

# CIVIL ENGINEERING

## (PAPER-I)

1. Timber can be made reasonably fire-resistant by
- soaking it in Ammonium Sulphate
  - coating with Tar paint
  - pumping creosote oil into timber under high pressure
  - seasoning process
2. Which one of the following statements is the correct description of the structure of fibre board?
- Thin slices of superior quality of wood are glued and pressed on the surface of inferior wood
  - Streamed mass of wood dusts, wood wool and other vegetable fibres are pressed hard to a thickness varying from 3 mm to 12 mm
  - Thin and narrow wood shavings are soaked in a refractory binder material and pressed hard
  - Thin and narrow wood shaving are soaked in a refractory binder material and pressed hard
3. Match List I (Constituents of bricks) with List II (corresponding influence) and select the correct answer:
- List I**
- Alumina
  - Silica
  - Magnesia
  - Limestone
- List II**
- Colour of brick
  - Plasticity recovery for moulding
  - Reacts with silica during burning and causes particles to unite together and development of strength
  - Preserve the for on brick at high temperature and prevents shrinkage
- |    |   |   |   |   |
|----|---|---|---|---|
|    | A | B | C | D |
| a. | 2 | 1 | 4 | 3 |
| b. | 3 | 4 | 1 | 2 |
- c. 2 4 1 3  
d. 3 1 4 2
4. In some brick masonry walls, patches of whitish crystals were found on the exposed surfaces, also chipping and spalling of bricks took place from the same walls. Which among the following are the causes of these defects?
- Settlement of foundation
  - Over-loading of the walls
  - Sulphate attack
  - Efflorescence
- 1 and 2
  - 2 and 3
  - 2 and 4
  - 3 and 4
5. Match List I with list II and select the correct answer
- List I (Property)**
- Specific heat of an aggregate
  - Thermal conductivity of an aggregate
  - Thermal expansion
  - Durability of concrete
- List II (Characteristic)**
- Breaks the bond between the aggregate and the paste
  - Is a measure of its heat capacity
  - Is affected by differences in thermal expansion of two different materials
  - Is a measure of its ability to conduct heat
- |    |   |   |   |   |
|----|---|---|---|---|
|    | A | B | C | D |
| a. | 1 | 3 | 2 | 4 |
| b. | 2 | 4 | 1 | 3 |
| c. | 1 | 4 | 2 | 3 |
| d. | 2 | 3 | 1 | 4 |
6. Consider the following methods of preservation of timber
- Pressure application
  - Brush application

3. Dipping
4. Open tank application

The correct sequence of these methods in the increasing order of their effectiveness is ;

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

7. Match List I with List II and select the correct answer ;

**List I (Name of defect)**

- A. Cupping
- B. Bowing
- C. Chucks
- D. Knots

**List II(Definition)**

1. Caused by wood limbs encased by the wood of the free trunk
2. Caused by grain irregularities in the board and can be eliminated by proper stacking
3. Small cracks appearing at the ends of boards caused by too rapid drying
4. Unequal shrinking in the radial and tangential direction

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

8. Match List I with list II and select the correct answer ;

**List I (Type of cement)**

- A. Ordinary Portland cement
- B. Rapid hardening cement
- C. Low heat cement
- D. Sulphate resistant cement

**List II(Characteristics)**

1. The percentage of  $C_3S$  is maximum and is of the order of 50%
2. The percentages of  $C_2S$  and  $C_3S$  are the same and of the order of 40%
3. Reacts with silica during burning and causes particles to unite together and development of strength

4. Preserves the for of brick at high temperature and prevents shrinkage

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

9. Match List I with List II and select the correct answer :

**List I(Type of cement)**

- A. High strength Portland cement
- B. Super sulphated cement
- C. High alumina cement
- D. Rapid hardening Portland cement

**List II(Property/Characteristic)**

1. Should not be used with any admixture
2. Is extremely resistant to chemical attack
3. Gives a higher rate of heat development during hydration of cement
4. has a higher content of tricalcium silicate

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

10. Consider the following stages in the manufacturing of bricks :

1. Weathering
2. Moulding
3. Tempering

The correct sequence of these stages in the manufacturing of the bricks, is

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

11. Four main oxides present in ordinary Portland cement are :  $CaO$ ,  $Al_2O_3$ ,  $SiO_2$  and  $Fe_2O_3$ . Identify the correct ascending order of their proportions in a typical composition of OPC

- a.  $Al_2O_3$ ,  $Fe_2O_3$ ,  $CaO$ ,  $SiO_2$
- b.  $Al_2O_3$ ,  $CaO$ ,  $Fe_2O_3$ ,  $SiO_2$
- c.  $Fe_2O_3$ ,  $Al_2O_3$ ,  $SiO_2$ ,  $CaO$



d.  $\text{Fe}_2\text{O}_3$ ,  $\text{SiO}_2$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{CaO}$

12. Consider the following statements .

Pozzolana used as an admixture in concrete has the following advantages :

1. It improves workability with lesser amount of water
2. It increases heat of hydration and so sets the concrete quickly
3. It increases resistance to attack by salts and sulphates
4. It leaches calcium hydroxide

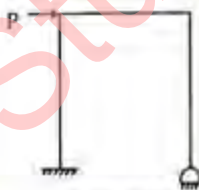
Select the correct answer using the code given below

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

13. The length of time for which a concrete mixture will remain plastic is usually more depended on

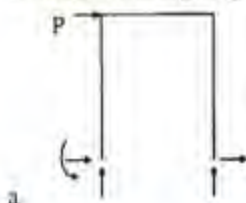
- a. the setting time of cement than on the amount of mixing water and atmospheric temperature
- b. the atmospheric temperature than on the amount of mixing water and the setting time of cement
- c. the setting time of cement and the amount of mixing water than on atmospheric temperature
- d. the amount of mixing water used and atmospheric temperature than on the setting time of cement

14.

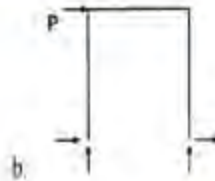


(Portal Frame)

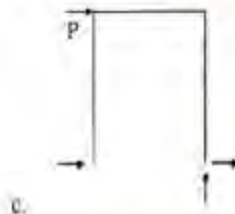
Which one among the following is the correct free body diagram for a portal frame shown in Figure given above ?



a.



b.



c.



d.

15. Consider the following statements

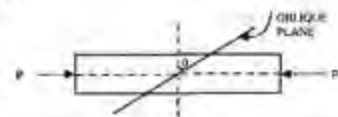
Mohr's circle is used to determine the stress on an oblique section of a body subjected to

1. direct tensile stress on one plane accompanied by a shear stress
2. direct tensile stresses in two mutually perpendicular directions accompanied by a simple shear stress
3. direct tensile stress in two mutually perpendicular directions
4. a simple shear stress

Select the correct answer using the codes given below

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

16. A bar of square cross-section, having an area of cross-section 'A' is subjected to a compressive force 'P' as shown in the figure



The intensity of the tangential stress on the oblique plane is given by

- a.  $P \sin 2\theta$
- b.  $P \cos 2\theta$

- c.  $P/2 \sin 2\theta$   
 d.  $P/2 \cos 2\theta$
17. The ratio of the torsional moment of resistance of a solid circular shaft of diameter  $D$ , and a hollow circular shaft having external diameter  $d$  and internal diameter  $d$  is given by

- a.  $\frac{D^4}{D^4 - d^4}$   
 b.  $\frac{D^4 - d^4}{D^4}$   
 c.  $\frac{D^3 - d^3}{D^3}$   
 d.  $\frac{D^3}{D^3 - d^3}$

18. Clapeyron's theorem is applied to  
 a. Simply supported beam  
 b. Propped cantilever beam  
 c. Fixed & continuous beam  
 d. Continuous beam only
19. The variation of the hoop stress across the thickness of a thick cylinder is  
 a. linear  
 b. uniform  
 c. parabolic  
 d. hyperbolic
20. The bulk modulus of elasticity of a material is twice its modulus of rigidity. The Poisson's ratio of the material is  
 a.  $1/7$   
 b.  $2/7$   
 c.  $3/7$   
 d.  $4/7$
21. Match List I with List II and select the correct answer :

**List I**

- A. Assumption in the theory of simple bending  
 B. The point at which the bending stress is maximum for any cross-section  
 C. The point at which the bending stress is zero for any cross-section  
 D. The point in the cross-section through which the neutral axis passes

**List II**

1. Neutral axis

2. Centroid  
 3. The plane sections remain plain  
 4. Extreme fibre  
 5. The cross-section is circular

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

22. A rectangular beam of width 200 mm and depth 300 mm is subjected to a shear force of 200 kN. The maximum shear stress produced in the beam is  
 a. 10.0 MPa  
 b. 7.5 MPa  
 c. 5.0 MPa  
 d. 3.00 MPa

23. A symmetrical channel section is made of a material which is equally strong in tension and compression. It is used as a simply supported beam with its web horizontal to carry vertical loads. It will  
 a. be strongest if the web is used as top face  
 b. be strongest if the web is used as bottom face  
 c. be equally strong in (a) and (b) above  
 d. not be possible to state which of the above statements is correct

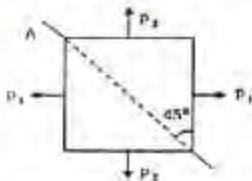
24. For which of the following conditions, the virtual work should be zero according to the Principle of virtual work ?  
 1. A body moving with constant acceleration  
 2. A body rotating with constant speed  
 3. A body in equilibrium  
 4. A body moving with constant momentum

Select the correct answer using the codes given below :

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

25.

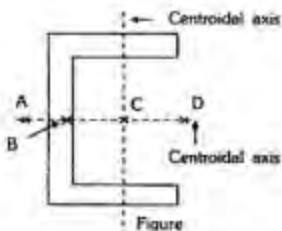




$p_1$  and  $p_2$  are two equal tensile principal stresses. On the plane AB inclined at  $45^\circ$  to the plane of  $p_1$

- the shear stress is a maximum
- the normal stress is zero
- the shear stress is zero
- the normal stress is maximum

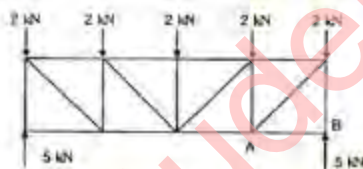
26.



In the symmetrical channel section shown in the figure, which point is likely to be the shear center?

- A
- B
- C
- D

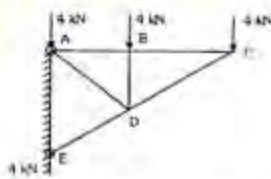
27.



The force in member AB is

- 5 kN compression
- 2 kN compression
- Zero
- 7 kN compression

28.



The force in the member BD of the truss shown in the figure given above is

- 4 kN tensile
- 4 kN compressive

c. Zero

d. 12 kN compressive

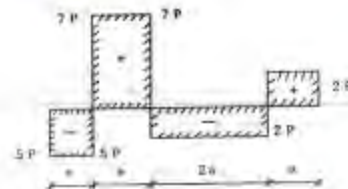
29. A free body diagram of a body shows

- A body isolated from all external effects without considering its own weight
- A body isolated from its surroundings and all external forces acting on it
- A body isolated from its surroundings and all external actions on it
- A body isolated from its surroundings and all internal forces acting on it

30. Neglecting self weight, which of the following beams will have points of contraflexure?

- A simply supported beam with uniformly distributed load over part of the structure
- An overhanging beam with loading only over supported span and not on overhangs
- Fixed beam subjected to concentrated load
- Cantilever beam subjected to uniformly varying load with zero load at free end

31.



The absolute maximum bending moment in the beam is

- $(2P \times a)$
- $(5P \times a)$
- $(4P \times a)$
- $(7P \times a)$

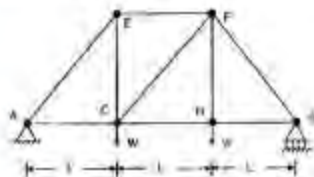
32. Which one of the following pairs is NOT correctly matched?

Boundary conditions of column	Euler's buckling load
a. Both ends hinged	$\pi^2 EI / l^2$
b. Both ends fixed	$4\pi^2 EI / l^2$
c. One end fixed and other end free	$\pi EI / 4l^2$

- d. One end fixed and the other hinged  $= \sqrt{2} \pi^2 EI / l^2$

33. For a two-hinged parabolic arch,  $V$  is sum of the vertical forces on the left hand side of the section.  $H$  is the horizontal thrust. If  $\alpha$  is the angle of tangent at the point on arch with the horizontal, the shearing force at section from left hand side is given by

- $V_x \sin \alpha - H \cos \alpha$
- $V_x \cos \alpha - H \sin \alpha$
- $V_x \sin \alpha + H \cos \alpha$
- $V_x \cos \alpha + H \sin \alpha$



34. In the truss shown in the figure given above, which one of the following members has no force induced in it?

- CD
- CE
- CF
- DF

35.

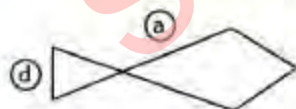
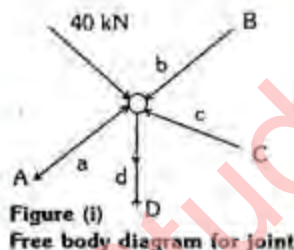


Figure (ii)  
Force Polygon

A joint of a roof truss has been isolated and shown in Figure (i). the force polygon for the joint is the shown in Figure (ii). Member 'a' is in compression, member 'd' is in tension.

Which one of the following is correct ?

- Both b and c are in tension
- Both b and c are in compression
- b is in tension, c is in compression
- b is in compression, c is in tension

36. Match List I with List II and select the correct answer :

#### List I

- Torque-twist relationship for a circular shaft
- Strain energy of elastic torsion
- Circumferential shear stress
- Maximum shearing stress due to combined torsion and direct stress

#### List II

- $1/2 \sqrt{\sigma^2 + 4\tau^2}$
- $G\theta / l$
- $(GJ/2l)\theta^2$
- $\frac{GJ}{l}\theta$

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



37.

A beam ( $EI = \text{constant}$ ) of span  $L$  is subjected to clockwise moments  $M$  at both the ends  $A$  and  $B$ . The rotation of end  $A$  works out to be

- $ML / 2 EI$
- $ML / 3 EI$
- $ML / 4 EI$
- $ML / 6 EI$

38. Consider the following statements :

The principle of superposition is not applicable when

- the material does not obey Hooke's law
- the effect of temperature changes are taken into consideration
- the structure is being analysed for the effect of support settlement

Which of the above statements is/are correct ?



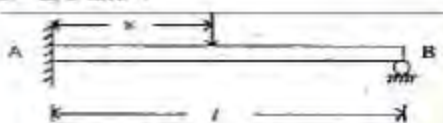
- a. 1 only
- b. 1 and 2
- c. 2 and 3
- d. 1, 2 and 3

39. Which of the following apply to 'fully rigid design' of steel structures?

- 1. End connections are capable of transmitting moments
- 2. angle between members at the joint does not change
- 3. The structure is assumed to be pin-pointed
- 4. A reduction in the maximum bending moment is permitted to provide a degree of direction fixity

Select the correct answer using the codes given below :

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



40.

For the propped cantilever shown in the figure, influence line for reaction at the propped end is given by  $y_1 = f(x)$ . The influence line ordinate ( $y_2$ ) for moment at A is given by the equation

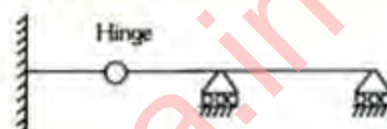
- a.  $y_2 = f(x)$
- b.  $y_2 = f(x) \cdot x$
- c.  $y_2 = x - f(x) \cdot x$
- d.  $y_2 = x - f(x) \cdot L$

41. In a system two weightless rigid bars AB and BC of length 'a' each having hinge supports at the ends A and C, respectively, are connected to each other at B by a frictionless hinge (internal hinge). The rotation at the hinge is restrained by a rotational spring of stiffness k and system assumes a straight line configuration ABC. The rotation at the supports due to vertical load P acting at joint B is

- a.  $Pa/2k$
- b.  $Pa/4k$
- c.  $Pa/k$
- d.  $2Pa/k$

42. A solid circular shaft, ABC, has a total length of '3 a'. A gear wheel positioned at B, at distance 'a' from the left hand end A, exerts a torque T. If the ends A and C are instantaneously locked in position by brakes just before the torque is applied, the torsional moments induced in both segments  $T_1$  (AB) and  $T_2$  (BC) are in the ratio

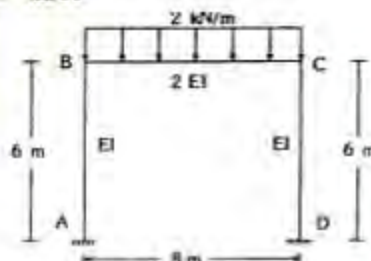
- a. 3 : 1
- b. 2 : 3
- c. 1 : 2
- d. 2 : 1



43.

The degree of indeterminacy of the beam given above is

- a. zero
- b. one
- c. two
- d. three



44.

For the frame shown above, the distribution factors for members BC and BA at joint B are

- a. 0.4, 0.6
- b. 0.5, 0.5
- c. 0.6, 0.4
- d. 0.7, 0.3

45. Creep of a material is a property indicated by

- a. a time-dependent strain of the material
- b. elongation of the material due to changes in the material properties
- c. shortening caused by shrinkage of the member
- d. the decrease in the volume of the material affected by the weather conditions

46. Principle of minimum strain energy is

1. a particular case of Castigliano's first theorem
2. a particular case of Castigliano's second theorem
3. applicable only when the redundant supports do not yield
4. applicable even when the redundant supports yield

Select the correct answer using the codes given below :

- a. 1 and 3
  - b. 1 and 4
  - c. 2 and 3
  - d. 2 and 4
47. Two shafts having same length and material are joined in series and subjected to a torque of 10 kNm. If the ratio of their diameters is 2 : 1, then the ratio of their angles of twist is
- a. 16 : 1
  - b. 2 : 1
  - c. 1 : 2
  - d. 1 : 16
48. Resilience is
- a. Maximum strain energy
  - b. Recoverable strain energy
  - c. Total potential energy
  - d. Shear strain energy (Beyond Hooke's law)
49. The slenderness ratio of a compression member in the context of Rankine's formula is defined as
- a.  $\frac{\text{length}}{\text{least lateral dimension}}$
  - b.  $\frac{\text{effective length}}{\text{least radius of gyration}}$
  - c.  $\frac{\text{effective length}}{\text{least lateral dimension}}$
  - d.  $\frac{\text{length}}{\text{least radius of gyration}}$
50. A propped cantilever of span 4 m is fixed at A and propped at B. The beam carries a u.d.l. of 1 t/m over the entire span. The reaction at B is
- a.  $5/2 t$
  - b.  $2 t$
  - c.  $1 t$

d.  $3/2 t$

51. The elements that are normally subjected to combined bending and axial forces are
- a. struts in reinforced concrete members
  - b. the members in long span bridges
  - c. columns in framed structures
  - d. space truss members

52. Which among the following assumptions are made in the design of roof trusses ?

1. Roof truss is restrained by the reactions
2. Axes of the members meeting at a joint intersect at a common point
3. riveted joints act as frictionless hinges
4. Loads act normal to roof surface

Select the correct answer using the codes given below :

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

53. The effective flange area in tension of a plate girder is equal to

- a.  $A_f$
- b.  $A_f + \frac{A_w}{2}$
- c.  $A_f + \frac{A_w}{8}$
- d.  $A_f + \frac{A_w}{6}$

where  $A_f$  is the area of each flange and  $A_w$  is the web area

54. The maximum deflection in timber beams or joists should not be greater than

- a. span / 300
- b. span / 325
- c. span / 360
- d. span / 380

55. A simply supported rectangular beam of span 20.0 m is subjected to u.d.l. The minimum effective depth required to check deflection of this beam, when modification factor for tension and compression are 0.9 and 1.1 respectively, will be

- a. 2.0 m
- b. 1.8 m
- c. 1.3 m

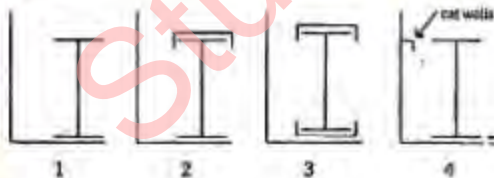


56. Prestressing of indeterminate structure should take care of the following

1. High strength concrete
2. High tensile steel
3. Load balancing
4. particle safety factors

Select the correct answer using the codes given below :

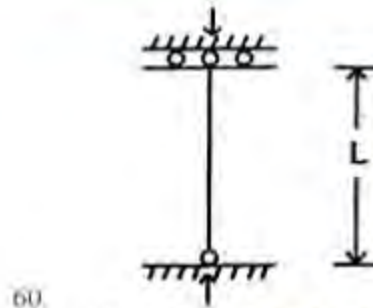
- a. 1 and 3
  - b. 2, 3 and 4
  - c. 1, 2 and 4
  - d. 1, 2, 3 and 4
57. For a portal truss column fixed at the base, the point of contraflexure is assumed at
- a. a distance mid-way between the base and the foot of the knee brace
  - b. a distance mid-way between the base and top of the column
  - c. the foot of the knee brace
  - d. quarter distance between base and top of the column
58. As the span of a bridge increases, the impact factor
- a. decreases
  - b. increases
  - c. remains constant
  - d. increases up to a critical value of span and then decreases
59. A gantry girder has been provided with the following section shown in the following figures



In which case(s), the allowable stresses in being compression is equal to that in tension ?

Select the correct answer using the codes given below :

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



60.

The effective length of the member shown in the figure is equal to

- a.  $1.2 L$
- b.  $1.5 L$
- c.  $2.0 L$
- d.  $3.0 L$

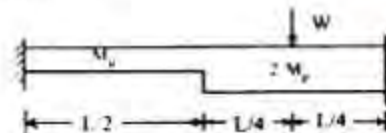
61. In a compression member, plate element may buckle locally before the entire member fails. To avoid this, which of the following recommendations are made ?

1. Thickness of members is taken in terms of lengths of compression members
2. length of element is increased
3. length of member is increased
4. Outstand is decreased

Select the correct answer using the codes given below :

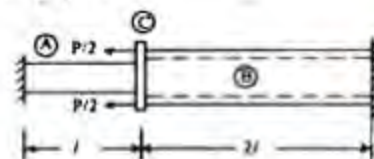
- a. 1, 2 and 3
- b. 1, 2 and 4
- c. 2 and 3
- d. 1 and 4

62. Figure given below shows a fixed beam of steel



At the point of collapse, the value of load  $W$  will be

- a.  $10 M_p / L$
- b.  $15 M_p / L$
- c.  $20 M_p / L$
- d.  $25 M_p / L$

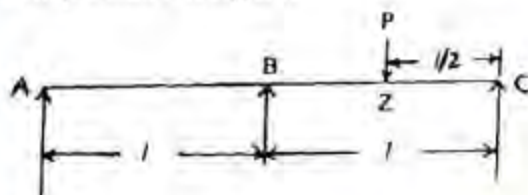


63.

A rigid plate C is fastened to steel rod A of area  $S$  and to steel pipe B of area  $2S$ . The other ends of A and B are fastened to rigid supports. When the force  $P$  is zero, there are no stresses in A and B. The yield stresses in tension and compression  $\sigma_y$ . The collapse load  $P$  under yield condition is

- $\sigma_y S$
- $2 \sigma_y S$
- $3 \sigma_y S$
- $\sigma_y S/2$

64. A continuous beam ABC of two equal spans AB and BC carries a load  $P$  at Z, the centre of BC. Then the magnitude of collapse load  $P$  is equal to



- $2 M_p / l$
- $4 M_p / l$
- $6 M_p / l$
- $8 M_p / l$

65. The shape factor for a solid circular section of diameter  $D$  is equal to

- $D / 2\pi$
- $15 / 2\pi$
- $16 / 3\pi$
- $D / 8\pi$

66. Gross flange area for a riveted plate girder is to be designed considering net area as 80% of its gross area. Consider width of the flange as 500 mm while web plate as 1000 mm  $\times$  12 mm. The girder is to resist a maximum BM of 4500 kNm. Maximum allowable bending stress in tension is 150 MPa. Gross flange area is

- $22000 \text{ mm}^2$
- $35500 \text{ mm}^2$
- $46000 \text{ mm}^2$
- $73000 \text{ mm}^2$

67. Match List I (Type of member) with List II (Slenderness ratio) and select the correct answer:

List I

- For compression members carrying dead and superimposed loads
- For members carrying compressive loads due to wind or seismic forces only
- For members carrying tension but in which the reversal of stress occurs due to wind or seismic forces

List II

- 350
- 180
- 250

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

68. A buttress in a wall is intended to provide

- lateral support to roof slab only
- lateral support to wall
- to resist vertical loads only
- lateral support to roof beams only

69. A continuous R.C. beam spans six span segments, each supporting a monolithic reinforced concrete slab. The beam will best be designed

- as a rectangular one throughout its span
- as a tee-beam throughout its span
- as a rectangular beam for span moments and tee-beam for support moments
- as tee-beam for span moments and as a rectangular beam for support moments

70. Shrinkage in a concrete slab

- causes shear cracks
- causes tension cracks
- causes compression cracks
- does not cause any cracking

71. The reinforcement for tension, when required in members, shall consist of

- only longitudinal reinforcement in the tension face
- only longitudinal reinforcement in the compression face
- only two legged closed loops enclosing the corner reinforcement



d. both longitudinal and transverse reinforcement

72. The codal provisions recommend minimum shear reinforcement in the form of stirrups in the beams .

1. to cater for any torsion in the beam section
2. to improve ductility of the cross-section
3. to improve dowel action of longitudinal tension bars

Select the correct answer using the codes given below :

- a. 1, 2 and 3 are correct
- b. 2 and 3 are correct
- c. Only 1 is correct
- d. Only 2 is correct

73. The specified span to depth ratios of beams satisfying the limits of vertical deflection are for spans up to 10 m.

1. for higher spans, these are to be modified by multiplying the ratio  $y$  (10/span in metre)
2. For higher spans, these are to be modified by multiplying the ratios by (span in metre/10)
3. They get further modified depending on area and type of tension reinforcement
4. However, they do not change further with the area and type of compression reinforcement

Select the correct answer using the codes given below :

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

74. When the tendon of a rectangular prestressed beam of cross-sectional area  $A$  is subjected to a load  $W$  through the centroidal longitudinal axis of beam, (where  $M$  = maximum bending Moment and  $Z$  = section modulus) then the maximum stress in the beam section will be

a.  $\frac{W}{A} - \frac{M}{Z}$

b.  $\frac{W}{A} + \frac{M}{Z}$

c.  $\frac{A}{W} - \frac{Z}{M}$

d.  $\frac{A}{W} + \frac{Z}{M}$

75. Which of the following deformations are important in case of deep beams when compared to flexure along?

- a. shear
- b. axial
- c. torsional
- d. bearing

76. The maximum depth of neutral axis for a beam with  $ad$  as the effective depth, in limit state method of design for Fe 415 steel is

- a. 0.46  $d$
- b. 0.48  $d$
- c. 0.50  $d$
- d. 0.53  $d$

77. The load factor to be used for plastic design of steel structures for dead load and imposed load is

- a. 2.2
- b. 2.0
- c. 1.7
- d. 1.5

78. Match List I with list II and select the correct answer :

List I

- A. A rubber bulldozer gives better output
- B. A bulldozer mounted on crawler tracks gives better output
- C. A rubber tyred bulldozer
- D. A crawler mounted bulldozer

List II

1. While working on earth or soft ground
2. Results in lesser operator fatigues
3. Has greater use and versatility on jobs
4. When working on a hard surface

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

79. A compression member has a centre to centre length of 4.0 m. It is fixed at one end and hinged at the other end. The effective length of the column is

a. 4.0 m  
b. 3.2 m  
c. 2.8 m  
d. 2.6 m

80. Deck bridges have the main disadvantage that

a. their compression flanges have no lateral support  
b. the traffic is exposed to winds  
c. it is not possible to provide portal bracings  
d. the road level has to be very high

81. If  $\sigma_{cbc}$  is permissible compressive stress in flexural compression in  $N/mm^2$  in service, the modular ratio is of the order of

a.  $280 / 3 \sigma_{cbc}$   
b.  $280 / 4 \sigma_{cbc}$   
c. 19  
d. 13

82. In a Pedestal, the factor by which the effective length should not exceed the least lateral dimension is

a. 2  
b. 3  
c. 4  
d. 5

83. The losses in prestress in pre-tensioning system are due to

1. elastic deformation of concrete when wires are tensioned successively  
2. friction  
3. shrinkage and creep of concrete

Select the correct answer using the codes given below :

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

84. Match list I with List II and select the correct answer :

List I (Type of mixers)

A. Tilting, drum type concrete mixers  
B. Pan type concrete mixers

C. Portable tilting drum type concrete mixers

D. Portable non-tilting drum type concrete mixers

List II (Characteristics)

1. Are very efficient especially with stiff mixes and the drum rotates about a vertical axis  
2. Are meant for small, scattered jobs using small-sized aggregates  
3. Are fed from one side of the drum while the mixed concrete is discharged from the other end and the drum rotates about a horizontal axis  
4. Are best suited for large sized aggregates as in mass concrete

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

85. Match List I with List II and select the correct answer :

List I (Vibrators)

A. Vibrating tables  
B. Screed vibrators  
C. Internal vibrators  
D. Form vibrators

List II (Application)

1. For thin tunnel linings  
2. for mass concrete work  
3. For precasting concrete members  
4. for thin slabs, pavements and floors

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

86. An equipment of purchased of Rs. 40, 000 and is fully depreciated by straight line method over 8 years. Considering interest on average annual cost at 15 p.a., the charge on the Company due to use of this equipment, if made uniformly over the 8 years, is

a. Rs. 5,750  
b. Rs. 8,000



c. Rs. 8,350

d. Rs. 14,000

87. Which of the following are the disadvantages of non-tilting type concrete mixers ?

1. They are not favoured when large sized aggregates are used
2. Mixing of the concrete occurs through both rolling and pulling from buckets
3. Content of fines is increased
4. They are not easy to clean

Select the correct answer using the codes given below :

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

88. Match List I with List II and select the correct answer :

**List I (Type of cranes)**

- A. Hydraulic crane
- B. Electric overhead crane
- C. Travelling bridge crane
- D. Hammerhead crane

**List II (Characteristics)**

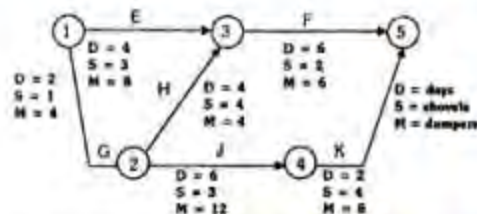
1. Has legs moving on tracks laid on the floor
2. Has cantilever arms on both sides
3. Has the unique advantage that the boom length and the angle can be changed during operation
4. Has three-way motion in mutually perpendicular directions

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

89. The norm for providing standby equipment for one shift operation is

- a. 5%
- b. 10%
- c. 20%
- d. 30%

90.



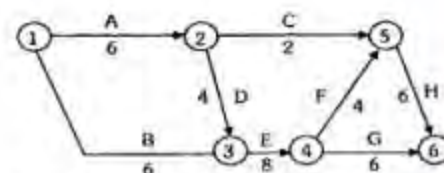
In the network given above, the maximum number of shovels and dumpers required are

- a. 6 shovels and 14 dumpers on days 9 and 10
- b. 24 shovels and 10 dumpers on days 3 and 4
- c. 30 shovels and 90 dumpers on all days
- d. 10 shovels and 24 dumpers on days 3 and 4

91. For cleaning and grubbing of construction site of 15000 m<sup>3</sup> area, a bulldozer is used which has effective width of 2 m of the blade and an average speed of 2.5 kmph. If hiring charges of bulldozer are Rs. 500/hr., then cost per m<sup>2</sup> is

- a. Rs. 10
- b. Rs. 12
- c. Rs. 15
- d. Rs. 18

92.



In the network given above, the critical path of activities is

- a. A-C-H
- b. B-E-F-H
- c. A-D-E-F-H
- d. A-D-E-G

93. The probability that the load on a scaffolding will exceed the design load of 3 tonnes is 0.15. At the same time, the probability that the strength of the scaffolding will be more than 3 tonnes is 0.85. The probability that the scaffolding will fail is

- a. 0.2775
- b. 0.1275
- c. 0.0225

- d. 0.0020
94. The optimum duration is the
- the summation of normal-durations of each activity in the project
  - summation of the normal-duration of activities on critical path
  - one, which gives minimum total cost for completing the project
  - summation of crash-time of activities on critical path
95. In order to investigate a method of least-cost scheduling, which of the following assumptions are made?
- the planned duration of an activity can be any whole day value between the normal and crash duration
  - the direct cost of an activity is linear between the normal and crash direct costs
  - The overhead costs are linear during the entire project.
- Select the correct answer using the codes given below :
- 1 and 2
  - 1 and 3
  - 2 and 3
  - 1, 2 and 3
96. Which one of the following statements applies to the declining balance method of depreciation accounting?
- Uniform write-off of cost throughout the service is aimed
  - Greater write-off in the early years is aimed
  - Smaller write-off in early years is aimed
  - A varying rate of depreciation is applied on the basis of market value of the assets
97. In selecting a roller I-section for a simply-supported beam, along with minimum sectional modulus, a minimum value of span/depth ratio is also ensured. This is stipulated to ensure that
- the buckling of beam does not take place
  - the shear stress in beam remains within permissible limit
  - the deflection of beam remains within permissible limit
  - the bending stress in compression is within permissible limit
98. Assertion (A) : Trees which have broad leaves and shed in the autumn are classified as hard woods, while trees having needle-like leaves, broadly evergreen are classified as soft woods.  
Reason (R) : The term hard wood and
- Both A and R are true and R is the correct explanation of A
  - Both A and R are true but R is NOT the correct explanation of A
  - A is true but R is false
  - A is false but R is true
99. Assertion (A) : Flash set is the stiffening of the cement paste within a few minutes after mixing.  
Reason (R) : Flash set occurs due to insufficient gypsum to control the rapid reaction of  $C_3A$  with water.
- Both A and R are true and R is the correct explanation of A
  - Both A and R are true but R is NOT the correct explanation of A
  - A is true but R is false
  - A is false but R is true
100. Assertion (A) : The amount of cement past should be sufficient to cover the surface of all particle for proper workability and bond.  
Reason (R) : The water -cement ratio is fixed accordingly.
- Both A and R are true and R is the correct explanation of A
  - Both A and R are true but R is NOT the correct explanation of A
  - A is true but R is false
  - A is false but R is true
101. Assertion (A) : the coefficient of friction is the ratio of limiting frictional force to normal reaction between two bodies in contact and one body being just on the sliding on the other.  
Reason (R) : The limiting friction is the maximum value of frictional force, which comes in to play, when a body just begins to slide over the surface of the other body.



- a. Both A and R are true and R is the correct explanation of A  
 b. Both A and R are 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
102. Assertion (A) : The bending moment at a section of a simply supported beam is a maximum.  
 (i) in the case of a concentrated load, where the S.F. changes sign.  
 (ii) in the case of u.d.l where shearing force is zero.  
 Reason (R) : Actually in both the above cases shearing force should be zero at the section of maximum bending moment, because  $dM/dx = f = 0$ , to satisfy the maxima condition.  
 a. Both A and R are true and R is the correct explanation of A  
 b. Both A and R are 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
103. Assertion (A) : The principle of superposition for deflection of beams subjected to a number of loads can be applied in the case of large deformation.  
 Reason (R) : In the principle of superposition, the resultant deflection is due to each load acting separately.  
 a. Both A and R are true and R is the correct explanation of A  
 b. Both A and R are 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
104. Assertion (A) : In the working stress design method the internal stresses at a section of member are computed for factored loads.  
 Reason (R) : In the working stress design method it is ensured that the internal stresses due to working loads are less than the allowable stresses.  
 a. Both A and R are true and R is the correct explanation of A  
 b. Both A and R are 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
- c. A is true but R is false  
 d. A is false but R is true
105. Assertion (A) : The salvage value is less in the initial period of the equipment and increases as the equipment ages.  
 Reason (R) : The salvage value of an equipment is the actual amount that can be realized on a trade-in for a replacement machine.  
 a. Both A and R are true and R is the correct explanation of A  
 b. Both A and R are 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
106. Assertion (A) : Knots, one of the common features in wood, are associated with the beginning of branches.  
 Reason (R) : Knots greatly improve the workability.  
 a. Both A and R are true and R is the correct explanation of A  
 b. Both A and R are 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
107. Assertion (A) : More uniformly burnt bricks are obtained from a downward draught kiln.  
 Reason (R) : The bricks are laid in a circular form in their kiln.  
 a. Both A and R are true and R is the correct explanation of A  
 b. Both A and R are 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
108. Assertion (A) : The higher percentage of Tricalcium silicate in cement results in rapid hardening with an early gain in strength at a higher heat of hydration.  
 Reason (R) : A higher percentage of dicalcium silicate in cement results in rapid slow hardening and less heat of hydration and greater resistance to chemical attack.



- a. Both A and R are true and R is the correct explanation of A
- b. Both A and R are 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

109. Assertion (A) : For a given composition, a finer cement will develop strength and generate heat more quickly than a coarse cement.

Reason (R) : The reaction between water and cement starts on the surface of the cement particles and in consequence the greater the surface area of a given volume of cement, the greater the hydration.

- a. Both A and R are true and R is the correct explanation of A
- b. Both A and R are 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

110. Assertion (A) : The strain and stress system for a bar of length 'l' subjected to an axial pull will be the same whether both ends of the bar are free or one end is fixed and the other end is free.

Reason (R) : Rigid body displacements have no effect on the elastic deformations.

- a. Both A and R are true and R is the correct explanation of A
- b. Both A and R are 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

111. Assertion (A) : for a section having an axis of symmetry, there will not be twisting if the loading axis coincides with the symmetrical axis.

Reason (R) : The plane of loading contains the bending axis.

- a. Both A and R are true and R is the correct explanation of A
- b. Both A and R are 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

112. Assertion (A) : A beam of fixed length and for given weight of material, a rectangular cross-section provides the greatest possible moment of resistance.

Reason (R) : In a beam of I cross-section, more material is positioned near the outer fibres representing regions of greatest stress and hence is stronger than beam of rectangular cross-section.

- a. Both A and R are true and R is the correct explanation of A
- b. Both A and R are 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

113. Assertion (A) : Whenever a column section is subjected to an eccentric loading, it causes a direct stress, as well as the bending stress to come into play. Since both these stresses act normal to the cross-section, these can be algebraically added into a single resultant stress.

Reason (R) : The maximum and minimum intensities of stress at the base of the column are

$$p_{\max} = \frac{W}{b} \left( 1 + \frac{6e}{b} \right)$$

$$p_{\min} = \frac{W}{b} \left( 1 - \frac{6e}{b} \right)$$

where

W = weight of column per unit length.

b = width of the column

e = eccentricity of the load.

- a. Both A and R are true and R is the correct explanation of A
- b. Both A and R are 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) : The intensity of the longitudinal stress is on half of the intensity of hoop-stress or circumferential stress in a thin cylindrical shell subjected to internal pressure.

Reason (R) : The stress in the longitudinal and circumferential directions develop when a thin cylindrical shell is subjected to



internal force which tries to burst the cylinder.

- a. Both A and R are true and R is the correct explanation of A.
- b. Both A and R are 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

115. Assertion (A) : When attempting resource optimization, activity-time cost trade off information could be gainfully employed.

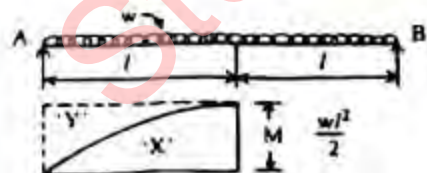
Reason (R) : Generally, as activity time is extended beyond the minimum cost duration, splitting of the activity duration is always possible.

- a. Both A and R are true and R is the correct explanation of A.
- b. Both A and R are 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

116. Assertion (A) : The more economical alternative of replacing an equipment is to redesign and improve the equipment.

Reason (R) : Redesigning and improving an equipment can result in labour saving.

- a. Both A and R are true and R is the correct explanation of A.
- b. Both A and R are 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



117. Assertion (A) : Area of BMD represented by 'X' in the figure given above equals  $2/3 Ml$ .

Reason (R) : Area of the figure represented by 'Y' equals  $ml/3$ .

- a. Both A and R are true and R is the correct explanation of A.
- b. Both A and R are 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

118. Assertion (A) : In the analysis of pin-jointed plane frames, the force method is generally preferable to the displacement method.

Reason (R) : The degrees of freedom for pin-jointed plane frames are generally much larger than the degrees of static indeterminacy and thus force method requires less formulation and computation than the displacement method.

- a. Both A and R are true and R is the correct explanation of A.
- b. Both A and R are 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

119. Assertion (A) : In a built-in beam, the centroids of the fixed moment diagram and the free moment diagram will lie on the same vertical line.

Reason (R) : the second theorem of area moment states that, if two points on the elastic line of the beam are at the same level, the moment of area of BMD enclosed between these point about any one of these point is zero.

- a. Both A and R are true and R is the correct explanation of A.
- b. Both A and R are 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

120. Assertion (A) : The strength of a beam does not depend upon the sectional area provided.

Reason (R) : It depends upon the disposition of the sectional area of the beam in relation to its neutral axis.

- a. Both A and R are true and R is the correct explanation of A.
- b. Both A and R are 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