QUIZ – ANSWER KEY

QUIZ NO: 90

TOPIC: ELECTRICAL ENGINEERING

DATE: 19/07/2022

1. In moving iron type instrument because of the hysteresis in the iron parts of the moving system the reading is ?

   [A] Higher on descending value but lower on ascending values

   [B] Higher on ascending values but lower and descending values

   [C] Higher on the both ascending as well as descending values

   [D] Lower on both ascending as well as descending values

Answer: A

Explanation:-

Errors in moving iron meters:

Usually, the following errors occur in a moving iron meters:

1. Friction error
2. Temperature error
3. Error due to stray magnetic fields
4. Hysteresis error
5. Frequency error
6. Waveform error

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Hysteresis error

- Due to the hysteresis effect, error in moving-iron instruments, owing to the magnetic hysteresis effect in the parts of the moving system which are made of iron.
- The magnetism lags behind the current resulting higher reading when descending values of current or voltage are measured than when ascending values are measured.
- The position of poles in the moving iron changes with rotation. This is known as position error and is usually small.
- The hysteresis error is reduced considerably by making the iron parts small, and reducing the length of paths of working fluxes to shortest possible and working of iron at a flux density where hysteresis error is small.

2. Which type of wattmeter can't be used for D.C?

[A] Electrostatic Type

[B] Dynamometer type

[C] Induction type

[D] None of the above

Answer: C

Explanation:-

Induction type instruments

- **These instruments works on AC supply only.** This is based on the principle of induction motor, therefore called induction type instrument.
- We can use these instruments as an ammeter, voltmeter, wattmeter and an energy meter.

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- The scale of induction type instruments is quite uniform and extends over an angle of 300°.
- Currents up to 100 A can be handled by induction type instrument so that their power consumption is fairly large and cost relatively high.

Meter	Measuring quantity
Permanent Magnet Type ammeter	DC current
Induction type ammeter	AC current
Moving iron voltmeter	AC and DC voltage
Moving iron ammeter	AC and DC current

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3. 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

Answer: A
Explanation:-

Error due to Hysteresis:- This source of error is due to hysteresis in the soft Iron part, due to which too high values are recorded by the instrument when the current is increasing and too low readings are liable to be indicated when the current is decreasing.

Hysteresis Loss = $K_h \times B_M^{1.67} \times f \times v$ watts

where Kh is the Hysteresis coefficient depends upon the material. The smaller the value of Kh of a magnetic material, the lesser is the hysteresis loss. The armatures of electrical machines and transformer cores are made of magnetic materials having low hysteresis coefficient in order to reduce the hysteresis loss. The steels have Kh values around 130, for cast steel they are around 2500 and for cast iron about 3750.

Errors due to Stray fields:- External stray magnetic fields are liable to affect adversely the accurate functioning of the instrument. Magnetic shielding of the working parts is obtained by using a covering of cast iron.

Errors with A.C only

Errors may be caused due to change km frequency because the change in frequency produces ;

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(i) change in impedance of the coil and

(ii) change in magnitude of eddy currents.

The error due to the former is negligible in ammeters, as the coil current is determined by the external circuit and the error due to the latter can normally be made small.

4. When the damping of an instrument is adjusted to enable the pointer to rise quickly to its deflected position without overshooting in that case the instrument is said to be

[A] Dead beat

[B] Off-Beat

[C] Over damped

[D] Under damped

Answer: A

Explanation:-

If the instrument is under-damped, the moving system oscillates a lot before it dismally settles down to its steady value.

In case of critically damped instruments, the pointer reaches its final steady position rapidly and smoothly. Such an instrument is also called dead-beat instrument.

An over-damped instrument produces damping torque more than the required value, as such the pointer moves slowly to its final steady-state value.

5. A wattmeter is marked 15 A/30 A, 300 V/600 V and it's scale is marked up

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to 4500 watts. When the meter is connected to 30 A, 600 V, the point indicated 2000 watts. The actual power of the circuit is

[A] 2000 watts

[B] 4000 watts

[C] 6000 watts

[D] 8000 watts

Answer: D

Explanation:-

Power consumed by wattmeter **= CT ratio x PT ratio x VIcosΦ……..1**

In the above question;

Power consumed by wattmeter = 2000 watts

CT ratio = 15 / 30

PT ratio = 300 / 600

VI = 600 x 30

Putting all the value in equation number 1 we get;

2000=(15/30) x (300/600) x 600 x 30 x cosΦ

CosΦ = 0.4444

Power = VI cosΦ = 600 x 30 x 0.4444

Power = 7999.2 ≅ 8000 watts

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6. Resistance is measured by the voltmeter ammeter method. The voltmeter reading is 50 V on 100 Volts scale and ammeter reading is 50 mA on 100 mA scale. If both the meter are guaranteed for accuracy within 2% of full scale, the limit within which resistance is measured will be ?

   [A] 10Ω

   [B] 20Ω

   [C] 80Ω

   [D] 40Ω

   Answer: C

   Explanation:-

   Given Reading on voltmeter and ammeter is;

   V = 50 V

   I = 50 mA

   Resistance R = V/I = $50/50 \times 10^{-3}$ = 1KΩ

   Limiting error in voltmeter at full scale is

   δE = ± 2% of 100

   δE = ±2V

   Thus when the reading is 50 V, the error will still be 2 V. Hence the % limiting error

   = (2/50)x100 = 4%

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Limiting error in ammeter at full scale is

$\delta E = \pm 2\%$ of 100

$\delta E = \pm 2$mvA

Thus when the reading is 50mA, the error will still be 2mA. Hence the % limiting error

= (2/50)x100 = 4%

Total Limiting Error = 4% + 4% = 8%

Limiting Error value of resistance

8% of 1000 = 8 × 1000/100 = 80Ω

7. A meter has a constant of 600 revolutions per kWh. If the meter makes 10 revolutions in 20 seconds, what is the load in kW?

   [A] 0.75 kW

   [B] 1.5 kW

   [C] 3 kW

   [D] 6 kW

Answer: C

Explanation:-

Meter constant K = Number of revolution/Kwh (rev/kWh)

Number of revolution = 10

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Energy consumed when the disc made 10 revolution

= 10 × 1/600 = 1/60 KWh

Now energy consumed is equal to load in kW multiplied by time in hours i.e.

Load × 20/3600 = 1/60

Load = 3600/120

Load = 3 kW

8. A 220 V single phase meter has a constant load current of 5.0 A passing through it for 2 hours, at unity power factor. If the meter disc makes 1056 revolution during this period. What is the meter constant in revolutions/kWh?
   [A] 120
   [B] 240
   [C] 360
   [D] 480

Answer: D

Explanation:-

Energy consumed in two hours = V.I.cosϕ.t

Where;

Voltage V = 220 V

Current I = 5 A

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Power factor cosϕ = 1

Time (t) = 2 hours

Number of revolution = 1056

Energy consumed = 220 × 5 × 1 × 2 = 2.2 kWh

Meter constant K = Number of revolution/Kwh (rev/kWh)

K = 1056/2.2 = 480 rev/kWh

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9. A balanced three-phase star-connected load draws power from a 440 V supply. The two connected wattmeters, W_1 and W_2, indicate 5 kW and 1200 W. Calculate the total power.

   [A] 5 kW

   [B] 6,200 kW

   [C] 62 kW

   [D] 6,200 W

   Answer: D

   Explanation:-

   The sum of two wattmeters gives the total power consumption in the three-phase load i.e

   Total Power = $P_1 + P_2$

   Reading of wattmeter 1

   W_1 = 5 kW = 5000 watts

   Reading of wattmeter 2

   W_2 = 1200 watts

   Total power = 5000 + 1200 = **6200 watts**

10. The reading on the ammeters connected for the three ammeter method of power measurement is 2.0 A, 4 A and 6 A in the non-inductive resistor, the load and the main respectively. The terminal voltage is 300V. The non-inductive resistance of the load is ?

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[A] 150 ohms

[B] 75 ohms

[C] 50 ohms

[D] 25 ohms

Answer: A

Explanation:-

Given:

I_1 = 2.0 A; I_2 =4 A; I_3 = 6 A

V = 300 V

Non-inductive resistance, R = (V/I_1) = 300/2 = **150Ω**