CIVIL ENGINEERING

(PAPER – I)

1. The moisture content in a properly seasoned timber will be in the range of
   a. 5% to 8%
   b. 8% to 10%
   c. 10% to 12%
   d. 12% to 15%
2. The strength of timber is maximum in the direction
   a. Perpendicular to the grains
   b. Parallel to the grains
   c. 45^{o} to he grains
   d. At all angles
3. The maximum permissible slenderness ratio for masonry walls is
   a. 40
   b. 30
   c. 20
   d. 10
4. When the corner of a brick is removed along the line joining mid-points of adjoining sides, the portion left is called
   a. Closer
   b. Squint brick
   c. Queen closer
   d. King closer
5. An arrangement for temporarily supporting a structure from beneath for safety, is known as
   a. Jacking
   b. Underpinning
   c. Supporting
   d. Hauling
6. Match List I (Cement) with List II(Characteristics) and select the correct answer :

   List I
   A. High alumina cement
   B. Blast furnace cement
   C. Quick setting cement
   D. Rapid hardening cement

   List II
   1. High early strength
   2. Gypsum free cement
   3. Selenetic cement
   4. Used in mass concrete work
   5. Used in chemical factories and mines

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

7. The fineness of cement is tested by
   a. Air-content method
   b. Air-permeability method
   c. Le-Chatelier apparatus
   d. Vicat’s apparatus
8. The test on cement designed to accelerate the slaking process of the ingredient of cement and to determine the resulting expansion in a short time is
   a. Setting time test
   b. Soundness test
   c. Normal consistency test
   d. Accelerated test
9. Consider the following statements :
   1. Addition of a small quantity of slaked lime to Portland cement in cement mortar increases the plasticity of the mortar.
   2. Light weight mortar is prepared by mixing cement and finely crushed fire bricks with water.
   3. Fire resistant mortar is prepared by mixing aluminous cement and finely ground china clay wares with water.

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

10. A mortar for which both cement and lime are mixed is called
    a. Gauged mortar
    b. Cement mortar
    c. Lime mortar
    d. Light weight mortar

11. As per I.S. Code of Practice, concrete should be cured at
    a. 5^{o}
    b. 1^{o}
    c. 27^{o}
    d. 40^{o}

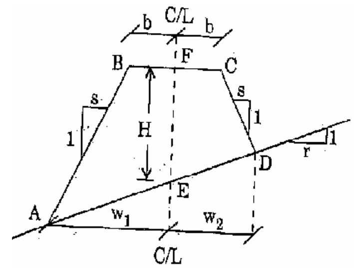
12. The correct sequence of workability test(s)/method(s) in the order of their application from low to high workability is
    a. Slump test, compacting factor test and Vee-bee consistometer
    b. Compacting factor test, Vee-bee consistometer and slump test
    c. Vee-bee consistometer, Slump test and Compacting factor test
    d. Vee-bee consistometer, compacting factor test and Slump test

13. While testing the compressive strength of cement concrete, the correct standard conditions (viz. temperature, age, humidity and size of the specimen) to be maintained as per I.S. are
    a. 27 ± 3^{0} C, 28 days, 90% and 15 cu.cm
    b. 26 ± 2^{0} C, 21 days, 80% and 15 cu.cm
    c. 25 ± 1^{0} C, 14 days, 75% and 10 cu.cm
    d. 27 ± 3^{0} C, 7 days, 70% and 10 cu.cm

14. Which one of the following statements is correct ?
    a. Bulking of sand always decreases with increase in the quantity of water
    b. The quantity of water in ordinary concrete should be 5% by weight of cement and 25% by weight of aggregate
    c. While mixing by weight, bulking effect of sand is not taken into account
    d. River sand is also known as standard sand

15. The ratio of direct tensile strength to that of modulus of rapture of concrete is
    a. 0.25
    b. 0.5
    c. 0.75
    d. 1.0

16. A two-level section ABCD is shown in the given figure with ground slope 1 on rand formation slope 1 on s.EF is the centre line (C/L) of the formation . Top width of the formation is 2b and widths to the toe are w_1 and w_2. The width 'w_1' will be



    a. $b + \frac{rs}{r-s}\left(H + \frac{b}{r}\right)$
    b. $b + \frac{rs}{r+s}\left(H - \frac{b}{r}\right)$
    c. $b - \frac{rs}{r-s}\left(H + \frac{b}{r}\right)$
    d. $b + \frac{rs}{r+s}\left(H + \frac{b}{r}\right)$

17. An equipment is available for Rs. 2,00,000. It has an estimated useful life of 5 years. By the double rate declining balance method of depreciation, the book value at the end of the second year will be
    a. Rs. 1,28, 000
    b. Rs. 1,20,000
    c. Rs. 72,000
    d. Rs. 60, 000

18. A 6 cu.m central concrete mixing plant takes in 1875 kg of cement, 5120 kg of sand and 6060 kg of coarse aggregate along with 865 kg of water per batch. There is a reduction of 1.5% in volume in the freshly mixed wet concrete from the nominal volume. The unit weight of the freshly mixed wet concrete will be
    a. 2320 kg per cu.m
    b. 2335 kg per cu.m
    c. 2345 kg per cu.m
    d. 2355 kg per cu.m

19. IC engines usable for earthwork are calibrated under standard conditions (denoted by suffix 'o') relating its horse power Ho, standard barometric pressure P_0

and standard test temperature T_o, all in absolute scales H, P and T refer to corresponding values when used under other than standard conditions. The ratio of H_o / H is

a. $P/P_o\sqrt{T/T_o}$

b. $P_o/P\sqrt{T/T_o}$

c. $\sqrt{P_o/P}\ T/T$

d. $\sqrt{P_o/P\ T/T_o}$

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

List I

A. Self-loading scraper

B. Narrow tread high pressure tyre

C. Supercharger

D. Gear ratios

List II

1. Reduce loss in power
2. Rim pull management
3. Lower rolling resistance
4. Compromise between loading and hauling performances

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

21. Match List I(Feasibility) with List II (Emphasises on or calls for) and select the correct answer :

List I

A. Social

B. Economic

C. Input

D. Co-ordination

List II

1. Optimising marginal costs and benefits
2. forward and backward linkages
3. Interfaces
4. Improving wealth

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

22. The probability that the load on scaffolding will exceed 2t is 0.15. The probability that the strength of the scaffolding will be more than 2t is 0.8. The probability of failure of the scaffolding will be

a. 0.68

b. 0.17

c. 0.12

d. 0.03

23. Every cu.m of excavation requires either 3 man-hours or 0.2 machine-hour. The respective rates are Rs. 8 per man-hour and Rs. 200 per machine-hour. A total quantity of 4000 cu.m of excavation is to be done. The possible minimum total cost for the complete job, by a suitable combination of manual and mechanical means of excavation will be

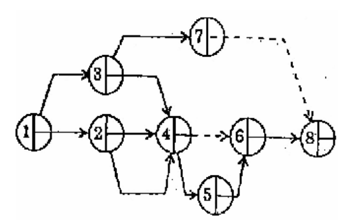
a. Rs. 80,000

b. Rs. 1,20,000

c. Rs. 1,50,000

d. Rs. 1,80,000

24. The total number of errors in the given AOA network is



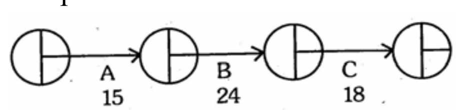
a. 1

b. 2

c. 3

d. 4

25. A, B and C are three activities to be executed in that order. Their total duration, in days, are 15, 24 and 18 respectively. However, fro better estimation of overall total duration; they are put into a ladder network with 3 equal sub-parts of each. The modified total duration for total completion of all the activities will be



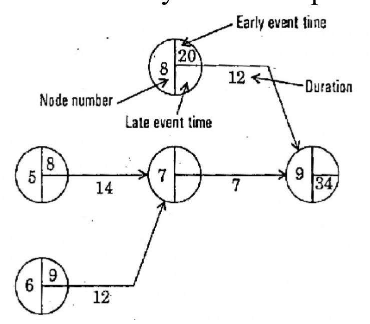
a. 35 days

b. 37 days

c. 39 days

d. 41 days

26. A part of the network with nomenclature of a typical legend is shown in the given figure. There can be other incoming activities at nodes 5, 6 and 8 but there are no other incoming activities at nodes 7 and 9. There are two outgoing activities at node 9 but no other outgoing activity at any of the other node. The other float and free float in activity 6-7 are respectively



a. 5 and 1

b. 6 and zero

c. 6 and 1

d. zero and zero

27. There are four consecutive activities in a simple linear network, each with mean duration of T and each with 'k' as the standard deviation of its duration. The overall project duration through these activities is likely to be in the range

a. $4T \pm k$

b. $4T \pm 2k$

c. $4T \pm 4k$

d. $4T \pm 6k$

28. A certain type of resource can be deployed in a variable strength during parts of the duration of an activity. The following are the data in the context :

1. Six weeks duration with 10 units of the resource in each week, or
2. four weeks duration with 7 units in each week followed by 5 weeks duration with 5 units in each week, or
3. eight weeks duration with 7 units in each week, or
4. four weeks duration with 7 units in each week followed by 3 weeks duration with 10 units in each week

For developing the CPM network involving this activity therein, the duration of this activity will be considered as

a. 9 weeks

b. 8 weeks

c. 7 weeks

d. 6 weeks

29. A project is of 4 months' duration and needs expenditure of Rs. 15, 000 per month uniformly, which should be available readily on hand at the beginning of each month. Bills can be raised with 15% profit over cost at the end of each month of work. The amount due on a bill raised will be reimbursed with a further month' delay without any deductions. The working capital required and the duration for which its maximum is needed are respectively

a. Rs. 15,000 and from beginning to end of month 1

b. Rs. 15,000 and uniformly beginning to end of month 4

c. Rs. 30,000 and from end of moth 1 to end of month 2

d. Rs. 45,000 and just at the end of the 2nd month

30. Five activities are scheduled between time— 3 days and time — 14 days in a bar chart. Resources loading per day for these activities, along with their durations are read on the bar chart grid are :

Activity	**A**	**B**	**C**	**D**	**E**
Duration	3–8	4–12	10–14	7–11	11–14
Resource loading per day	5	4	8	3	2

Match List I (Resource loading per day) with List II (Day number) derive from above data and select the correct answer :

List I

A. 16

B. 15

C. 14

D. 12

List II

1. 12th
2. 14th
3. None
4. 11th
5. 8th

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

31. **Assertion (A) :** In a two-dimensional stress system, the direct stresses on two planes at 45^o an 135^o to the principal planes have the same magnitude and nature and shear stress.

Reason (R) : Points representing these stresses are on the ends of vertical diameter of the Mohr's circle.

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

32. Consider a circular shaft of radius 'R' having the maximum shear stress 'f_S' developed by an applied torque.

Assertion (A) : The shear stress 'q' at a point on the section having coordinate (0, y) if f_S y /R.

Reason (R) : In the shaft, the shear stress 'q' at a point of coordinate (x, y) is $\frac{f_S}{R}\sqrt{x^2+y^2}$.

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

33. **Assertion (A) :** Project-time-cost schedules (inclusive of indirect costs) always show decreasing overall cost for decreasing overall project duration (so long a such compression is feasible).

Reason (R) : Generally, the incremental rate increases or consumption of a resource increases.

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

34. **Assertion (A) :** The use of fly ash as an admixture in concrete reduces segregation and bleedings.

Reason (R) : The use of fly ash as a replacement of sand in a lean-mix increase the workability and has no significant effect on drying shrinkage of concrete.

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

35. **Assertion (A) :** Lime mortar is able to retain its bond with masonry unit and be free from cracks.

Reason (R) : Lime mortar undergoes only negligible volume change after setting and initial shrinkage.

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

36. **Assertion (A) :** Shear capacity of a concrete beam increases with the increase in tension reinforcement.

Reason (R) : Increase in tension reinforcement increases aggregate interlocking force.

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

37. **Assertion (A) :** Tensile reinforcement bars of a rectangular beam are bent at suitable placed.

Reason (R) : Bent tensile reinforcement bars in a rectangular beam resist bending moment and provide local bond stress.

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

38. **Assertion (A) :** In the analysis of rigid frames by the energy method, it is usually considered sufficient to calculate the total strain energy due to flexure only

Reason (R) : The strain energies due to axial force and shear are normally insignificant when compared to that for flexure.

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

39. **Assertion (A) :** In the analysis of two-dimensional stresses, the normal stress on a plane will be greater than the average principal stress, if the inclination of that plane with the plane of maximum principal stress is less than 45^o.

Reason (R) : The horizontal co-ordinate of the point on the Mohr's circle represents the stresses on the given plane which is greater than the coordinate of the centre of Mohr's circle.

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

40. **Assertion (A) :** Crawler mounted power shovels have low speeds.

Reason (R) : Power shovels are usable with all classes of earth and rocks.

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

41. **Assertion (A) :** Crane and bucket arrangement is always and at all places preferable over tower and buckets arrangements for placement of concrete.

Reason (R) : With cranes, haul distances for buckets can be reduced.

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

42. **Assertion (A) :** When a mild steel bar is tested in tension, the stress drops down from upper yield point to lower yield point without elongation.

Reason (R) : The boundaries of grains of mild steel are composed of brittle material.

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

43. **Assertion (A) :** The vertical member of Howe roof truss is made of steel.

Reason (R) : ordinarily wood is not used fro tension members.

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

44. **Assertion (A) :** Battening of column shall be done where the columns are subjected to eccentric loading in the plane of battens.

Reason (R) : Batten plates are designed to resist moments and longitudinal forces arising due to transverse shear force.

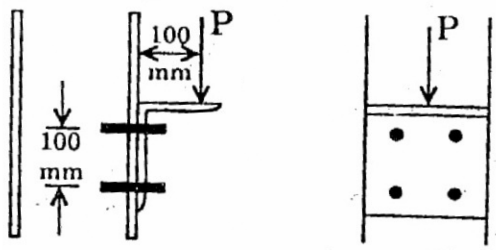
a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true but R is NOT the correct explanation of A
c. A is true but R is false
d. A is false but R is true

45. **Assertion (A) :** A through truss bridge is supported at the level of upper chord.

Reason (R) : Wind has a tendency to overtum the bridge about the lower chord of leeward truss.

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

46. Each bolt shown in the given figure is capable of resisting a shear force of 20 kN and tension of 15 kN. The interaction equation between the forces is



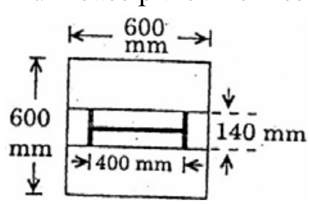
a. $\frac{P}{40}+\frac{P}{30}=1.4$

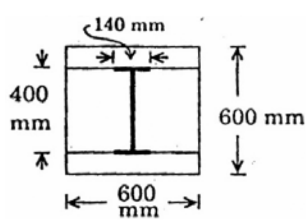
b. $\frac{P}{80}+\frac{P}{15}=1.4$

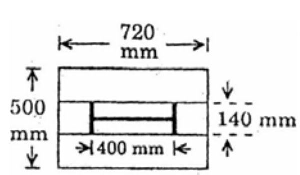
c. $\frac{P}{80}+\frac{P}{30}=1.4$

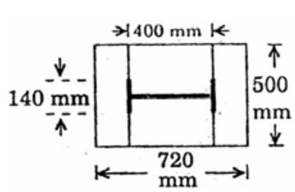
d. $\frac{P}{40}+\frac{P}{15}=1.4$

47. Which one of the following plan views of a gusseted base plate will result in minimum base plate thickness ?

a.


b.


c.


d.


48. The permissible stresses in rivets under wind load conditions as per IS : 800 can be exceeded by about

a. 15%

b. 25%

c. 33%

d. 50%

49. Consider the following statements regarding pin connections :

1. Moment at pin connection is zero
2. Only one pin is used in a connection
3. Secondary stresses do not occur
4. They are rigid.

Which of these are the advantages of pin connections ?

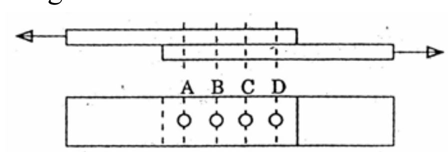
a. 1, 3 and 4

b. 2, 3 and 4

c. 1, 2 and 3

d. 1 and 3

50. Which one of the following statements regarding the riveted joint shown in the given figure is correct ?



a. In elastic theory all rivets equal forces

b. In plastic theory all rivets carry equal forces

c. Both in elastic and plastic theories all rivets carry equal forces

d. In plastic theory the outer rivets A and D carry greater proportion of load

51. In an eccentrically loaded bearing type connection, P_{dx} and P_{dy} are the components of the direct load. P_{tx} and P_{ty} are the components of the direct load. P_{tx} and P_{ty} are the components of the torsional load. The maximum load on any connector is given by

a. $\sqrt{(P_{dx}+P_{tx})^2+(P_{dy}+P_{ty})^2}$

b. $\sqrt{(P_{dx}+P_{ty})^2+(P_{dy}+P_{tx})^2}$

c. $\sqrt{(P_{dx}-P_{tx})^2+(P_{dy}-P_{ty})^2}$

d. $\sqrt{(P_{dx}-P_{ty})^2+(P_{dy}-P_{tx})^2}$

52. The economic spacing of a roof truss depends upon the

a. cost of purlins and cost of roof covering

b. cost of roof covering and dead loads

c. dead loads and live loads

d. live loads and cost of purlins

53. Consider the following statements :

Bearing stiffeners are provided in a plate girder

1. to avoid local bending failure of flange
2. to prevent buckling of web.
3. to strengthen the web
4. under uniformly distributed loads

Which of these statements are correct ?

a. 1, 2 and 3

b. 2 and 3

c. 1, 3 and 4

d. 1, 2 and 4

54. As per IS : 800 in the case of a plate girder with vertical and horizontal stiffeners, the greater and lesser unsupported clear dimension of a web panel in terms of web thickness 't_w' should not exceed respectively

a. 180 t_w and 85 t_w

b. 270 t_w and 200 t_w

c. 270 t_w and 180 t_w

d. 400 t_w and 250 t_w

55. In a truss girder of a bridge, a diagonal consists of mild steel falt 400 ISF and carries a pull of 800 kN. If the gross diameter of the rivets is 26 mm, then the number of rivets required in the splice is

a. 6

b. 7

c. 8

d. 9

56. Which one of the following is the load factor ?

a. Live load / Dead load

b. Failure load / Working load

c. Total load / Dead load

d. Dynamic load / Static load

57. Ina cantilever of span 'L', subjected to a concentrated load of 'W' acting at a distance of 1/3 L from the free end, the deflection under load will be

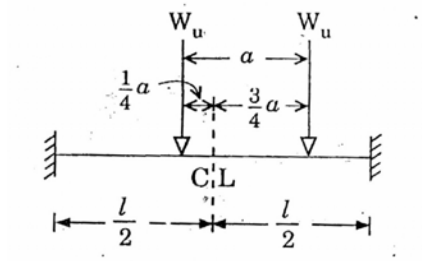
a. $WL^3 / 3\,El$

b. $WL^3 / 81\,El$

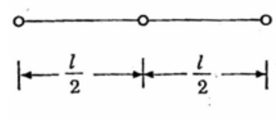
c. $14\,WL^3 / 81\,El$

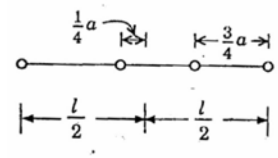
d. $WL^3 / 81\,El$

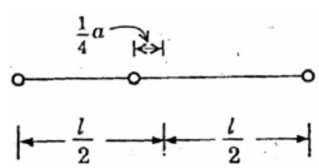
58. A beam of constant El is shown in the given figure :

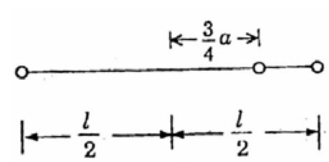


Which one of the following sketches gives a probable failure mechanism of this beam under plastic analysis ?

a.


b.


c.


d.


59. Consider the following statements :

In the stiffness method of analysis,

1. statically indeterminate structures along are considered
2. both statically determinate and indeterminate structures can be considered.
3. it is necessary to identify the redundant.
4. the displacements are considered a the unknowns
5. to calculate of equilibrium, it will be convenient to develop the stiffness matrix for the structure

Which of these statements are correct ?

a. 1, 3 and 4

b. 1, 3 and 5

c. 2, 4 and 5

d. 2, 3 4 and 5

60. Match List I(Actual beam) with List II(Conjugate beam) on the basis of analogy and select the correct answer :

List I

A. Curvature

B. Deflection

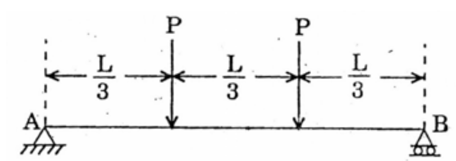
C. Slope

List II

1. Shear
2. Load
3. Moment

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

61. A simply supported beam of uniform flexural rigidity is loaded as shown in the given figure. The rotations of the end 'A' is



a. $PL^2 / 9\ El$

b. $PL^2 / 6\ El$

c. $PL^2 / 18\ El$

d. $PL^2 / 12\ El$

62. A circular segmental three-hinged arch of span 36 m and a rise of 6 ml is hinged at the crown the springings. It carries a horizontal load of 1000 N/m covering full height of the arch on left side. The horizontal thrust on the right springing will be

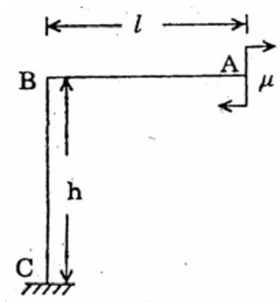
a. 6000 N

b. 4500 N

c. 3000 N

d. 1500 N

63. A rigid cantilever frame ABC is fixed at 'C' and carries a couple 'μ' at the free end 'A' as shown in the given figure. Neglecting axial deformation and assuming the flexural rigidity 'EI' to be constant throughout the frame, the vertical deflection of A is



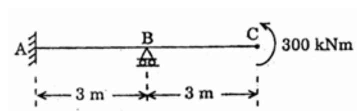
a. $\frac{\mu l}{EI}\left(h+\frac{l}{2}\right)$

b. $\frac{\mu l^2}{EI}\left(h+\frac{l}{2}\right)$

c. $\frac{\mu h^2}{EI}\left(\frac{h}{2}+l\right)$

d. $\frac{\mu h}{EI}\left(\frac{h}{2}+l\right)$

64. A propped cantilever of uniform flexural rigidity is loaded as shown in the given figure. The bending moment at fixed end A is



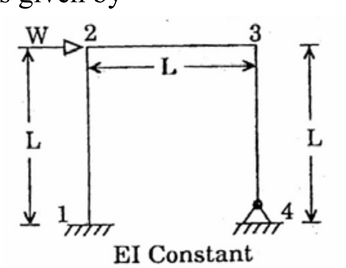
a. 150 kNm sagging

b. 3000 kNm sagging

c. 600 kNm hogging

d. 300 kNm hogging

65. The slope deflection equation at end 2 of the member 1-2 for the frame shown in the figure is given by



a. $M_{21}=\frac{2EI}{L}\left(2\theta_1+2\theta_2\right)-WL$

b. $M_{21}=\frac{2EI}{L}\left(2\theta_1-\frac{3\delta}{L}\right)$

c. $M_{21}=\frac{2EI}{L}\left(2\theta_1-\frac{3\delta}{L}\right)$

d. $M_{21}=\frac{2EI}{L}\left(\theta_1+2\theta_2-\frac{3\delta}{L}\right)+WL$

66. Consider the following assumptions :

1. All members have same cross-sectional area
2. The bending resistance of all the members is small in comparison with their axial force resistance
3. All the external loads are applied directly or indirectly at the joints
4. All joints are idealized to be frictionless hinges.

Which of these are the assumptions made in the force analysis of simple trusses ?

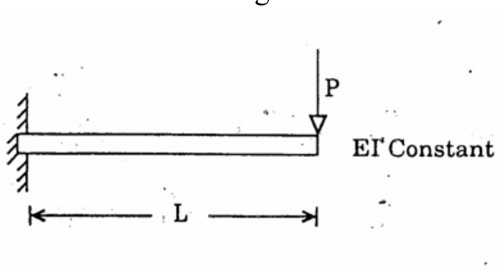
a. 1, 2 and 4

b. 2, 3 and 4

c. 1, 2 and 3

d. 3, and 4

67. The strain due to bending in the cantilever beam shown in the figure is



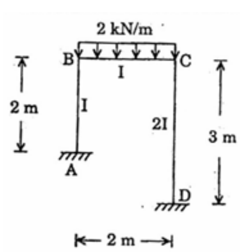
a. $\dfrac{PL}{3EI}$

b. $\dfrac{P^2L^2}{6EI}$

c. $\dfrac{P^2L^2}{EI}$

d. $\dfrac{P^2L^2}{2EI}$

68. In the portal frame shown in the given figure, the ratio of sway moments in columns AB and CD will be equal to



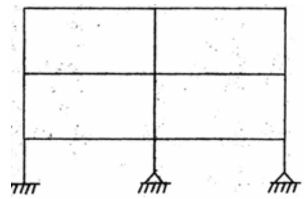
a. 1/3

b. 2/3

c. 9/8

d. 13/8

69. The total (both internal and external) degree of static indeterminacy of the plane shown in the given figure is



a. 18

b. 16

c. 14

d. 13

70. If a point load acting at the mid-span of a fixed beam of uniform section produces fixed end moments of 60 kNm, then the same load spread uniformly over the entire span will produced fixed end moments equal to

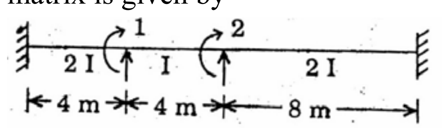
a. 20 kNm

b. 30 kNm

c. 30 kNm

d. 45 kNm

71. Displacement coordinates for a beam are shown in the given figure. The stiffness matrix is given by



a. $\begin{bmatrix} 3\text{ EI} & \text{EI} \\ \text{EI} & 2\text{ EI} \end{bmatrix}$

b. $\begin{bmatrix} 3\text{ EI} & -0.5\text{ EI} \\ -0.5\text{ EI} & 2\text{ EI} \end{bmatrix}$

c. $\begin{bmatrix} 3\text{ EI} & 0 \\ 0 & 2\text{ EI} \end{bmatrix}$

d. $\begin{bmatrix} 3\text{ EI} & 0.5\text{ EI} \\ 0.5\text{ EI} & 2\text{ EI} \end{bmatrix}$

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

List I(Collapse load for a

A. Fixed beam with a central point load

B. Fixed beam with a udl of intensity 'w_c'

C. Propped cantilever with a central point load

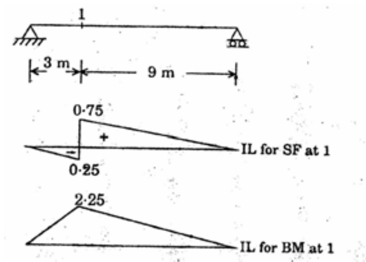
D. Simply supported beam with a central point load

List II

1. 8 M_p / L
2. 16 M_p / L
3. 6 M_p / L
4. 4 M_p / L

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

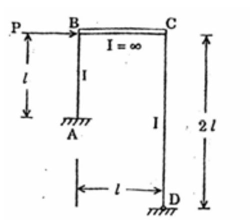
73. The given figures show a beam with its influence line for shear force and bending moment at section '1' :



The values of the shear force and bending moment at section '1' due to a concentrated load of 20 kN placed at mid-span will be

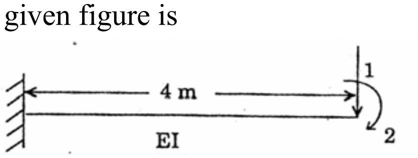
a. 0.75 kN and 2.25 kNm
b. 5 kN and 5 kNm
c. 7.5 kN and 10 kNm
d. 10 kN and 30 kNm

74. If an analysis of the frame shown in the given figure indicated final moment (−) 40 kNm at A and B of the column AB, then the moment M_{CD} will be



a. −5 kNm
b. −10 kNm
c. −20 kNm
d. −40 kNm

75. The flexibility matrix of the beam shown in the given figure is



a. $\begin{bmatrix} \frac{64}{EI} & -\frac{8}{EI} \\ -\frac{8}{EI} & \frac{8}{3EI} \end{bmatrix}$

b. $\begin{bmatrix} \frac{64}{3EI} & \frac{8}{EI} \\ \frac{8}{EI} & -\frac{64}{3EI} \end{bmatrix}$

c. $\begin{bmatrix} \frac{64}{3EI} & \frac{8}{EI} \\ \frac{8}{EI} & \frac{4}{EI} \end{bmatrix}$

d. $\begin{bmatrix} \frac{64}{3EI} & \frac{8}{EI} \\ \frac{4}{EI} & \frac{8}{EI} \end{bmatrix}$

76. The portal frame shown in figure I was analysed, and the final column moments were found to be as shown in figure II. The value of P is

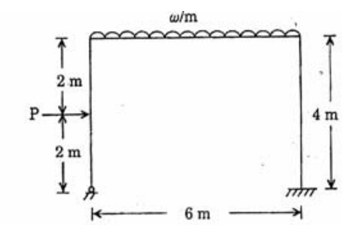


Figure I

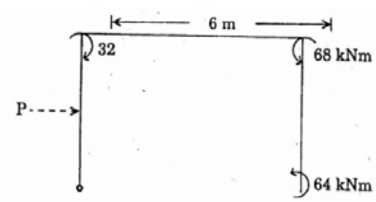
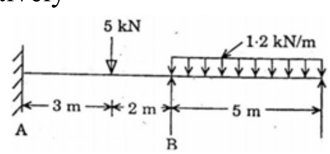


Figure II

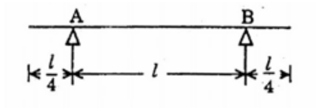
a. 25 kN
b. 41 kN
c. 45 kN
d. 50 kN

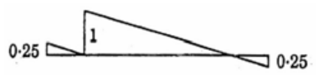
77. For the beam AB shown in the figure, the fixed end moments at ends A and B will be respectively

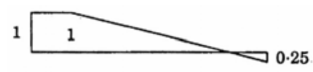


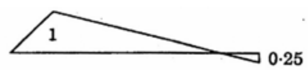
a. −3.6 kNm and + 1.1 kNm
b. −5.4 kNm and + 4.6 kNm
c. −2.4 kNm and + 3.6 kNm
d. −3.6 kNm and + 6 kNm

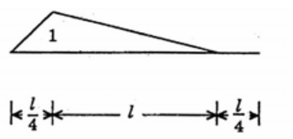
78. A beam with cantilevered ends is shown in the given figure. Which one of the following diagrams represent the influence line diagram for shear for a section just to the right of the support 'A' ?



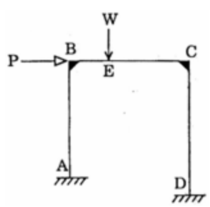
a. 

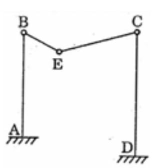
b. 

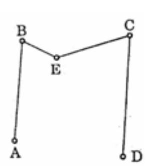
c. 

d. 

79. The failure mechanism for the rigid frame shown in the given figure I (Assume constant El)

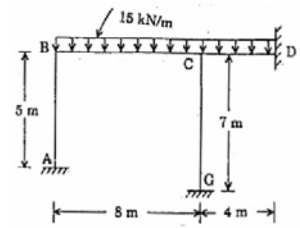
a. 

b. 

c. 

d. can (a), (b) or (c) depending upon the relative values of W, P and member dimensions

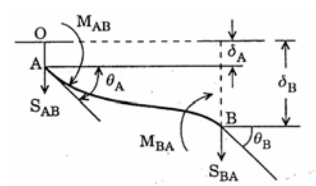
80. For the frame shown in the figure, the distribution factors for members CB, CD and CG are respectively (Assume EI as constant)



a. 14 / 29 , 8 /29 and 7 /29
b. 7 / 29 , 14 /29 and 8 /29
c. 7 / 29 , 8 /29 and 14 /29
d. 14 / 29 , 7 /29 and 8 /29

81. A member coordinate system is shown in the given figure. The symmetric stiffness square matrix obtained for the member AB of length 'l' with flexural rigidity 'EI' by using the slope deflection equation and rules of matrix multiplication is as follows:

$$\begin{bmatrix} M_{AB} \\ S_{AB} \\ M_{BA} \\ S_{BA} \end{bmatrix} = \frac{2EL}{l} \begin{bmatrix} \text{Symmetric} \\ \text{Stiffness} \\ \text{Square} \\ \text{Matrix} \end{bmatrix} \begin{bmatrix} \theta_A \\ \theta_A / l \\ \theta_B \\ d_B / l \end{bmatrix}$$



The correct sequence of elements of the first row of the symmetric stiffness square matrix is

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

82. The influence line diagram for reaction B of the beam shown in figure I is

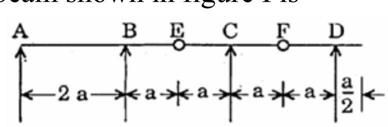
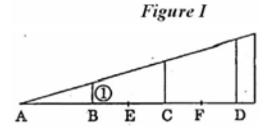
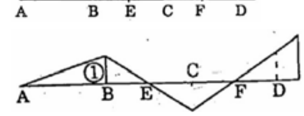
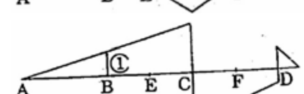
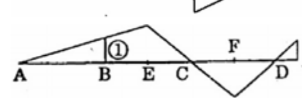


Figure I

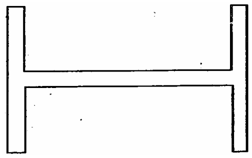
a. 

b. 

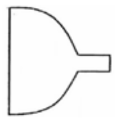
c. 

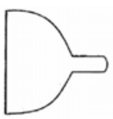
d. 

83. A simply supported I beam with its web horizontal is shown in the given figure. It is subjected to a vertical load.



The shape of the shear stress distribution in the cross-section of the beam under the load would be

a. 

b. 

c. 

d. 

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

List I

A. Tenacity
B. Plasticity
C. Ductility
D. Malleability

List II

1. Continues to deform without much increase of stress
2. Ultimate strength in tension
3. Extension in a direction without rupture
4. Ability to be drawn out by tension to a small section without rupture

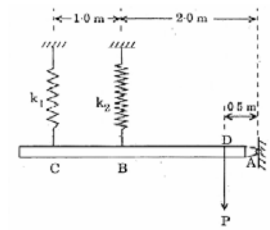
	A	B	C	D
a.	2	1	4	3
b.	2	1	3	4
c.	1	2	4	3
d.	1	2	3	4

85. A Steel bar, 300 mm long and 24 mm diameter, is turned down to 18 mm diameter for one third of its length. It is heated 30^o C above room temperature, clamped at both ends and then allowed to cool to room temperature. It the distance between the clamps is unchanged, the maximum stress is the bar

($\alpha = 12.5\times10^{-6}$ per ^oC and $E = 200\ GN/m^2$ is

a. $25\ MN/m^2$
b. $50\ MN/m^2$
c. $75\ MN/m^2$
d. $100\ MN/m^2$

86. A rigid beam CBDA is hinged at A and supported by two springs at C and B with a vertical load 'P' at point D as shown in the given figure. The ratio of stiffness (k_2/k_1) of springs at B and C is 2. The ratio of forces in spring at C to that at B is



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

87. A bar of uniform section is subjected to axial tensile loads such that the normal strain in the axial direction is 1.25 mm per m. If the Poisson's ratio of the material of the bar is 0.3, the volumetric strain would be

a. 2×10^{-4}
b. 3×10^{-4}
c. 4×10^{-4}
d. 5×10^{-4}

88. A square plot (a × a) rigidly held at three edges is free to move along the fourth edge. If temperature of the plate is raised by temperature 't', then the free expansion at the fourth edge will be (coefficient of thermal expansion of the material = α, modulus of elasticity of the material = E and its Poisson's ratio = v)

a. $a\,\alpha\,t\,v$
b. $a\,\alpha\,t\,(1+v)$

c. $a\,\alpha t + \left(\dfrac{\alpha\, t\, v}{E}\right)$

d. $a\,\alpha\, t\,(1 - v)$

89. Match List I (Elastic constant) with List II (Definition) and select the correct answer :

List I

A. Young's modulus

B. Poisson's ratio

C. Bulk modulus

D. Rigidity modulus

List II

The ratio of

1. Lateral strain to linear strain within elastic limit
2. stress to strain within elastic limit
3. shear stress to shear strain within
4. direct stress to corresponding volumetric strain

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

90. For a linear, elastic, isotropic material , the number of independent elastic constants is

a. 1

b. 2

c. 3

d. 4

91. Match List I(Theory of failures) with List II (Scientists) and select the correct answer:

List I

A. Maximum principal stress theory

B. Maximum shear stress theory

C. Maximum principal strain theory

D. Maximum distortion energy theory

List II

1. St. Venant
2. Beltrami and Ttaigh
3. Tresca
4. Von-Mises
5. Rankine

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

92. A member is made of structural steel. When it is subjected to simple tension, the limit of proportionally is 280 N mm^2. If the principal stress p_1 and p_2 developed in the member are 100 N/mm^2 (tensile) and 40 Nmm^2 (compressive) respectively and Poisson's ratio is 0.30, then the factor of safety according to maximum shear stress theory would be

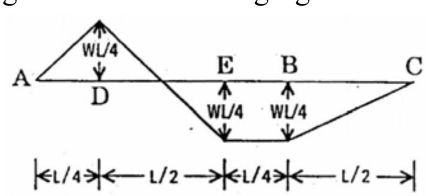
a. 2.75

b. 2.5

c. 2.25

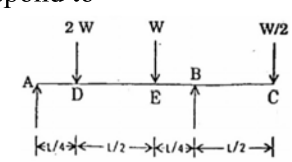
d. 2.0

93. A beam ABC has simply supported span AB and overhanging span BC. The bending moment diagram for the beam is given in the following figure :

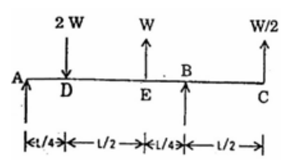


The loading diagram for the beam would correspond to

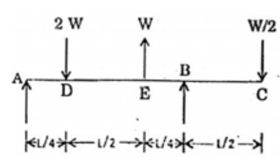
a.



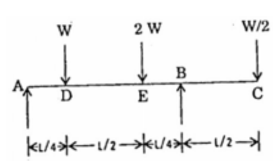
b.



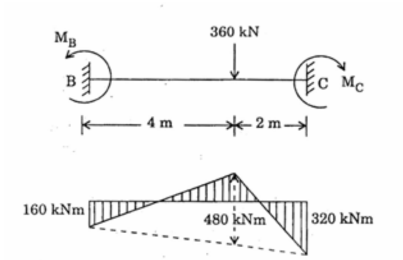
c.



d.



94. The load diagram and bending moment diagram of a beam are shown in the following figures :



The shear force at B would be

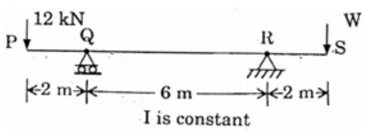
a. 93.33 kN

b. 120 kN

c. 146.66 kN

d. 200 kN

95. A loaded beam PQRS is shown in the given figure .



The magnitude of reaction at R will be zero if the value of load ‘W’ is

a. 2 kN

b. 2.5 kN

c. 3 kN

d. 6 kN

96. A cantilever beam is 2 m long. The cross-section of the beam is hollow square, with external sides 60 mm and the internal side is such that 1 = 6 × 10^5 mm^4. If the safe bending stress for the material is 100 N/mm^2, the safe concentrated load at the free end would be

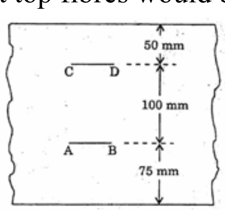
a. 400 N

b. 500 N

c. 600 N

d. 1000 N

97. A test is conducted on a beam loaded by end couples. The fibres at layer CD are found to lengthen by 0.03 mm and fibres at layer AB shorten by 0.09 mm in 20 mm gauage length as shown in the given figure Taking E = 2×10^5 N/mm^2, the flexural stress at top fibres would be



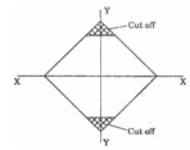
a. 900 N/mm^2 tensile

b. 1000 N/mm^2 tensile

c. 1200 N/mm^2 tensile

d. 1200 N/mm^2 compressive

98. In the case of a square beam subjected to couples acting about X-X axis, it is advisable to cut off the edges and keep the section as shown in the given figure because it increases



a. stresses in the beam

b. stresses and reduces the weight of the beam

c. the moment of inertia of the beam

d. the section modulus

99. A solid shaft of 100 mm diameter in a small hydraulic turbine is subjected to an axial compressive load of 100π kN and a torque of 5π kNm. The maximum shear stress induced in the shaft is

a. $20\sqrt{3}$ N/mm^2

b. $20\sqrt{8}$ N/mm^2

c. $20\sqrt{15}$ N/mm^2

d. $20\sqrt{17}$ N/mm^2

100. A solid circular shaft is subjected to a torque “T” Nm, which produces a maximum shear stress of f_S N/mm^2 in the shaft. These required diameter of the shaft would be

a. $10\left(\frac{16T}{\pi f_S}\right)^{1}$

b. $10\left(\frac{\pi f_S}{16T}\right)^{1/3}$

c. $10\left(\frac{16T}{\pi f_S}\right)^{1/2}$

d. $10\left(\frac{\pi f_S}{16T}\right)^{1/2}$

101. The principal stresses at a point in a strained material are p_1 and p_2. The resultant stress p_r on the plane carrying the maximum shear stress would be

a. $\frac{\left(p_1^2+p_2^2\right)^{1/2}}{2}$

b. $\left[\dfrac{p_1^2+p_2^2}{2}\right]^{1/2}$

c. $\left[2\left(p_1^2+p_2^2\right)\right]^{1/2}$

d. $2[p_1^2+p_2^2]^{1/2}$

102. If a prismatic member having are a of cross-section 'A' is subjected to a tensile load 'P', then the maximum shear stress and its inclination with the direction of load will be

a. P/A and 45 ^{o}

b. 2P /A and 45 ^{o}

c. P/2A and 45 ^{o}

d. P/A and 60^{o}

103. A king closer is a

a. full brick

b. ¾ brick

c. longitudinally ½ brick

d. crosswise ½ brick

104. Brick masonry walls and columns of a building are to be protected from earthquake. The earthquake proofing is done by providing

a. cross walls

b. less openings

c. under-reamed piles

d. a steel band at corners above windows below ceiling

105. When a beam or truss is placed on a masonry wall, it is supported on bed stone or bed plate. The bed stone or bed plate is necessary to

a. Add to aesthetic appearance

b. Transfer the reaction over a larger contact area

c. Increase stability of beam or truss

d. Prevent outward thrust on the wall

106. If modular ratio is 'm', effective depth is D and stress ratio is r (r = σ_{st} /σ_{cbc}), the depth of neutral axis of a balanced section is

a. $\dfrac{m}{m-r}.D$

b. $\dfrac{m}{m+r}.D$

c. $\dfrac{m+r}{m}.D$

d. $\dfrac{m}{r}.D$

107. Consider the following statements :

Bars that extend into a simple support must be able to develop their full strength at a designated point '1' so that their moment capacity is more than the bending moment at that point. The clauses of the code require that (σ_s = 0.85 σ_{sy})

1. $L_d \le \dfrac{1.3M_1}{V}+L_o$

2. $\dfrac{\phi\sigma_s}{4\tau_{bd}} \le \dfrac{1.3M_1}{V}+L_o$

3. $\phi \le \dfrac{4\tau_{bd}}{\sigma_s}\left(\dfrac{1.3M_1}{V}+L_o\right)$

Which of these statements are correct ?

a. 1 and 2

b. 2 and 3

c. 1 and 3

d. 1, 2 and 3

108. Lateral ties in RC columns are provided to resist

a. bending moment

b. shear

c. buckling of longitudinal steel bars

d. both bending moment and shear

109. For maximum sagging bending moment in a given span of a multiple span beam

a. that very span as well as alternate spans are loaded

b. adjacent spans are loaded

c. spans adjoining this span are loaded

d. adjacent spans are unloaded and next spans are loaded

110. In post-tensioned prestressed concrete beam, the end block zone is the zone between the end of the beam and the section where

a. no lateral stresses exist

b. only longitudinal stresses exist

c. only shear stresses exist

d. the shear stresses are maximum

111. Match list I with List Ii and select the correct answer

List I

A. Minimum percentage of tension reinforcement of RC beam

B. Minimum percentage of shear reinforcement of RC beam

C. Maximum allowable percentage of tension reinforcement of RC beam

D. Maximum allowable percentage of compression reinforcement of RC beam

List II

1. 4
2. 85 / f_v
3. 40 S_V / f_y d

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

112. According to Whitney's theory, the maximum depth of concrete stress block in a balanced RCC beam section of depth 'd' is
   a. 0.3 d
   b. 0.43 d
   c. 0.5 d
   d. 0.53

113. Partial safety for concrete and steel are 1.5 and 1.15 respectively, because
   a. Concrete is heterogeneous while steel is homogeneous
   b. The control on the quality of concrete is not as good as that of steel
   c. Concrete is weak in tension
   d. Voids in concrete are 0.5% while those in steel are 0.15%

114. The propagation of a shear crack in a prestressed concrete member depends on
   a. Tensile reinforcement
   b. Compression reinforcement
   c. Shear reinforcement
   d. Shape of the cross-section of the beam

115. A compared to working stress method of design, limit state method takes concrete to
   a. a higher stress level
   b. A lower stress level
   c. The same stress level
   d. Sometimes higher but generally lower stress level

116. While checking shear resistance of reinforced concrete beams for limit state of collapse as per IS : 456, which one of the following nominal shear stress recommendations is to be adhered to ? (V_u is shear force at vertical cross-section, 'b' and 'd' are overall breadth and effective depth of beam respectively)
   a. 0.5 V_u /bd
   b. 2 V_u / 5 bd
   c. V_u / 0.5 bd
   d. V_u / bd

117. As per IS : 456, for a singly reinforced rectangular section,
   a. $\frac{x_{u.\max}}{d}$ for Fe 415 is 0.48
   b. the depth of centroid of compression is 0.43 $x_{u.\ max}$
   c. the depth of the rectangular position of the stress block is 0.38 $x_{u.\ max}$
   d. The maximum value of lever arm is d—$x_{u.\ max}$

118. Fro the purpose of design as per IS : 456, deflection of RC slab or beam is limited to
   a. 0.2% of span
   b. 0.25 % of span
   c. 0.4 % of span
   d. 0.45% of span

119. As per IS : 456, side face reinforcement, not less than 0.05% of web area, is provided on each side when the depth of web is not less than
   a. 300 mm
   b. 400 mm
   c. 500 mm
   d. 750 mm

120. The yield line theory is a
   a. lower bound method of design of over-reinforced slabs
   b. lower bound method of design of under–reinforced slabs
   c. upper bound method of analysis of under–reinforced slabs
   d. upper bound method of analysis of under–reinforced slabs