

# CIVIL ENGINEERING

## (PAPER-I)

1. Match List I (Machinery) with List II (Purpose) and select the correct answer using the code given below the Lists :

### List I

- A. Bulldozer
- B. Power shovels
- C. Dragline
- D. Clamshell

### List II

- 1. Most suited for verticality lifting loose materials
- 2. The bucket in this unit digs by pulling the load towards it
- 3. To excavate all types of soils and dump it into trucks
- 4. For digging the earth at or below the operating level and loading it to hauling units
- 5. Largely employed for excavating and moving the earth

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

2. Consider the following statements?

The main reinforcement in the counter fort in a counter fort retaining wall of R.C.C. is provided on the

- 1. inclined face in front of counter fort.
- 2. bottom face in back counter fort.
- 3. inclined face in back counterfoil.
- 4. bottom face in front counterfoil.

Select the correct answer using the code given below:

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

3. A doubly reinforced concrete beam has effective cover  $d'$  to the centre of

compression reinforcement is the depth of neutral axis, and  $d$  is the effective depth to the centre of tension reinforcement. What is the maximum strain in concrete at the level of compression reinforcement?

- a.  $0.0035 (1 - d'/d)$
- b.  $0.0035 (1 - d'/x_u)$
- c.  $0.002 (1 - d'/x_u)$
- d.  $0.002 (1 - d'/d)$

4. Which one of the following method is employed to manufacture pre-stressed concrete sleepers for the railways?

- a. Post-tensioning
- b. Pre-tensioning
- c. Pre-tensioning followed by post-tensioning
- d. Partial pre-stressing

5. Consider the following statements:

In an under-reinforced concrete beam,

- 1. Actual depth of neutral axis is less than the critical depth of neutral axis.
- 2. concrete reaches ultimate stress prior to steel reaching the ultimate stress.
- 3. moment of resistance is less than that of balanced sections.
- 4. lever arm of resisting couple is less than that of balanced sections.

Which of the statements given above are correct?

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

6. What is the minimum number of longitudinal bars provided in a reinforced concrete column of circular cross section?

- a. 4
- b. 5
- c. 6
- d. 8

7. Drop panel is a structural component in:

- a. Grid floor

- b. Flat plate  
c. Flat slab  
d. Slab-beam system of floor
8. Match List I with List II and select the correct answer using the code given below the Lists :
- List I**  
A. Modular Ratio  
B. Seismic Forces  
C. Pedestal  
D. Composite Column
- List II**  
1. Increase of permissible stresses  
2. Minimum eccentricity  
3. Limit state method  
4. Metal core  
5. Permissible compressive stress due to bending in concrete
- |    | A | B | C | D |
|----|---|---|---|---|
| a. | 5 | 1 | 2 | 4 |
| b. | 4 | 2 | 3 | 5 |
| c. | 5 | 2 | 3 | 4 |
| d. | 4 | 1 | 2 | 5 |
9. Which one of the following systems of pre-stressing is suitable for pre-tensioned members?
- a. Freyssinet system  
b. Magnel-Blaton system  
c. Hoyer system  
d. Gifford-Udall system
10. Which of the following measures are resorted to for strengthening masonry walls?
1. Provide cross walls.  
2. Pre-stressing.  
3. Provide gunite slab on the surface(s) of walls.  
4. Provide buttresses.
- Select the correct answer using the code given below:
- a. 1, 3 and 4  
b. 1 and 2  
c. 2 and 3  
d. 1, 2, 3 and 4
11. When is a masonry wall known as a shear wall?
- a. If the earthquake load is out-of-plane
- b. If the earthquake load is in-plane  
c. If it is unreinforced  
d. If it is placed as infill to the frame
12. What is number of categories into which masonry buildings are divided on this basis of earthquake resistance features?
- a. Five  
b. Four  
c. Three  
d. Two
13. On which one of the following concepts is the basic principle of structural design based?
- a. Weak column strong beam  
b. Strong column and weak beam  
c. Equally strong column-beam  
d. Partial weak column-beam
14. Match List I (Post-tensioning System) with List II (Type of Anchorage) and select the correct answer using the code given below the Lists :
- List I**  
A. Freyssinet  
B. Gifford-Udall  
C. Lee-McCall  
D. Mangel Blaton
- List II**  
1. Flat steel wedges in sandwich plates  
2. High strength nuts  
3. Split conical wedges  
4. Conical serrated concrete wedges
- |    | A | B | C | D |
|----|---|---|---|---|
| a. | 2 | 1 | 4 | 3 |
| b. | 4 | 3 | 2 | 1 |
| c. | 2 | 3 | 4 | 1 |
| d. | 4 | 1 | 2 | 3 |
15. If the Young's modulus 'E' is equal to bulk modulus 'K', then what is the value of the Poisson's ratio?
- a. 1  
b.  $\frac{1}{4}$   
c.  $\frac{1}{3}$   
d.  $\frac{3}{4}$

16. What is the ratio of maximum shear stress to average shear stress for a circular section?

a. 2  
b.  $\frac{3}{2}$   
c.  $\frac{4}{3}$   
d.  $\frac{3}{4}$

17. For a state of plane stress  $\sigma_1 = \sigma_x = 40$  MPa, and  $\sigma_2 = \sigma_y = 20$  MPa. What are the values of the maximum in-plane shearing stress and absolute maximum shearing stress?

a.  $(\pm 10, 20)$  MPa  
b.  $(\pm 10, 10)$  MPa  
c.  $(\pm 20, 10)$  MPa  
d.  $(\pm 20, 20)$  MPa

18. At a certain point in a strained material, there are two mutually perpendicular stresses  $\sigma_x = 100$  N/mm<sup>2</sup> (Tensile) and  $\sigma_y = 50$  N/mm<sup>2</sup> (Compressive).

[Notation : Tension (+);  
Compression (-) ]

What are the values of the principal stresses in N/mm<sup>2</sup> at that point?

a. 100, -50  
b. -100, 50  
c. 75, -25  
d. -75, 25

19. In a plane strain problem in xy plane, the shear strain =  $12 \times 10^{-6}$ , and the normal strain in x and y direction = 0. For this state of strain, what is the diameter of the Mohr's Circle of strain?

a.  $6 \times 10^{-6}$   
b.  $8 \times 10^{-6}$   
c.  $12 \times 10^{-6}$   
d.  $24 \times 10^{-6}$

20. A mild steel bar of square cross-section 40 mm x 40 mm is 400 mm long. It is subjected to a longitudinal tensile stress of 440 N/mm<sup>2</sup> and lateral compressive stress is 200 N/mm<sup>2</sup> in perpendicular directions.  $E = 2 \times 10^5$  N/mm<sup>2</sup>,  $\mu = 0.3$ . What is the approximate elongation of the bar in the longitudinal direction?

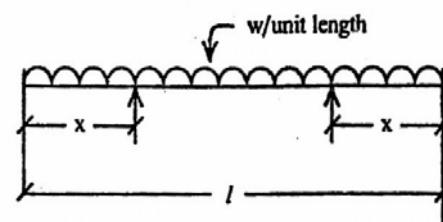
a. 0.44 mm

b. 0.88 mm  
c. 0.22 mm  
d. 1 mm

21. At a certain point in a structural member there are perpendicular stresses 80 N/mm<sup>2</sup> and 20 N/mm<sup>2</sup>, both tensile. What is the equivalent stress in simple tension, according to the maximum principal strain theory ? (Poisson's ratio = 0.25)

a. Zero  
b. 20 N/mm<sup>2</sup>  
c. 60 N/mm<sup>2</sup>  
d. 75 N/mm<sup>2</sup>

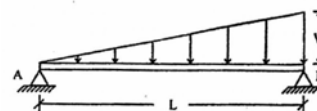
22.



A uniform beam of span  $l$  carries a uniformly distributed load  $w$  per unit length as shown in the figure given above. The supports are at a distance of  $x$  from either end. What is the condition for the maximum bending moment in the beam to be as small as possible?

a.  $x = 0.1071$   
b.  $x = 0.2071$   
c.  $x = 0.2371$   
d.  $x = 0.251$

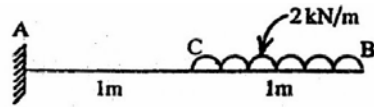
23.



For the simply supported beam shown in the figure given above, at what distance from the support A, is the shear force zero?

a.  $\frac{L}{4}$   
b.  $\frac{L}{3}$   
c.  $\frac{L}{2}$   
d.  $\frac{L}{\sqrt{3}}$

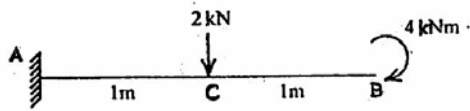
24.



A cantilever AB is loaded as shown in the figure given above. What is the shape of the bending moment diagram for portion AC?

- Parabolic
- Linearly varying with maximum value of the bending moment at C
- Linear with constant bending moment value from C to A
- Linearly varying with maximum value at A

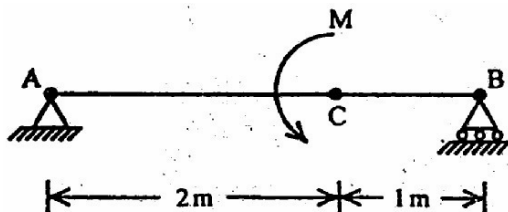
25.



A cantilever beam AB carries loadings as shown in the figure above. Which one of the following is the SFD for the beam?

- 
- 
- 
- 

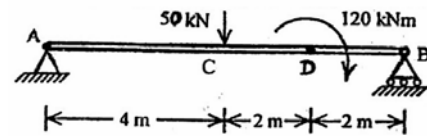
26.



Couple M is applied at C on a simply supported beam AB. What is the maximum shear force for the beam?

- Zero
- M
- $2M/3$
- $M/3$

27.



The beam shown in the figure given above is subjected to concentrated load and clockwise couple.

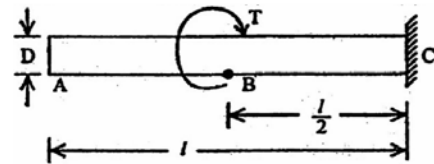
What is the vertical reaction at A?

- 10 kN
- 40 kN
- 50 kN
- 30 kN

28.

A beam has the same section throughout its length with  $I = 1 \times 10^8 \text{ mm}^4$ . It is subjected to a uniform B.M. = 40 kNm.  $E = 2 \times 10^5 \text{ N/mm}^2$ . What is the radius of curvature of the circle into which the beam will bend in the form of an arc of a circle?

- 1000m
- 500m
- 400m
- 350m

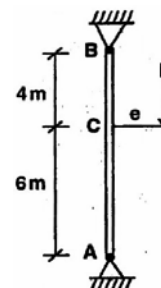


29.

A bar of circular cross-section of diameter D is subjected to a torque T at B as shown in the figure given above. What is the angle of twist at A?

- Same as that at B
- Zero
- Twice as that at B
- Half as that at B

30.



Consider the following statements for the column with a bracket as shown in the figure given above:

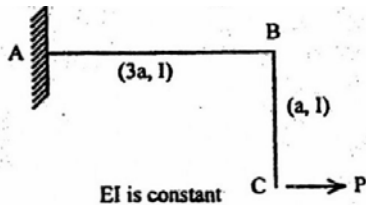
- Shear force is constant throughout.

2. Maximum moment in the column is  $P_e$ .
3. The compressive axial force in the column is  $0.4 P$ .

Which of the statements given above is/are correct?

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

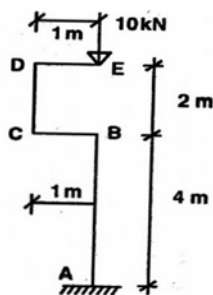
31.



What is the vertical displacement at the point C of the structure shown in the figure given above?

- a.  $\frac{9Pa^3}{2EI}$   
b.  $\frac{27Pa^3}{2EI}$   
c.  $\frac{27Pa^3}{8EI}$   
d.  $\frac{3Pa^3}{8EI}$

32.



What is the bending moment at A for the bent column shown in the figure given above?

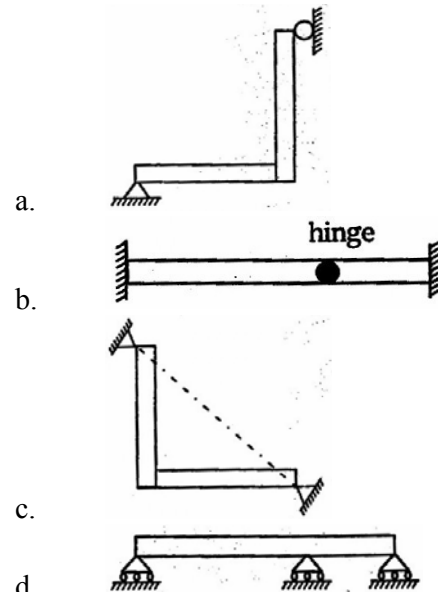
- a. 40 kNm  
b. 20 kNm  
c. 10 kNm  
d. zero

33. The deflection at the free end of a uniformly loaded cantilever of length 1 m

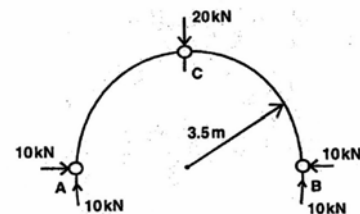
is 7.5 mm. What is the slope at the free end?

- a. 0.01 radian  
b. 0.02 radian  
c. 0.015 radian  
d. 0.025 radian

34. Which one of the following structures is statically determinate and stable?



35.



A three-hinged loaded semicircular arch ACB is shown in the figure given above. What is the shearing force at the hinge C?

- a. 20 kN  
b.  $20\sqrt{2}$  kN  
c. 10 kN  
d.  $10\sqrt{2}$  kN

36. Which one of the following statements is correct?

Linear arch is one which represents:

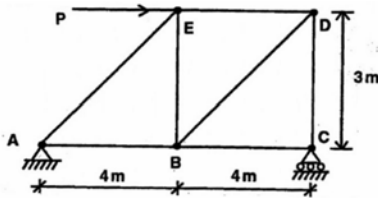
- a. centre line of an arch  
b. variation of bending moment  
c. thrust line  
d. variation of shear force

37. A point load applied at shear centre induces:

- a. Zero shear force

- b. Zero bending  
c. Pure twisting  
d. Pure bending

38.



What is the ratio of the forces in the members AB, BE and AE of the pin-jointed truss shown in the figure given above?

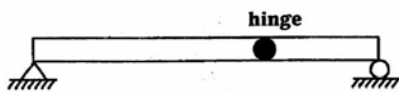
- a. 5 : 4 : 3  
b. 4 : 3 : 5  
c.  $\left(\frac{1}{4}\right) : \left(\frac{1}{3}\right) : \left(\frac{1}{5}\right)$   
d. None of the above

39.

Which one of the following is correct in respect of the influence line for the bending moment at one-fourths of the span from left support of a prismatic beam simply supported at ends?

- a. It is composed of straight lines only  
b. It is composed of curved lines only  
c. It is composed of straight and curved line  
d. It is parabolic

40.



A prismatic beam is shown in the figure given above.

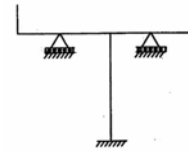
Consider the following statements:

1. The structure is unstable.
2. The bending moment is zero at supports and internal hinge.
3. It is mechanism.
4. It is statically indeterminate.

Which of the statements given above is/are correct?

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

41.



What is the degree of indeterminacy of the frame shown in the figure given above?

- a. 4  
b. 3  
c. 2  
d. Zero

42.

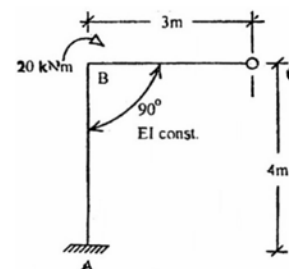
Consider the following statements:

1. In a non-circular structural member subjected to torsion, plane sections before twisting remain plane after twisting.
2. The analysis of indeterminate structures by the theorem of three moments does not give the exact solutions.
3. The work done by the external Loads during a vertical deformation is not equal to the increase in internal energy stored in the body.

Which of the statements given above is/are correct?

- a. 1 and 2  
b. 2 and 3  
c. 1 and 3  
d. None

43.



The figure given above shows a rigid frame fixed at A and hinged at C. If a pure moment of 20 kNm is applied at B in the plane of the figure, then what is the moment at the fixed end A?

- a. 10 kNm  
b. 7.5 kNm  
c. 5 kNm  
d. 2.5 kNm

44.

Match List I with List II and select the correct answer using the code given below the Lists :

**List I**

- A. Strain energy method
- B. Slope-deflection
- C. Moment distribution
- D. Kani's method

**List II**

- 1. Successive approximation
- 2. Flexibility method
- 3. Iteration process
- 4. Stiffness method

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

45. Which one of the following statements is correct? The number of unknowns to be determined in the stiffness method is equal to:

- a. the static indeterminacy
- b. the kinematic indeterminacy
- c. the sum of kinematic indeterminacy and static indeterminacy
- d. two times the number of supports

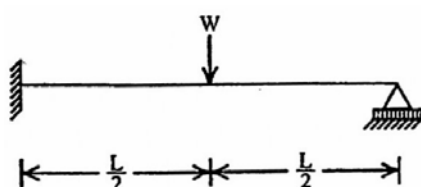
46. The stiffness matrix of a beam element is

$$\left(\frac{2EI}{L}\right) \begin{bmatrix} 2 & -1 \\ 1 & 2 \end{bmatrix}$$

Which one of the following is its flexibility matrix?

- a.  $\left(\frac{L}{2EI}\right) \begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$
- b.  $\left(\frac{L}{3EI}\right) \begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix}$
- c.  $\left(\frac{L}{5EI}\right) \begin{bmatrix} 1 & -2 \\ -2 & 1 \end{bmatrix}$
- d.  $\left(\frac{L}{6EI}\right) \begin{bmatrix} 1 & -2 \\ -2 & 1 \end{bmatrix}$

47.



For the propped cantilever beam shown in the figure given above, the plastic moment

capacity is  $M_p$ . What is the value of its collapse load?

- a.  $\frac{4M_p}{L}$
- b.  $\frac{6M_p}{L}$
- c.  $\frac{8M_p}{L}$
- d.  $\frac{11.7M_p}{L}$

48.



What is the total degree of indeterminacy, both internal and external of the plane frame shown above?

- a. 10
- b. 11
- c. 12
- d. 14

49.

Which one of the following is the correct statement? In beam to column connections in steel construction, if torsion is permitted at the ends of simply supported beams by not providing the cleats, the

- a. effective length of the beam increases by 20%
- b. effective length remains same as the actual length
- c. permissible bending stresses are increased by around
- d. joint has to be designed for torsion

50.

For a vertical stiffened web of a plate girder, the lesser clear dimension of the panel should not exceed:

- a. 85 t
- b. 180 t
- c. 200 t
- d. 250 t

(where t is the thickness of the web)

51.

What is the permissible tensile stress in bolts used for column bases?

- a. 120 N/mm<sup>2</sup>
- b. 150 N/mm<sup>2</sup>



- c.  $0.6f_y$   
d.  $0.4 f_y$   
(where  $f_y$  is the yield stress of the steel)
52. What is the effective height of a free-standing masonry wall for the purpose of computing slenderness ratio?
- a.  $0.5 L$   
b.  $1.0 L$   
c.  $2.0 L$   
d.  $2.5 L$
53. A square column section of size  $350 \text{ mm} \times 350 \text{ mm}$  is reinforced with four bars of  $25 \text{ mm}$  diameter and four bars of  $16 \text{ mm}$  diameter. Then the transverse steel should be:
- a.  $5 \text{ mm dia @ } 240 \text{ mm c/c}$   
b.  $6 \text{ mm dia @ } 250 \text{ mm c/c}$   
c.  $8 \text{ mm dia @ } 250 \text{ mm c/c}$   
d.  $8 \text{ mm dia @ } 350 \text{ mm c/c}$
54. Assertion (A) : In resource levelling approach of resource allocation, activity start times are scheduled such that the peak demand for a particular resource remains within available limit of the resources.  
Reason (R) : In resource levelling approach of resource allocation, the total project time is not changed.
- 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
55. Assertion (A): Interference float is the event slack at the headed node of an activity.  
Reason (R) : Interference float cannot be shared by any other activity.
- 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
56. Assertion (A): A rectangular element is subjected to pure shear. This will result in cracks along one diagonal and crushing along the other diagonal.

Reason (R) : Pure shear on a rectangular element results in tension along one diagonal and compression along the other diagonal.

- 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
57. Assertion (A): In certain special situations, omitting the shear effect deformations can lead to significant errors.  
Reason (R) : In general, when the bending moments vary along the length of the beams, the shearing stress, resultants will be present and will influence deformation.
- 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
58. Assertion (A): The total virtual work done by a system of forces acting on a rigid body. In equilibrium during a virtual displacement is zero.  
Reason (R) : If a system of forces acting on a deformable body is in equilibrium, as the body is subjected to a small deformation, the external virtual work done by the forces will also be zero.
- 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
59. Assertion (A): The design shear strength of axially loaded beams is increased by a factor as per IS codes,  $1 + \left( \frac{3P_u}{A_g f_{ck}} \right)$  or  $1.5$  whichever is less.  
(Where  $P_u$  is axial Load,  $A_g$  gross area of column and  $f_{ck}$  characteristic concrete strength)  
Reason (R) : The presence of axial compressive force is to hasten the formation of both flexural and inclined cracks.



- 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

60. Assertion (A): The concept of locating the neutral axis in a reinforced concrete flexural member as centroidal axis is applicable in working stress design method, but not in limit state design method.

Reason (R) : The working stress design method assumes that the structural material behaves in a non-linear elastic manner and there is strain compatibility in bond between steel and concrete.

- 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

61. Assertion (A): Minimum shear reinforcement in all shallow beams is provided when shear stress exceeds  $0.5 \tau_c$  (where  $\tau_c$  is design shear stress).

Reason (R) : Minimum shear reinforcement prevents formation of inclined cracks and avoids abrupt failures and introduces ductility in 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  
 c. A is true but R is false  
 d. A is false but R is true

62. In a tree, the cambium layer is situated between:

- a. The outer bark and inner bark  
 b. The inner bark and sap wood  
 c. The sap wood and heart wood  
 d. The pith and heart wood

63. Consider the following statements:  
 Kiln seasoning of timber results is:  
 1. reduced density.  
 2. reduced life.  
 3. dimensional stability.

Which of the following given above is/are correct?

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

64. Match List I (Diagram Based Nomenclature) with List II (Information Capability) and select the correct answer using the code given below the Lists

**List I**

- A. Work-breakdown structure  
 B. Bar chart  
 C. Linked bar chart  
 D. Time computations on network

**List II**

1. Target dates for interface events can be stipulated  
 2. Can be heretical  
 3. Can include information on cost distribution over time  
 4. Best suited for monitoring including that for costs

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

65. Which one of the following is the correct statement?

The strength of timber:

- a. is maximum in a direction parallel to the grain  
 b. is maximum in a direction perpendicular to the grain  
 c. is maximum in a direction  $45^\circ$  to the grain  
 d. remains same in all directions

66. Consider the following statements:

The disease of dry rot in timber is caused by:

1. complete submergence in water.  
 2. alternate wet and dry condition.  
 3. lack of ventilation.

Which of the statements given above is/are correct?

- a. 1 only  
 b. 3 only

- c. 2 only  
d. 2 and 3
67. Match List I (Term) with List II (Brief Description) and select the correct answer using the code given below the Lists :

**List I**

- A. Heart shakes  
B. Knot  
C. Rot  
D. Sap Wood

**List II**

1. Disintegration caused by fungi
2. Outer layers of a log of wood
3. A branch base embedded in timber by natural growth
4. Cracks widest at centre and diminishing towards the outer circumference

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

68. Which one of the following is the correct statement? Refractory bricks resist:

- a. high temperature
- b. chemical action
- c. dampness
- d. all the above three

69. Which one of the following is the correct statement? Smaller size of aggregates in a concrete mix:

- a. provides larger surface area for bonding with the mortar matrix which increases the compressive strength and reduces the stress concentration at the mortar-aggregate interface
- b. is economical as the concrete mix is more dense
- c. requires lesser cement for a particular water-cement ratio and hence is economical
- d. is beneficial as these aggregates can pass through the reinforcement bars more easily

70. On which of the following is the working principle of concrete hammer for non-destructive test based?

- a. Rebound deflections

- b. Radioactive waves
- c. Ultrasonic pulse
- d. Creep-recovery

71. Match List I (Apparatus) with List II (Purpose) and select the correct answer using the code given below the Lists :

**List I**

- A. Le-chatelier  
B. Vicat Needle with annular collar  
C. Vee-Bee  
D. Briquettes test machine

**List II**

1. Workability of concrete
2. Soundness of cement
3. Tensile strength of cement
4. Final setting time of cement

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

72. Match List I (Type of Cement) with List II (Characteristics) and select the correct answer using the code given below the Lists :

**List I**

- A. Rapidly hardening cement  
B. Low heat Portland cement  
C. Portland Puzzolana  
D. Sulphate resisting cement

**List II**

1. Lower  $C_3A$  content than that in OPC
2. Contains pulverised fly ash
3. Higher  $C_3S$  content than that in OPC
4. Lower  $C_3S$  and  $C_3A$  contents than that in OPC

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

73. Why is super plasticizer added to concrete?

1. To reduce the quantity of mixing water.
2. To increase the consistency
3. To reduce the quantity of cement.

4. To increase resistance to freezing and thawing.  
Select the correct answer using the code given below:  
a. 1, 2 and 3  
b. 1, 3 and 4  
c. 2 and 3  
d. 4 only
74. Consider the following statements:  
Cement concrete is a/an:  
1. elastic material.  
2. visco-elastic material.  
3. visco-plastic material.  
Which of the statements given above is/are correct?  
a. 1, 2 and 3  
b. 2 and 3  
c. 2 only  
d. 1 only
75. In a shape test of aggregate, which one of the following gives the correct slot for flakiness index of a material passing 50 mm sieve and retained on 40mm sieve?  
a. 25 mm  
b. 27mm  
c. 81 mm  
d. 30mm
76. On which one of the following factors, does strength of concrete depend primarily?  
a. Quality of coarse aggregate  
b. Quality of fine aggregate  
c. Fineness of cement  
d. Water-cement ratio
77. Consider the following statements regarding the phenomenon of bulking of sand:  
1. It is due to film of water around sand particles.  
2. It is due to capillary action.  
3. It is more in finer sands.  
Which of the following statements given above is, are correct?  
a. 1, 2 and 3  
b. 1 and 3  
c. 2 and 3  
d. 1 and 2
78. Which one of the following sections performs better on the ductility criterion?  
a. Balanced section  
b. Over-reinforced section  
c. Under-reinforced section  
d. Non-prismatic section
79. A beam of rectangular cross-section (b x d) is subjected to a torque T. What is the maximum torsional stress induced in the beam?  
a.  $\frac{T}{\alpha b^2 d}$   
b.  $\frac{T}{\alpha b d^2}$   
c.  $\frac{T}{\alpha b d}$   
d.  $\frac{T}{b d}$   
(Where  $b < d$ , and  $\alpha$  is a constant)
80. Match List I (Codal Parameter) with List II (Structural Member) and select the correct answer using the code given below the Lists :  
**List I**  
A.  $0.04 b D$   
B.  $250 b^2/d$   
C.  $100 b^2 d$   
D.  $(k_x l_x)/D_x$   
**List II**  
1. Column  
2. Cantilever  
3. Continuous beam  
4. Beam
- |    | A | B | C | D |
|----|---|---|---|---|
| a. | 4 | 1 | 2 | 3 |
| b. | 2 | 3 | 4 | 1 |
| c. | 4 | 3 | 2 | 1 |
| d. | 2 | 1 | 4 | 3 |
81. Which of the following are the additional moments considered for design of slender compression member in lieu of deflection in x and y directions?  
a.  $\frac{P_u l_{ex}^2}{2000 D}$  and  $\frac{P_u l_{ey}^2}{2000 D}$   
b.  $\frac{P_u l_{ex}}{2000}$  and  $\frac{P_u l_{ey}}{2000}$

c.  $\frac{P_u I_{ex}^2}{2000D}$  and  $\frac{P_u I_{ey}^2}{2000b}$

d.  $\frac{P_u I_{ex}^2}{200D}$  and  $\frac{P_u I_{ey}^2}{200D}$

(Where  $P_u$  is axial load;  $I_{ex}$  and  $I_{ey}$  are effective lengths in respective directions;  $D$  depth of section  $\perp$  to major axis;  $b$  width of the member)

82. What should be the minimum grade of reinforced concrete in and around sea coast construction?

- M 35
- M 30
- M 25
- M 20

83. Which one of the following correctly expresses the split tensile strength of a circular cylinder of length  $L$  and diameter  $D$ , subject to a maximum load of  $P$ ?

- $\frac{P}{\pi DL}$
- $\frac{P}{2\pi DL}$
- $\frac{2P}{\pi DL}$
- $\frac{P}{4\pi DL}$

84. What is the value of flexural strength of M 25 concrete?

- 4.0 MPa
- 3.5 MPa
- 3.0 MPa
- 1.75 MPa

85. Consider the following statements with regard to crack formation and its control:

- The surface width of the crack should not, in general, exceed 0.30 mm for structures not subjected to aggressive environment.
- When depth of web in a beam exceeds 750 mm, side face reinforcement @ 0.1 percent of web area should be provided on each face.
- The nominal spacing of main bars in a slab should not exceed three times the effective depth of a solid slab or 300 mm, whichever is smaller.

Which of the statements given above is/are correct?

- 1 only
- 1 and 2
- 1 and 3
- 2 and 3

86. Which of the following should be employed to provide lateral support to the beams?

- Bracing of compression flanges.
- Shear connectors.
- Bracing of tension flanges.
- Embedding compression flanges into R.C.C. slab.

Select the correct answer using the code given below:

- 1 only
- 1 and 4
- 2 and 3
- 1, 2 and 4

87. Where should splices in the columns be provided?

- At the floor levels
- At the mid height of columns
- At the beam-column joints
- At one-fourth height of columns

88. Which one of the following stresses is independent of yield stress as a permissible stress for steel members?

- Axial tensile stress
- Maximum shear stress
- Bearing stress
- Stress in slab base

89. Why are tie plates provided in laced columns?

- To check the buckling of column as whole
- To check the buckling of the lacing flats
- To check the buckling of the component columns
- To check the distortion of the end cross sections

90. A steel rod of 16 mm diameter has been used as a tie in a bracing system, but may be subject to possible reversal of stress due to the wind. What is the maximum permitted length of the member?

- a. 1600 mm
- b. 1400 mm
- c. 1200 mm
- d. 1000 mm

91. Consider the following statements in respect of plate girders:

1. A large number of cover plates are provided over flange angles so that curtailed flanges match the bending moment diagram exactly.
2. At least one cover plate should extend over the entire span so that rain water may not enter and corrode the connections.
3. A minimum of one-third of flange area should be provided in flange angles and balance in flange cover plates for stability.

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

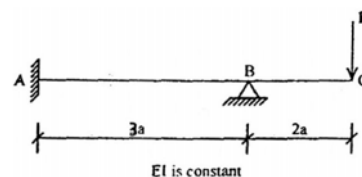
92. A beam of rectangular section having simply supported span  $L$ , is subject to a concentrated load at its mid-span. What is the length of elasto-plastic zone of the plastic hinge?

- a.  $\frac{L}{3}$
- b.  $\frac{L}{4}$
- c.  $\frac{L}{5}$
- d.  $\frac{L}{7}$

93. The plastic modulus of a section is  $5 \times 10^{-4} \text{ m}^3$ . Its shape factor is 1.2 and the plastic moment capacity is 120 kNm. What is the value of the yield stress of the material?

- a.  $100 \text{ N/mm}^2$
- b.  $200 \text{ N/mm}^2$
- c.  $240 \text{ N/mm}^2$
- d.  $288 \text{ N/mm}^2$

94.



In the propped cantilever shown in the figure given above, what are the values of the bending moment and shear force at the support A?

- a.  $2 Pa, P/3$
- b.  $Pa, P$
- c.  $Pa, P/3$
- d.  $2 Pa, 4P/3$

95. A, B, C, D and E are the 5 activities along the unique critical path of a AOA network of activities. Their characteristics are as under:

Activity	A	B	C	D	E
Expected duration, days	7	6	11	14	5
Standard deviation, days	2	2	3	4	1

What is the possible range of project duration (in days)?

- a. 31.2 to 54.8
- b. 28.1 to 57.9
- c. 25.5 to 60.5
- d. 24.6 to 61.4

96. What is the significant purpose of monitoring a project through its implementation phase?

- a. To fix responsibility for delays
- b. To rerail the project with control over cost over-run
- c. To rerail the project with minimum time over-run
- d. To rerail the project with optimal time and cost overrun

97. A bulldozer operates on a 30 m stretch and moves at 2.4 kmph when pushing the earth, and returns empty at 6 kmph. The time lost in loading and shifting gears per trip is 18 seconds. Its operating factor is nearly 50 mm/hour. What is the number of trips made per hour?

- a. 31
- b. 33
- c. 35
- d. 37

98. Match List I (Reporting Feature) with List II (Implication and/or Possibility) and

select the correct answer using the code given below the Lists :

**List I**

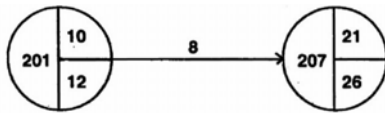
- PERT study
- Time-cost study
- Critical path identification
- Linked bar chart

**List II**

- Cost build up on project over time can be depicted
- Choice of technology can be concurrent
- Choice of technology is predetermined
- May be affected by probabilistic activity durations

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

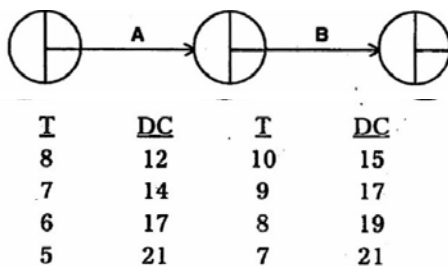
99.



For an activity 201-207 in an AOA network, the EEL values, LET values and activity duration are shown in the figure given above. Between free float interference float and independent float, which one of the following is the correct sequence in the decreasing magnitude order?

- Free float — Interference float — Independent float
- Free float — Independent float — Interference float
- Interference float — Free float — Independent float
- Interference float — Independent float — Free float

100.



Two activities A and B are to be done in the given sequence. The variation of direct cost (DC) with possible activity duration (T) (in days) is indicated for each activity above. What is the increase in total direct cost between a combined duration of 16 days and 13 days?

- 5
- 6
- 7
- 8

101. What type of vibrator is used for concreting thin section as well as heavily reinforced section?

- Vibrating needle
- Internal vibrator
- Surface vibrator
- Form vibrator

102. Which of the following advantages accrue to the use of Articulate Dump Trucks (ADT) over Rigid Dump Trucks (RDT) for construction and earth moving work?

- Higher manoeuvrability.
- Low turning radius.
- Lower fleet costs.

Select the correct answer using the code given below:

- 1, 2 and 3
- 1 and 2
- 1 and 3
- 2 and 3

103. Match List I with List U and select the correct answer using the code given below the Lists :

**List 1 (Type of Rollers)**

- Pneumatic roller
- Vibratory roller
- Sheep foot roller
- Grid and mesh roller

**List II (Uses)**

- Granular and silty materials, bituminous road works, etc.
- Compaction of cohesive material like clay
- Compaction of non-cohesive soil
- Compaction of gravel base

	A	B	C	D
a.	1	3	2	4



- b. 2 4 1 3  
 c. 1 4 2 3  
 d. 2 3 1 4

104. Consider the following statements:

The Salient features of a bar chart over network are that:

1. It is simple to draw and easy to understand.
2. It is unable to depict interdependence of activities.
3. It clearly distinguishes between critical and noncritical activities.
4. It is not possible to crash activities to get optimum and minimum duration of the project.

Which of the following statements given above are correct?

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

105. Match List I (Type of Equipment) with List II (Purpose) and select the correct answer using the code given below the Lists

**List I**

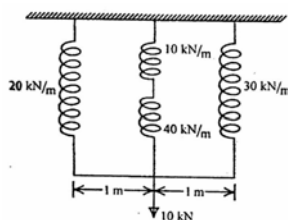
- A. Agitating Truck  
 B. Hoe  
 C. Derrick Pole  
 D. Sheep Foot roller

**List II**

1. Quarrying
2. Compacting
3. Hoisting
4. Transporting

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

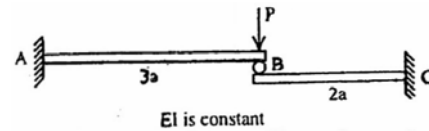
106.



What is the equivalent spring stiffness for the system of springs shown in the figure given above?

- a. 43 kN/m  
 b. 50 kN/m  
 c. 58 kN/m  
 d. 64 kN/m

107.



The free end of a cantilever beam is supported by the free end of another cantilever beam using a roller as shown in the figure given above. What is the deflection at the roller support B?

- a.  $8 Pa^3/(3 EI)$   
 b.  $9 Pa^3/(EI)$   
 c.  $64 Pa^3/(35 EI)$   
 d.  $216 Pa^3/(35 EI)$

108. Which one of the following statements is correct?

Lug angles

- a. are necessarily unequal angles  
 b. are always equal angles  
 c. increase the shear resistance of joint  
 d. reduce the length of joint

109. Purlins are provided, in industrial buildings, over roof trusses to carry dead loads, live loads and wind loads. As per IS code, what are they assumed to be?

- a. Simply supported  
 b. Cantilever  
 c. Continuous  
 d. Fixed

110. Consider the following statements about provision of sag rods:

1. Sag rods reduce span length of purlin in the weak direction.
2. Sag rods are installed in the plane of the roof.
3. Ridge purlin is subject to vertical components of sag rods on either side of slope.

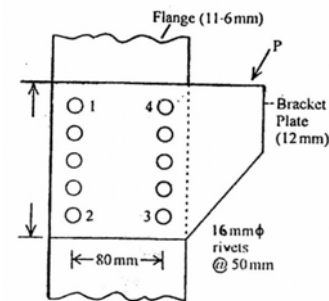
Which of the statements given above are correct?

- a. 1, 2 and 3  
 b. 2 and 3

- c. 1 and 2  
d. 1 and 3
111. The slenderness ratio of lacing bars should not exceed:  
a. 100  
b. 200  
c. 145  
d. 180
112. Consider the following statements:  
Bearing stiffness, in plate girders, are:  
1. Provided at supports.  
2. Provided under concentrated loads.  
3. Provided alternately on the web.  
Which of the statements given above is/are correct?  
a. 1 only  
b. 2 only  
c. 1 and 2  
d. 1, 2 and 3
113. The outstand of the flange of built-up beams from the line of connection should not extend beyond:  
a.  $10 T$   
b.  $85 T$   
c.  $\frac{256T}{\sqrt{f_y}}$   
d.  $180 t_w$   
(where  $T$  is the thickness of flange and  $t_w$  is the thickness of web)
114. Which one of the following is a compression member?  
a. Purlin  
b. Boom  
c. Girt  
d. Tie
115. In a situation where torsion is dominant, which one of the following is the desirable section?  
a. Angle section  
b. Channel section  
c. I-section  
d. Box type section
116. In a gusseted base, when the end of the column is machined smooth for complete bearing, the axial load is transferred to base slab:  
a. Fully through fastening

- b. fully by direct bearing  
c. 50% by direct bearing and 50% through fastening  
d. 60% by direct bearing and 40% through fastening
117. Which steel member section among the following combinations can carry maximum load?  
a. A pair of angles welded on opposite sides of a gusset plate, but not tack welded  
b. A pair of angles welded on opposite sides of a gusset plate, and tack welded along its length  
c. A pair of angles back to back on same side of a gusset plate, and tack welded  
d. A pair of angles on same side of a gusset plate, but not tack welded

118.



- Which one of the following is the most critical rivet in the joint shown in the figure given above?  
a. No. 1  
b. No. 2  
c. No. 3  
d. No. 4

119. What is the shape of Influence line diagram for the maximum bending moment in respect of a simply supported beam?  
a. Rectangular  
b. Triangular  
c. Parabolic  
d. Circular
120. In a plastic analysis of structures, the segment between any two successive plastic hinges is assumed to deform as:  
a. A plastic material  
b. A rigid material  
c. An elastic material  
d. An inelastic material