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T. B. C. : AEC – 1/2015

Test Booklet Series

Serial No. 08113

Test Booklet Series: A

TEST BOOKLET

ASSISTANT EXECUTIVE ENGINEER

CIVIL ENGINEERING (PAPER – I)

Time Allowed : 3 Hours

Maximum Marks : 180

: INSTRUCTIONS TO CANDIDATES :

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET **DOES NOT** HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET OF THE SAME SERIES ISSUED TO YOU.

2. ENCODE CLEARLY THE TEST BOOKLET SERIES A, B, C OR D, AS THE CASE MAY BE, IN THE APPROPRIATE PLACE IN THE ANSWER SHEET USING BALL POINT PEN (BLUE OR BLACK).

3. You have to enter your **Roll No.** on the Test Booklet in the Box provided alongside. **DO NOT** write *anything else* on the Test Booklet.

4. This Test Booklet contains **90** items (questions). Each item (question) comprises four responses (answers). You have to select the correct response (answer) which you want to mark (darken) on the Answer Sheet. In case, you feel that there is more than one correct response (answer), you should mark (darken) the response (answer) which you consider the best. In any case, choose **ONLY ONE** response (answer) for each item (question).

5. You have to mark (darken) all your responses (answers) **ONLY on the separate Answer Sheet** provided, by **using BALL POINT PEN (BLUE OR BLACK)**. See instructions in the Answer Sheet.

6. All items (questions) carry equal marks. All items (questions) are compulsory. Your total marks will depend only on the number of correct responses (answers) marked by you in the Answer Sheet. **There will be no negative marking for wrong answer.**

7. Before you proceed to mark (darken) in the Answer Sheet the responses to various items (questions) in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per the instructions in your **Admission Certificate**.

8. After you have completed filling in all your responses (answers) on the Answer Sheet and after conclusion of the examination, you should hand over to the Invigilator the *Answer Sheet* issued to you. You are allowed to take with you the candidate's copy/second page of the Answer Sheet along with the *Test Booklet* after completion of the examination for your reference.

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1. If a material has identical elastic properties in all directions, it is said to be :

   (A) Homogenous

   (B) Isotropic

   (C) Elastic

   (D) Orthotropic

2. If a composite bar of steel and copper is heated, the copper bar will be under :

   (A) Tension

   (B) Compression

   (C) Shear

   (D) Torsion

3. Maximum bending moment in a beam occurs where :

   (A) Deflection is zero

   (B) Shear force is maximum

   (C) Shear force is minimum

   (D) Shear force changes sign

4. Every material obeys the Hooke's law within its :

   (A) Elastic limit

   (B) Plastic limit

   (C) Limit of proportionality

   (D) None of these

5. In a rectangular element subjected to like principal tensile stresses p_1 and p_2 in two mutually perpendicular directions x and y, the maximum shear stress would occur along the :

   (A) Plane normal to y-axis

   (B) Plane normal to x-axis

   (C) Planes at 45° and 135° to the y-direction

   (D) Plane at 45° to the y-direction

6. Principle of superposition is applicable when :

   (A) Deflections are linear functions of applied forces

   (B) The action of applied forces will be affected by small deformations of the structure

   (C) Material obeys Hooke's law

   (D) None of these

7. Principal plane is defined as a plane on which the shear stress is :

   (A) Maximum

   (B) Half of the normal

   (C) Zero

   (D) None of these

8. Poisson's ratio is an involving :

   (A) Elastic Moduli

   (B) Stresses

   (C) Strains

   (D) None of these

9. The shear force and bending moment is zero at the free end of a cantilever beam, if it carries :

(A) Point load at the free end

(B) Point load at the middle of its length

(C) Uniformly distributed load over the whole length

(D) None of these

10. The shear stress on a beam section is maximum :

(A) On the extreme bottom surface fibres

(B) On the extreme top surface fibres

(C) At the free edges

(D) At the neutral axis of the section

11. The variation of the bending moment in the segment of a beam where the load is uniformly distributed is :

(A) Zero

(B) Linear

(C) Parabolic

(D) Cubic

12. The maximum bending moment (M) caused by a concentrated load (W) at the mid span of a simply supported beam is :

(A) $M = (WL/2)$

(B) $M = (WL/8)$

(C) $M = (WL/4)$

(D) $M = (WL/12)$

13. A simply supported beam with rectangular cross-section is subjected to a central concentrated load. If the width and depth of beam is doubled, the deflection at centre of the beam will be reduced to :

(A) 50%

(B) 25%

(C) 12.5%

(D) 6.25%

14. The maximum tensile stress in a cantilever beam with concentrated load acting downwards on the span is caused at :

(A) Top fibre at mid span

(B) Bottom fibre at mid span

(C) Bottom fibre at support

(D) Top fibre at support

15. A fixed beam of uniform section is carrying a point load at its mid span. If the moment of inertia of the middle half length is reduced to half its previous value, then the fixed end moments will :

(A) Decrease

(B) Increase

(C) Change their direction

(D) Remain constant

16. At a point 'P', the state of stress is $p_x = 6$ MPa, $p_y = -2$ MPa and $q_{xy} = 3$ MPa, the magnitude of principal stresses for this state of stress will be :

(A) 9 MPa and – 1 MPa

(B) 7 MPa and – 3 MPa

(C) 7 MPa and – 1 MPa

(D) 8 MPa and – 3 MPa

17. The most appropriate failure theory for ductile materials is :

(A) Maximum principal stress theory

(B) Maximum shear stress theory

(C) Maximum shear strain energy theory

(D) Maximum principal strain theory

18. A cantilever beam having length 'L' is subjected to a moment 'M' at its free end. If flexural rigidity of beam is EI, the deflection at free end will be :

(A) ML/EI

(B) ML/2EI

(C) ML^2/EI

(D) ML^2/2EI

19. The relationship between Young's Modulus of Elasticity E, Bulk Modulus K and Poisson's ratio μ is given by :

(A) $E = 2K(1 - 2\mu)$

(B) $E = 3K(1 + \mu)$

(C) $E = 3K(1 - 2\mu)$

(D) $E = 2K(1 + \mu)$

20. A beam simply supported at both the ends of length 'L' carries two unequal unlike couples M at the both ends. If the Flexural Rigidity EI is constant, the central deflection of beam will be :

(A) ML^2/4EI

(B) ML^2/16EI

(C) ML^2/64EI

(D) ML^2/8EI

21. Free body diagram is an :

(A) Isolated joint with only body forces acting on it

(B) Isolated joint with all the forces internal as well as external, acting on it

(C) Isolated joint with internal acting on it

(D) None of these

22. Independent displacement components at each joint of a rigid jointed plane frame are :

(A) Three linear movements

(B) One linear movement and two rotations

(C) Two linear movements and one rotation

(D) Three rotations

23. Which of the following methods of structural analysis is a force method ?

(A) Column analogy method

(B) Slope deflection method

(C) Moment distribution method

(D) None of these

24. For approximate analysis of building frames under vertical loads, the point of inflection is assumed at :

(A) Centre of each beam

(B) One-tenth of the span length from each end of the beam

(C) Centre of each column

(D) Both (A) and (C)

25. A fixed beam of uniform section is carrying a point load at its mid span. If the moment of inertia of the middle half length is reduced to half of its previous value, then the fixed end moments will :

(A) Decrease

(B) Increase

(C) Change their direction

(D) Remain constant

26. The deformation of a spring produced by a unit load method is called :

(A) Flexibility

(B) Stiffness

(C) Unit strain

(D) None of these

27. In the displacement method of structural analysis, the basic unknowns are :

(A) Forces

(B) Displacements

(C) Displacements and forces

(D) None of these

28. If the displacement at coordinate i due to unit force at coordinate j is δ_{ij} and and displacement at coordinate j due to unit force at coordinate i is δ_{ji}, then according to Maxwell's Reciprocal Theorem :

(A) $\delta_{ij} = \delta_{ji}$

(B) $\delta_{ij} > \delta_{ji}$

(C) $\delta_{ij} < \delta_{ji}$

(D) $\delta_{ij} \neq \delta_{ji}$

29. To generate the jth column of flexibility matrix :

(A) A unit force is applied at coordinate j and the displacement are calculated at all coordinates

(B) A unit force is applied at coordinate j and the forces are calculated at all coordinates

(C) A unit displacement is applied at coordinate j and the forces are calculated at all coordinates

(D) A unit displacement is applied at coordinate j and the displacement are calculated at all coordinates

30. For a statically indeterminate pin jointed plane frame, the relation between number of members 'm' and number of joints 'j' is expressed as :

(A) m = 3j – 6

(B) m = 2j – 3

(C) m > 2j – 3

(D) m > 3j – 6

31. Ratio of strain energy stored by solid shaft of diameter 'D' and strain energy stored by hollow shaft (external diameter 'D' and internal diameter 'd') is given by :

(A) $D^2/(D^2 - d^2)$

(B) $D^2/(D^2 + d^2)$

(C) $D^4/(D^4 + d^4)$

(D) $D^4/(D^4 - d^4)$

32. Muller Breslau principle in structural analysis is used :

(A) To obtain virtual work equation

(B) To draw influence line diagram for any force function

(C) For superposition of load effects

(D) None of these

33. Influence line for forcing function gives its variation at :

(A) Mid span

(B) A given section

(C) A support

(D) Everywhere in the beam

34. The moment required to rotate the near end of prismatic beam of length 'L' and flexural rigidity EI through unit angle, without translation (the far end being fixed), is given by :

(A) 2EI/L

(B) EI/L

(C) 3EI/L

(D) 4EI/L

35. Castigliano's first theorem is applicable :

(A) For statically determinate structure only

(B) When the system behaves elastically

(C) Only when principle of superposition is valid

(D) None of these

36. The deflection at any point of a perfect frame can be obtained by applying a unit load at the joint in :

(A) Vertical direction

(B) Horizontal direction

(C) Inclined direction

(D) The direction in which the deflection is required

43. The purpose of lateral ties in short RC columns is to :

(A) Avoid buckling of longitudinal bars

(B) Facilitate construction

(C) Facilitate compaction of concrete

(D) Increase the load carrying capacity of the columns

44. For vertical stirrups, the maximum spacing of shear reinforcement measured along the axis of the members shall not exceed :

(A) 0.70 d

(B) 0.75 d

(C) 0.80 d

(D) 0.90 d

45. In the limit state design of concrete section of limiting value of the depth of the neutral axis $X_{u(max)}/d$ for steel grade Fe 415 is :

(A) 0.53

(B) 0.48

(C) 0.46

(D) 0.42

46. Most common method of pre-stressing used for factory production is :

(A) Freyssinet system

(B) Long line method

(C) Lee-Macall system

(D) Magnel-Blaton system

47. Which of the following losses occurs only in post-tensioning ?

(A) Shrinkage of concrete

(B) Elastic shortening of concrete

(C) Loss due to friction

(D) Creep of concrete

48. Minimum reinforcement in a circular column as per IS 456 is :

(A) 4 bars of 12 mm

(B) Greater of 0.8% of cross sectional area and 4 bars of 12 mm

(C) 6 bars of 12 mm

(D) Greater of 0.8% of cross sectional area and 6 bars of 12 mm

49. The vertical retaining wall of the RCC Counterfort is designed as a _____.

(A) Cantilever

(B) Simply supported slab

(C) Continuous slab

(D) None of these

50. When width b, effective depth d, overall depth D, the maximum area of reinforcement in RCC beam shall not exceed :

(A) 0.04 bd

(B) 0.04 bD

(C) 0.05 bd

(D) 0.05 bD

37. The strain energy stored in a simply supported beam of span 'L' and flexural rigidity EI due to central concentrated load 'W' is given by :

(A) $W^2L^2/48EI$

(B) $W^2L^3/48EI$

(C) $W^2L^2/96EI$

(D) $W^2L^3/96EI$

38. A beam AB is fixed at both ends and carries a uniformly distributed load of intensity 'w' per unit length run over its entire length. Due to some construction defects, the end B is now reduced to a simple support. The percentage increase in bending moment at A is :

(A) 25

(B) 50

(C) 75

(D) 100

39. A fixed beam AB is subjected to a triangular load varying from zero at end A to W per unit length at end B. The ratio of fixed end moment at B to A will be :

(A) $\frac{1}{2}$

(B) $\frac{1}{3}$

(C) $\frac{2}{3}$

(D) $\frac{3}{2}$

40. In moment distribution method, the sum of distribution factors of all members meeting at any joint is always :

(A) Less than one

(B) Zero

(C) One

(D) Greater than one

41. In a slab, the minimum reinforcement for Fe 250 provided, is :

(A) 0.10% of its gross sectional area

(B) 0.12% of its gross sectional area

(C) 0.15% of its gross sectional area

(D) None of these

42. Whenever the earthquake or wind loading is considered in design of a member, the permissible stresses may be increased by :

(A) 25%

(B) 30%

(C) 33.33%

(D) 35%

51. In T-shaped RC retaining walls, the main reinforcement in the stem is provided on :

 (A) The front face in one direction

 (B) The front face in both direction

 (C) The inner face in one direction

 (D) The inner face in both direction

52. If nominal shear stress τ_v exceeds the design shear strength of concrete τ_c, the nominal shear reinforcement as per IS : 456-2000 shall be provided for a shear stress equal to :

 (A) τ_v

 (B) τ_c

 (C) $\tau_v - \tau_c$

 (D) $\tau_v + \tau_c$

53. As per IS 456, the minimum grade of concrete for the design of reinforced concrete structure in moderate exposure condition is :

 (A) M20

 (B) M25

 (C) M15

 (D) M30

54. In reinforced concrete footing on soils, the minimum thickness at the edge should not be less than :

 (A) 150 mm

 (B) 250 mm

 (C) 100 mm

 (D) 200 mm

55. Span to effective depth ratio for a two way continuous slab (upto span 3.5 m) with steel of grade Fe 415 should not be more than :

 (A) 7

 (B) 40

 (C) 26

 (D) 32

56. The gross diameter of a rivet is the diameter of :

 (A) Cold rivet measured before driving

 (B) Rivet measured after driving

 (C) Rivet hole

 (D) None of these

57. The maximum permissible slenderness ratio of tension members liable to reversal of stress due to action of wind and earthquake is :

 (A) 300

 (B) 350

 (C) 400

 (D) 425

58. The maximum deflection for a steel beam as per IS code should not exceed :

(A) 1/150 of span

(B) 1/250 of span

(C) 1/325 of span

(D) 1/350 of span

59. The average shear stress in a member calculated on the cross section of unstiffened web shall not exceed :

(A) $0.45 f_y$

(B) $0.40 f_y$

(C) $0.65 f_y$

(D) $0.66 f_y$

60. Generally the purlins are placed at the panel points so as to avoid :

(A) Axial force in rafter

(B) Shear force in rafter

(C) Deflection of rafter

(D) Bending moment in rafter

61. The yield stress of mild steel of normally rolled structural steel is about (in N/mm^2) :

(A) 240 to 260

(B) 330 to 360

(C) 420

(D) 550

62. The effective length of fillet weld should not be less than :

(A) Two times weld size

(B) Four times weld size

(C) Six times weld size

(D) Weld size

63. The rolled 'I' section for a given depth having largest moment of inertia, I_{xx} is designated as :

(A) ISMB

(B) ISHB

(C) ISLB

(D) ISWB

64. In a plate girder, bending is primarily resisted by :

(A) Web plate

(B) Flange plate only

(C) Flange angle only

(D) Flange plate and flange angle

65. The effective length of a steel compression member which is effectively held in position at both ends but restrained in direction at one end only :

(A) L

(B) 0.8 L

(C) 1.2 L

(D) 1.5 L

66. The addition of pozzolana to Portland cement may cause :

(A) Decrease in early strength

(B) Increase in early strength

(C) Decrease in curing time

(D) Increase in permeability

67. The two main compounds imparting strength for Ordinary Portland Cement are :

(A) Tricalcium silicate and dicalcium silicate

(B) Dicalcium silicate and aluminates

(C) Tricalcium aluminates and silicate

(D) Tricalcium silicate and tricalcium aluminates

68. For a satisfactory workable concrete with a constant water cement ratio, increase in aggregate cement ratio :

(A) Decrease the strength of concrete

(B) Does not change the strength of concrete

(C) Increase the strength of concrete

(D) None of these

69. The strength of concrete is directly proportional :

(A) Water cement ratio

(B) Cement water ratio

(C) Sand cement ratio

(D) Water aggregate ratio

70. The most commonly used admixture which prolongs the setting time is :

(A) Calcium chloride

(B) Gypsum

(C) Sodium silicate

(D) All of these

71. In ordinary residential buildings, D. P. C. may be provided :

(A) At ground level

(B) Between ground level and water table level

(C) At water table level

(D) At plinth level

72. The tolerance in the width of mould of a class I brick is about :

(A) ± 3 mm

(B) ± 6 mm

(C) ± 10 mm

(D) ± 12 mm

73. The slump recommended for mass concrete is about :

(A) 50 mm to 100 mm

(B) 25 mm to 75 mm

(C) 100 mm to 125 mm

(D) None of these

74. The most important purpose of frog in a brick is to :

(A) Reduce the weight of brick

(B) Emboss manufacture's name

(C) Form keyed joint between brick and mortar

(D) Improve insulation by providing 'hollows'

75. A type of bond in a brick masonry consisting of alternate course of headers and stretchers, is called :

(A) English bond

(B) Flemish bond

(C) Stretching bond

(D) Heading bond

76. Preventative maintenance for a building work means :

(A) Taking action before break-down

(B) Breakdown maintenance

(C) Taking action after break-down

(D) None of these

77. The slenderness ratio for masonry walls should not be more than :

(A) 10

(B) 20

(C) 30

(D) 40

78. Expansion joint in masonry wall is provided when length of wall is greater than :

(A) 20 m

(B) 10 m

(C) 40 m

(D) 30 m

79. The height between two floors is 3.00 m and risers are of 150 mm. Assuming two flights between the floors, the number of treads will be :

(A) 18

(B) 19

(C) 20

(D) 21

80. The type of flooring suitable for the use in theatres and public libraries and other places where noiseless floor covering is desired :

(A) Wooden flooring

(B) Linoleum flooring

(C) Cork flooring

(D) None of these

81. One of the main disadvantages of the bar chart for construction management is :

(A) The time schedule is not shown properly

(B) Progress of the work cannot be monitored

(C) The financial aspect is not shown

(D) Does not show the interdependencies of the activity

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(12)

82. Which of the following does not represent an activity ?

(A) Foundation is being dug

(B) Site located

(C) The office area is being cleaned

(D) None of these

83. Critical Path Method (CPM) network is :

(A) Activity oriented

(B) Event oriented

(C) Both activity as well as event oriented

(D) None of these

84. The security deposit deducted from contractor's bill is :

(A) Refunded as soon as the construction is over

(B) Not refunded

(C) Refunded in the middle of the contract

(D) Refunded after maintenance period

85. Earliest finish of an activity is always :

(A) Less than earliest event of the following node

(B) Greater than earliest event of the following node

(C) Less than or equal to earliest event of the following node

(D) Greater than or equal to earliest event of the following node

86. A contract is an agreement between :

(A) Two parties valid in law

(B) Several agencies

(C) Three agencies

(D) Two parties without legal binding

87. Measurement of 50 mm thick concrete flooring will be done in :

(A) Cubic m

(B) % sq m

(C) Meter

(D) Sq. m

88. The reduction in project time normally results in :

(A) Increasing the direct cost and decreasing the indirect cost

(B) Decreasing the direct cost and increasing the indirect cost

(C) Increasing the direct cost and the indirect cost both

(D) Decreasing the direct cost and the indirect cost both

89. A document containing detailed description of all the items of work together with their current rates is called :

(A) Analysis of rates

(B) Abstract of estimate

(C) Schedule of rates

(D) None of these

90. Work Breakdown Structure for a construction project will help in :

(A) Breaking the project into several elements

(B) Identifying the activities

(C) Identifying the functional elements of a project and their interrelationship

(D) None of these

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SPACE FOR ROUGH WORK