ENTRANCE TEST-2019

000012

SCHOOL OF APPLIED SCIENCES & TECHNOLOGY

M.TECH. IN EMBEDDED SYSTEMS & SOLUTIONS

Total Questions : 60

Time Allowed : 70 Minutes

Question Booklet Series **D**

Roll No:

Instructions for Candidates:

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 the 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 Answer Sheet, including answers to questions, are to be recorded in the Original Copy only.

4. Choose the correct / most appropriate response for each question among the options A, B, C and D and darken the circle of the appropriate response completely. The incomplete darkened circle is not correct read by the OMR Scanner and no complaint to this effect shall be entertained.

5. 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.

6. Do not darken more than one circle of options for any question. A question with more than one darkened response shall be considered wrong.

7. There will be 'Negative Marking' for wrong answers. Each wrong answer will lead to the deduction of 0.25 marks from the total score of the candidate.

8. Only those candidates who would obtain positive score in Entrance Test Examination shall be eligible for admission.

9. Do not make any stray mark on the OMR sheet.

10. Calculators and mobiles shall not be permitted inside the examination hall.

11. Rough work, if any, should be done on the blank sheets provided with the question booklet.

12. OMR Answer sheet must be handled carefully and it should not be folded or mutilated in such case it will not be evaluated.

13. Ensure that your OMR Answer Sheet has been signed by the Invigilator and the candidate himself/herself.

14. 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.

1. Which one of the following options correctly describes the locations of the roots of the equation $s^4 + s^2 + 1 = 0$ on the complex plane?
   (A) Four left half plane (LHP) roots
   (B) One right half plane (RHP) root, one LHP root and two roots on the imaginary axis
   (C) Two RHP roots and two LHP roots
   (D) All four roots are on the imaginary axis

2. The polar plot of the transfer function $G(s) = \frac{10(s-1)}{s-10}$ for $0 \leq \omega < \infty$ will be in the
   (A) first quadrant
   (B) second quadrant
   (C) third quadrant
   (D) fourth quadrant

3. A unity negative feedback system has an open–loop transfer function $G(s) = \frac{K}{s(s+10)}$. The gain K for the system to have a damping ratio of 0.25 is _____
   (A) 100
   (B) 200
   (C) 300
   (D) 400

4. The phase margin (in degrees) of the system $G(s) = \frac{10}{s(s-10)}$ is _____
   (A) 84.32
   (B) 72
   (C) 64.56
   (D) 35.45

5. A carrier $A_C.\cos(\omega_c t)$ is frequency modulated by a signal $E_m.\cos(\omega_m t)$. The modulation index is m_f. The expression for the resulting FM signal is

   (A) $A_c.\cos[\omega_c t + m_f.\sin(\omega_m t)]$
   (B) $A_c.\cos[\omega_c t + m_f.\cos(\omega_m t)]$
   (C) $A_c.\cos[\omega_c t + 2\pi.m_f.\sin(\omega_m t)]$
   (D) $A_c.\cos[\omega_c t + 2\pi.mf.E_m.\omega_m.\cos(\omega_m t)]$

6. Figure given below shows Fourier spectra of signal x(t)

   The Nyquist sampling rate for x(t) is

   (A) 100 kHz
   (B) 200 kHz
   (C) 300 kHz
   (D) 50 kHz
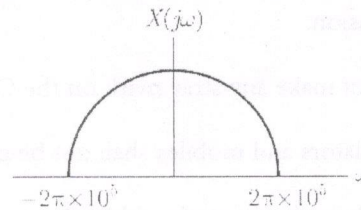
7. The electric field of a plane wave propagating in a lossless non–magnetic medium is given by the following expression

   $$\bar{E} = a_x 5\cos(2\pi \times 10^9 t - \beta z) - a_z 3\cos\left(2\pi \times 10^9 t - \beta z - \frac{\pi}{2}\right)$$

   The type of the polarization is
   (A) Right Hand Circular.
   (B) Left Hand Elliptical
   (C) Right Hand Elliptical
   (D) Linear

8. The directivity of an antenna array can be increased by adding more antenna elements, as a larger number of elements

   (A) improves the radiation efficiency
   (B) increases the effective area of the antenna
   (C) results in a better impedance matching
   (D) allows more power to be transmitted by the antenna

9. The frequency of an 555 timer based astable multivibrator is given by
   (A) $f = \frac{1.44}{(R_1 - 2R_2)C}$
   (B) $f = \frac{0.5}{(R_1 - 2R_2)C}$
   (C) $f = \frac{1.44}{RC}$
   (D) $f = \frac{0.5}{RC}$

10. Match List – I and List – II and select the correct answer using the codes given below the lists:

List – I	List – II
a. $\nabla \times \bar{H}$	i. continuity equation
b. $\bar{\nabla} \times E$	ii. current density
c $\nabla \times \bar{D}$	iii. Faraday's law of induction
d. $\nabla \times \bar{J}$	iv. Gausses law

   Codes:

	a	b	c	d
(A)	i	ii	iii	iv
(B)	ii	iii	iv	i
(C)	ii	iii	i	iv
(D)	iv	i	ii	iii

11. Consider the following :
   1. Quantization
   2. Sampling
   3. Encoding
   4. Low-pass filter
   The correct sequence for converting a lowpass analog signal to Digital signal is
   (A) 4, 3, 1, 2
   (B) 4, 1, 2, 3
   (C) 4, 2, 1, 3
   (D) 4, 3, 2, 1

12. The attenuation of single mode fibers is 0.2 dB/km, at a transmission length of 100 kms. The output signal strength is reduced to
   (A) 10% of transmitted power
   (B) 1% of transmitter power
   (C) 5% of the transmitted power
   (D) 20% of the transmitted power

13. Which one of the following statements about differential pulse code modulation (DPCM) is true?

   (A) the sum of message signal sample with its prediction is quantized
   (B) The message signal sample is directly quantized, and its prediction is not used
   (C) The difference of message signal sample and a random signal is quantized
   (D) The difference of message signal sample with its prediction is quantized

14. The default subnet mask for an IP address 172.90.10.1 is:
(A) 255.255.255.0
(B) 255.255.0.0
(C) 255.0.0.0
(D) 255.255.255.255

15. IPV6 is _____ address
(A) 128 bit
(B) 64 bit
(C) 256 bit
(D) 2 bit

16. Transmission control protocol (TCP) is _____ protocol
(A) Connection less
(B) Connection Oriented
(C) Serviceless
(D) None of above

17. Which of the following technique is used in congestion control in datagram subnets?
(A) Choke packets
(B) Load shedding
(C) Jitter control
(D) All of above

18. Which of the instruction is used in booth's Algorithm for carrying multiplication
(A) ashr
(B) shr
(C) mul
(D) rol

19. Which of the mappings are used in cache memory?
(A) direct mapping
(B) Associative mapping
(C)Set associative mapping
(D) All of above

20. Memory management algorithm with minimal wastage is
(A) First fit algorithm
(B) Next fit algorithm
(C)Worst fit algorithm
(D) All of above

21. If a=3. The expression $a<<2$ will yield
(A) 12
(B) 6
(C) 1
(D) 15

22. Which of the function is used to migrate from text mode to graphics mode?
(A) Fopen();
(B)Graph();
(C) Initgraph();
(D) None of above

23. Pointer is a variable which stores:
    (A) The address of another variable
    (B) The immediate data
    (C) Both float and integer data
    (D) Address of integer variables only

24. Which one of the following controls the program flow
    (A) for
    (B) while
    (C) Switch
    (D) All of the above

25. Which one of the following is the general solution of the first order differential equation $\frac{dy}{dx} = (x + y - 1)^2$, where x, y are real?
    (A) $y = 1 + x - \tan^{-1}(x + c)$ where c is a constant
    (B) $y = 1 + x + \tan(x + c)$ where c is a constant
    (C) $v = 1 - x + \tan^{-1}(x - c)$ where c is a constant
    (D) $y = 1 - x + \tan(x + c)$ where c is a constant

26. With initial condition $x(1) = 0.5$, the solution of the differential equation $t\frac{dx}{dt} - x = t$, is
    (A) $x = t - \frac{1}{2}$
    (B) $x = t^2 - \frac{1}{2}$
    (C) $x = \frac{t^2}{2}$
    (D) $x = \frac{t}{2}$

27. Let $f(z) = \frac{az+b}{cz+d}$. If $f(z_1) = f(z_2)$ for all $z_1 \neq z_2$, $a = 2$, $b = 4$ and $c = 5$. then d should be equal to _____.
    (A) 1
    (B) 3
    (C) 10
    (D) 12

28. Find the missing sequence in the letter series below:
    A, CD, GHI,?, UVWXY

    (A) LMN
    (B) MNO
    (C) MNOP
    (D) NOPQ

29. If x>y>1, which of the following must be true?
    (i) $\ln x > \ln y$ (ii) $e^x > e^y$ (iii) $y^x > x^y$ and (iv) $\cos x > \cos y$
    (A) (i) and (ii)
    (B) (i) and (iii)
    (C) (iii) and (iv)
    (D) (ii) and (iv)

30. Rizwan and Furqan appeared in an interview for two vacancies in the same department. The probability of Rizwan's selection is 1/6 and that of Furqan is 1/8. What is the probability that only one of them will be selected?
   (A) 1/4
    (B) 47/48
    (C) 13/48
    (D) 35/48

31. The solution of the differential equation $\frac{d^2 y}{dt^2} - 2\frac{dy}{dt} + y = 0$ with $y(0) = y'(0) = 1$ is

    (A) $(2 - t)e^t$

    (B) $(1 + 2t)e^{-t}$

    (C) $(2 - t)e^{-t}$

    (D) $(1 - 2t)e^t$

32. The variance of the random variable X with probability density function $f(x) = \frac{1}{2}|x|e^{-|x|}$ is

    (A) 1

    (B) 6

    (C) 3

    (D) 9

33. Let $f(x) = e^{x - x^2}$ for real x. From among the following, choose the Taylor series approximation of f (x) around x = 0, which includes all powers of x less than or equal to 3.(A) $1 + x + x^2 + x^3$

    (B) $1 + x + \frac{3}{2}x^2 + x^3$

    (C) $1 + x - \frac{3}{2}x^2 - \frac{7}{6}x^3$

    (D) $1 + x + 3x^2 + 7x^3$

34. The rank of the matrix $M = \begin{bmatrix} 5 & 10 & 10 \\ 1 & 0 & 2 \\ 3 & 6 & 6 \end{bmatrix}$ is

    (A) 0

    (B) 1

    (C) 2

    (D) 3

35. The maximum value of θ until which the approximation $\sin\theta = \theta$ holds to within 10% error is

    (A) 10.3^0

    (B) 18.3^0

    (C) 44.4^0

    (D) 73.4^0

36. What is the chance that a leap year, selected at random, will contain 53 Sundays?

    (A) 5/7

    (B) 3/7

    (C) 1/7

    (D) 2/7

37. The number of independent loops for a network with n nodes and b branches is:

    (A) n-1

    (B) b-n

    (C) b-n+1

    (D) Independent of the number of nodes

38. A network contains linear resistors and ideal voltage sources. If values of all the resistors are doubled, then the voltage across each resistor is:

    (A) Halved

    (B) Doubled

    (C) Increases by four times

    (D) Not changed

39. The damping ratio of a series RLC circuit can be expressed as

(A) $\frac{R^2 C}{2L}$

(B) $\frac{2L}{R^2 C}$

(C) $\frac{R}{2}\sqrt{\frac{C}{L}}$

(D) $\frac{2}{R}\sqrt{\frac{L}{C}}$

40. In the circuit shown, the Norton equivalent resistance (in Ω) across terminals a–b is_____.

(A) 2.666
(B) 1.666
(C) 2.333
(D) 1.333
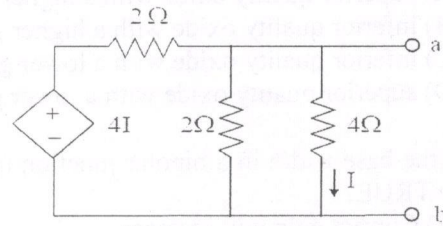
41. Which one of the following statements is NOT TRUE for a continuous time causal and stable LTI system?

(A) All the poles of the system must lie on the left side of the $j\omega$ axis
(B) Zeros of the system can lie anywhere in the s-plane
(C) All the poles must lie within $s = 1$
(D) All the roots of the characteristic equation must be located on the left side of the $j\omega$ axis

42. 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 $x(t) = -x(-t)$, 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) b_n are zero for all n
(D) a_n are zero for all n

43. Two causal discrete–time signal $x[n]$ and $y[n]$ are related as $y[n] = \sum_{m=0}^{n} x[m]$. If the z-transform of $y[n]$ is $\frac{2}{z(z-1)^2}$, the value of $x[2]$is_____

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

44. Two discrete-time signals x [n] and h [n] are both non-zero only for n = 0,1,2, and are zero otherwise. It is given that x(n) = {1,2,1} and h(n)= {1,1,1} Let y[n] be the linear convolution of x [n] and h [n] . The value of the expression (y[3] + 2y[4]) is_____

(A) 6
(B) 5
(C) 4
(D) 3

45. In a MOS capacitor with an oxide layer thickness of 10 nm, the maximum depletion layer thickness is 100 nm. The permittivities of the semiconductor and the oxide layer are ε_s and ε_{ox} respectively. Assuming $\varepsilon_s/\varepsilon_{ox} = 3$, the ratio of the maximum capacitance to the minimum capacitance of this MOS capacitor is _____

(A) 1
(B) 2.33
(C) 4.33
(D) 5

46. In IC technology, dry oxidation (using dry oxygen) as compared to wet oxidation (using steam or water vapor) produces

(A) superior quality oxide with a higher growth rate
(B) inferior quality oxide with a higher growth rate
(C) inferior quality oxide with a lower growth rate
(D) superior quality oxide with a lower growth rate

47. If the base width in a bipolar junction transistor is doubled, which one of the following statements will be TRUE?

(A) Current gain will increase
(B) Unity gain frequency will increase
(C) Emitter base junction capacitance will increase
(D) Early voltage will increase

48. For the NMOSFET in the circuit shown, the threshold voltage is V_{th}, where $V_{th}>0$. The source voltage V_{SS} is varied from 0 to V_{DD}. Neglecting the channel length modulation, the drain current I_D as a function V_{SS} is represented by

(A)

(B)

(C)

(D)
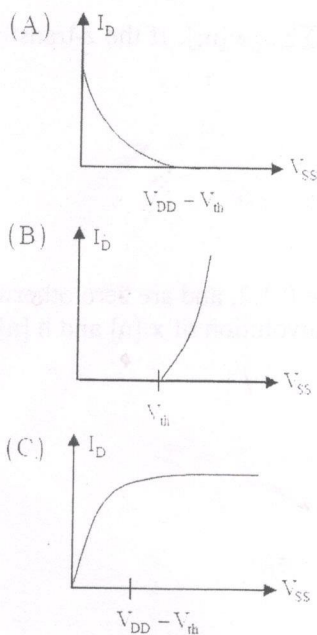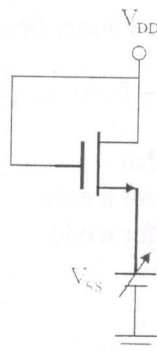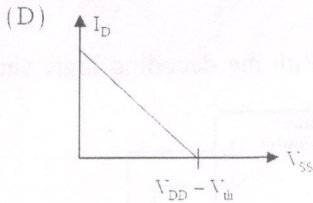
49. The ripple factor of a half-wave rectifier is ....
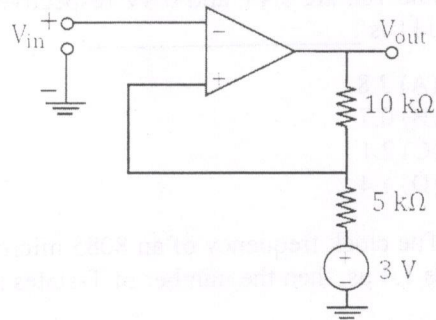(A) 2
(B) 1.21
(C) 2.5
(D) 0.48

50. If $A_d = 3500$ and $A_c = 0.35$, the CMRR is
(A) 60 dB
(B) 80 dB
(C) 100 dB
(D) 120 dB

51. For the operational amplifier circuit shown, the output saturation voltages are $\pm 15V$. The upper and lower threshold voltages for the circuit are, respectively.

(A) +7 V and − 3V
(B) +5 V and − 5V
(C) +3V and − 7V
(D) +3V and − 3V

52. In the circuit shown below, the silicon npn transistor Q has a very high value of β. The required value of R_2 in kΩ to produce $I_C = 1mA$ is

(A) 30
(B) 40
(C) 60
(D) 70
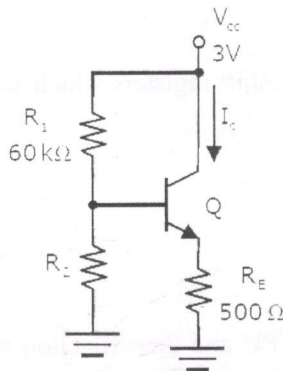
53. In the circuit shown, diodes D_1, D_2 and D_3 are ideal, and the inputs E_1, E_2 and E_3 are '0 V' for logic '0' and '10 V' for logic '1'. What logic gate does the circuit represent?

(A) 3 input OR gate
(B) 3 input NOR gate
(C) 3 input AND gate
(D) 3 input XOR gate
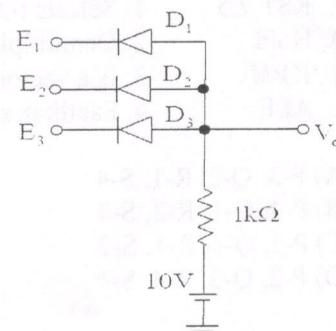
54. The figure shows a binary counter with synchronous clear input. With the decoding logic shown, the counter works as a

(A) mod–2 counter
(B) mod–4 counter
(C) mod–5 counter
(D) mod–6 counter
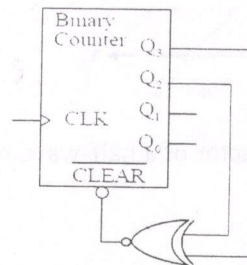
55. A function of Boolean variables X, Y and Z is expressed in terms of the min–terms as $F(X,Y,Z) - \Sigma(1,2,5,6,7)$. Which one of the product of sums given below is equal to the function $F(X,Y,Z)$?

(A) $(X + Y + Z)(X + \bar{Y} + \bar{Z})(\bar{X} + Y + Z)$
(B) $(\bar{X} + \bar{Y} + \bar{Z})(\bar{X} + Y + Z)(X + \bar{Y} + \bar{Z})$
(C) $(\bar{X} + \bar{Y} + Z)(\bar{X} + Y + \bar{Z})(X + \bar{Y} + Z)(X + Y + \bar{Z})(X + Y + Z)$
(D) $(X - Y - \bar{Z})(\bar{X} - Y - Z)(\bar{X} - Y - \bar{Z})(\bar{X} - \bar{Y} - Z)(\bar{X} - \bar{Y} - \bar{Z})$

56. Consider a three-bit D to A converter. The analog value corresponding to digital signals of values 010 and 100 are 0.4V and 0.8V respectively. The analog value (in Volts) corresponding to the digital signal 111 is _____ .

(A) 2.8
(B) 0.7
(C) 2.1
(D) 1.4

57. The clock frequency of an 8085 microprocessor is 5 MHz. If the time required to execute an instruction is 1.4 μs, then the number of T-states needed for executing the instruction is

(A) 1
(B) 6
(C) 7
(D) 8

58. In an 8085 microprocessor, the shift registers which store the result of an addition and the overflow bit are, respectively

(A) B and F
(B) A and F
(C) H and F
(D) A and C

59. Some of the pins of an 8085 CPU and their function are listed below. Identify the correct answer that matches the pins to their respective functions:

P. RST 7.5   1. Selects IO or memory
Q. Hold   2. Demultiplexes the address and data bus
R. IO/$\overline{M}$ 3. Is a vectored interrupt
S. ALE   4. Facilitates direct memory access

(A) P-3, Q-2, R-1, S-4
(B) P-4, Q-1, R-2, S-3
(C) P-3, Q-4, R-1, S-2
(D) P-2, Q-3, R-4, S-1

60. In 8051, Pin 30 (ALE / PROG), if this bit is set as logic zero ('0'), it signifies

   (A) Address is latched
   (B) For enabling internal ROM of programming
   (C) For disabling internal ROM programming
   (D) Both (A) and (C)