



RVUNL 2021

Electrical Engineering

Mini Mock Challenge

(April 21st - April 22nd 2021)

Questions &
Solutions

1. In the following question, select the related word from the given alternatives.
palaeontology : Fossil :: Phrenology : ?
- A. Skull
 - B. Pancreas
 - C. Thyroid
 - D. Lungs

Ans. A

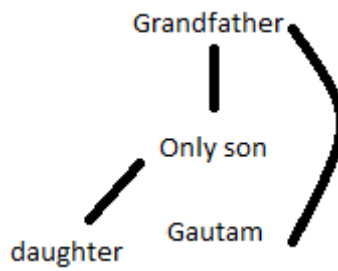
Sol.: Palaeontology is the study of fossils. Similarly, Phrenology is the study of the size and shape of the skull.

Hence, option A is the correct response.

2. Pointing to Gautam, Nandani says, "I am the daughter of the only son of his grandfather."
How Nandani is related to Gautam?
- A. Niece
 - B. Daughter
 - C. Sister
 - D. Cannot be determined.

Ans. C

Sol.:

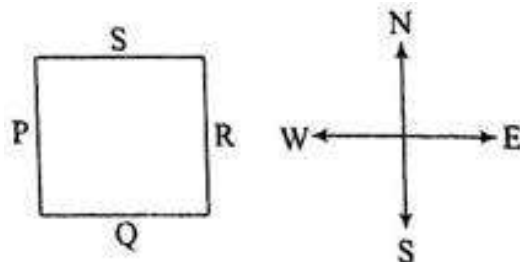


Nandani is the daughter of the only son of Gautam's grandfather. Hence, it is clear that Nandani is the sister of Gautam.

3. 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.:



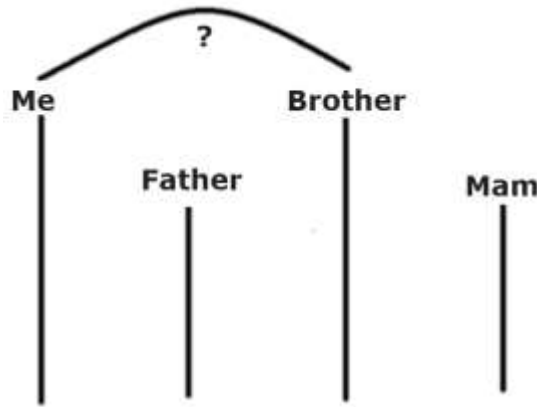
Q is facing North.

Hence, option D is correct.

4. I am taller than my father, my father is not taller than my brother and my mother is not taller than my brother. Who is the tallest?
- A. me
 - B. brother
 - C. mother
 - D. data inadequate

Ans. D

Sol.: Data is incomplete because heights of brother and me are not mentioned.



Hence, option D is the correct answer.

5. Janpad Panchayat works at which level?
- A. Village Level
 - B. District Level
 - C. Division Level
 - D. Block Development Level

Ans. D

Sol.: In Madhya Pradesh, **three-tier Panchayati Raj system** is implemented, where **gram panchayat** at **village level**, **janpad panchayat** at **development block level** and **district panchayat** is functioning at the **district level**. Hence the area comes under the **Janpad panchayat** is a **development block**.

6. Three crops that contribute maximum to global food grain production are _____
- A. wheat, rice, barley
 - B. rice, maize, sorghum
 - C. wheat, maize, sorghum
 - D. wheat, rice, maize

Ans. D

Sol.: Wheat, rice, maize contribute maximum to global food grain production.

7. Reverse Repo Rate and Base Rate are formulated by _____
- A. SBI
 - B. SEBI
 - C. RBI
 - D. Government of India

Ans. C

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Sol.:

- Reverse Repo Rate and Base Rate are formulated by Reserve Bank of India.
- Reverse repo rate is the rate of interest at which the RBI borrows funds from other banks in the short term.
- Base rate is the minimum rate set by the Reserve Bank of India below which banks are not allowed to lend to its customers

8. Who was the first Indian to be elected as a Member of the British House of Commons?

- A. Jayaprakash Narayan B. Dada Bhai Naoroji
C. Ram Manohar Lohia D. Sarojini Naidu

Ans. B

Sol.:

- Dadabhai Naoroji (4 September 1825 – 30 June 1917), known as the Grand Old Man of India, was a Parsi intellectual, educator, cotton trader, and an early Indian political and social leader.
- He was a Liberal Party member of parliament (MP) in the United Kingdom House of Commons between 1892 and 1895, and the first Asian to be a British MP.

9. Who was the founder of the Indian Reform Association in 1870?

- A. Debendranath Tagore B. Keshub Chandra Sen
C. Rammohan Roy D. Dayanand Saraswati

Ans. B

Sol.: The Indian Reform Association was formed on 29 October 1870 with Keshub Chunder Sen as president. It represented the secular side of the Brahmo Samaj and included many who did not belong to the Brahmo Samaj.

10. In respect of which type of bills, the President of India has no veto power?

- A. Money Bills
B. Constitutional Amendment Bills
C. Financial Bills
D. Ordinary Bills

Ans. B

Sol.:

1. The **President of India** has **no veto power** in respect of a **Constitutional Amendment Bill**. The **24th Constitutional Amendment Act of 1971** made it **obligatory** for the President to give his **assent** to a Constitutional Amendment Bill.
2. The power of **withholding** a bill sent for assent of the President is called **veto power** of the President. Different type of veto powers have been provided to the President of India by the Indian Constitution which are in the form of **Absolute, Suspensive** and **Pocket** veto.

11. The number of parliamentary seats (Lok Sabha) of Maharashtra is _____.

- A. 10
- B. 26
- C. 28
- D. 48

Ans. D

Sol.:

- The number of parliamentary seats (Lok Sabha) of Maharashtra is **48**.
- Maharashtra has a bicameral legislature.
- The major contenders in the state are the United Progressive Alliance (UPA) and National Democratic Alliance (NDA).

12. Silvassa is the capital of which of the following Union Territory of India?

- A. Daman & Diu
- B. Lakshadweep
- C. Puducherry
- D. Dadra & Nagar Haveli

Ans. D

Sol.: **Silvassa** is the capital of the Indian Union Territory of **Dadra and Nagar Haveli**. During Portuguese rule, Silvassa was also known as **Vila de Paço d'Arcos**, after the town of the same name near **Lisbon**.

The city has a large number of **factories** and **industries** providing significant government revenue, which allows the city to maintain a low level of **taxation**.

13. SHINYUU Maitri-18 is a bilateral exercise started in which of the following city?

- A. Noida
- B. Agra
- C. Varanasi
- D. Ghaziabad

Ans. B

Sol.:

- SHINYUU Maitri-18 is a bilateral exercise between India and Japan from 03 Dec -07 Dec 18
- It is started in **Agra**.

14. In which district of Uttar Pradesh Adani Group have set up a 50 MW solar photovoltaic plant?

- A. Mahoba
- B. RaeBareli
- C. Amethi
- D. Saharanpur

Ans. A

Sol.:

- Infrastructure conglomerate Adani Group had set up **50 megawatts (MW) solar photovoltaic (PV) plant in Mahoba**, Uttar Pradesh.
- The plant has been set up with an investment of Rs. 315 crore, under the National Solar Mission Scheme.

15. GEF, an international aid-giving agency has the full form:
- A. Global Economic Fund B. Global Educational Fund
C. Global Environment Facility D. Global Energy Fund

Ans. C

Sol.:

- The full form of GEF is **Global Environment Facility**.
- The Global Environment Facility (GEF) was established on the eve of the 1992 Rio Earth Summit to help tackle our planet's most pressing environmental problems.

16. What was the theme of the International Women's Day 2019?
- A. Re-Thinking Women's Empowerment and Gender Equality
B. Think Equal, Build Smart, Innovate for Change
C. Press for Progress
D. Equality for Women is Progress for All

Ans. B

Sol.:

- The International Women's Day is celebrated on **8 March every year**.
- "Think Equal, Build Smart, Innovate for Change" is the theme of International Women's Day.

17. Krivoy-Rog has rich resources of
- A. Manganese B. Coal
C. Iron-ore D. Copper

Ans. C

Sol.:

- Krivoy-Rog has rich resources of Iron ore.

- The city is a large industrial center, the center of the Kryvyi Rih iron ore basin.
- The total explored reserves of iron ore are over 32 billion tons.

18. Which animal has three eyes in the world?
- A. Octopus B. Tuatara
C. Cockroach D. Crocodiles

Ans. B

Sol.:

- **Tuatara animal has three eyes in the world.**
- The lizard-like reptile tuatara has a "well-developed parietal eye, with a small lens and retina".
- Parietal eyes are also found in lizards, frogs and lampreys, as well as some species of fish, such as tuna and pelagic sharks, where it is visible as a light-sensitive spot on top of their head.



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19. Which chemical compound is also known as Pearl Ash?
- A. Chromium Trioxide B. Zinc Phosphide
C. Potassium Carbonate D. None of these

Ans. C

Sol.: • **Potassium Carbonate (K_2CO_3)** is known as **pearl ash**.

- It is used in making glass, dyes, soap.
- It is also used in fire extinguisher and to soften water.
- Zinc Phosphide (Zn_3P_2) is used for killing rats.
- Chromium Trioxide (CrO_3) is mainly used in chrome plating.

20. Which one of the following catalyst is used for hydrogenation of vegetable oils?

- A. Zinc dust B. Nickel
C. Platinum D. Copper

Ans. B

Sol.:

21. The ratio of relative velocity of separation after collision to the velocity of approach before collision is called_____.

- A. Inelastic collision B. Elastic collision
C. Coefficient of Restitution resilience D. None of these

Ans. C

Sol.: • The **coefficient of restitution** (e) is defined as the ratio of the relative velocity of collision after separation to the relative velocity of approach before collision.

- The **coefficient of restitution** depends to a large extent on the nature of the two materials of which the colliding objects are made.
- It is also affected by the impact velocity, the shape and size of the colliding objects, the location on the colliding objects at which the collision occurs, and their temperatures.

22. If the mass of an object is 60 kgs, what will be its weight on the moon? (N=Newton)

- A. 60N B. 600N
C. 98N D. 10N

Ans. C

Sol.: Given mass = 60 kg

As we know,

Weight= mass \times acceleration due to gravity

Weight on the earth= $60 \times 9.8 = 588$

On moon the gravity is approx $1/6$ as compared to earth that is $9.8/6 \text{ m/s}^2$

Weight of that object on moon = $588 \times 1/6 = 98 \text{ N}$

Ans. A

Sol.: The Rajasthan Seva Sangh started a weekly publication from Ajmer called Naveen Rajasthan, whose publisher was Vijay Singh Pathik. Vijay Singh Pathik led the Bijolia and Bengu peasant movement. He is called the father of the peasant movement in India. He founded the Veer Bharat Samaj and edited newspapers like Rajasthan Kesari, Naveen Rajasthan / Tarun Rajasthan, etc.

27. Who was the first ruler of Gurjar-Pratihara dynasty?

- A. Nagabhatta I
- B. Banbhatta
- C. Vasudev
- D. Mihir Bhoj

Ans. A

Sol.: Nagabhatta was the first ruler of the first Gurjara Pratihara dynasty and the de facto founder of the Gurjara Pratihara Empire. We get this information from the Aihole inscription of the Chalukya king Pulakeshian II and Harshacharit composed by Banabhatta.

28. Which of the following is not the work and responsibility of Rajasthan Public Service Commission?

- A. Recruitment on vacant posts and newly created posts of all services like administrative, police, accounts, cooperative of the state
- B. Conducting examinations for appointment to state services
- C. To advise the State Government regarding disciplinary action taken against an employee
- D. Recruitment in selected services by promotion

Ans. D

Sol.: **Functions and responsibilities of Rajasthan Public Service Commission:**

- i. Recruitment on vacant posts and newly created posts of all services like administrative, police, accounts, cooperative of the state
- ii. Recruitment by promotion in **all services**
- iii. To advise the State Government regarding the policy of transfer, posting, compensation, expenses, etc., for the judicial matter
- iv. The Commission annually sends to the Governor all the details of its various activities, such as recruitment, promotion, seniority, determination, disciplinary proceedings, acceptance of temporary services and other consultancy related works
- v. Conducting examinations for appointment to state services
- vi. To advise the State Government regarding disciplinary action taken against an employee

29. Find the mean of the positive factors of 32

- A. 10.2
- B. 11.2
- C. 10.5
- D. 11.5

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Ans. C

Sol.: Number of these factors 1, 2, 4, 8, 16, 32 = 6

Some of these factors = $1 + 2 + 4 + 8 + 16 + 32 = 63$

$$\text{Mean} = \frac{\text{sum of factors}}{\text{number of factors}} = \frac{63}{6}$$

Mean = 10.5

30. Raju and Hemu are friends they were both born in 1995, what is the probability that they have same birthday?

A. $\frac{1}{365}$

B. $\frac{2}{365}$

C. $\frac{1}{366}$

D. $\frac{2}{366}$

Ans. A

Sol.: The year 1995 is a non-leap year out of two friends say Raju's birthday can be any day of 365 days in a non-leap year also Hamu's birthday can be any day of 365 days of the same year so the total number of outcomes is = 365, we assume all those 365 outcomes are equally likely.

Let E be the event (Raju and Hemu have the same birthday)

Then the number of favorable outcomes to the event

$$n(E) = 1$$

$$P(E) = \frac{n(E)}{n(S)} = \frac{1}{365}$$

31. If $\frac{x^4 + 1}{x^2} = 62$, then what is the value of $x^2 - \frac{1}{x^2}$?

A. $6\sqrt{35}$

B. $16\sqrt{15}$

C. $36\sqrt{5}$

D. $26\sqrt{45}$

Ans. B

Sol.: $\frac{x^4 + 1}{x^2} = 62$

$$x^4 + 1 = 62x^2$$

$$x^2 + \frac{1}{x^2} = 62$$

$$\left(x + \frac{1}{x}\right)^2 = x^2 + \frac{1}{x^2} + 2$$

$$\left(x + \frac{1}{x}\right)^2 = 62 + 2 = 64$$

$$\left(x + \frac{1}{x}\right) = \sqrt{64} = 8$$

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

$$\left(x - \frac{1}{x}\right)^2 = 62 - 2 = 60$$

$$\left(x - \frac{1}{x}\right) = \sqrt{60} = 2\sqrt{15}$$

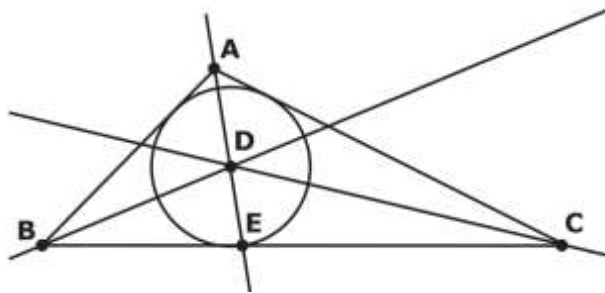
$$\text{Now, } x^2 - \frac{1}{x^2} = \left(x + \frac{1}{x}\right)\left(x - \frac{1}{x}\right) = 8 \times 2\sqrt{15} = 16\sqrt{15}$$

32. The incenter of a triangle is determined by

- A. altitudes
- B. angle bisectors
- C. medians
- D. perpendicular bisectors of the sides

Ans. B

Sol.: The incenter of a triangle is intersection point of the angle bisector of a triangle.



33. 'खूँटी' शब्द का बहुवचन बताइए?

- A. खूँटियाँ
- B. खूँटिया
- C. खूँटियों
- D. खूँटिया

Ans. A

Sol.: 'खूँटी' शब्द का बहुवचन खूँटियाँ है

34. उच्च की उत्तरावस्था क्या होगी?

- A. उच्चतम
- B. उच्चतर
- C. ऊँचा
- D. उच्चम

Ans. B

Sol.: मूलावस्था - उत्तरावस्था - उत्तमावस्था

उच्च - उच्चतर - उच्चतम

35. भूषण की कविता का प्रधान स्वर है-

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- A. व्यंग्यात्मक
B. प्रशस्तिपरक
C. श्रृंगारिक
D. कारुणिक

Ans. B

Sol.: भूषण शिवाजी और छत्रसाल के दरबारी कवि थे। भूषण की कविता का प्रधान स्वर प्रशस्तिपरक था।

36. मगरमच्छ का स्त्रीलिंग है?

- A. मगरमच्छी
B. मगरमच्छवी
C. मादा मगरमच्छ
D. मगरमच्छानी

Ans. C

Sol.: 'मगरमच्छ' का स्त्रीलिंग होता है 'मादा मगरमच्छ'। अन्य सभी विकल्प सही नहीं हैं। अतः इस आधार पर सही विकल्प मादा मगरमच्छ है।

37. **Choose the sentence with correct usage of pronoun:**

- A. These are nice shoes, but they look uncomfortable.
B. This are nice shoes, but they look uncomfortable.
C. It are nice shoes, but they look uncomfortable.
D. Them are nice shoes, but they look uncomfortable.

Ans. A

Sol.: Option A is the sentence which uses the correct form of pronoun.

38. **Choose the most appropriate option to change the narration (direct/indirect) of the given sentence.**

- A. The teacher said, "Be quiet, boys." A. The teacher said that the boys should be quiet.
B. The teacher called the boys and ordered them to be quiet.
C. The teacher urged the boys to be quiet.
D. The teacher commanded the boys that they be quiet.

Ans. C

Sol.: Statement A and D are incorrect due to inappropriate usage of connecting verb. In statement B 'called the boys' doesn't make much sense. Hence, statement C is the correct answer.

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

- I. ordered tasty two large pizzas for the game.
A. tasty large two

- B. large tasty two
- C. two tasty large
- D. No improvement

Ans. C

40. **Select the most appropriate option to fill in the blank.**

The show devoted two or three episodes to each novel, while short stories were _____ in a single episode.

- A. made up
- B. concealed
- C. narrated
- D. elucidate

Ans. C

Sol.: Made up = invented; not true

Concealed = hidden

Narrated = give a spoken or written account of

Elucidate = explain

The context of the sentence is related to novels and short stories that were aired in a show. With respect to this, 'narrated' is the most suitable word to make the sentence contextually correct.

Hence, option C is the correct answer.

41. Which of the following techniques can avoid race around condition in J-K flip flops?

- A. Edge triggering
- B. Master-slave configuration
- C. Reducing clock high time below propagation delay of the flip-flop
- D. All of the above

Ans. D

Sol.: If $J = K = 1$ and if $CLK = 1$ for a long time, then output will toggle as long as clock is high.

It makes the output of J-K Flip flop which can be avoided by using these techniques.

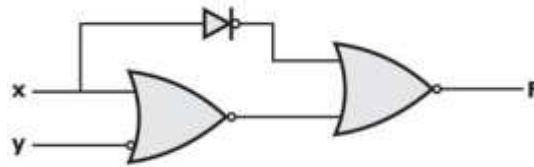
1. Edge triggering.
2. Using Master-slave configuration.
3. Making clock high time less than propagation delay.

42. Output of logic circuit shown below is:



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- A. X
- B. \bar{X}
- C. XY
- D. \bar{Y}

Ans. A

Sol.: $F = \overline{((x + \bar{y}) + \bar{x})} = \bar{x} \cdot \overline{(x + \bar{y})} = x(x + \bar{y}) = X + X\bar{y} = x(1 + \bar{y}) = x$

43. Characteristic equation of system is $s^3 + 4s^2 + 3s + k = 0$. The system is stable, if

- A. $K > 0$
- B. $K > 12$
- C. $0 < K < 12$
- D. None of the above

Ans. C

Sol.: Characteristic equation is

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

Using RH method,

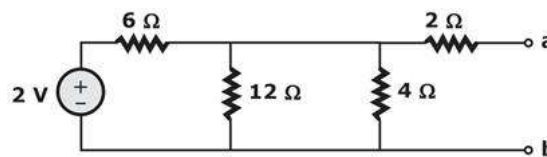
s^3	1	3
s^2	4	K
s^1	$\frac{12-K}{4}$	0
s^0	K	0

So, $\frac{12-K}{4} > 0$

$K < 12$ and $K > 0$

So, for stability, $0 < K < 12$.

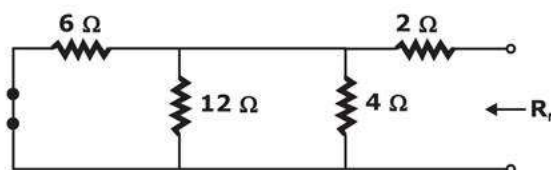
44. The value of Norton resistance across terminal ab.



- A. 4 Ω
- B. 2 Ω
- C. 6 Ω
- D. 10 Ω

Ans. A

Sol.: For Norton resistance, voltage source is short circuited



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$$R_N = (6 \parallel 12 \parallel 4) + 2$$

$$R_N = (4 \parallel 4) + 2 = 4\Omega$$

$$R_N = 4\Omega$$

45. The impulse response of a system is $h(n) = a^n u(n)$. The condition for the system to be BIBO stable is:

- A. a is real and positive
- B. a is real and negative
- C. $|a| > 1$
- D. $|a| < 1$

Ans. D

Sol.: $h(n) = a^n u(n)$

$$H(z) = \frac{z}{z - a}$$

When $|a| < 1$, then pole of the system lies in the unity circle which makes system stable.

46. Find $i(t)$ if $I(s) = \frac{s + 1}{(s + 4)(s + 3)}$:

- A. $3e^{-4t} - e^{-5t}$
- B. $3e^{-4t} - 2e^{-3t}$
- C. $3e^{-4t} - e^{-2t}$
- D. None of these

Ans. B

Sol.: Given,

$$I(s) = \frac{s + 1}{(s + 4)(s + 3)}$$

Using partial fractions, we can write,

$$I(s) = \frac{3}{s + 4} - \frac{2}{s + 3}$$

As we know,

$$\mathcal{L}[e^{-at}] = \frac{1}{s + a}$$

Hence, taking inverse Laplace transform, we get,

$$f(t) = 3e^{-4t} - 2e^{-3t}$$

47. Which of the following statements for Dirichlet conditions are true for signal $x(t)$?

1. $x(t)$ must be absolutely integrable.
2. $x(t)$ must have finite number of maxima and minima.
3. These conditions are also true for discrete signals.

4. These are necessary and sufficient conditions.

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

Ans. B

Sol.: Dirichlet conditions are sufficient conditions (not necessary) for a real-valued, periodic signal f to be equal to sum of its Fourier series at each point when f is continuous. The conditions are:

1. f must be absolutely integrable.
2. f must have finite number of maxima and minima.
3. f must have a finite number of displacement of discontinuities in any given interval.

48. If a 250 MVA, 11/400 kV three phase power transformer has leakage reactance of 0.05 per unit on the base of 250 MVA and the primary voltage of 11 kV, then the actual leakage reactance of the transformer referred to the secondary side of 400 kV is

- A. 0.8Ω
- B. 0.032Ω
- C. 3.2Ω
- D. 32Ω

Ans. D

Sol.: $Z_{1(\text{actual})} = Z_{\text{pu}} \cdot Z_{\text{base}} = 0.05 \left[\frac{400 \times 400}{250} \right] = 32$

$Z_{1(\text{actual})} = 32 \Omega$

49. For which of the following pair of machines, the stator, and its winding can be of the same type:

- A. Universal motor and stepper motor
- B. DC motor and hysteresis motor
- C. Hysteresis Motor and Reluctance Motor
- D. Induction motor and DC motor

Ans. C

Sol.: Like induction motor the reluctance motor and hysteresis motor can be built with either single phase or 3 phase.

There is a basic difference between hysteresis motor and reluctance motor. The reluctance motor starts as a single-phase induction motor and the rotor pulls into synchronism under favourable conditions. In a hysteresis motor, any load gets synchronized with stator poles provided hysteresis torque is able to accelerate it. Hence, in a reluctance motor, there is a tendency for the rotor to oscillate before synchronism, but in a hysteresis motor, the rotor and stator poles lock with each other without any oscillation.

50. For maximum power transfer to load, the value of load impedance should be equal to

- A. Thevenin impedance
- B. Conjugate of Thevenin impedance
- C. Magnitude of Thevenin impedance
- D. None of the above

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Ans. B

Sol.: For maximum power transfer to load,

$$Z_L = Z_{th}^*$$

Hence, load impedance is equal to conjugate of Thevenin impedance.

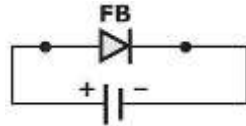
51. Which of the following statement correctly describes the forward biasing of the p-n junction?

- A. If the n-side is connected to the negative terminal of the battery the diode is forward biased.
- B. If the n-side is connected to ground the diode is said to be forward biased.
- C. If the p-side is connected to the positive terminal of the battery the diode is said to be forward biased.
- D. If the p-side is connected to higher voltage than n-side, the diode is said to be forward biased.

Ans. D

Sol.: For having forward biased, the potential on voltage of p-side should be higher than that of n-side.

Generally, p-side is connected. To positive terminal w.r.t. n-side to have forward biased.



- If p-side at positive voltage but n-side at higher positive voltage diode will be Reverse biased.
- If n-side at ground but p-side at negative voltage than also diode will be Reverse biased.

52. The nature of the spectrum of continuous time Fourier series is

- A. Continuous and periodic
- B. Discrete and continuous
- C. Discrete and periodic
- D. Discrete and Aperiodic

Ans. D

Sol.: Continuous time Fourier series is applied if the signal is continuous and periodic.

∴ The spectrum if Aperiodic and discrete.

53. $(55)_{10} = (x)_2$, then x is:

- A. 10100000
- B. 11011100
- C. 00110111
- D. None of the above

Ans. C

Sol.:

$$\begin{array}{r|rr} 2 & 55 & 1 \\ \hline 2 & 27 & 1 \\ 2 & 13 & 1 \\ 2 & 6 & 0 \\ 2 & 3 & 1 \\ & 1 & \\ \hline & & \Rightarrow (110111)_2 \end{array}$$

54. The maximum phase lag angle of the lag compensator given by transfer function is $F(s) = \frac{s+1}{s+2}$.

- A. $\tan^{-1}(1/3)$
- B. $\sin^{-1}(1/3)$
- C. $\tan^{-1}(3)$
- D. $\sin^{-1}(3)$

Ans. B

Sol.: $F(s) = \frac{s+1}{s+2} = 0.5 \frac{(1+s)}{(1+0.5s)}$

Here, $\beta = 0.5$

Maximum phase angle, $\phi_m = \sin^{-1}\left(\frac{1-\beta}{1+\beta}\right)$

$$\phi_m = \sin^{-1}\left(\frac{1}{3}\right)$$

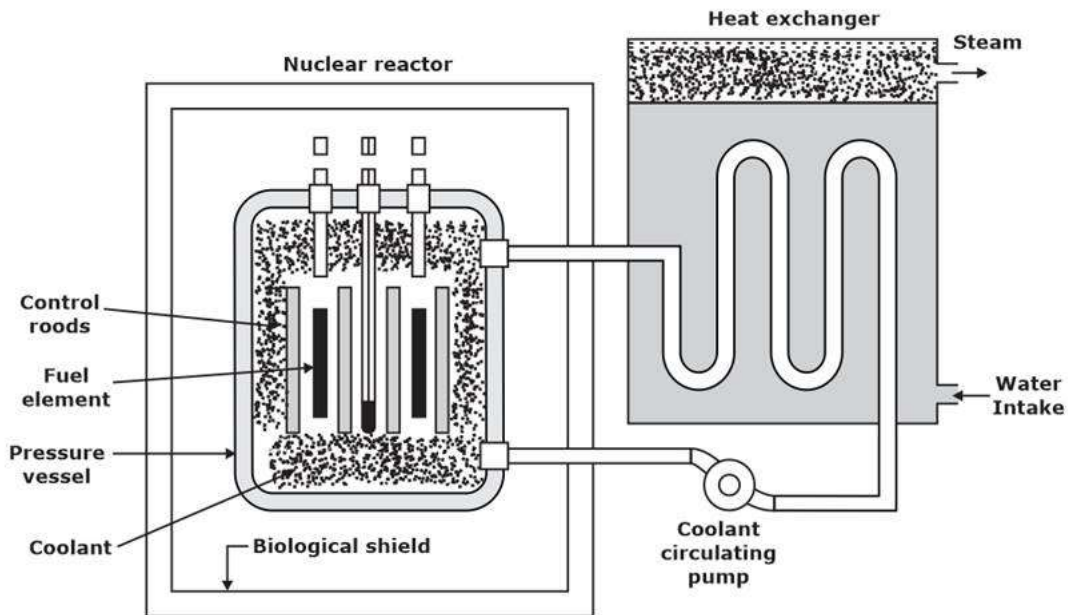
55. The substance used to take away heat energy produced in the nuclear reactor is called _____.

- A. Moderator
- B. Coolant
- C. Fuel
- D. Convectore

Ans. B

Sol.: The following are the brief description on the main parts of a nuclear reactor and shown in figure below:

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1. **Fuel elements:** These are in shape of plates or rods. The fissionable material used in nuclear reactors for producing energy by the fission process is enriched uranium-235. Enriched uranium contains about 2% to 3% of easily fissionable uranium-235 isotope and the remaining is uranium-238 isotope, which does not undergo fission easily.
2. **Coolant:** The substance that is used to take away heat energy produced in the nuclear reactor to the heat exchanger is called coolant. In general, some pipes are embedded in the reactor through which some coolant is circulated to take out heat produced in the reactor to the heat exchanger. In most of the successful reactors, liquid sodium metal is used as a coolant. However, in some of the reactors, carbon dioxide gas or even water is used as a coolant.
3. **Moderator:** The substance that is used to slow down (or moderate) the speed of neutrons in the nuclear reactor to a level appropriate to cause fission of uranium-235 effectively is called moderator. The commonly used moderators in the nuclear reactors are graphite or heavy water.
4. **Controlling rods:** The rods or plates made of some neutron absorbing substance like cadmium or boron used in the nuclear reactors to control the nuclear chain reaction are called controlling rods.
5. **Reflector:** In order to keep the size of the reactor small, and hence the amount of fissionable material, it is necessary to conserve the neutrons. For this purpose, the reactor core is surrounded by a material that reflects the escaping neutrons back into the core. This material is called the reflector.
6. **Pressure vessel:** Its purpose is to house the reactor core.
7. **Biological shield:** It is made of concrete or steel and its purpose is to protect the operating personal from radiations produced in the core.

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56. Area of B-H curve is equal to:
- A. Net work done/cycle/m³.
 - B. Net work done/cycle/m².
 - C. Net work done/cycle/m.
 - D. None of these.

Ans. A

Sol.: Area of B-H curve is equal to net work done/cycle/m³.

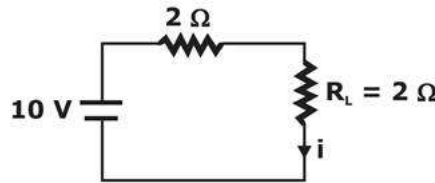
57. If the value of Thevenin voltage and Norton current across the load of 2Ω is 10 V and 5 A respectively. Then the value of current across load will be
- A. 5 A
 - B. 2.5 A
 - C. 10 A
 - D. 1.25 A

Ans. B

Sol.: Thevenin resistance,

$$R_{th} = \frac{V_{th}}{I_N} = \frac{10}{5} = 2\Omega$$

Thevenin equivalent circuit:



$$i = \frac{10}{4} = 2.5 \text{Amp}$$

58. An operational amplifier (op-amp) is basically:
- A. A negative feedback amplifier.
 - B. A positive feedback amplifier.
 - C. A low-gain amplifier.
 - D. None of these.

Ans. A

Sol.: An operational amplifier is basically a negative feedback amplifier.

59. Instruction not part of 8085 microprocessor:
- A. LDAX H
 - B. PUSH PSW
 - C. XTHL
 - D. LDA 3850

Ans. A

Sol.: LDAXH is not part of 5085 instruction set.

60. Let $x(n) = 16^n u(n) - b^{2n} u(-n - 1)$. If the z-transform of $x(n)$ exists. Then condition on 'b' is
- A. $b > 4$
 - B. $-4 < b < 4$
 - C. $b < 4$
 - D. No values of 'b' is possible

Ans. A

Sol.: $x(n) = 16^n u(n) - b^{2n} u(-n - 1)$

$$x_1(n) = 16^n u(n)$$

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$$X_1(z) = \frac{1}{1 - 16z^{-1}} \quad ; \quad |z| > 16 \text{ (causal signal)}$$

$$x_2(n) = -b^{2n}u(-n - 1)$$

$$X_2(z) = \frac{1}{1 - b^2z^{-1}} \quad ; |z| < b^2 \quad \text{(non-causal signal)}$$

For z-transform to exist, ROC should be in ring form i.e. non-causal signal.

$$16 < |z| < b^2$$

$$\text{Hence, } b^2 > 16$$

$$\Rightarrow b > 4$$

61. A 50 kVA transformer on full load has a copper loss of 600 W and iron loss of 500 W. Calculate the load at which maximum efficiency would occur.
- A. 48.55 kVA
 - B. 45.64 kVA
 - C. 38.25 kVA
 - D. 27.67 kVA

Ans. B

$$\text{Sol.: } \eta = \frac{\text{Output}}{\text{Output} + \text{Iron losses} + \text{Copper losses}} \times 100$$

Efficiency will be maximum when copper losses is equal to the iron losses = 500 W

Fraction at which the efficiency is maximum,

$$x = \sqrt{\frac{P_i}{P_{cu}}} = \sqrt{\frac{500}{600}} = 0.9128$$

Load at which the efficiency is maximum, i.e.,

Output is:

$$= x \times \text{kVA} = 0.9128 \times 50 = 45.64 \text{ kVA}$$

62. Which of the following circuit theorem states that power delivered in the circuit is equal to the power absorbed in the circuit.
- A. Superposition theorem
 - B. Thevenin's theorem
 - C. Tellegen's theorem
 - D. Milliman's theorem

Ans. C

Sol.: Tellegen's theorem states that power delivered in the circuit is equal to the power absorbed in the circuit.

63. The node voltage V in the circuit is

66. Under excited synchronous phase modifier
- A. Supplies leading current B. Supplies lagging current
C. Draws a leading current D. Draws a lagging current

Ans. D

Sol.: Synchronous phase modifier is a synchronous motor at no load. It is used to improve the power factor at transmission line.

An under excited machine will supply leading reactive power to line.

As a motor, it draws lagging reactive power from line.

Hence, it draws lagging current.

67. A PMMC-type instrument has a 4 cm x 3 cm size coil wound on its aluminium drum. The number of turns of the coil is 100. The magnetic field has a flux density of 0.2 Wb/m². The control spring provides a control torque of 1 x 10⁻⁶ Nm/degree of deflection of the moving coil. Calculate the value of current flowing through the coil when it is deflected by an angle of 48°.
- A. 1 mA B. 2 mA
C. 3 mA D. 4 mA

Ans. B

Sol.: Area of the coil = 0.04 x 0.03 m² = 12 x 10⁻⁴ m²

Deflecting torque, T_d = φ NI = BAN I = 0.2 x 12 x 10⁻⁴ x 100 x I Nm

Or T_d = 2.4 x 10⁻² x I Nm

Control torque produced by the spring when elongated at 48°,

T_c = 1 x 10⁻⁶ x 48 Nm.

Equating, 2.4 x 10⁻² x I = 48 x 10⁻⁶

$$I = \frac{48 \times 10^{-6}}{2.4 \times 10^{-2}} = 20 \times 10^{-4} \text{ A} = 2 \times 10^{-3} \text{ A}$$

I = 2 mA

68. In a certain transistor, the emitter current is 1.02 times as large as the collector current. If the emitter current is 12 mA, find the base current.
- A. 765 mA B. 765 μA
C. 235 mA D. 235 μA

Ans. D

Sol.: Given that: I_E = 12 mA, I_E = 1.02I_C

$$1.02I_C = 12 \times 10^{-3}$$

$$I_C = 11.765 \text{ mA}$$

$$I_E = I_B + I_C$$

$$I_B = I_E - I_C = (12 - 11.765) \text{ mA} = 0.235 \text{ mA}$$

$$I_B = 235 \text{ μA}$$

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69. The name plate of a single-phase energy meter installed in a house reads 1,200 revolutions/kWh. If 5 lamps of 100 W each and 5 lamps of 60 W are operated for 1 hour, the disc makes 1,000 revolutions. State which of the following about meter is correct.
- A. The meter is running slowly. B. The meter is running correctly.
C. The meter is running faster. D. None of these

Ans. C

Sol.: Energy meter constant, $K = 1,200$ revolutions per kWh

Energy consumed in 1 hour is:

$$= \frac{100 \times 5 \times 1 + 60 \times 5 \times 1}{1,000} = 0.8 \text{ kWh}$$

Number of revolutions required to be made by the disc,

$$N = K \times \text{energy consumed} = 1,200 \times 0.8 = 960$$

Actual number of revolutions made by the disc = 1,000

Hence, the meter reads incorrectly. In this case, the meter is running faster, and it records more than the actual energy passing through it.

70. Consider an amplitude modulated signal, $20 \cos(4\pi \times 10^3 t)$ with carrier signal $100 \cos(4\pi \times 10^3 t)$, then the modulation index is
- A. 0.2 B. 0.4
C. 2 D. 4

Ans. A

Sol.: Modulating signal,

$$m(t) = A_m \cos(2\pi f_m t) = 20 \cos(4\pi \times 10^3 t)$$

$$\text{So, } A_m = 20$$

Carrier signal,

$$c(t) = A_c \cos(2\pi f_c t) = 100 \cos(4\pi \times 10^3 t) = 100 \cos(4\pi \times 10^3 t)$$

$$\text{So, } A_c = 100$$

$$\text{So, modulation index, } m = \frac{A_m}{A_c} = \frac{20}{100} = 0.2$$

$$m = 0.2$$
