 % tolerance is connected in series with 5 kΩ resistor of 10% tolerance. What is the tolerance limit for the series network?

A. 5 % B. 6.67 %

C. 10 % D. 8 %

Ans. B

Sol. Error in 10 kΩ resistance = $10 \times \frac{5}{100} = 0.5k$

Error in 5 kΩ resistance = $5 \times \frac{10}{100} = 0.5k$

Total measurement resistance = 10 + 5 + 0.5 + 0.5 = 16k

$$\text{Error} = \frac{16-15}{15} \times 100 = 6.67\%$$

64. In 2-wattmeter method of measuring 3-φ power. Power factor is 0.5, then one of the wattmeter will read.

A. $\frac{W}{2}$ B. $\sqrt{3}W$

C. $\frac{W}{\sqrt{2}}$ D. zero

Ans. D

Sol. $\cos\theta = \frac{1}{2} \quad \Rightarrow \theta = 60^\circ$

$$\tan\theta = \sqrt{3}\left(\frac{\omega_1 - \omega_2}{\omega_1 + \omega_2}\right)$$

$$\sqrt{3} = \sqrt{3}\left(\frac{\omega_1 - \omega_2}{\omega_1 + \omega_2}\right)$$

$\Rightarrow W_2 = 0$

65. Which one of the type of standard resistance is three terminal type?

A. low resistance

B. medium resistance

C. High resistance

D. both B and C

Ans. C

Sol. High resistance standard are "three terminal type"

Guard terminal is used to avoid leakage current effect.

66. In MI meter the deflection torque is proportional to

A. square of the current through the coil

B. current through the coil

C. Sine of measurand

D. Square not of measurand

Ans. A

Sol. The instrument in which the moving iron is used for measuring the flow of current or voltage is known as the moving iron instrument. It works on the principle that the iron place near the magnet attracts towards it. The force of attraction depends on the strength of the magnet field.

$$T_d = \frac{1}{2} I^2 \frac{dL}{d\theta}$$

67. Which of the following is an integrating type instrument?

A. Energy meter B. Voltmeter

C. Ammeter D. Wattmeter

Ans. A

Sol. Energy meter is an integrating type instrument whereas voltmeter, ammeter and wattmeter are indicating type instruments.

68. Which one of the following does not employ a null method of measurement?

A. Megger

B. DC potentiometer

C. Kelvin double bridge

D. AC potentiometer

Ans. A

Sol. D.C. potentiometer, kelvin double bridge and ac potentiometer employ a null method of measurement.

69. A dynamometer type instrument can be used on

A. DC only B. AC only

C. Both AC and DC D. Rectified AC

Ans. C

Sol. A dynamometer type or electrodynamometer type instruments can works on both AC and DC.

70. Which of the following is used as a mechanical device for the measurement of pressure?

A. Diaphragms
B. Alphathron
C. Knudsen gauge
D. Thermistor gauge

Ans. A

Sol. Diaphragms have the same operating principle as that of Bellows and the pressure to be measured is applied to it, there is deflection in diaphragms. Which is proportional to the applied pressure.

71. The unit of solid angle is

A. Radian
B. Solid angle
C. Steradian
D. Candela

Ans. C

Sol. The unit of solid angle is steradian. Radian is the SI unit for phase angles. Candela is the SI unit of luminous intensity.

72. A wattmeter has current coil of 0.03 Ω resistance and pressure coil of 4500 Ω resistance. The load voltage is 300 V and 0.6 power factor. What will be the value of load current when error due to both connections will be equal?

A. 20 A
B. 25.81 A
C. 38.5 A
D. 15.7 A

Ans. B

Sol. The two possible connection is-

1) When voltmeter is connected at source end.

2) When voltmeter is connected at load end.

Error in connection (1) is-

$I^2 \times R_C$

error in the connection (2) is-

$= \frac{V_p^2}{R_p}$

For equal error

$I^2 \times 0.03 = \frac{(300)^2}{4500}$

$I = 25.81$ A

73. The flux produced by shunt and series coil of the induction type instruments should be

A. In quadrature with each other

B. In phase with each other

C. Displaced by 45 ° with respect to each other

D. Out of phase with respect to each other

Ans. A

Sol. When the angle between the shunt coil and the series coil is at complementary angle i.e. 90 °, then the flux produced in the instrument is maximum.

74. A d.c voltmeter has a sensitivity of 1000 Ω / V. When it measures half of full scale in 100 V range, the current through the voltmeter will be

A. 100 mA B. 1 mA

C. 0.5 mA D. 50 mA

Ans. B

Sol. Sensitivity of d.c. voltmeter = 100 Ω/volt

For half scale in 100 V range, i.e. 50 V current through the voltmeter,

$$\mathrm{I} = \frac{1}{1000} = 1\ \mathrm{mA}$$

75. Which of the following is the dimension of power?

A. $\left[ML^2T^{-3}\right]$

B. $\left[M^{-1}L^{-2}T^{2}\right]$

C. $\left[ML^2Q^{-1}T^{-2}\right]$

D. $\left[ML^2Q^{-1}T^{-1}\right]$

Ans. A

Sol. The dimension of power is $\left[ML^2T^{-3}\right]$.

76. The AC Bridge used for measurement of dielectric loss of capacitor is

A. Anderson Bridge

B. Schering Bridge

C. Wien Bridge

D. Hay’s Bridge

Ans. B

Sol. Schering Bridge is used for measurement of dielectric loss of capacitor.

77. Two holes are drilled in the disc on a diameter of the energy meter to

A. Increase ventilation

B. Eliminate creeping on no-load

C. Increase deflecting torque

D. Reduce the weight of disc

Ans. B

Sol. To eliminate the creeping on no-load condition two holes are drilled in the disc on a diameter of energy meter.

78. Which one the following can act as an inverse transducer?

A. capacitive transducer

B. Piezo-electric crystal

C. LVDT

D. Electrical resistance potentiometer

Ans. B

Sol. An inverse transducer convert electrical quantity into a non-electrical quantity.
Example: piezo-electrical crystal.

79. What is the purpose of aquadag in CRO?

A. to collect primary electrons

B. to collect secondary emission electron

C. Both primary and secondary emission electrons

D. None of these

Ans. B

Sol. Aquadag coating is used to collect secondary electrons emitted when the electron strikes the screen.

80. A single slide wire is used for measurement of current in a circuit. The voltage drops across a standard resistance of 2 Ω is balanced at 70 cm. What is the magnitude of current if standard cell having an emf of 1.8 V is balanced at 50 cm?

A. 1.05 A B. 1.26 A

C. 0 A D. 2.2 A

Ans. B

Sol. Since standard cell is balanced at 70 cm.
i.e. 70 cm of wire have resistance of 2 Ω.

So, the 50 cm of wire have resistance = $\frac{50}{70} \times 2$ = 1.428 Ω

Since it is balanced by emt of 1.8V

So, V = IR

I = $\frac{1.8}{1.428}$ = 1.26 A

81. What determines light intensity in a CRT ?

A. Voltage B. Current

C. Momentum of electrons D. Fluorescent series

Ans. C

Sol. Momentum of the electrons gives the intensity or brightness of the light emitted from the fluorescent screen due to electron bombardment. It is given as the product of the no. of electrons and their speed.

82. The power of 6 phase circuit can be measured with minimum of

A. Two wattmeter
B. Five wattmeter
C. Six wattmeter
D. Three wattmeter

Ans. B

Sol. According to Blondel's theorem:

The theorem states that the power provided to a system of N conductors is equal to the algebraic sum of the power measured by N watt-meters. The N watt-meters are separately connected such that each one measures the current level in one of the N conductors and the potential level between that conductor and a common point. In a further simplification, if that common point is located on one of the conductors, that conductor's meter can be removed and only N-1 meters are required.

83. Due to inductive effect of pressure coil the wattmeter.

A. reads higher than the ture value at low lagging p.f. and reads lower than the true value at low leading power factor.

B. reads lower than the ture value at low lagging p.f. and reads higher than the ture value at low leading p.f.

C. It will read same as ture value at low power factor.

D. None of these

Ans. A

Sol. Due to inductive effect of pressure coil of the wattmeter error is introduced at low power factor. It reads higher than the ture value at low lagging p.f. and reads lower than the ture value at low leading p.f.

84. Which of the following devices can be used to test the windings of an inductor for continuity?

A. Wheatstone bridge
B. Voltmeter
C. Wattmeter
D. Ohmmeter

Ans. D

Sol. Ohmmeters are used for testing continuity.

85. The meter constant of a single-phase 240 V induction watthour meter is 400 revolutions per kWh. The speed of the meter disc for a current of 10 A of 0.8 p.f. lagging will be

A. 12.8 rpm
B. 16.02 rpm
C. 18.2 rpm
D. 21.1 rpm

Ans. A

Sol. N = (meter constant) × (power) × time(in hours) =

$$N = 400 \times 240 \times 10 \times 0.8 \times \frac{1}{60} \times \frac{1}{1000} = 12.8 \text{ rpm}$$

86. A voltmeter measures a full scale voltage of 100 V produces a full scale error at 10 %. Find the error it voltmeter reads 50 V.

A. 10 %
B. 20 %
C. 5 %
D. 15 %

Ans. B

Sol. $\% \text{ error} = \frac{10}{50} \times 100 = 20\%$

87. Electrostatic instrument are normally used for

A. 10W current measurement
B. high current measurement
C. low voltage measurement
D. high voltage measurement

Ans. D

Sol. Electrostatic instrument uses the static electric field for producing the deflecting torque. The electrostatic instrument is used for measuring the high and low voltage and also the power of the given circuit.

88. Creeping in a 1-φ Induction type energy meter may be due to

A. Over voltage
B. Stray magnetic field
C. over-compensation for friction
D. All the above

Ans. D

Sol. Creeping is a slow but continuous rotation of disc when only pressure coil is excited, but no current is flowing in the circuit. It can be caused due to overcompensation for friction, Vibration, stray magnetic field and over voltage.

89. A resistance thermometer has a temperature coefficient of resonance 10^{-2} per degree and its resistance 10^{-2} per degree and its resistance of 0°C is 2.0 Ω. At what temperature is its resistance 2.1 Ω.

A. 5°C
B. 10°C
C. 50°C
D. 100°C

Ans. A

Sol. $R_2 = R_1(1 + \alpha\Delta T)$

Here, α = temperature coefficient

R_1 = Resistance at 0°C.

R_2 = Resistance at 7°C = 2.1 Ω

$2.1 = 2(1 + 10^{-2}T)$

$2.1 = 2 + 2 \times 10^{-2}T$

$2.1 - 2 = 2 \times 10^{-2}T$

$$T = \frac{0.1}{2 \times 10^{-2}} \Rightarrow \quad T = \frac{10^2}{20} = 5^{\circ}C$$

90. A voltmeter with an internal resistance of 4750 Ω issued to measure the voltage across a resistance of 600 Ω connected in series with a DC series of internal resistance 400 Ω. What is the error in measurement?

A. +5% B. −5%

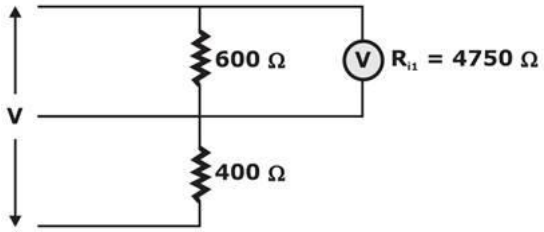
C. +10% D. −10%

Ans. B

Sol. Equivalent resistance of 600 Ω resistor & voltmeter internal resistance.

$$R_{eq} = \frac{4750 \times 600}{4750 + 600}$$

R_{eq} = 532.7 Ω



So, Voltage measured by voltmeter:

$$V_m = \frac{53207 \times V}{532 \cdot 7 + 400} = 0.57V$$

$$V_t = \frac{600V}{600 + 400} = 0.6V$$

$$\%error = \frac{V_M - V_t}{V_t} \times 100 = \frac{0.57 - 0.6}{0.6} \times 100 = -5\%$$

91. The DVM using the dual slope technique has a reference voltage of 100 V and the fixed time 1000 counts. What is the voltage indicated if the counter reads 762 on the downwards slope?

A. E_i = 562 V B. E_i = 662 V

C. E_i = 762 V D. E_i = −762 V

Ans. C

Sol. Reference voltage E_i = 1000 V

Fixed time counts, T_1 = 1000

Counts lead by counter, T_2 = 762

$$E_i = \left(\frac{T_2}{T_1}\right) E_r = \left(\frac{762}{1000}\right)(100) = 762 \text{ V}$$

92. The output of an LVDT is connected to a 5 V voltmeter through an amplifier having an amplification factor of 250. An output of 2 mV appears across the terminals of the LVDT when the core moves through a distance of 0.5 mm.

Calculate the resistivity of the LVDT.

A. 2 mV/nm
B. 2 V/m
C. 4 mV/mm
D. 4 mV/m

Ans. C

Sol.

Sensitivity of LVDT $= \frac{\text{Output voltage}}{\text{Displacement}} = \frac{2 \times 10^{-3}}{0.5}$ = 4 mV/mm

93. The voltage and current measured in a resistive network are 20V and 5A with accuracies of 2% and 1% respectively. Then the value of resistance of the network (in ohms) will be

A. $4 \pm 3\%$
B. $4 \pm 2\%$
C. $20 \pm 3\%$
D. $5 \pm 2\%$

Ans. A

Sol.

$$R = \frac{V}{I} = (20/5) \pm (2+1)\%$$

$$\Rightarrow P = 4 \pm 3\% \; ohms$$

94. If a (0 – 3 mA) meter with a meter resistance of 100Ω is to be converted into a voltmeter of (0 – 3V), then the series resistance to be inserted is?

A. 10 Ω
B. $11.11\ \Omega$
C. $99.9\ K\Omega$
D. 90 KΩ

Ans. C

Sol.

series resistance is given by:

$$R_{se} = R_m(m-1)$$

$$\Rightarrow R_{se} = 100\left(\frac{3}{3 \times 10^{-3}} - 1\right) = 100(999)$$

$$R_{se} = 99.9\ K\Omega$$

95. A 200/1 A CT has primary winding current of 100 A and secondary winding current of 0.45 A . Then find ratio correction factor.

A. 2.54 B. 1.11

C. 2.22 D. 1.55

Ans. B

Sol.

Nominal ratio: $K_n = \frac{200}{1} = 200$

Actual ratio: $R = \frac{100}{0.45} = 222.22$

$\Rightarrow K_n \times \text{ratio correction factor} = \text{R}$

$$\Rightarrow \text{ratio correction factor} = \frac{222.22}{200} = 1.11$$

96. A Q-meter is tuned into resonance at fundamental frequency with a resonating capacitance of 40pF. Resonance obtained at second harmonic with a resonating capacitance of 4pF. What is the self-capacitance of the coli?

A. 24 pF B. 10pF

C. 8 pF D. 4.5 pF

Ans. C

Sol. Self-capacitance of the coil is given by:

$$C_d = \frac{C_1 - n^2 C_2}{n^2 - 1} = \frac{40 - 2^2 \times 4}{2^2 - 1} = 8\,pF$$

97. Full scale deflecting torque of 1A Moving Iron ammeter is $5 \times 10^{-5} N - m$. The rate of change of self-inductance of the instrument at full scale in $"\mu H\ per\ radian"$ is

A. 8 B. 100

C. 40 D. 10

Ans. B

Sol. Deflecting torque in MI instrument is given by:

$$\tau_d = \frac{1}{2} I^2 \frac{dL}{d\theta}$$

$$\Rightarrow \frac{dL}{d\theta} = \frac{2\tau_d}{I^2} = \frac{2 \times 5 \times 10^{-5}}{1} = 100\ \mu H/rad$$

98. A resistor of value 4.7 kΩ is read as 4.65 kΩ in a measurement. Calculate the absolute error?

A. +25 Ω B. –25 Ω

C. +50 Ω D. −50 Ω

Ans. D

Sol.

Total value = R_E = 4.7 kΩ

Measured value = R_M = 4.65 kΩ

∴ Absolute error = δR = R_M = 4.65 kΩ

⇒ δR = −50 Ω

99. A platinum resistance thermometer has resistance of 200 Ω at 20°C . What is the resistance at 100°C . If the temperature coefficient of resistance of the thermometer at 20°C is 0.004?

A. 26.4 Ω B. 2.64 Ω

C. 264 Ω D. 0.264 Ω

Ans. C

Sol.

Temperature T_1 = 20°C

T_2 = 100°C

Resistance at $T_1 \Rightarrow R_1$ = 200 Ω

Temperature coefficient α = 0.004.

Resistance at T_2, $R_2 = R_1(1 + \alpha\Delta T)$

Here, $\Delta T = T_2 - T_1 = 100 - 20 = 80°C$

$R_2 = 200(1 + 0.004 \times 80) = 264\ \Omega$

Therefore, resistance at 100°C is 264 Ω.

100. An analog voltage signal whose highest frequency is 1 kHz is to be digitally coded with a resolution of 0.01% covering the voltage 0 – 10V. Choose the correct statements?

(i) The minimum sampling rate is 2 kHz

(ii) Minimum number of but in the digital code is 13

(iii) Analog value of LSB is 1 mV

A. (i), (ii) and (iii) B. (i) and (iii)

C. (ii) and (iii) D. (i) and (ii)

Ans. B

Sol.

(i) In order that signal may not be lost, sampling frequency should be atleast 2 times the highest frequency in the signal.

∴ $f_s = 2f_n = 2 \times 1$ kHz = 2 kHz

(ii) Resolution $= 0.011\% = \frac{0.01}{100} = \frac{1}{10000} = \frac{1}{2^n} = \frac{1}{L}$

∴ Minimum number of bits n = 14

(iii) Analog value of $\text{LSB} = \frac{10\text{V}}{\text{L}} = \frac{10}{10000}\text{V} = 10^{-3}\text{V} = 1\ \text{mV}$

***