

Entrance Examinations 2019
Ph.D. (Electronics Science and Engineering)

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 1.75 marks each. There is a negative marking of 0.5 marks for every wrong answer.

Part 'B': It consists of 35 objective type questions of ONE mark 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:



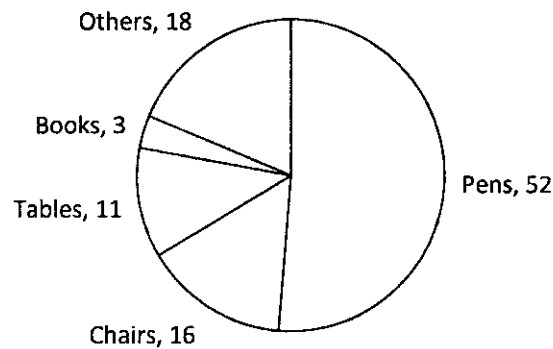
5. No additional sheets will be provided. Rough work can be done in the question paper itself.
6. Hand over the OMR answer sheet at the end of the examination to the invigilator.
7. Mobile phones, log tables and calculators of any type are NOT permitted
8. Values of some physical constants: $V_T = 26 \text{ mV}$, $\epsilon_0 = 8.85 \times 10^{-12} \text{ F/m}$
9. This book contains 16 pages including this cover sheet.

V-63

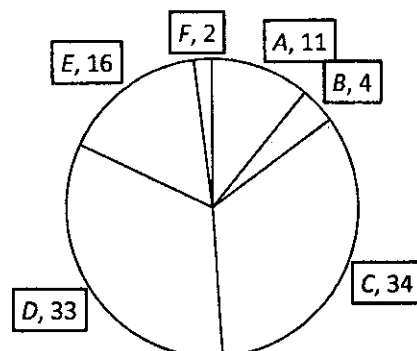
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PART - A

1. The following pie chart shows the distribution (as percentage of value) of the office items used in the office throughout the year. Pens were then dropped from the budget requirements and the budget reduced by an amount equal to their cost. What is the current percentage of books in the reduced budget?

Budget

- A. 3
 B. 6.25
 C. 5.76
 D. 9
2. The values of Market Share of 6 companies are distributed as shown in the following pie chart. If the value of market share of the company *A* is Rs 4000 crores, then the value of market share of companies *C* and *D* together is

Value of Market Share (%)

- A. 24,363 crores
 B. 24,432 crores
 C. 24,864 crores
 D. 25,827 crores

3. The radius of a circle is 3.0 ± 0.2 cm. What is its circumference and its uncertainty?
- A. 18.6, 1.0
 - B. 9.3, 0.6
 - C. 18.9, 1.3
 - D. 9.0, 0.4

4. Which of the following is not an example of negative correlation;
- A. Volume and pressure of a perfect gas.
 - B. Distance travelled by a train and energy consumed by the train.
 - C. Age and eye-sight.
 - D. Capacitance of a parallel plate capacitor and separation between its plates

5. Read the passage and answer the questions below it

“The Linear Integrated Circuit is one of the important components of electronics science and technology. It finds applications in equipment used in daily life such as mobile phones, washing machines, televisions and air-conditioners. It also enables the development of smart devices. However, smart devices have advantages and disadvantages. For example, they can make life better but they can also be misused to disseminate fake news.”

Which of the following can be inferred from the above passage:

- A. Linear integrated circuits lead to smart devices
 - B. All components of electronics science and technology find applications in daily life
 - C. All components of electronics science and technology leads to development of smart devices
 - D. Smart devices lead to fake news
6. Which of the following cannot be inferred from the passage in the previous question?
- A. Electronics science and technology can be used to develop smart devices
 - B. Air conditioners and mobile phones contain linear integrated circuits
 - C. Smart devices have advantages and disadvantages
 - D. Washing machines and televisions are smart devices.
7. Two measured quantities with random errors are $F = 5 \pm 3$, $J = 2 \pm 4$. What are the errors on $F+J$ and $F-J$?
- A. 5, -5
 - B. 7, 1
 - C. 5, 5
 - D. 7, -1

8. Measurement of a quantity A , linearly related to an independent variable B , yields the values $A=4.5$ at $B=2$ and $A=5.2$ at $B=4$. The values of A at $B=5$ and $B=10$ would be
- A. 5.55 and 11.1
 - B. 5.55 and 7.3
 - C. 3.65 and 7.3
 - D. 5.6 and 7.2
9. The most appropriate method to measure the resistance of a metallic sample is
- A. Using a multi-meter
 - B. Using two probes, one of which is a voltage probe and the other a current probe
 - C. Using four collinear probes, passing a current through outer two probes and measuring the voltage developed across the inner two probes
 - D. Using four collinear probes, passing a current through inner two probes and measuring the voltage developed across the outer two probes
10. If the standard deviation of a non-grouped set of 10 data points is 32, then the standard error of the mean is approximately
- A. 3.2
 - B. 320
 - C. 10¹
 - D. 10.1
11. A measured quantity Z is determined to be 9.000. The correct way of writing the value of the product $125Z$ with appropriate number of significant digits is
- A. 1125
 - B. 1125.000
 - C. 1.13×10^3
 - D. 112.5×10^1
12. The ages of a group of 5 people are 13, 25, 17, 32, and 20 years. The mean and median age of the group are
- A. 21.4, 20
 - B. 21.4, 32
 - C. 20, 21.4
 - D. 20, 20

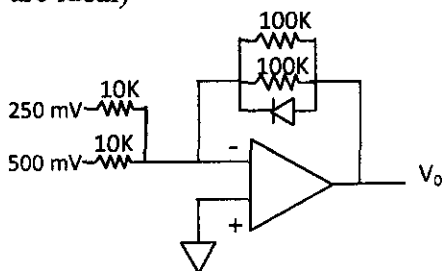
13. When all the valence band states are occupied in a semiconductor, the sum over all wave vectors of occupied states is
- A. A finite non-zero number
 - B. Infinite
 - C. Zero
 - D. Equal to the sum over all wave vectors in the conduction band
14. The conductivity of an intrinsic semiconductor measured at 77 K, 273 K and 300 K is C_{77} , C_{273} and C_{300} respectively. Which of the following relations is correct
- A. $C_{77} > C_{273} = C_{300}$
 - B. $C_{77} < C_{273} = C_{300}$
 - C. $C_{77} > C_{273} > C_{300}$
 - D. $C_{77} < C_{273} < C_{300}$
15. The refractive index of all metals at microwave frequencies is
- A. Less than unity
 - B. Unity
 - C. Greater than unity
 - D. No refractive Index
16. A lady F has two brothers K and P and two daughters L and J . L is married to K and they have a son M . P has a daughter D and J has a son Z . The relationship between Z and M ; J and M ; and D and F are respectively
- A. Z is nephew and cousin of M ; J is cousin and aunt of M ; F is aunt of D
 - B. Z is uncle of M ; J is mother of M ; F is aunt of D
 - C. M is uncle of and cousin of D ; J is cousin of M ; D is aunt of F
 - D. M and Z are brothers; J is aunt of M ; F is D 's mother
17. The missing number in the series 55,47,59,43,... is
- A. 39
 - B. 63
 - C. 55
 - D. 47

18. The coordinates of a point on the straight line L_1 are (1,2), on the straight line L_2 are (4,5) and on the straight line L_3 are (1,6). If all the straight lines pass through the origin, then the slopes m_1 , m_2 and m_3 are related as
- A. $m_1 < m_2 < m_3$
 - B. $m_1 > m_2 > m_3$
 - C. $m_1 > m_2 > m_3$
 - D. $m_1 > m_2 < m_3$
19. Two straight lines L_1 and L_2 have slopes m_1 and m_2 respectively in the ratio of 2:1. Line L_1 passes through the origin. The line L_2 passes through a point (x_2, y_2) and has a y-intercept, c . If the coordinates of a point on L_1 are (x_1, y_1) then the relationship between y_1 and y_2 is
- A. $y_1 = [2m_1x_1 / (m_1x_2 + 2c)]y_2$
 - B. $y_1 = [m_1x_1 / (m_1x_2 + c)]y_2$
 - C. $y_1 = [m_1x_1 / (m_1x_2 + 2c)]y_2$
 - D. $y_1 = [2m_1x_1 / (m_1x_2 + c)]y_2$
20. If $\vec{A} = 5\hat{i} + 4\hat{j}$ and $\vec{B} = 3\hat{i} + 4\hat{k}$, the value of $\vec{A} \cdot \vec{B} / |\vec{B}|$ is
- A. 9
 - B. 6.2
 - C. 3
 - D. 12.6

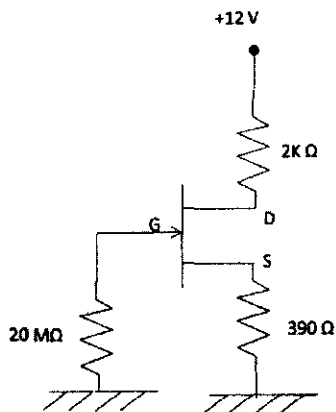
PART B

21. If the resistance in the collector circuit of a common-emitter amplifier is short circuited, then the small signal gain of this amplifier
- A. remains unchanged
 - B. will be zero
 - C. will be infinite
 - D. will change depending on the β of the transistor

22. The output voltage V_o of the following circuit is (assume the diode and operational amplifier are ideal)

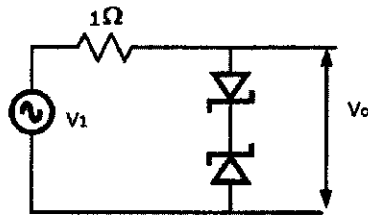


- A. Zero
 - B. 8.5V
 - C. -3.75V
 - D. 3.75V
23. If the drain-to-ground voltage in the circuit shown below, is measured to be 6 V, then the gate-to-source voltage (V_{GS}) is approximately



- A. 0V
- B. -6V
- C. -2.34V
- D. -1.17V

24. If each Zener diode in the following circuit has a breakdown voltage of 6V, what is the output waveform, for an input sinusoidal waveform with r.m.s. voltage of 5V?



- A. Output waveform is same as input waveform
 B. Sinusoidal waveform but clipped on the positive side at 6V
 C. Sinusoidal waveform but clipped on the negative side at 6V
 D. Sinusoidal waveform but clipped on both the positive and negative side at $\pm 6V$
25. Conductivity of a non-magnetic stainless steel is about 50 times less than that of copper. If cavities of equal geometry and dimensions are made with each of these metals, then which of the following statements is true about the cavity resonant frequency for the dominant mode?
- A. Both steel cavity and copper cavity will have the same resonant frequency and the same dominant mode
 B. Steel cavity will have a higher resonant frequency than the copper cavity
 C. Copper cavity will have a higher resonant frequency than the steel cavity
 D. Both steel cavity and copper cavity will have the same resonant frequency but different dominant modes
26. Which one of the following conditions will not guarantee a distortion less Transmission Line? (R,G,L,C refer to standard notations used in transmission line theory and ω is the angular frequency of the propagating wave)
- A. $R = 0, G = 0$
 B. $LG = RC$
 C. $R \gg \omega L, G \gg \omega C$
 D. $R \ll \omega L, G \ll \omega C$
27. A plane electromagnetic wave is incident normally on a good conductor. If the frequency of the wave is increased four times, then the skin depth will
- A. Increase by a factor of 2
 B. Decrease by a factor of 4
 C. Increase by a factor of 4
 D. Decrease by a factor of 2

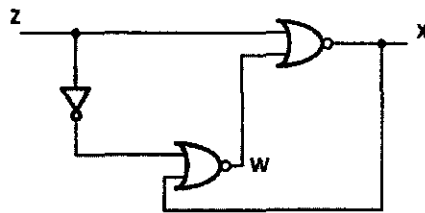
28. A waveguide operated below its cutoff frequency can be used as
- Load
 - Low pass filter
 - Attenuator
 - Impedance matching element
29. A Pulse communication system that is inherently immune to noise is
- Pulse Code Modulation
 - Pulse Amplitude Modulation
 - Pulse Position Modulation
 - Pulse Width Modulation
30. Which of the following antennas will radiate power in circularly polarized waves?
- Dipole Antenna
 - Helical Antenna
 - Yagi- Uda Antenna
 - Horn Antenna
31. $(e^{j\theta})^n + (e^{j\theta})^{-n}$ is
- $2\cos n\theta$
 - $(e^{j\theta})^{2n} + 1$
 - $2j \sin n\theta$
 - $(e^{j\theta})^n + 1$
32. The solution for $dy/dx = (2\cos 2x)/(3+2y)$ with $y(0) = -1$, is
- $4y + y^2 - 2 \sin 2x = 0$
 - $3y + y^2 + 2 \sin 2x = 0$
 - $8y + \cos 2x + 4y \sin 2x = 0$
 - $6y + 2x - \sin^2 x + \cos^2 x = 0$
33. The Eigen-values of the matrix $\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$ are
- 6,1
 - 1,-7
 - 6,-1
 - 7,1

34. A die has six faces marked 1 to 6. If 2 such dice are thrown, what is the probability that the sum of the numbers on the top faces is 6?
- A. $5/6$
 B. $3/36$
 C. $5/36$
 D. $1/6$
35. A 8-bit successive approximation Analog to Digital Converter is operated with a clock frequency of 100 kHz and reference voltage of 10V. The conversion time and resolution respectively are
- A. $10\mu\text{s}$, 1.25V
 B. $80\mu\text{s}$, 1.25V
 C. 2.56ms , 40mV
 D. $80\mu\text{s}$, 40mV
36. The open loop voltage gain of negative feedback amplifier is dropped from 80 dB to 60 dB. If the feedback factor of the amplifier is 0.01 then the closed loop gain will be approximately ($\log_{10}3=0.477$)
- A. Decrease by 1 dB
 B. Decrease by 5 dB
 C. Decrease by 10 dB
 D. Decrease by 20 dB
37. The Laplace transform of $u(t-t_0)$, where $u(t)$ is the unit function, is
- A. $\frac{e^{-st_0}}{s}$
 B. se^{-st_0}
 C. $\frac{e^{+st_0}}{s}$
 D. se^{+st_0}
38. If $\vec{F} = 4xy\hat{i} + 2z\hat{j} - 6yz\hat{k}$, then $\text{curl } \vec{F}$ is
- A. $(6z + 2)\hat{i} - 4x\hat{k}$
 B. $-(6z + 2)\hat{i} + 4x\hat{k}$
 C. $-(6z + 2)\hat{i} - 4x\hat{k}$
 D. $-(6z - 2)\hat{i} + 4x\hat{k}$

39. A safety circuit in a motorbike needs to generate a stop signal 'S' to stop the motorbike engine, whenever either of the following conditions occurs : (a) the rider is not wearing a helmet or (b) the rider is not having both his hands on the respective handles of the bike. The rider wearing the helmet is indicated by a logic HIGH signal 'M'. Indicators Q and R on the left and right handle produce a logic HIGH signal whenever the rider grips the handle. The logic expression to produce a HIGH output 'S' for the stated condition is

- A. $\overline{M \cdot Q \cdot R}$
- B. $\overline{M} \cdot Q \cdot R$
- C. $\overline{M + Q \cdot R}$
- D. $\overline{M} \cdot Q \cdot R$

40. In the circuit given below, if the propagation delay due to each gate is 'd' nano-seconds, then which of the following timing diagram corresponds to the circuit

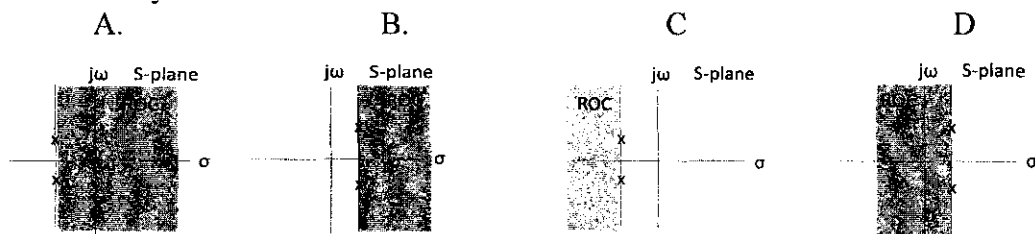


- A.
- B.
- C.
- D.

41. Which of the following expressions is equivalent to the Boolean expression, $Y=A + BC$
- A. $A + B$
 - B. $A+B+C$
 - C. $(A+B)(A+C)$
 - D. $(A+B)(B+C)$
42. An inductor can be converted into a capacitor, using a section of transmission line, by
- A. Series connecting the inductor with a quarter wave line
 - B. Series connecting the inductor with a half wave line
 - C. Shunt connecting the inductor with a quarter wave line
 - D. Shunt connecting the inductor with a half wave line
43. A transmission line of 50Ω characteristic impedance is terminated with a 100Ω resistance. The minimum impedance measured on the line is
- A. 0Ω
 - B. 25Ω
 - C. 50Ω
 - D. 100Ω
44. A 50Ω lossless transmission line has a pure reactance of $(j100)\Omega$ as its load. The Voltage Standing Wave Ratio in the transmission line is
- A. $1/2$
 - B. 2
 - C. 4
 - D. Infinity
45. The mobility of electrons in pure GaAs at 300 K is $8500\text{ cm}^2/\text{V}\cdot\text{s}$. The diffusion coefficient for electrons in GaAs at 300 K is approximately.
- A. $138.12\text{ cm}^2/\text{s}$
 - B. $4250\text{ cm}^2/\text{s}$
 - C. $400\text{ cm}^2/\text{s}$
 - D. $221\text{ cm}^2/\text{s}$

46. The resistivity of a material is found to decrease with increase in temperature, except for a plateau in a certain temperature range. The material is most likely
- An extrinsic semi-conductor
 - An insulator
 - A metal
 - An intrinsic semi-conductor
47. As the doping concentration in the channel of JFET increases, the magnitude of its threshold voltage
- Remains unchanged
 - Decreases
 - Increases
 - Decreases at small concentrations and saturates

48. Which of the following pole-zero plots correspond to the transfer function of a causal but unstable system?



49. A student measures the mass of an object 10 times using the same balance and gets the following values in grams : 10.58, 10.48, 10.50, 10.52, 10.54, 10.50, 10.56, 10.51, 10.53, 10.55. Which of the following statements describes the obtained values correctly
- These values are obtained due to systematic errors in measurement
 - These values are obtained due to propagating errors in measurement
 - These values are obtained due to random errors in measurement
 - These values are obtained due to errors in calculation.
50. For radiative recombination to occur in an indirect band gap semi-conductor, which of the following conditions need *not* be satisfied?
- The process must involve absorption or emission of a phonon
 - The phonon momentum should be equal to the difference in electron and hole momenta
 - The energy of emitted photon must be less than the band gap energy
 - The phonon momentum should be equal to the emitted photon momentum

51. A linear, time-invariant system has a transfer function $H(s)=1/(s^2+3s+2)$ with a right half-plane as Region of Convergence. Its impulse-response is
- $(e^t - e^{2t})u(t)$
 - $(e^{-t} - e^{-2t})u(t)$
 - $(e^{-t} + e^{-2t})u(t)$
 - $(e^{-t} \cdot e^{-2t})u(t)$
52. A signal, which has a maximum frequency of 20kHz, is digitized using an Analog-to-Digital Converter (ADC). In order to recover the signal from its samples, the upperbound on the ADC conversion time is
- 20 milliseconds
 - 100 microseconds
 - 50 microseconds
 - 25 microseconds
53. The advantage of the use of anti-fuse programming technology compared to SRAM technology in a field programmable gate array is
- It decreases the area overhead
 - It is reprogrammable
 - It is volatile
 - It has higher ON resistance
54. The advantage of NOR flash memory compared to NAND flash memory is that
- It has faster access time to read a random memory address
 - It has more storage cell density
 - It is cheaper
 - It has less probability of data leakage
55. The following verilog code is written for designing a *circuit*. Which of the following hardware will this code generate, when synthesized?

```

module circuit(input i0, i1, s, output reg y);
always@(i0, i1, s)
begin
if (s == 1'b0)
y = i0;
else y = i1;
end
endmodule

```

- Decoder
- Multiplexer
- Encoder
- Demultiplexer

University of Hyderabad

Entrance Examinations - 2019

Centre : Centre for Advanced Studies in Electronics Science and Technology

Course/Subject : Ph.D Electronics Science and Engineering

Revised Key:

Q.No.	Answer	Q.No.	Answer	Q.No.	Answer
1	B	26	C	51	B
2	A	27	D	52	D
3	C	28	C	53	A
4	B	29	A	54	A
5	A	30	B	55	B
6	D	31	A		
7	C	32	No correct answer		
8	B	33	A		
9	C	34	C		
10	D	35	D		
11	C	36	A		
12	A	37	A		
13	C	38	C		
14	D	39	D		
15	A	40	B		
16	A	41	C		
17	B	42	A		
18	D	43	B		
19	A	44	D		
20	C	45	D		
21	B	46	A		
22	C	47	C		
23	D	48	B		
24	D	49	C		
25	C	50	D		

Note/Remarks: Based on the revised key, all students will get the benefit of question no 32.

Signature *Sourabh Lal*
School/Department/Centre *Head, C.A.E.E.S.T*