# GATE 2023 Electrical Engineering Question Paper PDF

# (Memory Based)

## General Aptitude

**Question.**

The digit in the unit's place of the product $3^{999} \times 7^{1000}$ is

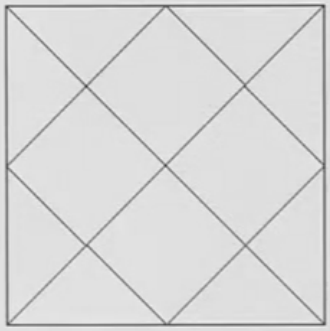
(a) 9 (b) 7

(c) 1 (d) 3

**Answer. 7**

**Question.**

How many triangles are present in the given figure?



(a) 12 (b) 16

(c) 24 (d) 20

**Answer. D**

**Question.**

Given a fair six faced dice where the faces are labelled as 1, 2, 3, 4, 5 and 6. What is the probability of getting a 1 on the first roll of the dice and 4 on the second roll of the dice?

(a) $\frac{5}{6}$ (b) $\frac{1}{6}$

(c) $\frac{1}{36}$ (d) $\frac{1}{3}$

**Answer. C**

## Electrical Engineering

**Question. A semiconductor switch needs to block the voltage V of only one polarity (v>0) during off state as shown in figure 1 and carry current in both directions during on state shown in figure 2. Which of the following switch centrations will realize the same.**

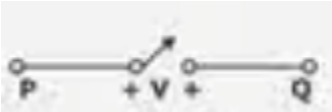
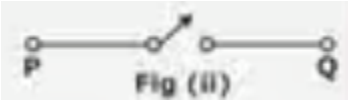
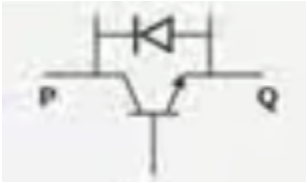
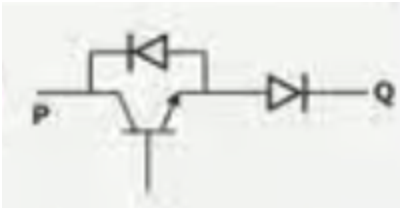
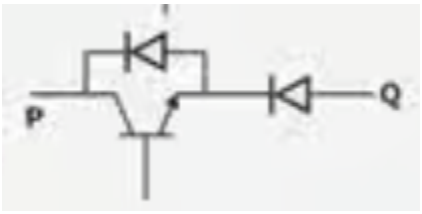


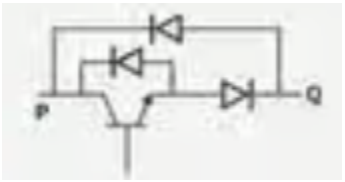

**Figure 1**




**A.** 

B. 


C. 


D. 


**Answer.**

**Question. A three phase, star connected, balanced load is supplied from a 3-phase, 400 V (rms), balanced voltage source with wattmeter reading is -400 W and rhw line current is $I_R$ = 2A (rms), then power factor of the load per phase is**

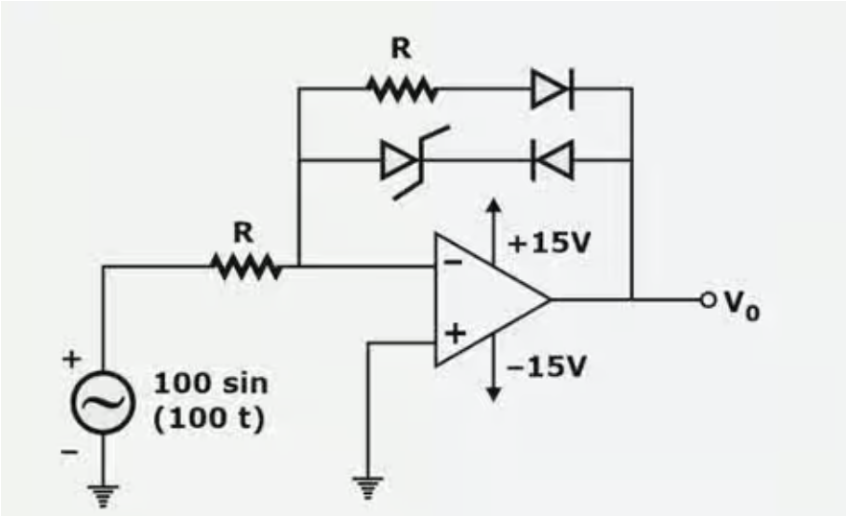

A. **0.707 lagging**
B. **0.5 leading**
C. **0.866 leading**
D. **Unity**

**Answer.** C

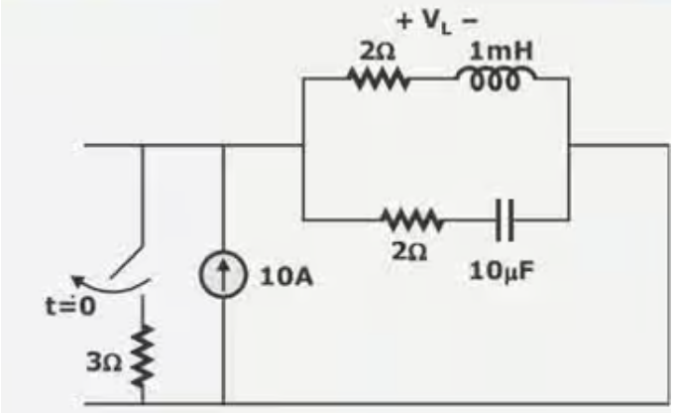
**Question. In a given 8-bit general-purpose mic controller, there are the following flags, C-carry, A-auxiliary Larry, and 0 overflows.**
**P- parity for even ⊥ for odd).**
**R0 and R1 are the general purpose register of the microcontroller. After execution of the following instruction, the decimal equivalent of the binary sequence of the flag path [CAOP] will be**
**MOV R0, + X60**
**MOV R1, +X 46**

**AOD R0, R1**

**Question. Find the minimum and maximum value of output voltage. Assume ideal diode $V_z$ = 5 Volt.**




**Question. Find $V_L$ at L = $0^+$**




**Question. The expressions of fuel cost of two thermal generating units as a function of the respective power generation $P_{Q1}$, & $F_1(P_{Q1}) = 0.1\,aP^2_{Q1} + 40P_{Q1} + 120$ Rs/hr**
**OMW $\leqslant P_{Q1} \leqslant$ 350 MW**
**$F_2(P_{Q2}) = 0.2P^2_{Q2} + 100$ Rs/hr**
**OMW $\leqslant P_{Q2} \leqslant$ 350 MW**

**where a is a constant. for given value of a optimal as $P_{Q3}$ = 175 MW & $P_{Q2}$ = 115 MW. With the load remaining dispatch is carried out Then changes in$P_{Q1}$ & the total cost of generation, F(= $F_1 + F_2$) in Rs/hr will be as follows.**

A. **Both $P_{Q1}$ and F will increase**
B. **$P_{Q1}$ will decrease and F will increase**
C. **$P_{Q1}$ will increase and F will decrease**
D. **Both $P_{Q1}$ and F will decrease**

**Question.**

The discrete-time fourier transform of a signal $x[n]$ is $X[\Omega] = (1 + \cos \Omega)e^{-j\Omega}$. Consider that $x_p[n]$ is a periodic signal of period $N = 5$ such that $x_p[n] = x[n]$, for $n = 0, 1, 2$.

Note that $x_p[n] = \sum_{k=0}^{N-1} a_k e^{j\frac{2\pi}{N}kN}$. The magnitude of the fourier series coefficient is _____

(round off to 3 decimal palces.

**Answer. 0.038**

**Question.**

A signal $x(t) = 2\cos(180\pi t)\cos(60\pi t)$ is sampled at 200 Hz and then passed through an ideal low pass filter having cut-off frequency of 100 Hz. The maximum frequency present in the filtered signal in Hz is ____ (round off to the nearest interger).

**Answer. 80**

**Question.**

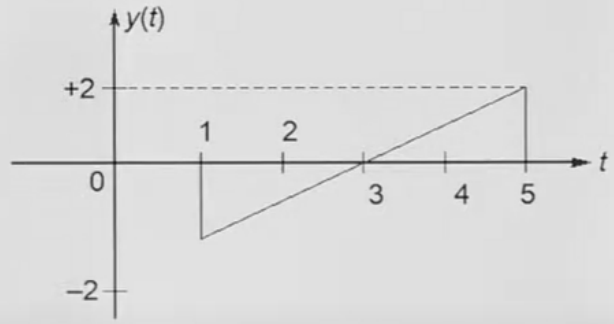
The period of the discrete-time signal $x[n]$ described by the equation below is $N =$ _____ (round off to the nearest integer).

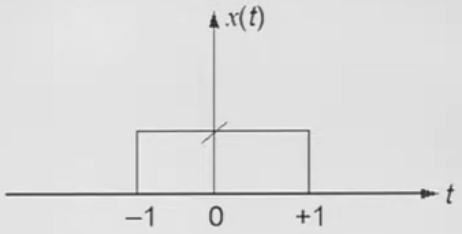
$$x[n] = 1 + 3\sin\left(\frac{15\pi}{8}n + \frac{3\pi}{4}\right) - 5\sin\left(\frac{\pi}{3}n - \frac{\pi}{4}\right)$$

**Answer. 58**

**Question.**

$z(t) = x(t) * y(t)$ is maximum at $t = T_1$, then $T_1$ is ____.




**Answer. 4**

**Question.**

$x(t) \xrightarrow{FT} X(\omega)$

$$X(\omega) = \begin{cases} 1, & |\omega| < \omega_o \\ 0, & |\omega| > \omega_o \end{cases}$$

Which one is true?

(a) At $t = \frac{\pi}{2\omega_o}$, $x(t) = \frac{1}{\pi}$

(b) $x(t)$ tends to be impulse as $\omega_o \to \infty$

(c) $x(o)$ decreases as $\omega_o$ increases

(d) At $t = \frac{\pi}{2\omega_o}$, $x(t) = -\frac{1}{\pi}$

**Answer. B**

**Question.**

Which one of the following is TRUE?

(a) DTFT of $x[n]$ converges if ROC is such that $x[n]$ is right handed side sequence.

(b) DTFT of $x[n]$ converges if ROC is $\frac{2}{3} < |z| < 3$

(c) DTFT of $x[n]$ converges if ROC is $|z| > 3$

(d) DTFT of $x[n]$ converges if ROC is such that $x[n]$ is left handed side sequence.

**Answer. B**

**Question.**

Which one of the following is/are TRUE?

(a) If LTI system is CAUSAL, it is stable.

(b) If Impulse Response $0 < |h(n)| < 1$ for all $n$, then LTI system is stable system.

(c) If discrete LTI system has impulse response $h[n]$ of finite duration the system is stable.

(d) A discrete time LTI system is causal if and only if its response to a step input $U[n]$ is zero for $n < 0$.

**Answer. D**

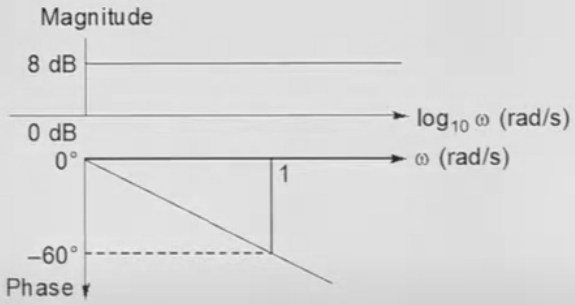
**Question.**

Consider the state-space description of an LTI system with matrices $A = \begin{bmatrix} 0 & 1 \\ -1 & -2 \end{bmatrix}$, $B = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$; $C = \begin{bmatrix} 3 & -2 \end{bmatrix}$, $D = 1$. For the input, $5 \sin(\omega t)$, $\omega > 0$, the value of $\omega$ for which the steady state output of the system will be zero, is ____ (round off to the nearest integer).

**Answer. 2**

**Question.**

The magnitude and phase plots of an LTI system are shown in the figure. The TF of the system is




(a) $\frac{e^{-2.514s}}{s+1}$

(b) $2.51e^{-1.047s}$

(c) $1.04e^{-2.514s}$

(d) $2.51e^{-0.032s}$

**Answer. B**

**Question.**

A continuous-time system that is initially at test is described by $\frac{dy(t)}{dt}+3y(t) = 2x(t)$, where $x(t)$ is the input voltage and y(t) is the output voltage. The impulse response of the system is

(a) $\frac{1}{3}e^{-2t}u(t)$

(b) $2e^{-3t}$

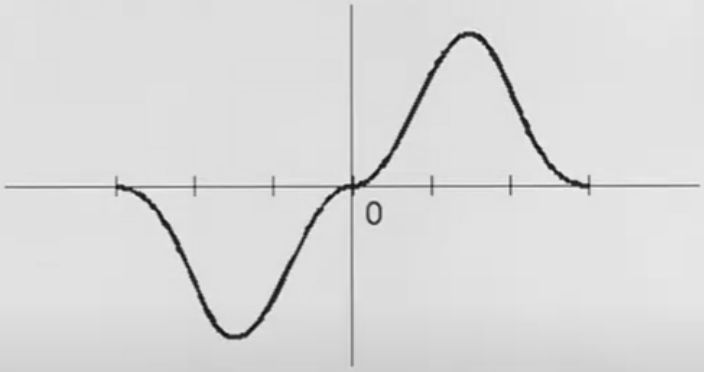
(c) $3e^{-2t}$

(d) $2e^{-3t}u(t)$

**Answer. D**

**Question.**

Which one of the following options represent the given graph?




(a) $x2^{-|x|}$

(b) $|x|2^{-x}$

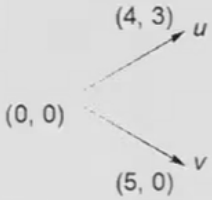
(c) $x2^{-x}$

(d) $x^2 e^{-|x|}$

**Answer. A**

**Question.**

In the figure, the vectors $u$ and $v$ are related as $Au = v$ by a transformation matrix $A$. The correct choice of $A$ is




(a) $\begin{bmatrix} \frac{4}{5} & \frac{3}{5} \\ -\frac{3}{5} & \frac{4}{5} \end{bmatrix}$

(b) $\begin{bmatrix} \frac{4}{5} & \frac{3}{5} \\ \frac{3}{5} & \frac{4}{5} \end{bmatrix}$

(c) $\begin{bmatrix} \frac{4}{5} & -\frac{3}{5} \\ \frac{3}{5} & \frac{4}{5} \end{bmatrix}$

(d) $\begin{bmatrix} \frac{4}{5} & -\frac{3}{5} \\ \frac{3}{5} & -\frac{4}{5} \end{bmatrix}$

**Answer. A**

**Question.**

Three points in the $x$-$y$ planes are (–1, 0.8) (0, 2.2) and (1, 2.8). The value of the slope of the best fit straight line in the least square sense is _____.

**Answer. 1**

**Question.**

For a given vector $\omega = [1\ 2\ 3]^T$, the vector normal to the plane defined by $\omega^T x = 1$ is

(a) $[3\ 2\ 1]^T$ (b) $[-2, -2, 2]^T$

(c) $[1, 2, 3]^T$ (d) $[3, 0\ -1]^T$

**Answer. C**

**Question.**

A quadratic function of 2 variables is given as

$$F(x_1, x_2) = x_1^2 + 2x_2^2 + 3x_1 + 3x_2 + x_1 x_2 + 1$$

The magnitude of the maximum rate of change of the function at the point (1, 1) is ____.

**Answer. 10**

**Question.**

The expected number of trails for first occurrence of a 'head' in a biased coin is known to be 4. The probability of first occurrence of a 'head' in the second trails is ____.

**Answer. 0.187**