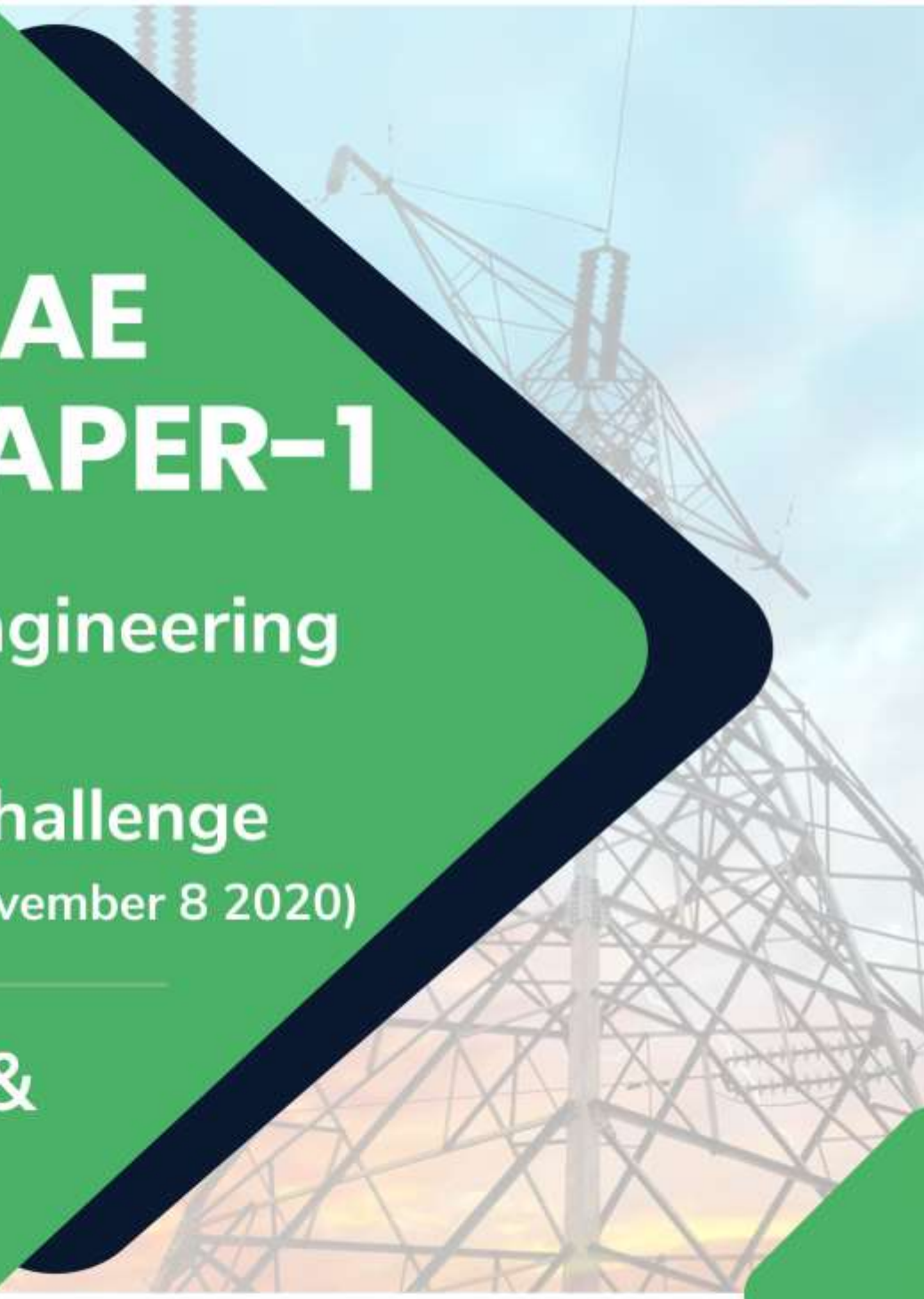
MEGA MOCK CHALLENGE

gradeup



UPPSC AE 2020 PAPER-1

Electrical Engineering

Mini Mock Challenge

(November 7 - November 8 2020)

Questions & Solutions

1. सही मुहावरे को मिलायें।

A) अपना उल्लू सीधा करना - 1. कंगाल होना

B) उन्नीस बीस का अंतर होना - 2. जबरदस्त बदला लेना

C) ईंट का जबाब पत्थर से देना - 3. बहुत कम अंतर होना

D) फूटी कौड़ी न होना - 4. मतलब निकालना

A. A-1 B-2 C-3 D-4
B. A-4 B-1 C-3 D-2
C. A-4 B-3 C-2 D-1
D. A-2 B-4 C-3 D-1

Ans. C

Sol. मुहावरों का अर्थ - मुहावरे का शाब्दिक अर्थ होता है - अभ्यास। विशेष अर्थ को प्रकट करने वाले वाक्यांश को मुहावरा कहते हैं।

अपना उल्लू सीधा करना - मतलब निकालना

उन्नीस बीस का अंतर होना - बहुत कम अंतर होना

ईंट का जबाब पत्थर से देना - जबरदस्त बदला लेना

फूटी कौड़ी न होना - कंगाल होना

2. निम्नलिखित में से कौन-सा शब्द बहुवचन है?

A. पुस्तक
B. लड़का
C. पौधा
D. प्राण

Ans. D

Sol. वचन - शब्द के जिस रूप से उसके एक अथवा अनेक होने का बोध हो उसे वचन कहते हैं।

बहुवचन - शब्द के जिस रूप से अनेकता का बोध हो उसे बहुवचन कहते हैं। जैसे- रोटियाँ, बेटे आदि।

प्राण, दर्शन और हस्ताक्षर हिंदी में वे गिने-चुने शब्द हैं जो हमेशा बहुवचन रूप में उपयोग किए जाते हैं। **उदाहरण:** प्राण सभी को प्यारे होते हैं।

लड़का - लड़के

पौधा - पौधे

पुस्तक - पुस्तकें

3. "**परिश्रम के बाद विश्राम आवश्यक है**" वाक्य के लिए उपयुक्त लोकोक्ति है।

A. दाँतो तले ऊँगली दबाना
B. थका ऊँट सराय ताकता है
C. आज काज महाकाज
D. बाँह गहे की लाज

Ans. B

Sol. लोकोक्ति - किसी विशेष स्थान पर प्रसिद्ध हो जाने वाले कथन को 'लोकोक्ति' कहते हैं।

"थका ऊँट सराय ताकता है" - परिश्रम के बाद विश्राम आवश्यक है

अन्य लोकोक्तियाँ -

दाँतो तले ऊँगली दबाना - आश्चर्यचकित रह जाना

आज काज महाकाज - स्वंय करने पर ही कार्य ठीक होता है

बाँह गहे की लाज - शरणागत की रक्षा करना

4. **'मुझसे उठा नहीं गया'** वाक्य में वाच्य है।

A. कृत्रवाच्य
B. कर्मवाच्य
C. भाववाच्य
D. उपर्युक्त में से कोई नहीं

Ans. C

Sol. **भाववाच्य -** क्रिया के उस रूपान्तर को भाववाच्य कहते हैं, जिससे वाक्य में क्रिया अथवा भाव की प्रधानता का बोध हो । क्रिया के लिंग वचन कर्म के लिंग एवं वचन के अनुसार होते है।

जैसे- मोहन से टहला भी नहीं जाता।

वाच्य का अर्थ: क्रिया के उस परिवर्तन को वाच्य कहते हैं, जिसके द्वारा इस बात का बोध होता है कि वाक्य के अन्तर्गत कर्ता, कर्म या भाव में से किसकी प्रधानता है।

5. **'हतभागी'** का स्त्रीलिंग शब्द है।

A. हतभागनी
B. हतभाग्यवती
C. हतभाग्या
D. हतभागु

Ans. C

Sol. लिंग -"संज्ञा के जिस रूप से व्यक्ति या वस्तु की नर या मादा जाति का बोध हो, उसे व्याकरण में 'लिंग' कहते है।

स्त्रीलिंग - जिस संज्ञा शब्द से स्त्री जाति का बोध होता है, उसे स्त्रीलिंग कहते है।

हतभागी शब्द पुल्लिंग है जिसका स्त्रीलिंग शब्द हतभाग्या होता है।

हतभागी शब्द का अर्थ - अभागा, बदकिस्मत, भाग्यहीन

6. इस वाक्य में किस प्रकार के चिन्हों का प्रयोग हुआ है?

"आह! बहुत दर्द हो रहा है।"

A. कोष्ठक चिन्ह+विराम
B. विराम चिन्ह+अर्द्ध विराम
C. अर्द्ध विराम+प्रश्नवाचक
D. विस्मयादिबोधक+पूर्ण विराम

Ans. D

Sol. दिए गए वाक्य में सबसे पहले आह के बाद विस्मयादि बोधक चिन्ह का प्रयोग हुआ है। इस चिन्ह का प्रयोग विस्मय, शोक, घृणा, प्रेम आदि की स्थिति में किया जाता है जबकि वाक्य के अंत में पूर्ण विराम के चिन्ह का उपयोग हुआ है।

7. निम्नलिखित में से कौन-सा 'ओष्ठ्य' वर्ण नहीं है?

A. ट्
B. प्
C. फ्
D. भ्

Ans. A

Sol. वर्णमाला : हिंदी भाषा की सबसे छोटी इकाई ध्वनि होती है। इसी ध्वनि को ही वर्ण कहा जाता है। वर्णों को व्यवस्थित करने के समूह को वर्णमाला कहते हैं।

उच्चारण स्थान - मुख के जिस स्थान से जो वर्ण या ध्वनि निकलती है , वह भाग उसका उच्चारण स्थान है।

ओष्ठ्य उच्चारण स्थल से उच्चारित वर्ण – प् फ् ब् भ् म्

अन्य वर्ण -

1. कण्ठ्य – कवर्ग- क् ख् ग् घ् ङ्
2. तालव्य – चवर्ग- च् छ् ज् झ् ञ्
3. मूर्द्धन्य – टवर्ग- ट् ठ् ड् ढ् ण् (ड् ढ्)
4. दन्त्य – तवर्ग- त् थ् द् ध् न्

8. निम्न में से गुण संधि है –

A. प्राणायाम
B. हितैषी
C. वीरोचित
D. अत्यधिक

Ans. C

Sol. प्राणायाम = प्राण + आयाम

हितैषी = हित + ऐषी

वीरोचित = वीर+उचित

अत्यधिक = अति + अधिक

9. जोड़कर लिखिए । (समानार्थक शब्द)

'अ'	'b'
A. धरा	1) इच्छा
B. अभिलाषा	2) काला
C. कृष्ण	3) धरती
D. गगन	4) नभ

A. a-3 b-1 c-2 d-4
B. a-1 b-3 c-2 d-4
C. a-3 b-2 c-1 d-4
D. a-2 b-1 c-3 d-4

Ans. A

Sol. शब्दों के अर्थ -

धरा- धरती, पृथ्वी, संसार अथवा जमीन को कहते हैं।

अभिलाषा-मन की चाह, कामना अथवा इच्छा को कहते हैं।

कृष्ण-इसका अर्थ काला अथवा श्याम होता है|

गगन- गगन का अर्थ आकाश, नभ अथवा आसमान होता है।

10. निम्नलिखित में से शुद्ध वाक्य है -

A. कोहिनूर एक अमूल्य हीरा है।
B. परीक्षा की प्रणाली बदलनी चाहिए।
C. विख्यात आतंकवादी मारा गया।
D. राम ने रावण की हत्या की।

Ans. B

Sol. परीक्षा की प्रणाली बदलनी चाहिए" वाक्य शुद्ध है अन्य विकल्पों में व्याकरण सम्बन्धी अशुद्धि हैं -

राम ने रावण की हत्या की। - राम ने रावण का वध किया ।

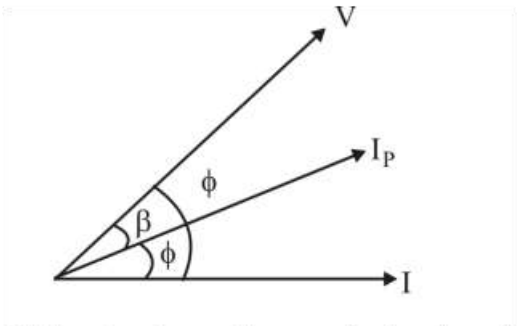
विख्यात आतंकवादी नारा गया। - कुख्यात आतंकवादी मारा गया ।

कोहिनूर एक अमूल्य हीरा है। - कोहिनूर एक बहुमूल्य हीरा है ।

11. In electrodynamometer type wattmeters, the indcutance of a pressure coil produces error. The error is
A. Constant irrespective of the power factor of the load
B. higher at high power factor load
C. highter at low power factor load
D. highter at unity power factor load

Ans. C

Sol. In an ideal wattmeter, the current in the pressure coil is in phase with the applied voltage. If the pressure coil of wattmeter has an inductance, than the current in it will lag the voltage by an angle b as shown in the phasor diagram. This will produce some serious error in meausrement specially at low power factors



Wattmeter phasor diagram for lagging pf

12. An LTI system has impulse response h(t) = u(t – 1). If the input to this system is x(t) = u(t – 2), then the output is given by

A. u(t – 3)
B. tu(t – 3)
C. (t – 3)u(t- 3)
D. (t – 3)u(t)

Ans. C

Sol. Output of an LTI system is given by

$$y(t) = x(t) * h(t) = u(t-2) * u(t-1)$$

$$\Rightarrow y(t) = r(t-3)$$

$$\Rightarrow y(t) = (t-3)u(t-3)$$

13. When starting a differentially connected compound motors, it is desirable to short circuit the series field winding to .....

A. avoid very high starting time.
B. avoid exercise starting speed
C. prevent the motor from starting in reverse direction
D. avoid heavy inrush of current

Ans. C

Sol. For differentially compounded motor:

$\varphi_{net} = \varphi_{shunt} - \varphi_{series}$

So,

when $\varphi_{series} > \varphi_{shunt}$ then motor may start in reverse direction.

14. Positive feedback increases.

A. System gain
B. System stability
C. System stability and gain
D. None of the above

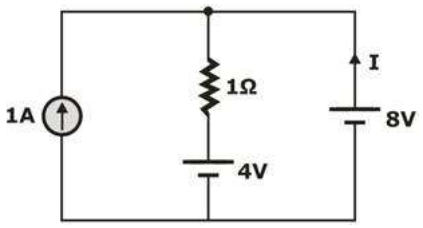
Ans. A

Sol. Positive feedback means that when some part of output is added in phase with input.

Hence, the gain of system increases.

It decreases the stability of system.

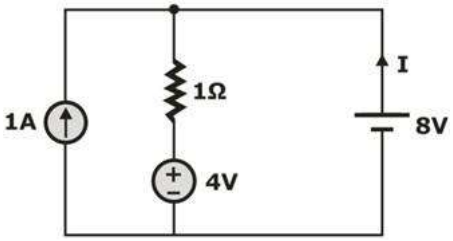
15. In the circuit shown below, find the value of current supplied by 8V source.



A. 2A
B. 3A
C. – 2A
D. – 3A

Ans. B

Sol.



Current through 1Ω resistance = $\frac{8-4}{1} = 4A$ applying kCL at node P

I + 1 – 4 = 0

I = 3

16. The open loop gain of unity feedback system is $G(B) = \frac{K}{s(s+1)(s+3)}$

The natural frequency of oscillation when tw1o poles lies on jω axis is

A. 3 rad/sec
B. 2 rad/sec
C. $\sqrt{2}$ rad/sec
D. $\sqrt{3}$ rad/sec

Ans. D

Sol. Characteristic equation ⇒ 1 + G(s) H(s) = 0

$$1 + \frac{K}{s(s+1)(s+3)} = 0$$

$s^3 + 4s^2 + 3s + K = 0$

Routh-Hurwitz criteria

s^3	1	3
s^2	4	K
s^1	$\frac{12-K}{4}$	0
s^0	K	

For poles on jω axis

$\frac{12-K}{4} = 0 \Rightarrow K = 12$

Auxiliary equation

$4s^2 + 12 = 0$

$s^2 = -3$

$s = j\sqrt{3}$

Frequency of oscillation = $\sqrt{3}$ rad/sec

17. Hartley oscillator is commonly used in

A. Radio receivers
B. Radio transmitters
C. TV receivers
D. None

Ans. A

Sol. The Hartley oscillator is an electronic oscillator circuit in which the oscillation frequency is determined by a tuned circuit consisting of capacitors and inductors, that is, an LC oscillator. It is commonly used in Radio receivers.

18. A DC series motor drives a constant power load. It is running at rated speed and rated voltage. If the current has to be brought down to 0.5p.u, the speed has to be approximately equal to

A. 8 times N_1
B. 2 times N_1
C. 4 times N_1
D. 12 times N_1

Ans. C

Sol. For constant power drive

NT= constant

$T \alpha I_a^2$ [for series motor]

$\therefore N_1 I_{a1}^2 = N_2 I_{a2}^2$

$$\frac{I_{a2}^2}{I_{a1}^2} = \frac{N_1}{N_2}$$

$$N_2 = N_1 \left(\frac{I_{a1}}{I_{a2}}\right)^2$$

$$N_2 = N_1 \left(\frac{I_{a1}}{0.5\, I_{a1}}\right)^2 = 4N_1$$

So, N_2 = 4 times N_1

19. A network has 10 nodes 6 independent loops, the number of branches in the network will be-

A. 10
B. 15
C. 9
D. 5

Ans. B

Sol. The number of independent loops

(L) = (B – N + 1)

B = no of branches

N = no of nodes

$\boxed{6 = (B - N + 1)} \Rightarrow B - 10 + 1 = 6$

Number of Branches (B) = 15 Ans.

20. A generator - transformer unit is connected to a line though a circuit breaker. When a three-phase fault occurs on the line just beyond the circuit breaker, the momentary current in the breaker is equal to

A. $\sqrt{2}$ × symmetrical rms AC current magnitude

B. Symmetrical rms AC current magnitude

C. 1.6 × symmetrical rms AC current magnitude

D. $\sqrt{3}$ × symmetrical rms AC current magnitude

Ans. C

Sol. Momentary current = 1.6 × symmetrical rms AC current magnitude

21. The deal op-amp has

A. infinite voltage gain and zero input impedance

B. infinite voltage gain and infinite Bandwidth.

C. Zero voltage gain and infinite CMRR

D. Zero output impedance and zero CMRR

Ans. B

Sol. Option B is correct.

22. The signal $x(t) = te^{-\frac{t}{\tau}}u(t)$ represents

A. Energy signal

B. Power signal

C. Neither energy nor power signal

D. None

Ans. A

Sol. As $t \to \infty$, the signal $x(t) \to 0$

So, it is an energy signal.

23. Convolution of two sequences $X_1[n]$ and $X_2[n]$ is represented as

A. $X_1(z) * X_2(z)$

B. $X_1(z)X_2(z)$

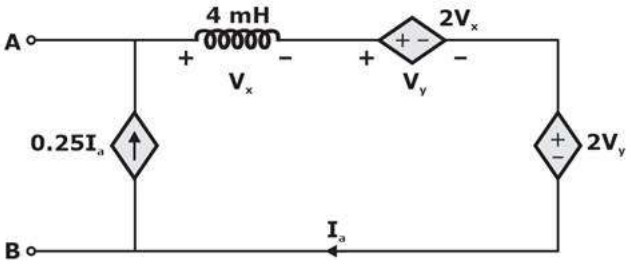
C. $X_1(z) + X_2(z)$

D. $\frac{X_1(z)}{X_2(z)}$

Ans. B

Sol. Convolution in time domain results multiplication in frequency domain.

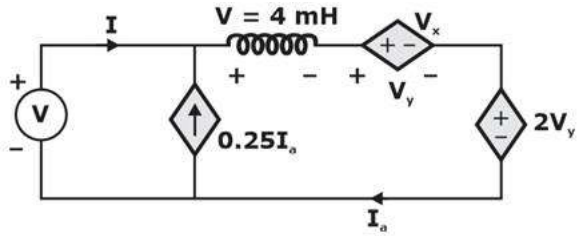
24. The equivalent inductance seen between terminals A and B is



A. 28 mH
B. 21 mH
C. 27.33 mH
D. 37.33 mH

Ans. D

Sol. By connecting Voltage source V across AB.



By KVL,

$V = V_x + V_y + 2V_y$

$V = V_x + 3V_y$

$V = V_x + 3[2V_x]$ [$\because V_y = 2V_x$]

$$V = 28 \times 10^{-3} \frac{dI_a}{dt} \quad ...(1)$$

$$I_a = \frac{4}{3} I \quad ...(2)$$

From equation (1) and (2),

$$V = 28 \times 10^{-3} \times \frac{4}{3}\left[\frac{dI}{dt}\right]$$

$$\frac{V}{(dI/dt)} = 37.33\ mH$$

$$\boxed{Leq = 37.33\ mH}$$

25. Dynamic braking can be used for which of the following?

A. Shunt motor only
B. Series motor only
C. Both shunt and series motor
D. None of the above

Ans. C

Sol. Dynamic braking can be used for both shunt and series motor.

26. Planes Z = 0 and Z = 4 carry current $\vec{K} = -20\hat{a}_x$ A/m and $\vec{K} = 10\hat{a}_x$ A/m respectively.

Determine $\vec{H}$ at. (0, –1, 3)

A. 0

B. $-20\hat{a}_x$

C. $20\hat{a}_x$

D. $20\hat{a}_y$

Ans. D

Sol. At (0, –1, 3), which is in between the plates (0 < z = 3 < 4)

$$\vec{H} = \vec{H}_0 + \vec{H}_4$$

$$\vec{H}_0 = \frac{1}{2}\vec{K} \times \vec{a}_n = \frac{1}{2}(-20\hat{a}_x) \times \hat{a}_z = 10\hat{a}_y \text{ A/m}$$

$$\vec{H}_4 = \frac{1}{2}\vec{K} \times \hat{a}_n = \frac{1}{2}(10\hat{a}_x) \times (\hat{a}_z) = 10\hat{a}_y \text{ A/m}$$

$$\vec{H} = 20\ \hat{a}_y \text{ A/m}$$

27. Why BJT amplifiers have high gain than FET amplifiers ?

A. Because of Bipolar charge carriers.

B. Due to high input impedance of FET gain decreases

C. BJT has larger area

D. Transconductance of BJT is higher than FET.

Ans. D

Sol. Since generally in common emitter/common source , gain = $g_m R_L$

g_m = transconductance

Since $g_m \uparrow\uparrow$ (high) for BJT so,

BJT amplifier has high gain.

28. If $\vec{F}(\rho, \phi, z) = \rho\vec{a}_\rho + \rho \sin^2\phi\ \hat{a}_\phi - Z\hat{a}_z$, which of arc of the following is correct?

A. $\nabla \cdot \vec{F}|_{\phi=0} < \nabla \cdot \vec{F}|_{\phi=\pi/2}$

B. $\nabla \cdot \vec{F}|_{\phi=\pi/4} = \nabla \cdot \vec{F}|_{\phi=0}$

C. $\nabla \cdot \vec{F}|_{\phi=\pi/4} = 2\nabla \cdot \vec{F}|_{\phi=0}$

D. $\nabla \cdot \vec{F}|_{\phi=0} > \vec{\nabla} \cdot \vec{F}|_{\phi=\pi/2}$

Ans. C

Sol. $\vec{F}(\rho, \phi, z) = \rho\hat{a}_f + \rho \sin^2\phi\hat{a}_\phi - z\hat{a}_z$

$$\vec{\nabla} \cdot \vec{F} = \frac{1}{\rho}\frac{\partial}{\partial p}(\phi f_\rho) + \frac{1}{\rho}\frac{\partial f_\phi}{\partial \phi} + \frac{\partial \hat{f}_z}{\partial z} = \frac{1}{\rho}\left[\frac{\partial}{\partial \rho}\rho^2 + \frac{\partial}{\partial \phi}\rho \sin^2\phi + \frac{\partial}{\partial z}\rho(-z)\right]$$

$$\nabla \cdot \vec{F} = 1 + \sin 2\phi$$

$$\nabla \cdot \vec{F}\Big|_{\phi=T/4} = 1 + \sin\frac{\pi}{2} = 2$$

$$\vec{\nabla} \cdot \vec{F}\Big|_{\phi=0} = 1$$

Hence, $\vec{\nabla} \cdot \vec{F}\Big|_{\phi=\pi/4} = 2\nabla \cdot \vec{F}\Big|_{\phi=0}$

29. A power station has a maximum demand of 2 MW. The plant capacity factor is 15%. Find out the value of load factor for the reserve capacity of 3.33 MW.

A. 40% B. 50%

C. 60% D. 80%

Ans. A

Sol. Reserve capacity = (Plant capacity - peak load)

3.33 = Plant capacity – 2

Plant capacity = 5.33 MW

Rated demand = 5.33 MW

Plant capacity factor

$$= \frac{\text{Average Demand}}{\text{Rated Demand}}$$

Average Demand = 0.15 × 5.33

=0.7995 MW

Average Demand ≃ 0.8 MW

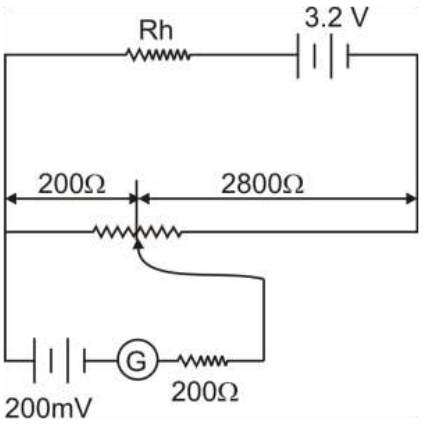
Load factor

$$= \frac{\text{Average Demand}}{\text{Maximum Demand}}$$

Load factor = 0.4 ≃ 40%

30. In the potentiometer circuit shown in figure balance is obtained.

When the value of R_h is (in Ω).



A. 200 B. 320

C. 160 D. 250

Ans. A

Sol.

$$I_w \times 200 = 200\,mV$$

$$I_w = 1\,mA$$

$$\therefore I_w = \frac{3.2}{R_h + 200 + 2800}$$

$$1mA = \frac{3.2}{R_h + 3000}$$

$$R_h + 3000 = \frac{3.2}{1mA} = 3200$$

$$R_h = 200\Omega$$

31. The open loop transfer function of a unity feedback system is G(s) = $\frac{98}{(s+1)(s+2)}$. The steady state error for input, x(t) = 2u(t)

A. 0.02 B. 0.04

C. 0.08 D. 0.01

Ans. B

Sol. For step input,

Steady state error can be expressed as:

$e_{ss} = \frac{A}{1 + K_p}$, where K_P is position constant

$$K_p = \lim_{s \to 0} G(s)\,H(s)$$

$$K_p = \lim_{s \to 0} \frac{98}{(s+1)(s+2)} = 49$$

$$e_{ss} = \frac{2}{1 + 49} = 0.04$$

32. If a 10-bus test system contains 12 transmission lines and one transformer, how many non-zero elements are there in the system Y-Bus?

A. 36 B. 34

C. 64 D. 66

Ans. A

Sol. Number of Transmission lines = 12

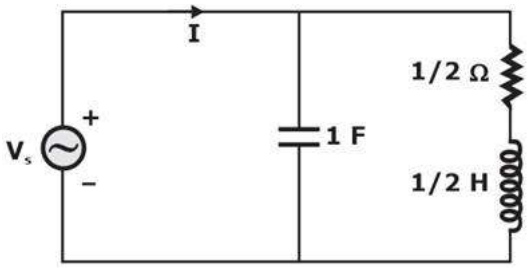
Number of Transformer = 1

Total elements = (12 + 1) = 13

Size of Y-Bus = 10 × 10 = 100

So, Number of Non-zero elements = (13 × 2) + 10 = 36

33. If V_S = sint V, then the current I is:



A. sin (t – 45°)A
B. sint A
C. cos t A
D. 0

Ans. B

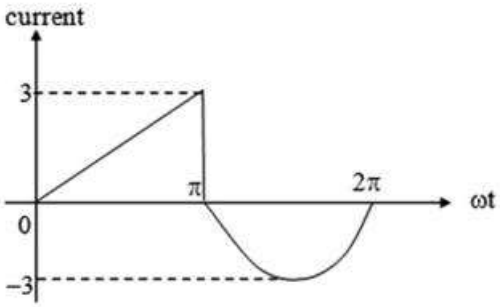
Sol. $Y_L = \frac{1}{\frac{1}{2} + \frac{1}{2}j} = (1 - j)\ \Omega^{-1}$

$Y_C = Y_L = j\omega C = j\ \Omega^{-1}$

$Y = Y_C + Y_L = 1\ \Omega^{-1}$

$I = YV = 1 \times \text{sint} = \text{sint A}$

34. A current waveform shown in the figure is fed to a moving iron ammeter.



The meter reading will be

A. 3.75A
B. 0.375A
C. 1.936A
D. 0.1936A

Ans. C

Sol. A moving iron meter measures RMS current

$$I^2rms = \frac{1}{2\pi}\left[\int_0^{\pi} \frac{9(\omega t)^2}{\pi^2} d\omega t + \int_{\pi}^{2\pi} 9\sin^2(\omega t)\, d\omega t\right]$$

$$= \frac{1}{2\pi}\left[\int_0^{\pi} \frac{9(\omega t)^2}{\pi^2} d\omega t + \int_{\pi}^{2\pi} \frac{9(1-\cos 2\omega t)}{2} d\omega t\right]$$

$$= \frac{9}{2\pi}\left[\left[\frac{(\omega t)^3}{3\pi^2}\right]_0^{\pi} + \left[\frac{\omega t}{2} - \frac{\sin 2\omega t}{4}\right]_{\pi}^{2\pi}\right]$$

$$= \frac{9}{2\pi}\left[\frac{\pi}{3}+\frac{2\pi}{2}-\frac{\pi}{2}\right] = \frac{9}{2}\left[\frac{1}{3}+\frac{1}{2}\right]$$

$$= \frac{9}{2}\times\left[\frac{5}{6}\right] = \frac{15}{4}$$

$$I_{RMS} = \sqrt{\frac{15}{4}} = 1.936A$$

35. Let U[n] be the unit step signal and

$$x[n] = \left(\frac{1}{2}\right)^n u[n] + \left(-\frac{1}{3}\right)^n u[n]$$

The region of convergence of z-transform of X[n] is

A. $|z| > \frac{1}{3}$

B. $\frac{1}{3} < |z| < \frac{1}{2}$

C. $|z| > \frac{1}{2}$

D. $|z| < \frac{1}{2}$

Ans. C

Sol. $x[n] = \left(\frac{1}{2}\right)^n u[n] + \left(-\frac{1}{3}\right)^n u[n]$

Taking z-transform of equation (i) we get

$$x(z) = \frac{z}{z-\frac{1}{2}} + \frac{z}{z+\frac{1}{3}}$$

So, the region of convergence is

$$z-\frac{1}{2} > 0 \text{ and } z+\frac{1}{3} > 0$$

$$\text{or } |z| > \frac{1}{2} \text{ and } |z| > -\frac{1}{3}$$

Thus, the common ROC will be

$$|z| > \frac{1}{2}$$

36. In a single phase transformer hysteresis and eddy current losses are 300W and 200W respectively at 50 Hz operation. If V/f is constant determine the core losses at 60 Hz operation

A. 248

B. 488

C. 648

D. 722

Ans. C

Sol. If V/f is constant

Then,

P_h is directly proportional to f

P_e is directly proportional to f^2

So, $\frac{P_{h(new)}}{P_{h(old)}} = \frac{60}{50}$

$P_{h(new)} = \frac{60}{50} \times 300$

$P_{h\,(new)} = 360$

and

$\frac{P_{e(new)}}{P_{e(old)}} = \frac{(60)^2}{(50)^2}$

$P_{e(new)} = \frac{60^2}{50^2} \times P_e(old)$

$P_{e(new)} = \frac{60^2}{50^2} \times 200 = 288$

Total losses at 60 Hz operation = 360 + 288 = 648

37. The condition at which the steady stale stability limit (P_{max}) is maximum for short transmission line is

A. X = R

B. X = ZR

C. X = $\sqrt{2}$ R

D. X = $\sqrt{3}$ R

Ans. D

Sol. The equation for receiving end power is given as

$$P_R = \frac{V_S V_R}{B}\cos(\beta - \delta) - \frac{AV_R^2}{B}\cos(\beta - \alpha)$$

For short transmission line,

$A = 1\angle 0°$

$B = Z\angle\theta°$

$$P_{R\,max} = \frac{V_S V_R}{Z} - \frac{V_R^2}{Z}\cos\theta$$

For $V_S = V_R$,

$$P_{R\,max} = V_R^2\left[\frac{1}{\sqrt{R^2 + X^2}} - \frac{R}{R^2 + X^2}\right]$$

For $P_{R\,max}$ to be maximum $\frac{dP_{R\,max}}{dX} = 0$

$\therefore X = \sqrt{3}\,R$

38. A $3\frac{1}{2}$ digit digital voltmeter is used for voltage measurement. How would 11.25 V be displayed on 10V range?

A. 011.2 V
B. 11.2 V
C. 11.25 V
D. none of these

Ans. C

Sol. Resolution on 10V range:

$$R = \frac{1}{10^3} \times 10 = 00.01$$

The display is 11.25

39. The maximum efficiency for a transformer occurs at 80% of full load. Its core loss is P_c and ohmic loss is P_{on}. For this transformer, the ratio $\frac{P_c}{P_{oh}}$ is

A. 0.8
B. 1.25
C. 0.64
D. 0.84

Ans. C

Sol. Percentage of load at $\eta_{max} = \sqrt{\frac{P_i}{P_{cu}\text{loss}}}$

So, $\sqrt{\frac{P_c}{P_{oh}}} = \frac{64}{100} = 0.64$

40. The Fourier transform of unit step sequence is

A. $\pi\delta(\Omega)$
B. $\frac{1}{1-e^{-j\Omega}}$
C. $\pi\delta(\Omega) + \frac{1}{1-e^{-j\Omega}}$
D. $1-e^{-j\Omega}$

Ans. C

Sol. $u(n) \xrightarrow{F.T.} \frac{1}{1-e^{-j\Omega}} + \pi\delta(\Omega)$

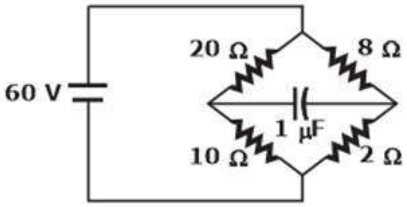
41. Which of the following statement is NOT correct regarding polar plot.

A. Polar plot is used for stability analysis
B. Polar plot is not used for response analysis.
C. The number of roots causing instability can be obtained.
D. None of the above

Ans. C

Sol. The number of roots causing instability cannot be obtained.

42. In the below figure the stored energy of the capacitor is-



A. 32 μJ
B. 64 μJ
C. 128 μJ
D. 16 μJ

Ans. A

Sol. Voltage across capacitor will be:

$$V_C = \left(\frac{10}{20+10} - \frac{2}{2+8}\right) \times 60$$

$V_C = 8$ V

Energy stored in the capacitor.

$$E = \frac{1}{2}CV^2 = \frac{1}{2} \times 1 \times 10^{-6} \times 8^2$$

$$\boxed{E = 32\ \mu J}$$

43. A current filament element carrying 20 A in the $\hat{a}_x$ direction lies along entire x-axis.

Find $\bar{H}$ in cartesian coordinates at [4, 0. √20]

A. 0.711 $\hat{a}_y$
B. –0.711 $\hat{a}_x$
C. –0.711 $\hat{a}_y$
D. 0.711 $\hat{a}_x$

Ans. C

Sol. $\bar{H} = \frac{I}{2\pi\rho}\hat{a}_\phi$

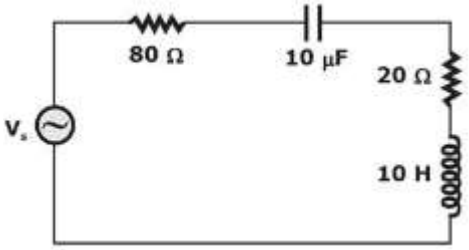
$I = 20$ A

$\rho = \sqrt{20}$

$\hat{a}_\phi = \hat{a}_e \times \hat{a}_f = \hat{a}_x \times \hat{a}_z = -\hat{a}_y$

$$\bar{H} = -\frac{20}{2\pi \times \sqrt{20}}\hat{a}_y = -0.177\hat{a}_y$$

44. The Bandwidth of the circuit shown below:



A. 3.18 Hz
B. 1.59 Hz
C. 10 Hz
D. 0.318 Hz

Ans. B

Sol. In case of series Resonance circuit,

$$\text{Bandwidth} = \frac{R}{L}\ \text{rad/sec}$$

$$\text{Bandwidth} = \frac{R}{2\pi L}\ \text{Hz}$$

$$\text{Bandwidth} = \frac{(80+20)}{2\pi \times 10} = \frac{5}{\pi}\ \text{Hz}$$

B.W. = 1.59 Hz

45. The advantage of operating power system with isolated neutral is

A. It is possible to maintain the supply with a fault on one line.

B. Voltage of the phases are limited to, phase to ground voltages.

C. Sensitive protective relay against line to ground faults can be used.

D. The high voltages due to arcing grounds are eliminated.

Ans. A

Sol. Possible to maintain the supply with a fault on one line.

46. The cost of manufacturing an article was ₹ 900. The trader wants to gain 25% after giving a discount of 10%. The marked price of that article should be how much?

A. ₹ 1250 B. ₹ 1200

C. ₹ 1000 D. ₹ 1500

Ans. A

Sol. **Short Trick:**

CP*125=MP*90

CP/MP=90/125

if CP=900

then MP = 1250

Basic Method:

Let the marked price be Rs. x

Now, according to the question,

$$\frac{x \times 90}{100} = \frac{900 \times 125}{100} = 1125$$

$$\Rightarrow x = \frac{1125 \times 100}{90} = Rs.1250$$

47. Which of the following statements is correct?

A. All meshes are loops but not all loops are meshes.

B. All loops are meshes.

C. All loops are meshes but not all meshes are loops.

D. Number of meshes are always equal to number of loops.

Ans. A

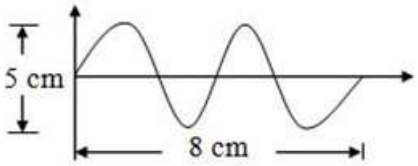
Sol. A mesh is a closed path which should not have further closed path in it.

Loop: A closed path that can have further closed path in it.

So, All meshes are loops but not all loops are meshes.

Option A is correct.

48. The figure shows a sinusoidal waveform observed on a CRO screen. The knobs on the CRO panel were on 100 ms/cm and 25V/cm positions. The frequency and RMS value of the waveform respectively are



A. 2.5 kHz, 12.57 V

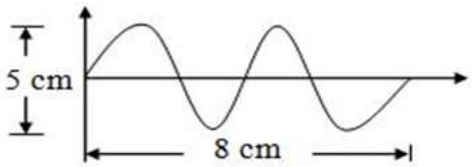
B. 2.5 kHz, 44.19 V

C. 1.25 kHz, 44.19 V

D. 1.25 kHz, 12.57 V

Ans. B

Sol.



2T = 8cm

T = 4cm

Given that 100m sec/cm (x-axis), 25V/cm(y-axis)

Time period =4×100 m sec

= 400 m sec

$$\text{Frequency} = \frac{1}{T} = \frac{1}{400\times10^{-6}}$$

= 2500 Hz

= 2.5 kHz

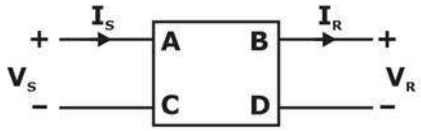
Peak to peak = 5 cm

$$2V_{max} = 5\times25V$$

$$2\times\sqrt{2}\times V_{rms} = 125$$

$$V_{rms} = \frac{125}{2\sqrt{2}} = 44.19V$$

49. A transmission line is represented by ABCD parameter shown in below figure.



The characteristic impedance Z_C is

A. $Z_C = \sqrt{\frac{AD}{BC}}$

B. $Z_C = \sqrt{\frac{A}{B}}$

C. $Z_C = \sqrt{\frac{A}{C}}$

D. $Z_C = \sqrt{\frac{AB}{CD}}$

Ans. D

Sol. Z_C = characteristic impedance $= \sqrt{Z_{OC} \times Z_{SC}}$

$$Z_{OC} = \left.\frac{V_S}{I_S}\right|_{I_R = 0} = \left[\frac{AV_R + BI_R}{CV_R + DI_R}\right]_{I_R = 0} = \frac{A}{C}$$

$$Z_{SC} = \left.\frac{V_S}{I_S}\right|_{V_R = 0} = \left[\frac{AV_R + BI_R}{CV_R + DI_R}\right]_{V_R = 0} = \frac{B}{D}$$

$$\therefore \; Z_C = \sqrt{\frac{AB}{CD}}$$

50. The loop transfer function of a system is given by

$$G(s)\,H(s) = \frac{k(s+1)^2(s+10)}{s(s+25)}$$

The number of loci terminating at infinity is-

A. 0

B. 1

C. 2

D. 3

Ans. A

Sol. No of poles = 2

No of zeroes = 3

The root locus starts at;

S = 0, - 25, ∞

The root locus terminates at;

S = -1, -1, - 10

Therefore, the no. of loci terminating at infinity is zero.

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