

Test Booklet Series



Test Booklet
(Electrical Engineering)

Test Booklet No.

Name of Applicant

Answer Sheet No.

Applicant ID/Roll No. :

Signature of Applicant :

Date of Examination :

Signature of the Invigilator(s)

Time of Examination :

1.

2.

Duration : 2 Hour]

[Maximum Marks : 100

IMPORTANT INSTRUCTIONS

- (i) The question paper is in the form of Test-Booklet containing **100 (Hundred)** questions. All questions are compulsory. Each question carries four answers marked (A), (B), (C) and (D), out of which only one is correct. Choose the correct option or the most appropriate option.
- (ii) 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. Discrepancy, if any, should be reported by the candidate to the invigilator immediately after receiving the Test-Booklet.
- (iii) 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.
- (iv) The candidate should write his/her Application ID/Roll number at the places provided on the cover page of the Test-Booklet/Question Paper and on the Answer-Sheet and NOWHERE ELSE.
- (v) 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.
- (vi) For every correct answer of the question **One (1) mark will be awarded**.
- (vii) Marking shall be done only on the basis of answers responded on the Answer-Sheet.
- (viii) 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.
- (ix) 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 answer will be treated as incorrect.
- (x) 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.
- (xi) Rough work may be done on the blank space provided in the Test-Booklet/Question Paper only.
- (xii) *Mobile phones (even in Switch-off mode) and such other communication/programmable devices are not allowed inside the examination hall.*
- (xiii) 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
(Research Methodology)

1. The main objective of fundamental/basic research is:
(A) To solve an immediate practical problem
(B) To discover new facts and develop theories
(C) To evaluate existing social programs
(D) To study historical events

2. The scientific method of research is characterized by:
(A) Subjectivity and intuition
(B) Empiricism, objectivity, and replicability
(C) Relying solely on authority
(D) Lack of logical reasoning

3. While selecting a research topic, which of the following is the LEAST important consideration?
(A) Feasibility of the study
(B) Researcher's interest
(C) Availability of funds and time
(D) Personal biases of the researcher

4. The ethical principle of "Informed Consent" implies that:
(A) Participants must be forced to participate for the greater good
(B) Participants must be fully aware of the research procedures and agree voluntarily
(C) Researchers can hide the true purpose of the study to avoid bias
(D) Data can be shared publicly without participant knowledge

5. Fabrication, falsification, and plagiarism in research are collectively known as:
(A) Research misconduct
(B) Sampling error
(C) Ethical compliance
(D) Research methodology

6. Which research design is primarily concerned with describing the characteristics of a population or phenomenon?
(A) Exploratory research design
(B) Descriptive research design
(C) Experimental research design
(D) Diagnostic research design

7. In an experimental research design, the variable that is intentionally manipulated by the researcher is the:
(A) Dependent variable
(B) Extraneous variable
(C) Independent variable
(D) Control variable

8. Research conducted to find out the causes of an event that has already happened, without manipulating variables, is known as:
- (A) Action research (B) Ex-post facto research
(C) Applied research (D) Pure research
9. The "Control Group" in an experimental design is used to:
- (A) Introduce the experimental treatment
(B) Serve as a baseline for comparison with the experimental group
(C) Eliminate the dependent variable
(D) Increase the sample size
10. Deductive reasoning in the scientific method moves from:
- (A) Specific observations to general theories
(B) General theories to specific hypotheses
(C) Empirical data to conceptualization
(D) Null hypothesis to alternative hypothesis
11. Internal validity in an experimental design refers to:
- (A) The generalizability of the findings to the real world
(B) The certainty that the independent variable caused the changes in the dependent variable
(C) The consistency of the measuring instrument
(D) The representativeness of the sample
12. If every member of the population has an equal and independent chance of being selected, the sampling technique is called:
- (A) Purposive sampling (B) Convenience sampling
(C) Simple random sampling (D) Quota sampling
13. When the population is heterogeneous with distinct subgroups (strata), the most appropriate probability sampling technique is:
- (A) Simple random sampling (B) Stratified random sampling
(C) Cluster sampling (D) Snowball sampling

- 14.** In cluster sampling, the sampling units selected are:
- (A) Individual elements
 - (B) Natural groupings or categories (e.g., districts, schools)
 - (C) Homogeneous subgroups
 - (D) Volunteers
- 15.** Snowball sampling is specifically used when:
- (A) The population size is very large
 - (B) The sampling frame is readily available
 - (C) The population is hidden, rare, or difficult to access
 - (D) The researcher needs a perfectly representative sample
- 16.** The difference between a sample statistic and the true population parameter is termed as:
- (A) Systematic error
 - (B) Sampling error
 - (C) Measurement error
 - (D) Non-sampling error
- 17.** Which measurement scale classifies data into mutually exclusive categories without any order or ranking?
- (A) Ordinal scale
 - (B) Interval scale
 - (C) Nominal scale
 - (D) Ratio scale
- 18.** A Likert scale (Strongly Disagree to Strongly Agree) is technically an example of:
- (A) Nominal scale
 - (B) Ordinal scale
 - (C) Interval scale
 - (D) Ratio scale
- 19.** Which scaling technique asks respondents to rate an object on a series of bipolar adjectives (e.g., Good-Bad, Fast-Slow)?
- (A) Likert scale
 - (B) Guttman scale
 - (C) Semantic Differential scale
 - (D) Thurstone scale

- 20.** The key difference between a questionnaire and a schedule is:
- (A) A questionnaire is filled by the enumerator, a schedule is filled by the respondent
 - (B) A questionnaire is filled by the respondent, a schedule is filled by the enumerator/ interviewer
 - (C) A schedule is mailed, a questionnaire is given face-to-face
 - (D) There is no difference between them
- 21.** Data collected by the researcher themselves for the specific purpose of the current study is called:
- (A) Secondary data
 - (B) Primary data
 - (C) Official data
 - (D) Documentary data
- 22.** The process of checking the raw data to ensure completeness, accuracy, and consistency before analysis is called:
- (A) Coding
 - (B) Editing
 - (C) Tabulation
 - (D) Classification
- 23.** Assigning numerical values or symbols to the responses for computational purposes is known as:
- (A) Editing
 - (B) Coding
 - (C) Transcription
 - (D) Tabulation
- 24.** A histogram is used to graphically represent the distribution of:
- (A) Discrete/categorical data
 - (B) Continuous data grouped into class intervals
 - (C) Qualitative characteristics
 - (D) Proportions of a whole
- 25.** A pie chart is most effective for representing:
- (A) Trends over time
 - (B) The relationship between two continuous variables
 - (C) The percentage breakdown of a whole
 - (D) Frequency distribution of continuous data

26. A hypothesis that states there is no significant difference or relationship is called:
- (A) Directional hypothesis
 - (B) Non-directional hypothesis
 - (C) Null hypothesis
 - (D) Alternative hypothesis
27. "Students who study using method A will score significantly higher than those who study using method B." This is an example of:
- (A) Null hypothesis
 - (B) Directional alternative hypothesis
 - (C) Non-directional alternative hypothesis
 - (D) Ex-post facto hypothesis
28. A Type I error in hypothesis testing occurs when:
- (A) We fail to reject a true null hypothesis
 - (B) We reject a true null hypothesis
 - (C) We fail to reject a false null hypothesis
 - (D) We reject a false null hypothesis
29. The probability of committing a Type I error is denoted by:
- (A) Beta (β)
 - (B) Alpha (α)
 - (C) P-value
 - (D) Standard error
30. A statistical test that makes assumptions about the population parameters (like normal distribution, homogeneity of variance) is called:
- (A) Non-parametric test
 - (B) Parametric test
 - (C) Chi-square test
 - (D) Distribution-free test
31. The Chi-square (χ^2) test is primarily used to test:
- (A) The difference between means of two groups
 - (B) The association between two categorical variables
 - (C) The significance of regression coefficients
 - (D) The variance within a single group

32. In a Chi-square test of independence, if the calculated value of χ^2 is greater than the critical/ table value at the 0.05 level, we:
- (A) Accept the null hypothesis
 - (B) Reject the null hypothesis
 - (C) Conclude the variables are independent
 - (D) Conclude the sample is biased
33. The formula for calculating expected frequency (E) in a Chi-square contingency table cell is:
- (A) (Row Total $\times$ Column Total) / Grand Total
 - (B) (Row Total + Column Total) / Grand Total
 - (C) Grand Total / (Row Total $\times$ Column Total)
 - (D) Row Total / Column Total
34. Analysis of Variance (ANOVA) is used instead of multiple t-tests to compare the means of three or more groups because:
- (A) ANOVA is easier to calculate
 - (B) Multiple t-tests increase the risk of Type I error
 - (C) ANOVA does not require normal distribution
 - (D) ANOVA uses nominal data
35. In a one-way ANOVA, the "one way" refers to:
- (A) One dependent variable and one independent variable with multiple levels
 - (B) One independent variable and multiple dependent variables
 - (C) Only one sample being tested
 - (D) One-tailed test of significance
36. The F-ratio in One-way ANOVA is calculated as:
- (A) Within-group variance / Between-group variance
 - (B) Between-group variance / Within-group variance
 - (C) Total variance / Residual variance
 - (D) Mean square error / Mean square total
37. The degrees of freedom for "Between Groups" in a One-Way ANOVA with 'k' groups is:
- (A) $N - 1$
 - (B) $N - k$
 - (C) $k - 1$
 - (D) $(N - 1) - (k - 1)$

38. Which of the following is a non-parametric alternative to One-way ANOVA?
- (A) Kruskal-Wallis test (B) Mann-Whitney U test
(C) Wilcoxon signed-rank test (D) Chi-square goodness of fit
39. A multivariate statistical technique used to reduce a large number of interrelated variables to a smaller set of unobservable factors is:
- (A) Cluster Analysis (B) Factor Analysis
(C) Discriminant Analysis (D) Conjoint Analysis
40. In Factor Analysis, the proportion of variance in a specific variable explained by the common factors is called:
- (A) Communality (B) Eigenvalue
(C) Factor loading (D) Uniqueness
41. Which concept in Factor Analysis represents the total variance explained by a specific factor across all variables?
- (A) Communality (B) Eigenvalue
(C) Factor score (D) Rotation
42. Multiple Regression is used to:
- (A) Classify objects into groups
(B) Predict the value of a dependent variable based on two or more independent variables
(C) Reduce the number of variables
(D) Determine the association between two categorical variables
43. In Multiple Regression, the coefficient of multiple determination (R^2) represents:
- (A) The correlation between two independent variables
(B) The proportion of variance in the dependent variable explained by all independent variables
(C) The regression coefficient of the strongest predictor
(D) The standard error of the estimate
44. Pearson's correlation coefficient (r) measures:
- (A) The causal relationship between two variables
(B) The linear association between two continuous variables
(C) The association between two categorical variables
(D) The variance of a single variable

45. If the Pearson correlation coefficient between X and Y is -0.85 , it indicates:
- (A) A weak positive relationship (B) A strong positive relationship
(C) A strong negative relationship (D) No relationship
46. Which multivariate technique is used to group objects or individuals so that objects in the same group are highly similar to each other but different from objects in other groups?
- (A) Discriminant Analysis (B) Factor Analysis
(C) Cluster Analysis (D) Conjoint Analysis
47. The main difference between Cluster Analysis and Discriminant Analysis is that:
- (A) Cluster analysis requires predefined groups, discriminant analysis does not
(B) Discriminant analysis requires predefined groups, cluster analysis does not
(C) Cluster analysis uses metric data, discriminant analysis uses non-metric
(D) Discriminant analysis is for data reduction, cluster analysis is for prediction
48. Conjoint Analysis is primarily used in marketing research to:
- (A) Determine the optimal number of clusters
(B) Measure how consumers value different features of a product by analyzing trade-offs
(C) Reduce the dimensions of product features
(D) Classify customers into predefined demographic groups
49. The standard format for writing a quantitative research report is generally known by the acronym:
- (A) IMRAD (Introduction, Method, Results, And Discussion)
(B) PEST (Political, Economic, Social, Technological)
(C) SWOT (Strengths, Weaknesses, Opportunities, Threats)
(D) APA (American Psychological Association)
50. Which section of the research report contains a brief summary of the entire study, including the problem, methodology, major findings, and conclusions?
- (A) Introduction (B) Abstract/Executive Summary
(C) Literature Review (D) Discussion

PART-B
(Electrical Engineering)

- 51.** The aim of elimination steps in the Gauss elimination method is to reduce the coefficient matrix to _____
- (A) Diagonal (B) Identity
(C) Lower triangular (D) Upper triangular
- 52.** What is the principle of factorization?
- (A) There exists no inverse for a singular matrix
(B) The determinant of an identity matrix is one
(C) Every square matrix can be expressed as a product of a lower triangular matrix and an upper triangular matrix
(D) Every matrix can be expressed as a sum of a skew-symmetric and a symmetric matrix
- 53.** Matrix which does not have an inverse by solving it, is classified as which of the following?
- (A) unidentified matrix (B) linear matrix
(C) non-singular matrix (D) singular matrix
- 54.** If the mean and the mode are given as 35 and 30. Find the Median.
- (A) 75 (B) 33.33
(C) 19 (D) 32
- 55.** Which of these is not a discrete probability distribution?
- (A) Hypergeometric Distribution (B) Binomial Distribution
(C) Normal Distribution (D) Poisson Distribution
- 56.** The Q-factor of a resonant circuit is
- (A) Bandwidth / Resonant frequency (B) Resonant frequency / Bandwidth
(C) Reactance / Resistance (D) None of these

57. A voltage waveform $V(t) = 12t^2$ is applied across a 1 H inductor for $t \geq 0$, with initial electric current through it being zero. The electric current through the inductor for $t \geq 0$ is given by ____
- (A) $12t$ (B) $24t$
(C) $12t^3$ (D) $4t^3$
58. If the resistors of star connected system are Z_R, Z_Y, Z_B then the impedance Z_{RY} in delta connected system will be
- (A) $(Z_R Z_Y + Z_Y Z_B + Z_B Z_R)/Z_B$ (B) $(Z_R Z_Y + Z_Y Z_B + Z_B Z_R)/Z_Y$
(C) $(Z_R Z_Y + Z_Y Z_B + Z_B Z_R)/Z_R$ (D) $(Z_R Z_Y + Z_Y Z_B + Z_B Z_R)/(Z_R + Z_Y)$
59. A periodic voltage $v(t) = 1 + 4 \sin \omega t + 2 \cos \omega t$ is applied across a 1Ω resistance. The power dissipated is _____
- (A) 1 W (B) 11 W
(C) 21 W (D) 24.5 W
60. In a time-varying magnetic field, an electric field is induced according to:
- (A) Gauss's Law (B) Ampere's Law
(C) Faraday's Law (D) Ohm's Law
61. Which of the following is true for electromagnetic waves in a vacuum?
- (A) They require a medium for propagation
(B) They travel at the speed of light
(C) They propagate in only one direction
(D) They are longitudinal waves
62. The relationship between the electric field (E), magnetic field (B), and the direction of wave propagation (k) in an electromagnetic wave is:
- (A) $E \times B = 0$
(B) E, B, and k are all parallel
(C) E, B, and k are mutually perpendicular
(D) E and B are parallel, and k is perpendicular to them

63. Faraday's law of electromagnetic induction states that:
- (A) A change in electric field creates a magnetic field
 - (B) A change in magnetic flux creates an electric field
 - (C) An electric field creates a magnetic field
 - (D) A magnetic field can never induce an electric field
64. The Poynting vector represents the direction of:
- (A) Electric field
 - (B) Magnetic field
 - (C) Electromagnetic wave propagation
 - (D) Electric flux
65. For time-varying currents, the field or waves will be
- (A) Electrostatic
 - (B) Magnetostatic
 - (C) Electromagnetic
 - (D) Electrical
66. The Z transform of $\delta(n - m)$ is _____
- (A) z^{-n}
 - (B) z^{-m}
 - (C) $1/(z - n)$
 - (D) $1/(z - m)$
67. Discrete time signal is derived from continuous time signal by _____ process.
- (A) Addition
 - (B) Multiplying
 - (C) Sampling
 - (D) Addition and multiplication
68. Noise generated by an amplifier of radio is an example for
- (A) Discrete signal
 - (B) Deterministic signal
 - (C) Random signal
 - (D) Periodic signal
69. The inverted V plots is plotted between _____
- (A) power factor vs. field current for constant shaft load
 - (B) field current vs. power factor for variable shaft load
 - (C) armature current vs. field current
 - (D) terminal voltage vs. power factor

70. When a delta-connected primary of a 3-phase transformer is connected to a 3-phase supply?
- (A) Magnetizing current in phase winding will carry third harmonics, but line current will be free from it
 - (B) Magnetizing current in phase winding will contain third harmonics, and line current will also contain third harmonics
 - (C) Magnetizing current in phase winding will not contain third harmonics, but line current will contain third harmonics
 - (D) None of the above
71. In an induction motor, when the number of stator slots is equal to an integral multiple of rotor slots?
- (A) The machine will fail to start
 - (B) The machine will get heated
 - (C) High starting torque will be achieved
 - (D) Discontinuity in torque slip characteristic
72. A 4-pole, 50 Hz induction motor has a starting current that is 5 times that of the full load current, working at a speed of 1450 rpm. What is the ratio of starting to full load torque?
- (A) 0.83
 - (B) 0.17
 - (C) 0.67
 - (D) 1
73. If the load current and the flux of a DC motor are held constant and the voltage applied across its armature is increased by 5%, the speed of the motor will
- (A) Reduce by 5%
 - (B) Increase by 5%
 - (C) Depend on other factors
 - (D) Remain unchanged
74. The main purpose of providing tertiary winding in a three-phase transformer
- (A) To suppress harmonic voltages and to limit voltage unbalance when the main load is asymmetrical
 - (B) To interconnect three supply systems operated at different voltages
 - (C) To carry adding extra load to the transformer which for some reason must be kept isolated
 - (D) None of the above

75. Two single phase transformers A and B are operating in parallel having same impedance. But the x/r ratio of them are not equal and $x_a > x_b$. Then
- (A) A has poorer pf than B
 - (B) B has poorer pf than B
 - (C) Lesser power factor angle
 - (D) Both operate at same power factor
76. Single line diagram of which of the following power system is possible?
- (A) Power system with LG fault
 - (B) Balanced power system
 - (C) Power system with LL fault
 - (D) Power system with LLG fault
77. The critical clearing time of a fault in power system is related to
- (A) Reactive power limit
 - (B) Short circuit limit
 - (C) Steady-state stability limit
 - (D) Transient stability limit
78. The positive sequence current of a transmission line is
- (A) Always zero
 - (B) One-third of the negative sequence current
 - (C) Equal to negative sequence current
 - (D) three times the negative sequence current
79. When load factor and diversity factor increases _____
- (A) cost of electricity decreases
 - (B) cost of electricity also increases
 - (C) cost of electricity remains same
 - (D) cost of electricity increases exponential
80. In load flow studies of a power system, a voltage control bus is specified by
- (A) Real power and reactive power
 - (B) Reactive power and voltage magnitude
 - (C) Voltage and voltage phase angle
 - (D) Real power and voltage magnitude

- 81.** An overhead transmission line has a span of 220 metres the conductor weight 0.604 kg/m. What will be the maximum sag if the working tension is 2879 kg.
- (A) 8.96 m (B) 8.86 m
(C) 8.85 m (D) 1.27 m
- 82.** A power system has a maximum load of 15 MW. Annual load factor is 50%. The reserve capacity of plant is _____ if the plant capacity factor is 40%.
- (A) 3.75 MW (B) 4.75 MW
(C) 18.75 MW (D) 5.75 MW
- 83.** Synchronous phase modifiers are installed at which of the following position of the transmission line?
- (A) Receiving end
(B) Sending end
(C) Between receiving end and sending end
(D) Near receiving end
- 84.** In a stable control system backlash can cause which of the following?
- (A) Overdamping
(B) Low-level oscillations
(C) Underdamping
(D) Poor stability at reduced values of open loop gain
- 85.** Feedback control system is basically _____
- (A) Band pass filter (B) Band stop filter
(C) High pass filter (D) Low pass filter
- 86.** What is the number of the root locus segments which do not terminate on zeroes?
- (A) The number of poles
(B) The number of zeroes
(C) The difference between the number of poles and zeroes
(D) The sum of the number of poles and the number of the zeroes

87. The frequency at which the Nyquist diagram cuts the unit circle is known as:
- (A) Gain crossover frequency
 - (B) Phase crossover frequency
 - (C) Damping frequency
 - (D) Corner frequency
88. In a bode magnitude plot, which one of the following slopes would be exhibited at high frequencies by a 4th order all-pole system?
- (A) -80dB/decade
 - (B) -40 dB/decade
 - (C) 40 dB/decade
 - (D) 80 dB/decade
89. A phase lead compensation leads to:
- (A) Increase in overshoot
 - (B) Reduction in bandwidth of closed loop system
 - (C) Reduction in rise time of closed loop system
 - (D) Reduction in gain margin
90. In voltage source inverters (VSIs), the amplitude of the output voltage is
- (A) Independent of the load
 - (B) Dependent on the load
 - (C) Dependent only on L loads
 - (D) None of the mentioned
91. Which filter type is called a flat-flat filter?
- (A) Cauer filter
 - (B) Butterworth filter
 - (C) Chebyshev filter
 - (D) Band-reject filter
92. The slew rate of an OP-AMP is
- (A) Maximum rate of change of output voltage
 - (B) Minimum input voltage
 - (C) Gain of amplifier
 - (D) Output current

93. Which of the following amplifier class have the highest linearity and lowest distortion?
- (A) Class A (B) Class B
(C) Class C (D) Class B push-pull
94. In the transfer characteristics of a MOSFET, the threshold voltage is the measure of the
- (A) Minimum voltage to induce a n-channel/p-channel for conduction
(B) Minimum voltage till which temperature is constant
(C) Minimum voltage to turn off the device
(D) None of the above mentioned is true
95. The voltage blocking capability of the IGBT is determined by the
- (A) Injection layer (B) Body layer
(C) Metal used for the contacts (D) Drift layer
96. A three-phase three pulse type controlled converter is constructed using 3 SCR devices. The circuit is supplying an R load with $\alpha < 30^\circ$. As such, each SCR device would conduct for
- (A) 60° each cycle (B) 120° each cycle
(C) 180° each cycle (D) 360° each cycle
97. In non-circulating current mode dual converters, the circulating current is avoided by
- (A) Connecting a series reactor (B) Maintaining $\alpha_1 + \alpha_2 = 180^\circ$
(C) Operating only one converter (D) Adding an extra SCR
98. For harmonic reduction by transformer connection, the output voltages from the two inverters must be
- (A) Similar and in-phase with each other
(B) Dissimilar but in-phase with each other
(C) Similar but phase shifted from each other
(D) Dissimilar and phase shifted from each other

- 99.** Which of the following is a stable nucleus?
- (A) The nucleus with even protons and odd electrons
 - (B) The nucleus with even number of protons and neutrons
 - (C) The nucleus with even neutrons and odd protons
 - (D) The nucleus with odd protons and neutrons
- 100.** An electron emitted in beta radiation originates from
- (A) Free electrons existing in the nuclei
 - (B) Inner orbits of an atom
 - (C) Photon escaping from the nucleus
 - (D) Decay of a neutron in nuclei

ROUGH WORK