MEGA MOCK CHALLENGE

gradeup

NLC GET 2020

Electrical Engineering

Mega Mock Challenge

(Apr. 18- Apr. 19 2020)

Questions & Solutions

1. The HCF of two numbers is 15 and their LCM is 225. If one of the numbers is 75, then the other is:

A. 105 B. 90
C. 60 D. 45

Ans. D

Sol. First number × Second number = HCF × LCM

75 ×Second number = 15 × 225

∴ Second number = $\frac{15\times225}{75}=45$

2. The sum and product of two numbers are 12 and 35 respectively. The sum of their reciprocals will be how much?

A. 1/3 B. 1/5
C. 12/35 D. 35/12

Ans. C

Sol. Let the two numbers be x and y

So, according to the question

x+y =12 ……………………..(i)

xy = 35 ..……………………(ii)

on dividing (i) by (ii), we get

$\frac{x+y}{xy}=\frac{1}{y}+\frac{1}{x}=\frac{12}{35}$

3. A and B can do a piece of work in 72 days. B and C can do it in 120 days and A and C can do it in 90 days. A alone can do it in:

A. 120 days B. 130 days
C. 150 days D. 100 days

Ans. A

Sol.

	Days	LCM	efficiency
(A + B)	72		5
(B + C)	120	360	3
(A + C)	90		4

By adding all

2(A + B + C) = 5 + 3 + 4 = 12

⇒(A + B + C) = 6

Efficiency of C = 6 – 5 = 1

Efficiency of A = 6 - 3 = 3

Efficiency of B = 6 - 4 = 2

Thus, Number of days required to complete the work by A alone = 360/3

= 120 days

4. A vendor sells lemons at the rate of 5 for ₹ 14, gaining thereby 40%. For how much did he buy a dozen lemons ?

A. ₹ 20 B. ₹ 21

C. ₹ 24 D. ₹ 28

Ans. C

Sol. C.P. of 5 lemons

$= \frac{100}{140} \times 14 = \text{Rs. } 10$

∴ C.P. of 12 lemons

10*12/5 =24

5. Find the square root of 2401?

A. 49 B. 41

C. 51 D. 71

Ans. A

Sol. 2401 = 7 x 7 x 7 x 7

$\sqrt{2401} = \sqrt{7 \times 7 \times 7 \times 7}$ = 7 x 7 = 49

6. When a number is increased by 120, it becomes 130% of itself. What is the number?

A. 400 B. 520

C. 460 D. 580

Ans. A

Sol. Let the number be x

Then x+120=130%of x

X+120=$\frac{130}{100} \times x$

120=1.3x-x

0.3x=120

X=400

7. If 25 is added to a number it becomes 3 less than thrice of the number. Then number is:

A. 15 B. 14

C. 19 D. 20

Ans. B

Sol. Let the number be x,

According to the question,

$x + 25 = 3x - 3$

$\Rightarrow 3x - x = 25 + 3$

$\Rightarrow 2x = 28$

$\Rightarrow x = 14$

8. If $2^x = \sqrt[3]{32}$, find x ?

A. 5 B. 3

C. 5/3 D. 4/5

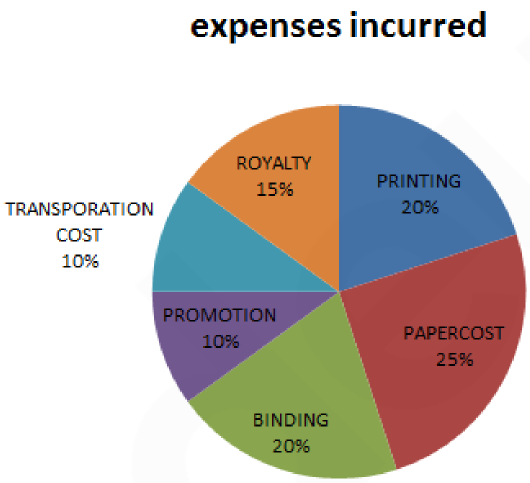
Ans. C

Sol. $2^x = 32^{1/3}$

$2^x = 2^{5/3}$

$x = \frac{5}{3}$

9. The following pie chart shows the percentage distribution of the expenses incurred by a publishing house. Study the pie chart and answer the following questions:



Royalty is less than printing cost by how much percent?

A. 5% B. 33.33%

C. 20% D. 25%

Ans. D

Sol. Percent Difference = 20% - 15% = 5%

We have to find out the percent difference with respect to printing cost. Hence, required percentage = (5/20)*100% = 25%

10. For an edition of 12500 copies, the amount of royalty paid is Rs 281250 What should be the selling price of the book if profit expected is 5%?

A. 152.50 B. 157.50

C. 162.50 D. 167.50

Ans. B

Sol. SP=105% CP

15:105=281250:SP of 12500 books

SP of 12500 books = 1968750

SP of one book= = 1968750/12500=157.50

11. In the following question, select the odd word from the given alternatives.

A. Kufri
B. Nainital
C. Dehradun
D. Ranikhet

Ans. A

Sol. All except 'Kufri', all others are in Uttarakhand while 'Kufri' is in Himachal Pradesh.

Hence, the correct option is A.

12. In the following question, select the related number from the given alternatives.

8 : 448

A. 10 : 900
B. 9 : 729
C. 15 : 3125
D. 6 :2160

Ans. A

Sol. The relation between the given number-pair is-

$\mathbf{x : x^2 (x - 1)}$

So,

$\mathbf{8 : 8^2 (8 - 1)}$
$\mathbf{8 : 64 \times 7}$
$\mathbf{8 : 448}$

Similarly,

$\mathbf{10 : 10^2 (10 - 1)}$
$\mathbf{10 : 100 \times 9}$
$\mathbf{10 : 900}$

Hence, option A is correct.

13. A series is given with one term missing. Select the correct alternative from the given ones that will complete the series.

7, 10, 15, 24, 41, 74, ?

A. 149
B. 169
C. 159
D. 139

Ans. D

Sol. Logic:

$2^1+5=7$

$2^2+6=10$

$2^3+7=15$

$2^4+8=24$

$2^5+9=41$

$2^6+10=74$

$\mathbf{2^7+11=139}$

So, Missing Number=139

Hence, option D is the correct response.

14. A is not elder to D, A is elder to C, C is not elder to A, B is not elder to C. Who is the eldest?

A. D B. C

C. A D. B

Ans. A

Sol. A.T.Q,

D > A, A > C, B > C

On combining all we get the order as,

B < C < A < D

So, D is eldest among all.

Hence, the correct option is (A).

15. In a certain language, 'sdr ngt olp' means 'Going to Patna', 'olp swq' means 'Going there' and 'yyt swq jht' means 'There was Golghar'. What is the code for 'there' in that language?

A. olp B. swq

C. yyt D. ngt

Ans. B

Sol. 'sdr ngt olp' = 'Going to Patna'__________(1)

'olp swq' = 'Going there' __________(2)

'yyt swq jht' = 'There was Golghar'_________(3)

From 1 and 2, 'Going' = olp.

Therefore, 'there' = swq

Hence, option (B) is the correct response.

16. Arrange the following words in a meaningful order.

1) Word

2) Paragraph

3) Letter

4) Sentence

5) Essay

A. (3, 1, 2, 4, 5)

B. (3, 2, 4, 1, 5)

C. (3, 1, 4, 2, 5)

D. (3, 1, 4, 5, 2)

Ans. C

Sol. The correct meaningful sequence is –

3. Letter

1. Word

4. Sentence

2. Paragraph

5. Essay

A combination of letters make a word, words together form a sentence, using sentences we write a paragraph and an essay comprises of paragraphs.

So, the order is (3, 1, 4, 2, 5).

Hence, the correct option is C .

17. If 'M' means '×', 'K' means '÷', 'G' means '+', and 'P' means '−', then what is the value of 34 P 12 M 5 G 20 K 4 M 2 P 3

A. 62
B. -19
C. 29
D. 41

Ans. B

Sol.

Symbols	M	K	G	P
Codes	×	÷	+	−

34 P 12 M 5 G 20 K 4 M 2 P 3

⇒ 34 − 12 × 5 + 20 ÷ 4 × 2 − 3

⇒ 34 − (12 × 5)+ (20 ÷ 4) × 2 − 3

⇒ 34 − 60 + (5× 2) − 3

⇒ 34 − 60 + 10 − 3

⇒ 34-50-3

⇒ − 19

Hence, option B is the correct response.

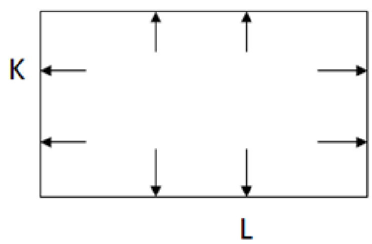
18. **Direction:** Study the following data carefully and answer the questions accordingly. Eight people J, K, L, M, N, O, P, and Q are sitting around a rectangular table facing outside. Two people are sitting on each side of the table. P and M are not immediate neighbors. Four people are sitting between Q and O. Three people are sitting between M and K. J is not an immediate neighbor of K and M. Two people are sitting between O and M where O is not sitting on the same side with K. K sits third to the right of L and both are not opposite to each other.

Who sits to the immediate right of Q?

A. K
B. L
C. P
D. M
E. None of these

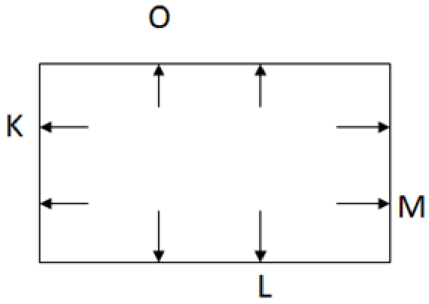
Ans. C

Sol. 1) K sits third to the right of L and both are not opposite to each other.



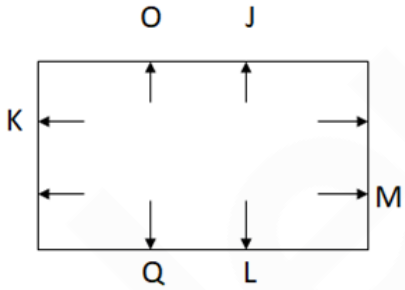
2) Three people are sitting between M and K.

3) Two people are sitting between O and M where O is not sitting on the same edge with K.

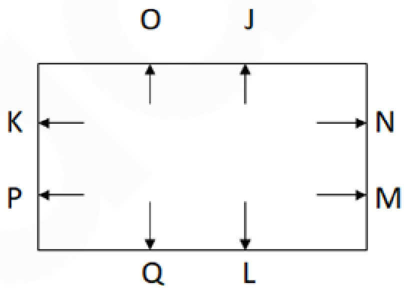


4) Four people are sitting between Q and O.

5) J is not an immediate neighbor of K and M.

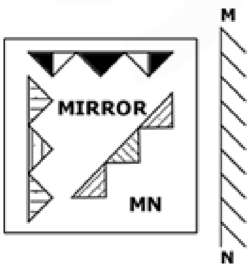


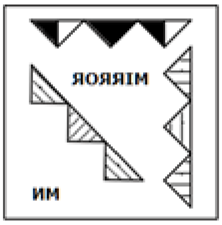
6) P and M are not immediate neighbors.

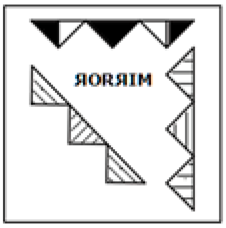


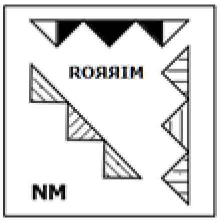
Therefore, option C is the correct answer.

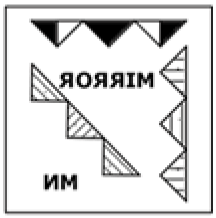
19. Which of the following options will give the mirror image of the given figure when a mirror is placed along MN?



A. 

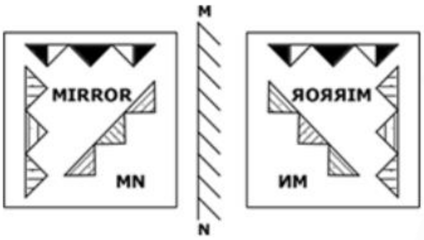
B. 

C. 

D. 

Ans. D

Sol. On observing the options we can see that the figure given under option (D) is the appropriate answer.

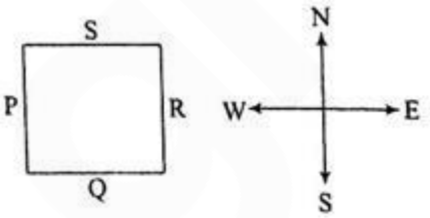


Hence, option D is correct.

20. P, Q, R and S are playing carrom. P and R are partners, S and Q are partners. S is sitting to the right of R who faces west, then Q faces which direction?

A. South
B. East
C. West
D. North

Ans. D

Sol. 

Q is facing North.

Hence, option D is correct.

21. Gandhiji was highly influenced by the book 'Unto the last'. Who was the author of this book?

A. Tolstoy
B. John Ruskin
C. Louis Fischer
D. Blavatsky

Ans. B

Sol. • **John Ruskin** was the author of the book '**Unto the Last**'.

• Some other **major works of Ruskin are**- Modern painters, The Seven Lamps of Architecture, Stones of Venice etc.

• Many founding fathers of Labour party in India were also influenced by this book.

22. Which ruler defeated the Marathas in the third battle of Panipat in 1761?

A. Ahmed Shah
B. Shah Alam II
C. Ahmad Shah Abdali
D. Muhammad Shah

Ans. C

Sol. * **Ahmad Shah Abdali**defeated the Marathas in the third battle of Panipat in 1761.

* In this battle, Marathas were led by Sadashiv Rao Bhau, while the Peshwa at that time was BalajiBajirao.

23. No Confidence Motion can be passed in ....?

A. Only Lok Sabha
B. Only Rajya Sabha
C. Both Rajya and Lok Sabha
D. Neither A and B

Ans. A

Sol. No Confidence Motion can be passed only in **Lok Sabha**.

• The no confidence motion needs **50 members** for support to be admitted in house.

• The motion is based on the fact under **Article 75** which says that the council of ministers shall be collectively responsible to the Lok Sabha.

• It is **not require to state reason** for putting No Confidence Motion.

• It can be moved against the whole council of ministers only.

24. Which among the following is the longest river of Peninsular India?

A. Narmada
B. Krishna
C. Godavari
D. Luni

Ans. C

Sol. • **Godavari is the longest river of Peninsular India** and 2nd longest river of India.

• This river is also known as Dakshin Ganga.

• It originates in Western Ghats of central India near Trimbak in Nashik District in Maharashtra.

25. Coimbatore is famous for which of the following industries?

A. Textile industry
B. Leather industry
C. Chemical industry
D. None of these

Ans. A

Sol. • **Coimbatore** is also known as **Kovai and Koyamuthur**.

• It is a major city in the Indian state of Tamil Nadu.

• This city is famous for textile industry.

• Coimbatore is called the "**Manchester of South India**" due to its extensive textile industry.

26. White blood cells are also known as ________.

A. Erythrocyte
B. Leukocytes
C. Thrombocytes
D. None of these

Ans. B

Sol. * **White blood cells are also known as Leukocytes**.

* They help from protecting against diseases.

* The normal white cell count is usually between 4×10^9/L and 1.1×10^{10}/L.

* Decrease in the White Blood cells is called Leukopenia.

27. Knot is a unit of which of the following quantity?

A. Distance
B. Velocity
C. Force
D. Torque

Ans. B

Sol. **Knot** is a unit of speed which is equal to nautical mile per hour.

• The knot is a non-SI unit.

• The ISO standard symbol for the knot is **kn.**

• Nautical miles and knots are convenient units to use when navigating an aircraft or ship.

28. World's largest cricket stadium is located in which of the following cities?

A. Melbourne
B. Sydney
C. London
D. Ahmedabad

Ans. D

Sol. • Sardar Patel Stadium, with seating capacity of 110,000, is the world's largest cricket stadium.

• The Sardar Vallabhbhai Patel Stadium is commonly known as Motera Stadium.

• It is located in Ahmedabad, Gujarat.

• It is the second largest stadium in the World.

29. Who wrote the book India – 'A wounded Civilization'?

A. Sushil Kumar
B. Satendra Kant
C. APJ Abdul Kalam
D. V.S. Naipaul

Ans. D

Sol. • **India: A Wounded Civilization (1977) is a book , written by V. S. Naipaul**.

• In 1971 he was awarded the **Booker Prize for In a Free State**.

• In 1990, V.S. Naipaul received a knighthood for services to literature.

• In 1993, He was the first recipient of the **David Cohen British Literature Prize**.

• He received the **Nobel Prize in Literature in 2001**.

• In this work he casts a more analytical eye than before over Indian attitudes, while recapitulating and further probing the feelings aroused in him by this vast, mysterious, and agonized country.

30. Junagarh caves are located in ________.

A. Rajasthan
B. Gujrat
C. MP
D. Maharashtra

Ans. B

Sol. * **Junagarh caves are situated in Junagarh district of Gujrat.**

* There are mainly Buddhist caves.

* The presence of "Upper Kot" is the unique feature of these caves.

31. In the sentence identify the segment which contains the grammatical error. If the sentence has no error, then select 'No error'.

These all mangoes are ripe.

A. These all
B. mangoes
C. are ripe
D. No error

Ans. A

Sol. Option A has the grammatically incorrect part. Here, it is an error related to position of words.

Hence, All these ……….should be used here.

32. Identify the best way to improve the underlined part of the given sentence. If there is no improvement required, select 'no Improvement'.

Hold <u>hands of your child</u> while crossing the road.

A. your child's hands
B. your child's hand
C. hand of your child
D. No improvement

Ans. B

Sol. While crossing a road, a single hand is held not both hands. So, it is incorrect to say hold hands. Apart from this, the sentence should use apostrophe (') as it is used to denote ownership and make the sentence concise. The sentence must be written as "hold your child's hand while crossing the road". Hence, option B is the correct answer.

33. Select the most appropriate option to fill in the blank.

They drove _________ the Marina beach.

A. on
B. along
C. for
D. with

Ans. B

Sol. The correct preposition to be used in the given sentence is "**along**". The word **along** can be used as a preposition or an adverb. As a preposition "***along***" is used to talk about movement on or beside a line. When used as a preposition, it is followed by a noun. Hence, option B is the correct answer.

Example: We walked **along** the road.

When **along** is used as an adverb, it is not followed by a noun.

Example: She brought her children **along**.

34. Select the most appropriate synonym of the given word.

CURSORY

A. little B. quick

C. eager D. tender

Ans. B

Sol. CURSORY means done quickly with little attention to detail.

Eager means strongly wanting to do or have something.

Tender means showing gentleness, kindness, and affection.

Hence, option B is the correct answer.

35. Select the most appropriate antonym of the given word.

DEFUSE

A. control B. understand

C. aggravate D. decelerate

Ans. C

Sol. Defuse means to make less dangerous, tense or hostile.

Aggravate means to provoke or to irritate.

Decelerate means to lose velocity; move more slowly

Hence, option C is the correct answer.

36. Given below are four jumbled sentences. Pick the option that gives their correct order.

P: Shardul was waiting for his school bus.

Q: As a leader of the house, he wanted to win the General Championship by scoring maximum points.

R: It was 7 o' clock in the morning.

S: He was keenly looking at the approaching vehicles.

A. PRSQ B. SRPQ

C. RSPQ D. RPSQ

Ans. D

Sol. R is an introductory sentence as it starts with the time- 7 O' clock in the morning. Sentence P points out that he is waiting for his school bus. Sentence S focuses on how keenly he is looking at the vehicle approaching him. The only option with sequence RPS is **option D**. Hence, it is the answer.

37. Select the correctly spelt word.

A. exacerbate B. exacarbate

C. exacerbate D. exacarbat

Ans. A

Sol. Option A has the correctly spelt word. The word "exacerbate" means make a problem, bad situation or negative feeling worse. Hence, option A is the correct choice.

38. Select the word which means the same as the group of words given.

Practice of employing spies in war

A. Esplanade B. Espionage

C. Espadrille D. Estrangement

Ans. B

Sol. Estrangement = Separation resulting from hostility

Espadrille = A sandal with a sole made of rope or rubber and a cloth upper part

Espionage = The systematic use of spies to get military or political secrets

Esplanade = A long stretch of open level ground (paved or grassy) for walking beside the seashore

Hence, option B is the correct answer.

39. Choose the most appropriate option to change the voice (active/passive) form of the given sentence.

Have you been invited by Krishna?

A. Have you invited Krishna? B. Has Krishna invited you?

C. Does Krishna have invited you? D. Has Krishna invite you?

Ans. B

Sol. The given sentence is in passive voice. The structure for passive/active voices would be:

Passive: Has/have + Object + Verb (IIIrd form) + by + subject...?

Active: Has/have + subject + verb (IIIrd form) + object...?

So, the active voice of the given sentence would be:

Has Krishna invited you?

Hence, option B is the correct answer.

40. Select the most appropriate meaning of the idiom given in bold in the sentence.

There was a job for me **to cut my teeth on.**

A. to gain experience B. to try

C. to sharpen my wits D. to earn a decent salary

Ans. A

Sol. The idom "cut your teeth on something" means to do something that gives you your first experience of a particular type of work. Hence, option A is the correct answer.

41. A 32:1 MUX can be designed using

(Assume all the MUXs are having enable inputs)

A. two 16 : 1 MUXs and one two input OR gate

B. two 16 : 1 MUXs and one two input AND gate

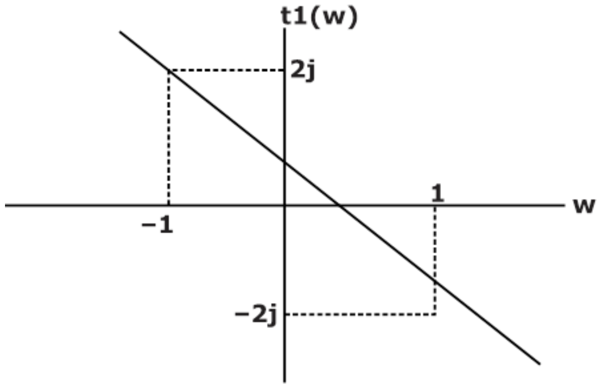
C. two 16 : 1 MUXs and two input OR

D. two 16 : 1 MUXs and a NOT gate.

Ans. A

Sol. A 32:1 MUX can be designed using two 16 : 1 MUXs and one two input OR gate.

42. A causal LTI system has the frequency response H(w) shown in figure.



If Fourier transform of input signal is $x(\omega) = \frac{1}{2+j\omega}$. The filtered output signal y(t) is.

A. $4e^{-2t}u(t)$

B. $-4e^{-2t}u(t) + \delta(t)$

C. $-4e^{-2t}u(t) - \delta(t)$

D. $-4e^{-2t}u(t) - 2\delta(t)$

Ans. D

Sol. Given that $x(\omega) = \frac{1}{2+j\omega}$

Taking the inverse Fourier transform, we obtain.

$x(t) = e^{-2t}4(t)$

The filter output signal is given by.

$$y(t) = -\frac{2d \times (t)}{dt} = -2\frac{d}{dt}e^{-2t}u(t)$$
$$= 4e^{-2t}4(t) - 2e^{-2t}\delta(t)$$
$$= 4e^{-2t}4(f) - 2\delta(t)$$

43. The Nyquist sampling interval corresponding to the continuous time signal.

x(t) = [Sa^3(150πt) * Sa^2 (200πt)] Sa(600πt) is

A. 0.5 m sec

B. 1 m sec

C. 2 m sec

D. 4 m sec

Ans. B

Sol. [Sa^3(150πt) → ω_{m1} = 3 × 150 π = 450π rad\sec

[Sa^2(200πt) → m_2 = 2 × 200π = 400 π rad/sec

For (f_1(t)*f_2(t)) → ω_m = min{ω_{m1}, ω_{m2}} = 40π rad/sec

Sn(600πt) → ω_m = ω_{mf} + ω_{mg} = 400π + 600π = 1000π rad/sec

Nyquist inertial, $T_N = \frac{\pi}{w_m} = \frac{\pi}{1000\pi}$

= 1 msec

44. A capacitor is made with a polymeric dielectric having a relative permittivity of 2.26 and a dielectric breakdown strength of 50 kV/cm. The permittivity of free space is 8.85 pF/m. If the rectangular plates of the capacitor have a width of 20 cm and a length of 40 cm, then the maximum electric charge in the capacitor is

A. 2 μC
B. 4 μC
C. 8 μC
D. 10 μC

Ans. C

Sol. Given dielectric has $\varepsilon_r = 2.26$

$E_{BD} = 50 \times 10^5$ V/m

Area of the plate = $20 \times 10^{-2} \times 40 \times 10^{-2} = 8 \times 10^{-2}$ m^2

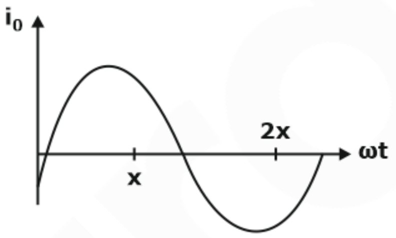
In a capacitor,

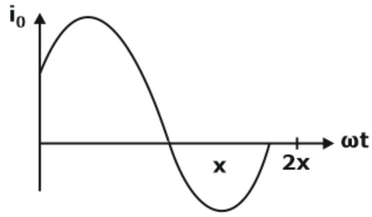
$$E = \frac{\rho_\varepsilon}{\varepsilon} = \frac{Q}{A\varepsilon}$$

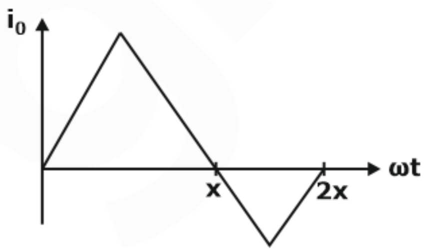
$$E_{BD} = \frac{W_{BD}}{A\varepsilon}$$

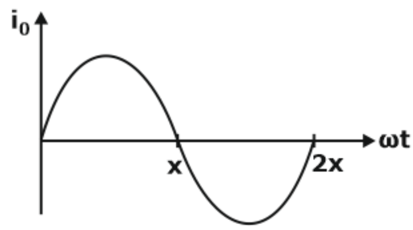
$$Q_{BD} = E_{BD}A\varepsilon$$
$$= 50 \times 10^5 \times (8 \times 10^{-2})(8.85 \times 10^{-12})(2.26)$$
$$= 8 \times 10^{-5} C = 8\mu C$$

45. A single phase full bridge voltage source inverter is feeding a RLC load with output voltage Waveform as a square wave. If the reactance $X_C > X_L$ then the output waveform will be

A.


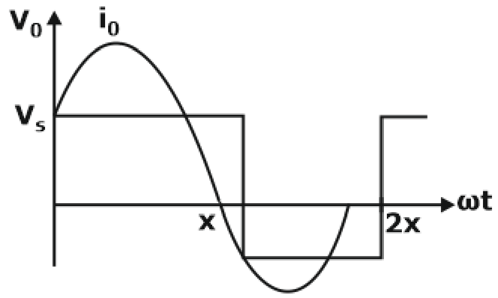
B.


C.


D.


Ans. B

Sol. In the case of $X_C > X_L$, the load is said to be under damped and it comes to zero before the voltage crosses the zero value.



46. The following program executed in microprocessor

Label	Mnemonics	T-stocts
	LXI B, 0256	10
DELAY:	H	6
	DCX B	16
	XTHL	4
	MOVA, C	4
	ORA, B	10/7T
	JNZ DELAY	

When the system clock period is 0.2 us. The delay in above loop is

A. 4.52 ms
B. 2.05 ms
C. 4.78 ms
D. 3.15 ms

Ans. C

Sol.

	0256H = 5980	Operations	No.of times of execution
	LXIB, 0256H	$BC \leftarrow 0256H$	1 time
DELAY:	DCX B	$BC \leftarrow (BC-1)$	598 times
	XTHL	$TOS \leftarrow HL$	598 times
	MOV A,C	$A \leftarrow HL$	598 times
	ORA,B	$A \leftarrow (A)VB$	598 times
	JNZ Delay	Jump to Delay, if z = 0	598 time

Total T State = 10T + 598 [6 +16+4+4+10]I3T

= 23927T

= 23927 × 0.2 μs

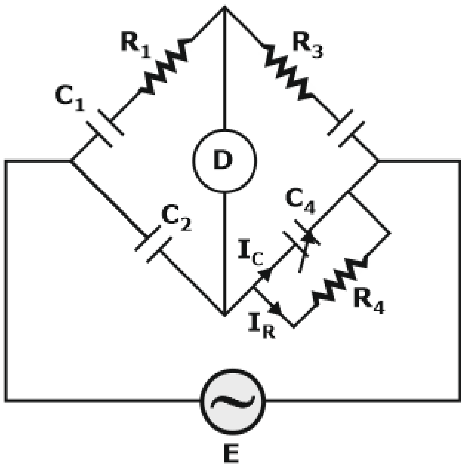
= 4.78 ms

47. The dielectric loss of a capacitor can be measured by

A. Wein Bridge
B. Owen bridge
C. Schering bridge
D. Maxwell bridge

Ans. C

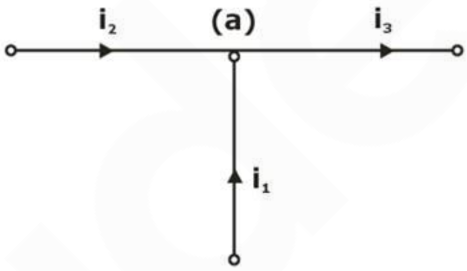
Sol.



Schering Bridge is used for the measurement of dielectric loss of capacitor. Here C_2 is standard capacitor, this capacitor is either Air or gas or a particular dielectric material.

When required, a co-reaction is also made for the measurement of dielectric loss.

48. The current i_1, i_2, and i_3 meet at a node as shown in figure below



If i_1 = 3 sinωt A, i_2 = 4 cosωt A and $i_3 = I_3 \sin(\omega t + \theta)$, then the value of I_3 will be

A. 1A
B. 2.5 A
C. 5A
D. 7A

Ans. C

Sol. At node A.

$$i_3 = i_1 + i_2 = 4\cos\omega t + 3\sin\omega t = \sqrt{3^2 + 4^2}\sin(\omega t + \theta)$$

$= 5 \sin (\omega t + \theta)$ A

I_3 = 5A

49. The corona loss on a particular system at 50 Hz is 1kW/km per phase. The corona loss at 60 Hz would be

A. 1kW/km per phase
B. 0.83kW/km per phase
C. 1.2kW/km per phase
D. 1.13kW/km per phase

Ans. D

Sol. Corona loss $= 241 \times 10^{-5} \times \frac{(f+25)}{\delta} \times \sqrt{\frac{r}{d}} \times (V_{ph} - V_c)^2$

Where, f = Supply frequency δ = Air density factor r = Radius of the conductor d = Distance between the conductors

V_{ph} = Operating voltage of the transmission line V_c = Critical disruptive voltage,

Therefore

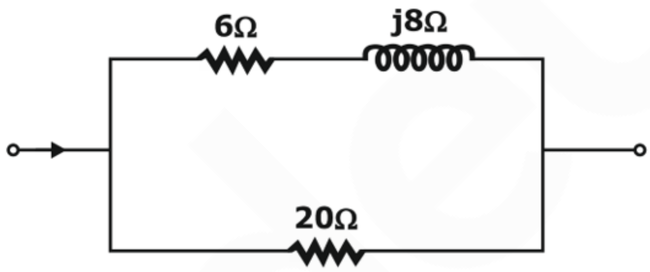
Corona loss $P \propto (f+25)$

$$\frac{P_1}{P_2} = \frac{(f_1+25)}{(f_2+25)}$$

$$P_2 = \frac{(60+25)}{(50+25)} \times 1$$

$P_2 = 1.13$ kW/km per phase

50. Consider the circuit shown below:



If the total average power absorbed by circuit is 4400 W, then the average power by 6Ω resistor will be

A. 2000 W

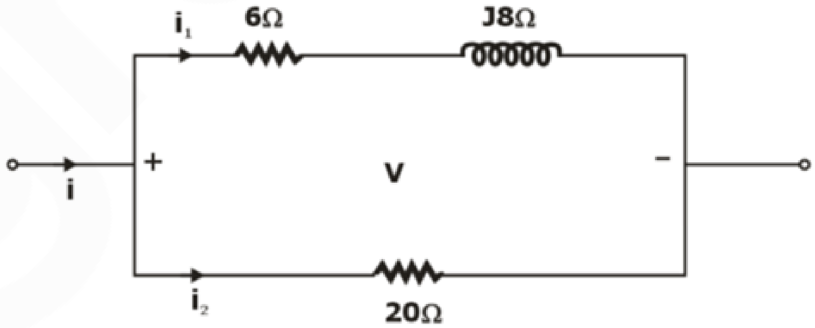
B. 400 W

C. 2400 W

D. 3384 W

Ans. C

Sol. Redrawing the given circuit, we get



$V = z \times I \Rightarrow i \propto \frac{1}{z}$

$$\frac{I_1 \text{ effective}}{I_2 \text{ effective}} = \frac{z_2}{z_1} = \frac{20}{\sqrt{6^2+8^2}} = 2$$

$$\therefore \frac{P_{6\Omega}}{P_{20\Omega}} = \frac{I_1^2(6)}{I_2^2(20)} = \left(\frac{I_1}{I_2}\right)^2 \times \frac{6}{20}$$

$$= (2)^2 \times \frac{6}{20} \times \frac{6}{5}$$

$$P_{20\Omega} = \frac{5}{6} P_{6\Omega}$$

and, $P_{6\Omega} + P_{20\Omega} = 4400$

$$P_{6\Omega} + \frac{5}{6} P_{6\Omega} = 4400$$

$$\Rightarrow P_{6\Omega} + \frac{4400}{11/6}$$

$= 400 \times 6 = 2400W$

51. In a CRO which of the following is not a part of electron gun?

A. Cathode
B. grid
C. accelerating anode
D. X-Y plate

Ans. D

Sol. X-Y plate is not a part of electron gun.

52. In control system compensation methods, lead compensation network,

A. achieves the desired result though the merit of its attenuation properties at high frequencies.
B. in the frequency domain decreases the bandwidth but increase phase margin.
C. in the frequency domain increases the bandwidth and phase margin.
D. improves steady state accuracy but reduces bandwidth.

Ans. C

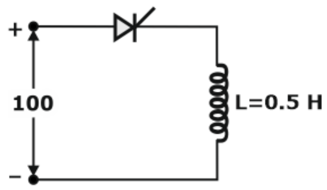
Sol. The phase of the forward path transfer function in the vanity of the gain crossover frequency is increased. This improves phase margin of the system. As the network moves the system to a higher gain cross over frequency the bandwidth (hence speed) is improved.

53. A D.C. source of 100V supplies a purely inductive load of 0.1 H; the controller is an S.C.R in series with source and load if the specified latching is 100 mA, then minimum width of the gating pulse to ensure turn -on of SCR would be

A. 10 μs
B. 50 μs
C. 100 μs
D. 1 μs

Ans. C

Sol. $V = L\frac{di}{dt}$



$$\int_0^{100} L\,di = \int_0^{t} V\,dt$$

$L \times 100 \times 10^{-3} = 100t$

$$\Rightarrow t = \frac{0.1 \times 100 \times 10^{-3}}{100} = 10^{-4}\ \text{sec}$$

$t = 100\ \mu$ sec.

54. What is simplified Boolean equation of a logic circuit? If the circuit output is 1 for following inputs?

ABCD = 0010

ABCD = 0110

ABCD = 1000

ABCD = 1100

And output is zero for all other inputs

A. $\bar{A}C\bar{D} + A\bar{C}\bar{D}$

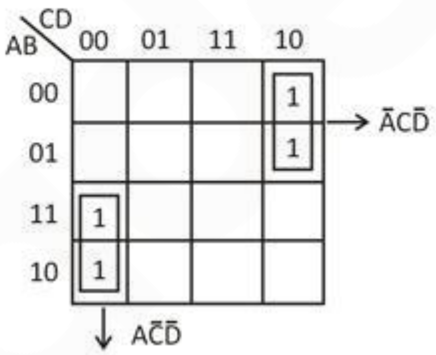
B. $\bar{A}CD + AC\bar{D}$

C. $AC\bar{D} + \bar{A}C\bar{D}$

D. $\bar{A}C\bar{D} + AC\bar{D}$

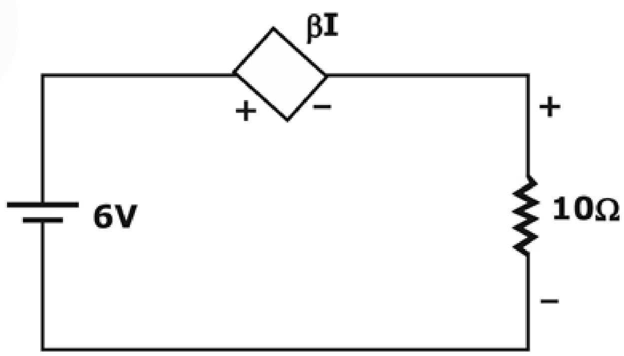
Ans. A

Sol.



simplied equation $= \bar{A}C\bar{D} + A\overline{CD}$

55. Consider a circuit shown in figure represent a series connection of a battery with a voltage source feeding a resistor. If β = 2 so the power delivered by the dependent voltage source is



A. $\frac{1}{2}$W

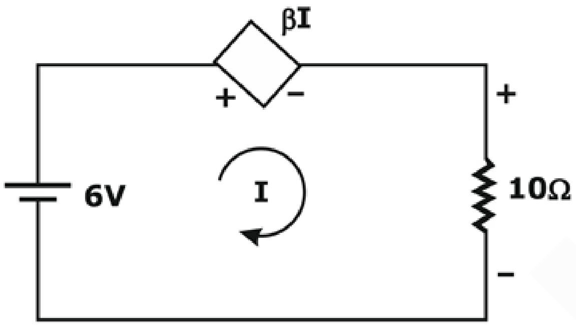
B. $-\frac{1}{4}$W

C. $\frac{1}{4}$W

D. $-\frac{1}{2}$W

Ans. D

Sol.



Using KVL, $\beta I + 10 \times I - 6 = 0$

$$I = \frac{6}{10+\beta} A$$

If $\beta = 2$

$I = ½ A$

So the power delivered by the dependent voltage source is the protect of voltage βI with the current

i.e., $= \left(-\frac{1}{2} \times \beta \times \frac{1}{2}\right)$

$= -\frac{1}{2}$W

Option D. is correct.

56. Eddy-current losses in a transformer are reduced

A. If laminations are thick

B. If the number of turns in primary winding is reduced

C. If the number of turns in secondary winding is reduced

D. If laminations are thin

Ans. D

Sol. Eddy current losses in a transformer can be reduced by making the laminations thinner.

57. A volume charge density $\rho = \rho_0 e^{-|x|-|y|-|z|}$ exists in a free space. The total charge present in the free space is

A. $2\rho_0$

B. $3\rho_0$

C. $8\rho_0$

D. $16\rho_0$

Ans. C

$$Q = \int_{-\infty}^{\infty}\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} \rho_0 e^{-|x|-|y|-|z|} dx\, dy\, dz$$

Sol. $= \rho_0 \int_{-\infty}^{\infty} e^{-|x|}dx \int_{-\infty}^{\infty} e^{-|y|}dy \int_{-\infty}^{\infty} e^{-|z|}dz$

$$= \rho_0 \times 2 \times 2 \times 2 \int_{-\infty}^{\infty} e^{-x}dx \int_{-\infty}^{\infty} e^{-y}dy \int_{-\infty}^{\infty} e^{-z}dz = 8\rho_0$$

58. A 100 MW power station delivers 100 MW for 2 hours, 50 MW for 6 hours in a day and is shut down for maintenance for 45 days each year. Calculate its annual load factor?

A. 20%
B. 21%
C. 22.5%
D. 18.3%

Ans. D

Sol. Energy consumption in a day = (100 x 2) + (50 x 6) = 500 MWhr

Energy consumption in a year = 500 MWhr x 320 = 160000 MWhr

Lead factor $\frac{160000}{365 \times 100 \times 24} \times 100 = 18.26\%$

59. An auto transformer having 1500 turns is connected across a 230 V supply. The value of secondary voltage obtained if the tap is taken at 900th turn will be

A. 150 V
B. 120 V
C. 172 V
D. 138 V

Ans. D

Sol. Input voltage of auto-transformer winding = 230 V

Total turns = Primary turns = 1500

Secondary voltage, $V_2 = \frac{230 \times 900}{1500} = 138V$

60. A single phase half bridge inverter has load resistance, R = 5Ω & a d.c source voltage V_s = 200 volt then find the power delivered to load due to fundamental component of current?

A. 1540 watt
B. 1580 watt
C. 1620 watt
D. 1680 watt

Ans. C

Sol. ∵ fundamental o/p voltage $V_{01} = \frac{2V_S}{\pi} \sin \omega t$

rms value of fundamental Vlg $= v_{01} = \frac{2V_s}{\pi}$

$\upsilon_{01} = \frac{2 \times 200}{\sqrt{2} \times 3.14} = 90$ volt

fundamental load current $= i_{01} = \frac{V_{01}}{R} = \frac{90}{5} = 18$ amp

∴ power delivered to load = I_{01}^2 R = $(18)^2 \times 5$ = 1620 watt

61. The electric field of the wave propagating through a lossless medium (μ_0, $49\varepsilon_0$) is given by

$\vec{E}- = 5sn\left(3\pi \times 10^8 t - \beta z\right)\hat{a}_y$

The wavelength 'λ' of the wave is

A. 0.06 m
B. 0.286 m
C. 0.95 m
D. 1.91 m

Ans. B

Sol. $v_p = \frac{1}{\sqrt{\mu\varepsilon}} = \frac{3 \times 10^8}{\sqrt{1 \times 49}} = \frac{3}{7} \times 10^8$

$\therefore v_p = \frac{\omega}{\beta}$ and $\beta = \frac{2\pi}{\lambda}$

$\therefore \lambda = \frac{2\pi}{\omega/v_p} = \frac{2\pi \times \frac{3}{7} \times 10^8}{3 \times \pi \times 10^8}$

$\lambda = \frac{2}{7} m = 0.286\ m$

62. Surge impedance of 3 Phase, 400 kV transmission line is 200 Ω. The surge impedance loading of the transmission line is

A. 400 MW
B. 1600 MW
C. 200 MW
D. 800 MW

Ans. D

Sol. Surge impedance loading $= \frac{V^2}{z}$

V = 400 kv

Z = 200 Ω

$SIL = \frac{(400)^2}{200} = 8000\ mw$

63. The output frequency of a decade counter that is clocked from 50 kHz signal is.

A. 12.5 kHz
B. 50 Hz
C. 5 kHz
D. 500 kHz

Ans. C

Sol. output frequency $= \frac{f_{clock}}{\text{mod value}}$

As decade counter is given ∴ Mod value = 10

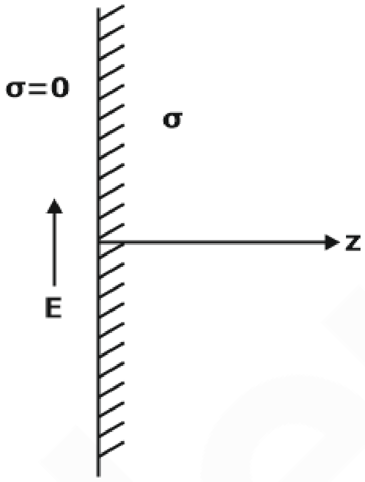
$f_0 = \frac{f_{clock}}{10} = \frac{50khz}{10} = 5khz$

64. Assume a field $E = 1.0e^{-\alpha z} e^{j(\omega t - \beta z)} a_x$ v/m with f = 100 MHz incident at the surface of a copper conductor, σ = 58 μs/m located at z > 0. At what distance (in μm) from the surface, the strength will be less than 1% of the original strength of wave.

A. 6.61
B. 33.05
C. 19.83
D. 26.44

Ans. B

Sol.



$|E| = 1.0e^{-\alpha z}$

$= 1.0e^{-z/\delta\delta}$

$\delta = \frac{1}{\sqrt{\pi f \mu \sigma}} = 6.61\ \mu m$

At 5δ the strength is 0.67% of its initial value so 5δ = 33.05 μm.

65. A 10V battery having internal resistance of 2 Ω is connected across a load resistance "R". If additional 5 Ω is added in series with this resistor R, then the power supplied by the battery becomes halved. The value of R is.

A. 2 Ω
B. 3 Ω
C. 5 Ω
D. 7 Ω

Ans. B

Sol. For 1st case : $P_1 = \frac{V^2}{R'} = \frac{100}{(2+R)}$

For 2nd case : $P_2 = \frac{V^2}{(2+R+5)} = \frac{V^2}{(7+R)} = \frac{100}{7+R}$

$P_1 = 2R_2$

$\frac{100}{2+R} = \frac{200}{7+R}$

R = 3 Ω

66. Which of the following is true?

Single layer associative neural networks do not have the ability to:

(i) perform pattern recognition

(ii) find the parity of a picture

(iii)determine whether two or more shapes in a picture are connected or not

A. (ii) and (iii) are true

B. (ii) is true

C. All of the mentioned are true

D. None of the mentioned are true

Ans. A

Sol. Pattern recognition is what single layer neural networks are best at but they don't have the ability to find the parity of a picture or to determine whether two shapes are connected or not.

67. Use of a reverse conducting thyristor in place of antiparallel combination of thyristor and feedback diode in an inverter:

A. Effectively minimizes the peak commutating current

B. Decreases the operating frequency of operation

C. Minimizes the effects of load inductance on the commutation performance

D. Causes deterioration in the commutation performance

Ans. D

Sol. Use of a reverse conducting thyristor in place of antiparallel combination of thyristor and feedback diode in an inverter causes deterioration in the commutation performance

68. A second-order discrete time system is characterized by the difference equation.

y(n)-3y(n-1) + 2y(n-2) = x(n) -2x(n-1)

when x(n) = u(n) and the initial conditions are given as y(-1) = y(-2) = 1 so y(n) for $n \geq 0$. Is

A. (n + 2) u (n)

B. n u(n)

C. (n+1) u (n)

D. (n-1) u (n)

Ans. A

Sol. For x(n) = u(n) we have

$$x(z) = \frac{1}{1 - z^{-1}}$$

Now, consider the given difference equation.

7(n) – 3y(n-1) + 2y(n-2) = x(n)-1x(n-1)

$Y(z) - 3\,[Z^{t}y(z) + y\,(-1)] + 2[z^{-2}y(z) + z^{-1}y(-1) + y\,(-2)]$

$$= \frac{1}{1 - z^{-1}} - \frac{2z^{-1}}{1 - z^{-1}}$$

$$Y(z)\,[1-3z^{-1}+2z^{-2}]-3y(-1)+2z^{-1}y(-1)+2y(-2)=\frac{1-2z^{-1}}{1-z^{-1}}$$

$$y(z)\left[1-2z^{-1}\right]\left[1-z^{-1}\right]-1+2z^{-1}=\frac{1-2z^{-1}}{1-z^{-1}}$$

$$y(z)=\frac{\left(1-2z^{-1}\right)}{\left(z-z^{-1}\right)^{2}\left(1-3z^{-1}\right)}+\frac{1-2z^{-1}}{\left(1+z^{-1}\right)\left(1-2z^{-1}\right)}$$

$$y(z)=\frac{1}{\left(1-z^{-1}\right)^{2}}+\frac{1}{1-z^{-1}}$$

The inverse z-transform of the above equation field.

$$y(n)=(n+)u(n)+u(n)=(n+2)u(n)$$

69. A certain Zener diode has maximum power rating of 200 mW at 50°C and a derating factor of 1.5 mW/°C . Determine the maximum power that the Zener diode can dissipate at a temperature of 90°C is.

A. 120 mW
B. 140 mW
C. 160 mW
D. 180 mW

Ans. B

Sol. Given, maximum power rating of Zener diode,

$P_D(max)$ = 200 mW

Derating factor = 1.5 mW/°C

$P_D(derated)$ = $P_{D(max)}$ – (1.5 mW/°C) ΔT

ΔT = 90 – 50 = 40°C

$P_{D(derated)}$ = 200 mW – (1.5 × 40) mW

= 140 mW

70. Two DC machines are mechanically coupled. One is operating as a motor and the other as generator. The iron and frictional losses of the machines will be identical when:

A. Their speeds are identical
B. Their speeds and excitation are identical
C. Their speeds are equal and back emfs are half the supply voltage
D. Their armature sizes are identical

Ans. B

Sol. For same iron and frictional losses, same frequency should be there. For that DC machines should be run on same speed.

71. In a series R-L circuit, the value of resistance is equal to 50 Ω. If the input current lags the supply voltage by 60°, then the value of inductance for 50 Hz. AC supply is

A. 31.83 mH
B. 55.16 mH
C. 128.24 mH
D. 275.66 mH

Ans. D

Sol. $\tan\phi = \frac{\omega L}{R}$

$\omega L = R \times \tan\varphi$

$= 50 \times \tan 60°$

$= 50\sqrt{3}$

$L = \frac{50\sqrt{3}}{2\pi f} = \frac{50\sqrt{3}}{2 \times 50 \times \pi}$

$= \frac{\sqrt{3}}{2\pi} = 275.66$ mH

72. A 200 mA ammeter is guaranteed to be accurate within x% at full scale deflection. Determine the value of x, if the instrument measures a current of 50 mA at a limiting error of 4.5%.

A. 1.125%
B. 1.25%
C. 1.5%
D. 2%

Ans. A

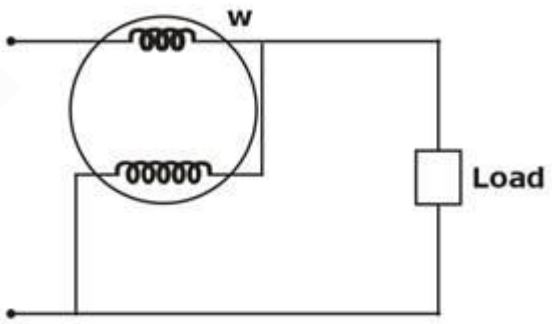
Sol. Magnitude of the limiting error $= x \times 200 = 200x$ mA

Limiting error at 50 mA is,

$\Rightarrow \frac{200x \text{ mA}}{50 \text{ mA}} \times 100 = 4.5 \times 100$

$\Rightarrow x = \frac{4.5 \times 50}{200} = 1.125\%$

73. The coils of wattmeter have resistance 0.01Ω and 1000Ω (their inductances may be neglected). The wattmeter is connected as shown in fig. to measure the power consumed by a load, which draws 25 A at power factor 0.8 .The voltage across the load terminals is 30 V. The percentage error in the wattmeter reading is ___.



Sol. True Power = VIcosø = 30*25*0.8 = 600W

Measured power = power loss in PC + Power in Load = (V^2/R_p) + VIcosø

= $(30^2/1000)$ + 600 = 600.9W

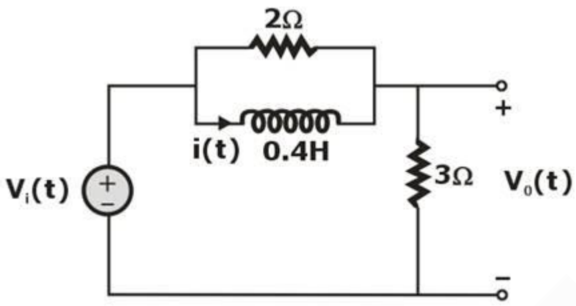
Percentage error in wattmeter reading

= (Measured value - True value) / True value

= (600.9 - 600) / 600

= 0.15%

74. Consider the circuit shown below:



If i(0) = 9A and $V_i(t)$ = 0, then the voltage $V_o(t)$ for t > 0 will be

A. $-1.2\ e^{-3t}$ V

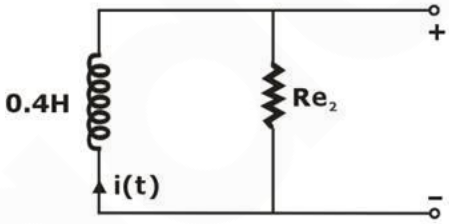
B. $-0.5\ e^{-t/3}$ V

C. Zero

D. $10.8\ e^{-3t}$ V

Ans. D

Sol. For $V_i(t)$ = 0, the circuit can be redrawn as



Here, Req $= \frac{2 \times 3}{2+3} = \frac{6}{5}\Omega$

Leq = 0.4H

$Z = \frac{Leq}{Req} = \frac{0.4}{6/5} = \frac{2}{6} = \frac{1}{3}$ sec

$i(t) = i(0)e^{-t/z} = 9e^{-3t}$ A; t > 0

$Vo(t) = Req\ i(t) = 10.8\ e^{-3t}$ V, t > 0

75. HVDC Homo polar links uses

A. One conductor usually of negative polarity

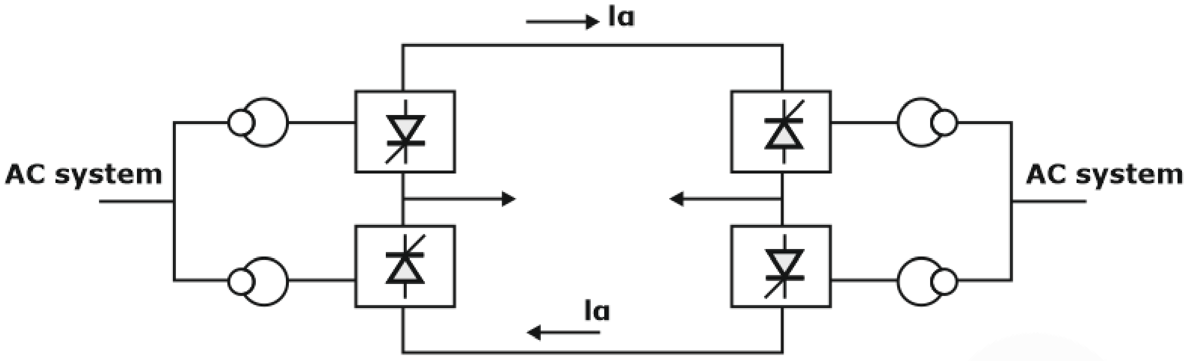
B. One conductor usually of positive polarity

C. Two conductors of positive and negative polarity

D. Two conductors of negative polarity

Ans. D

Sol.



In homopolar, two conductors of same polarity which is negative polarity are used.

76. In a boost chopper circuit if Vs, Vo. L are input voltage, output voltage and inductance, respectively, and when the conducting switch is opened, the rate of change of inductive current is

A. $\frac{V_s}{L}$

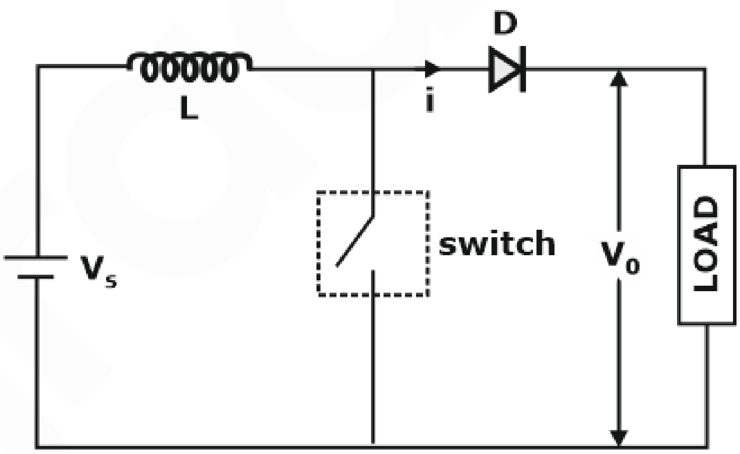
B. $\frac{V_o}{L}$

C. $\frac{V_s - V_o}{L}$

D. $\frac{V_s + V_o}{L}$

Ans. C

Sol.



Boost converter

When the switch is opened and applying KVL to the circuit $\rightarrow V_S = L\frac{di}{dt} + V_o$

$$L = \frac{di}{dt} = V_S - V_o \Rightarrow \boxed{\frac{di}{dt} = \frac{V_S - V_o}{L}}$$

77. The speed of a dc shunt motor may be varied be varying

1) Field current

2) Armature voltage control

3) Armature circuit resistance

Select the correct statements :

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

Ans. A

Sol. Speed of a de shunt motor may be varied by flux control, armature voltage control and armature-resistance control.

78. A 200 kVA, 1-φ, 50 Hz, 2000/200 V transformer has a core loss of 300 W. The full load copper loss is 800 W and leakage reactance is 0.032 p.u. Then winding resistance in per unit will be

A. 0.002
B. 0.024
C. 0.004
D. 0.012

Ans. C

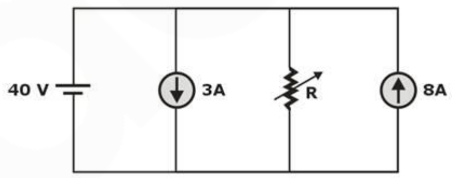
Sol. Given, KVA rating = 200 kVA

Full load copper loss = 800 W

Winding resistance in per unit

$$= \frac{I^2 R loss}{kVA} = \frac{800}{200 \times 1000} = 0.004 p.u.$$

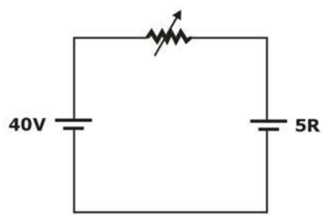
79. Consider the circuit shown below: The value of 'R' such that the current through 40 V source is zero is



A. 5 Ω
B. 8 Ω
C. 3 Ω
D. 10 Ω

Ans. B

Sol. The circuit can be redrawn as:



When I= 0,

40V = 5R

V = 8 Ω

80. A 3-input neuron is trained to output a zero when the input is 110 and a one when the input is 111. After generalization, the output will be zero when and only when the input is?

A. 000 or 110 or 011 or 101
B. 010 or 100 or 110 or 101
C. 000 or 010 or 110 or 100
D. 100 or 111 or 101 or 001

Ans. C

Sol. The truth table before generalization is:

Inputs	Output
000	$
001	$
010	$
011	$
100	$
101	$
110	0
111	1

where $ represents don't know cases and the output is random.

After generalization, the truth table becomes:

Inputs	Output
000	0
001	1
010	0
011	1
100	0
101	1
110	0
111	1

81. A 4-pole 50 Hz, 3-φ induction motor has a rotor resistance per phase equal to 0.2 Ω and a maximum torque of 200 N-m t 900 rpm. The value of slip when induction motor delivers maximum torque will be

A. 0.125
B. 0.4
C. 0.250
D. 0.2

Ans. B

Sol. Synchronous speed,

$$N_S = \frac{120f}{P} = \frac{120 \times 50}{4} = 1500 \text{ rpm}$$

$$\text{Slip at maximum torque} = \frac{N_S - N_r}{N_S} = (1500 - 900) / 1500 = 0.4$$

82. If the positive, negative and zero sequence reactance's of an element of a power system are 0.3, 0.3 and 0.8 p.u. respectively, then the element would be a?

A. Synchronous generator
B. Synchronous motor
C. Static load
D. Transmission line

Ans. D

Sol. For a transmission line,

$X_1 = X_2 < X_0$

83. The Genetic Algorithm are a part of

A. Evolutionary Computing.

B. inspired by Darwin's theory about evolution - "survival of the fittest.

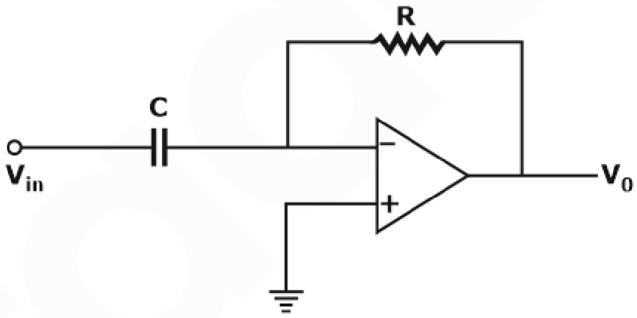
C. are adaptive heuristic search algorithm based on the evolutionary ideas of natural selection and genetics.

D. All of the above

Ans. D

Sol. GA is part of all the all the options provided. So, option D is correct.

84. Assume that OP-amp in the following circuit is ideal. If V_{in} is a triangular wave, then V_o will be



A. A square wave
B. A triangular wave
C. A sine wave
D. A parabolic wave

Ans. A

Sol. Transfer function $H(s) = \frac{V_o(s)}{V_{in}(s)} = \frac{-R}{\frac{1}{5C}} = -R5C$

So, the given circuit is a differentiator.

When a triangular wave is applied to a differentiator, the output will be a square wave.

85. How does Refractive index vary in Graded index fibre ?

A. Tangentially
B. Transversely
C. Radially
D. Longitudinally

Ans. C

Sol. The refractive index of the core is maximum along the fibre axis and if gradually decreases. Here the refractive index varies radially from the axis of the fibre. Hence it is called graded index fibre.

86. Electromagnetic wave is incident on the interface of two media at an angle θ with the normal directed along y-axis. The direction of the surface current k will be

A. Along + y axis
B. Along – y axis
C. Along + z axis
D. Along – z axis

Ans. D

Sol. The direction of surface current can be given by

$$(H_1 - H_2) \times a_{n_{12}} = k$$

$$\hat{a}_x \times (-\hat{a}_y) = -\hat{a}_z \rightarrow \text{along} - \text{zaxis}$$

87. For an SCR, during turn-on and turn-off, the quantities responsible, respectively, are

A. gate voltage and gate current
B. holding current and latching current
C. latching current and holding current
D. forward break over voltage and reverse break over voltage

Ans. C

Sol. Latching current and holding current are responsible for turn-on and turn-off of an SCR respectively.

88. Four resistors of equal value when connected in series across a supply dissipates 25W. It the same resistors are now connected in parallel across the same supply, the power dissipated will be

A. 12.5 W
B. 25 W
C. 400 W
D. 2000 W

Ans. C

Sol. Let R be value of one resistor,

∴ The power dissipated by combined resistor is

$$P_1 = \frac{V^2}{4R}\left(R_{eq} = R + R + R + R = 4R\right)$$

$$\frac{V^2}{R} = 4 \times 25 = 100$$

When resistor are connected in parallel,

$$R_{eq} = \frac{1}{\frac{1}{R} + \frac{1}{R} + \frac{1}{R} + \frac{1}{R}} = \frac{R}{4}\Omega R$$

$$P_2 = \frac{V^2}{R_{eq}} = \frac{V^2}{R} \times 4 = (100) \times 4$$

= 400 W

89. We want to design a discrete-time LTI system with the property if the input is

$$x(n) = \left(\frac{1}{2}\right)^n u(n) - \frac{1}{4}\left(\frac{1}{2}\right)^{n-1} u(n-1)$$

Then the output is $y(n) = \left(\frac{1}{3}\right)^n u(n)$

Difference equation relating x(n) and y(n) that characterized the system is

A. $7(n) + \frac{1}{4}y(n-1) + \frac{1}{12}y(n-2) = x(n) - \frac{1}{2}x(n-1)$

B. $7(n) + \frac{7}{12}y(n-1) + \frac{1}{12}y(n-2) = x(n) - \frac{1}{2}x(n-1)$

C. $7(n) - \frac{7}{12}(n-1) + \frac{1}{12}y(n-2) = x(n) - \frac{1}{2}x(n-1)$

D. $7(n) + \frac{7}{12}y(n-1) - \frac{1}{12}y(n-2) = x(n) + \frac{1}{2}x(n-1)$

Ans. C

Sol. $$x\left(e^{j\omega}\right) = \frac{1}{1 - \frac{1}{2}e^{-j\omega}} - \frac{1}{4}\frac{1}{1 - \frac{1}{2}e^{-j\omega}}e^{-j\omega}$$

$$X\left(e^{j\omega}\right) = \frac{1 - \frac{1}{4}e^{-j\omega}}{1 - \frac{1}{2}e^{-j\omega}}$$

Taking the DTFT of the output y(n). we obtain

$$y\left(e^{j\omega}\right) = \frac{1}{1 + \frac{1}{3}e^{-j\omega}}$$

The frequency response of the system is given by

$$H\left(e^{j\omega}\right) = \frac{y\left(e^{j\omega}\right)}{x\left(e^{j\omega}\right)} = \frac{\frac{1 - \frac{1}{2}e^{-j\omega}}{2}}{\left(1 - \frac{1}{4}e^{-j\omega}\right)\left(1 - \frac{1}{3}e^{-j\omega}\right)}$$

$$H\left(e^{j\omega}\right) = \frac{1 - \frac{1}{2}e^{-j\omega}}{1 - \frac{7}{12}e^{-j\omega} + \frac{1}{12}e^{-j\omega}}$$

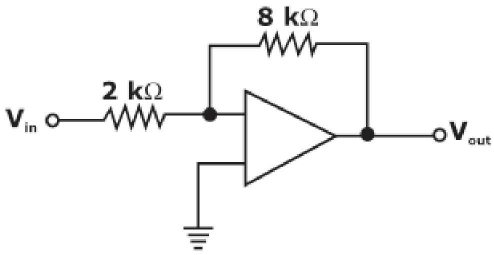
$$\frac{y\left(e^{j\omega}\right)}{x\left(e^{j\omega}\right)} = \frac{1 - \frac{1}{2}e^{-j\omega}}{1 - \frac{7}{12}e^{-j\omega} + \frac{1}{12}e^{-j\omega}}$$

Taking the inverse DTFT yield

$$y(n) - \frac{7}{12}y(n-1) + \frac{1}{12}y(n-2) = x(n) - \frac{1}{2}x(n-1)$$

Option C is correct.

90. Consider the inverting amplifier shown below :



If the open-loop gain of the op-amp is equal to A_{OL} = 100 and the op-amp is ideal in all other aspects, then the value of the overall voltage gain of the circuit is equal to

A. -4.1

B. -4

C. -3.81

D. -2.16

Ans. C

Sol.

$$A = \frac{-R_2 / R_1}{1 + \frac{(1 + R_2/R_1)}{A_{CL}}} = \frac{-8/2}{1 + \frac{(1 + 8/2)}{100}}$$

$$= \frac{-4}{1 + \frac{5}{100}} = \frac{-4}{1.05} = -3.8095 = -3.81$$

91. A voltage commutated chopper operating at 1 kHz delivers constant load current 10 A . The minimum time (in µseC. for which the main thyristor should be ON is

(Assume L = 4 µH and C = 1 µF)

A. 6.28 µsec

B. 12 µsec

C. 2 µsec

D. 5.5 µsec

Ans. A

Sol. The capacitor voltage change from $+V_S$ to $-V_S$

So it takes π radian

$\therefore \omega_o t = \pi$

$$t = \frac{\pi}{\omega_o} = \pi\sqrt{LC}$$

$$t = \pi\sqrt{4 \times 10^{-6} \times 1 \times 10^{-6}}$$

$$= 2\pi \times 10^{-6} = 6.28\mu s$$

92. A system is described by the following state model :

$$x = \begin{bmatrix} 0 & 2 \\ -2 & -2 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u; y = \begin{bmatrix} 1 & 1 \end{bmatrix} x$$

Then the transfer function of the system is

A. $\frac{2}{s^2 + s + 4}$

B. $\frac{2 - s}{s^2 + s + 4}$

C. $\frac{4 + s}{s^2 + s + 4}$

D. $\frac{s + 2}{s^2 + s + 4}$

Ans. D

Sol. Since, transfer function,

$$T(S) = C[SI - A]^{-1} \cdot B$$

$$[SI - A] = \begin{bmatrix} s & -2 \\ s & s+1 \end{bmatrix}$$

$$[sI - A]^{-1} = \frac{1}{s^1 + s + 4}\begin{bmatrix} s+1 & 2 \\ -2 & s \end{bmatrix}$$

$$T(s) = [1 \quad 1] \times \frac{1}{s^2 + s + 4}\begin{bmatrix} s+1 & 2 \\ -2 & s \end{bmatrix} \times \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

$$= [1 \quad 1] \times \frac{1}{s^2 + s + 4}\begin{bmatrix} 2 \\ s \end{bmatrix}$$

$$T(s) = \frac{s+2}{s^2 + s + 4}$$

93. Which of the following is true?

(i) On average, neural networks have higher computational rates than conventional computers.

(ii) Neural networks learn by example.

(iii) Neural networks mimic the way the human brain works

A. (ii) and (iii) are true

B. (i), (ii) and (iii) are true

C. All of the mentioned are true

D. None of the mentioned are true

Ans. C

Sol. Neural networks have higher computational rates than conventional computers because a lot of the operation is done in parallel. That is not the case when the neural network is simulated on a computer. The idea behind neural nets is based on the way the human brain works. Neural nets cannot be programmed, they can only learn by examples

94. A unity feedback (negative) system has open loop transfer function

$$G(s) = \frac{k}{S(S+4)}$$

For the gain K closed-loop system has a steady state unit ramp error of 0.2. If the system is now modified to include a forward path zero at S = -8 new value of steady state error is

A. $\frac{1}{40}$ B. $\frac{1}{20}$

C. $\frac{1}{10}$ D. $\frac{1}{50}$

Ans. A

Sol. Given

$$G(s) = \frac{K}{S(S+4)} H(s) = 1 e_{ss} = 0.2$$

$$e_{ss} = \lim_{s \to 0} \frac{1}{SG(s)},$$

$$0.2 = \lim_{s \to 0} \frac{1}{S\frac{K}{S(S+4)}}$$

$$0.2 = \frac{4}{K}$$

K = 20

And modified transfer function

$$G(s) = \frac{K(S+6)}{S(S+6)}$$

New value of steady state error

$$e_{SS} = \lim_{S \to 0} \frac{1}{SG(s)}$$

$$e_{SS} = \lim_{S \to 0} \frac{1}{S\frac{k(S+8)}{S(S+4)}}$$

$$e_{zz} = \frac{1}{20 \times \frac{8}{4}}$$

$$e_{ss} = \frac{1}{40}$$

95. A step down chopper operates from a DC voltage source V_s and feeds a DC motor armature with counter emf E_B. From oscilloscope traces it is found that current increases for time t_r, s falls to zero over a time t_f and remains zero for a time t_o in every chopping cycle. Then the average voltage across the motor would be

A. $\frac{V_s t_r}{t_r + t_r + t_o}$

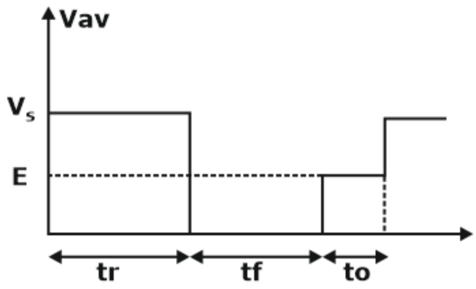
B. $\frac{V_s t_r + E_o t_r}{t_r + t_r + t_o}$

C. $\frac{V_o t_r + E_o t_r}{t_r + t_r + t_o}$

D. $\frac{V_s t_r + E_o (t_r - t_o)}{t_r + t_t + t_o}$

Ans. C

Sol.



$$Vav = \frac{Vstr + Ebto}{tr + tf + to}$$

96. For a dielectric conductor interface, consisting of surface charge ρs, the boundary condition that is satisfied is

A. $E_1E_{t1} = E_2E_{t_2}$

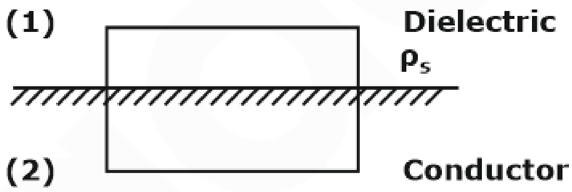
B. $E_{t_1} = E_{t_2}$

C. $\frac{E_{n1}}{E_1} = \rho_s$

D. $\frac{E_{n1}}{E_1} - \frac{E_{n2}}{E_2} = \rho_s$

Ans. B

Sol.



E-field inside the

Conductor is 0.

So, $D_{n1} = \rho_s \Rightarrow \frac{E_{n1}}{E_1} = \rho_s$

Where ρ_s = surface charge

97. A second order system with no zeros has its poles located at (-3 + j4) in the s-plane. The undamped natural frequency (ω_n) and the damping factor (ξ) of the system are respectively.

A. 4 rad/sec and 0.75

B. 3 rad /sec and 0.60

C. 5 rad/sec and 0.80

D. 5 rad / sec and 0.60

Ans. D

Sol. $(s+3+j4)(s+3-4j)=0$

$$(s+3)^2-(j4)^2=S^2+6s+25$$

By comparing it with standard characteristic equation,

$\omega_n^2=25(rad/sec)^2$

or $\omega_n=\sqrt{25}=5$ rad/sec

and $2\xi\omega_n=6$

or $\xi=\frac{6}{2\times 5}=0.6$

98. A phase lag network has the transfer function $G(s)=\frac{s+0.9}{s+0.15}$. The angular frequency at which the maximum phase shift for the network occur is

A. 2.72 rad/sec
B. 2.86 rad/sec
C. 0.36 rad/sec
D. 0.30 rad/sec

Ans. C

Sol. Given transfer function

$G(s)=\frac{s+0.9}{s+0.15}$

Phase lag network

$G_\xi(s)=\frac{s+9}{s+6}a>b$

Angular frequency which the maximum phase shift for the network

$w_a=\sqrt{ab}$

$w_a=\sqrt{0.9\times 0.15}=0.367$ rad/sec

Option C. is correct

99. The Nyquist sampling rate of the signal, x(t) = sinc2 (1000t)* sinc3 (2000t) is [Assume that, $\text{sinc}(t)=\sin(\pi t)/\pi t$]

A. 2 kHz
B. 4 kHz
C. 6 kHz
D. 8 kHz

Ans. A

Sol. $\text{Sinc}(1000t)\xleftrightarrow{CTFT}\frac{1}{1000}\text{rect}\left(\frac{f}{1000}\right)_{\grave{e}}.f_{max}=50\text{ Hz}$

$$\xleftrightarrow{CTFT}\frac{1}{10^6}\left[\text{rect}\left(\frac{f}{1000}\right)\times\text{rect}\left(\frac{f}{1000}\right)\right]_{\grave{e}}f_{max}=1000\text{ Hz}$$

$$X_1(t)=\text{Sinc}^2(2000)^3\xleftrightarrow{CTFT}\frac{1}{(2000)^3}\left[\text{rect}\left(\frac{f}{2000}\right)\times\text{rect}\left(\frac{f}{2000}\right)\times\left(\frac{f}{2000}\right)\right]_{\grave{e}}f_{max}=3000\text{ Hz}$$

$$X(t)=x_1(t)x_2(t)\xleftrightarrow{CTFT}X_1(f)X_2(f)\dot{a}.f_{max}=\min\{1000\text{Hz},\ 3000\text{Hz}\}=1000\text{Hz}$$

So, $f_{s(min)}=2f_{(max)}=2000\text{ Hz}=2\text{kHz}$

100. A wattmeter will read zero under the following condition

A. The voltage and current are exactly in phase

B. The voltage and current have the same time periods but the voltage is sinusoidal whereas the current is a square wave

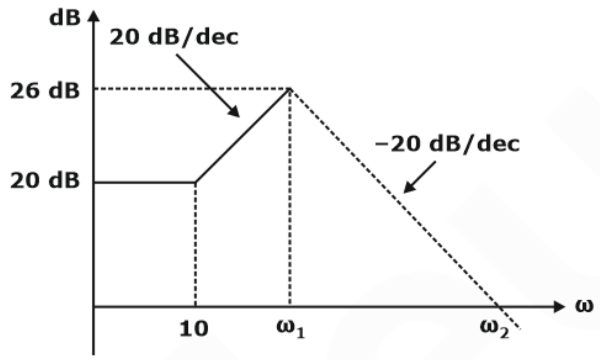
C. The voltage frequency is twice the current frequency

D. A wattmeter will read zero when current and the voltages are in quadrature

Ans. D

Sol. A wattmeter will read zero when current and the voltages are in quadrature

101. The magnitude-frequency response of a control system is given in figure below:



The values of ω_1 and ω_2 (in rad/sec) are respectively

[Take the approximation $\log_{10}(2) = 0.3$]

A. 100 and 400

B. 20 and 400

C. 20 and 200

D. 10 and 200

Ans. B

Sol. Number of decade change from first corner frequency 10 rad/sec to $\omega_1 = \frac{26-20}{20} = \frac{6}{20}$

Now, $\log\frac{\omega_1}{10} = \frac{6}{20} \Rightarrow \omega_1 = 20$ rad/sec

Now, no. of decade change from corner frequency

$\omega_1 \text{to} \omega_2 = \frac{26}{20} = 1.3$

$\therefore \log\frac{\omega_2}{\omega_1} = 1.3$ or $\log\frac{\omega_2}{20} = 1.3$

or, $\omega_2 = 400$ rad/s

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

A. copper

B. silver

C. platinum-iridium

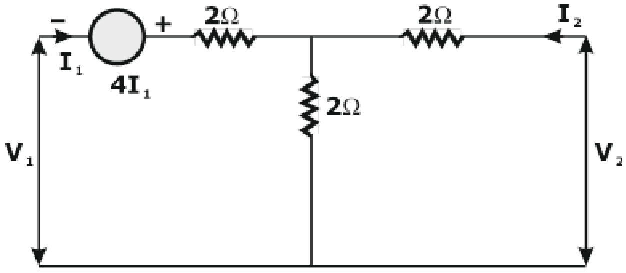
D. copper-nickel

Ans. C

Sol. In hot wire instruments the sensing wire is made of platinum-iridium.

103. Which of the following is/are correct?

The circuit shown in the figure below:



(1) Z_{11} = 8 Ω, Z_{22} = 4 Ω

(2) Z_{11} = 0 Ω, Z_{22} = 4 Ω

(3) is Reciprocal

(4) is symmetrical

Select the correct answer using the case given below

A. 2 and 4

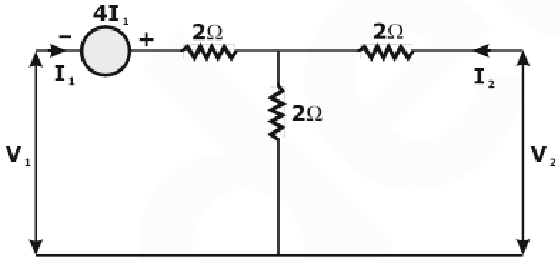
B. 1 and 3

C. 2 and 3

D. 1 and 4

Ans. C

Sol. Given circuit



$$Z_{11} = \left.\frac{V_1}{I_2}\right|_{I_2=0}$$

When $I_1 = 0$

$V_1 = -4I_1 + 4I_1 = 0$

$$\frac{V_1}{I_1} = 0$$

$Z_{11} = 0$

And $\frac{V_2}{I_2} = 2\Omega = Z_{21}$

If $I_1 = 0$

$V_2 = 2I_2 + 2I_2 = 4I_2$

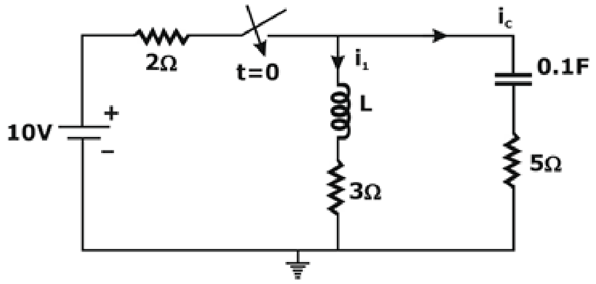
$$Z_{22} = \frac{V_2}{I_2} = 4$$

And $\frac{V_1}{I_2} = 2 = Z_{12}$

$$[Z] = \begin{bmatrix} 0 & 2 \\ 2 & 4 \end{bmatrix}$$

This network is reciprocal and Z_{11} = 0, Z_{22} = 4 so option C. is correct.

104. Consider the circuit shown in figure:



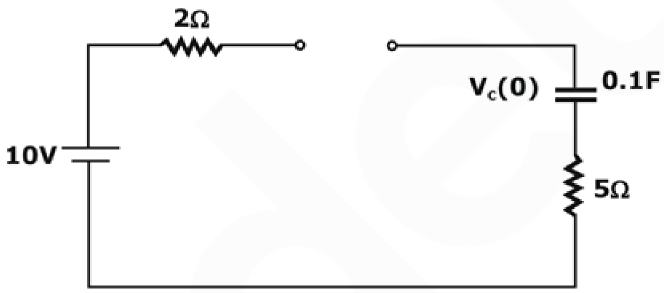
If switch is opened from a long time and at t = 0 switch is closed, then value of $\frac{dt_c}{dt}$ at $t = 0^+$ is

A. 0.8 A/sec B. – 0.6 A/sec

C. – 1.6 A/sec D. 1.6 A/sec

Ans. D

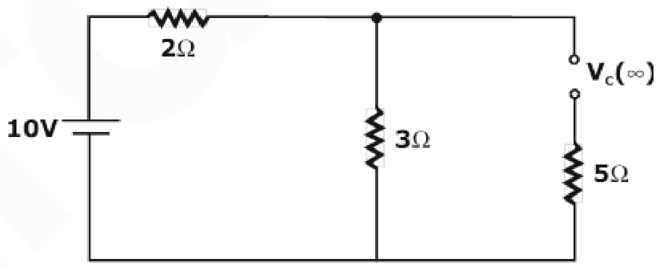
Sol. at $t = 0^-$ circuit is



$i_L = i_i = 1$

$i_c = 0$ or $V_c(0^-) = V_c(0^+) = 10V$

at t = ∞ circuit is switch is closed and inductor is short and capacitor open.



$V_c(\infty) = \frac{3}{2+3} \times 10 = 6V$

And voltage equation in capacitance.

$V_c(t) = V_c(\infty) - [V_c(\infty) - V_s(0)]e^{-t/RC}$

$= 6 - [6 - 10]e^{-t/0.5}$

$= 6 + 4\, e^{-2t}$

$$i_c = \frac{CdV_c(t)}{dt} = 0.1\left[-8e^{-2t}\right]$$

$i_c = -0.8\ e^{-2t}$

$$\frac{d_{ic}}{dt} = +1.6e^{-2t}$$

$$\frac{d_{ic}(0)}{dt} = 1.6A / sec$$

105. In a three phase half controlled rectifier with constant current load and freewheeling diode, what is the fraction of cycle the diode conducts? Consider firing angle (α) of thyristors greater than 60^{0}.

A. $(\alpha - \pi/3)2\pi$ B. $(\alpha + \pi/3)2\pi$

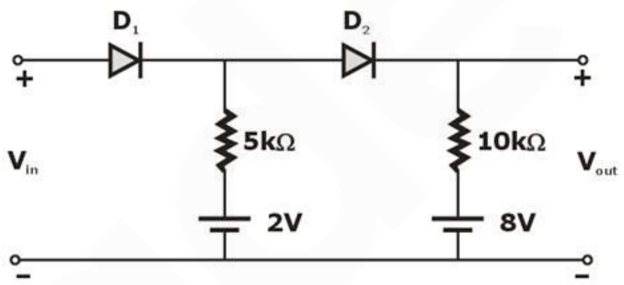
C. $(\alpha - \pi/3)\times 3/2\pi$ D. $(\alpha + \pi/3)\times 3/2\pi$

Ans. C

Sol. for α >60 °

Diode conduction cycle is the period of time for which diode will conduct $= \left(\alpha - \frac{\pi}{3}\right)\times\frac{3}{2\pi}$

106. Consider the circuits with ideal diodes as shown below:



For $V_{in} < 0$, the output voltage V_{out} is equal to

A. Zero B. V_{in}

C. 2V D. 8V

Ans. D

Sol. Since $V_{in} < 0$ both D_1 and D_2 will be off thus V_{out} = 8V

107. For good commutation of thyristor which one of the following must be met?

A. circuit turn off time should be greater than thyristor turn off time

B. Circuit turn off time should be less than thyristor turn off time.

C. Circuit turn off time must be equal to thyristor turn off time.

D. Circuit turn off time is less than or equal to thyristor turn off time

Ans. A

Sol. For a good commutation circuit turn OFF (t_c) time should be greater than thyristor turn OFF time (t_q) in case if $t_c < t_q$. commutation will be failure & during this condition, If the rate of rise of fault current is large enough SCR may be damaged in case if protective element is not able to clear the fault.

108. The internal state of neuron is called ___________, is the function of the inputs the neurons receives.

A. Weight

B. activation or activity level of neuron

C. Bias

D. None of these

Ans. B

Sol. The internal state of neuron is called activation or activity level of neuron, is the function of the inputs the neurons receives.

109. A 200 V, 5 A D.C. energy meter is tested at its marked ratings. The resistance of the pressure circuit is 8000 Ω and that of current coil is 0.1 Ω. The power consumed when testing the meter with phantom loading with current circuit excited by a 6 V battery is

A. 2.5 W

B. 5 W

C. 32.5 W

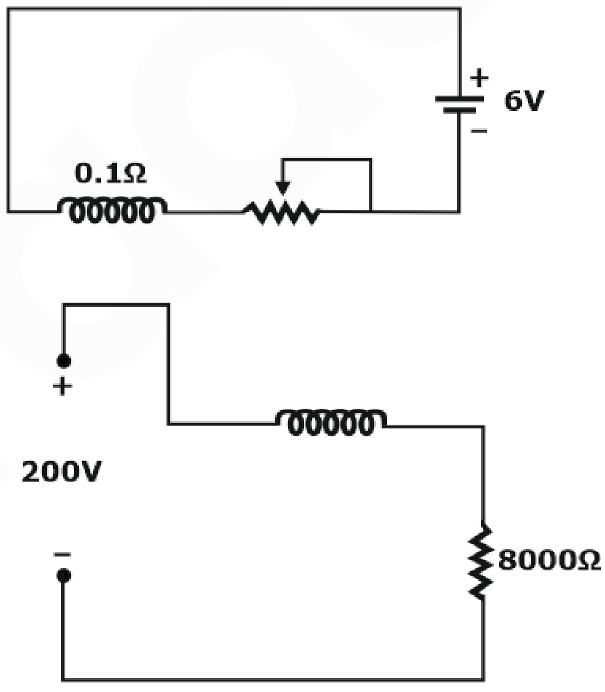
D. 35 W

Ans. D

Sol. When tested with phantom loading power consumed in current coil circuit

= VE

= 6 × 5 = 30 W



Power consumed in pressure coil circuit $\frac{V^2}{R_p} = \frac{(200)^2}{8000} = \frac{200 \times 200}{8000} = 5W$

Total power consumed = 30W + 5W = 35W

110. Consider the following statements:

1) A current mirror can be used as active load because it has low output AC resistance.

2) The gain of practical op-amp at high frequencies is less as compared to that of at medium frequencies.

3) In self bias circuit for CE amplifier, the base voltage is equal to supply voltage.

Which of the above statements are incorrect?

A. 1 and 2 B. 2 and 3

C. 1 and 3 D. None of these

Ans. C

Sol. Current mirror has high output AC resistance. Practical op-amp behaves as low pass filter. In self bias circuit, base voltage is less than the supply voltage.

111. A coil of inductance 240 mH and resistance 75 Ω is connected in parallel with a capacitor across a 30 V, variable frequency supply. The current drawn by the circuit is found to be minimum when the supply frequency is 1 kHz. The approximate values of Q- factor and bandwidth are, respectively

A. 40, 400 Hz B. 10, 100 Hz

C. 20, 50 Hz D. 50, 20 Hz

Ans. C

Sol. We know that Quality factor is given as:

$$Q = \frac{\omega L}{R} = \frac{2\pi f L}{R}$$

$$Q = \frac{\left(2 \times 3.14 \times 1 \times 10^{3} \times 240 \times 10^{-3}\right)}{75}$$

Q = 20.096

Also,

$$\text{Bandwidth} = \frac{f}{Q}$$

$$= \frac{1 \times 10^{3}}{20.096}$$

= 49.76

Therefore option C. is correct.

112. Fuzzy logic is usually represented as ___________

A. IF-THEN-ELSE rules

B. IF-THEN rules

C. Both IF-THEN-ELSE rules & IF-THEN rules

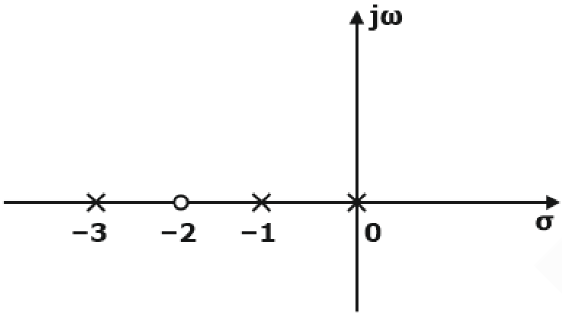
D. None of the mentioned

Ans. B

Sol. Fuzzy set theory defines fuzzy operators on fuzzy sets. The problem in applying this is that the appropriate fuzzy operator may not be known. For this reason, fuzzy logic usually uses IF-THEN rules, or constructs that are equivalent, such as fuzzy associative matrices. Rules are usually expressed in the form:

IF variable IS property THEN action

113. The pole-zero configuration of a transfer function is shown below.



The value of the transfer function at s = 2 is found to be 4. The transfer function is

A. $\frac{(s+2)}{(s+1)(s+3)}$

B. $\frac{30(s+2)}{s(s+1)(s+3)}$

C. $\frac{10(s+1)(s+3)}{s(s+2)}$

D. $\frac{15(s+2)}{s(s+1)(s+3)}$

Ans. B

Sol. Let system gain be K.

$$\therefore \text{T.F.} = \frac{C(s)}{R(s)} = H(s) = \frac{K(s+2)}{s(s+1)(s+3)}$$

Given, H (2) = 4

So, $\frac{K \times 4}{2 \times 3 \times 5} = 4$ or $K = 30$

$$\therefore H(s) = \frac{30(s+2)}{s(s+1)(s+3)}$$

114. If the signal $x_1(n) = e^{15\pi n/7}$ and $x_2(n) = e^{12\pi n}$, and a signal made by $x_1(n)$ and $x_2(n)$. this is $x(n) = x_1(n) + x_2[3n/4]$ so fundamental time period of the signal x(n) is

A. 56

B. 7

C. 28

D. 14

Ans. C

Sol. Given $x_1(n) = e^{j5\pi n/7}$

$x_2(n) = e^{j2\pi n}$

and $x(n) = x_1(n) + x_2(3n/4)$

$$x(n) = e^{j5\pi n/7} + e\frac{j6\pi n}{4}$$

$$\omega_1 = 5\pi / 7 \qquad \omega_2 = \frac{3\pi}{2}$$

$$\frac{N_1}{m_1} = \frac{2\pi}{\frac{5\pi}{7}} = \frac{14}{5}$$

$$\frac{N_2}{m_2} = \frac{2\pi}{\frac{3\pi}{2}} = \frac{4}{3}$$

Fundamental time period is = LCM (N, N_2)

= LCM [14, 4]

= 28

Option (C) is correct.

115. A shunt generator has armature copper loss equal to 4800 W when the armature current is 200 A. If the generator was operating at maximum efficiency at the given condition the value of armature resistance and total fixed losses will be respectively.

A. 0.12 Ω, 2400 W
B. 0.24 Ω, 2400W
C. 0.24 Ω, 4800W
D. 0.12 Ω, 480 W

Ans. D

Sol. Given armature copper loss at 200 A

$$FR_a = 4800W$$

$$R_a = \frac{4800W}{200 \times 200} = \frac{24}{200} = \frac{12}{100} = 0.12\Omega$$

At maximum efficiency,

Variable losses= constant loss = 4800 W

116. Which one of the fundamental equation was modified by Maxwell to form the basis of electromagnetic theory ?

A. Gauss law of magneto static
B. Gauss law of electrostatic
C. Ampere's law
D. Faraday law

Ans. C

Sol. $\nabla \times H = J_C + \frac{\partial D}{\partial t}$

Ampere's law

$$\oint H \cdot d\ell \int_s \left(J_C + \frac{\partial D}{\partial t}\right) \cdot ds$$

J_C = conduction current density

$J_d = \frac{\partial D}{\partial t} \rightarrow$ Diffusion current density

117. In a 132 kV system, Phase to Ground capacitance is 0.01 μF and inductance is 4H. Calculate the critical resistance to be connected in order to eliminate restriking if a magnetizing current of 5 A is interrupted by the circuit

A. 20 kΩ
B. 10 kΩ
C. 100 kΩ
D. 200 kΩ

Ans. B

Sol. Critical resistance

$$R = \frac{1}{2}\sqrt{\frac{L}{C}} = \frac{1}{2}\sqrt{\frac{4}{0.01\times 10^{-6}}}$$

= 10 kΩ

118. If the reflection coefficient of a 2 port network is 0.4 then the return network loss in the network is

A. 6.5 dB
B. 8 dB
C. 4 dB
D. 6 dB

Ans. B

Sol. Return loss of the network $= -20\log|\Gamma|$

⇒ –20 log (0.4) = 7.95 dB

≃ 8dB

119. A continuous-time periodic signal x(t) is real-valued and has a fundamental period T = 16. The non-zero Fourier series coefficient for x(t) signal are :

$x_1 = x_{-1} = 2 \qquad x_3 = x_{-3} = 4j$

Which of the following signal represents the continuous time periodic signal for these coefficients ?

A. $2\cos\frac{\pi}{8}t + 4\cos\left[\frac{3\pi}{8}t - \pi/2\right]$

B. $4\cos\frac{\pi}{8}t + 8\cos\left[\frac{3\pi}{8} + \pi/2\right]$

C. $4\cos\frac{\pi}{8}t + 8\cos\left[\frac{3\pi}{8} - \pi/2\right]$

D. $2\cos\frac{\pi}{8}t + 4\cos\left[\frac{3\pi}{8}t + \pi/2\right]$

Ans. B

Sol. The Signal x(t) periodic with fundamental frequency $\omega_o = 2\pi/16 = \pi/8$

$$x(t) = \sum_{h=-\infty}^{\infty} X_n e^{jn\omega_o t}$$

$$= x_1 e^{j\omega_o t} + x_{-1}e^{-j\omega_o t} + x_3 e^{j3\omega_o t} + x_{-3}e^{-3j\omega_o t}$$

$$x(t) = 2e^{\pi j/8t} + 2e^{-j\pi/8t} + 4e^{\frac{j3\pi}{8}t} + 4e^{-\frac{j3\pi}{8}t}$$

$$= 4\cos\left[\frac{\pi}{8}t\right] - 8\sin\left[\frac{3\pi}{8}t\right]$$

$$= 4\cos\left[\frac{\pi}{8}t\right] + 8\cos\left[\frac{3\pi t}{8} + \frac{\pi}{2}\right]$$

Option (B) is correct.

120. Two equivalent circuit given in figure (A) and figure (B)

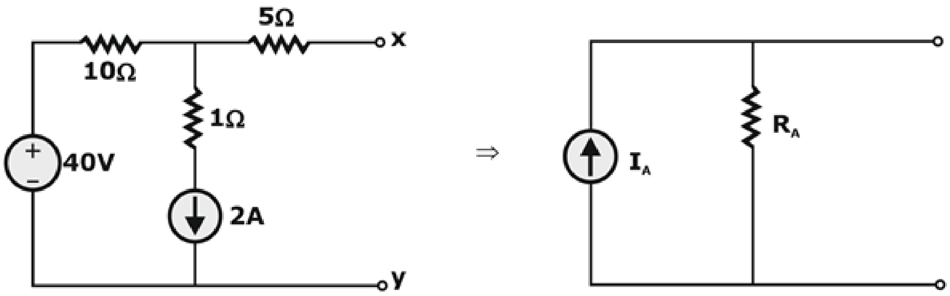


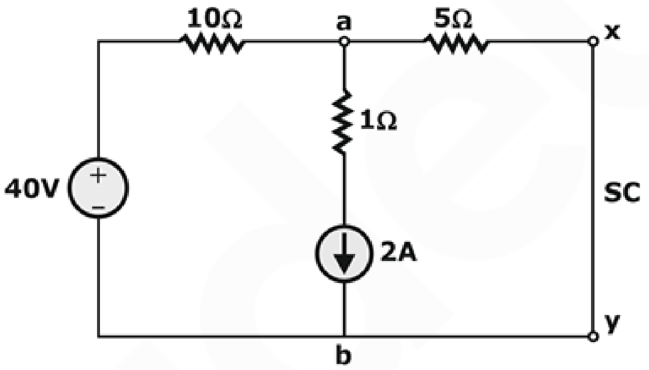
fig (a) fig (b)

If the value of $\alpha I_A + R_A = 20$. So the value of α is

A. 0
B. 3.75
C. - 3.75
D. 4.25

Ans. B

Sol. In given question fig B. is Norton equivalent of figure A. where I_A is short circuit current.



Applying nodal at node A.

$$\frac{V_a - 40}{10} + 2 + \frac{V_a}{5} = 0$$

$$\frac{3V_a}{10} - 4 + 2 = a$$

$$\frac{3V_a}{10} = 2$$

$$V_a = \frac{20}{3}$$

And

$$I_{sc} = \frac{V_a}{5}'$$

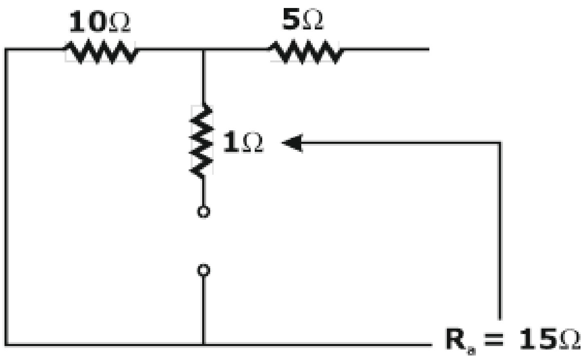
$$= \frac{20}{3 \times 5} = \frac{4}{3}$$

And, given $\alpha I_A + R_A = 20$.

$I_A = I_{sc}$

R_A = thevenin equivalent

$$I_{sc} = \frac{4}{3}$$



$$\alpha \times \frac{4}{3} + 15 = 20$$

$$\alpha = \frac{15}{4}$$

α =3.75

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