

gate 8

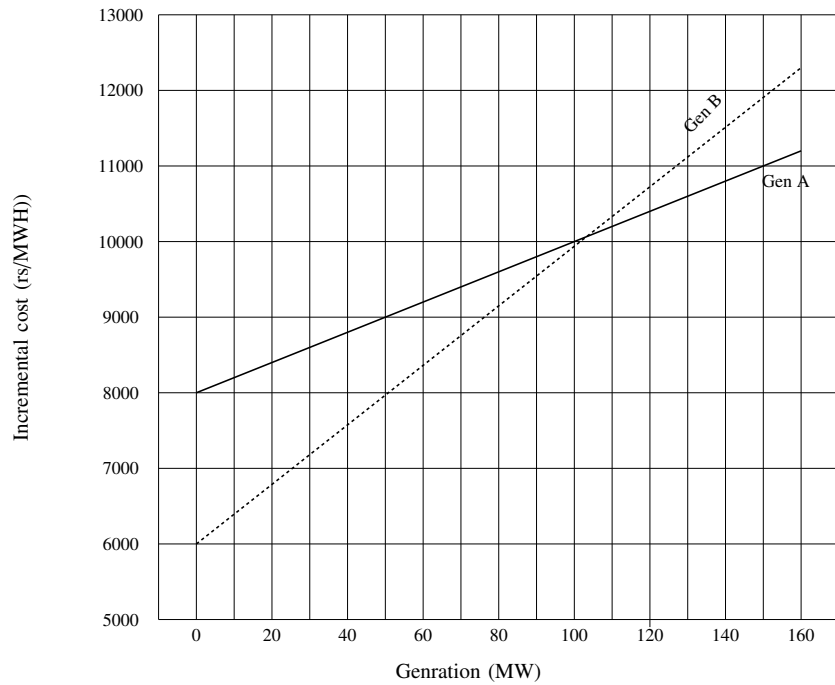
EE24Btech11041 - Mohit

- 1) If the following switching devices have similar power ratings, which one of them is the fastest? (EE 2024)
 - a) SCR
 - b) GTO
 - c) IGBT
 - d) Power MOSFET
- 2) A single-phase triac based AC voltage controller feeds a series RL load. The input AC supply is 230V, 50Hz. The values of R and L are 10Ω and $18.37mH$, respectively. The minimum triggering angle of the triac to obtain controllable output voltage is (EE 2024)
 - a) 15°
 - b) 30°
 - c) 45°
 - d) 60°
- 3) Let X be a discrete random variable that is uniformly distributed over the set $\{-10, -9, \dots, 0, \dots, 9, 10\}$. Which of the following random variables is/are uniformly distributed? (EE 2024)
 - a) X^2
 - b) X^3
 - c) $(X - 5)^2$
 - d) $(X + 10)^2$
- 4) Which of the following complex functions is/are analytic on the complex plane? (EE 2024)
 - a) $f(z) = \operatorname{Re}(z)$
 - b) $f(z) = \operatorname{Im}(z)$
 - c) $f(z) = e^{|z|}$
 - d) $f(z) = z^2 - z$
- 5) Consider the complex function $f(z) = \cos z + e^{z^2}$. The coefficient of z^5 in the Taylor series expansion of $f(z)$ about the origin is _____ (rounded off to 1 decimal place). (EE 2024)
- 6) The sum of the eigenvalues of the matrix $A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ is _____ (rounded off to the nearest integer). (EE 2024)
- 7) Let $X(w)$ be the Fourier transform of the signal

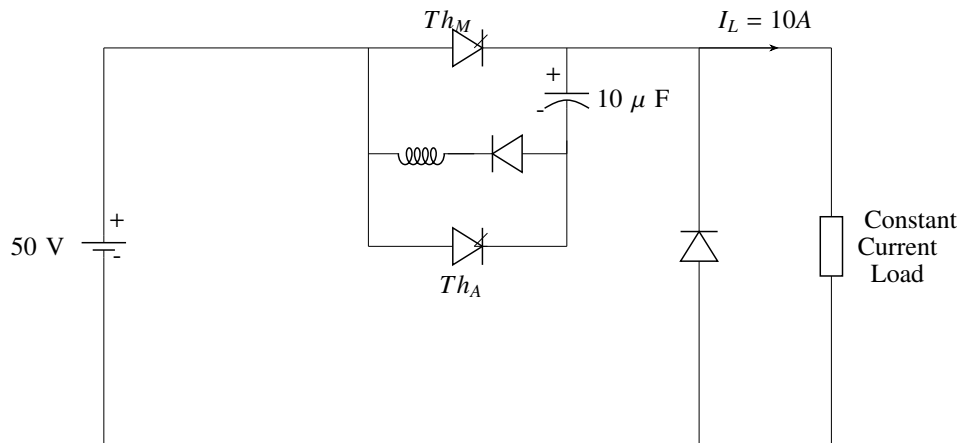
$$x(t) = e^{-t^4} \cos t, \quad -\infty < t < \infty. \quad (1)$$

The value of the derivative of $X(w)$ at $w = 0$ is _____ (rounded off to 1 decimal place). (EE 2024)

- 8) The incremental cost curves of two generators (Gen A and Gen B) in a plant supplying a common load are shown in the figure. If the incremental cost of supplying the common load is Rs. 7400 per MWh, then the common load in MW is _____ (rounded off to the nearest integer). (EE 2024)



- 9) A forced commutated thyristorized step-down chopper is shown in the figure. Neglect the ON-state drop across the power devices. Assume that the capacitor is initially charged to 50V with the polarity shown in the figure. The load current (I_L) can be assumed to be constant at 10A. Initially, Th_M is ON and Th_A is OFF. The turn-off time available to Th_M in microseconds, when Th_A is triggered, is _____ (rounded off to the nearest integer). (EE 2024)



- 10) Consider a vector $\mathbf{u} = 2\hat{x} + \hat{y} + 2\hat{z}$, where $\hat{x}, \hat{y}, \hat{z}$ represent unit vectors along the coordinate axes x, y, z respectively. The directional derivative of the function $f(x, y, z) = 2 \ln(xy) + 3 \ln(yz) + 3 \ln(xz)$ at the point $(x, y, z) = (1, 1, 1)$ in the direction of \mathbf{u} is (EE 2024)

- 0
- $\frac{7}{5\sqrt{2}}$
- 7
- 21

- 11) The input $x(t)$ and the output $y(t)$ of a system are related as (EE 2024)

$$y(t) = e^{-t} \int_{-\infty}^t e^{\tau} x(\tau) d\tau, \quad -\infty < t < \infty. \quad (2)$$

The system is

(EE 2024)

- nonlinear.

- b) linear and time-invariant.
- c) linear but not time-invariant.
- d) noncausal.

12) Consider the discrete-time systems T_1 and T_2 defined as follows:

$$\{T_1x\}[n] = x[0] + x[1] + \cdots + x[n] \quad (3)$$

$$\{T_2x\}[n] = x[0] + \frac{1}{2}x[1] + \cdots + \frac{1}{2^n}x[n] \quad (4)$$

Which one of the following statements is true?

(EE 2024)

- a) T_1 and T_2 are BIBO stable.
- b) T_1 and T_2 are not BIBO stable.
- c) T_1 is BIBO stable and T_2 is not BIBO stable.
- d) T_1 is not BIBO stable and T_2 is BIBO stable.

13) If the Z-transform of a finite-duration discrete-time signal $x[n]$ is $X(z)$, then the Z-transformation of the signal $y[n] = x[2n]$ is

(EE 2024)

- a) $Y(z) = X(z^2)$
- b) $Y(z) = \frac{1}{2}[X(z^{-\frac{1}{2}}) + X(-z^{-\frac{1}{2}})]$
- c) $Y(z) = \frac{1}{2}[X(z^{\frac{1}{2}}) + X(-z^{\frac{1}{2}})]$
- d) $Y(z) = \frac{1}{2}[X(z^2) + X(-z^2)]$