



QUESTION BOOKLET CIVIL ENGINEERING

762645

PAPER - I (02)

Time Allowed : 2 Hours

Maximum Marks : 200

INSTRUCTIONS FOR CANDIDATES

1. Please do not open this Question Booklet until you are told to do so.
2. Candidate must fill up the necessary informations in the space provided on the OMR answer sheet before commencement of the examination.
3. Answer sheet will be processed by electronic device. Invalidation of answer sheet due to incomplete / incorrect filling of relevant circle of Roll No. and Question Booklet Series in the OMR answer sheet shall result in cancellation of candidature. Any deficiency in filling up OMR answer sheet will be the sole responsibility of the candidate.
4. An example is given below how to fill / mark (darken) Roll No. 41311706 and Question Booklet Series - B. Accordingly, you have to fill / mark (darken) the Roll No. and Question Booklet Series given to you in your OMR answer sheet.

EXAMPLE

Roll No.										Question Booklet Series
4	1	3	1	1	7	0	6			B
1	2	3	4	5	6	7	8	9	0	A ☐
1	2	3	4	5	6	7	8	9	0	B ☒
1	2	3	4	5	6	7	8	9	0	C ☐
1	2	3	4	5	6	7	8	9	0	D ☐

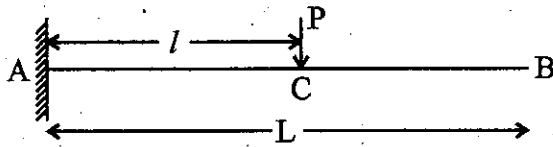
5. For marking the correct answer, darken one circle by **BLUE BALLPOINT PEN** only.
6. Please do not mark (darken) more than one circle. Darkening more than one circle against an answer will be treated as wrong answer.
7. Do not detach any leaf from this Question Booklet. After the examination, hand over the OMR answer sheet to the Room Invigilator. You are allowed to take the Question Booklet and carbon copy of the OMR answer sheet after examination is over.
8. Each question carries 2 marks. There is no negative marking for any wrong answer.
9. Possession and use of Calculator, Mobile Phone, Pager or any other electronic gadget is strictly prohibited in the Examination Hall.
10. Please abide by the instructions above and those given on the OMR answer sheet, failure to comply these instructions will be sole responsibility of the candidates.



1. What is the polar modulus of a solid circular metal shaft of diameter 8 cm ?
 (A) $64\pi \text{ cm}^3$
 (B) $32\pi \text{ cm}^3$
 (C) $16\pi \text{ cm}^3$
 (D) $8\pi \text{ cm}^3$
2. A solid circular shaft has a diameter d . Its polar modulus will be
 (A) $\frac{\pi}{16} d^2$
 (B) $\frac{\pi}{64} d^3$
 (C) $\frac{\pi}{16} d^3$
 (D) $\frac{\pi}{32} d^2$
3. A circular shaft rotates at 200 rpm and is subject to a torque of 1500 Nm. The power transmitted would be
 (A) $10\pi \text{ kW}$
 (B) $15\pi \text{ kW}$
 (C) $20\pi \text{ kW}$
 (D) $30\pi \text{ kW}$
4. In the case of a rectangular beam subjected to a transverse shearing force, the ratio of maximum shear stress to average shear stress is
 (A) 0.75
 (B) 1.00
 (C) 1.25
 (D) 1.50

5. A mild steel bar of uniform cross-section 'A' and length L is subjected to an axial load 'W'. The strain energy stored in the bar would be
 (A) $\frac{WL}{2AE}$
 (B) $\frac{W^2L}{4AE}$
 (C) $\frac{WL}{4AE}$
 (D) $\frac{W^2L}{2AE}$
6. The radius of Mohr's circle is zero when the state of stress is such that
 (A) Shear stress is zero.
 (B) There is pure shear.
 (C) There is no shear stress but identical direct stresses.
 (D) There is no shear stress, but equal direct stresses, opposite in nature, in two mutually perpendicular directions.
7. A simply supported beam of span 'L' is subjected to a concentrated load W at midspan. The strain energy due to bending in the beam would be
 (A) $\frac{W^2L^3}{48EI}$
 (B) $\frac{W^2L^3}{96EI}$
 (C) $\frac{W^2L^3}{24EI}$
 (D) $\frac{WL^3}{96EI}$

8. A cantilever carries a load P at C as shown in the given figure. The deflection at B is



- (A) $\frac{Pl^2}{2EI} (L - l)$
- (B) $\frac{Pl^2}{3EI} (L - l)$
- (C) $\frac{Pl^2}{2EI} \left(L + \frac{l}{3} \right)$
- (D) $\frac{Pl^2}{2EI} \left(L - \frac{l}{3} \right)$
9. Consider the following statements :
- A simply-supported beam is subjected to a couple somewhere in the span. It would produce
1. A rectangular SF diagram
 2. Parabolic BM diagram
 3. Both (+ve) and (-ve) BMs which are maximum at the point of application of the couple.

Of these statements :

- (A) 1, 2 and 3 are correct.
- (B) 1 and 2 are correct.
- (C) 2 and 3 are correct.
- (D) 1 and 3 are correct.

10. A solid metal bar of uniform diameter D and length L is hung vertically from a ceiling. If the density of the material of the bar is e and the modulus of elasticity is E , then the total elongation of the bar due to its own weight is
- (A) $eL/2E$
- (B) $eL^2/2E$
- (C) $eE/2L$
- (D) $eE/2L^2$
11. Creep is the gradual increase of
- (A) Plastic strain with time at constant load.
- (B) Elastic strain with time at constant load.
- (C) Plastic strain with time at varying load.
- (D) Elastic strain with time at varying load.
12. The strength of the beams mainly depends on
- (A) Bending moment
- (B) Centre of gravity of the section
- (C) Section modulus
- (D) Its weight
13. The point of contraflexure is also called
- (A) the point of inflection
- (B) a virtual hinge
- (C) Either of these
- (D) None of these

14. Modulus of elasticity is defined as the ratio of
- Shear stress to shear strain
 - Linear stress to linear strain
 - Linear strain to lateral strain
 - Lateral strain to linear strain
15. In case of a circular section,
- $\tau_{\max} = \frac{1}{2} \tau_{\text{mean}}$
 - $\tau_{\max} = \frac{4}{3} \tau_{\text{mean}}$
 - $\tau_{\max} = \frac{3}{2} \tau_{\text{mean}}$
 - $\tau_{\max} = \frac{5}{2} \tau_{\text{mean}}$
16. Force method in structural analysis always ensures
- compatibility of deformation
 - equilibrium of forces
 - kinematically admissible strains
 - overall safety
17. At the point of application of a concentrated load on a beam there is
- sudden change of slope of B.M. diagram
 - maximum B.M.
 - point of contraflexure
 - maximum deflection
18. In a cantilever with uniformly distributed load the shear force varies following a
- Linear law
 - Parabolic law
 - Both (A) and (B)
 - None of these
19. Bending moment at supports in case of simply supported beams is always
- less than unity
 - more than unity
 - zero
 - None of these
20. If the axial deformation is neglected, what is the kinematic indeterminacy of a single bay portal frame fixed at base?
- 2
 - 3
 - 4
 - 6
21. A single-bay portal frame of height h , fixed at the base, is subjected to a horizontal displacement δ at the top. The base moments developed are each proportional to
- $\frac{1}{h}$
 - $\frac{1}{h^2}$
 - $\frac{1}{h^3}$
 - $\frac{1}{h^4}$

22. Due to some point load anywhere on a fixed beam, the maximum free bending moment is M . The sum of fixed end moments is

- (A) M
- (B) $1.5 M$
- (C) $2.0 M$
- (D) $3.0 M$

23. Muller-Breslau principle is applicable to get influence line for which one of the following ?

- (A) Reaction at the ends of a simple beam
- (B) Bending moment at a section
- (C) Shear force at a section
- (D) Forces and moments at any section

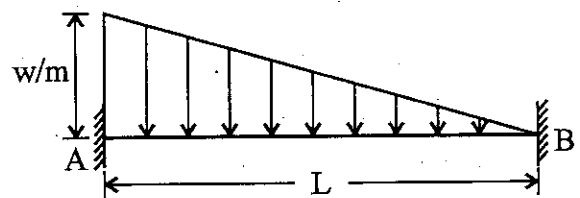
24. If a point load acting at the mid-span of a fixed beam of uniform section produces fixed end moments of 60 kNm , then the same load spread uniformly over the entire span will produce fixed end moments equal to

- (A) 20 kNm
- (B) 30 kNm
- (C) 40 kNm
- (D) 45 kNm

25. The moment distribution method in structural analysis falls in the category of

- (A) Displacement method
- (B) Force method
- (C) Flexibility method
- (D) First order approximate method

26. A fixed beam is loaded as in figure. The fixed end moment at support A ?



- (A) $wl^2/30$
- (B) $wl^2/20$
- (C) $wl^2/10$
- (D) $wl^2/8$

27. The displacement method is also referred to as which one of the following ?

- (A) Minimum strain energy method
- (B) Maxwell-Mohr method
- (C) Consistent deformation method
- (D) Slope-deflection method

28. Clapeyron's theorem is applied to
- Simply supported beam
 - Propped cantilever beam
 - Fixed and continuous beam
 - Continuous beam only
29. The number of independent equations to be satisfied for static equilibrium in a space structure is
- 3
 - 6
 - 4
 - 2
30. Which one of the following is true for a statically determinate beam ?
- One end is fixed and the other end is simply supported.
 - Both the ends are fixed.
 - The beam overhangs over two supports.
 - The beam is supported on three supports.
31. What is the number of plastic hinges formed if an indeterminate beam with redundancy R is to become determinate ?
- $R - 1$
 - R
 - $R + 1$
 - $R + 2$
32. The moment capacity of a section at plastic hinge equals
- Yield moment
 - Zero
 - Full plastic moment
 - Twice the yield moment
33. The shape of the cross-section, which has the largest shape factor is
- Rectangle
 - I-section
 - Diamond
 - Solid circular
34. The shape factors of a triangle section and a diamond section are respectively.
- 2.343 and 2.0
 - 2.0 and 2.343
 - 1.343 and 2.0
 - 2.0 and 1.343
35. The plastic moment capacity M_p is
- less than the yield moment
 - equal to the yield moment
 - greater than the yield moment
 - dependent on section dimensions

36. What value of the shape factor is taken for a rectangular section in plastic design ?
- 1.0
 - 1.5
 - 2.0
 - 2.5
37. At the location of plastic hinge
- radius of curvature is infinite
 - curvature is infinite
 - moment is infinite
 - flexural stress is infinite
38. Which one of the following is the load factor ?
- Live load / Dead load
 - Failure load / Working load
 - Total load / Dead load
 - Dynamic load / Static load
39. The effective flange area in tension of a plate girder is equal to
- A_f
 - $A_f + \frac{A_w}{2}$
 - $A_f + \frac{A_w}{8}$
 - $A_f + \frac{A_w}{6}$
- where A_f is the area of each flange and A_w is the area of web.
40. Web crippling is caused by
- Excessive bending moment
 - Failure of web under point loads
 - Width of flanges
 - Column action of web
41. How are the most commonly produced and used structural elements in frames, floor beams, etc. with high moment of inertia about x-axis, are designated ?
- ISWB-section
 - ISLB-section
 - ISMB-section
 - ISHB-section
42. Which one of the following is a compression member ?
- Purlin
 - Boom
 - Girt
 - Tie
43. The effective length of a battened strut of actual length L , effectively held in position at both ends but not restrained in direction, is taken as
- L
 - $1.1 L$
 - $1.5 L$
 - $1.8 L$

44. The best-suited rolled steel section for a tension member is
- Angle section
 - T-section
 - Channel section
 - Flat section
45. The effective length of the fillet weld is
- Total length $- 2 \times$ throat size
 - Total length $- 2 \times$ weld size
 - $0.7 \times$ throat length
 - Total length $- \left(\frac{\text{weld size}}{\sqrt{2}} \right)$
46. Which one of the following is the mode of failure in a fillet weld material ?
- Tension
 - Shear
 - Bearing
 - Crushing
47. The permissible stresses in rivets under wind load conditions as per IS : 800 can be exceeded by about
- 15%
 - 25%
 - 33%
 - 50%
48. The common assumption that all rivets share equally a non-eccentric load is valid at a load
- below the working load
 - equal to the working load
 - above the working load
 - equal to the failure load
49. Which of the following steel sections should preferably be used at places where torsion occurs ?
- Box-type section
 - Channel section
 - Angle section
 - Any of these
50. The order of elongation which a specimen of mild steel undergoes before fracture is
- 0.1%
 - 1%
 - 10%
 - 100%
51. The appropriate expression in assessing development length is
- $L_d = \frac{\phi \sigma_s}{4 \tau_{bd}}$
 - $L_d = \frac{\phi \sigma_{bc}}{\tau_{bd}}$
 - $L_d = \frac{\sigma_s}{4 \tau_{bd}}$
 - $L_d = \frac{\phi \sigma_s}{8 \tau_{bd}}$

52. High strength steel used in prestressed concrete can take how much maximum strain ?
- (A) 2%
 - (B) 3%
 - (C) 4%
 - (D) 6%
53. In a pre-stressed member, it is advisable to use
- (A) low strength concrete
 - (B) high strength concrete
 - (C) high-strength concrete and high-tension steel
 - (D) high-strength concrete and low-tension steel
54. Design of foundation for a large generator is guided, primarily by
- (A) Frequency
 - (B) Deformation
 - (C) Strength
 - (D) Stiffness
55. The critical section for two-way shear of footing is at the
- (A) face of the column
 - (B) distance d from the column face
 - (C) distance $d/2$ from the column face
 - (D) distance $2d$ from the column face
56. What is the minimum number of longitudinal bars provided in a reinforced concrete column of circular cross-section ?
- (A) 4
 - (B) 5
 - (C) 6
 - (D) 8
57. In limit state approach, spacing of main reinforcement controls primarily
- (A) Cracking
 - (B) Deflection
 - (C) Durability
 - (D) Collapse
58. Factor of safety is the ratio of
- (A) tensile stress to working stress
 - (B) compressive stress to working stress
 - (C) bending stress to working stress
 - (D) yield stress to working stress
59. Shear resistance of concrete in a reinforced concrete beam is dependent on
- (A) Tension reinforcement in the beam
 - (B) Compression reinforcement in the beam
 - (C) Shear reinforcement in the beam
 - (D) None of the reinforcement in the beam

60. As per IS 456-2000, the maximum permissible shear stress, $\tau_{c \max}$ is based on

- (A) Diagonal tension failure
- (B) Diagonal compression failure
- (C) Flexural tension failure
- (D) Flexural compression failure

61. When HYSD bars are used in place of mild steel bars in a beam, the bond strength

- (A) does not change
- (B) increases
- (C) decreases
- (D) becomes zero

62. Lap length of reinforcement in compression shall not be less than

- (A) 30ϕ
- (B) 24ϕ
- (C) 20ϕ
- (D) 5ϕ

where ϕ is the diameter of bar

63. Torsion reinforcement provided at the corners of a two-way slab

- (A) distributes bending moment uniformly
- (B) prevents cracking from lifting
- (C) controls cracking at corners
- (D) does not allow any twist at corners

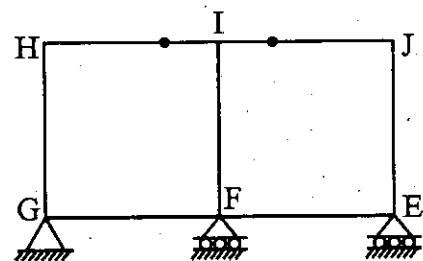
64. For the purpose of design as per IS : 456, deflection of RC slab or beam is limited to

- (A) 0.2% of span
- (B) 0.25% of span
- (C) 0.4% of span
- (D) 0.45% of span

65. The maximum depth of neutral axis for a beam with d as the effective depth, in limit state method of design for Fe415 steel is

- (A) $0.46 d$
- (B) $0.48 d$
- (C) $0.50 d$
- (D) $0.53 d$

66. The degree of static indeterminacy of the rigid frame having two internal hinges as shown in the figure below is



- (A) 8
- (B) 7
- (C) 6
- (D) 5

67. The unit load method used in structural analysis is

- (A) applicable only to statically indeterminate structures
- (B) another name for stiffness method
- (C) an extension of Maxwell's reciprocal theorem
- (D) derived from Castigliano's theorem

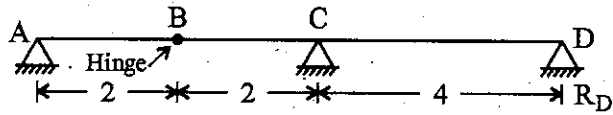
68. Shrinkage in a concrete slab

- (A) causes shear cracks
- (B) causes tension cracks
- (C) causes compression cracks
- (D) does not cause any cracking

69. A three-hinged arch of span L and rise R is subjected to a concentrated load P at the crown point. The horizontal thrust at the support is

- (A) $\frac{PL}{4R}$
- (B) $\frac{PL}{R}$
- (C) $\frac{PR}{L}$
- (D) $\frac{PL}{3R}$

70. What is the ordinate of influence line at B for reaction R_D in figure below?



- (A) 0.5
- (B) 0.4
- (C) 0.2
- (D) zero

71. As per IS-456 : 2000, side face reinforcement in a beam is provided where depth of the web exceeds

- (A) 750 mm
- (B) 250 mm
- (C) 500 mm
- (D) 1000 mm

72. The limits of percentage 'p' of the longitudinal reinforcement in a column is

- (A) 0.15% to 2%
- (B) 0.8% to 4%
- (C) 0.8% to 6%
- (D) 0.8% to 8%

73. A live load 20 kN/m, 6 m long, moves on a simply supported girder AB 12 m long. For maximum bending moment to occur at 4 m from left end A, where will the head of load be as measured from A ?
- (A) 4 m
 - (B) 6 m
 - (C) 8 m
 - (D) 10 m
74. The purpose of lateral ties in a short RC column is to
- (A) avoid buckling of longitudinal bars.
 - (B) facilitate compaction of concrete.
 - (C) increase the load carrying capacity of the column.
 - (D) facilitate construction.
75. In pre-stressed concrete, high grade concrete is used for
- (A) controlling the pre-stress loss
 - (B) having concrete of low ductility
 - (C) having concrete of high brittleness
 - (D) having low creep
76. What is the time by which the completion of an activity can be delayed without affecting the start of succeeding activities, called ?
- (A) Total float
 - (B) Interfering float
 - (C) Independent float
 - (D) Free float
77. Which one of the following project management techniques is deterministic in nature ?
- (A) CPM
 - (B) PERT
 - (C) GERT
 - (D) LCES
78. Which one of the following is associated with a critical activity in a A-O-A network ?
- (A) Maximum float
 - (B) Minimum float
 - (C) Zero float
 - (D) Free float

79. Slack time is associated with
- (A) A real activity
 - (B) An event
 - (C) Both event and real activity
 - (D) Dummy activity
80. Critical path moves along the activities having total float as
- (A) Positive
 - (B) Negative
 - (C) Zero
 - (D) Unity
81. In PERT analysis, the time estimates of activities follow
- (A) Normal distribution curve
 - (B) β -distribution curve
 - (C) Poisson's distribution curve
 - (D) Binomial distribution curve
82. Slack time in PERT analysis
- (A) can never be greater than zero
 - (B) is always zero for critical activities
 - (C) can never be less than zero
 - (D) is minimum for critical events
83. A serious limitation of inter dependences between various activities is generally observed in
- (A) Bar charts
 - (B) Milestone charts
 - (C) Network analysis
 - (D) Job layout
84. The amount of time by which the start of the activity may be delayed without interfering with the start of any succeeding activity is called
- (A) Activity float
 - (B) Free float
 - (C) Total float
 - (D) Interfering float
85. In a construction project, the cost-slope of an activity is an indication of
- (A) extra-time needed
 - (B) extra-cost needed
 - (C) reduction of durability of critical activity
 - (D) crashing of an activity

86. Hydration of which compound is responsible for increase in strength of cement in later age ?

- (A) Tri-Calcium Aluminate (C_3A)
- (B) Tetra-Calcium Aluminoferrite (C_4AF)
- (C) Tri-Calcium Silicate (C_3S)
- (D) Di-Calcium Silicate (C_2S)

87. Gypsum is used as an admixture in cement grouts for

- (A) accelerating the setting time
- (B) retarding the setting time.
- (C) increasing the plasticity.
- (D) reducing the grout shrinkage.

88. Efflorescence of bricks is due to

- (A) Excessive burning of bricks.
- (B) High Silt content in brick clay.
- (C) High porosity of bricks.
- (D) Soluble salts present in parent clay.

89. Which method of curing of concrete is recommendable for rapid gain of strength of concrete ?

- (A) Sprinkling water
- (B) Membrane curing
- (C) High-pressure steam curing
- (D) Infrared radiation curing

90. The moisture content in a properly seasoned timber will be in the range of

- (A) 5% to 8%
- (B) 8% to 10%
- (C) 10% to 12%
- (D) 12% to 15%

91. In the cross-section of a timber, cambium layer can occur in

- (A) Inner bark and Sap wood
- (B) Pith and Heart wood
- (C) Sap wood and Heart wood
- (D) Outer bark and Sap wood

92. A mortar for which both cement and lime are mixed is called

- (A) Gauged mortar
- (B) Cement mortar
- (C) Lime mortar
- (D) Light weight mortar

93. Guniting is the application of mortar

- (A) on a surface under pneumatic pressure.
- (B) on a vertical surface.
- (C) on brickwork by manual method.
- (D) of fluid consistency for repair works.

94. Lime mortar is generally made with

- (A) Quick lime
- (B) Fat lime
- (C) Hydraulic lime
- (D) White lime

95. The standard size of a brick is

- (A) 20 cm × 10 cm × 10 cm
- (B) 19 cm × 9 cm × 9 cm
- (C) 18 cm × 9 cm × 9 cm
- (D) 18 cm × 10 cm × 10 cm

96. A cantilever AB of length l has a moment M applied at free end. The deflection at the free end B is

- (A) $\frac{M^2 l}{EI}$
- (B) $\frac{Ml^2}{2EI}$
- (C) $\frac{Ml}{2EI}$
- (D) $\frac{Ml^3}{2EI}$

97. A beam of length ' l ' fixed at both the ends carries a udl ' w ' per unit length throughout the span. The bending moment at the ends is

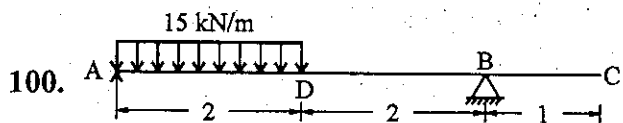
- (A) $\frac{wl^2}{8}$
- (B) $\frac{wl^2}{12}$
- (C) $\frac{wl^3}{12}$
- (D) $\frac{wl^2}{24}$

98. The major and minor principal stresses at a point are 3 MPa and -3 MPa respectively. The maximum shear stress at the point is

- (A) zero
- (B) 3 MPa
- (C) 6 MPa
- (D) 9 MPa

99. Shear span is defined as the zone where

- (A) Bending moment is zero.
- (B) Shear force is zero.
- (C) Shear force is constant.
- (D) Bending moment is constant.



At what distance from left support of the above beam is the shear force zero?

- (A) 1 m
- (B) 1.25 m
- (C) 1.5 m
- (D) 2.5 m