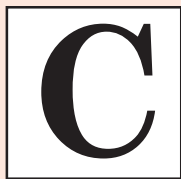


*Solutions of*

# MPSC 2019

MAIN EXAMINATION

**Assistant Engineer**  
(Group A & Group B)



Paper Code

**Civil Engineering**  
**Paper-I**

Date of Exam: 24-11-2019

**Paper Code T13**



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# MAHARASHTRA PUBLIC SERVICE COMMISSION



**Main Examination : 2019**

**Civil Engineering : Paper-I**

**Assistant Engineer : Group A & Group B**

1. The brick piece obtained by cutting a triangular portion of the brick such that half a headers and half a stretcher are obtained on adjoining cut faces is called as:

(1) Queen closer      (2) Mitred closer  
(3) King closer      (4) Three-Quarter Bat

**Ans. (3)**

2. Maximum water-cement ratio and minimum cement content for moderate exposure used in plain cement concrete are \_\_\_\_\_ ; \_\_\_\_\_ respectively, as per IS-456-2000.

(1) 0.60; 220 kg/m<sup>3</sup>  
(2) 0.60; 240 kg/m<sup>3</sup>  
(3) 0.50; 250 kg/m<sup>3</sup>  
(4) 0.55; 260 kg/m<sup>3</sup>

**Ans. (2)**

3. \_\_\_\_\_ are provided as a protective coatings to walls at its top to prevent seepage of water.

(1) Corbels              (2) Cornica  
(3) Copings            (4) Floating

**Ans. (3)**

4. Fire load, a fire risk criteria to classify occupancies, for a building having an area of 100 m<sup>2</sup> with combustible material of 1,000 kg having calorific value of 4,000 kcal/kg will be

(1) 4,00,000 kcal/m<sup>2</sup> (2) 40,000 kcal/m<sup>2</sup>  
(3) 250 kcal/m<sup>2</sup>      (4) 25 kcal/m<sup>2</sup>

**Ans. (2)**

5. Who had discovered direct relationship between water-cement ratio and strength of concrete?

(1) Jon Abraham      (2) Abraham Lincoln  
(3) Duff Abrams      (4) Albert Pinto

**Ans. (3)**

6. A well caisson is a foundation facilitating structure sunk in the ground or water; which is:

(1) Open at top as well as at bottom  
(2) Open at top and closed at bottom  
(3) Open at bottom and closed at top  
(4) Closed at top as well as at bottom

**Ans. (1)**

7. How much is the Carbon Content (%) in hard-steel?

(1) 0.5-0.8              (2) 0.8-1.5  
(3) 0.3-0.5              (4) 0.15-0.3

**Ans. (1, 2)**

8. Which of the following tests is not a test for evaluating workability of concrete?

(1) Slump Test  
(2) Flow Test  
(3) Compacting Factor Test  
(4) Le-Chatellier Test

**Ans. (4)**

9. One of the following measure could not reduce or eliminate plastic shrinkage cracks:

(1) Erect temporary wind breakers  
(2) Concrete should be poured in layers

- (3) Erect temporary roof
- (4) Reduce the time between placing and finishing

**Ans. (4)**

**10.** If the compressive strength of concrete increases, then tensile strength is also increases, but at a \_\_\_\_\_.

- (1) Increasing rate
- (2) Decreasing rate
- (3) Constant rate
- (4) Exponential increasing rate

**Ans. (2)**

**11.** One of the following is not a principle related to thermal insulation

- (1) Thermal resistance is directly proportional to thickness of a material
- (2) Provision of air gap plays an important role in thermal insulation
- (3) Transfer of heat from outside to inside increases
- (4) Thermal resistance of a building depends on orientation also

**Ans. (3)**

**12.** For the formwork design, IS 456-2000 suggested the deviation from specified dimensions of cross-section of columns and beams at \_\_\_\_\_.

- (1) +12 mm, -6 mm (2) +50 mm, -12 mm
- (3) +25 mm, -25 mm (4) +12 mm, -12 mm

**Ans. (1)**

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

- (1) Point load at the free end
- (2) Point load at the middle of its length
- (3) Uniformly distributed load over the whole length
- (4) None of the above

**Ans. (2)**

**14.** If a prismatic bar of uniform c/s 'A' and length 'L' is suspended from top, then the elongation of bar due to its self-weight only is \_\_\_\_\_. Where, E is modulus of elasticity of bar material and  $\gamma$  is the density of bar.

- (1)  $\frac{\gamma L^2}{2E}$  (2)  $\frac{\gamma L^2}{3E}$
- (3)  $\frac{\gamma L^2}{5E}$  (4)  $\frac{\gamma L^2}{6E}$

**Ans. (1)**

**15.** A simply supported beam carries couple at a point on its span, the shear force:

- (1) Varies by cubic law
- (2) Varies by parabolic law
- (3) Varies linearly
- (4) Is uniformly throughout

**Ans. (4)**

**16.** A point in a strained material is subjected to two mutually perpendicular stresses of 150 MPa (tensile) and 50 MPa (compression), then what will be the magnitude of maximum shear stress in the component?

- (1) 50 MPa (2) 100 MPa
- (3) 150 MPa (4) 200 MPa

**Ans. (2)**

**17.** Euler buckling load for one end fixed and the other hinged is given by:

- (1)  $\frac{\pi^2 EI}{l^2}$  (2)  $\frac{2\pi^2 EI}{l^2}$
- (3)  $\frac{4\pi^2 EI}{l^2}$  (4)  $\frac{\pi^2 EI}{4l^2}$

**Ans. (2)**

**18.** A simply supported beam AB of span 10 m carries a point load  $W = 10$  kN at C such that  $AC = 3$  m and  $BC = 7$  m, maximum deflection occur \_\_\_\_\_.

- (1) at C
- (2) at centre of span

- (3) between A and C  
(4) between B and C

Ans. (4)

19. A steel bar of 5 mm is heated from 15° to 40°C and it is free to expand. The bar will induce \_\_\_\_\_.  
(1) No stress (2) Shear stress  
(3) Tensile stress (4) Compressive stress

Ans. (1)

20. A steel rod of c/s area 100 mm<sup>2</sup> and 1 m long is subjected to a tensile force of 40 kN. What is the total elongation of the rod? If modulus of elasticity of steel is 200 GPa.  
(1) 0.5 mm (2) 0.7 mm  
(3) 1.2 mm (4) 2.0 mm

Ans. (4)

21. The relation governing the simple bending of beam is:  
(1)  $\frac{\sigma}{y} = \frac{M}{E} = \frac{I}{R}$  (2)  $\frac{\sigma}{y} = \frac{M}{E} = \frac{E}{I}$   
(3)  $\frac{\sigma}{E} = \frac{M}{I} = \frac{y}{R}$  (4)  $\frac{\sigma}{E} = \frac{M}{I} = \frac{E}{R}$

Ans. (4)

22. Maximum deflection of a simply supported beam with the total uniformly distributed load 'W' is  
(1)  $\frac{WL^2}{384EI}$  (2)  $\frac{5}{384} \frac{WL^3}{EI}$   
(3)  $\frac{WL^3}{48EI}$  (4)  $\frac{5}{48} \frac{WL^3}{EI}$

Ans. (2)

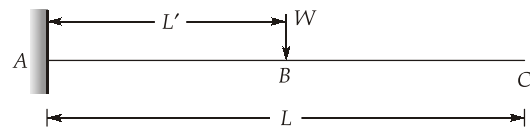
23. Euler's formula for buckling of column does not hold good if slenderness ratio  $\left(\frac{le}{K}\right)$  is \_\_\_\_\_ for mild steel column.  
(1) Less than 80 (2) Greater than 90  
(3) 120-160 (4) 90-120

Ans. (1)

24. The deflection at the free end of a cantilever of rectangular cross-section due to certain loading is 0.8 cm. If the depth of the section is doubled keeping the width same, then the deflection at the free end due to the same loading will be:  
(1) 0.1 cm (2) 0.4 cm  
(3) 0.8 cm (4) 1.6 cm

Ans. (1)

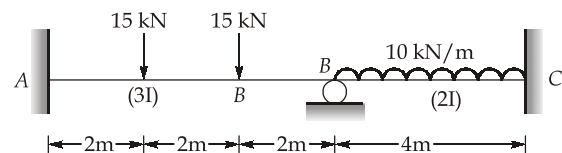
25. Which of the following is true in the following figure?



- (1) Deflection at C = deflection at B +  $\theta_B (L - L')$   
(2) Deflection at C =  $\frac{L}{L'}$  deflection at B  
(3) deflection at C = deflection at B +  $\theta_C (L - L')$   
(4) Both (1) and (3)

Ans. (4)

26. A two span continuous beam ABC is as shown in figure below. The distribution factors at joint B are



- (1) 0.4, 0.6 (2) 0.6, 0.4  
(3) 0.5, 0.5 (4) 0.55, 0.45

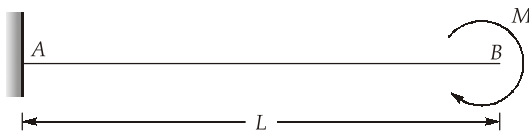
Ans. (3)

27. A two hinged semicircular arch of radius R carries a concentrated load W at the crown. Assuming uniform flexural rigidity, the horizontal thrust at each support will be

- (1)  $\frac{W}{2\pi}$  (2)  $\frac{W}{\pi}$   
 (3)  $\frac{4}{3} \frac{WR}{\pi}$  (4)  $\frac{W}{2}$

Ans. (2)

28. A cantilever beam AB of span 'L' is subjected to a moment 'M' at the free end as shown in figure. What is the slope and deflection at free end B?



- (1)  $\frac{ML}{EI}, \frac{ML^2}{2EI}$  (2)  $\frac{M}{LEI}, \frac{ML^2}{EI}$   
 (3)  $\frac{2ML}{EI}, \frac{2ML^2}{EI}$  (4)  $\frac{ML}{EI}, \frac{2ML^2}{EI}$

Ans. (1)

29. Maximum deflection for a simply supported beam subjected to UDL 'W' throughout span 'l' is

- (1)  $\frac{Wl^3}{48EI}$  (2)  $\frac{Wl^4}{48EI}$   
 (3)  $\frac{5}{384} \frac{Wl^3}{EI}$  (4)  $\frac{5}{384} \frac{Wl^4}{EI}$

Ans. (4)

30. A statically indeterminate structure is the one which:

- (1) Cannot be analysed at all  
 (2) Can be analysed using equations of statics only  
 (3) Can be analysed using equations of statics and compatibility equations  
 (4) Can be analysed using equations of compatibility only

Ans. (3)

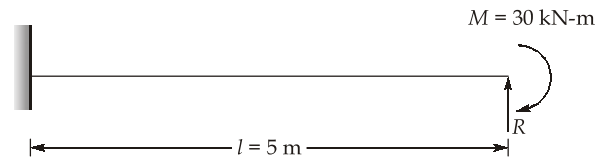
31. The moment required to rotate the near end of a prismatic beam through a unit angle

without translation, the far end being simply supported, is given by:

- (1)  $\frac{3EI}{l}$  (2)  $\frac{4EI}{l}$   
 (3)  $\frac{2EI}{l}$  (4)  $\frac{EI}{l}$

Ans. (1)

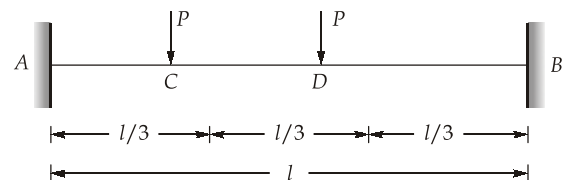
32. In the propped cantilever as shown in figure, the value of propped reaction 'R' will be:



- (1) 9 kN (2) 6 kN  
 (3) 3 kN (4) 2 kN

Ans. (1)

33. A fixed beam AB of length 'l' having constant flexural rigidity EI carries two loads P at its third points C and D as shown in figure.

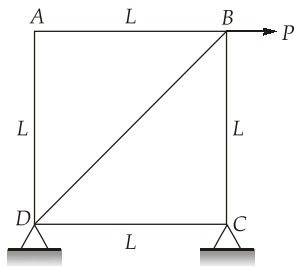


Numerically, maximum bending moment will occur:

- (1) at C and at D and will be equal to  $\frac{2}{9}Pl$   
 (2) between C and D and will be equal to  $\frac{Pl}{9}$   
 (3) at A and at B and will be equal to  $\frac{2}{9}Pl$   
 (4) between A and C and also between B and D and will be equal to  $\frac{Pl}{9}$

Ans. (3)

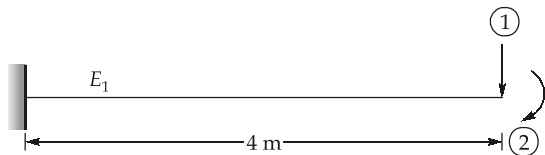
34. What is the force in member AB of the pin-jointed frame as shown below?



- (1) P (tension)      (2) P (compression)  
 (3)  $\frac{P}{\sqrt{2}}$  (compression) (4) Zero

Ans. (4)

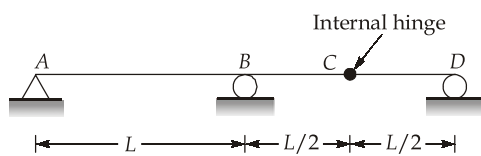
35. Displacement coordinates for the beam are as shown in figure. The flexibility matrix is given by:

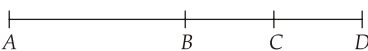
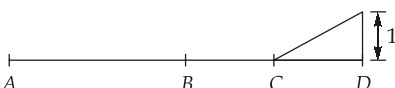


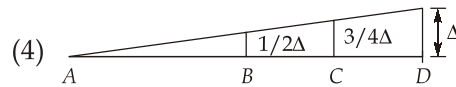
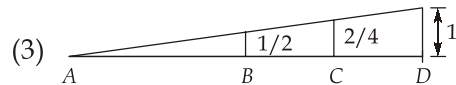
- (1)  $\frac{1}{EI} \begin{bmatrix} 64/3 & -8 \\ -8 & 64 \end{bmatrix}$     (2)  $\frac{1}{EI} \begin{bmatrix} 64/3 & 8 \\ 8 & -64/3 \end{bmatrix}$   
 (3)  $\frac{1}{EI} \begin{bmatrix} 64/3 & 8 \\ 8 & 4 \end{bmatrix}$     (4)  $\frac{1}{EI} \begin{bmatrix} 4 & -8 \\ -8 & 64-3 \end{bmatrix}$

Ans. (3)

36. For the continuous beam shown in figure, the ILD for reaction at D is \_\_\_\_\_



- (1)   
 (2) 



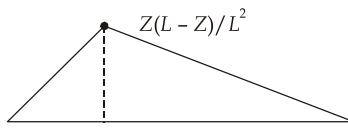
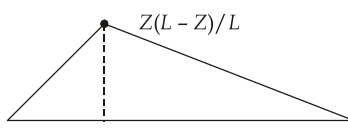
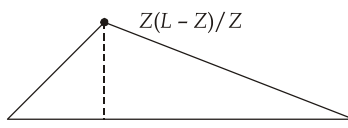
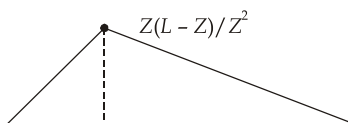
Ans. (2)

37. The cable and arch are subjected to axial force respectively as \_\_\_\_\_

- (1) Tensile and Compressive  
 (2) Compressive and Tensile  
 (3) Tensile and Tensile  
 (4) Compressive and Compressive

Ans. (1)

38. For a simply supported beam AB of span L with point load W at point C, Z m from left support, ILD for bending moment at C ( $M_C$ ) is:

- (1)   
 (2)   
 (3)   
 (4) 

Ans. (2)

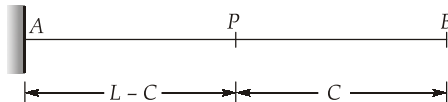
39. A parabolic three hinged arch ABC is supporting Uniformly Distributed Load of 500 N/m over its entire span of 100 m. The center point 'B' is vertically 25 m high from supports A and C. The reactions shall be \_\_\_\_\_.

- (1) 50 kN horizontal and vertical reactions at each support  
 (2) 25 kN horizontal and 50 kN vertical reaction at each support

- (3) 50 kN horizontal and 25 kN vertical reaction at each support  
 (4) 25 kN horizontal and vertical reaction at each support

Ans. (4)

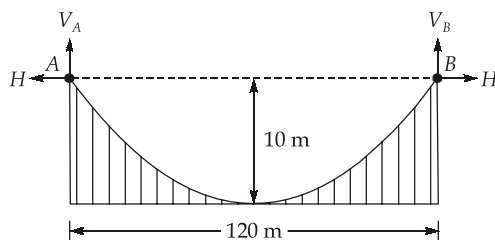
40. Influence line diagram for BM at P for cantilever as shown is:



- (1)
- (2)
- (3)
- (4)

Ans. (1)

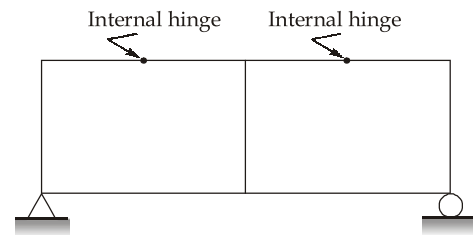
41. A cable of span 120 m and dip 10 m carries a load of 6 kN/m of horizontal span. The maximum tension in the cable is \_\_\_\_\_.



- (1) 1238.42 kN      (2) 1138.42 kN  
 (3) 1038.42 kN      (4) 1338.42 kN

Ans. (2)

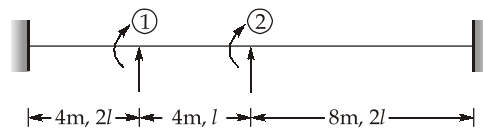
42. Degree of static indeterminacy for the frame shown below is \_\_\_\_\_.



- (1) 8      (2) 7  
 (3) 6      (4) 5

Ans. (4)

43. Displacement coordinators for the beam as shown in figure. The stiffness matrix is given by:



- (1)  $E_1 \begin{bmatrix} 3 & 1 \\ 1 & 2 \end{bmatrix}$       (2)  $E_1 \begin{bmatrix} 3 & -0.5 \\ -0.5 & 2 \end{bmatrix}$   
 (3)  $E_1 \begin{bmatrix} 3 & 0 \\ 0 & 2 \end{bmatrix}$       (4)  $E_1 \begin{bmatrix} 3 & 0.5 \\ 0.5 & 2 \end{bmatrix}$

Ans. (4)

44. The stiffness matrix of a beam is given as

$$K \times \begin{bmatrix} 12 & 4 \\ 4 & 5 \end{bmatrix}$$

Calculate the flexibility matrix.

Flexibility matrix will be \_\_\_\_\_.

- (1)  $\frac{K}{44} \begin{bmatrix} 12 & -4 \\ -4 & 5 \end{bmatrix}$       (2)  $\frac{K}{44} \begin{bmatrix} 12 & 4 \\ 4 & 5 \end{bmatrix}$   
 (3)  $\frac{1}{44} \begin{bmatrix} 12 & -4 \\ -4 & 5 \end{bmatrix}$       (4)  $\frac{1}{44} \begin{bmatrix} 5 & -4 \\ -4 & 12 \end{bmatrix}$

Ans. (4)

45. For simply supported beam of span 10 m, influence line diagram is drawn for bending moment at a section 4 m from left hand support. The maximum bending moment at the section due to moving point load of 160 kN is equal to \_\_\_\_\_.

- (1) 640 kN-m      (2) 960 kN-m  
(3) 384 kN-m      (4) 400 kN-m

**Ans. (3)**

46. The thickness of the base plate is determined from the:  
(1) Flexural strength of the plate  
(2) Shear strength of the plate  
(3) Bearing strength of the concrete pedestal  
(4) Punching criteria

**Ans. (1)**

47. The plate used as a connecting piece at the intersection of two or more members in a roof truss is called as:  
(1) Template      (2) Gusset plate  
(3) Base plate      (4) Shoe plate

**Ans. (2)**

48. The design shear stress for which of the following weld types is same as that for fillet welds?  
(1) Plug weld only  
(2) Slot weld only  
(3) Plug and Slot weld only  
(4) Slot and Butt weld only

**Ans. (3)**

49. The economical range of spacing of roof trusses is:  
(1)  $\frac{1}{2}$  to  $\frac{1}{3}$  of span    (2)  $\frac{1}{2}$  to  $\frac{1}{4}$  of span  
(3)  $\frac{1}{4}$  to  $\frac{1}{6}$  of span    (4)  $\frac{1}{3}$  to  $\frac{1}{5}$  of span

**Ans. (4)**

50. The purpose of stiffness in a plate girder is to:  
(1) Prevent buckling of web  
(2) Increase moment carrying capacity of the girder  
(3) Reduce the shear stress  
(4) take care of bearing stress

**Ans. (1)**

51. Which of the following statement is correct for reducing web buckling due to diagonal compression?

- (1) Not providing web stiffeners to increase shear strength  
(2) Providing web stiffener to reduce shear strength  
(3) Increasing depth of thickness ratio  
(4) Reducing depth to thickness ratio

**Ans. (4)**

52. Spot welding is used when two plates are placed:

- (1) One below the other  
(2) One butting against the other  
(3) One next to other  
(4) At right angles to each other

**Ans. (1)**

53. The metal added at the joint while welding is known as \_\_\_\_\_.

- (1) Weld metal  
(2) Filler  
(3) Fillet metal  
(4) All the above are correct

**Ans. (2)**

54. The behaviour of a beam column cross-section is expressed by which of the following relationship?

- (1) Moment-Curvature  
(2) Moment-Axial compression  
(3) Axial compression-Curvature  
(4) Moment-Curvature-Axial compression

**Ans. (4)**

55. An angle section can be used as purlin when slope of the roof truss is:

- (1) between  $40^\circ$  and  $70^\circ$   
(2) less than  $30^\circ$   
(3) greater than  $30^\circ$   
(4) less than  $45^\circ$

**Ans. (2)**

56. The anchor bolts are provided to check the:

- (1) settlement of foundation
- (2) punching shear of base plate
- (3) uplift of base plate
- (4) moment of base plate

Ans. (3)

57. In design of slab, as per IS-456, what should be minimum percent of distribution steel if Fe415 reinforcement is used?

- (1) 0.12% of total cross-section
- (2) 0.15% of total cross-section
- (3) 0.50% of total cross-section
- (4) 1% of total cross-section

Ans. (1)

58. What is the effective span of staircase, supported at each end by landing spanning parallel with the risers, if the width of landing is 2.5 m, width of starting passage is 1.5 m and going of the stair is 2.2 m?

- (1) 6.2 m
- (2) 4.2 m
- (3) 3.95 m
- (4) 4.5 m

Ans. (3)

59. For high yield strength deformed bars of grade Fe500, the permissible stress in direct tension and flexure tension shall be \_\_\_\_\_ used in working stress method.

- (1)  $0.87 f_y$
- (2)  $0.67 f_y$
- (3)  $0.55 f_y$
- (4)  $0.48 f_y$

Ans. (3)

60. A column c/s  $300 \text{ mm} \times 400 \text{ mm}$ , 2250 mm long fixed at one end and free at other end. The ratio of effective length to the least lateral dimension is :

- (1) 7.5
- (2) 15
- (3) 11.25
- (4) 9

Ans. (2)

61. If, in any given plane, one end of the column is unrestrained, its unsupported length 'l'

shall not exceed \_\_\_\_\_. Where 'b' is width and 'D' is depth of cross-section in plane under consideration.

- (1)  $\frac{100b}{D}$
- (2)  $\frac{100b^2}{D}$
- (3)  $\frac{100D}{b}$
- (4)  $\frac{100D^2}{b}$

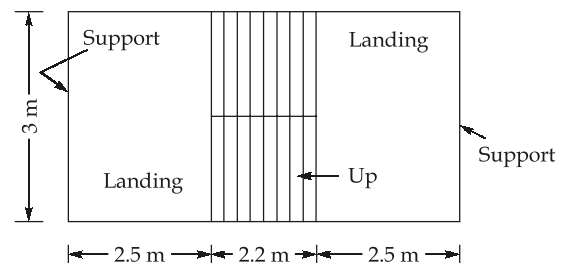
Ans. (2)

62. What is the maximum diameter of main reinforcement used in the slab of overall thickness 160 mm as per IS 456 : 2000?

- (1) 10 mm
- (2) 12 mm
- (3) 16 mm
- (4) 20 mm

Ans. (4)

63. What is the effective span of staircase supported at each end by edge of the landing slab, which spans parallel, with the risers, if width of both landings is 2.5 m and going of stair is 2.2 m (see fig.):



- (1) 7.2 m
- (2) 4.7 m
- (3) 4.2 m
- (4) 2.2 m

Ans. (3)

64. If top of earth retained is horizontal, the coefficient of passive earth pressure for retaining wall become:

- (1)  $Cp = \frac{1 - \sin \phi}{1 + \sin \phi}$
- (2)  $Cp = \frac{1 + \sin \phi}{1 - \sin \phi}$
- (3)  $Cp = \frac{\sin \phi - 1}{\sin \phi + 1}$
- (4)  $Cp = \frac{\sin \phi + 1}{\sin \phi - 1}$

Ans. (2)

65. The minimum area of tension reinforcement shall be not less than \_\_\_\_\_ for design of beam.

- (1)  $\frac{0.87}{f_y} bD$  (2)  $\frac{0.85}{f_y} bd$   
 (3)  $\frac{0.67}{f_y} bD$  (4)  $\frac{0.76}{f_y} bd$

Ans. (2)

66. For the design of staircase, self-weight of waist slab is calculated as \_\_\_\_\_. Where, T = Tread, R = Riser and D = depth of waist slab,  $\gamma_c$  = density of R.C.C.

- (1)  $\gamma_c D$  (2)  $\gamma_c D \left( \frac{T}{\sqrt{R^2 + T^2}} \right)$   
 (3)  $\gamma_c \frac{\sqrt{T^2 + R^2}}{T}$  (4)  $\gamma_c D \frac{\sqrt{T^2 + R^2}}{T}$

Ans. (4)

67. In the design of retaining wall, both, active earth pressure and passive earth pressure is considered due to soil available on both sides (with different heights) of R.C.C. retaining wall. If angle of repose,  $\phi = 30^\circ$ , then what will be the relation between coefficient of active earth pressure ( $K_a$ ) and passive earth pressure ( $K_p$ )

- (1)  $K_a = \frac{1}{3} K_p$  (2)  $K = 3K_p$   
 (3)  $K_a = 9K_p$  (4)  $K_a = \frac{1}{9} K_p$

Ans. (4)

68. High tensile bars threaded at the ends are used in:

- (1) Freyssinet system  
 (2) Gifford-Udall system  
 (3) Lee-McCall system  
 (4) Magnel-Blaton system

Ans. (3)

69. The rate of increase of stress is large in case of :

- (1) Bonded beams  
 (2) Unbonded beams  
 (3) Tensioned beams  
 (4) Anchorage beams

Ans. (1)

70. The minimum transverse reinforcement is prestressed concrete beam is given by formula:

- (1)  $\frac{bS_v}{A_{S_v}} = \frac{0.87 f_y}{0.4}$  (2)  $\frac{A_{S_v}}{bS_v} = \frac{0.4}{0.87 f_y}$   
 (3)  $\frac{A_{S_v}}{0.87 f_y} = \frac{0.4}{bS_v}$  (4)  $\frac{bS_v}{0.87 f_y} = \frac{A_{S_v}}{0.4}$

Ans. (2)

71. A simply supported prestressed concrete beam of span 10 m is subjected to a point load of 10 kN at centre. Prestressing force of 2000 kN is applied through inclined tendon, zero eccentricity at support and 'e' at mid-span. To nullify the external point load effect, how much 'e' should be provided? Neglect the self-weight of beam.

- (1) 12.5 mm (2) 50 mm  
 (3) 70 mm (4) 85 mm

Ans. (1)

72. A concrete beam is post-tensioned by a cable carrying an initial stress of 1000 N/mm<sup>2</sup>, the slip at jacking end was observed to be 5 mm, modulus of steel is 210 kN/mm<sup>2</sup> and span of beam is 30 m; what is % of loss of stress due to anchorage?

- (1) 3.5% (2) 2.5%  
 (3) 1.5% (4) 4.0%

Ans. (1)

73. On the areas immediately behind external anchorage, the permissible unit bearing stress on the concrete, after accounting for losses

due to relaxation of steel, elastic shortening and seating of anchorages, shall not exceed \_\_\_\_\_.

$$(1) 0.48 f_{ci} \sqrt{\frac{A_{bearing}}{A_{punching}}} \text{ or } 0.8 f_{ck}$$

whichever is smaller

$$(2) 0.45 f_{ci} \sqrt{\frac{A_{bearing}}{A_{punching}}} \text{ or } 0.40 f_{ck}$$

whichever is smaller

$$(3) 0.48 f_{ci} \sqrt{\frac{A_{bearing}}{A_{punching}}} \text{ or } 0.76 f_{ck}$$

whichever is smaller

$$(4) 0.40 f_{ci} \sqrt{\frac{A_{bearing}}{A_{punching}}} \text{ or } 0.78 f_{ck}$$

whichever is smaller

**Ans. (1)**

74. A post tensioned concrete beam is prestressed by means of three cables each  $100 \text{ mm}^2$  areas and stressed to  $1100 \text{ MPa}$ . All three cables are straight and located at an eccentricity of  $50 \text{ mm}$ . If modulus modular ratio ( $m$ ) = 6 and stress in concrete at the level of steel ( $f_c$ ) =  $5 \text{ MPa}$ , then what is the loss of stress in cables due to elastic shortening if all cables are simultaneously tensioned and anchoring?

- (1)  $90 \text{ MPa}$                       (2)  $60 \text{ MPa}$   
(3)  $30 \text{ MPa}$                       (4)  $0 \text{ MPa}$

**Ans. (4)**

75. The net downward force of prestressed concrete beam with bent tendon is given as:

- (1)  $w - 2P \sin \theta$                       (2)  $w + 2P \sin \theta$   
(3) Zero                                  (4) 2

**Ans. (1)**

76. In a prestressed concrete beam, the ratio of applied prestressing force ( $P$ ) to the concrete

capacity of the section in compression is known as \_\_\_\_\_.

- (1) Moment ratio ( $R$ )  
(2) Eccentricity ratio ( $\epsilon$ )  
(3) Reinforcement Ratio ( $m$ )  
(4) Efficiency factor ( $\rho$ )

**Ans. (4)**

77. A system usually adopted in the production of pre-tensioned members like railway sleepers, poles, etc. on large scale is \_\_\_\_\_.

- (1) Magnel-Blaton system  
(2) P.S.C. Monowire system  
(3) Hoyer system  
(4) Gifford-Udall system

**Ans. (3)**

78. At the time of initial tensioning, the maximum tensile stress  $f_{pi}$  immediately behind the anchorage shall not exceed \_\_\_\_\_ of the ultimate tensile strength  $f_{pu}$  of the wire or bar or strand.

- (1) 55%                                  (2) 69%  
(3) 76%                                  (4) 85%

**Ans. (3)**

79. The PERT is a management tool, having expected mean time ( $t_m$ ), optimistic time ( $t_o$ ) and pessimistic time ( $t_p$ ), where the variance is given by \_\_\_\_\_.

- (1)  $\frac{t_p - t_o}{6}$                                   (2)  $\frac{t_o + 4t_m + t_p}{6}$   
(3)  $(t_p - t_o)^2$                                   (4)  $\left(\frac{t_p - t_o}{36}\right)^2$

**Ans. (\*)**

80. Items of 'C' type are identified for a project using ABC analysis. Which of the following statements are true for them?

- (a) Even rough quantity estimate is sufficient  
(b) Bulk ordering is preferred

- (c) Ordering on EOQ basis is preferred
- (d) Even junior level staff authorised to order

**Answer Options:**

- (1) All of the above (2) (a), (b) and (d)
- (3) Only (c) (4) None of the above

**Ans. (2)**

81. A construction company has annual demand of 200 M./T. of steel, The annual cost of carrying per M.T. of steel is Es. 2000 and the cost of place an order is Rs. 50000. What is the economic order quantity?

- (1) 50 M.T. (2) 70.7 M.T.
- (3) 100 M.T. (4) 40 M.T.

**Ans. (3)**

82. A part of quality management system, that indicates the degree to which design quality is achieved in the actual construction work is called:

- (1) Quality Assurance
- (2) Quality of design
- (3) Quality of conformance
- (4) Quality of performance

**Ans. (1)**

83. Which among the following equipment found suitable for removing material from coffer dam, sewer manholes and well foundations?

- (1) Clamshell (2) Power shovel
- (3) Dragline (4) Back hoe

**Ans. (1)**

84. The following technique is not a quality control method \_\_\_\_\_.

- (1) Inspection (2) Testing
- (3) Designing (4) Sampling

**Ans. (3)**

85. Which among the following construction equipment would you recommend for compaction of cohesive soil?

- (1) Smooth-Wheeled Rollers
- (2) Sheep Foot Rollers
- (3) Vibratory Rollers
- (4) Tampers

**Ans. (2)**

86. Which of the following is not a type of drilling equipment?

- (1) Jack Hammer (2) Shot drill
- (3) Drifter (4) Ripper

**Ans. (4)**

87. Which are some of the factors to be considered while designing site layout?

- (a) Construction sequence
- (b) Quantity of materials to be stored
- (c) Parking of workers
- (d) Sanitary facilities
- (e) Soil conditions

**Answer Options:**

- (1) (a), (b), (c) and (d)
- (2) All of the above
- (3) (a) and (b)
- (4) (a), (b) and (e)

**Ans. (2)**

88. When was the National Safety Council set up in India?

- (1) 1966 (2) 1867
- (3) 1948 (4) 1962

**Ans. (1)**

89. Independent float of an activity (i, j) is denoted by IF (i, j). The earliest occurrence times of i and j are denoted by  $E_i$  and  $E_j$  respectively. The latest occurrence times of i and j are denoted by  $L_i$  and  $L_j$  respectively.  $D(i, j)$  indicates the duration of the activity. Select correct option giving IF (i, j):

- (1)  $E_j - L_i - D(i, j)$  (2)  $L_j - E_i - D(i, j)$
- (3)  $L_j - E_j - D(i, j)$  (4)  $E_j - E_i$

**Ans. (1)**

90. The convergence in the Bisection method is \_\_\_\_\_.

- (1) non-linear (2) linear  
(3) exponential (4) all of the above

Ans. (2)

91. The Bisection method is also known as \_\_\_\_\_.

- (1) Quaternary chopping  
(2) Tri-region chopping  
(3) Binary chopping  
(4) Hex-region chopping

Ans. (3)

92. A cross-section area of river flow can be calculated by using following formula \_\_\_\_\_.

- (1) Simpson's rule (2) Trapezoidal rule  
(3) Both (1) and (2) (4) Thumb rule

Ans. (3)

93. Newton-Raphson method has \_\_\_\_\_.

- (1) first order convergence  
(2) second order convergence  
(3) first order divergence  
(4) second order divergence

Ans. (2)

94. In Gauss Jordan method which of the following transformations are allowed:

- (1) Diagonal transformations  
(2) Column transformations  
(3) Row transformations  
(4) Square transformations

Ans. (3)

95. The value of  $\int_{-3}^3 x^4 dx$  by using Trapezoidal rule is :

- (1) 112 (2) 114  
(3) 113 (4) 115

Ans. (4)

96. Bisection method is based on the repeated application of the \_\_\_\_\_ value property.

- (1) intermediate (2) mediate  
(3) convergent (4) divergent

Ans. (1)

97. The curve in a trapezoidal rule passing through the coordinates of a straight line has a polynomial of \_\_\_\_\_.

- (1) First order (2) Second order  
(3) Third order (4) Fourth order

Ans. (1)

98. A river is 80 metre wide. The depth 'd' in metres at a distance 'x' metres from one bank is given, by the following table:

x:	0	10	20	30	40	50	60	70	80
d:	0	4	7	9	12	15	14	8	3

Hence the area of c/s of the river using Simpson's rule is :

- (1) 713 sq. met. (2) 710 sq. met.  
(3) 715 sq. met (4) 716 sq. met.

Ans. (2)

99. Evaluate  $\int_0^2 \frac{1}{2x+1}$  by using Trapezoidal rule.

Take number of intervals = 2 (with each step = 1).

- (1) 0.867 (2) 0.933  
(3) 1.267 (4) 1.333

Ans. (2)

100. The quadratic equation  $2x^2 + 3x + 8 = 0$  is to be solved numerically starting with an initially value for  $x_0 = 2$ . The new estimate of x after the first iteration using Newton Raphson method is \_\_\_\_\_.

- (1) 4 (2) 1  
(3) 0 (4) -1

Ans. (3)