



GATE 2020

Electrical Engineering

Questions



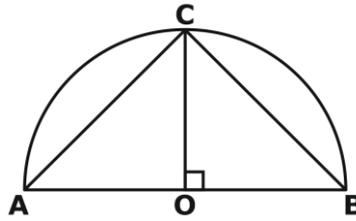
GENERAL APTITUDE

- This book, including all its chapters, _____ interesting. The students as well as the instructor _____ in agreement about it.
A. is, was
B. are, are
C. is, are
D. were, was
- People were prohibited _____ their vehicles near the entrance of the main administrative building.
A. to park
B. from parking
C. to parking
D. to have parked
- Select the word that fits the analogy:
Do : Undo :: Trust : _____
A. Entrust
B. Intrust
C. Distrust
D. Untrust
- Stock markets _____ at the news of the coup.
A. poised
B. plunged
C. plugged
D. probed
- If P, Q, R, S are four individuals, how many teams of size exceeding one can be formed, with Q as a member?
A. 5
B. 6
C. 7
D. 8
- Non-performing Assets (NPAs) of a bank in India is defined as an asset, which remains unpaid by a borrower for a certain period of time in terms of interest, principal, or both. Reserve Bank of India (RBI) has changed the definition of NPA thrice during 1993-2004, in terms of the holding period of loans. The holding period was reduced by one quarter each time. In 1993, the holding period was four quarters (360 days). Based on the above paragraph, the holding period of loans in 2004 after the third revision was _____ days.
A. 45
B. 90
C. 135
D. 180
- Select the next element of the series: Z, WV, RQP, _____.
A. LKJI
B. JIHG
C. KJIH
D. NMLK
- A four-digit integer number from 1001 - 9999, the digit group '37' (in the same sequence) appears _____ times.
A. 270
B. 279
C. 280
D. 299

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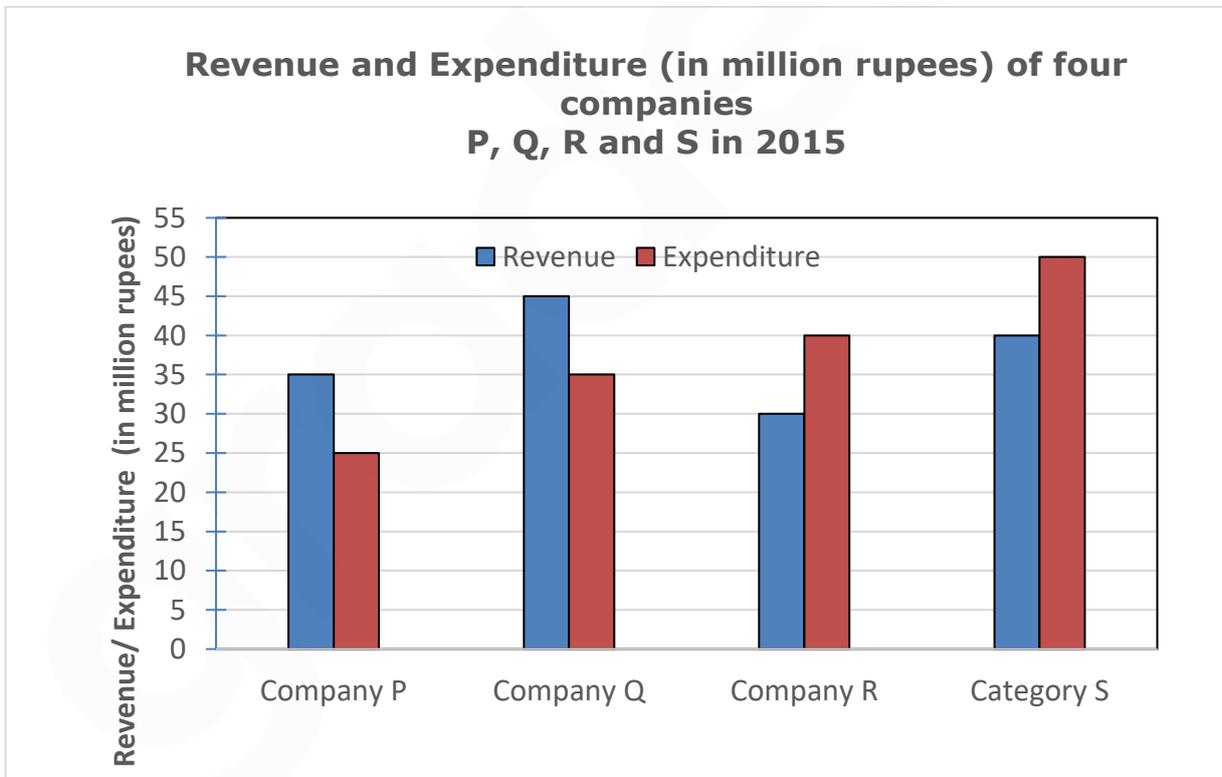
9. Given a semi-circle O as the center, as shown in the figure, the ratio $\frac{\overline{AC} + \overline{CB}}{\overline{AB}}$ is _____,



Where \overline{AC} , \overline{CB} & \overline{AB} are chords.

- A. $\sqrt{2}$
- B. $\sqrt{3}$
- C. 2
- D. 3

10. The revenue and expenditure of four different companies P, Q, R and S in 2015 are shown in the figure. If the revenue of company Q in 2015 was 20% more than that in 2014, and company Q had earned a profit of 10% on expenditure in 2014, then its expenditure (in million rupees) in 2014 was _____ .



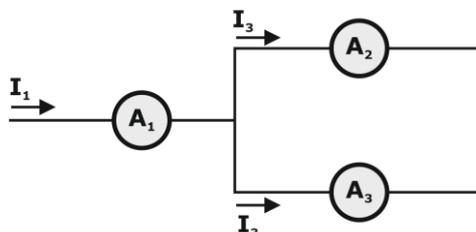
- A. 32.7
- B. 33.7
- C. 34.1
- D. 35.1

TECHNICAL

11. $ax^3 + bx^2 + cx + d$ is a polynomial on real x over real coefficients a, b, c, d wherein $a \neq 0$. Which of the following statements is true?
 A. d can be chosen to ensure that $x = 0$ is a root for any given set a, b, c .
 B. c alone cannot ensure that all roots are real.
 C. a, b, c, d can be chosen to ensure that all roots are complex.
 D. No choice of coefficients can make all roots identical.
12. A lossless transmission line with 0.2 p.u. reactance per phase uniformly distributed along the length of the line, connecting a generator bus to a load bus, is protected up to 80 % of its length by a distance relay placed at the generator bus. The generator terminal voltage is 1 p.u. There is no generation at the load bus. The threshold p.u. current for operation of the distance relay for a solid three phase-to-ground fault on the transmission line is closest to:
 A. 6.25
 B. 3.61
 C. 1.00
 D. 5.00
13. The value of the following complex integral, with C representing the unit circle centered at origin in the counter clockwise sense, is:

$$\int_C \frac{z^2 + 1}{z^2 - 2z} dz$$

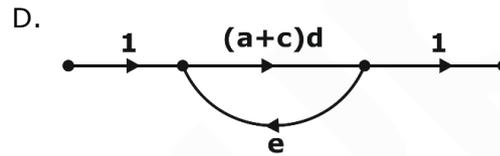
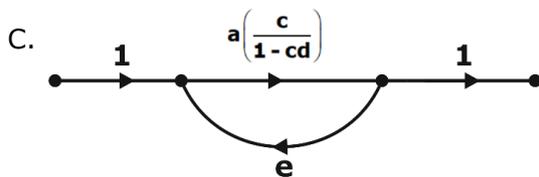
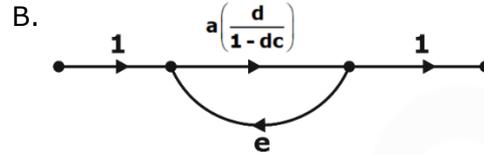
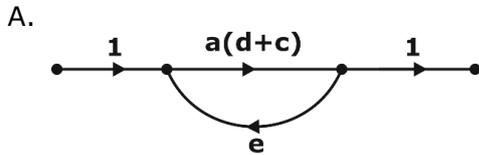
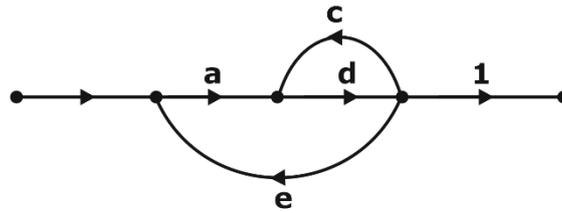
 A. $-8\pi i$
 B. $-\pi i$
 C. πi
 D. $8\pi i$
14. Consider a negative unity feedback system with forward path transfer function $G(s) = \frac{K}{(s + a)(s - b)(s + c)}$, where K, a, b, c are positive real numbers. For a Nyquist path enclosing the entire imaginary axis and right half of the s -plane in the clockwise direction, the Nyquist plot of $(1 + G(s))$, encircles the origin of $(1 + G(s))$ -plane once in the clockwise direction and never passes through this origin for a certain value of K . Then, the number of poles of $\frac{G(s)}{1 + G(s)}$ lying in the open right half of the s -plane is _____.
15. Current in ammeters A_2 and A_3 are $1\angle 10^\circ$ and $1\angle 70^\circ$ respectively. The reading of the ammeter A_1 (round off to 3 decimal places) is _____ A.



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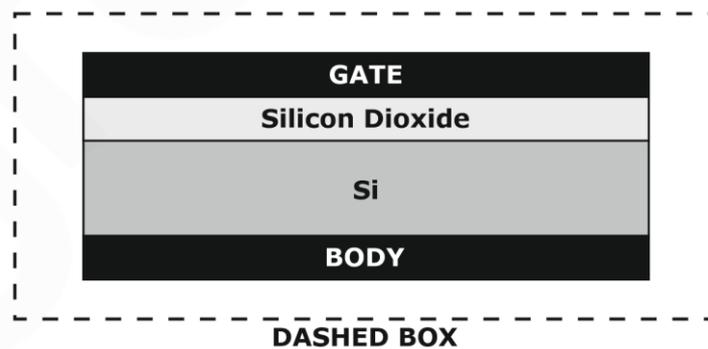
26. Which of the options is an equivalent representation of signal flow graph shown here ?



27. A single-phase, full-bridge rectifier fed from 230V, 50 Hz sinusoidal source supply a series combination of finite resistance 'R' and a very large inductance, L. The two most dominate frequency components in the source current are:

- A. 150 Hz, 250 Hz
- B. 50 Hz, 100 Hz
- C. 50 Hz, 0 Hz
- D. 50 Hz, 150 Hz

28. The cross-section of a metal-oxide-semiconductor structure is shown schematically. Starting from an uncharged condition, a bias of +3 V is applied to the gate contact with respect to the body contact. The charge inside the silicon dioxide layer is then measured to be +Q. The total charge contained within the dashed box shown, upon application of bias, expressed as a multiple of Q (absolute value in Coulombs, rounded off to the nearest integer) is _____ .

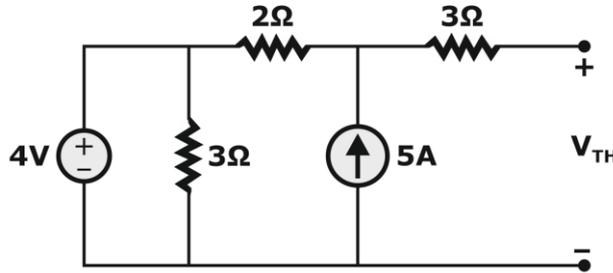


29. Out of the following options, the most relevant information needed to specify the real power (P) at the PV buses in the load flow analysis is

- A. Solution of economics load dispatch
- B. rated voltage of generator
- C. rated power output of generator
- D. base power of generator

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33. A three phase, 50 Hz, 4-pole induction motor runs at no-load with a slip of 1%. With full load, the slip increases to 5%. The % speed regulation of the motor (rounded off to 2 decimal places) is _____
34. The Thevenin equivalent voltage, V_{TH} , in V (rounded off to 2 decimal places) of the network shown below, is _____



35. A single 50Hz, synchronous generator on droop control was delivering 100 MW power to a system. Due to increase in load, generator power has to be increased by 10 MW, as a result of which, system frequency dropped to 49.75 Hz. Further increase in load in the system resulted in a frequency of 49.25 Hz. At this condition, the power in MW supplied by the generator is _____. (rounded off to 2 decimal places).

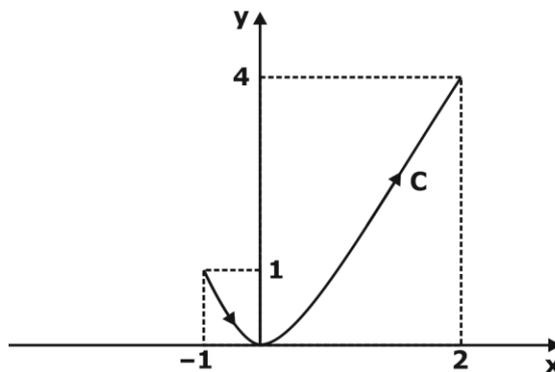
36. A stable real linear time-invariant system with single pole at p , has a transfer function $H(s) = \frac{s^2 + 100}{s - p}$ with a dc gain of 5. The smallest positive frequency, in rad/s, at unity gain is closest to:

- A. 8.84
- B. 122.87
- C. 78.13
- D. 11.08

37. Let a_x and a_y be unit vectors along x and y directions, respectively. A vector function is given by $F = a_x y - a_y x$
The line integral of the above function,

$$\int_C F \cdot dl$$

along the curve C, which follows the parabola $y = x^2$ as shown below is _____ (rounded off to 2 decimal places).



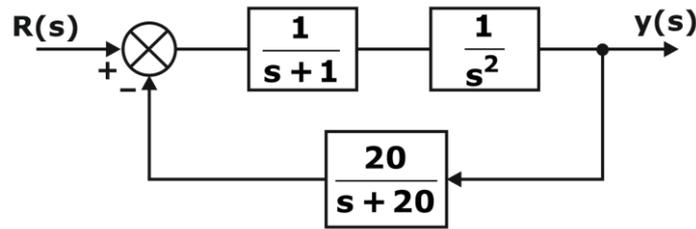
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43. Which of the following options is correct for the system shown below?

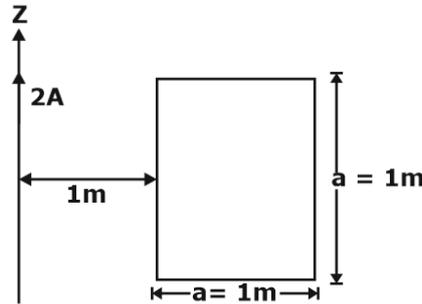


- A. 4th order and stable
 - B. 4th order and unstable
 - C. 3rd order and stable
 - D. 3rd order and unstable
44. A single-phase, full-bridge, fully controlled thyristor rectifier feeds a load comprising a 10 Ω resistance in series with a very large inductance. The rectifier is fed from an ideal 230 V, 50 Hz sinusoidal source through cables which have negligible internal resistance and a total inductance of 2.28 mH. If the thyristors are triggered at an angle $\alpha = 45^\circ$, the commutation overlap angle in degree (rounded off to 2 decimal places) is _____.
45. The causal realization of a system transfer function $H(s)$ having poles at $(2,1)$, $(-2,1)$ and zeros at $(2,1)$ $(-2,1)$ will be:
- A. Stable, real, all pass.
 - B. Unstable, real, high pass.
 - C. Stable, complex, low pass.
 - D. Unstable, complex, all pass.
46. A cylindrical rotor synchronous generator has steady state synchronous reactance of 0.7 p.u. and sub transient reactance of 0.2 p.u. It is operating at $(1 + j0)$ p.u. terminal voltage with an internal emf of $(1 + j0.7)$ p.u. Following a three-phase solid short circuit fault at the terminal of the generator, the magnitude of the sub transient internal emf (rounded off to 2 decimal places) is _____ p.u.
47. Two buses i and j are connected with a transmission line of admittance = Y, at the two ends of which there are ideal transformers with turns ratios as shown. Bus admittance matrix for the system is



- A. $\begin{bmatrix} t_i^2 Y & -t_i t_j Y \\ -t_i t_j Y & t_j^2 Y \end{bmatrix}$
- B. $\begin{bmatrix} t_i t_j Y & -t_j^2 Y \\ -t_i^2 Y & t_i t_j Y \end{bmatrix}$
- C. $\begin{bmatrix} -t_i t_j Y & t_j^2 Y \\ t_i^2 Y & -t_i t_j Y \end{bmatrix}$
- D. $\begin{bmatrix} t_i t_j Y & -(t_i - t_j)^2 Y \\ -(t_i - t_j)^2 Y & t_i t_j Y \end{bmatrix}$

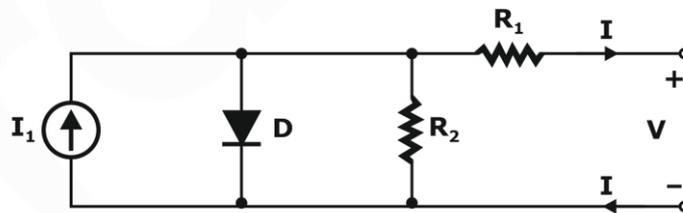
56. A conducting square loop of side length 1 m is placed at a distance of 1 m from a long straight wire carrying a current of $I = 2\text{ A}$ as shown below. The mutual inductance in nH (round off to 2 decimal places), between the conducting loop and the long wire is _____



57. A non-ideal diode is biased with a voltage of -0.03 V , and a diode current of I_1 is measured. The thermal voltage is 26 mV and the ideality factor for the diode is $15/13$. The voltage, in V , at which the measured current increases to $1.5 I_1$ is closest to:

- A. -1.50
- B. -0.09
- C. -4.50
- D. -0.02

58. Consider the diode circuit shown below. The diode, D , obeys the current-voltage characteristic $I_D = I_s \left(\exp\left(\frac{V_D}{nV_T}\right) - 1 \right)$, where $n > 1$, $V_T > 0$, V_D is the voltage across the diode and I_D is the current through it. The circuit is biased so that voltage, $V > 0$ and current, $I < 0$. If you had to design this circuit to transfer maximum power from the current source (I_1) to a resistive load (not shown) at the output, what values of R_1 and R_2 would you choose ?



- A. Small R_1 and small R_2 .
- B. Small R_1 and large R_2 .
- C. Large R_1 and large R_2 .
- D. Large R_1 and small R_2 .

59. Which of the following options is true for a LTI discrete time system that obeys the difference equation: $y[n] - ay[n - 1] = b_0 x[n] - b_1 x[n - 1]$

- A. The system is necessary causal
- B. When $x[n] = 0, n < 0$, the function $y[n]; n > 0$ is solely determined by the function $x[n]$.
- C. $y[n]$ is unaffected by the values of $x[n - k]; k > 2$
- D. The system impulse response is non-zero at infinite many instant.

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