

--

Ph.D. ENTRANCE EXAMINATION, August-2026

Name of Candidate	Answer Sheet No.
Roll No. of the Candidate	Signature of the Candidate.....
Date of Examination	Signature of the Invigilator(s)
	1.
	2.

Time: 2 Hours**Maximum Marks: 100****IMPORTANT INSTRUCTIONS**

- i. The question paper is in the form of Test-Booklet containing **100 (Hundred)** questions. Each question may carry maximum four answer marked. (A), (B), (C) and (D) out of which only one is correct.
- ii. There are 100 multiple choice questions, each question carrying 1 mark. The test includes 50 questions of Research Methodology (Part A) and 50 questions of the subject/Domain (Part B).
- iii. On receipt of the Test-Booklet (Question Paper), the candidate should immediately check it and ensure that it contains all the pages, i.e., **100** questions (50 in Part-A+50 in Part-B). Discrepancy, if any, should be reported by the candidate to the invigilator immediately after receiving the Test-Booklet.
- iv. A separate Answer- Sheet is provided with the Test-Booklet/Question Paper. On this sheet there are 100 rows containing four circles each. One row pertains to one question.
- v. The candidate should write his/her roll number at the places provided on the cover page of the Test-Booklet/ Question Paper and on Answer Sheet and NOWHERE ELSE.
- vi. No second test -Booklet /Question Paper and Answer -Sheet will be given to a candidate. The candidates are advised to be careful in handling it and writing the answer on the Answer-Sheet.
- vii. For every correct answer of the question **One (1) mark will be awarded**. For every unattempted question/ wrong answer, zero (0) mark shall be awarded. **There is no Negative Marking**.
- viii. Marking shall be done only on the basis of answers responded on the Answer- Sheet.
- ix. To mark the answer on the Answer- Sheet, candidate should **darken** the appropriate circle in the row of each question with Blue or Black pen.
- x. For each question, only one circle should be darkened as a mark of the answer adopted by the candidate. If more than one circle for the question are found darkened or with one black circle any other circle carries any mark, the question will be treated as cancelled.
- xi. The candidates should not remove any paper from the Test- Booklet/Question Paper. Attempting to remove any paper shall be liable to be punished for use of unfair means.
- xii. Rough work may be done on the blank space provided in the Test- Booklet /Question Paper only.
- xiii. Mobile phones (even in Switch -off mode) and such other communication/ programmable devices are not allowed inside the examination hall.
- xiv. No candidate shall be permitted to leave the examination hall before the expiry of the time.

DO NOT OPEN THIS QUESTION BOOKLET UNTIL ASKED TO DO SO

(PART-A)

1. Which of the following statements is true about the collection of data?
 - a. The data that is collected from the place of origin is known as primary data
 - b. The data that is collected from the place of origin is known as secondary data
 - c. The data that is collected from the place of origin is known as tertiary data
 - d. None of the above
2. Which of the following is the main point of difference between primary data and secondary data?
 - a. The collection of secondary data is costlier and more time consuming when compared to primary data
 - b. The secondary data is always original whereas the primary data is not
 - c. The primary data is much more reliable than secondary data because it is collected directly from respondents
 - d. None of the above
3. Which of the following is an example of qualitative data?
 - a. Temperature readings in Celsius
 - b. Monthly income in dollars
 - c. Transcript of an interview
 - d. Total population count
4. How is qualitative data usually analyzed?
 - a) By using statistical formulas and graphs
 - b) By finding themes, patterns, and categories
 - c) By running computer software for percentages
 - d) By measuring numerical weight or length
5. Which graph is used to show cumulative frequency?
 - a) Bar graph
 - b) Ogive
 - c) Histogram
 - d) Pie chart
6. Which chart is most suitable to show the comparison of parts to a whole?
 - a) Line graph
 - b) Histogram
 - c) Frequency polygon
 - d) Pie chart
7. In a moderately asymmetrical (skewed) distribution, what is the empirical relationship between mean, median, and mode?
 - a. $\text{Mean} - \text{Mode} = 3(\text{Mean} - \text{Median})$
 - b. $\text{Mean} = \text{Median} + \text{Mode}$
 - c. $\text{Mode} = 3\text{Mean} - 2\text{Median}$
 - d. $\text{Median} = \text{Mean} / \text{Mode}$
8. Which measure of central tendency includes the magnitude of scores?
 - a. Mean
 - b. Mode
 - c. Median
 - d. Range
9. What is the mean of the following numbers: 23, 45, 87, 40, 50?
 - a. 59
 - b. 49
 - c. 56
 - d. 39

10. Which of the following are methods under measures of dispersion?
- Standard deviation
 - Mean deviation
 - Range
 - All of the above
11. _____ and _____ are types of measures of dispersion.
- Nominal, Real
 - Nominal, Relative
 - Absolute, Relative
 - Real, Relative
12. The standard deviation of a set of 90 observations is 105. If the value of each observation is decreased by 9, then the new standard deviation of these observations would be _____.
- 96
 - 105
 - 100
 - None of the above
13. The average of squared deviations from the arithmetic mean is known as _____.
- Quartile deviation
 - Standard deviation
 - Variance
 - None of the above
14. If Mohan secures 97 percentiles in an examination, it means that his position is below _____ of the total candidates who had appeared in the exam.
- 97 percent
 - 3 percent
 - 90 percent
 - None of the above
15. Which of the following cannot be calculated for open-ended distributions?
- Standard deviation
 - Mean deviation
 - Range
 - None of the above
16. The interquartile range (IQR) is calculated as:
- $Q3 - Q1$
 - $Q3 + Q1$
 - $Q1 - Q3$
 - $Q1 \times Q3$
17. Which of the following statements is TRUE?
- Standard deviation is less reliable than range.
 - Mean deviation uses all scores.
 - Quartile deviation uses the entire dataset.
 - Range uses all scores.
18. If range is 20 and the smallest value is 5, the largest value is:
- 25
 - 15
 - 30
 - Cannot be determined
19. A distribution with low variability is considered:
- Scattered
 - Skewed
 - Consistent
 - Unreliable

20. Coefficient of variation is helpful in:
- Finding mode
 - Comparing variability between two datasets
 - Identifying mean
 - Finding median
21. If the variance is 16, then the standard deviation is:
- 8
 - 4
 - 2
 - 16
22. Kurtosis is a measure of:
- Central tendency
 - Dispersion
 - Symmetry
 - Skewness
23. Choose the correct option concerning the correlation analysis between 2 sets of data.
- Multiple correlations is a correlational analysis comparing two sets of data.
 - A partial correlation is a correlational analysis comparing two sets of data.
 - A simple correlation is a correlational analysis comparing two sets of data.
 - None of the preceding.
24. Which one of the below statements regarding the regression line is correct?
- The prediction equation is another name for a regression line.
 - A regression line is also referred to as the line of the average relationship.
 - The estimating equation is another name for a regression line.
 - All of the above.
25. Who introduced the term 'regression'?
- Karl Pearson
 - R.A Fischer
 - Croxtan and Cowden
 - Francis Galton.
26. Company A produces 10% defective products, Company B produces 20% defective products and C produces 5% defective products. If choosing a company is an equally likely event, then find the probability that the product chosen is defective.
- 0.12
 - 0.21
 - 0.22
 - 0.11
27. A well-defined research problem helps the researcher most by:
- Determining the exact budget
 - Guiding the selection of the research design and methods
 - Eliminating the need for a literature review
 - Guaranteeing publication in a journal
28. Why is a literature review critical during problem formulation?
- It proves that your bias is correct
 - It helps reveal gaps and inconsistencies in existing knowledge
 - It provides unrelated background facts
 - It replaces the need to state research objectives
29. Which of the following statement is correct?
- Reliability ensures the validity
 - Validity ensures reliability
 - Reliability and validity are independent of each other
 - Reliability does not depend on objectivity



30. The study in which the investigators attempt to trace an effect is known as:
- Survey Research
 - Summative Research
 - Historical Research
 - 'Ex-post Facto' Research
31. Generalized conclusion on the basis of a sample is technically known as:
- Data analysis and interpretation
 - Parameter inference
 - Statistical inference
 - All of the above
32. Authenticity of a research finding is its:
- Originality
 - Validity
 - Objectivity
 - All of the above
33. Which technique is generally followed when the population is finite?
- Area Sampling Technique
 - Purposive Sampling Technique
 - Systematic Sampling Technique
 - None of the above
34. Research problem is selected from the stand point of:
- Researcher's interest
 - Social relevance
 - Financial support
 - Availability of relevant literature
35. The research is always –
- Verifying the old knowledge
 - Exploring new knowledge
 - Filling the gap between knowledge
 - All of these
36. Manipulation of independent variable is always a part of
- Historical research
 - Fundamental research
 - Descriptive research
 - Experimental research
37. The Factorial Analysis is used:
- To know the relationship between two variables
 - To know the difference among the many variables
 - To know the difference between two variables
 - To test the Hypothesis
38. Which of the following is classified in the category of the developmental research?
- Philosophical research
 - Action research
 - Descriptive research
 - All the above
39. What is the name of the conceptual framework in which the research is carried out?
- Research hypothesis
 - Research design
 - Research paradigm
 - Synopsis of Research

40. Which of the following features are considered as critical in qualitative research?
- Collecting data with the help of standardized research tools.
 - Design sampling with probability sample techniques.
 - Collecting data with bottom-up empirical evidence.
 - Gathering data with top-down schematic evidence.
41. Tippet table refers to as _____
- Table of random digits
 - The table used in sampling methods
 - The table used in statistical investigations
 - All of the above
42. What are the conditions in which Type-I error occurs?
- The null hypotheses get accepted even if it is false
 - The null hypotheses get rejected even if it is true
 - Both the null hypotheses as well as alternative hypotheses are rejected
 - None of the above
43. Research and Development become the index of development of the country. Which of the following reasons are true with regards to this statement?
- R&D targets human development
 - R&D can enhance people's standard of living in the country
 - R&D reflects the actual economic and social conditions being prevailed in the country
 - All the above
44. What is the main aim of interdisciplinary research?
- To over simplify the problem of research
 - To bring out the holistic approach to research
 - To create a new trend in research methodology
 - To reduce the emphasis on a single subject in the research domain
45. A researcher is interested in studying the prospects of a particular political party in an urban area. So, what tool should he prefer for the study?
- Rating Scale
 - Interview
 - Questionnaire
 - Schedule
46. The conclusions/findings of which type of research cannot be generalized to other situations?
- Casual Comparative Research
 - Historical Research
 - Descriptive Research
 - Experimental Research
47. Which one is called non-probability sampling?
- Quota sampling
 - Cluster sampling
 - Systematic sampling
 - Stratified random sampling
48. What are the core elements of a dissertation?
- Introduction; Data Collection; Data Analysis; Conclusions and Recommendations
 - Executive Summary; Literature Review; Data Gathered; Conclusions; Bibliography
 - Research Plan; Research Data; Analysis; References
 - Introduction; Literature Review; Research Methodology; Results; Discussions and Conclusions
49. The "Sociogram" technique is used to study _____
- Vocational Interest
 - Human Relations
 - Professional Competence
 - Achievement Motivation

50. Action-research can be understood as _____
- A longitudinal research
 - An applied research
 - A kind of research being carried out to solve a specific problem
 - All of the above

(PART-B)

51. In a network graph, the incidence matrix represents the relationship between:
- Loops and branches
 - Nodes and branches
 - Nodes and loops
 - Sources and loads
52. Which network theorem states that the current or voltage in a linear circuit can be determined by considering the effect of each independent source separately and then adding the individual effects?
- Thevenin's theorem
 - Norton's theorem
 - Superposition theorem
 - Maximum Power Transfer theorem
53. For maximum power transfer from a network to a resistive load, the load resistance R_L should be:
- Zero
 - Equal to the source resistance R_{th}
 - Twice the source resistance R_{th}
 - Infinite
54. Which transform is particularly useful for solving network equations involving RLC circuits and initial conditions?
- Fourier transform
 - Z-transform
 - Laplace transform
 - Hilbert transform
55. In sinusoidal steady-state analysis, a sinusoidal voltage or current is commonly represented using:
- Boolean variables
 - Phasors
 - Truth tables
 - State-transition diagrams
56. At absolute zero temperature, the valence band of an intrinsic silicon crystal is:
- Completely empty
 - Completely filled
 - Half-filled
 - Partially filled
57. Which impurity is commonly used as a donor in silicon to produce **n-type** semiconductor?
- Boron
 - Aluminium
 - Phosphorus
 - Gallium
58. The current produced in a semiconductor due to the movement of charge carriers under an applied electric field is called:
- Diffusion current

- B. Drift current
 - C. Generation current
 - D. Current
59. Diffusion current in a semiconductor occurs primarily due to:
- A. Applied electric field
 - B. Temperature-independent carrier motion
 - C. Carrier concentration gradient
 - D. Magnetic field
60. The mobility of charge carriers in a semiconductor is defined as the ratio of:
- A. Current density to electric field
 - B. Drift velocity to electric field
 - C. Electric field to drift velocity
 - D. Resistivity to conductivity
61. The depletion region of a p-n junction primarily contains:
- A. Large numbers of free electrons and holes
 - B. Immobile ionized donor and acceptor ions
 - C. Only electrons
 - D. Only holes
62. In a conventional BJT, the emitter is generally:
- A. Lightly doped and thin
 - B. Heavily doped
 - C. Undoped
 - D. Reverse biased with respect to the base
63. In an n-channel enhancement MOSFET, an inversion layer is formed when:
- A. The gate voltage is sufficiently negative
 - B. The gate voltage exceeds the threshold voltage positively
 - C. The drain voltage becomes zero
 - D. The substrate is heavily doped with donors
64. Light emission in an LED primarily occurs due to:
- A. Impact ionization
 - B. Electron-hole recombination
 - C. diffusion only
 - D. Zener breakdown
65. In semiconductor fabrication, photolithography is primarily used to:
- A. Increase carrier mobility
 - B. Define and transfer patterns onto the wafer surface
 - C. Reduce the band gap of silicon
 - D. Generate minority carriers
66. The twin-tub CMOS process is advantageous because it:
- A. Uses only n-type transistors
 - B. Uses only p-type transistors
 - C. Allows independent optimization of n-well and p-well regions
 - D. Eliminates the need for photolithography
67. In the small-signal model of a forward-biased diode, the diode is primarily represented by:
- A. A voltage source only
 - B. A dynamic resistance
 - C. A capacitor only
 - D. An ideal current source
68. The small-signal drain current of a MOSFET operating in the saturation region is primarily controlled by:
- A. Gate-source voltage variation
 - B. Drain-source voltage only

- C. Gate current
 - D. Substrate current
69. The main function of a clamper circuit is to:
- A. Change the frequency of a signal
 - B. the amplitude without changing the DC level
 - C. the DC level of an AC waveform
 - D. Amplify the input signal
70. A full-wave rectifier converts:
- A. DC into AC
 - B. AC into pulsating DC using both half cycles
 - C. AC into pure DC without filtering
 - D. DC into pulsating AC
71. The primary purpose of biasing a transistor amplifier is to:
- A. Increase the supply voltage
 - B. Establish a suitable operating point
 - C. Eliminate the transistor
 - D. Increase the frequency of the input signal
72. Negative feedback in an amplifier generally:
- A. Increases distortion
 - B. Reduces bandwidth
 - C. Improves stability and reduces distortion
 - D. Makes the amplifier unstable
73. The voltage gain of an ideal inverting op-amp amplifier is given by:
- A. R_f/R_{in}
 - B. $-R_f/R_{in}$
 - C. $(1+ R_f/R_{in})$
 - D. $-R_{in}/R_f$
74. The bandwidth of an amplifier is generally defined as the frequency range between:
- A. Zero and resonant frequency
 - B. Lower and upper 3-dB frequencies
 - C. DC and lower cutoff frequency
 - D. Carrier and modulation frequencies
75. According to the Barkhausen criterion, sustained oscillations require the loop gain to satisfy:
- A. $A\beta=0$
 - B. $|A\beta|<1$
 - C. $|A\beta|=1$ with zero net phase shift
 - D. $|A\beta|>10$
76. In the astable mode, a 555 timer is commonly used to generate:
- A. A continuous square-wave signal
 - B. A pure DC signal
 - C. A fixed reference voltage only
 - D. A sinusoidal signal only
77. In a regulated DC power supply, the primary purpose of the voltage regulator is to:
- A. Convert DC into AC
 - B. Maintain a relatively constant output voltage despite variations in input or load
 - C. Increase ripple voltage
 - D. Eliminate the transformer
78. Which digital IC family generally has very low static power dissipation and high input impedance?
- A. TTL
 - B. CMOS
 - C. ECL

- D. DTL
79. A 4-to-1 multiplexer requires how many select lines?
- A. 1
 - B. 2
 - C. 3
 - D. 4
80. Which of the following is a universal logic gate?
- A. AND
 - B. OR
 - C. NAND
 - D. XOR
81. Which flip-flop is commonly used to eliminate the invalid state associated with the SR flip-flop?
- A. D flip-flop
 - B. T flip-flop
 - C. JK flip-flop
 - D. RS latch
82. A 4-bit binary counter can have a maximum of how many distinct states?
- A. 4
 - B. 8
 - C. 16
 - D. 32
83. A shift register is primarily used for:
- A. Data storage and serial/parallel data transfer
 - B. Voltage amplification
 - C. Frequency modulation only
 - D. Analog signal generation
84. Which type of semiconductor memory is volatile?
- A. ROM
 - B. PROM
 - C. RAM
 - D. EPROM
85. The primary purpose of interfacing in the 8085 microprocessor is to:
- A. Increase the clock frequency
 - B. Connect the microprocessor with memory and peripheral devices
 - C. Reduce the size of the ALU
 - D. Replace the accumulator
86. The Laplace transform of a unit impulse signal $\delta(t)$ is:
- A. 0
 - B. 1
 - C. $1/s$
 - D. s
87. The primary advantage of the Fast Fourier Transform (FFT) over direct computation of the DFT is:
- A. Higher sampling frequency
 - B. Reduced computational complexity
 - C. Elimination of frequency components
 - D. Conversion of analog signals into digital signals
88. According to the Nyquist sampling theorem, a band-limited signal with maximum frequency f_m should be sampled at a frequency:
- A. $f_s < f_m$
 - B. $f_s = f_m/2$
 - C. $f_s \geq 2f_m$

- D. $f_s \leq 2f_m$
89. For a stable continuous-time LTI system, the poles of a rational system function must lie:
- A. On the imaginary axis only
 - B. the right-half s-plane
 - C. In the left-half s-plane
 - D. the origin only
90. The main characteristic of a closed-loop control system is that it:
- A. Does not use feedback
 - B. Uses feedback to compare the output with the reference input
 - C. Always has zero error
 - D. Cannot become unstable
91. Mason's gain formula is primarily used to determine the:
- A. Stability margin only
 - B. Transfer function from a signal flow graph
 - C. Frequency response only
 - D. Time constant of a system
92. Which component of a PID controller primarily helps eliminate steady-state error?
- A. Proportional component
 - B. Integral component
 - C. Derivative component
 - D. Feedback component
93. In frequency modulation (FM), the information signal primarily varies the:
- A. Amplitude of the carrier
 - B. Frequency of the carrier
 - C. Phase of the carrier only
 - D. Power supply voltage
94. In Pulse Code Modulation (PCM), the basic sequence of operations is:
- A. Modulation $\rightarrow$ amplification $\rightarrow$ filtering
 - B. Sampling $\rightarrow$ quantization $\rightarrow$ encoding
 - C. Encoding $\rightarrow$ sampling $\rightarrow$ amplification
 - D. Quantization $\rightarrow$ modulation $\rightarrow$ sampling
95. In Phase Shift Keying (PSK), digital information is represented by changing the:
- A. Carrier amplitude
 - B. Carrier frequency
 - C. Carrier phase
 - D. Sampling frequency
96. For a uniform plane electromagnetic wave propagating in a lossless medium, the electric and magnetic fields are:
- A. Parallel to each other
 - B. Perpendicular to each other and to the direction of propagation
 - C. Parallel to the direction of propagation
 - D. Independent of each other
97. S-parameters are particularly useful for characterizing:
- A. High-frequency and microwave networks
 - B. DC power supplies only
 - C. Digital logic gates only
 - D. Low-frequency transformers only
98. The cut-off frequency of a mode in a rectangular waveguide depends primarily on:
- A. Waveguide dimensions and mode indices
 - B. Antenna gain only
 - C. Dielectric loss only
 - D. Transmitted power only

--

99. The basic principle responsible for guiding light through an optical fiber is:
- A. Diffraction
 - B. Total internal reflection
 - C. Polarization
 - D. Electromagnetic induction
100. The radiation pattern of an ideal half-wave dipole antenna in free space is approximately:
- A. Omnidirectional in all three dimensions
 - B. Doughnut-shaped
 - C. Highly directional along the antenna axis
 - D. Circularly symmetric along its axis

=== END OF PAPER ===

Answer Key of Research Methodology

- 1. a**
- 2. c**
- 3. c**
- 4. b**
- 5. b**
- 6. d**
- 7. a**
- 8. a**
- 9. b**
- 10. d**
- 11. c**
- 12. b**
- 13. c**
- 14. b**
- 15. b**
- 16. a**
- 17. b**
- 18. a**
- 19. c**
- 20. b**
- 21. b**
- 22. d**
- 23. c**
- 24. d**
- 25. d**

- 26. a**
- 27. b**
- 28. b**
- 29. c**
- 30. d**
- 31. a**
- 32. c**
- 33. c**
- 34. b**
- 35. d**
- 36. d**
- 37. b**
- 38. d**
- 39. b**
- 40. c**
- 41. d**
- 42. b**
- 43. d**
- 44. b**
- 45. c**
- 46. b**
- 47. a**
- 48. d**
- 49. b**
- 50. c**

Answer Key Ph. D Entrance Exam (July Session -2026)
Skill Department of Industry 4.0, Skill Faculty of Engineering and Technology

Time: 01 hour

Total Marks- 50 (1×50)

Question 51: In a network graph, the incidence matrix represents the relationship between:

- A) Loops and branches
- B) Nodes and branches
- C) Nodes and loops
- D) Sources and loads

Answer: B) Nodes and branches

Question 52: Which network theorem states that the current or voltage in a linear circuit can be determined by considering the effect of each independent source separately and then adding the individual effects?

- A) Thevenin's theorem
- B) Norton's theorem
- C) Superposition theorem
- D) Maximum Power Transfer theorem

Answer: C) Superposition theorem

Question 53: For maximum power transfer from a network to a resistive load, the load resistance R_L should be:

- A) Zero
- B) Equal to the source resistance R_{th}
- C) Twice the source resistance R_{th}
- D) Infinite

Answer: B) Equal to the source resistance R_{th}

Question 54: Which transform is particularly useful for solving network equations involving RLC circuits and initial conditions?

- A) Fourier transform
- B) Z-transform
- C) Laplace transform
- D) Hilbert transform

Answer: C) Laplace transform

Question 55: In sinusoidal steady-state analysis, a sinusoidal voltage or current is commonly represented using:

- A) Boolean variables
- B) Phasors
- C) Truth tables
- D) State-transition diagrams

Answer: B) Phasors

Question 56: At absolute zero temperature, the valence band of an intrinsic silicon crystal is:

- A. Completely empty
- B. Completely filled
- C. Half-filled
- D. Partially filled

Answer: B. Completely filled

Question 57: Which impurity is commonly used as a donor in silicon to produce **n-type** semiconductor?

- A. Boron
- B. Aluminium
- C. Phosphorus
- D. Gallium

Answer: C. Phosphorus

Question 58: The current produced in a semiconductor due to the movement of charge carriers under an applied electric field is called:

- A. Diffusion current
- B. Drift current
- C. Generation current
- D. Recombination current

Answer: B. Drift current

Question 59: Diffusion current in a semiconductor occurs primarily due to:

- A. Applied electric field
- B. Temperature-independent carrier motion
- C. Carrier concentration gradient
- D. Magnetic field

Answer: C. Carrier concentration gradient

Question 60: The mobility of charge carriers in a semiconductor is defined as the ratio of:

- A. Current density to electric field
- B. Drift velocity to electric field
- C. Electric field to drift velocity
- D. Resistivity to conductivity

Answer: B. Drift velocity to electric field

Question 61: The depletion region of a p-n junction primarily contains:

- A. Large numbers of free electrons and holes
- B. Immobile ionized donor and acceptor ions
- C. Only electrons
- D. Only holes

Answer: B. Immobile ionized donor and acceptor ions

Question 62: In a conventional BJT, the emitter is generally:

- A. Lightly doped and thin
- B. Heavily doped
- C. Undoped
- D. Reverse biased with respect to the base

Answer: B. Heavily doped

Question 63: In an n-channel enhancement MOSFET, an inversion layer is formed when:

- A. The gate voltage is sufficiently negative
- B. The gate voltage exceeds the threshold voltage positively
- C. The drain voltage becomes zero
- D. The substrate is heavily doped with donors

Answer: B. The gate voltage exceeds the threshold voltage positively

Question 64: Light emission in an LED primarily occurs due to:

- A. Impact ionization
- B. Electron-hole recombination
- C. Carrier diffusion only
- D. Zener breakdown

Answer: B. Electron-hole recombination

Question 65: In semiconductor fabrication, photolithography is primarily used to:

- A. Increase carrier mobility
- B. Define and transfer patterns onto the wafer surface
- C. Reduce the band gap of silicon
- D. Generate minority carriers

Answer: B. Define and transfer patterns onto the wafer surface

Question 66: The twin-tub CMOS process is advantageous because it:

- A. Uses only n-type transistors
- B. Uses only p-type transistors
- C. Allows independent optimization of n-well and p-well regions
- D. Eliminates the need for photolithography

Answer: C. Allows independent optimization of n-well and p-well regions

Question 67: In the small-signal model of a forward-biased diode, the diode is primarily represented by:

- A. A voltage source only
- B. A dynamic resistance
- C. A capacitor only
- D. An ideal current source

Answer: B. A dynamic resistance

Question 68: The small-signal drain current of a MOSFET operating in the saturation region is primarily controlled by:

- A. Gate-source voltage variation

- B. Drain-source voltage only
- C. Gate current
- D. Substrate current

Answer: A. Gate-source voltage variation

Question 69: The main function of a clamper circuit is to:

- A. Change the frequency of a signal
- B. Change the amplitude without changing the DC level
- C. Shift the DC level of an AC waveform
- D. Amplify the input signal

Answer: C. Shift the DC level of an AC waveform

Question 70: A full-wave rectifier converts:

- A. DC into AC
- B. AC into pulsating DC using both half cycles
- C. AC into pure DC without filtering
- D. DC into pulsating AC

Answer: B. AC into pulsating DC using both half cycles

Question 71: The primary purpose of biasing a transistor amplifier is to:

- A. Increase the supply voltage
- B. Establish a suitable operating point
- C. Eliminate the transistor
- D. Increase the frequency of the input signal

Answer: B. Establish a suitable operating point

Question 72: Negative feedback in an amplifier generally:

- A. Increases distortion
- B. Reduces bandwidth
- C. Improves stability and reduces distortion
- D. Makes the amplifier unstable

Answer: C. Improves stability and reduces distortion

Question 73: The voltage gain of an ideal inverting op-amp amplifier is given by:

- A. R_f/R_{in}
- B. $-R_f/R_{in}$
- C. $(1 + R_f/R_{in})$
- D. $-R_{in}/R_f$

Answer: B. $-R_f/R_{in}$

Question 74: The bandwidth of an amplifier is generally defined as the frequency range between:

- A. Zero and resonant frequency
- B. Lower and upper 3-dB frequencies
- C. DC and lower cutoff frequency
- D. Carrier and modulation frequencies

Answer: B. Lower and upper 3-dB frequencies

Question 75: According to the Barkhausen criterion, sustained oscillations require the loop gain to satisfy:

- A. $A\beta=0$
- B. $|A\beta|<1$
- C. $|A\beta|=1$ with zero net phase shift
- D. $|A\beta|>10$

Answer: C. $|A\beta|=1$ with zero net phase shift

Question 76: In the astable mode, a 555 timer is commonly used to generate:

- A. A continuous square-wave signal
- B. A pure DC signal
- C. A fixed reference voltage only
- D. A sinusoidal signal only

Answer: A. A continuous square-wave signal

Question 77: In a regulated DC power supply, the primary purpose of the voltage regulator is to:

- A. Convert DC into AC
- B. Maintain a relatively constant output voltage despite variations in input or load
- C. Increase ripple voltage
- D. Eliminate the transformer

Answer: B. Maintain a relatively constant output voltage despite variations in input or load

Question 78: Which digital IC family generally has very low static power dissipation and high input impedance?

- A. TTL
- B. CMOS
- C. ECL
- D. DTL

Answer: B. CMOS

Question 79: A 4-to-1 multiplexer requires how many select lines?

- A. 1
- B. 2
- C. 3
- D. 4

Answer: B. 2

Question 80: Which of the following is a universal logic gate?

- A. AND
- B. OR
- C. NAND
- D. XOR

Answer: C. NAND

Question 81: Which flip-flop is commonly used to eliminate the invalid state associated with the SR flip-flop?

- A. D flip-flop
- B. T flip-flop
- C. JK flip-flop
- D. RS latch

Answer: C. JK flip-flop

Question 82: A 4-bit binary counter can have a maximum of how many distinct states?

- A. 4
- B. 8
- C. 16
- D. 32

Answer: C. 16

Question 83: A shift register is primarily used for:

- A. Data storage and serial/parallel data transfer
- B. Voltage amplification
- C. Frequency modulation only
- D. Analog signal generation

Answer: A. Data storage and serial/parallel data transfer

Question 84: Which type of semiconductor memory is volatile?

- A. ROM
- B. PROM
- C. RAM
- D. EPROM

Answer: C. RAM

Question 85: The primary purpose of interfacing in the 8085 microprocessor is to:

- A. Increase the clock frequency
- B. Connect the microprocessor with memory and peripheral devices
- C. Reduce the size of the ALU
- D. Replace the accumulator

Answer: B. Connect the microprocessor with memory and peripheral devices

Question 66: The Laplace transform of a unit impulse signal $\delta(t)$ is:

- A. 0
- B. 1
- C. $1/s$
- D. s

Answer: B. 1

Question 87: The primary advantage of the Fast Fourier Transform (FFT) over direct computation of the DFT is:

- A. Higher sampling frequency
- B. Reduced computational complexity
- C. Elimination of frequency components
- D. Conversion of analog signals into digital signals

Answer: B. Reduced computational complexity

Question 88: According to the Nyquist sampling theorem, a band-limited signal with maximum frequency f_m should be sampled at a frequency:

- A. $f_s < f_m$
- B. $f_s = f_m/2$
- C. $f_s \geq 2f_m$
- D. $f_s \leq 2f_m$

Answer: C. $f_s \geq 2f_m$

Question 89 For a stable continuous-time LTI system, the poles of a rational system function must lie:

- A. On the imaginary axis only
- B. In the right-half s-plane
- C. In the left-half s-plane
- D. At the origin only

Answer: C. In the left-half s-plane

Question 90 The main characteristic of a closed-loop control system is that it:

- A. Does not use feedback
- B. Uses feedback to compare the output with the reference input
- C. Always has zero error
- D. Cannot become unstable

Answer: B. Uses feedback to compare the output with the reference input

Question 91 Mason's gain formula is primarily used to determine the:

- A. Stability margin only
- B. Transfer function from a signal flow graph
- C. Frequency response only
- D. Time constant of a system

Answer: B. Transfer function from a signal flow graph

Question 92: Which component of a PID controller primarily helps eliminate steady-state error?

- A. Proportional component
- B. Integral component
- C. Derivative component
- D. Feedback component

Answer: B. Integral component

Question 93: In frequency modulation (FM), the information signal primarily varies the:

- A. Amplitude of the carrier
- B. Frequency of the carrier
- C. Phase of the carrier only
- D. Power supply voltage

Answer: B. Frequency of the carrier

Question 94: In Pulse Code Modulation (PCM), the basic sequence of operations is:

- A. Modulation → amplification → filtering
- B. Sampling → quantization → encoding
- C. Encoding → sampling → amplification
- D. Quantization → modulation → sampling

Answer: B. Sampling → quantization → encoding

Question 95: In Phase Shift Keying (PSK), digital information is represented by changing the:

- A. Carrier amplitude
- B. Carrier frequency
- C. Carrier phase
- D. Sampling frequency

Answer: C. Carrier phase

Question 96: For a uniform plane electromagnetic wave propagating in a lossless medium, the electric and magnetic fields are:

- A. Parallel to each other
- B. Perpendicular to each other and to the direction of propagation
- C. Parallel to the direction of propagation
- D. Independent of each other

Answer: B. Perpendicular to each other and to the direction of propagation

Question 97: S-parameters are particularly useful for characterizing:

- A. High-frequency and microwave networks
- B. DC power supplies only
- C. Digital logic gates only
- D. Low-frequency transformers only

Answer: A. High-frequency and microwave networks

Question 98: The cut-off frequency of a mode in a rectangular waveguide depends primarily on:

- A. Waveguide dimensions and mode indices
- B. Antenna gain only
- C. Dielectric loss only
- D. Transmitted power only

Answer: A. Waveguide dimensions and mode indices

Question 99: The basic principle responsible for guiding light through an optical fiber is:

- A. Diffraction
- B. Total internal reflection
- C. Polarization
- D. Electromagnetic induction

Answer: B. Total internal reflection

Question 100: The radiation pattern of an ideal half-wave dipole antenna in free space is approximately:

- A. Omnidirectional in all three dimensions
- B. Doughnut-shaped
- C. Highly directional along the antenna axis
- D. Circularly symmetric along its axis

Answer: B. Doughnut-shaped

‘END OF PAPER’