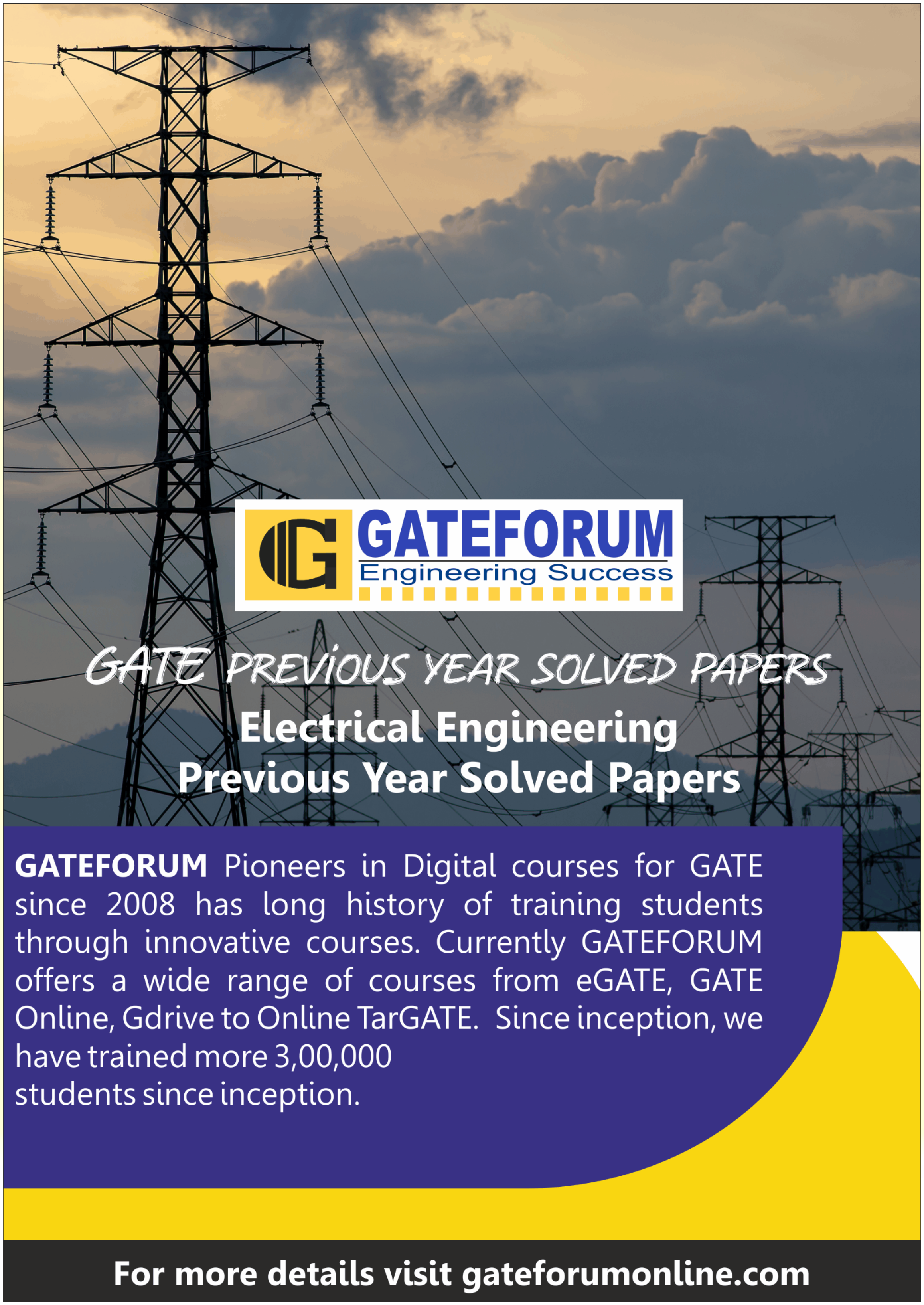
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GENERAL APTITUDE

Q. No. 1 – 5 Carry One Mark Each

1. Which one of the following options is the closest in meaning to the word given below?

Latitude

(A) Eligibility (B) Freedom (C) Coercion (D) Meticulousness

Answer: (B)

---

2. Choose the most appropriate alternative from the options given below to complete the following sentence:

If the tried soldier wanted to lie down, he _________ the mattress out on the balcony

(A) should take (B) shall take

(C) should have taken (D) will have taken

Answer: (C)

---

3. One of the parts (A, B, C, D) in the sentence given below contains an ERROR. Which one the following is INCORRECT?

I requested that the should be given the driving test today instead of tomorrow.

(A) requested that (B) should be given

(C) the driving test (D) instead of tomorrow

Answer: (B)

---

4. Choose the most appropriate word from the options given below to complete the following sentence:

Given the seriousness of the situation that he had to face, his __ was impressive.

(A) beggary (C) jealousy

(B) nomenclature (D) nonchalance

Answer: (D)

---

5. If $(1.001)^{1259} = 3.52$ and $(1.001)^{2062} = 7.85$, then $(1.001)^{3321} =$

(A) 2.23 (B) 4.23 (C) 11.37 (D) 27.64

Answer: (D)

Q. No. 6 – 10 Carry Two Marks Each

6. The data given in the following table summarizes the monthly budget of an average household.

Category	Amount (Rs)
Food	4000
Clothing	1200
Rent	2000
Savings	1500
Other expenses	1800

The approximate percentage of the monthly budget NOT spent on saving is

(A) 10% (B) 14% (C) 81% (D) 86%

Answer: (D)

---

7. Raju has 14 currency notes in his pocket consisting of only Rs.20 notes and Rs. 10 notes. The total money value of the notes is Rs.230. The number of Rs. 10 notes that Raju has is

(A) 5 (B) 6 (C) 9 (D) 10

Answer: (A)

---

8. A and B are friends. They decide to meet between 1 PM and 2 PM on a given day. There is a condition that whoever arrives first will not wait for the other for more than 15 minutes. The probability that they will meet on that day is

(A) 1/4 (B) 1/16 (C) 7/16 (D) 9/16

Answer: (C)

9. There are eight bags of rice looking alike, seven of which have equal weight and one is slightly heavier. The weighting balance is of unimited capacity. Using this balance, the minimum number of weighings required to identify the heavier bag is

(A) 2 (B) 3 (C) 4 (4) 8

Answer: (A)

---

10. One of the legacies of the Roman legions was discipline. In the legions, military law prevailed and discipline was brustal. Discipline on the battlefield kept units obedient, intact and fighting, even when the odds and conditions were against them

Which one of the following statements best sums up the meaning of the above passage?

(A) Through regimentation was the main reason for the efficiency of the Roman legions even in adverse circumstances.

(B) The legions were treated inheritance from their seniors

(C) Discipline was the armies' inheritance from their seniors.

(D) The harsh discipline to which the legions were subjected to led to the odds and conditions being against them.

Answer: (A)

ELECTRICAL ENGINEERING

Q. No. 1 – 25 Carry One Mark Each

1. The bridge method commonly used for finding mutual inductance is

(A) Heaviside Campbell bridge (B) Schering bridge

(C) De Sauty bridge (D) Wien bridge

Answer: (A)

---

2. A two phase load draws the following phase currents: $i_1(t) = I_m \sin(\omega t - \phi_1)$, $i_2(t) = I_m \cos(\omega t - \phi_2)$. These currents are balanced if ϕ_1 is equal to

(A) $-\phi_2$ (B) ϕ_2 (C) $(\pi/2 - \phi_2)$ (D) $(\pi/2 + \phi_2)$

Answer: (D)

3. The slip of an induction motor normally does not depend on

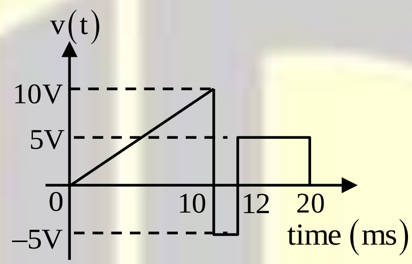
(A) Rotor speed (B) Synchronous speed

(C) Shaft torque (D) Core-loss component

Answer: (D)

---

4. A periodic voltage waveform observed on an oscilloscope across a load is shown. A permanent magnet moving coil (PMMC) meter connected across the same load reads



(A) 4V (B) 5V (C) 8V (D) 10V

Answer: (A)

---

5. The bus admittance matrix of a three-bus three-line system is

$$Y = j\begin{bmatrix} -13 & 10 & 5 \\ 10 & -18 & 10 \\ 5 & 10 & -13 \end{bmatrix}$$

If each Transmission line between the two buses is represented by an equivalent π-network, the magnitude of the shunt susceptance of the line connecting bus 1 and 2 is

(A) 4 (B) 2 (C) 1 (D) 0

Answer: (A)

---

6. If $x[n] = \left(\frac{1}{3}\right)^{|n|} - (1/2)^n u[n]$, then the region of convergence (ROC) of its z-transform in the Z-plane will be

(A) $\frac{1}{3} < |Z| < 3$ (B) $\frac{1}{3} < |Z| < \frac{1}{2}$ (C) $\frac{1}{2} < |Z| < 3$ (D) $\frac{1}{3} < |Z| < 2$

Answer: (C)

7. In the sum of products function $f(X,Y,Z)=\Sigma(2,3,4,5)$, the prime implicants are

(A) $\bar{X}Y, X\bar{Y}$ (B) $\bar{X}Y, X\bar{Y}\bar{Z}, X\bar{Y}Z$

(C) $\bar{X}Y\bar{Z}, \bar{X}YZ, X\bar{Y}$ (D) $\bar{X}Y\bar{Z}, \bar{X}YZ, X\bar{Y}\bar{Z}, X\bar{Y}Z$

Answer: (A)

---

8. A system with transfer function

$$G(s)=\frac{(s^2+9)(s+2)}{(s+1)(s+3)(s+4)}$$

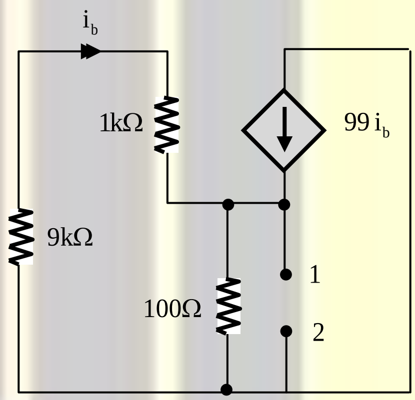
Is excited by $\sin\omega t$. The steady-state output of the system is zero at

(A) $\omega=1\,\text{rad/s}$ (B) $\omega=2\,\text{rad/s}$ (C) $\omega=3\,\text{rad/s}$ (D) $\omega=4\,\text{rad/s}$

Answer: (C)

---

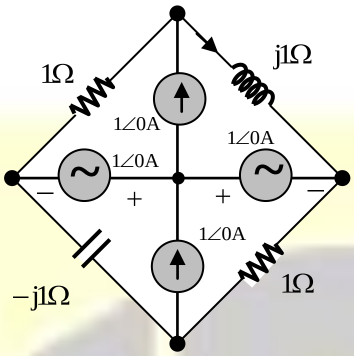
9. The impedance looking into nodes 1 and 2 in the given circuit is



(A) 50Ω (B) 100Ω (C) $5k\Omega$ (D) $10.1\,k\Omega$

Answer: (A)

10. In the circuit shown below, the current through the inductor is



(A) $\frac{2}{1+j}$A (B) $\frac{-1}{1+j}$A (C) $\frac{1}{1+j}$A (D) 0A

Answer: (C)

---

11. Given $f(z)=\frac{1}{z+1}-\frac{2}{z+3}$. If C is a counterclockwise path in the z-plane such that $|z+1|=1$, the value of $\frac{1}{2\pi j}\oint_C f(z)dz$ is

(A) –2 (B) –1 (C) 1 (D) 2

Answer: (C)

---

12. Two independent random variables X and Y are uniformly distributed in the interval [–1, 1]. The probability that max[X, Y] is less than 1/2 is

(A) ¾ (B) 9/16 (C) 1/4 (D) 2/3

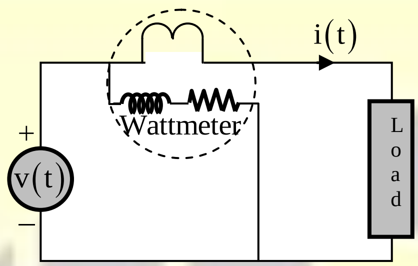
Answer: (B)

13. For the circuit shown in the figure, the voltage and current expressions are

$v(t) = E_1 \sin(\omega t) + E_3 \sin(3\omega t)$ and

$i(t) = I_1 \sin(\omega t - \phi_1) + I_3 \sin(3\omega t - \phi_3) + I_5 \sin(5\omega t)$.

The average power measured by the Wattmeter is



(A) $\frac{1}{2}E_1I_1\cos\phi_1$

(B) $\frac{1}{2}\left[E_1I_1\cos\phi_1 + E_1I_3\cos\phi_3 + E_1I_5\right]$

(C) $\frac{1}{2}\left[E_1I_1\cos\phi_1 + E_3I_3\cos\phi_3\right]$

(D) $\frac{1}{2}\left[E_1I_1\cos\phi_1 + E_3I_1\cos\phi_1\right]$

Answer: (C)

---

14. If $x = \sqrt{-1}$, then the value of x^x is

(A) $e^{-\pi/2}$ (B) $e^{\pi/2}$ (C) x (D) 1

Answer: (A)

---

15. The typical ratio of latching current to holding current in a 20A thyristor is

(A) 5.0 (B) 2.0 (C) 1.0 (D) 0.5

Answer: (B)

---

16. A half-controlled single-phase bridge rectifier is supplying an R-L load. It is operated at a firing angle α and the load current is continuous. The fraction of cycle that the freewheeling diode conducts is

(A) $\frac{1}{2}$ (B) $\left(1 - \frac{\alpha}{\pi}\right)$ (C) $\frac{\alpha}{2\pi}$ (D) $\frac{\alpha}{\pi}$

Answer: (D)

17. The sequence components of the fault current are as follows:

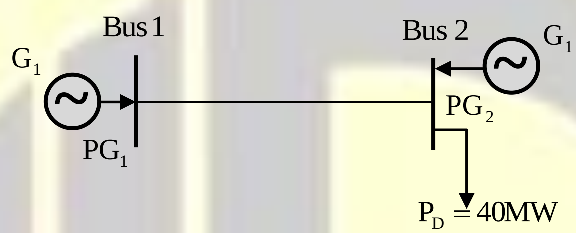
$I_{positive} = j1.5pu, I_{negative} = -j0.5pu, I_{zero} = -j1pu$. The type of fault in the system is

(A) LG (B) LL (C) LLG (D) LLLG

Answer: (C)

---

18. The figure shows a two-generator system supplying a load of $P_D = 40MW$, connected at bus 2



The fuel cost of generators G_1 and G_2 are:

$C_1(P_{G1}) = 10,000\ Rs/MWh$ and $C_2(P_{G2}) = 12500\ Rs/MWh$ and the loss in the line is $P_{loss(pu)} = 0.5\ P^2_{G1(pu)}$, where the loss coefficient is specified in pu on a 100 MVA base. The most economic power generation schedule in MW is

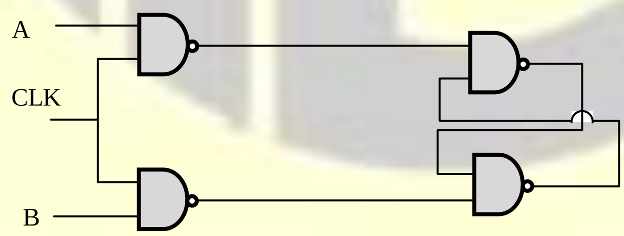
(A) $P_{G1} = 20, P_{G2} = 22$ (B) $P_{G1} = 22, P_{G2} = 20$

(C) $P_{G1} = 20, P_{G2} = 20$ (D) $P_{G1} = 0, P_{G2} = 40$

Answer: (A)

---

19. Consider the given circuit



In this circuit, the race around

(A) does not occur (B) occurs when CLK = 0

(C) occurs when CLK = 1 and A = B = 1 (D) occurs when CLK = 1 and A = B = 0

Answer: (A)

20. The output Y of a 2-bit comparator is logic 1 whenever the 2-bit input A greater than the 2-bit input B. The number of combinations for which output is logic 1, is

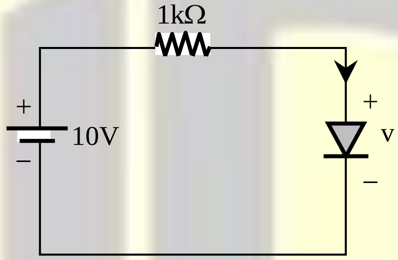
(A) 4 (B) 6 (C) 8 (D) 10

Answer: (B)

---

21. The i-v characteristics of the diode in the circuit given below are

$$i = \begin{cases} \dfrac{v-0.7}{500} A, & v \geq 0.7V \\ 0A, & v < 0.7V \end{cases}$$



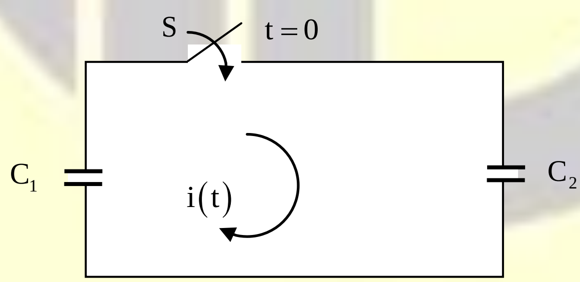
The current in the circuit is

(A) 10 mA (B) 9.3 mA (C) 6.67 mA (D) 6.2 mA

Answer: (D)

---

22. In the following figure, C_1 and C_2 are ideal capacitors. C_1 has been charged to 12V before the ideal switch S is closed at t = 0. The current i(t) for all t is



(A) zero (B) a step function

(C) an exponentially decaying function (D) an impulse function

Answer: (D)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23. The average power delivered to an impedance $(4-j3)\Omega$ by a current $5\cos(100\pi t+100)A$ is

(A) 44.2W (B) 50W (C) 62.5W (D) 125W

Answer: (B)

---

24. The unilateral Laplace transform of $f(t)$ is $\frac{1}{s^2+s+1}$. The unilateral Laplace transform of t f(t) is

(A) $-\frac{s}{(s^2+s+1)^2}$ (B) $-\frac{2s+1}{(s^2+s+1)^2}$ (C) $\frac{s}{(s^2+s+1)^2}$ (D) $\frac{2s+1}{(s^2+s+1)^2}$

Answer: (D)

---

25. With initial condition x(1) = 0.5, the solution of the differential equation $t\frac{dx}{dt}+x=t$ is

(A) $x=t-\frac{1}{2}$ (B) $x=t^2-\frac{1}{2}$ (C) $x=\frac{t^2}{2}$ (D) $x=\frac{t}{2}$

Answer: (D)

Q. No. 26 – 51 carry Two Marks Each

26. A 220 V, 15 kW, 1000 rpm shunt motor with armature resistance of 0.25Ω, has a rated line current of 68 A and a rated field current of 2.2A. The change in field flux required to obtain a speed of 1600 rpm while drawing a line current of 52.8 A and a field current of 1.8 A is

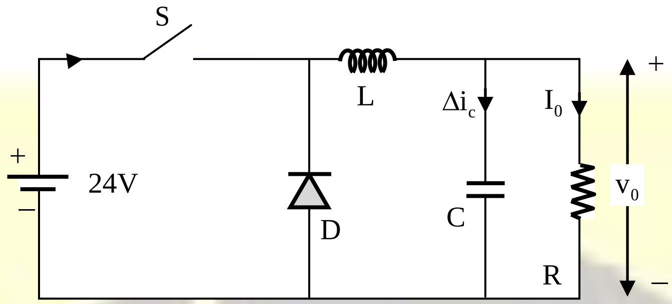
(A) 18.18% increase (B) 18.18% decrease

(C) 36.36% increase (D) 36.36% decrease

Answer: (D)

---

27. In the circuit shown, an ideal switch S is operated at 100 kHz with a duty ratio of 50%. Given that Δi_c is 1.6A peak-to-peak and I_0 is 5A dc, the peak current in S is



(A) 6.6 A (B) 5.0 A (C) 5.8 A (D) 4.2 A

Answer: (C)

---

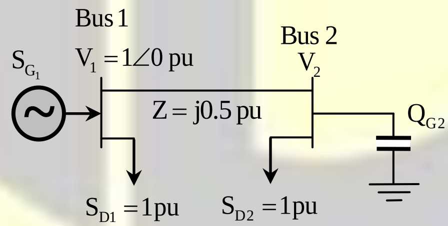
28. A cylindrical rotor generator delivers 0.5 pu power in the steady-state to an infinite bus through a transmission line of reactance 0.5 pu. The generator no-load voltage is 1.5 pu and the infinite bus voltage is 1 pu. The inertia constant of the generator is 5MW-s/MVA and the generator reactance is 1 pu. The critical clearing angle, in degrees, for a three-phase-dead short circuit fault at the generator terminal is

(A) 53.5 (B) 60.2 (C) 70.8 (D) 79.6

Answer: (D)

---

29. For the system shown below, S_{D1} and S_{D2} are complex power demands at bus 1 and bus 2

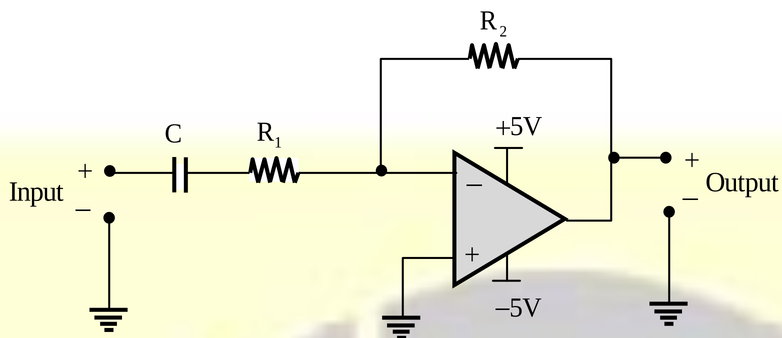


respectively. If $|V_2| = 1$pu, the VAR rating of the capacitor (Q_{G2}) connected at bus 2 is

(A) 0.2 pu (B) 0.268 (C) 0.312 (D) 0.4 pu

Answer: (B)

30. The circuit shown is a



(A) low pass filter with $f_{3dB} = \frac{1}{(R_1 + R_2)C}$ rad / s

(B) high pass filter with $f_{3dB} = \frac{1}{R_1C}$ rad / s

(C) low pass filter with $f_{3dB} = \frac{1}{R_1C}$ rad / s

(D) high pass filter with $f_{3dB} = \frac{1}{(R_1 + R_2)C}$ rad / s

Answer: (B)

---

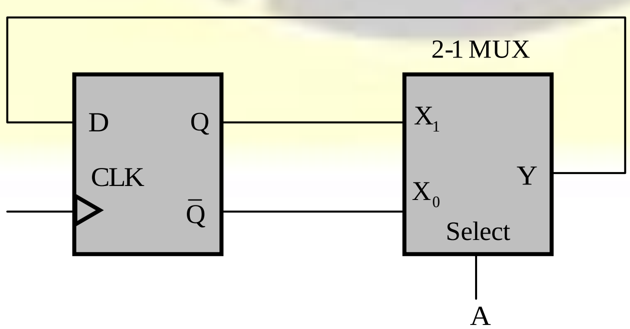
31. Let y[n] denote the convolution of h[n] and g[n], where $h[n] = (1/2)^n u[n]$ and g[n] is a causal sequence. If y[0] = 1 and y[1] = 1/2 then g[1] equals

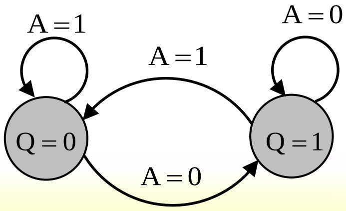
(A) 0 (B) 1/2 (C) 1 (D) 3/2

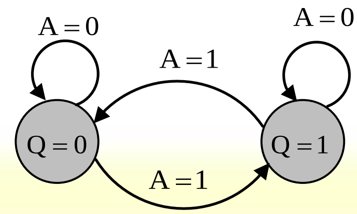
Answer: (A)

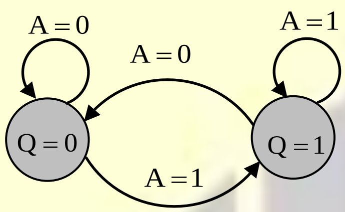
---

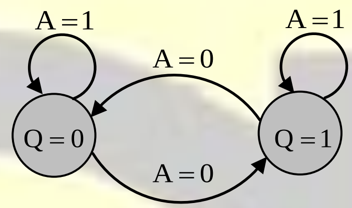
32. The state transition diagram for the logic circuit shown in



(A)


(B)


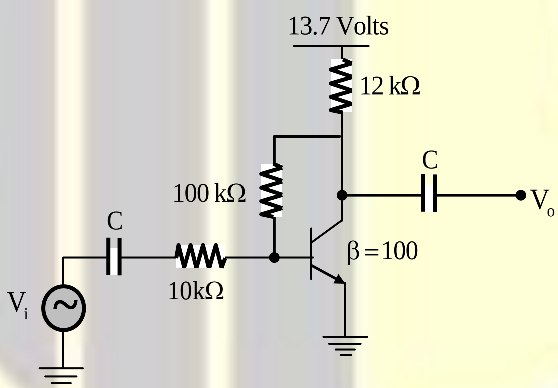
(C)


(D)


Answer: (D)

---

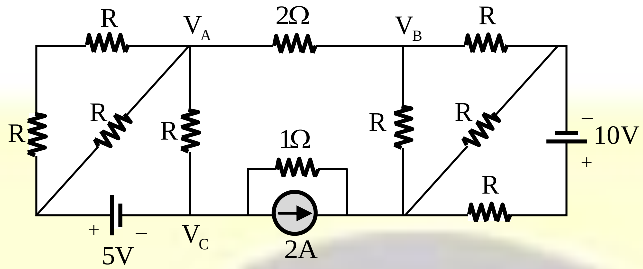
33. The voltage gain A_v of the circuit shown below is



(A) $|A_v| \approx 200$ (B) $|A_v| \approx 100$ (C) $|A_v| \approx 20$ (D) $|A_v| \approx 10$

Answer: (D)

34. If $V_A - V_B = 6V$, then $V_C - V_D$ is



(A) –5V (B) 2V (C) 3V (D) 6V

Answer: (A)

---

35. The maximum value of $f(x) = x^3 - 9x^2 + 24x + 5$ in the interval [1, 6] is

(A) 21 (B) 25 (C) 41 (D) 46

Answer: (C)

---

36. Given that $A = \begin{bmatrix} -5 & -3 \\ 2 & 0 \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, the value of A^3 is

(A) $15A + 12I$ (B) $19A + 30I$ (C) $17A + 15I$ (D) $17A + 21I$

Answer: (B)

---

37. A single phase 10 kVA, 50 Hz transformer with 1kV primary winding draws 0.5 A and 55 W, at rated voltage and frequency, on no load. A second transformer has a core with all its linear dimensions $\sqrt{2}$ times the corresponding dimensions of the first transformer. The core material and lamination thickness are the same in both transformers. The primary windings of both the transformers have the same number of turns. If a rated voltage of 2 kV at 50 Hz is applied to the primary of the second transformer, then the no load current and power, respectively, are

(A) 0.7 A, 77.8 W (B) 0.7 A, 155.6 W

(C) 1 A, 110 W (D) 1 A, 220 W

Answer: (B)

38. The1ocked rotor current in a 3-phase, star connected 15 kW, 4-pole, 230 V, 50 Hz induction motor at rated conditions is 50 A. Neglecting losses and magnetizing current, the approximate locked rotor line current drawn when the motor is connected to a 236 V, 57 Hz supply is

(A) 58.5 A (B) 45.0 A (C) 45.7 A (D) 55.6 A

Answer: (B)

---

39. An analog voltmeter uses external multiplier settings. With a multiplier setting of $20\,k\Omega$, it reads 440 V and-with a multiplier setting of $80\,k\Omega$ it reads 352 V. For a multiplier setting of $40\,k\Omega$, the voltmeter reads

(A) 371 V (B) 383 V (C) 394 V (D) 406 V

Answer: (D)

---

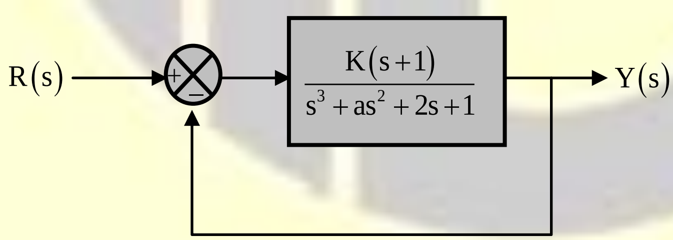
40. The input x(t) and output y(t) of a system are related as $y(t)=\int_{-\infty}^{t} x(\tau)\cos(3\tau)d\tau$. The system is

(A) time-invariant and stable
(B) stable and not time-invariant
(C) time-invariant and not stable
(D) not time-invariant and not stable

Answer: (D)

---

41. The feedback system shown below oscillates at 2 rad/s when



(A) K = 2 and a = 0.75
(B) K = 3 and a = 0.75
(C) K = 4 and a = 0.5
(D) K = 2 and a = 0.5

Answer: (A)

42. The Fourier transform of a signal h(t) is $H(j\omega)=(2\cos\omega)(\sin\omega)/\omega$. The value of h(0) is

(A) 1/4 (B) 1/2 (C) 1 (D) 2

Answer: (C)

---

43. The state variable description of an LTI system is given by,

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\\ \dot{x}_3\end{bmatrix}=\begin{bmatrix}0 & a_1 & 0\\ 0 & 0 & a_2\\ a_3 & 0 & 0\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}+\begin{bmatrix}0\\0\\1\end{bmatrix}u;\ y=\begin{bmatrix}1 & 0 & 0\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}$$

Where y is the output and u is the input. The system is controllable for

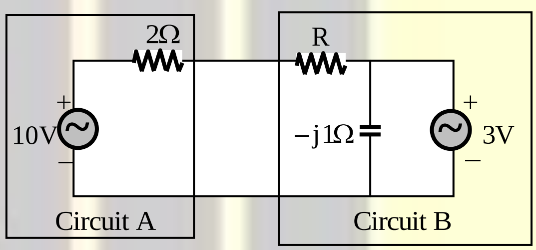
(A) $a_1 \neq 0, a_2 = 0, a_3 \neq 0$ (B) $a_1 = 0, a_2 \neq 0, a_3 \neq 0$

(C) $a_1 = 0, a_2 \neq 0, a_3 = 0$ (D) $a_1 \neq 0, a_2 \neq 0, a_3 \neq 0$

Answer: (D)

---

44. Assuming both the voltage sources are in phase, the value of R for which maximum power is transferred from circuit A to circuit B is



(A) 0.8Ω (B) 1.4Ω (C) 2Ω (D) 2.8Ω

Answer: (A)

---

45. Consider the differential equation

$$\frac{d^2y(t)}{dt^2}+2\frac{dy(t)}{dt}+y(t)=\delta(t) \text{ with } y(t)\Big|_{t=0}=-2 \text{ and } \frac{dy}{dt}\Big|_{t=0^-}=0.$$

The numerical value of $\left.\frac{dy}{dt}\right|_{t=0^+}$ is

(A) –2 (B) –1 (C) 0 (D) 1

Answer: (D)

46. The direction of vector A is radially outward from the origin, with $|A| = k r^n$ where $r^2 = x^2 + y^2 + z^2$ and k is constant. The value of n for which $\nabla . A = 0$ is

(A) –2 (B) 2 (C) 1 (D) 0

Answer: (A)

---

47. A fair coin is tossed till a head appears for the first time. The probability that the number of required tosses is odd, is

(A) 1/3 (B) 1/2 (C) 2/3 (D) ¾

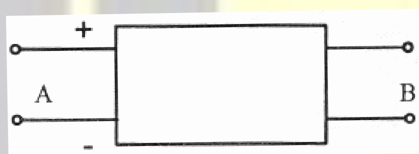
Answer: (C)

Common Data Questions: 48 & 49

With 10V dc connected at port A in the linear nonreciprocal two-port network shown below, the following were observed:

(i) 1Ω connected at port B draws a current of 3 A

(ii) 2.5Ω connected at port B draws a current of 2 A



48. For the same network, with 6V dc connected at port A, 1Ω connected at port B draws 7/3 A. If 8 V dc is connected to port A, the open circuit voltage at port B is

(A) 6V (B) 7V (C) 8V (D) 9V

Answer: (B)

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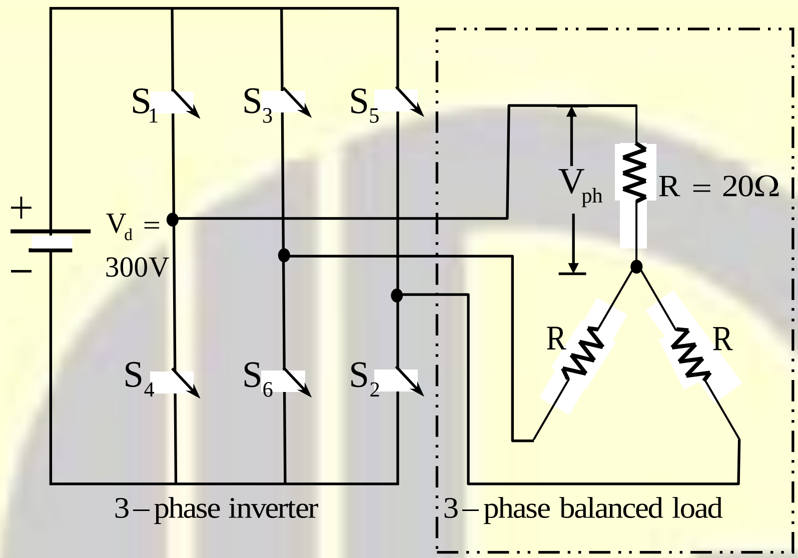
49. With 10V dc connected at port A, the current drawn by 7Ω connected at port B is

(A) 3/7 A (B) 5/7 A (C) 1 A (D) 9/7 A

Answer: (C)

Common Data Questions: 50 & 51

In the 3-phase inverter circuit shown, the load is balanced and the gating scheme is 180° - conduction mode. All the switching devices are ideal



50. The rms value of load phase voltage is

(A) 106.1 V (B) 141.4 V (C) 212.2 V (D) 282.8 V

Answer: (B)

---

51. If the dc bus voltage $V_d = 300\,V$, the power consumed by 3-phase load is

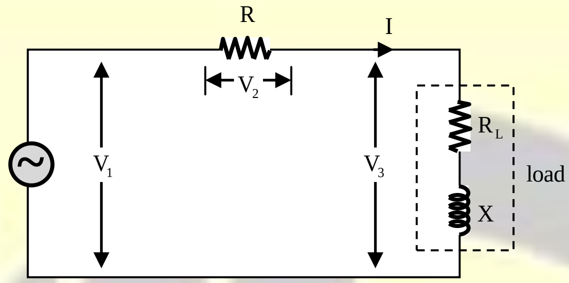
(A) 1.5 kW (B) 2.0 kW (C) 2.5 kW (D) 3.0 kW

Answer: (D)

Linked Answer Questions: Q.52 to Q.55 Carry Two Marks Each

Statement for Linked Answer Questions: 52 & 53

In the circuit shown, the three voltmeter readings are $V_1 = 220V, V_2 = 122V, V_3 = 136V$



52. The power factor of the load is

(A) 0.45 (B) 0.50 (C) 0.55 (D) 0.60

Answer: (A)

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53. If $R_L = 5\Omega$, the approximate power consumption in the load is

(A) 700W (B) 750W (C) 800W (D) 850W

Answer: (B)

Statement for Linked Answer Questions: 54 & 55

The transfer function of a compensator is given as $G_c(s) = \frac{s+a}{s+b}$

54. $G_c(s)$ is a lead compensator if

(A) $a = 1, b = 2$ (B) $a = 3, b = 2$ (C) $a = -3, b = -1$ (D) $a = 3, b = 1$

Answer: (A)

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55. The phase of the above lead compensator is maximum at

(A) $\sqrt{2}$ rad / s (B) $\sqrt{3}$ rad / s (C) $\sqrt{6}$ rad / s (D) $1/\sqrt{3}$ rad / s

Answer: (A)