Test Booklet Series

A

Test Booklet
(Civil)

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

1. Research is
   (A) Searching again and again
   (B) Finding a solution to any problem
   (C) Working in a scientific way to search for the truth of any problem
   (D) None of the above

2. The conceptual framework in which research is conducted is called a
   (A) Synopsis of research
   (B) Research design
   (C) Research hypothesis
   (D) Research paradigm

3. What are the main characteristics of Scientific Research?
   (A) Empirical
   (B) Theoretical
   (C) Experimental
   (D) All the above

4. Which research design will be most appropriate to study the relationship between the level of aspirations and achievement of rural children?
   (A) Experimental Research Design
   (B) Ex Post Facto Research Design
   (C) Historical Research Design
   (D) Survey Research Design

5. The principles of fundamental research are used in:
   (A) action research
   (B) applied research
   (C) philosophical research
   (D) historical research

6. A shift in attitude in respondents between two points during data collection is called
   (A) Reactive effect
   (B) Maturation effect
   (C) Regression effect
   (D) Conditioning effect

7. Ethical Norms in research do not involve guideline for:
   (A) Thesis Format
   (B) Copyright
   (C) Patenting Policy
   (D) Data sharing Policy

8. The primary objective of an experimental research design is to:
   (A) Explore an unknown topic.
   (B) Establish cause-and-effect relationships.
   (C) Describe a population or situation.
   (D) Examine the relationship between variables without manipulation.

9. The research that aims at immediate application is:
   (A) Action Research
   (B) Empirical Research
   (C) Conceptual Research
   (D) Fundamental Research

10. A null hypothesis is
   (A) when there is no difference between the variables
   (B) the same as research hypothesis
   (C) subjective in nature
   (D) when there is difference between the variables

11. When the researcher rejects a true null hypothesis a ---------- error occurs.
   (A) Type I
   (B) Type A
   (C) Type II
   (D) Type B

12. The researcher is usually interested in supporting ..... when he or she is engaging in hypothesis testing:
   (A) The alternative Hypothesis
   (B) The null Hypothesis
   (C) Both alternative and null Hypothesis
   (D) Neither the alternative or null Hypothesis

13. A research design is often described as the "blueprint" for a research project. This emphasizes its role in:
   (A) Collecting data
   (B) Analysing data
   (C) Providing a strategy and framework for the study
   (D) Presenting findings

14. What is a cross-sectional research design?
(A) A design in which a data is collected at one point of time.
(B) A design in which data is collected over a period of time.
(C) A design in which data is collected from a representative sample of the population.
(D) A design in which data is collected from a non-representative sample of the population.

15. Match the measurement scale to the given variables:

Scale of measurement	**Variable**
(a) Nominal	(i) Height of student
(b) Ordinal	(ii) Time of day
(c) Interval	(iii) Caste
(d) Ratio	(iv) Rank of Army Personnel

Choose the correct answer from the options given below:
(A) (a) – (i), (b) – (ii), (c) – (iii), (d) – (iv)
(B) (a) – (ii), (b) – (iii), (c) – (iv), (d) – (i)
(C) (a) – (iii), (b) – (iv), (c) – (ii), (d) – (i)
(D) (a) – (iv), (b) – (i), (c) – (ii), (d) – (iii)

16. Which is the simplest form of Measurement?
(A) Ordinal (B) Nominal
(C) Ratio (D) Interval

17. The data is obtained through a survey conducted is called:
(A) Primary data (B) Secondary data
(C) Continuous data (D) Qualitative data

18. A survey in which the information is collected from each and every individual of the population is known as:
(A) Sample survey (B) Pilot survey
(C) Biased survey (D) Census survey

19. Interview is an example of which data?
(A) Primary data (B) Secondary data
(C) Both (A) and (B) (D) None of the above

20. What is the process of organizing raw data into rows and columns for systematic analysis called?
(A) Compilation
(B) Presentation
(C) Tabulation
(D) Classification

21. The graphical representation of a frequency distribution is called
(A) Bar chart
(B) Line chart
(C) Histogram
(D) Pie char

22. Identify the correct sequence of research steps:
(A) Selection of topic, review of literature, data collection, interpretation of findings
(B) Review of literature, selection of topic, data collection, and interpretation of findings
(C) Selection of topic, data collection, review of literature, interpretation of findings
(D) Selection of topic, review of literature, interpretation of findings, data collection

23. When a research problem is related to heterogeneous population, the most suitable sampling method is:
(A) Cluster Sampling
(B) Stratified Sampling
(C) Convenient Sampling
(D) Lottery Method

24. A researcher wants to study the long-term effects of a new teaching method on student performance over several years. Which research design would be most appropriate?
(A) Cross-sectional design
(B) Case study design
(C) Longitudinal design
(D) Survey design

25. From the list given below identify those which are called non-probability sampling procedures:
(i) Simple random sampling
(ii) Dimensional sampling
(iii) Snowball sampling
(iv) Cluster sampling
(v) Quota sampling
(vi) Stratified sampling
Choose the correct option
(A) (i), (ii) and (iii)
(B) (ii), (iv) and (v)
(C) (i), (iii) and (v)
(D) (ii). (iii) and (v)

26. Among the following types of sampling techniques, which one is also known as 'Judgmental' sampling?

(A) Quota sampling
(B) Convenience Sampling
(C) Cluster Sampling
(D) Purposive Sampling

27. The primary objective of an experimental research design is to:

(A) Explore an unknown topic.
(B) Establish cause-and-effect relationships.
(C) Describe a population or situation.
(D) Examine the relationship between variables without manipulation.

28. "Students from the pure mathematics background can crack a bank recruitment test"—Which type of hypothesis is this?

(A) Relational Hypothesis
(B) Descriptive hypothesis
(C) Two tailed Hypothesis
(D) Null Hypothesis

29. Parametric tests make assumptions on:

(A) The population size
(B) The underlying distribution
(C) The sample size
(D) The mean sample

30. If the researcher has a nominal data, which non parametric test will he/she can use:

(A) T-test
(B) Z-test
(C) Chi square test
(D) All the above

31. If a researcher needs to verify whether there is a significant difference between the means of two groups to test a hypothesis, which statistical method would he/she employ?

(A) Chi-square test
(B) Correlation coefficient
(C) Sign-test
(D) Student's t-test

32. Chi-square is used to analyse:

(A) Scores (B) Ranks

(C) Frequencies (D) None of these

33. On which of the following does the critical value for a chi-square statistic rely?

(A) The degrees of freedom (B) The sum of the frequencies

(C) The row totals (D) The number of variables

34. Calculated value of chi-square is always.....

(A) Positive (B) Negative

(C) Zero (D) None of these

35. Which of the following best describes the purpose of using ANOVA in research?

(A) ANOVA is used to compare the means of two groups.

(B) ANOVA is use to compare the means of more than two groups.

(C) ANOVA is used to determine the correlation between two variables.

(D) ANOVA is used to determine the interaction effect between dependent variables.

36. What do ANOVA calculate?

(A) T-Ratio (B) Chi-square

(C) Z-Ratio (D) F-Ratio

37. What is the primary goal of factor analysis?

(A) To predict a dependent variable from multiple independent variables.

(B) To reduce a large number of variables into a smaller set of underlying factors.

(C) To determine the causal relationship between variables.

(D) To calculate the correlation between two variables.

38. Which assumption is required for factor analysis?

(A) Extreme collinearity exists among variables.

(B) Variables have a skewed distribution.

(C) A linear relationship exists among variables.

(D) There are many outliers in the data.

39. When using Principal Component Analysis (a common method for factor analysis), what does the first principal component capture?
(A) The minimum variance.
(B) The mean deviation.
(C) The maximum variance.
(D) The average variance.

40. Which statistical measure is used to assess the sampling adequacy for conducting factor analysis?
(A) Kaiser-Meyer-Olkin (KMO) measure.
(B) Bartlett's test of sphericity.
(C) Eigenvalue.
(D) All of the above.

41. The process by which we estimate the value of dependent variable on the basis of one or more independent variable is called:
(A) Correlation
(B) Regression
(C) Residual
(D) Slope

42. The major characteristic of correlation analysis is to seek out
(A) Differences among variables
(B) Variations among variables
(C) Association among variables
(D) Regression among variables

43. A correlation coefficient (r) of –1.0 indicates a:
(A) Perfect positive correlation
(B) Weak positive correlation
(C) No correlation
(D) Perfect negative correlation

44. The statistical tool that studies the degree of association between two variables is called:
(A) Regression
(B) Standard error
(C) Index numbers
(D) Correlation

45. Which type of correlation analysis is appropriate for examining the relationship between variables with non-linear relationships?
(A) Pearson's correlation
(B) Spearman's rank correlation
(C) Both Pearson's and Spearman's
(D) Neither Pearson's nor Spearman's

46. What is the primary goal of cluster analysis?
    (A) Classifying data into predefined groups.
    (B) Predicting a continuous value.
    (C) Grouping similar data points together based on their characteristics.
    (D) Reducing the number of variables in a dataset.

47. The primary purpose of conjoint analysis is to:
    (A) Identify which customer segments are most profitable.
    (B) Determine the price elasticity of demand for an existing product.
    (C) Quantify the value that consumers place on different features of a product or service.
    (D) Predict sales volume for a new product with absolute certainty.

48. The most common type of conjoint analysis, which presents respondents with sets of product profiles and asks them to choose the one they prefer most, is known as:
    (A) Adaptive Conjoint Analysis (ACA).
    (B) Choice-Based Conjoint (CBC).
    (C) Full-Profile Conjoint Analysis.
    (D) Self-Explicated Conjoint Analysis.

49. Which statement is an accurate representation of a "trade-off" in conjoint analysis?
    (A) A decision to buy a product from one brand over another.
    (B) A decision to delay a purchase until a later date.
    (C) A customer choosing a larger screen over longer battery life for a phone.
    (D) A customer buying a product with all the most desired features.

50. What is the primary purpose of discriminant analysis?
    (A) To determine the effect of independent variables on a continuous dependent variable.
    (B) To identify the underlying structure or dimensions within a set of variables.
    (C) To classify cases into two or more distinct, pre-defined groups based on a set of predictor variables.
    (D) To cluster data points into a specific number of groups based on their similarities.

PART–B

(Civil)

51. A simply supported beam of span 6 m carries a uniform load of 20 kN/m. The maximum bending moment (in kN/m) is :

(A) 90 (B) 100

(C) 120 (D) 150

52. The vertical deflection at the free end of a cantilever 3 m long subjected to a 25 kN end load ($E = 2 \times 10^5$ MPa, $I = 4 \times 10^8$ mm^4) is approximately :

(A) 2.0 mm (B) 2.8 mm

(C) 4.2 mm (D) 5.0 mm

53. A steel bar 20 mm in diameter and 2.5 m long is subjected to an axial tensile load of 40 kN. The elongation (in mm) is approximately :

(A) 0.6 (B) 0.8

(C) 1.6 (D) 1.2

54. A column 3 m long with both ends fixed ($E = 2 \times 10^5$ MPa, $I = 6 \times 10^6$ mm^4) has Euler's critical buckling load (in kN) approximately:

(A) 20 (B) 34

(C) 44 (D) 53

55. A solid circular shaft 100 mm in diameter transmits 18 kN/m torque. The maximum shear stress (in MPa) is approximately :

(A) 92 (B) 40

(C) 46 (D) 52

56. The limiting neutral-axis depth (x_n, max) for Fe-500 steel as per IS 456 (2000) is :

(A) 0.48 d (B) 0.46 d

(C) 0.50 d (D) 0.53 d

57. For a singly reinforced RCC beam (M25 concrete, Fe500 steel), if the ratio $\frac{M_u}{bd^2}$ is less than the limiting value, the beam section is :

(A) Over-reinforced
(B) Balanced
(C) Under-reinforced
(D) Doubly reinforced

58. The development length (L_d) for a 20 mm Fe-500 bar in M25 concrete τ_{bd} = 1.4 N/mm²) is approximately :

(A) 640 mm
(B) 750 mm
(C) 1740 mm
(D) 1550 mm

59. In a rectangular beam, the ratio of maximum to average shear stress is :

(A) 1.5
(B) 1.2
(C) 1.8
(D) 2.0

60. A two-hinged parabolic arch of span 22 m and rise 4.4 m carries 45 kN/m UDL. The horizontal thrust (in kN) approximately is :

(A) 310
(B) 620
(C) 500
(D) 930

61. A clay layer 4 m thick attains 50% consolidation in 6 months. Time for 90% consolidation (C_v constant) approximately is :

(A) 18 months
(B) 22 months
(C) 26 months
(D) 48 months

62. Terzaghi's ultimate bearing-capacity formula for general shear failure of strip footing :

(A) $c\ N_c + \gamma D_f\ N_q$
(B) $c\ N_\varphi + \gamma B\ N^c$
(C) $q\ N^c + \gamma B\ N_\varphi$
(D) $c\ N_c + \gamma D_f\ N_q + 0.5\ \gamma B\ N_\gamma$

63. A saturated soil (G = 2.7, e = 0.8) has unit weight (kN/m^3) approximately equals to :

(A) 19.1 (B) 18.6

(C) 19.9 (D) 20.6

64. The factor of safety in slope stability =

(A) c/φ (B) Shear strength/Shear stress

(C) W/H (D) $\tan \varphi$

65. Critical hydraulic gradient for soil (G = 2.65, e = 0.65) $\approx$

(A) 0.85 (B) 0.95

(C) 1.00 (D) 1.05

66. In a 0.25 m diameter pipe with velocity 3.2 m/s and head loss 4.2 m per 100 m, the Darcy friction factor =

(A) 0.016 (B) 0.035

(C) 0.028 (D) 0.020

67. Flow in a 3.2 m wide rectangular channel (Q = 10 m^3/s, y = 1.6 m) has Froude number approximately :

(A) 0.5 (B) 1.0

(C) 1.2 (D) 1.5

68. Which of the following parameters does not influence the Darcy friction factor in turbulent flow directly?

(A) Reynolds number (B) Pipe diameter

(C) Relative roughness (D) Fluid viscosity

69. Discharge over a 2.5 m wide rectangular weir with head 0.62 m ($C_d = 0.62$) ≈

(A) 1.25 m^3/s (B) 1.35 m^3/s

(C) 2.23 m^3/s (D) 2.55 m^3/s

70. Specific energy of flow E =

(A) $y^2/2g$ (B) V^2/g

(C) $y - V^2/2g$ (D) $y + V^2/2g$

71. A water sample (BOD_5 = 240 mg/L, k = 0.23 day^{-1}) has BOD_u approximately :

(A) 350 (B) 380

(C) 400 (D) 450

72. If suspended solids reduce from 260 mg/L to 55 mg/L, efficiency ≈

(A) 70% (B) 79%

(C) 85% (D) 82%

73. Most common coagulant in water treatment :

(A) Ferric chloride (B) Lime

(C) Alum (D) Soda ash

74. Trickling filter (16 m diameter) at 40 $m^3/m^2/day$ loading handles flow approximately :

(A) 6500 m^3/day (B) 7000 m^3/day

(C) 7500 m^3/day (D) 8000 m^3/day

75. In activated-sludge process, F/M ratio =

(A) Food/Microorganism (B) Flow/Microorganism

(C) MLSS/Flow (D) Return sludge ratio

76. Concrete pavement slab 5 m long expands 5 mm for $\Delta T = 15°C$. Required joint gap is equal to :

(A) 4 mm (B) 5 mm

(C) 6 mm (D) 8 mm

77. Vehicle damage factor for 80 kN standard axle =

(A) 3.0 (B) 2.0

(C) 1.0 (D) 4.0

78. Mean speed = 60 km/h, density = 40 veh/km. Flow rate (veh/h) =

(A) 2000 (B) 2200

(C) 2800 (D) 2400

79. Design speed of a highway is 100 km/h. Minimum safe overtaking sight distance as per IRC is equal to :

(A) 640 m (B) 400 m

(C) 470 m (D) 520 m

80. Capacity of a signalized intersection mainly depends on :

(A) Cycle length (B) Saturation flow

(C) Green time (D) All of these

81. Which soil type typically has the highest coefficient of permeability?

(A) Clay (B) Silt

(C) Coarse sand (D) Silty clay

82. The zero-air-voids line on a compaction curve denotes :

(A) 75% saturation (B) 50% saturation

(C) Dry soil (D) 100% saturation

83. In a confined aquifer, the piezometric surface lies :

(A) Above the top of aquifer
(B) Below ground surface
(C) At ground level
(D) None of these

84. For laminar flow in pipes, Reynolds number is less than :

(A) 1000
(B) 2000
(C) 2300
(D) 4000

85. Manning's velocity equation :

(A) $V = R^{1/2} S^{2/3}$
(B) $V = n R S$
(C) $V = (1/n) R^{2/3} S^{1/2}$
(D) None of these

86. Froude number expresses ratio of :

(A) Pressure to velocity
(B) Viscous to inertial
(C) Gravity to surface tension
(D) Inertial to gravitational forces

87. Hydraulic jump occurs when flow changes from :

(A) Supercritical to subcritical
(B) Subcritical to supercritical
(C) Laminar to turbulent
(D) None of these

88. Duty of irrigation water =

(A) Discharge/Area
(B) Area irrigated/unit discharge
(C) Depth of irrigation
(D) Duration of irrigation

89. BOD removal in Activated Sludge Process (ASP) depends on :

(A) F/M ratio
(B) Sludge age
(C) Aeration time
(D) All of these

90. Sludge Volume Index (SVI) =

(A) Volume of settled sludge / g of MLSS

(B) MLSS / Volume

(C) Solids × Volume

(D) None of these

91. Domestic wastewater with BOD/COD = 0.6 indicates :

(A) High biodegradability (B) Low biodegradability

(C) Toxic content (D) None of these

92. Adding air to remove dissolved gases is called :

(A) Coagulation (B) Aeration

(C) Sedimentation (D) Filtration

93. Standard BOD test =

(A) 5 days at 27°C (B) 3 days at 25°C

(C) 5 days at 20°C (D) 10 days at 20°C

94. Hardness due to Ca^{2+} and Mg^{2+} is commonly removed by :

(A) Soda ash (B) Alum

(C) Ferric chloride (D) Lime–Soda

95. Sedimentation-tank efficiency depends primarily on :

(A) Surface overflow rate (B) Depth

(C) Width (D) Inlet velocity

96. Negative skin friction acts :

(A) Upward on a pile (B) Downward on a pile

(C) Horizontally (D) None of these

97. Permeability of soil is affected by :

(A) Grain size
(B) Void ratio
(C) Temperature
(D) All of these

98. Compaction increases :

(A) Porosity
(B) Compressibility
(C) Permeability
(D) Shear strength

99. Bond stress in RCC develops mainly due to :

(A) Adhesion and friction
(B) Bearing
(C) Shear
(D) None of these

100. For a circular sewer flowing half-full, velocity is (provided the slope and roughness coefficient remain constant) :

(A) Double of the full flow
(B) Same as at full flow
(C) Minimum
(D) Zero

ROUGH WORK

ROUGH WORK