CIVIL ENGINEERING

(PAPER–I)

1. Consider the following statements Dry rot in timber is due to
   1. stacking wood in open areas
   2. lack of ventilation
   3. decomposition of sap
   4. lack of preservatives

   Which of the statements given above are correct ?
   a. 1 and 2
   b. 1 and 3
   c. 2 and 3
   d. 3 and 4

2. In static bending test Match List I (Type of Failure) with List II (Figure) and select the correct answer using the codes :

   List I
   A. Simple tension
   B. Gross grain tension
   C. Splintering tension
   D. Brash tension

   List II

   1.
   2.
   3.
   4.

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

3. Match List I (Pr duct) with List II (Its Use) and select the correct answer using the codes :

   List I
   A. Fibre board
   B. Heartwood
   C. Laminated timber
   D. Plywood

   List II
   1. Panelling
   2. Insulation
   3. Scantling
   4. Arches I trusses

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

4. Consider the following characteristics with respect to brick
   1. Minimum compressive strength = 175 (Standard units)
   2. Minimum absorption is 24 hours, (in % of dry weight) = 12
   3. 3. Very little efflorescence
   4. Tolerance in dimension = ±8%

   As per Indian standards classification, a brick with the characteristics given above is termed as
   a. H I
   b. F II
   c. L II
   d. H II

5. Match List I (Test) with List II (Procedure) and select the correct answer using the codes :

   List I
   A. Absorption
   B. Hardness
   C. Soundness
   D. Structure

   List II
   1. A brick is to be broken for the test
   2. Two bricks are taken and they can be struck with each other without breaking
   3. A scratch is easily made on brick surface with the help of a finger nail

4. Difference in weight between the brick immersed in water for 16 hours and its dry weight

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

6. Consider the following statements :
Low percentage of C_3S and high percentage of C_2S in cement will result in
   1. higher ultimate strength with less heat generation
   2. rapid - hardening
   3. better resistance to chemical attack

Which of the statements given above are correct ?
   a. 1 and 2
   b. 2 and 3
   c. 1 and 3
   d. 1,2 and 3

7. Match List I (Type of Cement) with List II (Property) and select the correct answer using the codes :

List I
   A. Blast furnace slag cement
   B. High alumina cement
   C. Low heat cement
   D. White cement

List II
   1. High percentage of tricalcium silicate
   2. Initial setting time is approximately three and a half hours
   3. Low percentage of iron oxide
   4. Rate of hardening is low

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

8. What is the quantity of cement (in kg) and of dry sand (in cubic metre) respectively required for preparing 1 cubic metre of wet cement mortar of 1 : 5 proportion?
   a. 270 and 1.00
   b. 290 and 1.05
   c. 290 and 1.00
   d. 310 and 1.05

9. Consider the following statements regarding cement mortar :
   1. Silicate type chemical resistant molar has good resistance to hydrofluoric acid
   2. Sulphur-type chemical resistant mortar has poor resistance to alkalis
   3. The interior surface of a building may be plastered with cement mortar containing cement and sand in the ratio 1 : 6

Which of the statements given above are correct?
   a. 1, 2 and 3
   b. 1 and 2
   c. 2 and 3
   d. 1 and 3

10. Which one of the following statements is correct?
The use of super plasticisers as admixture
   a. increases compressive strength of concrete
   b. permits lower water cement ratio, thereby strength is increased
   c. reduces the setting time of concrete
   d. permits lower cement content, thereby strength is increased

11. Match List I (Aggregate) with List II (Effect) and answer using the codes select the correct :

List I
   A. Rounded aggregates
   B. Crushed aggregates
   C. Flaky aggregates
   D. Irregular aggregates

List II
   1. Reduce workability appreciably because of a high ratio of surface area to volume
   2. Require more water than rounded aggregates and give strength lesser than crushed aggregates
   3. Give concrete of higher compressive strength due to development of stronger aggregate mortar bond
   4. Require lesser amount of water and cement paste for a given workability

	A	B	C	D
a.	1	2	4	3
b.	1	3	4	2

c.   4   3   1   2
d.   4   2   1   3

12. Consider the following statements : For increasing the workability of concrete, it is necessary to
 1. increase the quantity of cement
 2. decrease the quantity of sand
 3. alter the proportion of fine and coarse aggregates
 4. decrease the quantity of water
 5. use angular aggregate
 Which of the statements given above are correct ?
 a. 1, 2, 3, 4 and 5
 b. 2, 4 and 5
 c. 2 and 3
 d. 1 and 5

13. Slump and compaction factors are two different measures of workability of concrete. For a slump of 0 to 20 mm, what is the equivalent range of compaction factor?
 a. 0.50 - 0.70
 b. 0.70 - 0.80
 c. 0.80 - 0.85
 d. 0.85 - 0.92

14. The values of slump commonly adopted for the various concrete mixes are given below:
 Type of Concrete   Slump Adopted (mm)
 1. Concrete for road works - 20 to 28
 2. Ordinary RCC work   - 50 to 100
 3. Columns retaining walls - 12 to 25
 4. Mass concrete   - 75 to 175
 Which of the pairs given above are correctly matched ?
 a. 1, 3 and 4
 b. 1 and 2
 c. 3 and 4
 d. 2 and 4

15. Consider the following pairs
 1. Hand compaction of heavily reinforced sections – Low workability (0 - 25 mm slump)
 2. Concreting of shallow sections with vibrations -High workability (125-150 mm slump)

3. Concreting of lightly reinforced sections like pavements - Low workability (5 - 50 mm slump)
4. Concreting of lightly reinforced sections by hand or heavily reinforced sections with vibration - Medium workability (25 -75 mm slump)
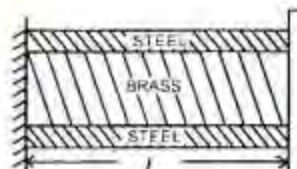Which of the pairs given above are correctly matched ?
 a. 1 and 2
 b. 2 and 3
 c. 3 and 4
 d. 1 and 3

16. The fineness modulus of fine aggregate is 2.78 and of coarse aggregate is 7.82 and the desired fineness modulus of mixed aggregate is 6.14. What is the amount of fine aggregate to be mixed with one part of coarse aggregate ?
 a. 55%
 b. 50%
 c. 45%
 d. 40%

17.

A brass bar of solid section is encased in a steel tube as shown in the above diagram
The coefficient of expansion of steel is 11.2×10^{-6} per °C and the coefficient of expansion of brass is 16.5×10^{-6} per °C.
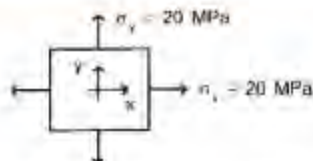The composite bar is heated through $60^{0}C$.
Now consider the following statements :
 1. The stress in the brass will be tensile
 2. The stress in the steel will be tensile
 3. The stress in the steel will be compressive
 4. The stress in the brass will be compressive
Which of the statements given above are correct ?
 a. 1 and 2
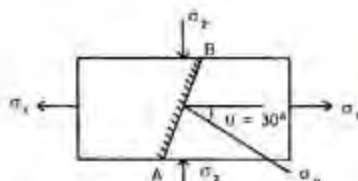 b. 1 and 3
 c. 2 and 4
 d. 2 and 3

18.

For the plane stress situation shown in the above diagram, what is the maximum shear stress ?

a. Zero, when X and Y axes are rotated 45° clockwise
b. Zero, at all positions of orientation of X and Y axes
c. 20 MPa, at all positions of orientation of X and Y axes
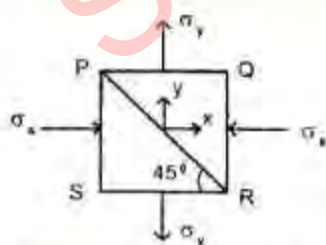d. —20 MPa, when X and Y axes are rotated 45° anticlockwise.

19.

In a piece of stressed material, the principle stress are $\sigma_1 = 3.0$ kN/m^2 tensile and $\sigma_2 = 7.0$ kN/m^2 compressive as shown in the above diagram. The line of action of the tensile stress makes an angle $\theta = 30°$ to the normal to the plane AB. What is the normal stress σ_n ?

a. $+0.5$ kN/m^2
b. -1.5 kN/m^2
c. $+2.0$ kN/m^2
d. -2.5 kN/m^2

20.

A thin wooden plate PQRS is made by gluing two pieces of wood along PR as shown in the above diagram.
If $\sigma_x = -30$ Mpa, $\sigma_y = 10$ MPa and $\tau_{xy} = 0$, then what is the normal stress on the surface PR?

a. —10 MPa
b. —20 MPa
c. 110 MPa
d. 20 MPa

21. In a plane strain condition in the xy plane, the strain components associated with xy axes are $\varepsilon_x = 800 \times 10^{-6}$, $\varepsilon_y = 100 \times 10^{-6}$, $\upsilon_{xy} = -800 \times 10^{-6}$. What are the principal strains for these strain values ?

a. 981×10^{-6}, -81×10^{-6}
b. 891×10^{-6}, -18×10^{-6}
c. 881×10^{-6}, 71×10^{-6}
d. 839×10^{-6}, -81×10^{-6}

22. In a plane strain case in the xy plane, normal strain in x and y directions are equal to zero and shear strain is equal to 3×10^{-6}. What is the value of diameter of Mohr's circle of strain for these strain values ?

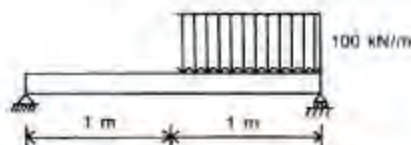a. 6×10^{-6}
b. 3×10^{-6}
c. 1.5×10^{-6}
d. Zero

23. For a case of plane stress, $\sigma_x = 40$ MN/m^2, $\sigma_y = 0$, $\tau_{xy} = 80$ MN/m^2. What are the principal stresses and their orientation with x and y axes ?

a. $\sigma_1 = 80$ MN/m^2, $\sigma_2 = 40$ MN/m^2, θ_1 30^0
b. $\sigma_1 = 100$ MN/m^2, $\sigma_2 = -60$ MN/m^2, $\theta_1 = 32^0$
c. $\sigma_1 = 102.5$ MN/m^2, $\sigma_2 = -62.5$ MN/m^2, $\theta_1 = 36^0$
d. $\sigma_1 = 105$ MN/m^2, $\sigma_2 = 62$ MN/m^2, $\theta_1 = 36^0$
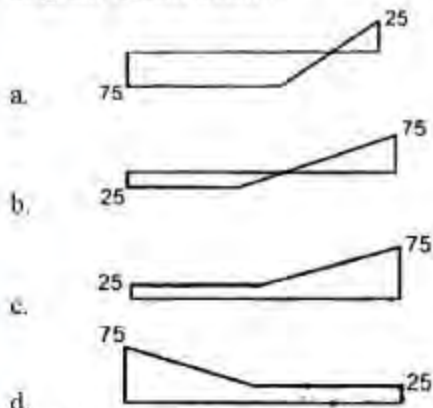
24. A thin rod of 10 mm diameter is subjected to a tensile force of 7850 N. What are the principal stresses and maximum shear stress ?

a. 70MPa, 50 MPa, 10 MPa
b. 100 MPa, Zero, 50 MPa
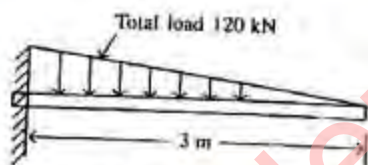c. 100 MPa, 50 MPa, 25 MPa
d. 100 MPa, Zero, Zero

25.

The above diagram shows a simply supported beam with load. Which one of the following diagrams is the shear force diagram for this beam ?

a.

b.

c.

d.

26. In which one of the following, the point of contraflexure will not occur ?

a. A two span continuous beam of equal spans, simply supported and loaded by UDL over both spans
b. A simply supported beam loaded by UDL
c. A fixed beam loaded by UDL
d. A propped cantilever loaded by UDL

27.

What are the support reactions at the fixed end of the cantilever beam shown in the above diagram?

a. 120 kN, 120 kNm
b. 120 kN, 240 kNm
c. 240 kN, 120 kNm
d. 120 kN, 60 kNm

28. The maximum shear stress produced in a shaft in 5N/mm². The shaft is of 40 mm diameter. What is the approximate value of twisting moment ?

a. 628 Nm
b. 63 Nm
c. 126 Nm
d. 251 Nm

29. For S. F. to be uniform throughout the span of a simply supported beam, which of the following loads should be applied on to the beam ?

a. Two equally spaced concentric loads
b. A couple at mid - span only
c. A couple anywhere in the span
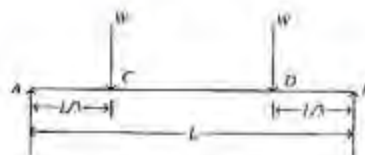d. UDL over the entire span

30. Consider the following statements for a beam based on theory of bending
1. Strain developed in any fibre is directly proportional to the distance of fibre from neutral surface
2. For flexural loading and linearly elastic action the neutral axis passes through the centroid of cross - section
3. The assumption of the plane cross sections remaining plane will not hold good during inelastic action
4. Instances in which the neutral axis does not pass through the centroid of a cross - section include a homogenous symmetrical 'beam (with respect to neutral axis) and subjected to inelastic action

Which of the statements given above are correct ?

a. 1,2, 3 and 4
b. 1,2 and 4
c. 3 and 4
d. 1 and 2

31.

Consider the simply supported beam AB subjected to the point loads of equal magnitude as shown in the above diagram.

Which one of the Following statements is correct ?

The portion CD of the beam is

a. in pure bending
b. in pure shear
c. having maximum bending moment
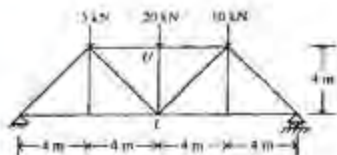d. having maximum shear force

32.

A rigid bar AB is supported by a spring as shown in the diagram above. What is the deflection of the point 'b'?

a. 25 mm
b. 20 mm
c. 15 mm
d. 10 mm

33.

The diagram above shows a plane truss. What is the force in vertical member UL of the truss ?
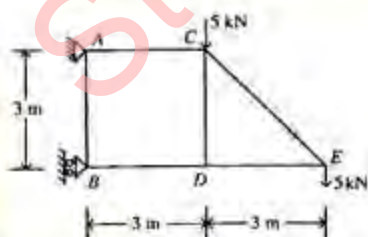
a. 35 kN
b. 30 kN
c. 20 kN
d. 15 kN

34. Which one of the following statements is correct?

The influence line diagram (ILD) for bending moment at a section in a cantilever is a triangle extending between the section and the

a. fixed end with maximum ordinate under the section
b. fixed end with maximum ordinate under the fixed end
c. unsupported end with maximum ordinate at the section
d. unsupported end with maximum ordinate at the unsupported end

35.

The diagram above shows a truss subjected to loading as indicated. What is the force induced in the member AB?

a. 5 kN
b. 10 kN
c. Zero
d. $5\sqrt{2}$ kN

36.

An angle is connected to the back of the flange of a channel section to be used as a beam as shown in the above diagram.

This is done to

a. increase the compression flange area
b. increase the moment of inertia about the major axis
c. increase the moment of inertia about the minor axis
d. make the load pass through the shear centre

37. Match List I with List II and select the correct answer using the codes

List I

A. The shape of a cable suspended between two supports is defined by
B. The cable uniformly loaded along the horizontal span takes the shape of
C. The cable uniformly loaded along its length assumes the shape of
D. the girder in a suspension bridge transmits to its supports

List II

1. A catenary
2. A little load
3. A parabola
4. Applied loads

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

38. Which one of the following statements is correct ?

An indeterminate building frame may be converted to a determinate one by assuming

a. hinges at mid-height of columns
b. hinges at mid-span of the beams
c. hinges at both mid-height of columns and mid-spam of beams

d. one support as fixed at base and other support on rollers

39. Consider the following statements
   1. An indeterminate structure is not economical from the material stand-point in comparison to a determinate structure
   2. If n redundant in a statically indeterminate structure of n degree indeterminacy are removed, the structure will become statically determinate but unstable
   3. In the rigid frame analysis, the axial effects are ignored as their influence is negligibly small compared to bending and shear effects

   Which of the following statements is/are correct ?
   a. 1 only
   b. 1 and 2
   c. 3 only
   d. 2 and 3

40. What is the horizontal thrust in a symmetric, parabolic two - hinged arch of span L and central rise y subjected to a uniformly distributed load of intensity per unit length over its entire span ?
   a. $\omega L^2/4y$
   b. $\omega L^2/8y$
   c. $\omega L^2/12y$
   d. $\omega L^2/16y$

41.

Match List I with List II and select the correct answer using the codes :

List I
A. Moment at B
B. Slope at A
C. Reaction at A
D. Stiffness of AB

List II
1. $3/8\,\omega L$
2. $4E\,1/l$
3. $1.50\,M$ where $M = \omega L^2/12$
4. $Ml/4EI$ where $M = \omega L^2/12$

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

42. Moments of the same sense are applied to both the ends of a simply supported beam. The ratio of the rotation of the two ends is 2. What is the ratio of the applied moments?
   a. 3/2
   b. 4/3
   c. 5/4
   d. 6/5

43. A beam is hinged at end A and fixed at B. A moment M is applied at end A. What is the moment developed at end B?
   a. —M
   b. M
   c. M/2
   d. —M/2

44. Consider the following statements
   1. The total potential energy is the sum of strain energy and potential energy due to external loading
   2. The strain, energy is always positive
   3. The potential energy is always positive
   4. For equilibrium position the total potential energy is a minimum

   Which of the statements given above are correct ?
   a. 1, 2, 3 and 4
   b. 1, 2 and 4
   c. 2, 3 and 4
   d. 1 and 3

45. A uniform beam of length 2L and flexural rigidity EI is fixed at both the ends. What is the moment required for unit rotation at the centre of span ?
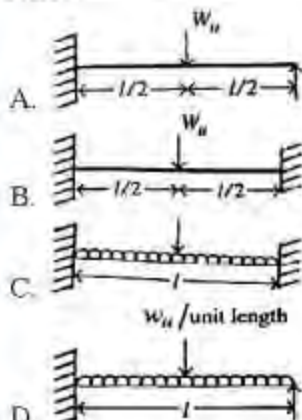   a. $2EI/L$
   b. $4EI/L$
   c. $6EI/L$
   d. $8EI/L$

46. An elastic uniform bar of length l and cross - sectional area A is subjected, within its elastic limit to a rapidly applied tensile force increasing from zero to a final value P. What is the final strain energy stored in the bar after vibrations have

ceased ? (E is the modulus of elasticity of the bar material.)

a. $2P^2l / AE$

b. P^2l / AE

c. $P^2l / 4AE$

d. $P^2l / 2AE$

47. Match List I (Type of Beam) with List II (Collapse Load W_u, w_u) and select the correct answer using the codes given below the Lists :

List I

List II

1. $8M_p/l$
2. $16M_p/l^2$
3. $6M/l$
4. $11.66 M_p/ l^2$

W_u, and w_u per unit length denote the collapse loads and M_p denotes the plastic moment capacity of the beams corresponding to the collapse loads

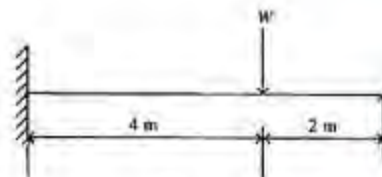|	A	B	C	D
a.	2	1	3	4
b.	3	4	1	2
c.	3	1	2	4
d.	2	4	1	3

48. Which one of the following statements is correct?

In Kani's method hinged column is replaced by an equivalent column fixed at the base with length and stiffness as

a. 1.5 times the original length and 3/4th stiffness of original column -

b. 1.5 times the original length and stiffness same as original column

c. same length as original column but stiffness 3/4th of the original column stiffness

d. twice the original column length arid 1.5 times the stiffness of original column

49.

What is the collapse load for propped cantilever beam shown in the above diagram with a plastic moment capacity of M_p ?

a. $1.25 M_p$

b. $1.5 M_p$

c. M_p

d. $2 M_p$

50. Consider the following statements

1. The development of a plastic hinge in a determinate beam results in effective destruction of the beam

2. For fixed ended beams of rectangular section, the design by elastic theory is not conservative

3. In the ideal plastic material, if the material is stressed to a point beyond the elastic limit and is then unstressed, there will not be any residual strain

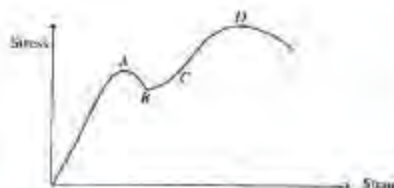Which of the statements given above is/are correct ?

a. 1 only

b. 1 and 2

c. 2 and 3

d. 1, 2 and 3

51. Some steels do not show yield plateau and show continuous curve. For such steels, how is the yield strength obtained?

a. By drawing 0.2% offset of the strain

b. By drawing 0.5% offset of the strain

c. By drawing initial tangent

d. By drawing initial secant modulus

52.

The stress strain diagram for mild steel subjected to tensile load is given above. Now consider the following statements

1. The diagram represents average stress strain diagram
2. The diagram represents actual stress strain diagram
3. A represents upper yield point
4. B represents lower yield point

Which of the statements given above are correct ?

a. 1, 2 and 4
b. 1, 3 and 4
c. 2, 3 and 4
d. 1, 2 and 3

53. Consider the following statements
Lug angles are used to

1. increase the lengths of the end connections angle section
2. decrease the lengths of the end connections of angle section
3. increase the lengths of the end connections of channel section
4. decrease the lengths of the end connections of channel section

Which of the statements given above are correct?

a. 1 and 2
b. 2, 3 and 4
c. 1, 3 and 4
d. 1, 2 and 3

54. When the effect of wind or earthquake load is considered in the design of rivets and bolts for steel structures, by what percentage the permissible stresses may be exceeded?

a. 15%
b. 25%
c. 33.33%
d. 50%

55. A 6 mm thick mild steel plate is connected to an 8 mm thick plate by 16 mm diameter shop rivets. What is the number of rivets required to carry an 80 kN load ?

a. 2
b. 3
c. 4
d. 6

56. Consider the following statements

1. The gross area of a rivet is taken as the cross - sectional area of the rivet hole
2. The distance between the centres of the rivets should not be less than 2.5 times the gross diameter of the rivet
3. 3. In no case shall fewer than two bolts or rivets be used for attaching the lug angle to the gusset

Which of the statements given above are correct ?

a. 1 and 2
b. 1 and 3
c. 2 and 3
d. 1, 2 and 3

57. A member is subjected to axial compression. Effective length is 3000 mm. Size of the angle used is 100 × 100 × 10. What is the maximum capacity (if $f_y = 250$ MPa) ?

a. 101.2 kN
b. 81.7 kN
c. 59.2 kN
d. 95.1 kN

58. What is the maximum slenderness ratio for a steel member carrying compressive bade resulting from dead loads and imposed loads?

a. 180
b. 250
c. 350
d. 400

59. A_f is the area of flanges and A_w is the area of web What is the effective flange area in the design of a plate girder?

a. $A_f + A_w / 8$
b. $A_f + A_w / 6$
c. $A_f - A_w / 8$
d. $A_f - A_w / 6$

60. Consider the following statements

1. As far as practicable, the lacing system shall be varied throughout the length of the strut
2. Single laced systems on opposite sides of the components shall preferably be in mutually opposite directions, so that one is not the shadow of the other
3. Rolled sections or tubes of equivalent strength may be used as lacing bars instead of flats

Which of the statements given above are correct?

a. 1 and 2
b. 2 and 3
c. 1 and 3
d. 1, 2 and 3

61. 2-ISMB 300 × 140 section are acting as a compound column. The height of the column is 400 mm. Two sections are spaced 400 mm, centre to centre. In the longitudinal direction there is runner at the top of the column. What is the maximum capacity of the column in compression (f_y = 250 Mpa) ?

a. 2002 kN
b. 1629 kN
c. 1501 kN
d. 1799 kN

62. Consider the following statements
Horizontal stiffness is provided when
1. the depth of webs is small
2. tendency to web buckling is less
3. vertical stiffness becomes too close
4. only thin plates are available for web
Which of the statements given above are correct.?

a. 1 and 2
b. 3 and 4
c. 1, 2 and 4
d. 1, 3 and 4

63. Which one of the following statements is correct?
Only s portion of the area of outstanding leg in an angle section serving as tension member is considered in computing the effective area of the member. This is because

a. near the joint, the outstanding leg does not take its full stress
b. the outstanding leg has a number of rivet holes reducing the net area
c. the outstanding leg is susceptible to buckling
d. additional safety is preferred in the case of tension failure

64. In a gabled industrial building in order to minimize the wind forces on the roof, the roof slope should be kept close to

a. 5°
b. 15°
c. 30°
d. 45°

65. Which one of the following statements is correct ?
In a crane gantry girder, a channel is provided at the top flange girder. This accounts for bending in

a. horizontal plane only
b. vertical plane only
c. horizontal and vertical planes
d. horizontal and vertical planes and twisting

66. Which one of the following statements is correct ?
For a simply supported beam of rectangular cross - section, a point load is applied at mid span. If the superimposed load alone is considered to cause the collapse, the beam is fully elastic

a. For a distance of one third of beam length from either end
b. at mid span
c. for the middle third of beam length
d. for the distance of one fourth of beam length from either end

67. For steel structure proportioned using plastic design. the working load (dead load + imposed load) should be multiplied by which one of the following minimum load factor?

a. 1.3
b. 1.5
c. 1.7
d. 2.0

68. A simply supported beam of span 4000 mm is loaded with a uniformly distributed load of 30 kN/m f_y for the material is 250 MPa. Which rolled steel section is required?

a. ISMB 500
b. ISMB 400
c. ISMB 300
d. ISMB 600

69. 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 ?

a. ISWB - section
b. ISLB - section

c. ISMB - section

d. JSHB - section

70. Which one of the following statements is correct ?

Minimum tension steel in RC beam needs to be provided to

a. prevent sudden failure

b. arrest crack width

c. control excessive deflection

d. prevent surface hair cracks

71. Consider the following statements

1. The limit state of collapse is defined as the acceptable limit for the stresses in the materials.

2. Limit state method is one that ensures adequate safety of structure against collapse

3. In the limit state design method, actual stresses developed at collapse differ considerably from the theoretical values

Which of the above statements is/are correct?

a. 1 and 2

b. 1 and 3

c. 2 and 3

d. None

72. Consider the following statements

1. Reinforcement that is no longer required for flexure beyond a certain section, shall however be extended by d or 12 ϕ, whichever is greater, before being curtailed

2. At least half the bars should be bent up at the cut -off point

3. The shear capacity at cut-off point should at least be 1.5 times the shear force at that section

Which of the statements given above are correct ?

a. 1 and 2

b. 1 and 3

c. 2 and 3

d. 1, 2 and 3

73. Which one of the following statements is correct ?

Temperature and shrinkage steel is provided in reinforced concrete slabs because

a. it occupies larger area

b. its thickness is less

c. it is a main structural element

d. it is a flexural member

74. Match List I (Reinforcement Type) with List II (Anchorage Requirement) and select the correct answer using the codes given below the Lists :

List I

A. Footing slab, tensile reinforcement

B. Cantilever beam, tensile reinforcement

C. Simply supported beam, tensile reinforcement

D. Beam, shear stirrup

List II

1. $L_d/3$ into the support

2. 6 ϕ for 135° bend

3. L_d into the support

4. L_d from the column face

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

75. Which one of the following statements is correct ?

Minimum shear reinforcement in beams is provided in the form of stirrups

a. to resist extra shear force due to live load

b. to resist the effect of shrinkage of concrete

c. to resist principal tension

d. to resist shear cracks at the bottom of beam

76. Which one of the following statements is correct ?

Diagonal tension reinforcement is provided in a beam as

a. longitudinal bars

b. bent up bars

c. helical reinforcement

d. 90° bend at the bends of main bars

77. Which one of the following statements is correct ?

In a combined footing for two columns carrying unequal loads, the maximum hogging moment occurs at

a. inside face of the heavier column

    b. a section equidistant from both the columns

    c. a section having maximum shear force

    d. a section having zero shear force

78. Which one of the following statements is correct ?

The critical section for computing design shear force in an R.C. beam where the supports exert a compressive reaction is at

    a. the centre of support

    b. the face of support

    c. a distance of half of effective depth from the face of support

    d. a distance of effective depth from the face of support

79. Which one of the following statements is correct ?

Doubly reinforced beams are recommended when

    a. the depth of the beam is restricted

    b. the breadth of the beam is restricted

    c. both depth and breadth are restricted

    d. the shear is high

80. Which one of the following statements is correct ?

In a reinforced concrete member, the best way to ensure adequate bond is

    a. to provide minimum number of large diameter bars

    b. to provide large number of smaller diameter bars

    c. to increase the cover for reinforcement

    d. to provide additional stirrups

81. Which one of the following statements is correct ?

M 40 concrete is preferred to M 20 concrete for pre-stressed concrete to

    a. overcome bursting stresses at the ends

    b. avoid brittle failure of concrete

    c. eliminate the effect of shrinkage

    d. economise the use of cement

82. Which one of the following statements is correct?

Minimum shear reinforcement is provided to

    a. resist shear force at the support

    b. resist shear on account of accidental torsion

    c. arrest the longitudinal cracks on side faces due to shrinkage and temperature variation

    d. resist shear in concrete developing on account of non-homogeneity of concrete

83. Which one of the following statements is correct ?

In a cantilever beam carrying gravity load, main reinforcement is provided

    a. above the neutral axis

    b. as vertical stirrups

    c. as a helical reinforcement

    d. below the neutral axis

84. What is the volume of concrete mix produced if a batch type concrete mixer of 1500 litres capacity takes an effective time of 15 seconds for one batch of production?

    a. $36 \text{ m}^3/\text{hr}$

    b. $180 \text{ m}^3/\text{hr}$

    c. $360 \text{ m}^3/\text{hr}$

    d. $720 \text{ m}^3/\text{hr}$

85. Consider the following statements

When acquiring a crane for a project work, the important aspects of the specifications will include information on

    1. length of the hoist line

    2. length of boom line

    3. tipping condition

    4. bucket size

    5. angle of swing in absolute terms

    6. haul distance

Which of the statements given above are correct?

    a. 2, 3, 5 and 6

    b. 1, 2, 3 and 6

    c. 1 and 5

    d. 2, 4, 5 and 6

86. Match List I (Beam Variable) with List II (Design Provision) and select the correct answer using the codes :

List I

A. Flexure

B. Shear

C. Bond

D. Deflection

List II

1. Minimum depth of section

2. Longitudinal steel reinforcement

3. Stirrups
4. Anchorage in support

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

87. Match List I (Type of Jobs) with List II (Type of Equipment) and select the correct answer using the codes :

List I

A. Handling stiff and cohesive mixes used in the manufacturing of precast concrete
B. Road construction where space and access are limited
C. Consolidating concrete in thin slabs
D. Vibrating both the form and the concrete

List II

1. External vibrator
2. Dual drum mixers
3. Pan mixers
4. Electric hammer
5. Vibrating roller

	A	B	C	D
a.	3	5	1	4
b.	3	2	5	1
c.	5	2	4	3
d.	5	3	4	1

88. Which of the following are taken into consideration in determining ultimate operating factor of a typical earthmoving equipment?

a. Rated output at flywheel (or similar power smoothing fitting). maximum power consumption time factor and fuel consumption
b. Maximum power consumption time (actor, idle running time proportion. overall shut-down time proportion
c. Total load/output of earthwork delivered as a proportion of rated capacity
d. Maximum power consumption time factor, cycle time as proportion of running time, idle running time between sites, overall shut-down time proportion

89. If the depth of face from which a shovel is excavating material is too shallow, then which one of the following is correct ?

a. The dipper may not be filled in one pass up the face
b. The depth of penetration of the dipper can be increased
c. The depth of penetration of the dipper would be decreased
d. Excess earth will spill down to the bottom of the face

90. A scraper of self weight 27 tonnes works on a sandy clay soil weighing 1800 kg/m^3 of bank measure. Haul road rolling resistance is 3.5% and grade is 2% adverse for loaded unit. The earth carried per trip is 14 m3 (b.m.) What rim pull, in newton (approximately) is required when travelling loaded and empty, respectively?

a. 35600,5100
b. 32200,4800
c. 30100,4400
d. 28700,4050

91. A roller with 1.5 m effective width of drum moves with an average speed of 1.5 km/h What is the output when six number of passes are used for effectiveness ?

a. 13.5 m^2/hr
b. 37.5 m^2/hr
c. 135 m^2/hr
d. 375 m^2/hr

92. Two centrifugal pumps work in parallel at a common delivery head of 18 m. The first pump delivers 90 lps at an efficiency of 60% and the second pump delivers 60 lps at an efficiency of 50%. What is the overall efficiency of the system?

a. 62.5%
b. 58%
c. 55.5%
d. 52%

93. Match List I (Earth Excavating Equipment) with List II (Uses) and select the correct answer using the codes:

List I

A. Power shovel
B. Hoe
C. Clam-shell
D. Bulldozer

List II

1. Excavation of earth in confined area or pit
2. Rehauling of loose or excavated material from one place to another place
3. Clearing and scrubbing of worksite
4. Excavation of trenches

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

94. Match List I (Working Details), with List II (Type of Pumps) and select the correct answer using the codes

List I

A. The water which has entered inside the pump is revolved at high speed by means of the impeller revolving in a tight casing
B. The pump gives constant discharge even under variable heads
C. Usable in pumping from crooked holes and for handling corrosive liquids
D. Water can be lifted to large heights using the hydraulic ram

List II

1. Air-lift pump
2. Impulse pump
3. Reciprocating pumps
4. Diesel engine driven pumps
5. Centrifugal pumps

	A	B	C	D
a.	1	3	5	2
b.	5	3	1	2
c.	4	2	5	3
d.	5	2	4	3

95. Match List I (Performance Parameters) with List II (Performance Pattern) and select the correct answer using the codes :

List I

A. RPM vs. discharge
B. Head vs. discharge
C. BHP vs. discharge
D. Efficiency vs. discharge

List II

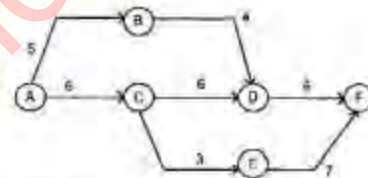1. Increases with increasing head but decreases slightly with discharge
2. Increases initially, stalls and then decreases fast
3. Generally decreases continuously
4. Increases and stalls

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

96. How many litres of water will be pumped per minute by a double acting reciprocating pump with 6 cm cylinder diameter and 15 cm stroke length, driven by a crankshaft running at 90 rpm with no slippage?
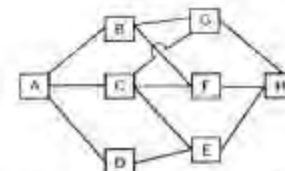
a. 84.6
b. 81.2
c. 78.5
d. 76.4

97.

A network of seven activities is shown in the diagram given above. The respective activity durations are shown beside the arrows. Which one of the following is the total float in AB, the total float in CE and free float in EF, respectively ?

a. 2, 2, 3
b. 3, 3, 2
c. 3, 2, 2
d. 2, 3, 2

98.

Consider the above AON diagram

What is the minimum number of dummy arrows required for conversion into AQA diagram ?

a. 3
b. 4
c. 5

99.

$$A \xrightarrow{8,8,11} B \xrightarrow{9,15,15} C \xrightarrow{6,8,10} D \xrightarrow{4,7,10} E$$

The line of a PERT network is shown above in the diagram with a, m, b durations.
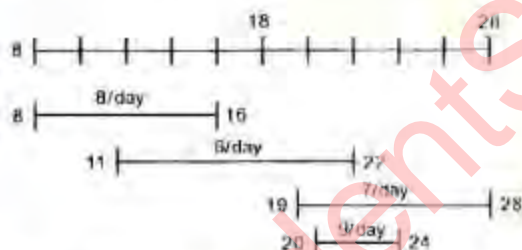
What is the probable range of the total duration ?

a. 34.2 to 47.2
b. 34.2 to 44.2
c. 32.6 to 44.2
d. 32.6 to 42.4

100. Which one of the following is the correct sequence to analyse a project for implementation ?
  a. Time-cost study. Network, WBS, Scheduling with resource allocation
  b. Network, Time-cost study. Scheduling with resource allocation, WBS
  c. WBS, Network, Scheduling with resource allocation, Time-cost study
  d. WBS, Time-cost study, Network, Scheduling with resource allocation

101.

A bar chart of four activities indicating their scheduled start and finish "end-of-day" values and the resource requirement per day are given above.

What will be the maximum and the minimum resource- need on any of the days?

a. 22, 6
b. 21, 6
c. 21, 8
d. 20, 8

102. Consider the following statements
Hardest timber is obtained from the wood grown in
  1. the moderately dry climatic regions
  2. the Himalayan slopes
  3. the open areas
  4. the thin jungles

Which of the statements given above are correct?

a. 1 and 3
b. 1 and 4
c. 2 and 3
d. 2 and 4

103. What is the range of fineness modulus sand which is least suitable for making good concrete?
  a. 3.5 - 4.5
  b. 2.9 - 3.2
  c. 2.6 - 2.9
  d. 22 - 2.6

104. σ_x, σ_y and τ_{xy} are normal and shear stresses on the x and y faces. What is the radius of Mohr's circle in terms of their stresses?

a. $\dfrac{\sigma_x - \sigma_y}{2}$

b. $\dfrac{\sigma_x - \sigma_y}{2} + \tau_{xy}$

c. $\sqrt{\left(\dfrac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^2}$

d. $\sqrt{\left(\dfrac{\sigma_x + \sigma_y}{2}\right)^2 - \tau_{xy}^2}$

105. What is the maximum slenderness ratio of lacing bars in built-up columns ?
  a. 120
  b. 145
  c. 180
  d. 200

106. Which one of the following statements is correct ?
The characteristic strength of concrete is
  a. higher than the average cube strength
  b. lower than the average cube strength
  c. the same as the average cube strength
  d. higher than 90% of the average cube strength

107. Which one of the following is true of a statically determinate beam?
  a. One end is fixed and the other end is simply supported
  b. Both the ends are fixed
  c. The beam overhangs over two supports

d. The beam is supported on three supports

108. What is the value of minimum reinforcement (in case of Fe 415) in a slab?
a. 0.1%
b. 0.12%
c. 0.15%
d. 0.2%

109. Consider the following statements
1. The ideal output of a power shovel is achieved at 900 angle of swing.
2. Output from a power shovel is independent of size of trucks.
3. The optimum depth of cut of a power shovel is the one at which the dipper comes out with full load.
4. The optimum depth of cut does not vary with the size of the dipper of a power shovel.

Which of the statements given above are correct?
a. 1 and 3
b. 2 and 4
c. 1, 2 and 3
d. 1, 2 and 4

110. Match List I (Cost) with List II (Feature) and select the correct answer using the codes :
List I
A. Optimal cost
B. Overhead cost
C. Direct cost;
D. Indirect cost
List II
1. Activity related
2. Developed by crashing process
3. Project-related
4. Contained in, or contributing exclusively to the related product

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

111. Assertion (A) : The splitting test for determining the tensile strength of concrete gives more uniform results than any other tension test.

Reason (R) The splitting test moulds can be used for casting specimens for both compression and tension tests.
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 consist of two
c. A is true but R is false
d. A is false but R is true

112. Assertion (A) : One year strength of continuously moist cured concrete is 40% higher than that of 28-day strength, while no-moisture-curing can lower the strength to about 40%.

Reason (R) : Moist curing for the first seven to fourteen days results in a compressive strength of 70 to 80% of that of 28-day moisture curing.
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 consist of two
c. A is true but R is false
d. A is false but R is true

113. Assertion (A) :. A plane stress system consists of two principal stresses σ_1 and σ_2 and a plane strain system consists of two principal strains $\varepsilon_1 = \sigma_1/E$ and $\varepsilon_2 = \sigma_2/E$. Both the systems are identical.

Reason (R) : Stress is proportional to strain.
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 consist of two
c. A is true but R is false
d. A is false but R is true

114. Assertion (A) ; The slope-deflection method is a stiffness method in which the joint displacements are found by applying the equilibrium conditions at each joint.

Reason (R) : The displacements at a joint of a member are independent of the displacements of the member at the far end of the joint.
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 consist of two

c. A is true but R is false

d. A is false but R is true

115. Assertion (A) : In the elastic-plastic behaviour of statically indeterminate structures the ultimate load can be calculated from equilibrium considerations without any reference to the stiffness characteristics of the structure.

Reason (R) : The ultimate load of a structure is influenced by settlement of supports, thermal stress and residual stresses.

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 consist of two

c. A is true but R is false

d. A is false but R is true

116. Assertion (A) : The principle of super-position cannot be applied in plastic design and as such all the loads must be in position simultaneously for the analysis.

Reason (R) : The relationship between loads and deformations in the plastic range is not linear

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 consist of two

c. A is true but R is false

d. A is false but R is true

117. Assertion (A) : The stress block used in the limit state design method is obtained by testing of concrete cylinder under uniform rate of strain.

Reason (R) : If a uniform rate of strain is not adopted it is not possible to obtain the descending portion of stress and strain curve beyond maximum stress.

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 consist of two

c. A is true but R is false

d. A is false but R is true

118. Assertion (A) : Minimum shear reinforcement as stirrups must be provided in beams, even if the shear stress τ_v is less than the shear strength of concrete τ_c.

Reason (R) : The bending of beams creates a tendency in the particles to slide upon each other within the beam. This tendency is called shear.

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 consist of two

c. A is true but R is false

d. A is false but R is true.

119. Assertion (A) : Detailing of bars as per the requirements of maximum spacing of reinforcement in beams and slabs is sufficient to control flexural cracking.

Reason (R) : A large number of smaller diameter bars, well distributed in the tension zone, reduce the crack width more effectively than a few larger diameter bars of the same area.

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 consist of two

c. A is true but R is false

d. A is false but R is true.

120. Assertion (A) : In assigning activity durations in developing an AOA network, the technology to be adopted is inherently considered but not the rate of utilization (or consumption) of resources (or inputs).

Reason (R): The adopted technology dictates the compatibly preferred consumption pattern of the inputs.

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 consist of two

c. A is true but R is false

d. A is false but R is true.