Dear Students,

The GATE Academy team has tried to provide the best memory based questions and answers, however if you find any discrepancy then write your doubts to The GATE Academy at: info@thegateacademy.com. The GATE academy owes no responsibility for any kind of error due to data insufficiency/misprint/human errors etc.
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<th>No. of Ques.</th>
<th>Topics Asked in Paper (Memory Based)</th>
<th>Level of Toughness</th>
<th>Total Marks</th>
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<tr>
<td>Engineering Mathematics</td>
<td>1 Marks:5</td>
<td>Newton Raphson, Taylors Series, Probability, Calculus, Matrix</td>
<td>Tough</td>
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<td>2 Marks:5</td>
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<td>Network Theory</td>
<td>1 Marks:1</td>
<td>Transient analysis, Steady State Analysis,</td>
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<td>Signals &amp; Systems</td>
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<td>DTFT, Sampling, Filter, Fourier Series, System analysis</td>
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<td>Control Systems</td>
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<td>Nyquist plot, RH criterion, Compensator, Root locus</td>
<td>Easy</td>
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<td>Analog Circuits</td>
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<td>FET amplifier, BJT Amplifier, Op-amp</td>
<td>Medium</td>
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<td>Digital Circuits</td>
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<td>Counters, Excitation machine, K-map</td>
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<td>Random variable, ITC, DTCM</td>
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<td>Electronic Device</td>
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<td>General Aptitude</td>
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<td>Distance time, Probability, Permutation and Combination</td>
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<td>Total</td>
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**Faculty Feedback**

Majority of the question were concept based. Mathematics, Signals & Systems, Control System and Digital Circuits weightage were comparatively high.
GATE 2017 Examination*
Electronics and Communication Engineering

Test Date: 05/02/2017
Test Time: 9:00 AM 12:00 PM
Subject Name: Electronics and Communication Engineering

Section I General Aptitude

1. In a group of 6 people there are 3 Indians and 3 Chinese. How many subset can be created such that there are atleast 1 Indian in each subset?
   (A) 52 (B) 48 (C) 44 (D) 56
   [Ans. D]

2. Length of the truck is 10 m and car is 5 m. 20 m distance should be maintain after each truck and 15 m distance should be maintain after each car. If the average speed of car and truck is 36 kmph, then how many vehicles can cross the bridge of negligible length in 1 hour?
   [Ans. *} Range: 1440 to 1440

3. 40% in pai chart in degree is ____
   [Ans. *] Range: 144 to 144
1. The open loop gain of op-amp $10^5$ and cut off frequency ($f_c$) is 8 kHz.

$$V_{in} \rightarrow \frac{79 \Omega}{1 \Omega} \rightarrow V_o$$

Calculate the gain $\frac{V_o}{V_i}$ of the given circuit at 15 kHz?

[Ans. *]

2. Positive feedback Schmitt trigger figure shown below. The biasing supply of op-amp is $+15$ V and $-15$ V. Calculate the upper threshold and lower threshold voltage of the given circuit.

$$V_{in} \rightarrow \frac{10 \Omega}{5 \Omega} \rightarrow V_o$$

(A) 7, -3  
(B) 3, -3  
(C) 5, -5  
(D) 4, -4

[Ans. A]

3. In the given circuit the BJT will switch from cutoff to saturation. Voltage across base to a Emitter ($V_{be}$) is 0.7 V and Collector to a Emitter $V_{ce}$ is 0.2 V. The $V_{in}$ is applied to the base of the transistor. A common base current gain $\alpha$ is ________

$$V_{in} \rightarrow \frac{12 \text{k} \Omega}{4.8 \text{k} \Omega} \rightarrow V_{o}$$

[Ans. *] Range: 0.9022 to 0.9022
4. Common emitter amplifier circuit is shown in figure. Thermal equivalent voltage \( V_T \) is 25 mV and collector current is equal to emitter current. Calculate the gain \( \frac{V_o}{V_i} \) of the given circuit?

![Circuit Diagram]

[Ans. *]

5. Threshold voltage of N channel MOSFET \( (V_T) \) is 1 V and a constructional parameter \( \mu_n C_{ox} \frac{W}{L} \) is 1 mA/V². Calculate \( I_d \) drain current of the MOSFET?

![Circuit Diagram]

[Ans. *] Range: 2 to 2

6. Graph of drift velocity \( V_d \) electric field is shown in figure. Doping concentration is \( 1 \times 10^{16} \) atoms/cm³ and charge of electron is \( 1.6 \times 10^{-19} \) C. 5 V is applied across the 1 \( \mu \)m length. Calculate the current density _________ A/cm².

![Graph of Drift Velocity]

[Ans. *] Range: 160 to 162

7. If two diodes are having concentration as \( N_{A_1} = 10^{14}, N_{D_1} = 10^{14} \) and \( N_{A_2} = 10^{16}, N_{D_2} = 10^{16} \). If the cross sectional area and reversed bias potential is constant. Calculate the ratio of the capacitance \( C_1/C_2 \)

\[
\frac{N_{A_1}}{N_{D_1}} \quad \frac{N_{A_2}}{N_{D_2}}
\]

[Ans. *] Range: 10 to 10
8. In any LTI system input and impulse response is given by
   \[ x(0) = 1 \quad h(0) = 1 \]
   \[ x(1) = 1 \]
   \[ x(2) = 1 \]
   Calculate \[ 10y(1) + y(4) \]
   [Ans. \*] Range: 10 to 10

9. \[ f(x) = e^{x^2} \] The Taylor’s Series expansion up to third order of x
   [Ans. \*]

10. Calculate phase difference between \( V_2 \) and \( V_1 \) is \( \pi/4 \) Calculate \( \omega \) \( \__ \) (in rad/sec)
    
    [Ans. \*] Range: 1 to 1

11. \[ f(ABC)m = (m_0 + m_2 + m_3 + m_5) \] minimized expression of the function is \( \__ \)
    [Ans. \*]
    \( AC + A\bar{B}C + \bar{A}B \)

12. Minority carrier concentration of p-n-p transistor is given under quasi equilibrium state. In which mode the transistor is acting

    \[ \text{(A) Active} \quad \text{(C) Reverse active} \]
    \[ \text{(B) Saturation} \quad \text{(D) Cut off} \]
    [Ans. C]

13. The constant voltage source is applying across the given circuit at \( t = 0 \). Calculate time at which current through 2 H inductor will be 2 A in seconds

    [Ans. \*]
    \[ t = 1/3 \]
14. At $K = 1.5$ roots will lie on the imaginary axis calculate range of $K$ for which system will be stable

\[ G(s) = \frac{K(s^2 + 2s + 2)}{s^2 - 3s + 2} \]

unity feedback system

[Ans. *]

$k > 1.5$

15. $G(s) = \frac{K}{(s+2)(s^2+2s+2)}$

In the Nyquist plot $G(s)$ does not encircle the point $(-1 + j0)$ for $K = 10$ and does encircle the point $(-1 + j6)$ for $K = 100$. Then tell about stability

(A) $K = 10$ stable, $K = 100$ stable
(B) $K = 10$ stable, $K = 100$ unstable
(C) $K = 10$ unstable, $K = 100$ stable
(D) $K = 10$ unstable, $K = 100$ unstable

[Ans. B]

16. Calculate $\left| \frac{V_1}{V_2} \right| = ?$

[Ans. *] Range: 2.6 to 2.6

17. Here two clock pulse are given as shown in figure. Second pulse is delayed by $\frac{1}{5}$ time of period of the pulse. After applying clock 1 and 2, calculate the duty cycle of ‘Q’ in percentage?

[Ans. *] Range: 30 to 30

18. $x^2 + y^2 \leq z^2$; $0 \leq z \leq 1$

This is the function of region $R$. Calculate volume under the region ‘$R$’.

[Ans. *]
19. NAND-gate latch is given in the circuit. Consider both gates are having non-zero delay and not equal also.

![Circuit Diagram]

Presently \( P = Q = 0 \). If \( P \) and \( Q \) are changing simultaneously at \( P = Q = 1 \) instant then the possible condition for \( X \) and \( Y \)

[Ans. *]

20. The shift register is having 1011 data initially. How many pulses are required to set the register by data as 1111.

![Shift Register Diagram]

[Ans. *] Range: 10 to 10

21. Rank of the given matrix is

\[
\begin{bmatrix}
5 & 10 & 10 \\
1 & 6 & 2 \\
1 & 0 & 2 \\
\end{bmatrix}
\]

[Ans. *] Range: 2 to 2

22. Here in the matrix only one Eigen value is real. Calculate the real Eigen value?

\[
[T] = \\
\begin{bmatrix}
1 & 5 & 4 & 3 & 2 \\
2 & 1 & 5 & 4 & 3 \\
3 & 2 & 1 & 5 & 4 \\
4 & 3 & 2 & 1 & 5 \\
5 & 4 & 3 & 2 & 1 \\
\end{bmatrix}
\]

(A) -0.25  
(B) 0  
(C) 15  
(D) 25

[Ans. C]

23. \( x(t) = 90 + \sum_{n=1}^{\infty} a_n \cos \omega_0 nt + b_n \sin \omega_0 nt \)

\( x(t) = -x(-t) = -x \left( t + \frac{\pi}{100} \right) \)

The Fourier series coefficient

(A) \( a_n = 0 \) for all \( n \), \( b_n = 0 \) for all even \( n \)

(B) \( a_n = 0 \) for all \( n \), \( b_n = 0 \) for all odd \( n \)

(C) \( a_n = 0 \) for even \( n \), \( b_n = 0 \) for all even \( n \)

(D) \( a_n = 0 \) for odd \( n \), \( b_n = 0 \) for all odd \( n \)

[Ans. A]
24. In this system the steady error for unit step is zero and 6 for unit ramp input. The value of P is
\[ G(s) = \frac{1}{s^p(s + 4)(s^2 + 2s + 2)} \]
[Ans. *] Range: 1 to 1

25. At \( \omega \to \infty \) the slope of the bode plot is \(-60 \text{ dB/decade}\)
\[ \frac{a_0 s^p + a_1 s^{p-1} + \cdots + a_n}{b_0 s^q + b_1 s^{q-1} + \cdots + b_n} \]
The possible combination of \( p \) and \( q \) is
(A) 4, 7
(B) 7, 4
(C) 3, 5
(D) 5, 3
[Ans. A]

26. Location of the roots of the equation
\[ f(s) = s^4 + s^2 + 1 \]
(A) 2 poles in RHP, 2 poles in \( j\omega \) axis
(B) 2 poles in RHP, 2 poles in LHP
(C) 2 poles at \( j\omega \) axis and 2 poles in LHP
(D) All form roots at \( j\omega \) axis
[Ans. A]

27. Input and output resistance of trans conductance amplifier
(A) Low, low
(B) High, low
(C) Low, high
(D) High, high
[Ans. D]

28. The differential equation is given by
\[ \frac{dy}{dx} = (x + y - 1)^2 \]
Calculate \( y \)?
[Ans. *]