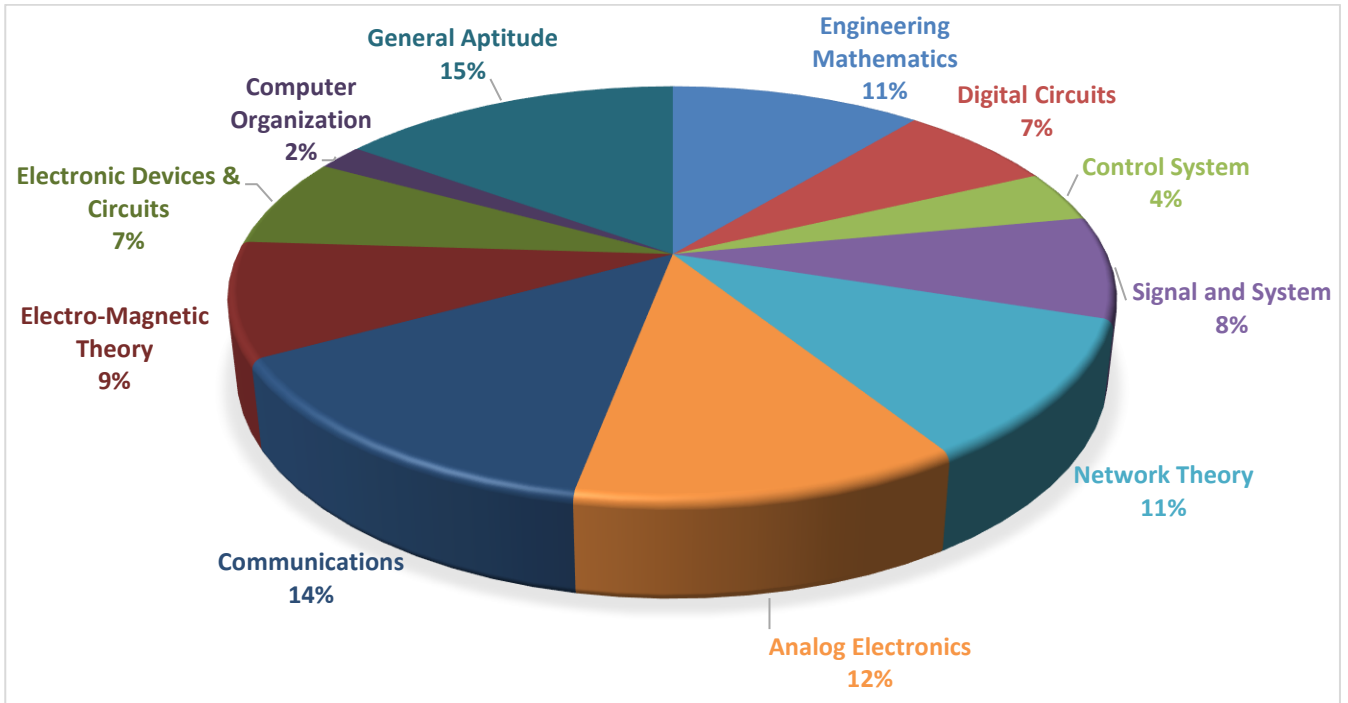




ANALYSIS OF GATE 2021
Memory Based

Electronics and Communication Engineering



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**ECE ANALYSIS-2021_Feb-7_Afternoon**

SUBJECT	No. of Ques.	Topics Asked in Paper (Memory Based)	Level of Ques.	Total Marks
Engineering Mathematics	1 Marks: 5 2 Marks: 3	First order differential equations, Eigen values, Complex integral, Probability	Medium	11
Digital Circuits	1 Marks: 3 2 Marks: 2	Number system, Sequential circuit. Mux	Easy	7
Control System	1 Marks: 2 2 Marks: 1	Transfer function, state space, Nyquist plot	Easy	4
Signal and System	1 Marks: 2 2 Marks: 3	Fourier series, convolution,	Medium	8
Network Theory	1 Marks: 1 2 Marks: 5	Transient analysis, KCL and KVL,	Medium	11
Analog Electronics	1 Marks: 2 2 Marks: 4	Operational amplifier, diode circuit, MOSFET	Medium	12
Communications	1 Marks: 4 2 Marks: 5	Amplitude modulation, phase modulation, PCM	Medium	14
Electro-Magnetic Theory	1 Marks: 3 2 Marks: 3	Wave guide, impedance matching, divergence theorem	Medium	9
Electronic Devices & Circuits	1 Marks: 3 2 Marks: 2	MOSFET (body effect), reverse bias, optical excitation	Medium	7
Computer Organization	1 Marks: 0 2 Marks: 1			2
General Aptitude	1 Marks: 5 2 Marks: 5	Geometry, Syllogism		15
Total	65			100
Faculty Feedback	25 -MCQ, 30-NAT No MSQ Questions, overall paper was Medium level			

**GATE 2021 Examination* (Memory Based)****Electronics and Communication Engineering**Test Date: 7th Feb 2021

Test Time: 3-00 pm to 6-00 pm

Stream Name: Electronics and Communication Engineering

General Aptitude

1. Nostalgia is to anticipation as _____ is to _____.
Which one of the following options maintains a similar logical relation in the above sentence?
- (A) Future, Past
(B) Future, Present
(C) Past, Future
(D) Present, Past

[Ans. *]

2. The current population of a city is 1102500. If it has been increasing at the rate of 5% per annum, what was its population 2 years ago?
- (A) 1000000
(B) 995006
(C) 1251506
(D) 992500

[Ans. *]

3. Consider the following sentences: -
- (i) I woke up from sleep.
(ii) I woked up from sleep.
(iii) I was woken up from sleep
(iv) I was wakened up from sleep
- Which are grammatically correct?

- (A) (i) and (ii)
(B) (ii) and (iii)
(C) (i) and (iii)
(D) (i) and (iv)

[Ans. *]



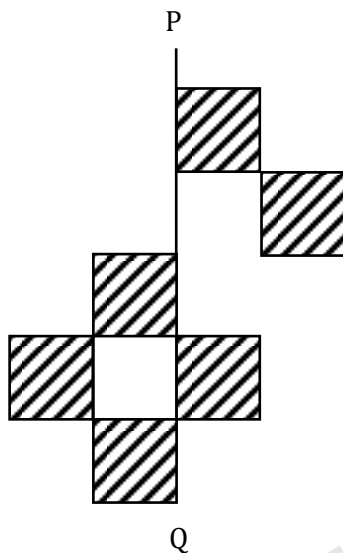
4. p and q are positive integers and

$$\frac{p}{1} + \frac{q}{p} = 3, \text{ then } \frac{p^2}{q^2} + \frac{q^2}{p^2} =$$

- (A) 7
 (B) 11
 (C) 3
 (D) 9

[Ans. A]

5. The least number of squares that must be added so that the line P-Q becomes the line of symmetry is



- (A) 4
 (B) 7
 (C) 6
 (D) 3

[Ans. *]

6. Computers are ubiquitous. They are used to improve efficiency in almost all field from agriculture to space exploration. AI is currently a hot topic. AI enables computer to kam, given enough training data. For humans, sitting in front of a computer for long hours can lead to health issues.

Which of the following can be deduced from the above message?

- (i) Now a days, computers are present in almost all places.
 - (ii) Computer cannot be used for solving problems in engineering.
 - (iii) For humans, there are positive and negative effects of using computers.
 - (iv) Artificial Intelligence can be done without data.
- (A) (i) and (iii)
 - (B) (ii) and (iv)
 - (C) (i), (ii), (iv)
 - (D) (i) and (ii)

[Ans. A]

7. Consider a square sheet of side 1 unit. In the first step, it is cut along the main diagonal to get two triangles. In the next step, one of the cut triangles is revolved about its short edge to form solid cone. The volume of a resulting cone in a cube unit

- (A) 3π
- (B) $\pi/3$
- (C) $3\pi/2$
- (D) $2\pi/3$

[Ans. *]

8. Given below are two statements and two conclusions.

S1: All purple are green

S2: All black are green

C1: Some black are purple

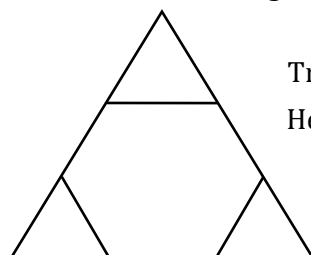
C2: No black is purple

Based on above statement and conclusion which of the following options is logically correct?

- (A) Either C1 or 2 or correct
- (B) Both correct
- (C) Only C1 is correct
- (D) Only 2 is correct

[Ans. *]

9. Ratio of area of Hexagon to original equilateral is



Triangle → Equilateral

Hexagon → Regular

[Ans. *]



10. The number of minimum minutes spent by two students X and Y exercising everyday in a given week are shown in the table below.

Days	Y	X
Sunday	65	55
Saturday	50	60
Friday	35	20
Thursday	55	60
Wednesday	50	60
Tuesday	65	55
Monday	70	45

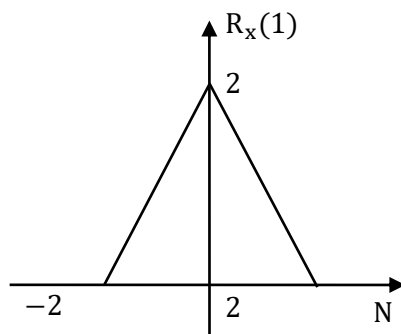
The number of days in a given week in which one of the students spent a minimum of 10% more than the other student in a given day is

- (A) 5
- (B) 9
- (C) 7
- (D) 6

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Technical

1. Consider a superheterodyne receiver tuned to 600 kHz. If the local oscillator generates a carrier of frequency 1000kHz. Then the image signal frequency is _____ kHz.
2. Consider an Amplitude modulated signal having modulation index of 50%. If carrier and one sideband are suppressed, then the percentage power saved is _____.
3. Auto correlation function of a wide sense stationary random process is given by



4. A message signal has peak to peak voltage of 2V rms value of 0.1V and bandwidth of 5kHz. If this message is sampled and applied to a PCM modulator having bit rate of 50kHz and uses uniform quantization. The maximum value of ratio of signal power to noise power is _____.
5. A speech signal band limited to 4kHz is sampled at 1.25 times the Nyquist rate. The signal amplitude ranges from $-5V$ to $+5V$. A s -bit PCM having uniform quantizer. The signal power to noise power ratio is 26dB. The maximum channel bandwidth for reliable transmission of signal is _____ kHz.
6. A (7, 4) hamming code is used which has message as m_i and code as C_i the (m_i, C_i) pairs are given by
 $(m_i, C_i) \rightarrow (1100; 01\ 01\ 100)$
 $(1110; 0011\ 110)$
 $(0110; 100\ 0\ 110)$
 They which of the following is a valid code.
 (A) 11 01 001
 (B) 000 10 11
 (C) 0110 100
 (D) 10 11 010
7. A Non-Return to zero signaling is used for $+2, -2$ for encoding bits 1 and 0. The channel adds AWGN noise having variance of $0.4V^2$. If the priori probability of transmission of binary '1' is 0.4 then optimum threshold voltage for a MAP receiver is _____ V.



8. A sinusoidal signal having rms value of UV has a frequency of 1kHz. If it is applied to a PM modulator having phase constant of 2 rad/v and carrier $c(t) = 2 \cos(2\pi 10^6 t)$ they the maximum instantaneous frequency is _____ Hz

9. If $\frac{dy}{dx} + \frac{x}{(1-x)^2}y = x\sqrt{y}$ is

(A) $(1 - x^2)^{-1/4}$

(B) $(1 - x^2)^{-1/2}$

(C) $(1 - x^2)^{-3/2}$

(D) $(1 - x^2)^{-3/4}$

[Ans. *]

10. $y = 2x + 3$

$\sigma_x^2 - \text{var}(x)$

$\sigma_y^2 - \text{var}(y)$

(A) $\sigma_y^2 = 4 \sigma_x^2$

(B) $\sigma_y^2 = 2 \sigma_x^2$

(C) $\sigma_y^2 = 25 \sigma_x^2$

(D) $\sigma_x^2 = 5 \sigma_x^2$

[Ans. *]

11. $F = (4y + C_1 z)\hat{a}_i + (4x + 2z)\hat{a}_j + (2y + z)\hat{a}_k$

F is irrotational, $C_1 = ?$

[Ans. *]

12. A 2×2 non-singular matrix with repeated Eigen values is given as

$$A = \begin{bmatrix} x & -3.0 \\ 3.0 & 4.0 \end{bmatrix}$$

where x is a real positive number the value of x is _____.

[Ans. *]



13. A box contains 3 coins

I: A fair coin with head on one face and tail on other face.

II: A coin with head on both the faces.

III: A coin with tails on both the faces.

A coin is picked randomly from box and tossed out two remaining coins in the box. One coin is then picked randomly and tossed. If first toss result is a head, the probability of getting head in second toss is _____.

- (A) $\frac{1}{3}$
 (B) $\frac{2}{3}$
 (C) $\frac{1}{2}$
 (D) $\frac{2}{5}$

[Ans. *]

14. If

$$\oint_C \frac{\sin x}{x^2(x^2 + 4)} dx = \text{_____} \quad C: |x - 1| = 2$$

- (A) $\pi/8 \sin(2i)$
 (B) $\pi/4 \sin(2i)$
 (C) $-\pi/8 \sin(2i)$
 (D) $-\pi/4 \sin(2i)$

[Ans. *]

15. Vectors $(1, 0, -1, 0, 2), (7, 3, x), (2, 3, 1)$ in \mathbb{R}^3 are linearly dependent. The value of x is _____.

[Ans. *]

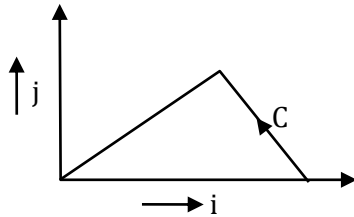
16. $x(n), n(n) \rightarrow N + 16$ $z(n) = 1$ DFT $[x(n) \times n(n)]$ $y(n) = x(n) \times n(n)$ The values of K for which $z(K) = y(K)$ is

- (A) $K = 0, 1, \dots, 15$
 (B) $K = 0, K = 15$
 (C) $K = 15$
 (D) $K = 0$

[Ans. *]



17. $f(r) = -xi + yj$



$\int f(r)dr$ is _____

- (A) $\frac{1}{3}$
- (B) $\frac{1}{2}$
- (C) $\frac{1}{6}$
- (D) $\frac{1}{4}$

[Ans. *]

18. Input $\rightarrow u(n) \xrightarrow{\text{LTI}}$ output $\rightarrow 2\delta(n + 1) + \delta(n) + \delta(n - 1)$. Let $y(n)$ is output for input $\left(\frac{1}{2}\right)^n u(n) - y(0) =$ _____

19. $x(n) = 2^{n-1}u(n + 2)y(n) = 2^{-n+2}u(n + 1) \frac{1}{2\pi} \int_0^{2\pi} \times (e^{jw}) \times (e^{-jw})dw =$ _____ (one decimal)

20. $x(t) \xleftrightarrow{\text{CFS}} a_k$
 I: $x(t) \rightarrow R, E$ having $T = 6$;
 II : Avg of $x(t) = 2$
 III: $a_k = K, 1 \leq k \leq 3$
 $= 0 \quad k > 3$
 $P(x(t)) =$ _____ (one decimal)

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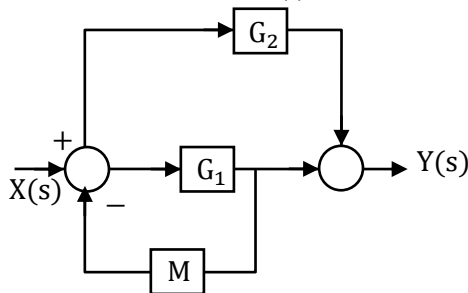
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21. The transfer function $\frac{y(s)}{x(s)}$ is



- (A) $\frac{G_1 + G_2 + G_1 G_2}{1 + G_1 H + G_2}$
- (B) $\frac{G_1 + G_2 + G_1 G_2}{1 + G_1}$
- (C) $\frac{G_1 + G_2}{1 + G_1}$
- (D) $\frac{G_1 G_2}{1 + G_1 + G_2}$

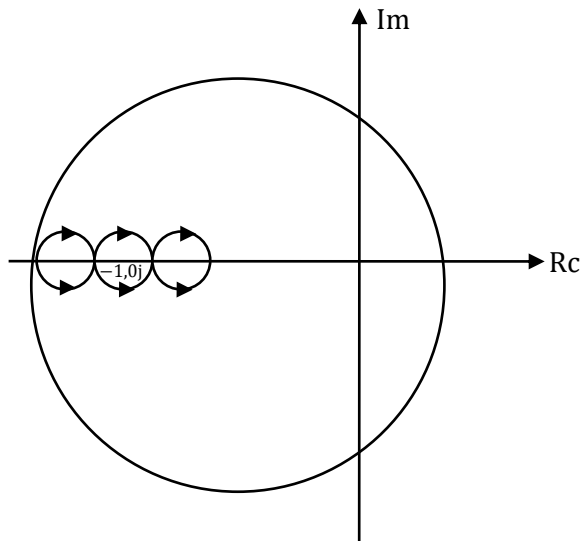
22. $G_p(s) = \frac{22}{(1+0.1s)(1+0.4s)(1+1.2s)}$

$G_c(s) = K \left(\frac{1 + T_1 s}{1 + T_2 s} \right)$

The external disturbance $D(s)$. It is desired that when the disturbance is a unit step, the steady-state error should not exceed 0.1 unit. The minimum value of K _____?



23. Given $G(s)H(s)$ is OLTF of system

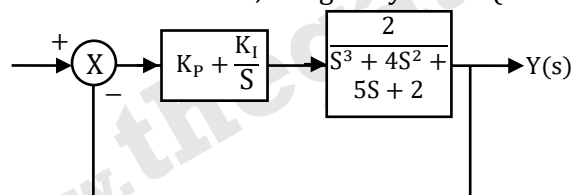


$G(s)H(s)$ has one zero in right side, the CLTF has number of pole in right side $G(s)$ -plane

- (A) 3
- (B) 2
- (C) 0
- (D) 1

24. The stability of the overall system is controlled by tuning the PI control parameter.

K_P and K_I . The maximum value of K_I that can be chosen so as to keep the overall system stable or in the worst case, marginally stable (3 decimal place)

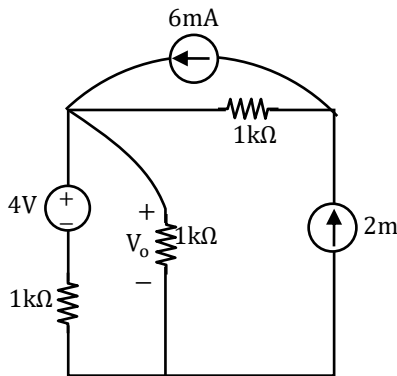


25. An 2-bit unipolar (all analog output are positive) DAC has a full scale Voltage range from 0 to 7.68V. If the digital input code 10010110 there the analog output of DAC _____.

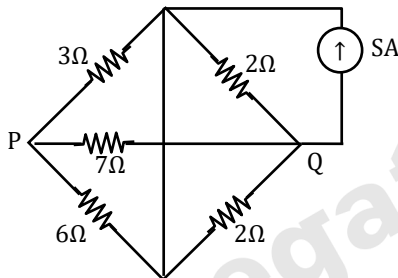
[Ans. *]

26. The admittance parameters are
 (A) $Y_{11} = 2, Y_{12} = -4, Y_{21} = -4, Y_{22} = 2$
 (B) $Y_{11} = 1, Y_{12} = -2, Y_{21} = -1, Y_{22} = 3$
 (C) $Y_{11} = 2, Y_{12} = -4, Y_{21} = -4, Y_{22} = 3$
 (D) $Y_{11} = 2, Y_{12} = -4, Y_{21} = -1, Y_{22} = 2$
[Ans. *]

27. $V_o = ?$



28. The current I flowing through the resistor between P and Q (one decimal)



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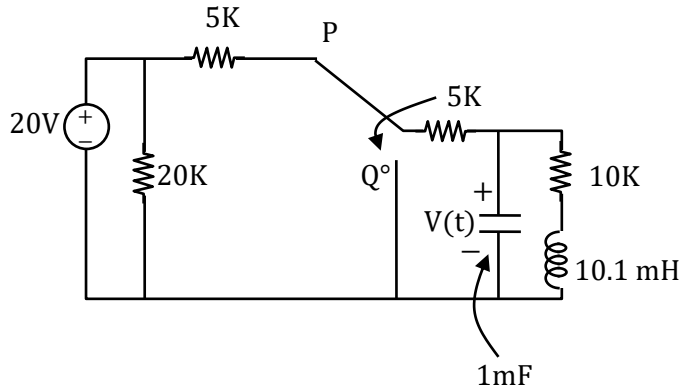
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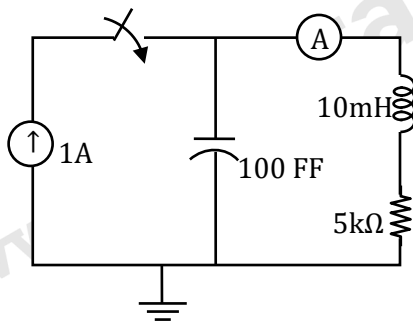
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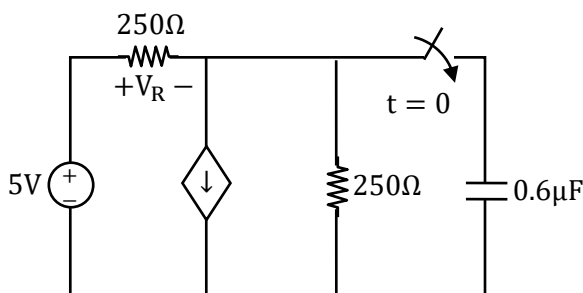
29. The switch is at position P for a long time and then moved to Q at $t = 0$
The value of $\frac{dv(t)}{dt}$ at $t = 0^+$ is



- (A) -5 V/S
 (B) 3 V/S
 (C) 0 V/S
 (D) -3 V/S
30. The circuit in the figure contains a current source driving a load having an inductor and resistor in series with a shunt capacitor across the load. The ammeter is assumed to have zero resistance. The switch is closed at time $t = 0$. Initially capacitor is discharged, and ammeter reads 0A. After switch is closed the ammeter reading keeps fluctuating for some time till it settles to a final steady state use. The maximum ammeter reading that we will observe after the switch is closed (two decimal place) _____ A



31. In the circuit shown in the 2m,k N/W figure, the switch is closed at $t = 0$ while the capacitor is initially charged to The time after which voltage across the capacitor = 0 is _____ msec.



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