Y-65

ENTRANCE EXAMINATIONS – 2020

(Ph.D. Admissions - January 2021 Session)

Ph.D. Electronics Science and Engineering

Marks: 70
Time: 2.00 hrs

Hall Ticket no: [ ]

1. Write your Hall Ticket Number in 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 **1.75**marks each. **There is NO negative marking.**

   Part 'B: It consists of 20 objective type questions of **1.75 marks. There is 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 at the end of the examination to the invigilator.

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

8. Values of some physical constants: Planck's constant, h=6.6x10^{-34} m^{2}kg/s, speed of light in vacuum, c= 3x10^8 m/s, Boltzmann constant k_B= 1.38x10^{-23} m^{2}kgs^{-2}K^{-1}, $V_T = k_BT/e$ = 26 mV at room temperature, free space permittivity $\epsilon_o = 8.85 \times 10^{-12}\ F/m$, electronic charge, e= -1.6x10^{-19}C

9. This book contains 13 pages including this cover sheet.

PART – A

1. The mileage of a car decreased by 10% in a week. The driver checked the pressure of the four tyres and found that the tyre pressure had decreased by 10%. The inference drawn based on the given facts is: "Decrease in tyre pressure leads to decrease in mileage", then

   A. The inference is "definitely true" i.e., it follows from the statement of facts given.
   B. The inference is "probably true" i.e., it may follow from the statement of facts given.
   C. The data is inadequate to draw any inference i.e., from the facts given, one cannot say whether the inference is likely to be true or false.
   D. The inference is "definitely false" i.e., it cannot be drawn from the facts given or it contradicts the given facts.

2. Consider the statements: (1) the resistance of a conducting element is directly proportional to its length, at a given temperature. (2) The resistance increases linearly with increase in temperature. From the given statements, the following conclusions are drawn

   I. These facts can be used to design a temperature sensor
   II. These facts can be used to design a length sensor
   III. These facts can be used to design a voltage sensor

Which of the following options is correct based on the given statements

   A. conclusions I and II follow
   B. only conclusion II follows
   C. only conclusion I follows
   D. conclusions I and III follow

3. Consider the following statement: To enhance your skills in carrying out experiments you have to conduct a large number of experiments. From the given statement, following conclusions are drawn:

   I. If you do not conduct experiments, you cannot have experimental skills.

   II. A skilled experimentalist has carried out a large number of experiments.

   III. Enhancement of experimental skills is not necessary

Which of the following options is correct based on the given statements

   A. only conclusion I follows
   B. only conclusion II follows
   C. both conclusion I and conclusion II follow
   D. only conclusion III follows

4. An experiment is expected to yield a linear dependence between two measured parameters. The first time you carry out the experiment and you plot the data between the measured parameters, you found that the straight line is observed only if you delete two of the ten measured data points. Then these options are given to you as course of action(s):

I) Find the source of error, eliminate it and repeat the experiment.

II) Repeat the experiment a statistically significant number of times and fit a straight line to the data points.

III) Discard the two data points that are not falling on the line and consider the remaining eight data points for the analysis.

Identify the course of action that is/are logically worth pursuing

A. Option I only.

B. Option II only.

C. Option III only.

D. Options I and II.

5. A meeting of four employees out of seven (*A, B, C, D, E, F,* and *G*), has to be arranged with the conditions below:

- Either *B* or *C* must be present, but both *B* and *C* cannot be present.
- Either *F* or *G* must be present, but both *F* and *G* cannot be present.
- *F* cannot be present unless *D* is present.
- *A* cannot be present unless *C* is present.

If it is known that *G* is not present on the day of the meeting, how many different groups of four employees can be made, following the above criteria?

A. One
B. Two
C. Three
D. Four

6. A simple pendulum of length l makes n beats in time t. If there is no change in the acceleration due to gravity g, then the change in the number of beats when the length of pendulum is increased by dl is

A. $n(dl/l)$
B. $n(dl/2)$
C. $-(n/2)(dl/l)$
D. $-n(dl/l)$

7. A 2 W, 50 Ω resistor is connected in series with a 1W, 400 Ω resistor. The maximum dc voltage that can be applied continuously to the series circuit without exceeding the upper limit of power of either of the two resistors is

A. 22.5 V
B. 45 V
C. 150 V
D. 450 V

8. If an oscilloscope displays a straight line inclined at 45^0 to the X-axis and its Y-inputs are sine waves of frequency f, then the X-inputs will be sine wave of frequency

A. f and 45^o phase shift with the Y-inputs
B. 2f and 45^o phase shift with the Y-inputs
C. 2f and 0^o phase shift with the Y-inputs
D. f and 0^o phase shift with the Y-inputs

9. Consider the equation

$$R = \frac{1}{AV + D}$$

where R and V are two physically measurable parameters. The values of A and D can be found by plotting a graph of

A. $1/R$ on the y-axis and V on the x-axis with A being the slope and D being the y-intercept
B. R on the y-axis and V on the x-axis with A being the slope and D being the y-intercept
C. $1/R$ on the x-axis and V on the y-axis with A being the slope and D being the y-intercept
D. $1/R$ on the y-axis and V on the x-axis with D being the slope and A being the y-intercept.

10. The initial temperature of a liquid is recorded as (24.5 ± 0.3) °C and on heating its final temperature is recorded as (52.7 ± 0.4) °C. The uncertainty in measuring the increase in temperature is

A. ± 0.1 °C
B. ± 0.5 °C
C. ± 0.7 °C
D. ± 0.4 °C

11. The iterative formula for finding the square root of 2 using the Newton Raphson method is (n is the iteration number and x_n is the value of the function after n^{th} iteration)

A. $[x_n + 2/x_n]/2$
B. $[x_n + 2/x_n]$
C. $[x_n^2 + 2/x_n]/2$
D. $[x_n^2+2x_n]$

12. Let $x = \sqrt{-1}$ then x^x is

A. -1
B. $\sqrt{-1}$
C. $e^{\pi/2}$
D. $e^{-\pi/2}$

13. It takes 50 seconds for the lift in a building to arrive at the ground floor from the top floor. It is assumed that the probability of the lift arriving at the ground floor between 0 and 50 seconds after the button is pressed is uniform. The probability that the lift arrives at the ground floor in less than 20 seconds after the button is pressed, is

A. 2/5
B. 1/5
C. 1
D. 1/20

14. Which of the following statements is true?

A. Thevenin's theorem is not applicable to RLC circuits with one or more independent or dependent voltage and current sources.
B. Thevenin's theorem is not applicable to circuits with unilateral elements.
C. Norton's theorem is applicable only to networks with unilateral elements.
D. Norton's theorem is applicable only to circuits with non-linear elements.

15. In a "230 V, 3 phase" electric outlet, the phase between voltages at the different output leads and the peak voltage at each lead with respect to the neutral line are respectively

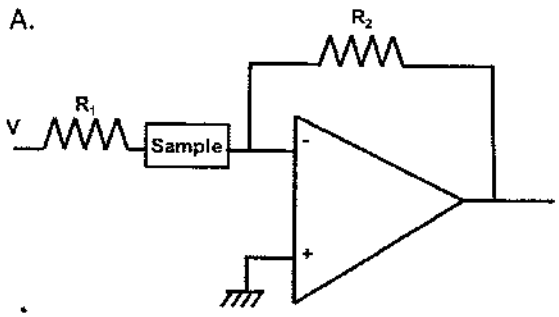
A. 60°, 230 V
B. 120°, 230 V
C. 60°, 300 V
D. 120°, 324 V

16. Number of "8 x 4" RAM ICs required for constructing a "24 x 8" RAM are

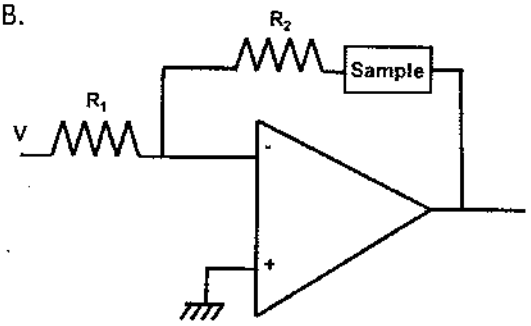
A. 2
B. 4
C. 6
D. 8

17. In an experiment, a semiconductor sample is to be electrochemically etched at a constant current. The resistivity of the sample varies during the etching process. Then which of the following is the most appropriate configuration to conduct this experiment?

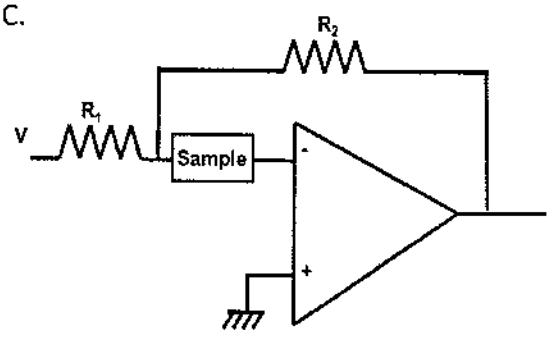
A.



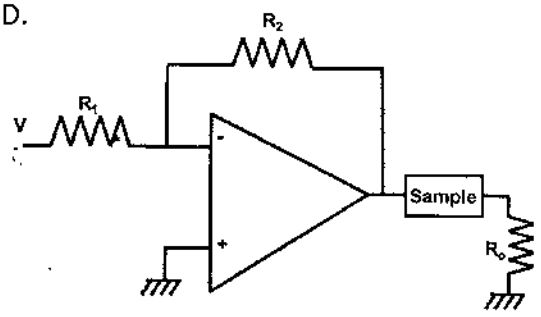
B.



C.



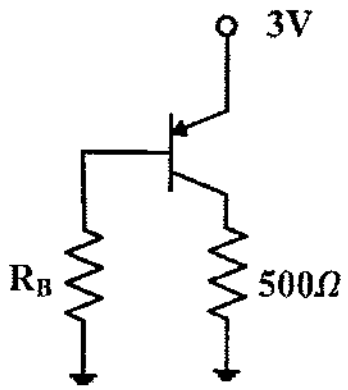
D.



18. The electric field strength at a distant point, P, due to the point charge, +q, located at the origin is 100 μV/m. If the point charge is now enclosed by a perfectly conducting metal sphere whose centre is at the origin, then the electric field strength at point P outside the sphere becomes

A. Zero
B. 100 μV/m
C. -100 μV/m
D. 50 μV/m

19. In the circuit shown below, the silicon p-n-p transistor has a common emitter current gain of 50. If the emitter collector voltage (V_{EC}) is 2V then the value of the base resistor R_B is approximately



A. 30 kΩ
B. 60 kΩ
C. 90 kΩ
D. 120 kΩ

20. An electromagnetic wave propagating through a lossless transmission line of characteristic impedance Z_o Ω which is coupled to a load of impedance $+jZ_o$ Ω . Then the wave will be

A. dissipated in the load without any reflection.
B. reflected back to the line with a phase change of 90°
C. reflected back to the line with a phase change of 180°
D. propagated as if there is no termination.

PART B

21. If the matrix $A=\begin{bmatrix}2 & 3 & -1\\ 4 & 6 & x\\ 0 & 3 & 4\end{bmatrix}$ is a singular matrix, then the value of x is:

A. 2
B. -2
C. -14
D. 14

22. The series $\sum_{n=0}^{\infty}(-1)^n \frac{x^{2n}4^n}{(2n)!}$ is a Maclaurin series for the following function

A. $\cos(x)$
B. $\cos(2x)$
C. $\sin(x)$
D. $\sin(2x)$

23. $\int_0^{\infty} x^{3/2}e^{-x}dx =$

A. 0
B. $\frac{3}{2}\sqrt{\pi}$
C. $\frac{5}{2}\pi$
D. $\frac{3}{4}\sqrt{\pi}$

24. The Fourier series expansion of the function $f(x) = x^2$, $0 < x < 2\pi$ with the period 2π is

A. $\frac{4\pi^2}{3} + \sum_{n=1}^{\infty}\left(\frac{4}{n^2}cosnx - \frac{4\pi}{n}sinnx\right)$
B. $\frac{8\pi^2}{3} + \sum_{n=1}^{\infty}\left(\frac{8}{n^2}cosnx - \frac{8\pi}{n}sinnx\right)$
C. $\frac{2\pi^2}{3} + \sum_{n=1}^{\infty}\left(\frac{2}{n^2}cosnx + \frac{2\pi}{n}sinnx\right)$
D. $\frac{4\pi^2}{3} + \sum_{n=1}^{\infty}\left(\frac{4}{n^2}cosnx + \frac{4\pi}{n}sinnx\right)$

25. The mobility and diffusion constants for electrons in two semiconductors at room temperature are given as μ_{e1}, D_{n1} (in semiconductor-1) and μ_{e2}, D_{n2} (in semiconductor-2) respectively. If $\mu_{e1} = 2\mu_{e2}$ then

A. $D_{n1} = D_{n2}$
B. $D_{n1} = 2D_{n2}$
C. $D_{n1} = 0.5D_{n2}$
D. $D_{n1} = \sqrt{2}D_{n2}$

26. The current – voltage (I-V) characteristics of an electronic device is given by

$$I = k_1\left[V - k_2(V + k_3)^{\frac{3}{2}}\right]$$

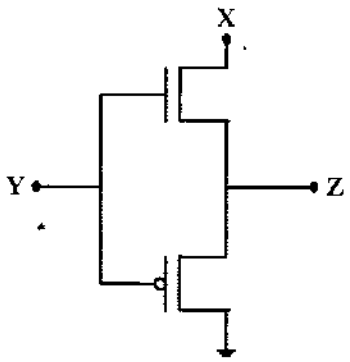
where k_1, k_2 and k_3 are constants. Then the voltage at which the current saturates is

A. $[2/(3k_2)]^2 - k_3$
B. $[2V/(3k_2)]^2 - k_3$
C. $[2/(3k_2)]^{1/2} - k_3$
D. $[2k_1/(3k_2)]^{3/2} - k_3$

27. In a p-n diode if the acceptor doping concentration on p-side is increased then the built – in voltage of the diode will

A. remain same
B. decrease
C. increase
D. become zero

28. If X and Y are the inputs for the circuit shown in figure then the output Z =



A. X'+ Y'
B. X'Y + XY'
C. Y'
D. XY

29. If the thermal oxidation rates of the (100), (111) and (110) planes of a single crystal of Si are R(100), R(111) and R(110) respectively, then which of the following is true?

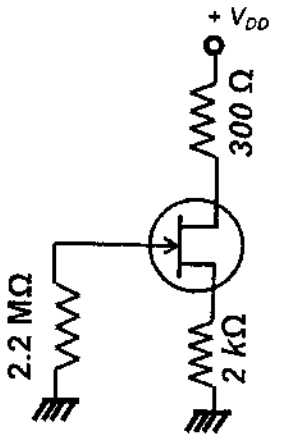
A. R(100) > R(111) < R(110)
B. R(100) < R(111) < R(110)
C. R(100) < R(111) > R(110)
D. R(100) = R(111) = R(110)

30. A depletion type n-channel MOSFET is biased in its linear region for use as a voltage controlled resistor. Assume that the threshold voltage V_{TH} = 0.5 V, Gate to Source voltage V_{GS}= *2.0 V*, Drain to Source voltage V_{DS}=5 V, the ratio of channel width to length W/L =100, effective oxide capacitance C_{OX} = 10^{-8} F/cm^2 and the mobility of electrons in channel μ_n = 800 cm^2/Vs. The value of the resistance of the voltage controlled resistor is

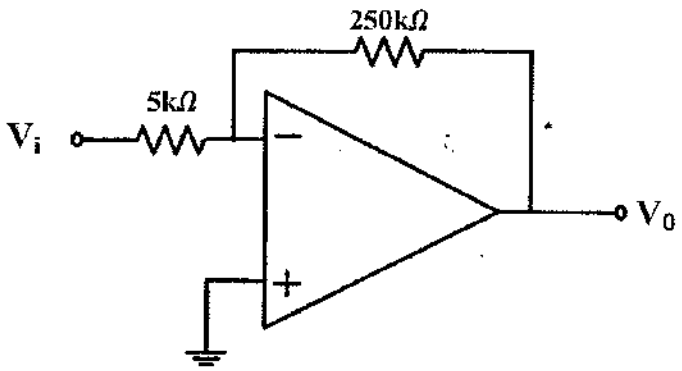
A. 50 Ω
B. 500 Ω
C. 447 Ω
D. 550 Ω

31. In the JFET circuit shown in the figure, if the drain current is 4 mA then the gate to source voltage is

A. 0 V
B. -6.8 V
C. -8 V
D. +8 V



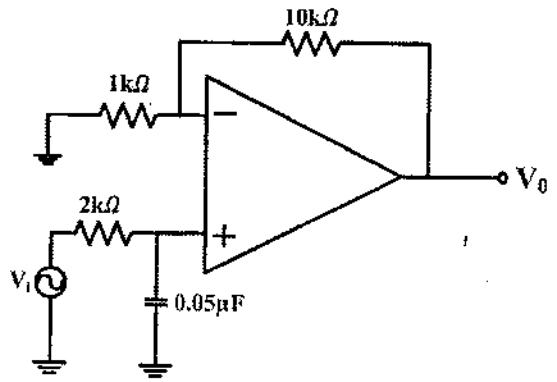
32. The input voltage to the Op-Amp circuit given below is V_i= *0.2 sin(200×10^{3}t)* V and the slew rate of the Op-Amp is 3.2 V/μs. The maximum frequency above which the output waveform gets distorted is approximately



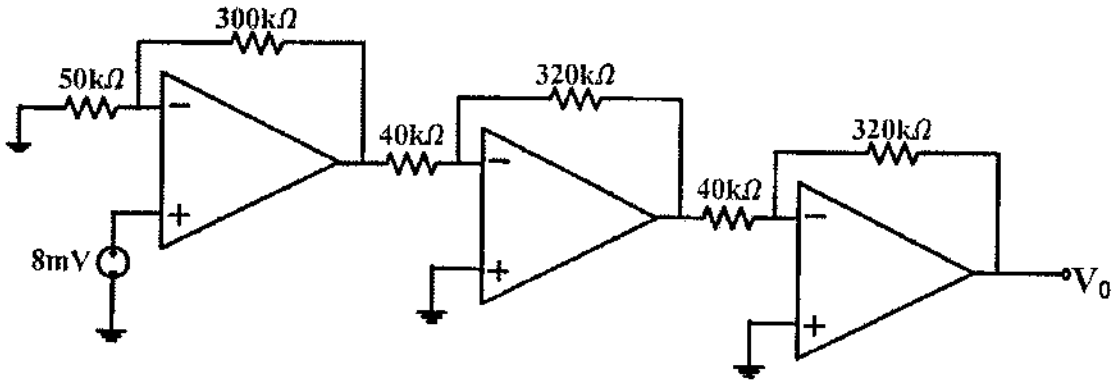
A. 50 kHz
B. 320 kHz
C. 50 MHz
D. 320 MHz

33. If the value of the capacitance in the following circuit is doubled then the cut-off frequency

A. will remain same
B. will be doubled
C. will be halved
D. will be reduced by 4



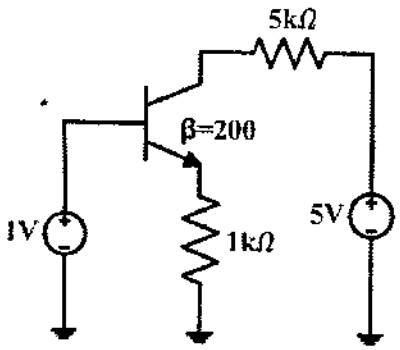
34. The output voltage of the circuit given below is approximately



A. -3.1 V
B. 3.6 V
C. +12 V
D. -12 V

35. For the circuit shown below, the silicon transistor operates in the

A. saturation region
B. cut off region
C. active region
D. inverse active region

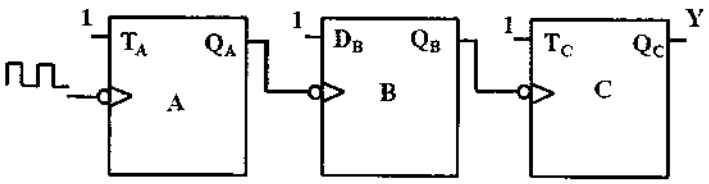


36. A Boolean function (Y) is represented in the Karnaugh map as shown below. The complement of this function (Y') is

A. P' + Q'R'
B. P'Q + Q'R'
C. PQ+Q'R
D. P'(Q'+R')

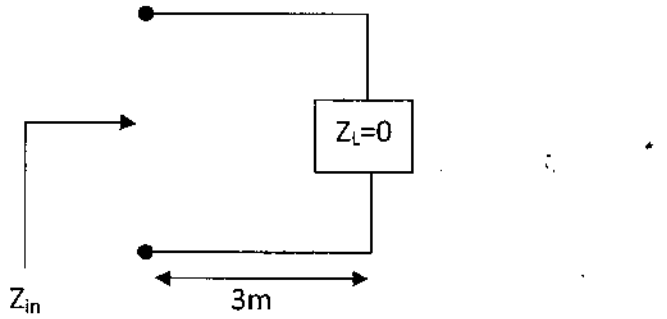
Y	Q'R' 00	Q'R 01	QR 11	QR' 10
P' 0	1	0	1	1
P 1	1	0	0	0

37. Two T-flip-flops (A, C) and a D flip-flop (B) are connected as shown below. All the flip-flops were reset initially and the inputs as shown are applied. A square wave of frequency *f* is applied to the clock input of the flip-flop A. Then the output Y is



A. a square wave of frequency *f/2*.
B. a square wave of frequency *f/4*.
C. always "one".
D. always "zero".

38. Consider a 3 m long lossless air-filled transmission line as shown below. It has a characteristic impedance of 120 pΩ which is terminated by a short circuit, and is excited with a frequency of 37.5 MHz. The nature of the input impedance (Z_{in}) is



A. open
B. short
C. inductive
D. capacitive

39. A linear time-invariant system has an impulse response $h(t) = \delta(t) - e^{-5t}.u(t)$, where $\delta(t)$ and *u(t)* correspond to delta function and unit function respectively. Its frequency response H(ω) is

A. $\frac{4+j\omega}{5+j\omega}$

B. $\frac{1}{5+j\omega}$

C. $\frac{6+j\omega}{5+j\omega}$

D. $\frac{4-j\omega}{5-j\omega}$

40. If the thickness of a piezoelectric crystal is doubled, keeping the applied pressure and voltage sensitivity constant, then the output voltage will be

A. remain same
B. halved
C. increase by √2 times
D. doubled

UNIVERSITY OF HYDERABAD

Entrance Examinations – Jan. 2021

Ph.D. (Electronics Science and Engineering)

Part A	
S.No.	Answer
1.	C
2.	A
3.	B
4.	D
5.	C
6.	C
7.	A
8.	D
9.	A
10.	B
11.	A
12.	D
13.	A
14.	B
15.	D
16.	C
17.	B
18.	A
19.	B
20.	B

Part B	
S.No.	Answer
21.	B
22.	B
23.	D
24.	A
25.	B
26.	A
27.	C
28.	D
29.	C
30.	B
31.	C
32.	A
33.	C
34.	B
35.	C
36.	C
37.	D
38.	D
39.	A
40.	D

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25-01-2021.