O-54

Entrance Examinations 2019
M.Tech. (Microelectronics and VLSI Design)

Marks: 70
Time: 2.00 hrs

Hall Ticket no:

1. Write your Hall Ticket Number on the OMR Answer Sheet given to you. Also write the Hall Ticket Number in the Space provided above.

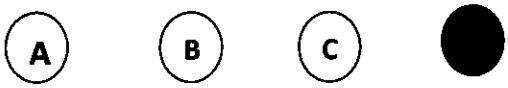
2. Read the following instructions carefully before answering the questions.

3. This Question paper has TWO parts: PART 'A' and PART 'B'.

   Part 'A': It consists of 20 objective type questions of **ONE** mark each. There is a negative marking of **0.33** marks for every wrong answer.

   Part 'B: It consists of 25objective type questions of **TWO** marks each with no negative marking.

4. All questions are to be answered. Answers for these questions are to be entered on the OMR sheet, filling the appropriate circle against each question. For example, if the answer to a question is D, it should be marked as below:

5. No additional sheets will be provided. Rough work can be done in the question paper itself.

6. Hand over the OMR answer sheet to the invigilator at the end of the examination.

7. Mobile phones, log tables and calculators of any type are NOT permitted

8. Values of some physical constants: $V_T = 26$ mV, $\epsilon_o = 8.85 \times 10^{-12}\ F/m$.

9. Positive logic is to be followed for all digital electronics questions.

10. This book contains 12 pages including this cover sheet.

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PART – A

1. If $f(x)$ is an even function, continuous on $-L \leq x \leq L$, then

   A. $\int_{-L}^{L} f(x)dx = 0$
   B. $\int_{-L}^{L} f(x)dx = 2\int_{0}^{L} f(x)dx$
   C. $\int_{-L}^{L} f(x)dx = 1$
   D. $\int_{-L}^{L} f(x)dx = -2\int_{0}^{L} f(x)dx$

2. The value of $i^{64,002}$ is

   A. 1
   B. 2
   C. -1
   D. 64

3. Which of the following statements is incorrect for the exponential function e^z, where z is a complex number of the form $x+iy$

   A. e^z is a single valued function
   B. $e^z \neq 0$ for any z
   C. The series expansion of e^z converges for all z.
   D. The series expansion of e^z diverges for all z

4. Every square matrix can be uniquely expressed as the

   A. Sum of a symmetric and a skew-symmetric matrix
   B. Product of a symmetric and a skew-symmetric matrix
   C. Sum of two symmetric matrices
   D. Sum of two skew-symmetric matrices.

5. "Curl of the magnetic field intensity is equal to the conduction current density" is the statement of

   A. Coloumb's law
   B. Stokes theorem
   C. Biot-Savart's law
   D. Ampere's law

6. Which of the following is not a source of magnetic field?

   A. A d.c. current in a wire
   B. A static charge fixed in space
   C. An electric field intensity changing linearly with time
   D. A charged disc rotating at uniform speed

7. Two thin parallel wires carry currents along the same direction. The force experienced by one due to the other is

   A. perpendicular to the wires and attractive
   B. perpendicular to the wires and repulsive
   C. parallel to the wires
   D. zero

8. If two conducting plates are inclined at angle of 60^0 to each other with a point charge between them, the number of image charges for this system is

   A. 7
   B. 6
   C. 5
   D. 1

9. The crystal structures of Si, Ge and GaAs are respectively

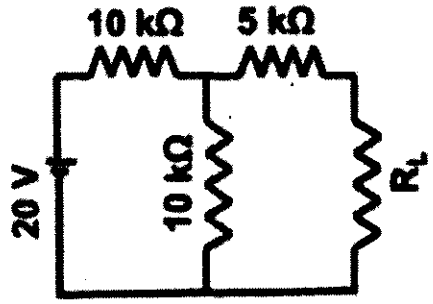
   A. Zinc blende, Diamond cubic, Diamond cubic.
   B. Diamond cubic, Diamond cubic, Diamond cubic.
   C. Diamond cubic, Zinc blende, Diamond cubic.
   D. Diamond cubic, Diamond cubic, Zinc blende.

10. The Hall coefficient of a doped semiconductor is

   A. always positive
   B. always negative
   C. can be negative or positive depending on the dopant type
   D. always zero

11. The value of the load resistance (R_L) to draw maximum power in the given circuit is

   A. 5 kΩ
   B. 10 kΩ
   C. 25 kΩ
   D. 13.33 kΩ



12. An a.c. current of amplitude 2 mA and frequency 2 kHz is flowing through an ideal capacitor of capacitance 0.5 μF. The power dissipated by this capacitor is

   A. $(2/\pi)$ mW
   B. $(\pi/2)$ mW
   C. $(4/\pi^2)$ mW
   D. Zero

13. Which of the following expressions is equivalent to the Boolean expression

$$Y = \bar{A}\bar{B} + \bar{A}B + A\bar{B}$$

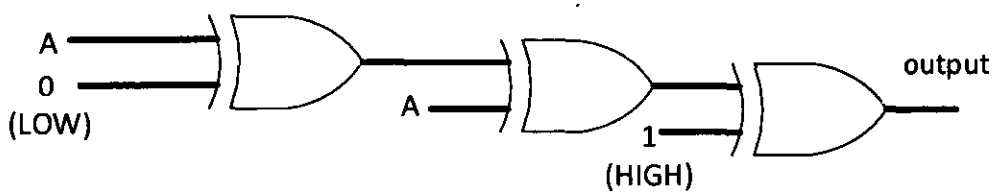
A. $Y = \bar{A}B$
B. $Y = \overline{AB}$
C. $Y = \overline{A + B}$
D. $Y = A + B$

14. The complement of the Boolean expression

$$Y = \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + A\bar{B}\bar{C} + \bar{A}B\bar{C} + AB\bar{C}$$

is
A. $\bar{A}\bar{B} + \bar{C}$
B. $AC + BC$
C. $\overline{(A + B)C}$
D. $A + B + C$

15. The output of the following logic circuit is



A. 0
B. A
C. $\bar{A}$
D. 1

16. The reference voltage of an 8-bit ADC is 5 V. The weight of its Most Significant Bit (MSB) is

A. 2.5 V
B. 5 V
C. $\frac{5}{256}$ V
D. $\frac{5}{128}$ V

17. A CMOS differential amplifier with resistive load is designed with an ideal tail current source carrying a d.c. current of 1 mA. The common mode rejection ratio is

A. 0
B. 1
C. ∞
D. 0.5

18. A power amplifier connected in class B push-pull configuration has to deliver 10 W of power to the load. The minimum required collector (or drain) dissipation rating of the transistor is

A. 2 W
B. 4 W
C. 10 W
D. 20 W

19. An FM wave is represented by the following equation.

$$V = 14\ \sin(60 \times 10^8 t + 5\sin(1250t))$$

The power dissipated by this FM wave across a 50 Ω resistor is

A. 1.96 W
B. 3.92 W
C. 0.28 W
D. 0.7 W

20. The effect of noise on the data channel can be reduced by increasing the signal–to–noise ratio (SNR). If a channel has an ideal bandwidth (BW) of 3 kHz, then the required SNR is

A. 4,8 dB
B. 3.2 dB
C. 9.6 dB
D. 10 dB

PART B

21. If $\vec{a} = \hat{\imath} + 2\hat{\jmath} + 3\hat{k}$, $\vec{b} = -\hat{\imath} + 2\hat{\jmath} + \hat{k}$ and $\vec{c} = 3\hat{\imath} + 2\hat{\jmath}$ then the value of t for which $\vec{a} + t\vec{b}$ is perpendicular to $\vec{c}$ is

A. 3
B. 1
C. 0
D. 5

22. The Laplace transform of the function $[e^{at}\sin(bt)]$ for $s > 0$ is (where s is a complex variable; a and b are arbitrary scalars).

A. $\frac{b}{(s-a)^2+b^2}$

B. $\frac{s-a}{(s-a)^2+b^2}$

C. $\frac{b}{(s-a)^2-b^2}$

D. $\frac{s+a}{(s-a)^2-b^2}$

23. The result of differentiating the power series expansion of $\cos(ax)$ term by term is

A. $a\cos(ax)$
B. $-a\sin(ax)$
C. $a\sin(ax)$
D. $\sin(ax)$

24. The variation of magnetic flux with time can be caused by having a

A. time varying loop area in a time varying magnetic field.
B. time varying loop area in a time varying electric field.
C. Stationary loop in a stationary field.
D. Time varying electric field in a time varying magnetic field.

25. The polarization of a plane wave described by the following equation (where A,B,k and m are constants) is

$$\vec{E}(z,t) = Ae^{-kz}\cos(\omega t - mz)\vec{a}_x + Be^{-kz}\sin(\omega t - mz)\vec{a}_y$$

A. Linear
B. Circular
C. Spherical
D. Elliptical

26. The definition of an active transducer is that it is a self-generating device operating under energy conversion principles. Based on this, which of the following is not an active transducer?

A. Thermoelectric
B. Piezoelectric
C. Pyroelectric
D. Capacitive

27. The ideal potentiometer and thermocouple are examples of a

A. zero order measurement system
B. first order measurement system
C. zero and first order measurement systems respectively
D. first and zero order measurement systems respectively

28. If N_A is the acceptor concentration and N_D is the donor concentration in a p-n junction diode, then the width of the depletion region of an open circuited junction is proportional to

A. $\sqrt{\frac{1}{N_A}+\frac{1}{N_D}}$

B. $\sqrt{\frac{1}{N_A}}$

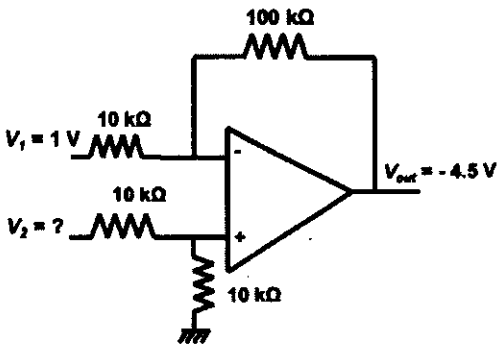
C. $\sqrt{N_A+N_D}$

D. $\sqrt{\frac{1}{N_D}}$

29. A sinusoidal signal of amplitude 0.2 V is applied to the input of an amplifier. The voltage gain of this amplifier is 2000 and it operates at a supply voltage of ±12 V. The output of this amplifier is a

A. Sinusoidal signal of an amplitude that is close to ±400 V.
B. Square wave of an amplitude that is close to ±400 V.
C. Sinusoidal signal of an amplitude that is close to ±12 V.
D. Square wave of an amplitude that is close to ±12 V.

30. The input voltage V_2 in the following ideal operational amplifier circuit is



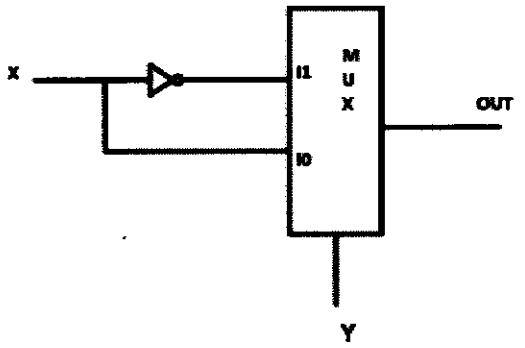
A. 0.5 V
B. 1 V
C. 1.5 V
D. Zero

31. A battery (E), a resistor (R) and an ideal diode are connected in series such that the diode is forward biased. The load-line of this circuit intercepts *X*-axis at 12 V and *Y*-axis at 3 mA. Calculate the values of E and R

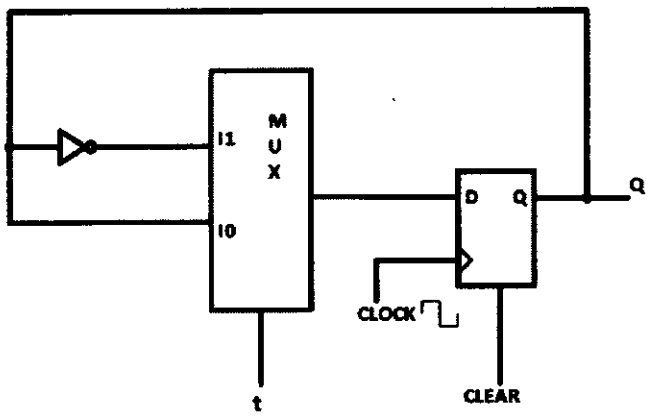
A. E = 16 V and R = 6 kΩ
B. E = 12 V and R = 3 kΩ
C. E = 12 V and R = 4 kΩ
D. E = 12 V and R = 1.737 kΩ

32. Which of the following logic gates is functionally equivalent to the circuit given below (X= input and Y= Control line)?

A. 2 input XOR gate with inputs as *X, Y* and output as *OUT.*
B. 2 input OR gate with inputs as *X,Y* and output as *OUT.*
C. 2 input NOR gate with inputs as *X, Y* and output as *OUT.*
D. 2 input AND gate with inputs as *X, Y* and output as *OUT.*

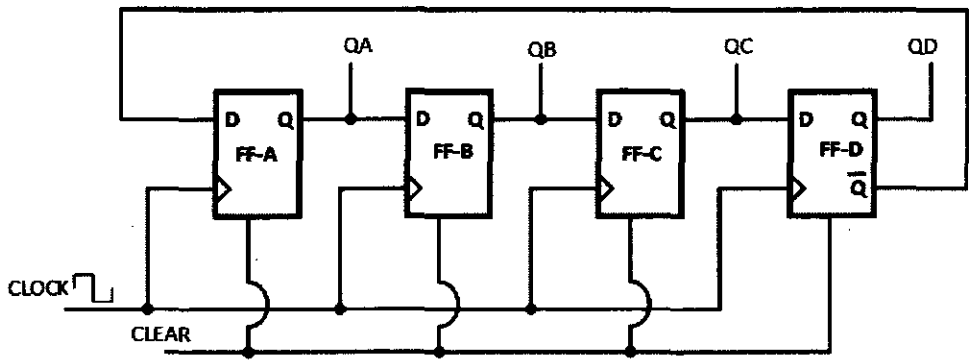


33. The initial condition of the circuit below is that CLEAR is given a HIGH logic pulse. What is the output, Q, at the rising edge of the CLOCK, when control line t = 1?



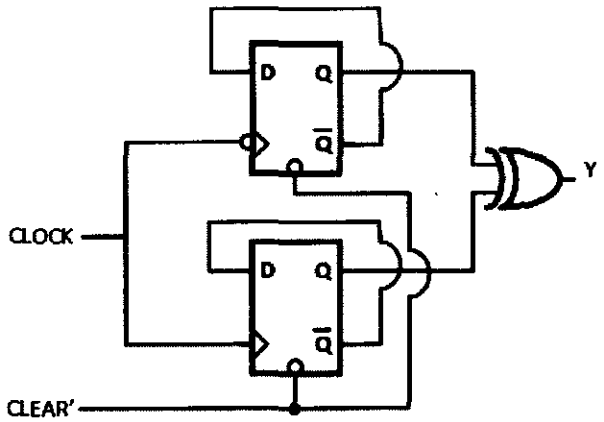
A. Q
B. $\bar{Q}$
C. 0
D. 1

34. In the circuit given below, initially all the D – flip flops are cleared by a positive pulse "CLEAR" of duration *T/4*. If the flip flops are clocked by a clock of period *T* then the time period of the signal observed at *QA, QB, QC & QD* respectively are



A. T, T/2, T/4, T/8
B. *T, 2T, 4T, 8T*
C. *T, T, T, T*
D. *T/8, T/4, T/2, T*

35. In the circuit shown below, at time $t = 0$ a negative pulse (CLEAR') of duration *T/2* was applied synchronously with the clock to RESET both the D- flip flops. If the flip flops are clocked by a CLOCK of frequency *F* kHz, then the frequency of the output signal Y is



A. *F* kHz
B. *F/2* kHz
C. *2F* kHz
D. *F/4* kHz

36. For a TE_{30} mode, the field components that will exist are

A. H_x only
B. E_y only
C. Both H_x and E_y
D. Both H_y and E_x

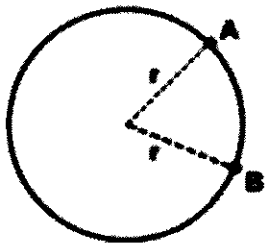
37. A communication receiver is operating over a frequency range from 40 MHz to 80 MHz and has a 50 Ω input resistance. The *r.m.s* noise voltage at 27 ^{0}C is

A. 5.75 μV
B. 6.20μV
C. 0 μV
D. 2.87μV

38. A 20 W carrier is amplitude modulated to a depth of 75%. The total power in the modulated wave is

A. 15.240 W
B. 14.625 W
C. 40.125 W
D. 25.625 W

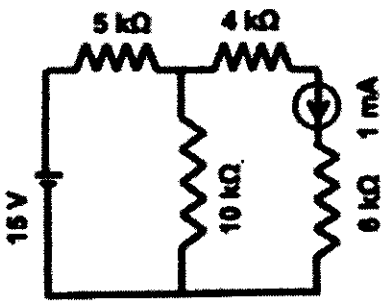
39. A conducting wire of uniform cross-sectional area and finite length has a resistance of 10 kΩ. This wire is used to make a circular ring of radius (*r*). The resistance between two points (say *A&B*) on this ring is measured to be 1.6 kΩ. Then the length of the shortest arc between the points *A&B* is



A. $2\pi r$
B. $2\pi r/5$
C. $8\pi r/5$
D. $1.6\pi r/5$

40. The Ammeter connected in the circuit shown below reads a current of 1 mA. This is possible if the

A. 5 kΩ resistor is opened
B. 5 kΩ resistor is shorted
C. 10 kΩ resistor is opened
D. 4 kΩ resistor is shorted



41. A voltage source (V_S), a 2 kΩ resistor and a 10 nF capacitor are connected in series. The voltage source abruptly changes its value from 5 V to 0 V at time $t = 0$. Assume that the source was at 5 V for a very long time before $t = 0$. The time at which the voltage across the capacitor $V_c = 1$ V is

A. 16.1 μs
B. 32.2 μs
C. 8.05 μs
D. 1.08 ms

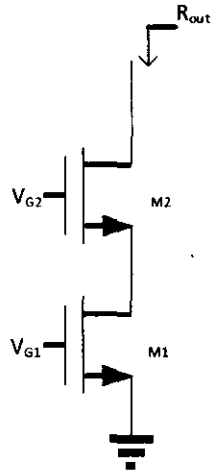
42. Consider a series circuit containing an EMF source and two passive elements. The current flowing through this circuit is measured as a function of frequency. If it is observed that the maximum current is flowing at low frequency and minimum current is flowing at high frequency then the passive elements in this circuit are

A. a capacitor and a resistor
B. both resistors.
C. an inductor and a resistor
D. both capacitors.

43. In an inverting amplifier the open loop gain (A_{OL}) of an operational amplifier is equal to 10^3. If the input resistance is 1 kΩ and feedback resistance is 100 kΩ, then the voltage gain of the amplifier is closest to

A. -80
B. -90
C. -100
D. -101

44. The output resistance of the MOS cascode circuit shown in figure belowis (assume M_1 and M_2 are biased in the saturation region. g_{m1}, r_{01} are transconductance and drain resistance respectively of M_1 and g_{m2}, r_{02} are transconductance and drain resistance respectively of M_2.)



A. 0
B. ∞
C. $g_{m2}r_{o1}r_{02}$
D. $g_{m1}r_{o1}r_{02}$

45. The terminal voltages of a PMOSFET are given as: source voltage = 3.3 V; gate voltage = 1.1 V; drain voltage = 2.5 V and the bulk voltage = 3.3 V. If the threshold voltage of this device is -1 V, then the operating region in which this FET is

A. Triode
B. Saturation
C. Cut off
D. Transition

University of Hyderabad

Entrance Examinations - 2019

Centre : Centre for Advanced Studies in Electronics Science and Technology

Course/Subject :M.Tech (Microelectronics and VLSI Design)

Revised Key:

Q.No.	Answer	Q.No.	Answer
1	B	26	D
2	C	27	C
3	C	28	A
4	A	29	D
5	D	30	B
6	B	31	C
7	A	32	A
8	C	33	B
9	D	34	C
10	C	35	A
11	B	36	C
12	D	37	A
13	B	38	D
14	B	39	B
15	D	40	C
16	A	41	B
17	C	42	C
18	A	43	B
19	A	44	C
20	A	45	A
21	No correct answer		
22	A		
23	B		
24	A		
25	D		

Note/Remarks: Based on the revised key, all students will get the benefit of question no 21.

Signature Samrat Sahoo

School/Department/Centre Head, CASEST