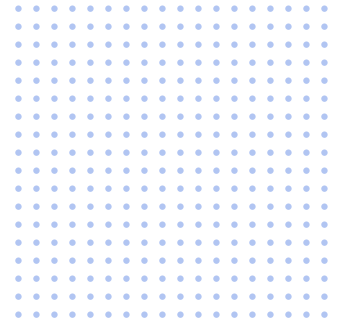




FOR KUET EXAM PREPARATION

KUET 2024 Question Paper · M.Tech Embedded Systems

EXAM	YEAR	TYPE	SUBJECT
KUET	2024	Question Paper	M.Tech Embedded Systems

Sr. No. **17005**.....**ENTRANCE TEST-2024****2-Year M Tech Programme
Embedded Systems and Solutions**

Total Questions : 60
Time Allowed : 70 Minutes

Roll No.

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1. Write your roll number in the space provided at the top of this page of question booklet and fill up the necessary information in the spaces provided on OMR Answer sheet.
2. OMR Answer sheet has an original copy and a candidate's copy glued beneath it at the top. While making entries in the original copy, candidate should ensure that the two copies are aligned properly so that the entries made in the original copy against each item are exactly copied in the candidate's copy.
3. All entries in the OMR answers sheet including answers to questions are to be recorded in the original/Carbon copy.
4. Use only blue/ black ball point pen to darken the circle of correct / most appropriate response. In no case gel/ ink pen or pencil should be used.
5. Do not darken more the one circle of option for any question. A question with more than one darkened response shall be considered wrong.
6. There will be negative marking for wrong answers. Each wrong answer will lead to deduction of 0.25 marks from the total score of the candidate.
7. Only those candidates who would obtain positive score in entrance test examination shall be eligible for admission.
8. Do not make any stray mark on the OMR sheet.
9. Calculators and mobiles shall not be permitted inside the examination hall.
10. Rough work, if any, should be done on the blank sheets provided with the question booklet.
11. OMR answer sheet must be handled carefully and it should not be folded or mutilated in such case it will not be evaluated.
12. Ensure that your OMR Answer sheet has been signed by the invigilator and the candidate himself/herself.
13. At the end of the examination hand over the OMR answer sheet to the invigilator who will first tear off the original OMR sheet in presence of the candidate and hand over the candidate's copy to the candidate.
14. If any of the information in the response Sheet/Question Paper has been found missing or not mentioned as stated above the candidate is solely responsible for that lapse.

Q1) An orthogonal set of non zero vectors are

- a) Linearly independent
- b) linear dependent
- c) constant
- d) none of these

Q2) All the eigen values of the matrix $\begin{bmatrix} 1 & 2 & 0 \\ 2 & 1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$ lie in the disc

- a) $|\lambda + 1| \leq 1$
- b) $|\lambda - 1| \leq 1$
- c) $|\lambda + 1| \leq 0$
- d) $|\lambda - 1| \leq 2$

Q3) For $0 < \theta < \pi$, the matrix $\begin{bmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{bmatrix}$

- a) has no real eigen value
- b) is orthogonal
- c) is symmetric
- d) is skew symmetric

Q4) For function $f(x, y)$ to have maximum value (a, b) is?

- a) $rt - s^2 > 0$ and $r < 0$
- b) $rt - s^2 > 0$ and $r > 0$
- c) $rt - s^2 < 0$ and $r < 0$
- d) $rt - s^2 > 0$ and $r > 0$

Q5) The solution of the partial differential equation $z = px + qy + f(pq)$, where $p = \frac{\partial z}{\partial x}$ and

$$q = \frac{\partial z}{\partial y} \text{ is}$$

- a) $z = ax + by$
- b) $z = ax + by + f(a, b)$
- c) $z = ax - by + f(a, b)$
- d) $z = ax - by$

Q6) The particular solution of $4x^2 \left(\frac{d^2 y}{dx^2} \right) + 8x \left(\frac{dy}{dx} \right) + y = 4\sqrt{x}$ is

- a) $\frac{1}{2\sqrt{x}}$
- b) $\frac{\log x}{2\sqrt{x}}$
- c) $\frac{(\log x)^2}{2\sqrt{x}}$
- d) $\frac{(\sqrt{x} \log x)}{2}$

Q7) The gradient of a scalar function $\phi(x, y, z)$ is

- a) $\frac{\partial^2 \phi}{\partial x^2} \hat{i} + \frac{\partial^2 \phi}{\partial y^2} \hat{j} + \frac{\partial^2 \phi}{\partial z^2} \hat{k}$
- b) $\frac{\partial \phi}{\partial x} + \frac{\partial \phi}{\partial y} + \frac{\partial \phi}{\partial z}$
- c) $\frac{\partial \phi}{\partial x} \hat{i} + \frac{\partial \phi}{\partial y} \hat{j} + \frac{\partial \phi}{\partial z} \hat{k}$
- d) $\frac{\partial^2 \phi}{\partial x^2} + \frac{\partial^2 \phi}{\partial y^2} + \frac{\partial^2 \phi}{\partial z^2}$

Q8) The vector field F is solenoidal if

- a) $\nabla \times \vec{F} = 0$
- b) $\nabla \cdot \vec{F} = 0$
- c) $\nabla^2 \vec{F} = 0$
- d) $\vec{F} \cdot \nabla = 0$

Q9) If the function $u = 2x(1 - y)$ is harmonic. Then its harmonic conjugate is

- a) $v = 2x + x^2 - y^2$
- b) $v = 2x + x^2 + y^2$
- c) $v = 2y + x^2 - y^2$
- d) $v = 2x - x^2 + y^2$

Q10) For the Binomial distribution mean is 10 and variance is 5 then the parameters are

- a) $\frac{1}{10}, 20$
- b) $20, \frac{1}{2}$
- c) $1, \frac{1}{2}$
- d) None of these

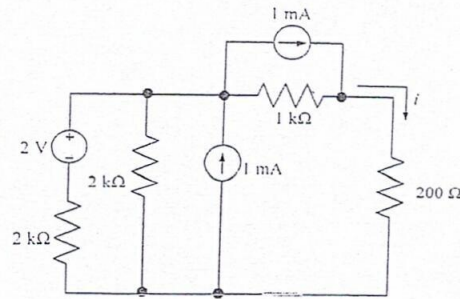
Q11) Let X has a Poisson distribution, if $P(X = 1) = 0.3$, $P(X = 2) = 0.2$, then $P(X = 0)$ is

- a) 0.0264
- b) 2.64
- c) 0.264
- d) None of these

Q12) The smallest positive root of $x^3 - 5x + 3 = 0$ lies between

- a) 1 and 2
- b) 2 and 3
- c) 0 and 1
- d) None of these

Q13) In the circuit shown below, the current I flowing through 200Ω resistor is mA.



- a) 2
- b) 1.36
- c) 2.20
- d) 2.36

Q14) What is the bandwidth of a series R-L-C circuit with $R = 1000\Omega$, $L = 100mH$, $C = 10pF$? Supply voltage is $100V$.

- a) 50 k rad/s
- b) 1 rad/s
- c) 100 k rad/s
- d) 10 k rad/s

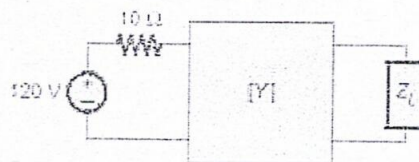
Q15) Between the branch voltage of a loop the KVL imposes

- a) Nonlinear constraints
- b) Linear constraints
- c) No constraints
- d) None

Q16) For the two port network shown below, the $[Y]$ parameters is given below:

$$[Y] = \frac{1}{100} \begin{bmatrix} 2 & -1 \\ -1 & \frac{4}{3} \end{bmatrix} S, \text{ the value of}$$

Z_L , in Ω , for max power transfer will be



- a) 80
- b) 40
- c) 120
- d) 48

Q17) A sequence $x(n)$ has z-transform $X(z)$ with two first order poles at $+j/2$ and $-j/2$. Then the sequence $j^n x(n)$ will have poles at

- a) $+j/2$ and $-j/2$ (no change)
- b) j and $-j$
- c) $+1/2$ and $-1/2$
- d) $+1$ and -1

Q18) The ROC of the transfer function of a system is given as $|z| < 2$

- a) The system is causal but NOT stable
- b) The system is stable but NOT causal
- c) The system is causal AND stable
- d) The system is NEITHER causal NOR stable

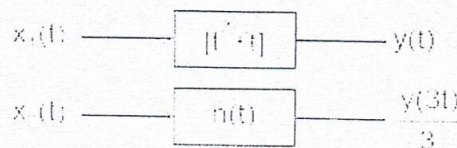
Q19) A periodic signal $x(t)$ has a trigonometric Fourier series expansion

$$x(t) = a_0 + \sum_{n=1}^{\infty} (a_n \cos n\omega_0 t + b_n \sin n\omega_0 t)$$

If $x(t) = -x(-t) = -x(t - \pi/\omega_0)$, we can conclude that

- a) a_n are zero for all n and b_n are zero for n even
- b) a_n are zero for all n and b_n are zero for n odd
- c) a_n are zero for n even and b_n are zero for n odd
- d) a_n are zero for n odd and b_n are zero for n even

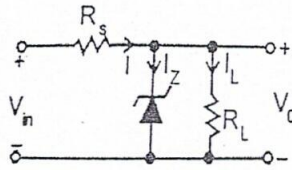
Q20) Two systems are shown below, By using 1st system what should be the value of $h(t)$ in the second system?



- a) $3t^2 + t$
- b) $27t^2 + 3t$
- c) $3t^2 + t$
- d) $9t^2 + 3t$

Q21) Consider the following statements regarding the circuit given in the figure below, where the output voltage is constant.

- 1) $V_{in} >$ the voltage at which the zener breaks down.
- 2) $I_L <$ the difference between " I " and " I_Z ", current at which the zener breaks down.
- 3) $R_s <$ the zener nominal resistance

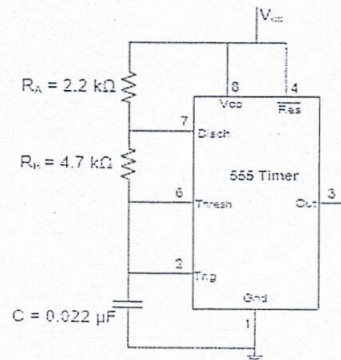


- a) 1, 2 and 3 are correct
 - b) 1 and 2 are correct
 - c) 2 and 3 are correct
 - d) 1 and 3 are correct
- Q22) The values of radiative and non-radiative lifetime of minority carriers in a semiconductor are 50ns and 100ns, respectively. What is the effective lifetime?
- a) 12.2 ns
 - b) 150ns
 - c) 33.3ns
 - d) 75ns
- Q23) What is the main purpose of using a twin-tub process in CMOS technology?
- a) To enhance thermal conductivity
 - b) To allow for better isolation between n-channel and p-channel devices
 - c) To increase the overall chip size
 - d) To simplify the packaging process
- Q24) The drift velocity of electrons in silicon varies with applied electric field in which one of the ways?
- a) It monotonically increases with increasing field
 - b) It first increases linearly, then sub-linearly and finally attains saturation with increasing field.
 - c) It first increases, then decreases showing a negative differential region, again increases and finally saturates.
 - d) The drift velocity remains unchanged with increase in field.

Q25) An operational amplifier has a slew rate of $2 \text{ V}/\mu\text{sec}$. If the peak output is 12 V , what will be the power bandwidth?

- a) 36.5 kHz
- b) 26.5 kHz
- c) 22.5 kHz
- d) 12.5 kHz

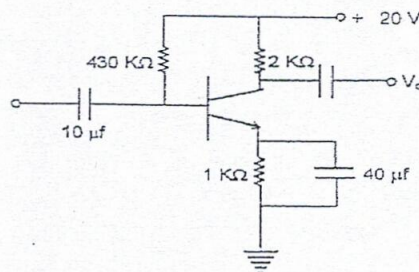
Q26) In the astable multivibrator circuit shown in the figure, the frequency of oscillation (in kHz) at the output pin 3 is ____



- a) 5.618 kHz
- b) 4.518 kHz
- c) 6.918 kHz
- d) 2.228 kHz

Q27) The circuit using a BJT with $\beta = 50$ and $V_{BE} = 0.7 \text{ V}$ is shown in figure. The basecurrent I_B and collector V_C are respectively

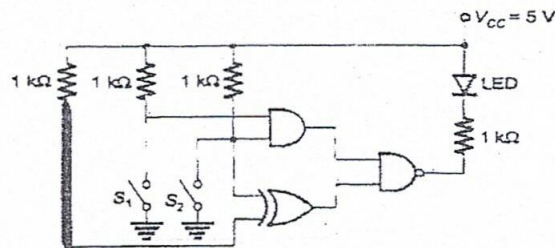
- a) $43 \mu\text{A}$ and 11.4 Volts
- b) $40 \mu\text{A}$ and 14 Volts
- c) $45 \mu\text{A}$ and 11 Volts
- d) $50 \mu\text{A}$ and 10 Volts



Q28) Consider an ideal long channel n MOSFET (enhancement mode) with gate length $10\mu\text{m}$ and width $100\mu\text{m}$. The product of electron mobility (μ_n) and oxide capacitance per unit area (C_{OX}) is $\mu_n C_{OX} = 1\text{mA/V}^2$. The threshold voltage of the transistor is 1V . For a gate-to-source voltage $V_{GS} [2 - \sin(2t)]\text{V}$ and drain-to-source voltage $V_{DS} = 1\text{V}$ (substrate connected to the source), the maximum value of the drain-to-source current is

- a) 15 mA
- b) 20 mA
- c) 5 mA
- d) 40 mA

Q29) In the given circuit, LED



- a) Emits light when both S1 and S2 are closed
- b) Emits light when both S1 and S2 are open
- c) Emits light when only S1 is open and S2 is closed
- d) Does not emit light, irrespective of the switch positions

Q30) Match the items given in List 1 with those in list 2. Select your answer using the codes given below:

List 1
(logic gates)

- A. HTL
- B. CMOS
- C. I^2L
- D. ECL

List 2
(characteristics)

- 1. High fan-out
- 2. Highest speed of operation
- 3. High noise immunity
- 4. Lowest product of power and delay

Codes	A	B	C	D
a)	3	2	4	1
b)	4	2	3	1
c)	3	1	4	2
d)	4	1	3	2

Q31) Consider an IC-FFs and choose the wrong statements regarding its Hold time (T_H) and Setup time (T_S)

- 1) T_S and T_H should be maximum
 - 2) only T_H should be in maximum range
 - 3) T_S and T_H should be minimum
 - 4) T_S should be maximum but T_H should be minimum
- a) Only 3
 - b) 1,2 and 4
 - c) 1 and 2
 - d) Only 2

Q32) Which of the following statements is/are correct?

- 1) The toggle frequency is the maximum clock frequency at which the flip-flop will toggle reliably.
 - 2) The data input must precede the clock triggering edge transition time by some minimum time.
 - 3) The data input must remain for a given time after the clock triggering edge transition time for reliable operation.
 - 4) Propagation delay time is equal to the rise time and fall time of the data.
- a) 1,2 and 3
 - b) 1 and 2 only
 - c) 2 and 3 only
 - d) 3 and 4 only

Q33) In an 8085 microprocessor, the contents of the accumulator and the carry flag are A7 (in hex) and 0, respectively. If the instruction RLC is executed, then the contents of the accumulator (in hex) and the carry flag, respectively, will be

- a) 4E and 0
- b) 4E and 1
- c) 4F and 0
- d) 4E and 1

Q34) The following five instructions were executed on an 8085 microprocessor.

MVI A, 33H

MVI B,

78H

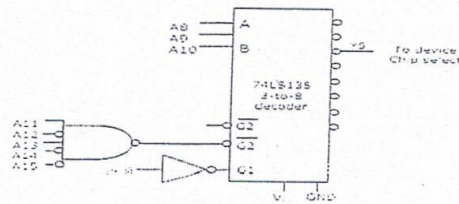
ADD B

ANI 32H.

The Accumulator value immediately after the execution of the fifth instruction is

- a) 00H
- b) 10H
- c) 11H
- d) 32H

Q35) In the circuit shown, the device connected to Y5 can have address in the



range

- a) 2000H-20FFH
- b) 2D00H-2DFFH
- c) 2E00H-2F00H
- d) 2B00H-2F00H

Q36) Which of the following pins of a microcontroller are directly connected with 8255?

- a) WR
- b) D0-D7
- c) RD
- d) All of the mentioned

Q37) In a bode magnitude plot, which one of the following slopes would be exhibited at high frequencies by a 4th order all-pole system?

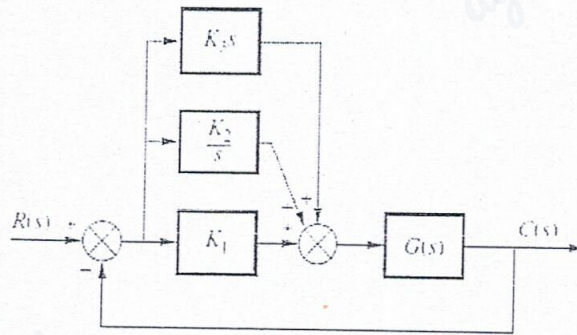
- a) -80dB/decade
- b) -40dB/decade
- c) +40dB/decade
- d) +80dB/decade

Q38) The state variable description of a linear autonomous system is $\dot{x} = Ax$; where x is the two dimensional state vector and A is given by

$A = \begin{bmatrix} 0 & 1 \\ -4 & 5 \end{bmatrix}$. The poles of the system are located at

- a) -5, -4
- b) -5, 4
- c) 4, 1
- d) 1, -5

Q39) the given block diagram resembles which of the following controller?



- a) PD
- b) PI
- c) PID
- d) Integral

Q40) A unity feedback system with the forward transfer function

$$G(s) = \frac{K}{S(S + 8)}$$

Is operating with a closed loop step response that has 15% overshoot. The value of gain K is

- a) 59.86
- b) 67.86
- c) 86.59
- d) 34.86

Q41) A FM signal is described as

$x_c(t) = 10 \cos(6\pi \times 10^6 t + \frac{1}{4} \sin(8 \times 10^2 \pi t))$. The approximate bandwidth of $x_c(t)$ is

- a) 400KHz
- b) 1KHz
- c) 3KHz
- d) 5KHz

Q42) When probability of error during transmission is 0.5, it indicates that

- a) Channel is very noisy
- b) No information is received
- c) Channel is very noisy & No information is received
- d) None of the mentioned

Q43) The spectral efficiency of SSB modulation is

- a) Twice that of DSB-SC modulation
- b) Equal to that of DSB-SC modulation
- c) Half of DSB-SC modulation
- d) Four times that of DSB-SC modulation

Q44) Consider the random process

$x(t) = U + Vt$, Where U is a zero mean Gaussian random variable and V is a random variable uniformly distributed between 0 and 2. Assume that U and V are statistically independent. The mean value of the random process at $t = 2$ is _____

- a) 1
- b) 2
- c) 3
- d) 4

Q45) Sample resolution for LPCM _____ bits per sample.

- a) 8
- b) 16
- c) 24
- d) All of the mentioned

Q46) Which of the following statements is/are true?

- 1) The attenuation constant (α) causes the frequency distortion, whereas the phase constant(β) causes the phase distortion.
 - 2) α is zero for lossless transmission lines
 - 3) α represents amplitude reduction of travelling waves
- a) only 1) is true
 - b) only 2) is true
 - c) 3) is true
 - d) All are true

Q47) The bit Stream 01101 is differentially encoded using “delay and Ex-OR” scheme for DPSK transmission. Assuming the reference bit as a ‘1’ and assigning phase of 0 and π for 1’s and 0’s resp. in the encoded sequence, the transmitted phase sequence becomes

- a) π 0 π π 0
- b) 0 π π π 0
- c) 0 π 0 0 π
- d) None

Q48) Which of the following is a function of position of antennas in array and the weights?

- a) Array Factor
- b) Field pattern
- c) Total array field
- d) Beamwidth

Q49) Which layer of the OSI model is responsible for encryption & decryption?

- a) Layer 4
- b) Layer 5
- c) Layer 6
- d) Layer 7

Q50) Which routing protocol assigns a cost metric to each route?

- a) RIP
- b) BGP
- c) OSPF
- d) EGP

Q51) Class D IP addresses are reserved for

- a) multiplexing
- b) multicasting
- c) multiprocessing
- d) multiprogramming

Q52) Which of the following standards specifies wifi networks

- a) 802.11
- b) 802.15
- c) 802.3
- d) 802.1

Q53) Which of the following would be placed at the top of the memory hierarchy?

- a) register
- b) main memory
- c) cache memory
- d) disk

Q54) Which addressing mode involves no reference to memory?

- a) Indirect
- b) Immediate
- c) Direct
- d) Register Indirect

Q55) IEEE 754 is the standard for

- a) ICs
- b) buses
- c) integers
- d) floating point numbers

Q56) For a k-way set associative cache memory, k represents

- a) number of sets in the cache
- b) number of lines in the cache
- c) number of lines in a set
- d) number of words in a set

Q57) Which of the following cannot be used as the name of a variable?

- a) Mtech_2024
- b) _Mtech2024
- c) 2024_Mtech
- d) M2t0e2c4h

Q58) Which of the following data types occupies the least amount of memory space?

- a) integer
- b) unsigned integer
- c) floating point
- d) character

Q59) If x is a five-element array, then its last element is denoted by

- a) x[4]
- b) x[5]
- c) x[6]
- d) x[end]

Q60) Which of the following is not an operator?

- a) type
- b) typedef
- c) sizeof
- d) &

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