



VIZAG

Steel Management Trainee 2020

Electrical Engineering

Mega Mock Challenge (August 23 - August 24 2020)

Questions & Solutions

1. In the following question, select the related word from the given alternatives.

Bee : Honey :: Cow:?

- A. Animal
- B. Grass
- C. Milk
- D. Water

Ans. C

Sol. Honey is obtained from bees. Similarly, milk is obtained from cows.

Hence, option C is the correct response.

2. Find the wrong number in the series.

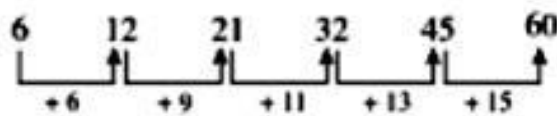
6, 12, 21, 32, 45, 60

- A. 6
- B. 12
- C. 21
- D. 32

Ans. A

Sol. **Given series:** 6, 12, 21, 32, 45, 60

The pattern is:



In the given series the odd numbers are added to get the next number in the series So, the order will be **(+5, +9, +11, +13, +15)**. Therefore, **7 must replace 6 in the given series.**

Clearly, 6 is the wrong number in the given series.

New series will be: **7, 12, 21, 32, 45, 60**

Hence, option A is correct.

3. **Direction:** In the question given below there is a statement followed by two conclusions numbered I and II. You have to assume everything in the statement to be true. Then consider the 2 conclusions together and decide which of them follows beyond a reasonable doubt from the information given in the statement.

Statement:

One can master the English language only through extensive reading and constant use of the language through writing and conversing.

Conclusions:

I. People who do not read English books cannot master the language fully.

II. Only reading is not enough, one needs to practise speaking and writing in the language to master it.

- A. Only conclusion I follows
- B. Only conclusion II follows
- C. Both conclusion I and II follows
- D. Neither conclusion I nor II follows
- E. Either conclusion I nor II follows

Ans. C

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Sol. One cannot learn complete command over the language without reading books or articles in that language. His/her knowledge regarding the usage will be incomplete. So I conclusion follows. Conclusion II also follows as the practice makes a man perfect. Without using the language accumulated by reading by conversing and writing one will not master the language.

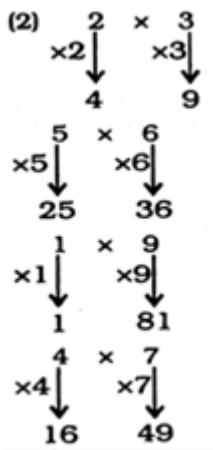
4. Equations given below are solved on the basis, of a certain system. On the same basis, find out the correct answer for the unsolved equation.

$2 \times 3 = 49, 5 \times 6 = 2536, 1 \times 9 = 181, 4 \times 7 = ?$

- A. 1628
- B. 1649
- C. 2549
- D. 1219

Ans. B

Sol.



Hence, option B is the right answer.

5. Arrange the given words in the sequence in which they occur in the dictionary.

- 1). Manifest
- 2). Meticulous
- 3). Meridian
- 4). Merchant

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

Ans. A

Sol. The correct order of the words is,

- 1). Manifest
- 4). Merchant
- 3). Meridian
- 2). Meticulous

→ 1, 4, 3, 2

6. **Direction:** If LUXOR is coded as 30, then GUILDS will be coded as?

- A. 36
- B. 38
- C. 24
- D. 40

Ans. C

Sol. LUXOR : 12, 21, 24, 15, 18 = 90 (sum) $90/3 = 30$

Similarly

GUILDS : 7, 21, 9, 12, 4, 19 = 72 sum hence $72/3 = 24$

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

- A. Japanese
- B. Italian
- C. French
- D. German

Ans. A

Sol. Japanese is an Asian country language, while Italian, French and German are European country languages.

Hence, option A is different from others.

8. Choose the correctly spelt word.

- A. Rhapsody
- B. Rhapsody
- C. Rapcode
- D. Rapsody

Ans. A

Sol. Option A has the correctly spelt word. Rhapsody means an effusively enthusiastic or ecstatic expression of feeling.

9. **Direction:** In the following question, some part of the sentence have error and some have none. Find out which part of the sentence has an error. If the sentence is correct as it is, your answer is 'No error'.

Travel agents around the world have to rely on computers (A)/ to book seats in air flights or rooms in hotels (B)/ either now or a year from now. (C)/ No error

- A. (A)
- B. (B)
- C. (C)
- D. No error

Ans. B

Sol. The error is in part (B) of the sentence. The preposition should be "on" instead of "in".

10. Select the correct option to fill in the blank. |||End|||

He agreed _____ my business proposal.

- A. at
- B. on
- C. to
- D. for

Ans. C

Sol. The correct preposition to be used in the given sentence is "to". Hence, option C is the correct answer.



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Explanation:

When you agree with someone/something, it means you accept the point of someone/something.

I agree with you.

She does not agree with my answer.

You agree on some issue or point of debate.

We agreed on this issue.

You agree to demands/queries, or you agree to do something.

He agreed to my demands.

He agreed to join me for the movie.

11. Select the word which means the same as the group of words given.
A written declaration of government or a political party. A. Manifesto
B. Affidavit
C. Dossier
D. Document

Ans. A

Sol. Manifesto = a public declaration of policy and aims, especially one issued before an election by a political party or candidate.

Affidavit = a written statement confirmed by oath or affirmation, for use as evidence in court.

Dossier = a collection of documents about a particular person, event, or subject.

Hence, the correct word is "manifesto".

12. Select the most appropriate antonym of the given word. |||End|||
Permit
A. endorse
B. approve
C. certify
D. forbid

Ans. D

Sol. Permit means to allow someone to do something. The word which is opposite in meaning is "forbid" as it means to refuse to allow.

Endorse means declare one's public approval or support of.

13. First time in India which state announced cow cess?
A. Madhya Pradesh
B. Uttar Pradesh
C. Haryana
D. Rajasthan
E. Uttarakhand

Ans. D



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Sol. First time in India Rajasthan announced cow cess. Rajasthan is the only state in India which has a dedicated Cow Ministry. Rajasthan government has imposed a 10% cow cess as surcharge on stamp duty for protection and propagation of cows in the state.

14. International boundary between India and Pakistan is demarcated by

- | | |
|-------------------|-----------------|
| A. McMahon Line | B. Durand Line |
| C. Radcliffe Line | D. Maginot Line |

Ans. C

Sol. McMahon Line - India China

Durand Line - Pakistan Afghanistan

Radcliffe Line - India Pakistan

Maginot Line - France Germany

15. Who was the first Indian awarded the Oscar for lifetime achievements in Cinema?

- | | |
|---------------------|---------------------|
| A. Amitabh Bachchan | B. Satyajit Ray |
| C. Bhanu Athaiya | D. Shivaji Ganeshan |

Ans. B

Sol.

- Satyajit Ray is one of the world's finest directors, producers, screenwriters, composers, writers, and graphic designers.
- **Satyajit Ray was the first Indian awarded the Oscar for lifetime achievements in Cinema.**
- Oscars are awards for artistic and technical merit in the film industry.

16. Where is Lomas rishi caves situated?

- | | |
|--------------------------------|---------------------|
| A. Barabar and Nagarjuni hills | B. Garo hills |
| C. Aravalli range | D. Baba budan hills |
| E. khasi hills | |

Ans. A

Sol.

- The Lomas Rishi Cave, also called the Grotto of Lomas Rishi, is a sacred architectural feature located in the Barabar and Nagarjuni hills of Jehanabad district in the Indian state of Bihar.
- This rock-cut cave was carved out as a sanctuary. It was built during the Ashokan period of the Maurya Empire in the 3rd century BC, as part of the sacred architecture of the Ajivikas.

17. NABARD was established on the recommendations of ____.

- | | |
|----------------------------|-------------------------|
| A. B. Sivaraman Committee | B. S. Wanchoo Committee |
| C. T. Rangarajan Committee | D. N. Tandon Committee |
| E. None of these | |



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Ans. A

Sol. NABARD was established on the recommendations of **B. Sivaraman Committee**, (by Act 61, 1981 of Parliament) on 12 July 1982 to implement the National Bank for Agriculture and Rural Development Act 1981.

18. Successive discounts of 20% and 10% are equivalent to a single discount of :

- A. 28%
- B. 25%
- C. 30%
- D. 15%

Ans. A

Sol. We have two successive discount be x% and y%, then equivalent discount

$$\begin{aligned} &= \left(x + y - \frac{xy}{100} \right) \% \\ &= \left(20 + 10 - \frac{20 \times 10}{100} \right) \% \\ &= (30 - 2) \% \\ &= 28\% \end{aligned}$$

19. **Direction:** What should come in place of question mark (?) in the following number series?

- 12, 7, 8, 13, ?, 68.5
- A. 27
 - B. 19
 - C. 21
 - D. 24
 - E. 28

Ans. A

Sol. This series following this pattern,

$$\times 0.5 + 1, \times 1 + 1, \times 1.5 + 1, \times 2 + 1, \times 2.5 + 1$$

$$= 13 \times 2 + 1 = \mathbf{27}$$

$$\mathbf{7 = 12 \times 0.5 + 1}$$

$$\mathbf{8 = 7 \times 1 + 1}$$


$$\mathbf{13 = 8 \times 1.5 + 1}$$

$$\mathbf{27 = 13 \times 2 + 1} \text{-----hence 27 is missing term}$$

$$\mathbf{68.5 = 27 \times 2.5 + 1}$$

20. A car goes one kilometer at 30 km per hour and then goes another kilometer at 40 km per hour. The average speed (in km/hour) of the car for 2 km is

- A. 35
- B. $34\frac{2}{7}$
- C. $33\frac{3}{7}$
- D. $33\frac{5}{7}$



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Ans. B

Sol. Time taken by a car to cover 1 km at a speed of 30 km/hr = $\frac{1}{30}$ hr

Time taken by a car to cover another 1 km at a speed of 40 km/hr = $\frac{1}{40}$ hr

Now, total distance covered by the car = 1 + 1 = 2 km

$$\text{Total time} = \frac{1}{30} + \frac{1}{40} = \frac{7}{120} \text{ hr}$$

Therefore, The average speed of the car =

$$\frac{\text{total distance}}{\text{total time}} = \frac{2}{\frac{7}{120}} = \frac{2 \times 120}{7} = \frac{240}{7} = 34 \frac{2}{7} \text{ km / hr}$$

Hence, option B is correct.

21. A tree increases annually by 1/8th of its height. By how much will it increase after 2 years, if it stands today 64 cm high?

- A. 72 cm
- B. 74 cm
- C. 75 cm
- D. 81 cm

Ans. D

Sol. In first year tree will increase by;

$$= 64 \times \frac{1}{8} = 8 \text{ cm}$$

$$\text{Tree's Height at the end of I year} = 64 + 8 = 72 \text{ cm}$$

In second year tree will increase by;

$$= 72 \times \frac{1}{8} = 9 \text{ cm}$$

$$\text{Tree's Height at the end of II year} = 72 + 9 = 81 \text{ cm}$$

Hence Option D is correct.

22. Ram and Shyam together can do a work in 8 days. Both of them began to work. After 3 days Ram fell ill. Shyam completed the remaining work in 15 days. In how many days can Ram complete the whole work?

- A. 17
- B. 12
- C. 15
- D. 13

Ans. B

Sol. Work of Ram and Shyam for

$$1 \text{ day} = \frac{1}{8}$$

$$\therefore \text{Work of Ram and Shyam for 3 days} = \frac{3}{8}$$



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$$\therefore \text{Remaining work} = 1 - \frac{3}{8} = \frac{5}{8}$$

$$\therefore \frac{5}{8} \text{ work is done by Shyam in 15 days}$$

\therefore 1 work is done by Shyam

$$= 15 \times \frac{8}{5} = 24 \text{ days.}$$

$$\therefore \text{work of Shyam for 1 day} = \frac{1}{24}$$

\therefore work of Ram for 1 day

$$= \frac{1}{8} - \frac{1}{24} = \frac{1}{12}$$

Hence Ram alone will complete the work in 12 days.

23. The ages of Puja and Rani were in the ratio 3 : 2 a year ago. Five year hence, the ratio of their ages become 7 : 5. Find the present age of Rani

- A. 37
- B. 28
- C. 25
- D. 32
- E. 27

Ans. C

Sol. Let the present ages of Puja and Rani be 'a' and 'b'.

Given, ages of Puja and Rani were in the ratio 3 : 2 a year ago.

$$\therefore \frac{a-1}{b-1} = \frac{3}{2}$$

$$\Rightarrow 2a - 2 = 3b - 3$$

$$\Rightarrow a = 1.5b - 0.5$$

Also, five year hence, the ratio of their ages become 7 : 5.

$$\therefore \frac{a+5}{b+5} = \frac{7}{5}$$

$$\Rightarrow 5a + 25 = 7b + 35$$

$$\Rightarrow 7.5b - 2.5 + 25 = 7b + 35$$

$$\Rightarrow 0.5b = 12.5$$

$$\Rightarrow b = 25$$

\therefore Present age of rani = 25 years

24. When a number is divided by 24, the remainder is 16. The remainder when the same number is divided by 12 is

- A. 3
- B. 4
- C. 6
- D. 8

Ans. B



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Sol. the number is of form

$$N = 24Q + 16$$

on dividing by 12

$$N/12 = 2Q + (16/12)$$

$$= 2Q + 1 + (4/12)$$

Thus the remainder is 4

OR

Required remainder = 16 - 12 = 4 because 24 is the multiple of 12

Hence Option B is correct.

25. **Direction:** What approximate value should come in place of the question mark (?) in the following equation (Note: You are not expected to calculate the exact value)?

$$9980 \div 49 \times (4.9)^2 - 1130 = ?$$

A. 3870

B. 4500

C. 2600

D. 3000

E. 4080

Ans. A

Sol. Approximate value be calculated as

$$9980 \div 49 \times (4.9)^2 - 1130 = ?$$

$$? \approx 10000 \div 50 \times 25 - 1130$$

$$= 200 \times 25 - 1130 = 3870$$

26. For the given signal x(t), which of the given following is correct?

$$x(t) = 10 \sin(2\pi ft + 45^\circ)u(t)$$

A. Energy = ∞ , Power = 25unit

B. Energy = ∞ , Power = 50unit

C. Energy = ∞ , Power = 100unit

D. Energy = 50unit, Power = 0unit

Ans. A

Sol. $A \sin(\omega t + \Phi)u(t)$ is a Power signal;

$$P = \lim_{T \rightarrow \infty} \frac{1}{T} \int_{-T/2}^{T/2} [A \sin(\omega t)u(t)]^2 dt$$

$$P = \lim_{T \rightarrow \infty} \frac{1}{T} \int_0^{T/2} A^2 \sin^2(\omega t) dt$$

$$P = \lim_{T \rightarrow \infty} \frac{1}{T} \int_0^{T/2} A^2 \left[\frac{1 - \cos 2\omega t}{2} \right] dt$$

$$P = \lim_{T \rightarrow \infty} \frac{A^2}{T} \left[\frac{t}{2} - \frac{\sin 2\omega t}{4\omega} \right]_0^{T/2}$$

$$P = \lim_{T \rightarrow \infty} \frac{A^2}{T} \left[\frac{T}{4} - \left(\frac{\sin 2\pi - \sin 0}{4\omega} \right) \right]$$



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$$P = \lim_{T \rightarrow \infty} \frac{A^2}{4}$$

$$P = \frac{A^2}{4} = \frac{100}{4} = 25$$

27. Consider a signal $x(t)$ whose coefficient is C_n .

If, $x(t) = x^*(t)$ and $-x(t) = x(-t)$

Then, which of the given statement is true?

- 1. C_n is purely real
- 2. $C_n^* = C_{-n}$
- 3. $C_n^* = -C_{-n}$
- 4. C_n is purely imaginary

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

Ans. C

Sol. $x(t) = x^*(t)$ (given)

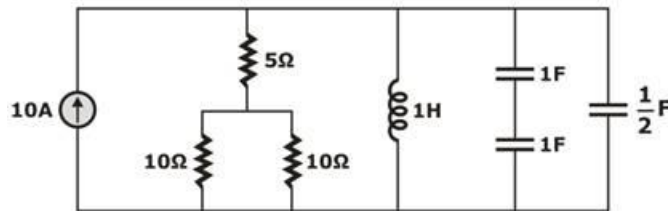
So, the signal is real

$-x(t) = x(-t)$, the signal is odd

For real odd signal $x(t)$, its coefficient C_n will be imaginary odd (conjugate symmetry)

Hence, $C_n^* = C_{-n}$ & C_n is purely imaginary.

28. The Q factor of the given circuit is:



- A. 15.81
- B. 10
- C. 5
- D. 0.1

Ans. B

Sol. For parallel RLC circuit the quality factor is given by

$$Q = R \sqrt{\frac{C}{L}}$$

$$\text{Equivalent resistance of the circuit } R = 5 \times \left[\frac{10 \times 10}{10 + 10} \right]$$

$$R_{eq} = 10\text{ohm}$$

$$L = 1\text{H}$$

$$\text{Equivalent capacitance of the circuit } C = \left[\frac{1 \times 1}{1 + 1} \right] + \frac{1}{2}$$

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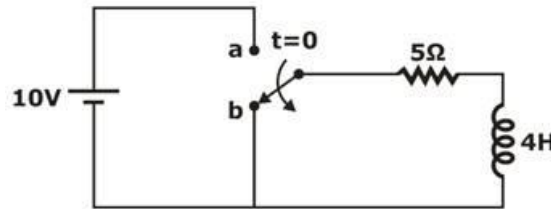
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$$C_{eq} = 1F$$

$$Q = 10\sqrt{\frac{1}{1}} = 10$$

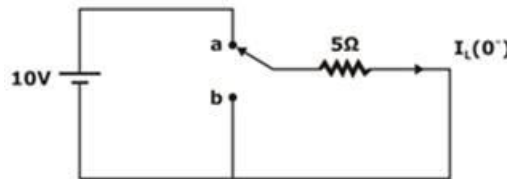
29. An inductor of 4H is charged when switch is connected to 'a'. At $t = 0$ sec switch is moved from 'a' to 'b'. Calculate the instant at which current in the given circuit will be 36.9% of its initial value.



- A. 0.8sec.
- B. 1.25sec.
- C. 2sec.
- D. 2.5sec.

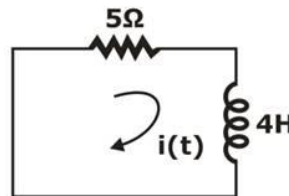
Ans. A

Sol. When switch is connected to 'a', at $t=0^-$ inductor will be short circuited.

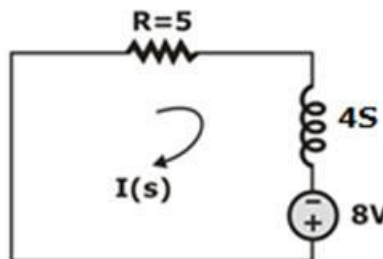


$$I_L(0^-) = \frac{10}{5} = 2A = I_L(0^+)$$

When switch is connected to 'b', at $t=0$ the circuit is shown below.



Apply Laplace transform



$$I(s) = \frac{8}{5 + 4s}$$

Taking inverse Laplace transform: $i(t) = 2e^{-\frac{5t}{4}}$

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At $t = t_0$

$i(t_0) = 36.9\%$ of initial value

$$i(t_0) = 0.369 \times 2 = 2e^{-5t/4}$$

$$0.369 = e^{-5t/4}$$

$$1 = \frac{5t}{4}$$

$$t = \frac{4}{5} = 0.8 \text{ sec.}$$

30. In a step-down chopper circuit, the 7th harmonic component of output voltage needs to be eliminated completely. What will be the Ton time for the desired result if the Total time period is 540μsec?

A. 57.14μsec

B. 67.14μsec

C. 77.14μsec

D. 7th harmonic is not present in output

Ans. C

Sol. For harmonic Elimination is case of step-down chopper: $\delta = \frac{1}{n}$

Where,

δ = duty cycle

n = harmonic

Here we are telling about 7th harmonic, So n = 7

$$\delta = \frac{1}{7}$$

$$\frac{T_{on}}{T} = \frac{1}{7}$$

$$T_{on} = \frac{T}{7} = \frac{540}{7}$$

$$= 77.14\mu\text{sec}$$

31. For the matched load line, the current transmission coefficient is

A. 0

B. 1

C. -1

D. 2

Ans. B

Sol. Current transmission coefficient (β) = $1 + \alpha$

where α = Current relation Coefficient

$$\alpha = \frac{Z_S - Z_L}{Z_S + Z_L}$$

Since it is matched line, $Z_S = Z_L$

$$\alpha = \frac{Z_S - Z_S}{Z_S + Z_S}$$



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$$\alpha = 0$$

$$\text{Hence } \beta = 1$$

32. A DC shunt motor runs at 500rpm at 220V, a resistance of 4.5ohm is added in series with armature for speed control, R_a is 0.5ohm, what is the armature current during stalling?

- A. 11A
- B. 22A
- C. 33A
- D. 44A

Ans. D

Sol. Motor is stalled i.e., $\omega = 0$

$$\text{So } E_a = 0$$

$$0 = 220 - I_a (4.5 + 0.5)$$

$$I_a = 44A$$

33. Hydrometer is used to determine

- A. Specific gravity of liquids
- B. Relative Humidity
- C. Specific gravity of solids
- D. Specific gravity of gases

Ans. A

Sol. A hydrometer is an instrument that measures the specific gravity (relative density) of liquids—the ratio of the density of the liquid to the density of water. A hydrometer is usually made of glass, and consists of a cylindrical stem and a bulb weighted with mercury or lead shot to make it float upright.

34. If magnetic flux density expressed as $4x\hat{a}_x + 2ky\hat{a}_y + 8\hat{a}_z$. The value of 'K' which will satisfy the differential form of Maxwell equation.

- A. 1
- B. -1
- C. 12
- D. -2

Ans. D

Sol. Differential form of max well equation $\nabla \cdot B = 0$

$$\left(\hat{a}_x \frac{\partial}{\partial x} + \hat{a}_y \frac{\partial}{\partial y} + \hat{a}_z \frac{\partial}{\partial z} \right) \cdot (4x\hat{a}_x + 2ky\hat{a}_y + 8\hat{a}_z) = 0$$

$$\left[\frac{\partial}{\partial x} (4x) \right] + \left[\frac{\partial}{\partial y} (2ky) \right] + \left[\frac{\partial}{\partial z} (8) \right] = 0$$

$$4 + 2K = 0$$

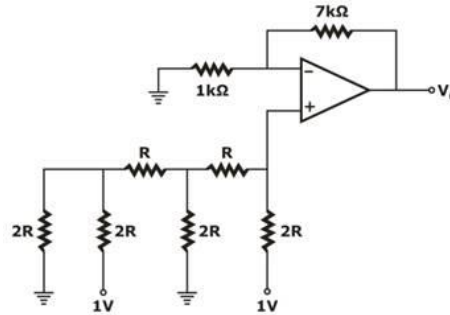
$$K = -2$$



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35. For the 3-bit DAC shown below, obtain the output V_o .



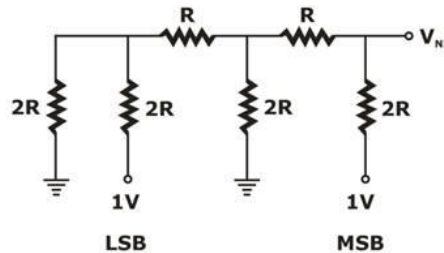
- A. 3V
- B. 8V
- C. 1V
- D. 5V

Ans. D

Sol. For the given ideal non inverting op-amp, the output is given as

$$V_o = V_{NI} \left(1 + \frac{7}{1} \right) = 8V_{NI}$$

3 bit DAC:



$$V_{NI} = \frac{1}{2^{3-0}} + \frac{1}{2^{3-2}} = \frac{1}{8} + \frac{1}{2} = \frac{5}{8}$$

$$V_o = 8 \times \frac{5}{8} = 5V$$

36. The gradient can be replaced by which of the following?

- A. Maxwell Equation
- B. Volume Integral
- C. Differential Equation
- D. Surface Integral

Ans. C

Sol. Since gradient is the maximum space rate of change of flux. Differential equation is used to find the maximum value. Hence gradient Can be replaced by differential Equation.

37. Which of the following statement is incorrect?

- A. Output of CE amplifier is out of phase with respect to its input.
- B. CC amplifier is a voltage buffer
- C. CB amplifier is a voltage buffer
- D. CE amplifier is used as an audio amplifier

Ans. C

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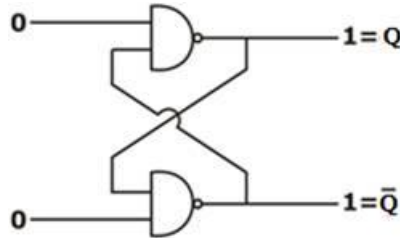
Sol. The output of the CE amplifier has a phase shift of 180° with respect to the input.
 The CC amplifier has voltage gain of 1 thus it is voltage buffer.
 However, the CB amplifier has large voltage gain and current gain = 1 thus it is a current buffer.

38. In NAND Latch and NOR Latch, the invalid state (Q, \bar{Q}) respectively is:

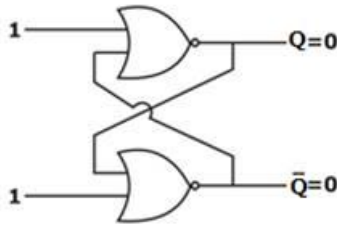
- A. (0,0), (1,1)
- B. (0,0), (0,0)
- C. (1,1), (1,1)
- D. (1,1), (0, 0)

Ans. D

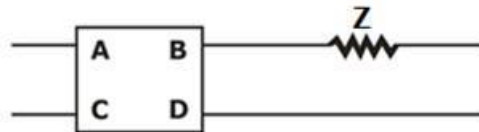
Sol. For NAND Latch, if the input is (0,0), the output state will be (1,1), which is invalid



For NOR gate, if the input is (1,1), the output state will be (0,0), which is invalid



39. The overall ABCD parameters of the given below series combination will be:



- A. $\begin{bmatrix} AZ & B \\ \frac{C}{Z} & D \end{bmatrix}$
- B. $\begin{bmatrix} A & AZ + B \\ C + \frac{D}{Z} & D \end{bmatrix}$
- C. $\begin{bmatrix} A & B + Z \\ C & D \end{bmatrix}$
- D. $\begin{bmatrix} A & AZ + B \\ C & CZ + D \end{bmatrix}$

Ans. D

Sol. Cascade combination is represented in given figure. Hence the overall combination of ABCD parameter is

$$= \begin{bmatrix} A & B \\ C & D \end{bmatrix} \begin{bmatrix} 1 & Z \\ 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} A & AZ + B \\ C & CZ + D \end{bmatrix}$$

40. For the incident and the reflected current waves sketched below, the terminal condition at the receiving end of a loss-less overhead transmission line having surge impedance Z is



- A. Short circuit
- B. Open circuit
- C. Line terminated with impedance $Z = R_{ohm}$
- D. None of the above

Ans. A

Sol. For, Incident current wave = Reflected current wave

$$I_I = I_R$$

$$\alpha_1 = 1 = \frac{Z - Z_L}{Z_L + Z}$$

Where $Z \rightarrow$ surge impedance

$Z_L \rightarrow$ Load impedance

$$Z_L + Z = Z - Z_L$$

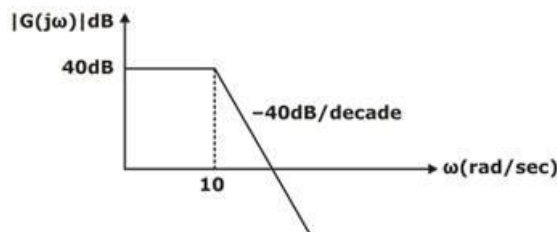
$$Z_L = 0 \rightarrow \text{short circuit}$$

41. In case of Induction motor & synchronous motor, the speed control is respectively
- A. Possible, Possible
 - B. Not possible, Not possible
 - C. Possible, Not possible
 - D. Not possible, Possible

Ans. C

Sol. Synchronous motor is a constant running motor which runs only at synchronous speed. While Induction motor runs always less than synchronous speed. Hence speed variation is possible in induction motor only.

42. The asymptotic bode plot for the gain magnitude of a minimum phase system $G(s)$ is shown in figure



The system $G(s)$ is :

- A. Under damped
- B. Critically damped
- C. Un-damped
- D. Negative critical damped

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Ans. B

Sol. Transfer function of the given system is

$$G(s) = \frac{K}{\left(1 + \frac{S}{10}\right)^2}$$

$$20\log K = 40$$

$$K = 100$$

$$G(s) = \frac{100 \times 100}{(S + 10)^2} = \frac{10^4}{S^2 + 20S + 100}$$

Comparing with 2nd order transfer function characteristic equation: $S^2 + 2\xi\omega_n S + \omega_n^2$

$$\omega_n = 10$$

$$\xi = 1$$

Hence system is critically damped.

43. A 400kV, 3-phase, 50Hz overhead line of surge impedance of 400ohms is delivering 300MW load. The voltage profile of the line is -
- A. Flat voltage profile
 - B. Rising characteristics
 - C. Drooping characteristics
 - D. None of the above

Ans. B

Sol. Loading = 300MW (given)

$$\text{Surge impedance loading (SIL)} = \frac{400^2}{400} = 400 \text{ MW}$$

$$\text{SIL} > \text{Loading}$$

Hence, the voltage will rise along the line which is called as Ferranti effect.

44. For steady Torque production in synchronous machine.
- A. Number of poles on stator & rotor must be same
 - B. Relative speed between stator & rotor magnetic field must be zero
 - C. Both (A) & (B)
 - D. Either (A) or (B) but not both

Ans. C

Sol. For steady Torque production both the condition needs to be satisfied i.e. Same number of poles on stator & rotor & relative speed must be zero.

45. Electric Energy and Magnetic Energy are related to which of the following element respectively.
- A. Inductor, Inductor
 - B. Capacitor, Capacitor
 - C. Inductor, Capacitor
 - D. Capacitor, Inductor

Ans. D



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Sol. Capacitor has capability of storing energy in the form is electric field while Inductor has capability of storing energy in the form of magnetic field.

46. In a Feedback network, Input voltage is 14V, feedback voltage is 6V and source voltage is 20V. β i.e. feedback factor is in ohms. What is the configuration?

- A. Shunt–Shunt feedback
- B. Shunt–Series feedback
- C. Series–Series feedback
- D. Series–Shunt feedback

Ans. C

Sol. Input $V_i = 14V$

Feedback $V_f = 6V$

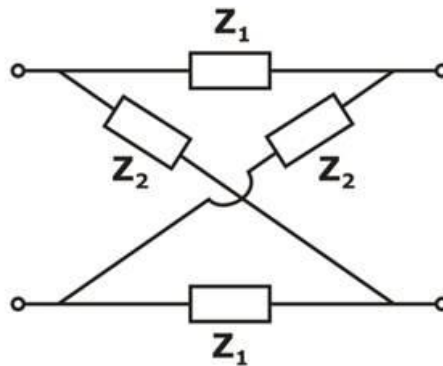
Source $V_S = 20V$

We can write $V_i = V_S - V_f$, which is voltage mixing.

Since β is in ohms i.e. $\frac{\text{Voltage}}{\text{Current}}$

Since output of feedback is voltage and input is current therefore the output has current sampling. Thus, configuration is current–series feedback or series–series feedback.

47. What is the expression for h_{22} in the network shown below?



- A. $\frac{2}{Z_1 + Z_2}$
- B. $\frac{2}{Z_1 - Z_2}$
- C. $\frac{Z_1 + Z_2}{2}$
- D. $\frac{Z_1 - Z_2}{2}$

Ans. A

Sol. h-parameter of two port is expressed as:

$$V_1 = h_{11}I_1 + h_{12}V_2$$

$$I_2 = h_{21}I_1 + h_{22}V_2$$

$$h_{22} = \left. \frac{I_2}{V_2} \right|_{I_1=0}$$

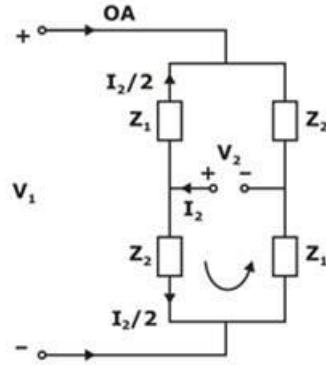
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Simplifying the given Lattice network

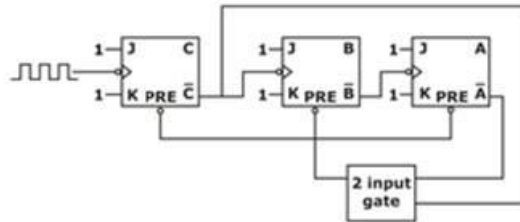


$$-V_2 + \frac{I_2}{2} Z_2 + \frac{I_2}{2} Z_1 = 0$$

$$\frac{I_2}{2} (Z_1 + Z_2) = V_2$$

$$\left. \frac{I_2}{V_2} \right|_{I_1=0} = h_{22} = \frac{2}{Z_1 + Z_2}$$

48. Below figure shows a mod-5 ripple counter, the 2-Input gate used in order to Pre-set the J-K flip flops. The 2-input gate is:



- A. OR gate
- B. NOR gate
- C. AND gate
- D. NAND gate

Ans. D

Sol. State table for mod-5 down counter is given below

CLK	Count			Y(Output of 2-input gate)
	A	B	C	
0	1	1	1	1
1	1	1	0	1
2	1	0	1	1
3	1	0	0	1
4	0	1	1	1
5	0	1	0	0

$$Y = \overline{\overline{A.C}}$$

Hence, the two-input gate is NAND gate.

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49. The microwave frequency range is considered to start at:

- A. 1GHz
- B. 5GHz
- C. 10GHz
- D. 100GHz

Ans. A

Sol. Microwave frequency range is Considered to be start at 1GHz. It is standard and fixed.

50. Which of the following properties are true for the state transition matrix?

- 1. $\Phi(t_1/t_2) = \Phi(t_1) \Phi^{-1}(t_2)$
- 2. $\Phi(-t) = \Phi^{-1}(t)$
- 3. $\Phi(t_1-t_2) = \Phi(-t_2) \Phi(t_1)$
- 4. $\Phi(0) = I$

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

Ans. C

Sol. $\Phi(t) = e^{At}$

- 2. $\Phi(-t) = e^{-At} = (e^{At})^{-1} = \Phi^{-1}(t)$
- 3. $\phi(t_1 - t_2) = e^{A(t_1-t_2)} = e^{At_1} \cdot e^{-At_2} = \phi(t_1) \phi^{-1}(t_2)$
- 4. $\Phi(0) = I$

$$\Phi(0) = e^{A \times 0} = e^0 = I$$

- 1. $\phi(t_1 / t_2) \neq \phi(t_1) \phi^{-1}(t_2)$

Hence option (c) is correct.



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