BYJU'S EXAM PREP

GATE 2022

Electrical Engineering

Questions & Answers (Memory Based)

(MEMORY BASED)

1. The maximum clock frequency in MHz of a 4-stage ripple counter, utilizing flip-flop with each flip-flop having propagation delay of 20 ns is _____.

[NAT - 1 Mark]

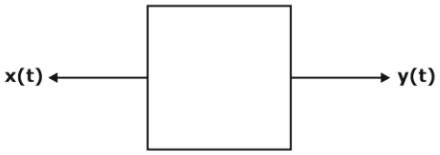
Ans. 12.5

2. A MOD-2 and a MOD-5 up counter when cascaded together results in a MOD _____ counter.

[NAT - 1 Mark]

Ans. 10

3. Consider the system as shown below



Where $y(t) = x(e^t)$. The system is

[MCQ - 2 Marks]

A. linear & causal
B. non-linear & causal
C. linear & non-causal
D. non-linear & non-causal

Ans. C

4. Let s causal LTI system be governed by following differential equations

$y(t)+\frac{1}{4}\frac{dy}{dt}=2x(t)$, where x(t) and y(t) are input & output respectively. The impulse response is

[MCQ - 2 Marks]

A. $2e^{-4t}\,u(t)$ B. $2e^{-t/4}\,u(t)$
C. $8e^{-4t}\,u(t)$ D. $8e^{-t/4}\,u(t)$

Ans. C

5. Let an input x(t) = 2 sin(10πt) + 5 cos(15πt) + 7 sin(42πt) + 4 cos(45πt) is passed through an LTI system having impulse response,

$$h(t)=2\left(\frac{\sin(10\pi t)}{\pi t}\right)\cos 40\pi t$$

The output of the system is

[MCQ - 2 Marks]

A. 7 sin(42πt) + 4 cos(45πt)
B. 2 sin(10πt) + 5 cos(15πt)
C. 2 sin(10πt) + 4 cos(45πt)
D. 5 cos(15πt) + 7 sin(42πt)

Ans. A

6. The open loop transfer function of unity gain negative feedback system is

$$G(s)=\frac{k}{s^2+4s-5}$$

The range of k for which system is stable is

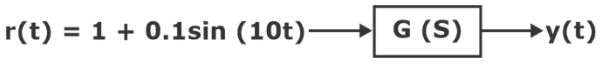
A. k > 5 B. k < 5
C. k = 5 D. k > 3

[MCQ – 1 Mark]

Ans. A

7. An LTI system has G(s) $\frac{100}{s^2+0.1s+100}$

∵ y(t) = a + b sin (10t + θ),

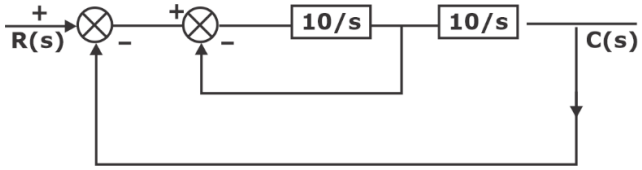


A. a = 1, b = 100 B. a = 10, b = 1
C. a = 100, b = 1 D. a = 1, b = 10

[MCQ – 2 Mark]

Ans. D

8. Consider a control system as shown in figure below:



Find the values of δ and ω_n for the complete system.

A. ξ = 0.707, ω_n = 10 rad/sec
B. ξ = 0.707, ω_n = 100 rad/sec

C. $\xi = 0.1, \omega_n = 10$ rad/sec
D. $\xi = 0.5, \omega_n = 10$ rad/sec

[MCQ – * Mark]

Ans. D

9. The price of an item is 10% cheaper in an online store S compared to the price of another online store M. Store S charges ₹150 for delivery. There is no delivery charges for orders from the store M. A person bought the item the store S and saved ₹100. What is the price of the item at the online store S (in ₹) if there are no other charges than what is described above?

A. 1750 B. 2500
C. 2250 D. 1500

[MCQ – 2 Marks]

Ans. C

10. Given below are two statements and four conclusions drawn based on the statements.
Statement 1: Some bottles are cups.
Statement 2: All cups are knives.
Conclusion 1: Some bottles are knives.
Conclusion 2: Some knives are cups.
Conclusion 3: All cups are bottles.
Conclusion 4: All knives are cups.
A. Conclusion III & IV follows
B. Conclusion II & IV follows
C. Conclusion II & III follows
D. Conclusion I & II follows

[MCQ – 1 Mark]

Ans. D

11. As you grow older, an injury to your _____ may take longer to _____.

A. heel/heal B. heal/heal
C. heal/heel D. heel/heal

[MCQ – 1 Marks]

Ans. D

12. There are two identical die with a single letter on each of the following six letters: Q, R, S, T, U & V one in each of the faces. Any of the six outcomes are equally likely. The two dice are thrown once independently at random. What is the probably that outcome on the dice were composed only of any combination of the following possible outcomes Q, U & V ?

A. 1/4 B. 5/36
C. 3/4 D. 1/6

[MCQ – 2 Marks]

Ans. A

13. Three bells P, Q & R are rung periodically in a school. P is rung every 20 min, Q is rung every 30 min, R is rung every 50 min. If all the three bells are rung at 12:00 pm, when will the three bells ring together again the next time?

A. 5:00 pm B. 5:30 pm
C. 6:00 pm D. 6:30 pm

[MCQ – 1 Marks]

Ans. A

14. In a 500 m race, P & Q have speeds in the ratio of 3:4. Q starts the race when P has already covered 140 m. What is the distance P & Q (in m) when P wins the race ?

A. 60 B. 40
C. 140 D. 20

[MCQ – 1 Marks]

Ans. D

15. An inductor having Q-factor of 60 is connected in series with a capacitor having Q-factor of 240. The overall Q-factor of the circuit is _____

Ans. 48

16. A 3-phase, 415 V, 4 pole, 50 Hz Induction motor draws 5 times the rated current at rated voltage at starting. It is required to bring down the starting current from the supply to 2 times of rated current using a 3-phase autotransformer. If the magnetizing impedance of the Induction motor and no-

load current of the autotransformer is neglected, then the transformation ratio of the autotransformer is _____.

Ans. 0.6324

17. A 280 V, separately excited DC motor with armature resistance, R_a = 1 Ω and constant field excitation drives a load. The load torque is proportional to speed. The motor draws a current of 30 A when running at a speed 1000 rpm. Neglect frictional loss. The speed (in rpm) at which motor will run, if additional resistance of value 10 Ω is connected in series with the armature, is _____.

Ans. 482.75

18. A star-connected 3-φ, 400 V, 50 kVA, 50 Hz synchronous motor has synchronous reactance = 1 Ω per phase with negligible R_a. The shaft load of motor is 10 kW, while the power factor is 0.8 leading. The loss in motor is 2 kW. The magnitude of per phase excitation emf _____.

Ans. 244.54

19. The frequencies of stator and rotor current flowing in three phase, 8 pole Induction motor are 40 Hz and 1 Hz respectively. The speed of motor, (in rpm) is _____.

Ans. 585

20. The type of single-phase Induction motor expected to have the maximum power factor during steady state running condition is

A. Shaded pole

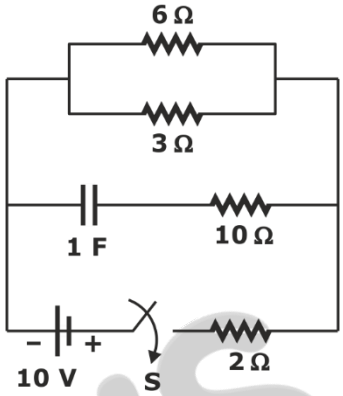
B. Split phase (resistance start)

C. Capacitor start

D. Capacitor start & Capacitor run

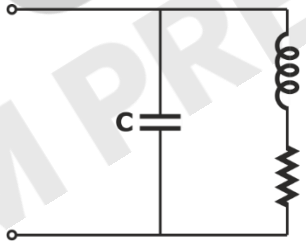
Ans. D

21. In the circuit below, the switch S is closed at t = 0. The magnitude of steady-state voltage, (in volts) across 6Ω resistor is _____.



Ans. 5 V

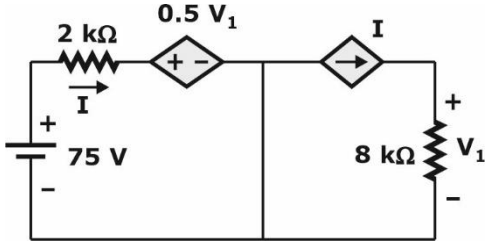
22. The network shown below has a resonant frequency of 150 kHz and bandwidth of 600 Hz. The Q-factor of the network is _____.



[NAT – 1 Mark]

Ans. 250

23. In the circuit shown below, the magnitude of voltage V_1 (in volts) across 8 Ω resistor is



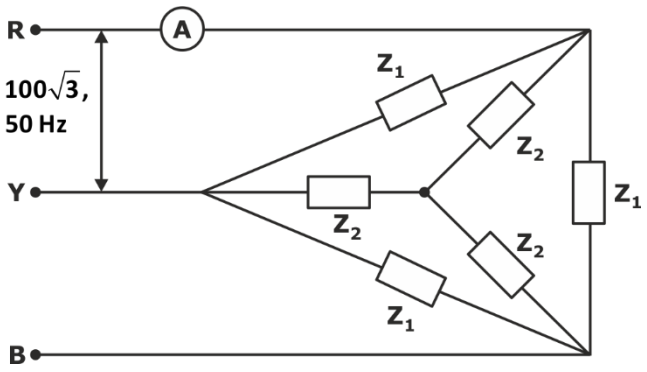
Ans. 100 V

[NAT – 2 Marks]

24. Consider a three-phase as shown in figure below:

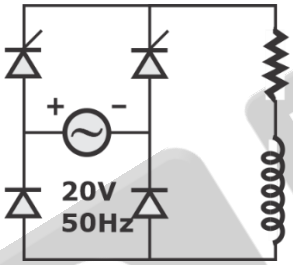
$Z_1 = (18 + j24),\ Z_2 = (6 + j8)\Omega$

Find ammeter reading?



Ans. 20 A

25. For the ideal AC-DC Rectifier circuit shown in the figure below. The ideal current magnitude is I_{dc} = 15A. And is ripple free. The thyristor are fired with a delay angle of 45°. The amplitude of the fundamental component of source current in Amp is _____.

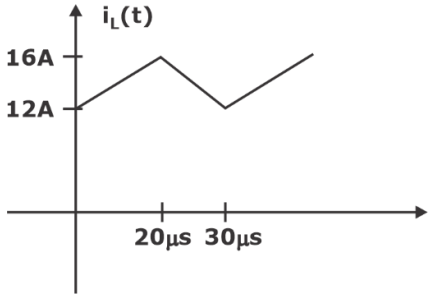


Ans. 17.65

26. A single-phase Inverter voltage output waveform given with 50% duty cycle. Dc voltage given is 1000 V and output current equation is in form 10sin(ωt-60).
What is the active power output?

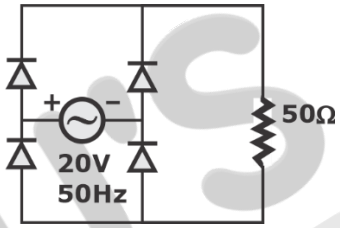
Ans. 3183.09 Watts

27. For Buck Boost converter output voltage ripple is 1 V and inductor current waveform is shown in the figure. Find value of C?



Ans. 168 μF

28. For Power lost in 50 W.



Ans. 800 Watts

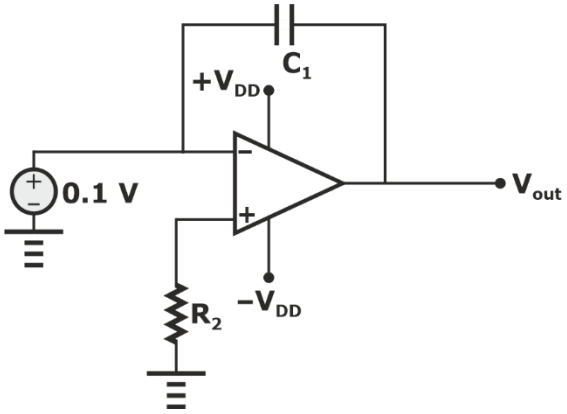
29. The voltage at the input of AC-DC rectifier is $v(t)=230\sqrt{2}\sin\omega t$ where ω = 100π rad/sec and current drawn is

$$i(t)=10\sin\left(\omega t-\frac{\pi}{3}\right)+4\sin\left(3\omega t-\frac{\pi}{6}\right)+3\sin\left(5\omega t-\frac{\pi}{3}\right)$$

Then find the input power factor, is _____ lag.

Ans. 0447

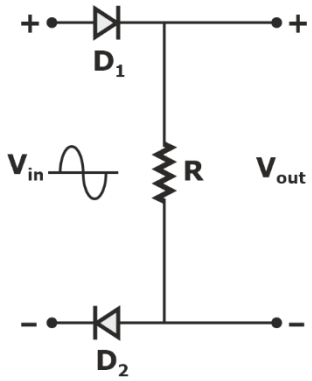
30. The steady-state output (V_{out}) will be



A. Saturate to $-V_{BE}$
B. Saturate to $+V_{DD}$
C. Become equal to −0.1 V
D. Become equal to 0.1 V

Ans. A

31. Consider the circuit shown in figure below:



A. $V_{out} = +V_{in}$ for $V_{in} < 0$
B. $V_{out} = -V_{in}$ for $V_{in} < 0$
C. $V_{out} = +V_{in}$ for $V_{in} > 0$
D. $V_{out} = -V_{in}$ for $V_{in} > 0$

Ans. C

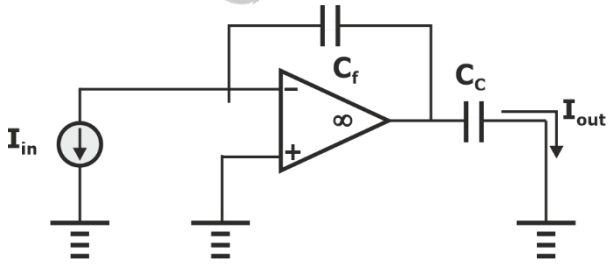
32. For an ideal MOSFET biased in saturation, the magnitude of small signal current gain for a common drain amplifier is

A. ∞ B. 0
C. 1 D. 100

Ans. A

[2 Marks]

33. The current gain (I_{out}/I_{in}) with an ideal current amplifier given below is



A. $-C_C/C_f$ B. C_f/C_C
C. $-C_f/C_C$ D. C_C/C_f

Ans. D

34. $H = x^2\hat{i} + x^2y^2\hat{j} + x^2y^2z^2\hat{k}$

Calculate magnitude of current density at (1, 2, 1) is

A. 12 B. 8
C. 20 D. 16

[MCQ - 2 Marks]

Ans. A

35. Let $f(x, y, z) = 4x^2 + 7xy + 3xz^2$. The direction in which the function f(x, y, z) increases most rapidly at point P = (1, 0, 2) is

A. $20\hat{i}+12\hat{k}$ B. $20\hat{i}$
C. $20\hat{i}+7\hat{j}$ D. $20\hat{i}+7\hat{j}+12\hat{k}$

Ans. D

36. Let $f(x)=\int_0^x e^t(t-1)(t-2)dt$. Then f(x) decreases in internal

A. $x \in (1, 2)$ B. $x \in (2, 3)$
C. $x \in (0.5, 1)$ D. $x \in (0, 1)$

Ans. A

37. Let the probability density formation of a random variable x is given as

$$f(x)=ae^{-2|x|}$$

The value of 'a' as ____.

Ans. 1

38. Consider a matrix, A $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 4 & -2 \\ 0 & 1 & 1 \end{bmatrix}$. The matrix A satisfices the equation:

$6A^{-1} = A^2 + CA + DI$, where C and D are scalars, and I is identity matrix. Then (c + d) is equals to

A. 17 B. 11
C. −6 D. 5

Ans. D

39. Consider a 3 × 3 matrix A whose (i, j)th element, $a_{ij} = (I - j)^3$. Then the matrix A will be

A. Show-symmetric B. symmetric

C. null D. unitary

Ans. A

40. e^A denotes the exponential of a square matrix A. suppose λ is an eigenvalue and v is the corresponding eigen-vector of A. consider two statements:

Statement 1: e^{λ} is eigen value of e^A.

Statement 2: v is eigin vector of e^A.

A. Both statement-1 and statement-2 are true.

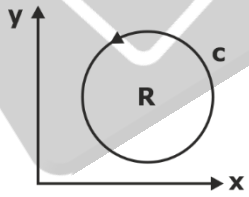
B. Statement-1 is true, but statement-2 is false.

C. Both statement-1 and statement-2 are false.

D. Statement-1 is false, but statement-2 is true.

Ans. A

41. Let R be a region in 1st quadrant of x-y plane enclosed by a closed curve C considered in counter-clock-wise direction. Which of the following does not represents area of region represents area of region R.



A. $\oint_c x\,dy$

B. $\int\int dx\,dy$

C. $\frac{1}{2}\oint_c (x\,dy - y\,dx)$

D. $\oint_c y\,dy$

Ans. C

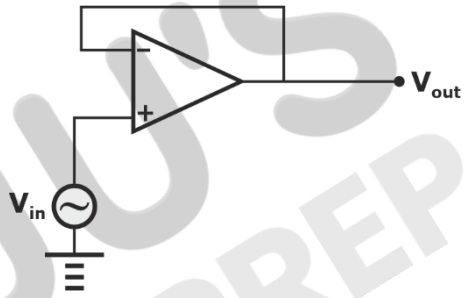
42. $\vec{E}(y,z) = 2x^2\hat{i} + 5yj + 3z\hat{k}$

find $\iiint_v (\vec{\nabla}\cdot\vec{E})kV, V \rightarrow$ volume of cube defined by

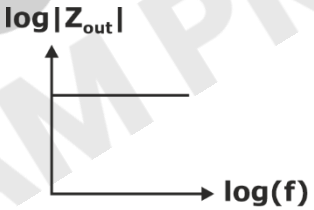
$0 \le x \le 1, 0 \le y \le 1, 0 \le z \le 1$

Ans. 10

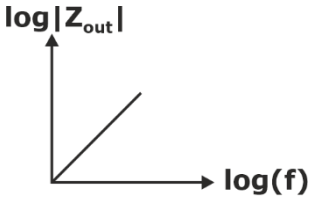
43. The output independence of a non-ideal op-amp is denoted by Z_{out}. The variation in the magnitude Z_{out} with increasing frequency, f is best represented by



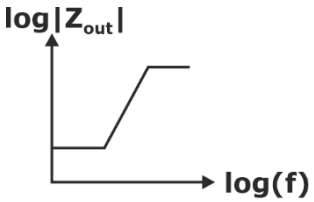
A.



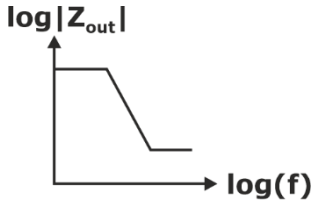
B.



C.



D.



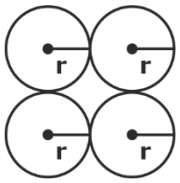
Ans. C

44. If only 5% of the supplied power to a cable reaches the output terminal the power loss in cable, in decibels, is _____.

[1 Mark]

Ans. 13

45. Consider the system as shown in figure below:



Find GMR = ?

[1 Mark]

A. 1.414r B. 4r
C. 2r D. 1.723r

Ans. D

46. The valid positive, negative 0 sequence impedance (in p.u.) respectively for 220 V, fully transposed three phase transmission line, from the given choices are

A. 0.1, 0.3 & 0.1
B. 0.15, 0.15 & 0.35
C. 0.2, 0.2 & 0.2
D. 1.1, 0.15 & 0.08

[1 Mark]

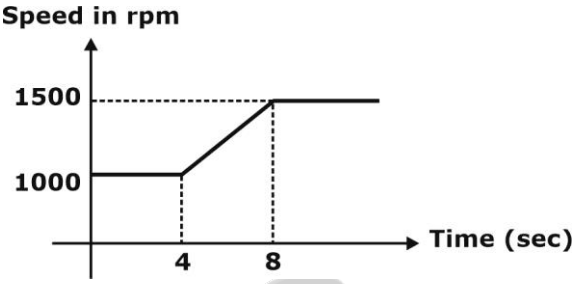
Ans. B

47. The most commonly used relay, for protection of an alternator against loss of excitation is

A. offset mho relay
B. Buchholz relay
C. Differential relay
D. Over current relay

Ans. A

48. A 4-pole induction motor with inertia of 0.1 kg-m^2 drives a constant load torque of 2 Nm. The speed of the motor is increased linearly from 1000 rpm to 1500 rpm in 4 seconds as shown in figure below, neglect losses in the motor. The energy in joules, consumed by the motor during the speed change is _____. (round off to nearest integer)



Ans. 1733

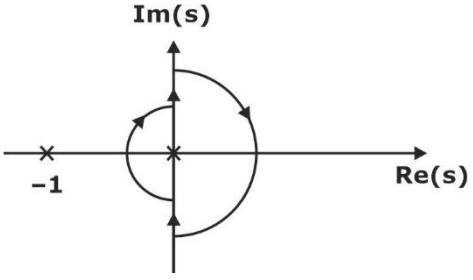
49. A 3-phase grid-connected voltage source converter with DC link voltage of 1000 V is switched using sinusoidal pulse width modulation (PWM) technique. If the grid phase current is 10 A and the 3-phase complex power supplied by the converter is given by (–4000 – j3000) VA, then the modulation index used in sinusoidal PWM is _____. (round off to two decimal places)

Ans. 0.471

50. The open loop transfer function of unity gain negative feedback system is given as

$$G(s)=\frac{1}{s(s+1)}$$

The Nyquist contour in the s-plane encloses the entire right half plane and a small neighborhood around the origin in the left half plane as shown in the figure. The Nyquist plot of G(s) corresponding to the Nyquist contour is denoted as N. Then N equals to



Ans. 1