Engg. Services Exam, 2011

DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE ASKED TO DO SO

T.B.C. : P-RSR-L-PRA **Test Booklet Series**

A

Serial 22901

TEST BOOKLET

CIVIL ENGINEERING

Paper I

Time Allowed : Two Hours ***Maximum Marks : 200***

INSTRUCTIONS

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.
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.
3. You have to enter your Roll Number on the Test Booklet in the Box provided alongside. ***DO NOT*** write ***anything else*** on the Test Booklet.
4. This Test Booklet contains **120** items (questions). Each item comprises four responses (answers). You will select the response which you want to mark on the Answer Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose ***ONLY ONE*** response for each item.
5. You have to mark all your responses ***ONLY*** on the separate Answer Sheet provided. See directions in the Answer Sheet.
6. All items carry equal marks.
7. Before you proceed to mark in the Answer Sheet the response to various items in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per instructions sent to you with your Admission Certificate.
8. After you have completed filling in all your responses on the Answer Sheet and the examination has concluded, you should hand over to the Invigilator ***only the Answer Sheet.*** You are permitted to take away with you the Test Booklet.
9. Sheets for rough work are appended in the Test Booklet at the end.
10. **Penalty for wrong answers :**

    THERE WILL BE PENALTY FOR WRONG ANSWERS MARKED BY A CANDIDATE IN THE OBJECTIVE TYPE QUESTION PAPERS.

    (i) There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, **one-third (0·33)** of the marks assigned to that question will be deducted as penalty.

    (ii) If a candidate gives more than one answer, it will be treated as a **wrong answer** even if one of the given answers happens to be correct and there will be same penalty as above to that question.

    (iii) If a question is left blank, i.e., no answer is given by the candidate, there will be **no penalty** for that question.

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1. For different concrete specimens, each hydrated to the same degree, the permeability is

(a) Higher with lower water cement ratio and higher cement content

(b) Lower with lower water cement ratio and higher cement content

(c) Lower with higher water cement ratio and lower cement content

(d) Lower with higher water cement ratio and higher cement content

2. Modulus of elasticity of concrete is increased with

(a) Higher W/C ratio

(b) Shorter curing period

(c) Lesser vibration

(d) Increase in age

3. Stress-strain curve of concrete is

(a) A perfect straight line upto failure

(b) Straight line upto 0·002% strain value and then parabolic upto failure

(c) Nearly parabolic upto 0·002% strain value and then a straight line upto failure

(d) Hyperbolic upto 0·002% strain value and then a straight line upto failure

4. Match List I with List II and select the correct answer using the code given below the lists :

List I (Grade of cement & Age)	*List II (Compressive strength in N/mm^2)*
A. Grade 33 (7 days)	1. 27
B. Grade 43 (28 days)	2. 43
C. Grade 53 (3 days)	3. 22
D. Grade 43 (7 days)	4. 33

Code :

	A	B	C	D
(a)	4	2	1	3
(b)	3	2	1	4
(c)	4	1	2	3
(d)	3	1	2	4

5. When percentage of mica present in sand is large, it

(a) Reduces the strength of mortar, or concrete

(b) Increases the strength of mortar, or concrete

(c) Has no effect on mortar, or concrete strength

(d) Enhances the strength of mortar, or concrete, but only marginally

6. Consider the following statements :

1. Dry rot in sap wood is caused by fungal attack.
2. Brown rot in conifereus woods is a result of fungal attack.
3. Alternate wetting and drying of unseasoned timber causes 'powdery' form of decay in wood

Which of these statements are correct ?

(a) 1, 2 and 3

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1 and 3 only

7. Which of the following statements refer to correct purposes as regards testing of concrete by ultrasonic pulse velocity method ?

1. To assess the quality of concrete in-situ.
2. To determine the dynamic modulus of elasticity of concrete.
3. To locate the presence of cracks in it.

(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2 and 3

8. If 'W' is the percentage of water required for normal consistency of cement, water to be added for determination of initial setting time is

(a) 0·50 W
(b) 0·62 W
(c) 0·75 W
(d) 0·85 W

9. Consider the following statements :

Fibre saturation point in wood is reached when

1. Free water is removed.
2. Cell water is removed.
3. Shrinkage of wood is rapid.
4. Strength gain is rapid.

Which of these statements are correct ?

(a) 1, 2 and 3
(b) 1 and 2 only
(c) 2 and 4 only
(d) 1, 3 and 4

10. Which of the following theories of failure is most appropriate for a brittle material ?

(a) Maximum principal strain theory
(b) Maximum principal stress theory
(c) Maximum shear stress theory
(d) Maximum strain energy theory

11. A simply supported beam AB is subjected to a concentrated load at C, the centre of the span. The area of the SF diagram from A to C will give

(a) BM at C
(b) Load at S
(c) SF at C
(d) Difference between BM values at A and C

12. In a strained material, the principal stresses in the X and Y directions respectively are 100 N/mm^2 (Tensile) and 60 N/mm^2 (Compressive). On an inclined plane, the normal to which makes an angle of 30° to the X-axis, the major principal stress, in N/mm^2, would be

(a) 60
(b) 80
(c) 20
(d) 40

13. Which one of the following statements is correct ?

(a) Principal stress is defined as the shear stresses on planes on which the normal stress is maximum or minimum.
(b) The centre of Mohr's circle for a two-dimensional stress system always lies in the y-axis (adopting conventional axes notation).
(c) The plane of maximum shear stress is inclined to the plane of principal stress at an angle of 45°.
(d) In case of biaxial state of normal stresses, the normal stress on 45° plane is equal to the sum of normal stresses.

14. Consider the following statements :

1. Failure occurs beyond elastic limit.
2. Rupture takes place immediately after elastic limit.
3. Permanent set occurs beyond elastic limit.

Which of these are considered in the theories of failure ?

(a) 1, 2 and 3
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1 and 2 only

15. Consider the following salient points in a stress-strain curve of a mild steel bar :

1. Yield point
2. Braking point
3. Yield plateau
4. Proportionality limit
5. Ultimate point

The correct sequence in which they occur while testing the mild steel bar in tension from initial zero strain to failure is

(a) 4, 1, 2, 3 and 5
(b) 1, 4, 3, 5 and 2
(c) 4, 1, 3, 5 and 2
(d) 1, 4, 2, 3 and 5

16. A pedestal of rectangular cross-section of size B × D is subjected to a vertical load P. For the stress to be zero at the farthest point in the first quadrant of X Y axes of the section (with the origin at the symmetric midpoint) due to the load acting in the third quadrant is bounded by the straight line,

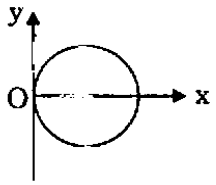
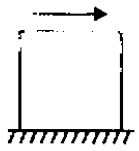
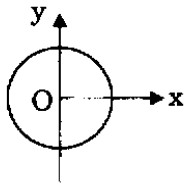
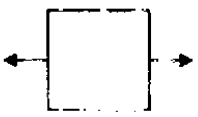
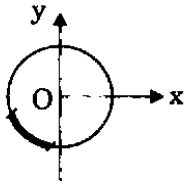
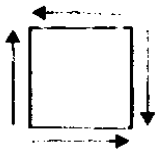
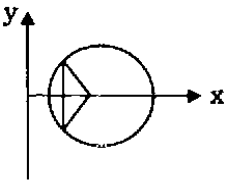
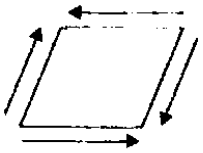
(a) $\frac{6X}{B} - \frac{6Y}{D} = 1$

(b) $\frac{6X}{B} + \frac{6Y}{D} = -1$

(c) $\frac{6X}{B} + \frac{6Y}{D} = 1$

(d) $\frac{6X}{D} + \frac{6Y}{B} = 1$

17. Match List I with List II and select the correct answer using the code given below the lists :

List I (Mohr's Circle)	*List II (Stress System)*
A. 	1. 
B. 	2. 
C. 	3. 
D. 	4. 

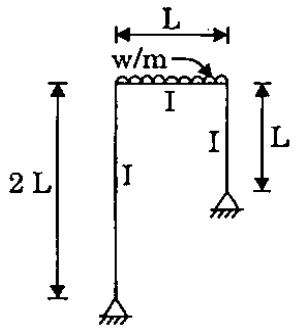
Code :

	A	B	C	D
(a)	2	4	1	3
(b)	3	4	1	2
(c)	2	1	4	3
(d)	3	1	4	2

18. A uniformly distributed load (w) of length shorter than the span crosses a girder. The bending moment at a section in the girder will be maximum when

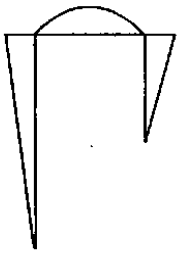
(a) Head of the load is at the section
(b) Tail of the load is at the section
(c) Section divides the load in the same ratio as it divides the span
(d) Section divides the load in two equal lengths

19.

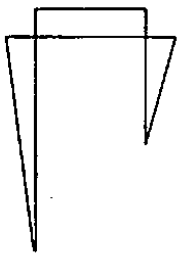


The bending moment diagram for the above shown portal frame is

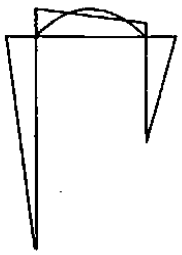
(a)



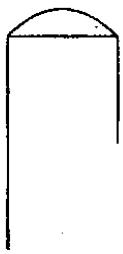
(b)



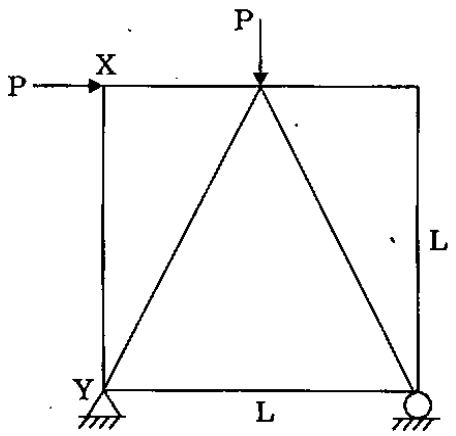
(c)



(d)



20.



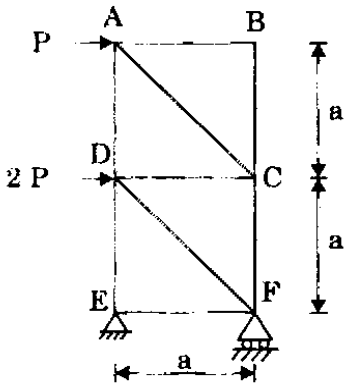
The truss is shown in figure. The cross-sectional area of each member is 'A', and the modulus of elasticity of the material is uniformly E. The strain energy in the member XY is given by

(a) $\frac{P^2L}{6\,AE}$

(b) $\frac{P^2L}{3\,AE}$

(c) Zero

(d) $\frac{P^2L}{2\,AE}$

21. 

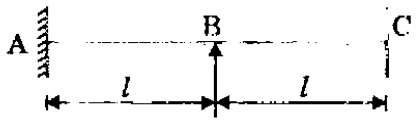
The force in the member CD is

(a) P Tensile

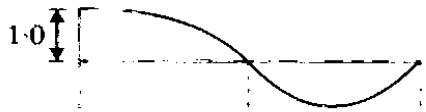
(b) P Compressive

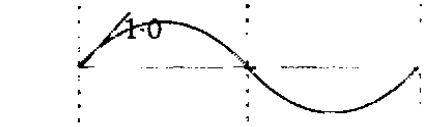
(c) 2P Tensile

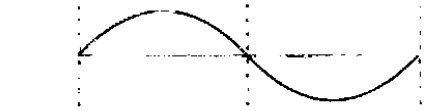
(d) 2P Compressive

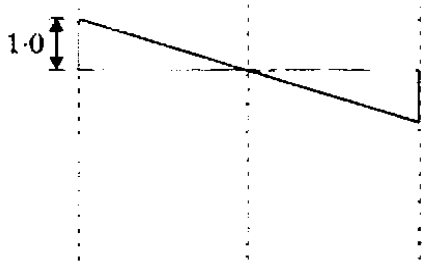
22. 

The influence line for vertical reaction at A of the beam is

(a) 

(b) 

(c) 

(d) 

23. The moment capacity of a section at plastic hinge equals

(a) Yield moment

(b) Zero

(c) Fully plastic moment

(d) Twice the yield moment

24. Which one of the following is the correct ratio of plastic moment to yield moment for a simply supported beam of uniform square cross-section throughout the span ?

(a) 1·5

(b) 1·7

(c) 2·0

(d) 2·34

25. A fixed beam with central point load undergoes a slight settlement at one end.

Select suitable answer from the following :

(a) Moment induced at both ends will be same

(b) Moment induced at the end that has undergone settlement will be maximum

(c) Moment induced will be maximum at the end having no settlement

(d) Zero moment at the end that has settled

26. An increase in temperature on the top fibre of a simply supported beam will cause

(a) Downward deflection

(b) Upward deflection

(c) No deflection

(d) Angular rotation about neutral axis

27. The number of independent equations to be satisfied for static equilibrium in a space structure is

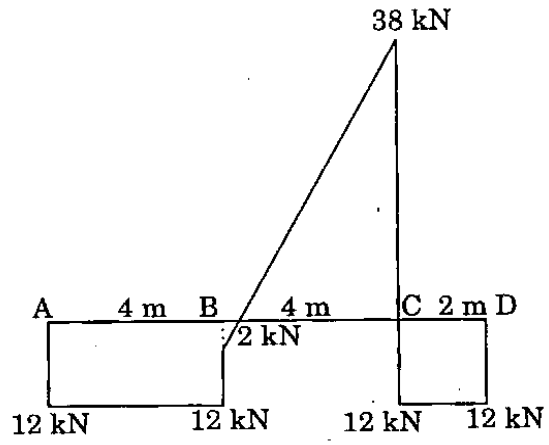
(a) 3

(b) 6

(c) 4

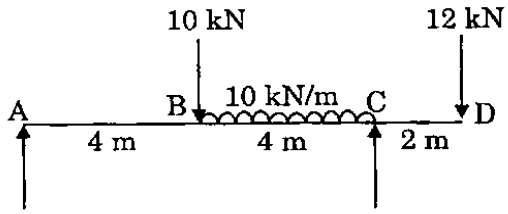
(d) 2

28. The loading on a beam is shown



The shear force diagram for the above figure is

(a)



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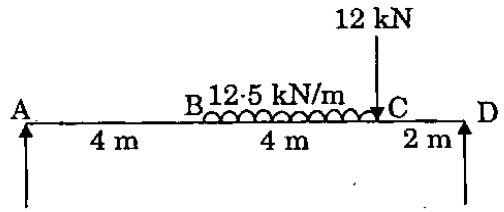

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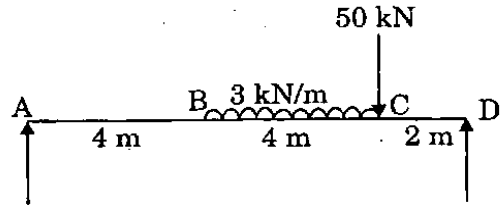
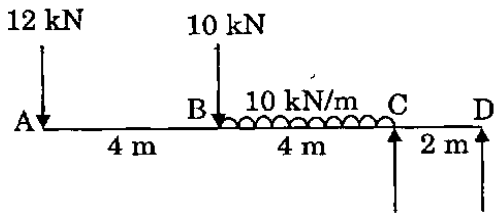
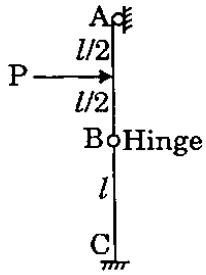


(d).

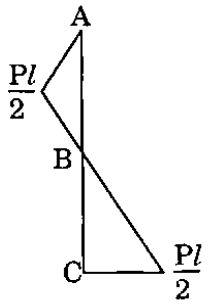


29.

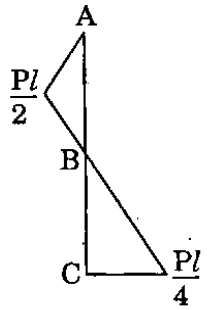


The correct bending moment diagram for the column is

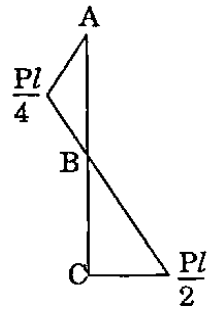
(a)



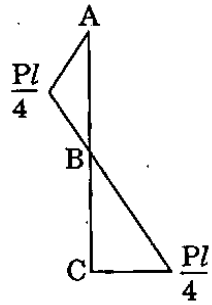
(b)



(c)



(d)



30. A propped cantilever beam AB of span L is subjected to a moment M at the prop end B. The moment at fixed end A is

(a) 2M

(b) $\frac{M}{2}$

(c) M

(d) $\frac{3M}{4}$

31. Which of the following steel sections should preferably be used at places where torsion occurs ?

(a) Box-type section

(b) Channel section

(c) Angle section

(d) Any of the above

32. The effective length of the fillet weld is

(a) Total length - 2 × throat size

(b) Total length 2 × weld size

(c) 0·7 × total length

(d) Total length $= \left(\frac{\text{Weld size}}{\sqrt{2}}\right)$

33. The compatibility conditions in terms of strains in a two-dimensional problem are associated with

(a) Stresses

(b) Forces

(c) Properties of materials

(d) Deformations

34. The material in which large deformation is possible before absolute failure by rupture takes place, is known as

(a) Ductile

(b) Plastic

(c) Brittle

(d) Elastic

35. 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

36. Consider the following statements :

Web crippling due to excessive bearing stress can be avoided by

1. Increasing the web thickness
2. Providing suitable stiffeners.
3. Increasing the length of the bearing plates.

Which of these statements are correct ?

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

37. In the virtual work method of plastic analysis of steel structures, the virtual quantity is

(a) Slope

(b) Moment

(c) Load

(d) Displacement

38. A protective or decorative non-structural element placed at the level of the truss supports and column head is called

(a) Eaves girder

(b) Baluster

(c) Eaves board

(d) Tie girder

39. The purlins in roof trusses are placed at the panel points essentially to avoid

(a) Axial force in rafter

(b) Shear force in rafter

(c) Deflection in rafter

(d) Bending moment in rafter

40. When the distance between centers of two adjacent rivets connecting the members subjected to either compression or tension exceeds the maximum pitch, then the additional rivets which are not subjected to the calculated stresses are known as

(a) Packing rivets

(b) Long-grip rivets

(c) Tacking rivets

(d) Auxiliary rivets

41. Which of the following conditions is to be satisfied both in elastic and plastic analyses ?

(a) Equilibrium condition

(b) Yield condition

(c) Plastic moment condition

(d) Mechanism condition

42. The base of a column is subjected to moment. If the intensity of bearing pressure due to axial load is equal to stress due to moment, then the bearing pressure between the base and the concrete is

(a) Uniform compression throughout

(b) Zero at one end and compression at the other end

(c) Tension at one end and compression at the other end

(d) Compression, varying as a parabolic profile

43. The allowable shear stress in the web of mild steel beams decreases with

(a) Decrease in h/t ratio

(b) Increase in h/t ratio

(c) Decrease in thickness

(d) Increase in height

where h is the height and t is the thickness.

44. The most critical consideration in the design of a rolled steel column carrying axial loads is the

(a) Percentage elongation at yield and the net cross-sectional area

(b) Critical bending strength and axial yield strength of material

(c) Buckling strength based on the net area of the section and percentage elongation at ultimate load

(d) Compressive strength based on slenderness ratio and gross cross-sectional area

45. For an I beam, the shape factor is 1·12. If the allowable stress (with factor of safety in bending as 1·5) is increased by 20% for wind and earthquake loads, the modified load factor is

(a) 1·10

(b) 1·25

(c) 1·35

(d) 1·40

46. Top chord of a truss is continuous over joints l apart. Effective lengths of the member in the plane perpendicular to the truss is

(a) $0{\cdot}7\,l$

(b) $0{\cdot}85\,l$

(c) l

(d) $1{\cdot}5\,l$

47. The mechanism method and the statical method guide in estimating

(a) The lower and upper bounds respectively on the strength of structure

(b) The upper and lower bounds respectively on the strength of structure

(c) The lower bound on the strength of structure

(d) The upper bound on the strength of structure

48. If the shape factor of a section is 1 5 and the factor of safety to be adopted is 2, then the load factor will be

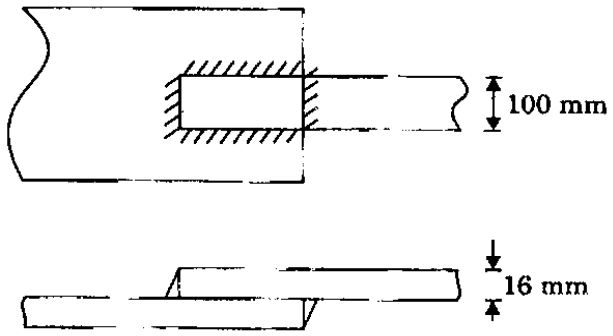
(a) 3

(b) 4

(c) 1·5

(d) 2

49.



A tie bar 100 mm × 16 mm thick is to be welded to another plate as shown in figure using 8 mm fillet welds. If the tensile stress in plates is 150 N/mm^2 and shear stress in weld is 110·0 N/mm^2, the minimum overlap required will be

(a) 50 mm

(b) 75 mm

(c) 100 mm

(d) 150 mm

50. A propped cantilever beam of span 'L' and constant plastic moment M_P, carries a concentrated load at midspan. The load at collapse will be

(a) $\frac{2M_P}{L}$

(b) $\frac{8M_P}{L}$

(c) $\frac{6M_P}{L}$

(d) $\frac{4M_P}{L}$

51. For two plates of equal thickness, full strength of square-edged fillet weld can be ensured if its maximum size is limited to

(a) 1·5 mm less than the plate thickness

(b) 67% of the plate thickness

(c) 80% of the plate thickness

(d) Thickness of the plate

52. When a column is supported throughout its length either by masonry walls or by construction on all the sides, then its slenderness ratio is

(a) Infinite

(b) Zero

(c) Reasonably high

(d) Low

53. The allowable shear stress in stiffened webs of mild steel beams decreases with

(a) Decrease in the spacing of the stiffeners

(b) Increase in the spacing of the stiffeners

(c) Decrease in the effective depth

(d) Increase in the effective depth

54. In a roof truss, if pitch is 1/2 and slope is 1, the angle of inclination with the horizontal would be

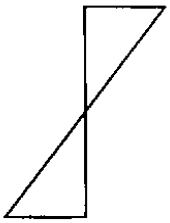
(a) 30°

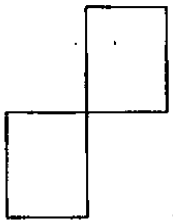
(b) 45°

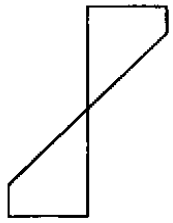
(c) 60°

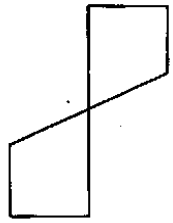
(d) 75°

55. In a plastic hinge, the actual distribution of strain across the section is essentially as

(a) 

(b) 

(c) 

(d) 

56. Consider the following statements in respect of design of web and flange splices :

1. Flange splice shall be designed for actual BM at the section.
2. Flange splice shall be designed to resist the actual shear at the section.
3. Web splice shall be designed to resist the actual shear at the section.
4. Web splice shall be designed for actual BM.

Which of these statements are correct ?

(a) 1 and 3

(b) 2 and 3

(c) 3 and 4

(d) 1 and 4

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

(a) 30 ϕ

(b) 24 ϕ

(c) 20 ϕ

(d) 5 ϕ

where ϕ = diameter of bar.

58. Match List I with List II and select the correct answer using the code given below the lists :

List I	*List II*
A. Doubly reinforced section	1. Serviceability
B. Limit state design	2. Durability
C. Minimum cover	3. Reduction in sectional depth
D. Span-depth ratio	4. Ultimate moment capacity

Code :

	A	B	C	D
(a)	1	2	4	3
(b)	3	2	4	1
(c)	1	4	2	3
(d)	3	4	2	1

59. The main reinforcement of a R.C. slab consists of 10 mm bars at 100 mm spacing; if it is desired to replace the 10 mm bars by 12 mm bars, then the spacing of 12 mm bars should be

(a) 120 mm

(b) 140 mm

(c) 144 mm

(d) 160 mm

60. In prestressed concrete members, the shear force depends upon

(a) Distributed load

(b) Torsion

(c) Concentrated load

(d) Variation in net bending moment

61. In case of Magnel-Blaton system of prestressing, each sandwich plate can generally anchor

(a) 6 wires

(b) 8 wires

(c) 10 wires

(d) 16 wires

62. In case of prestressed concrete members, the bursting stresses develop at

(a) Bond zone

(b) Maximum bending moment zone

(c) Maximum shear stress zone

(d) Anchorage zone

63. In limit state approach, spacing of main reinforcement controls primarily

(a) Cracking

(b) Deflection

(c) Durability

(d) Collapse

64. Minimum clear cover (in mm) to the main steel bars in slab, beam, column and footing respectively, are

(a) 10, 15, 20 and 25

(b) 15, 25, 40 and 75

(c) 20, 25, 30 and 40

(d) 20, 35, 40 and 75

65. 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 reinforcements in the beam

66. A prestressed concrete section is said to have failed in strength at the moment when all the material in the section has exhausted its

(a) Stress limitations

(b) Strain limitations

(c) Stress as well as strain limitations

(d) Load limitations

67. The minimum wall thickness of any load bearing wall in case of public building built with mortar, as per IS code, should be ***not*** less than

(a) $\frac{1}{2}$ brick

(b) 1 brick

(c) $1\frac{1}{2}$ brick

(d) 2 brick

68. The position of the neutral axis in reinforced brick masonry is independent of the loading and is at a depth of

(a) One-third of the effective depth

(b) Half of the effective depth

(c) Full depth

(d) $\frac{1}{\sqrt{2}}$ times the effective depth

69. Maximum slenderness ratio for load-bearing masonry wall built in cement mortar, as per IS code, shall ***not*** exceed

(a) 13

(b) 20

(c) 27

(d) 30

70. As per masonry code, the stiffening coefficient for walls stiffened by piers, buttresses or intersecting walls can be

(a) 0 to 1·0

(b) 1·0 to 2·0

(c) Greater than 2·0

(d) Invariantly 1·0

71. Consider the following statements :

Maximum slenderness ratio of load-bearing masonry walls for a dwelling having more than two storeys shall ***not*** exceed

1. 12, if lime mortar is used.
2. 18, if cement-lime mortar 1 : 2 : 9 is used.
3. 24, if cement mortar 1 : 6 is used.

Which of these statements are correct ?

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

72. The loss due to relaxation of stress in steel in PSC member depends on

1. Applied stress level
2. Temperature
3. Type of steel

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1, 2 and 3

(d) 1 and 3 only

73. The 'transmission length' requirement is to be satisfied in the design of

(a) Pre-tensioned concrete beams

(b) Post-tensioned concrete beam

(c) Unbonded post-tensioned concrete beams

(d) Post-tensioned continuous concrete beams

74. Which one of the following statements is ***not*** correct with respect to PSC beams ?

(a) Loss due to shrinkage is proportional to water-cement ratio used in concrete.

(b) Loss due to creep is proportional to the age of the member at the time of loading.

(c) Loss due to elastic deformation is directly proportional to the modulus of elasticity of concrete.

(d) Loss due to friction occurs in post-tensioned concrete members.

75. In limit state design of concrete for flexure, the area of stress block is taken as

(a) $0{\cdot}530\ f_{ck} \cdot X_u$

(b) $0{\cdot}446\ f_{ck} \cdot X_u$

(c) $0{\cdot}420\ f_{ck} \cdot X_u$

(d) $0{\cdot}360\ f_{ck} \cdot X_u$

where f_{ck} is characteristic compressive strength of concrete and X_u is the depth of neutral axis from top.

76. In a combined footing, in the zones where the shear stresses are less than 5 kg/cm^2, stirrups to be provided are generally

(a) 2-legged

(b) 4-legged

(c) 8-legged

(d) 12-legged

77. The purpose of lateral ties in short R.C. columns is to

(a) Increase the load carrying capacity of column

(b) Facilitate compaction of concrete

(c) Facilitate construction

(d) Avoid buckling of longitudinal bars

78. The number of plastic hinges required in a structure of indeterminate status for a 'mechanism' to develop is

(a) i

(b) i + 1

(c) i + 2

(d) i - 1

where i is the degree of indeterminacy.

79. According to IS 456, minimum slenderness ratio for a short concrete column is

(a) Less than 12

(b) Between 12 and 18

(c) Between 18 and 24

(d) More than 24

80. For a continuous slab of 3 m × 35 m size, the minimum overall depth of slab to satisfy vertical deflection limits is

(a) 120 mm

(b) 100 mm

(c) 75 mm

(d) 50 mm

81. The effective length of a R.C. column continuing through two storeys, properly restrained at both ends in position and direction, is

(a) 0·50 L

(b) 0·75 L

(c) L

(d) 2 L

82. A reinforced concrete slab is 75 mm thick. The maximum size of reinforcement bar that can be used is

(a) 6 mm diameter

(b) 8 mm diameter

(c) 10 mm diameter

(d) 12 mm diameter

83. A reinforced concrete cantilever porch has thickness t. The main reinforcing steel will be placed

(a) At mid-thickness

(b) At t/3 from the top

(c) Close to the bottom surface

(d) Close to the top surface

84. A simply supported rectangular beam is uniformly loaded and is prestressed. The tendon provided for prestressing should be

(a) Straight, above centroidal axis

(b) Straight, below centroidal axis

(c) Parabolic, with convexity upward

(d) Parabolic, with convexity downward

85. For a certain set of external loads, concordant profile in a prestressed beam represents to some scale the

(a) Influence line diagram

(b) Shear force diagram

(c) Bending moment diagram

(d) Williot-Mohr diagram

86. Consider the following statements :

Cement mortars richer than 1 : 3 are not used in masonry work because

1. There is no gain in strength of masonry.
2. There is high shrinkage.
3. They are prone to segregation.

Which of these statements are correct ?

(a) 1, 2 and 3

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1 and 3 only

87. Consider the following statements :

Percentage of steel for balanced design of a singly reinforced rectangular section by limit state method depends on

1. Characteristic strength of concrete.
2. Yield strength of concrete.
3. Modulus of elasticity of steel.
4. Geometry of the section.

Which of these statements are correct ?

(a) 2, 3 and 4

(b) 1, 3 and 4

(c) 1, 2 and 4

(d) 1, 2 and 3

88. The minimum strain at failure in the tensile reinforcement (F_y = 400 MPa) of RCC beam as per limit state method is

(a) 0·0020

(b) 0·0028

(c) 0·0037

(d) 0·0045

89. A bar chart is commonly used because

(a) It is simple to draw and easy to understand

(b) It indicates at a glance the overall progress of the project

(c) It shows critical and non-critical activities

(d) It incorporates uncertainties for delay in estimation of time required for completion of activities

90. Which one of the following rollers is suitable for soil-cement stabilized road construction ?

(a) Vibratory roller

(b) Sheepfoot roller

(c) Pneumatic roller

(d) Smooth wheel roller

91. In a group housing project, it is proposed to use pre-fabricated RCC beams and columns. The most useful construction equipment is

(a) Derrick Crane

(b) Chute

(c) Weigh Batcher

(d) Transit Mixer

92. Tractive coefficient of a Crawler truck in loose soil is

(a) Less than that of rubber tyre tractors

(b) More than that of rubber tyre tractors

(c) Same as that of rubber tyre tractors

(d) Nearly zero

93. The thickness of web for unstiffened plate girder with clear distance 'd' between the flanges shall be ***not*** less than

(a) $\frac{d}{200}$

(b) $\frac{d}{85}$

(c) $\frac{d}{100}$

(d) $\frac{d}{160}$

94. The maximum longitudinal pitch in bolted joints, subjected to tensile forces, wherein t = thickness of the plate and D = diameter of bolt, is

(a) 32 D

(b) 16 D

(c) 32 t

(d) 16 t

95. A centrifugal pump 18 cm diameter, running at 1460 rpm delivers 0·096 m^3/sec water against a head of 36 m of water with an efficiency of 86%. If another pump, twice the size of this said pump, is run at the same speed, how much water would the bigger pump deliver and at what head of water ? (Take $\sqrt[3]{2} = 1{\cdot}26$)

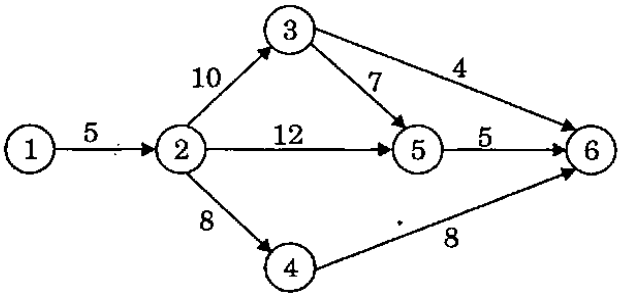
(a) 0·192 m^3/sec and 45·36 m

(b) 0·192 m^3/sec and 90·72 m

(c) 0·384 m^3/sec and 45·36 m

(d) 0·384 m^3/sec and 90·72 m

96.



In the network shown above, the number on the arrow gives the duration of the activity. The earliest expected time for event 6 to be attained is

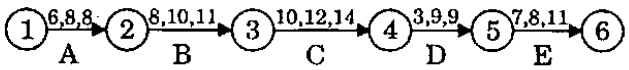
(a) 22

(b) 27

(c) 23

(d) 24

97.



Consider a series of activities A, B, C, D and E comprising a project wherein, a, m, b durations of each activity are indicated. What is the probability of completing the project in 45 days ? The area under the normal probability curve is indicated in the table by adopting standard notations.

Z	1·0	0·8	0·6	0·4	0·2	0·0
A	0·841	0·788	0·726	0·655	0·579	0·500

(a) 0·20

(b) 0·23

(c) 0·26

(d) 0·29

98. Which one of the following is the objective in crashing ?

(a) Reduction in duration

(b) Reduction in resources

(c) Reduction in cost

(d) Reduction in project size

99. If the depth of actual neutral axis in a beam is more than the depth of critical axis, then the beam is called

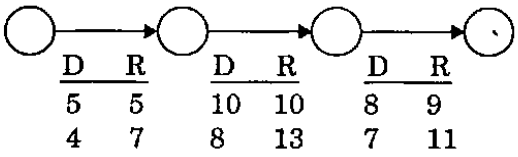
(a) Over-reinforced beam

(b) Under-reinforced beam

(c) Balanced beam

(d) Deep beam

100.



D	R	D	R	D	R
5	5	10	10	8	9
4	7	8	13	7	11

Consider the three activities indicated in sequence. The possible alternatives for individual durations (D) in days, and the corresponding cost of resource consumption in units of money per day (R) respectively, are also indicated beside the activities. Overhead costs are to be added at 12 units of money per day of duration. What is the most optimal total cost including overheads, if all the activities are to be completed in either 22 or 21 days ?

(a) 466 units of cost

(b) 460 units of cost

(c) 453 units of cost

(d) 450 units of cost

101. In a R.C. section under flexure, the assumption that "a plane section before bending remains plane after bending" leads to

(a) Strain distribution being linear across the depth

(b) Stress distribution being linear across the depth

(c) Both stress and strain distribution being linear across the depth

(d) Shear stress distribution being uniform along the depth

102. Critical path moves along the activities having total float as

(a) Positive

(b) Negative

(c) Zero

(d) Unity

103. The probability distribution taken to represent the completion of time in PERT analysis is

(a) Normal Distribution

(b) Beta Distribution

(c) Gamma Distribution

(d) Gaussian Distribution

104. The output from a power shovel is 144 cum/hr. The required number of trucks of 12 cum capacity each with 16 minute cycle time and with 80% operating efficiency will be

(a) 5

(b) 4

(c) 3

(d) 2

105. A supercharger is used in the engines of earthmoving machines at higher altitudes because

(a) The ambient atmospheric pressure is less at higher altitudes

(b) Four-cycle engines depend on the suction of the engines for the supply of air

(c) Two-cycle engines are not rugged enough for higher altitudes

(d) The ambient temperature is less as the altitude is higher

106. A contractor wishes to determine a suitable combination of manual labour and machine work for the excavation of a multistorey construction. For every cum of excavation, 3 man-hours are needed; or 0·2 machine-hour. Costs involved are ₹ 20 per man-hour and ₹ 500 per machine-hour. The total quantity of excavation is estimated to be 4,000 cum. The optimal quantity of excavation to be done manually for minimum total cost will be

(a) 1500 cum

(b) 1800 cum

(c) 2250 cum

(d) 2500 cum

107. Match List I with List II and select the correct answer using the code given below the lists :

List I	*List II*
A. Concrete pumps	1. Ready Mix concrete
B. Agitating trucks	2. Multi-storey concreting works
C. Transit Mixer	3. Tunnel works
D. Crane Bucket	4. Built-up and busy area

Code :

	A	B	C	D
(a)	3	4	1	2
(b)	2	1	4	3
(c)	3	1	4	2
(d)	2	4	1	3

108. Match List I with List II and select the correct answer using the code given below the lists :

List I	*List II*
A. Crawler-mounted lifting cranes	1. Limiting load is within 75% of tipping load
B. Rubber-tire-mounted lifting cranes	2. Allow use of dipper with its stick
C. Drag lines with 1·34 cum bucket, digging and loading in gravel	3. Time taken in swinging between 45° to 180° is 23 to 35 seconds
D. Power shovel converted into hoe	4. Limiting load is upto 85% of tipping load

Code :

	A	B	C	D
(a)	1	3	4	2
(b)	2	3	4	1
(c)	1	4	3	2
(d)	2	4	3	1

109. Slack time is associated with

(a) A real activity

(b) An event

(c) Both event and real activity

(d) Dummy activity

110. A crane is purchased now; its useful life is 8 years after which a new crane must be purchased. If the interest rate is 6%, the capital recovery factor (crf) is

(a) 0·3141

(b) 0·5420

(c) 0·1610

(d) 0·1259

111. If the effective length, effective height and effective thickness of a masonry wall are l, h and t respectively; then the slenderness ratio of the wall shall be

(a) $\frac{l}{t}$

(b) $\frac{h}{t}$

(c) Larger of $\frac{l}{t}$ and $\frac{h}{t}$

(d) Smaller of $\frac{l}{t}$ and $\frac{h}{t}$

112. Which one of the following statements is correct ?

(a) Adding 5% to 6% of moisture by weight increases the volume of dry sand from 18% to 38%

(b) The bulking of fine sand is more than that of coarse sand

(c) Volume of fully saturated sand is equal to that of dry sand

(d) All of the above

113. What is the distance away from midspan of a plastic hinge if developing in a simply supported beam of rectangular cross-section and span 6 m, subjected to a point load at the centre ?

(a) Zero

(b) 1 m

(c) 2 m

(d) 3 m

***Directions** : Each of the next seven (07) items consists of two statements, one labelled as the 'Assertion (A)' and the other as 'Reason (R)'. You are to examine these two statements carefully and select the answers to these items using the codes given below :*

Codes :

(a) Both A and R are individually true and R is the correct explanation of A

(b) Both A and R are individually true but R is ***not*** the correct explanation of A

(c) A is true but R is false

(d) A is false but R is true

114. *Assertion (A)* : Pumps for concreting are generally of the positive displacement category

Reason (R) : Roto-dynamic pumps may effect more crushing of the coarse aggregate.

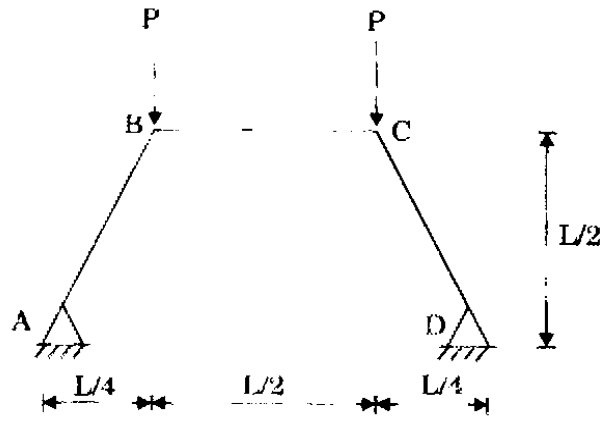
115. *Assertion (A)* : The tests for determining the setting times of cements are of little use in assessing the hardening of cement concrete.

Reason (R) : Ultimate strength of concrete in-situ is not dependent upon the setting times of cement used.

116. *Assertion (A)* : A material is incompressible if its Poisson's ratio is 0·5.

Reason (R) : The Bulk modulus K is related to Modulus of elasticity E and to Poisson's ratio μ as per well known relationship.

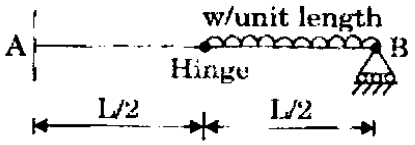
117.



Assertion (A) : For the frame shown above, the BM at every cross-section is zero.

Reason (R) : The shape of the structure follows the funicular polygon.

118.



Assertion (A) : The propped cantilever beam shown in figure above is a determinate structure.

Reason (R) : At the internal hinge shown, there exists a shear transfer and no bending moment.

119. *Assertion (A)* : In a plate girder of uniform cross-section, intermediate vertical stiffeners are provided at closer spacing in the middle rather than at supports.

Reason (R) : Intermediate vertical stiffeners are provided to prevent the web from buckling under a complex and variable stress situation resulting from combined action of shear force and bending moment.

120. *Assertion (A)* : Centrifugal pumps are not normally usable for pumping mixed concrete even if the concrete (to be pumped) can be dropped in by a hopper system.

Reason (R) : When dropping (mixed) concrete, segregation of aggregates may occur.

SPACE FOR ROUGH WORK

SPACE FOR ROUGH WORK

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